Environmental Impact Analysis
(E I A)

Ammonia Industry and Supporting Facilities

Banggai – Central Sulawesi, Indonesia

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CHAPTER I
INTRODUCTION

1.1 Background

An Ammonia industry and supporting facilities is proposed to be developed by PT Panca Amara Utama (PAU) in the village of Uso, Sub-district Batui, District Banggai, Central Sulawesi Province (Map 1.1) for ±2.000 tons per day or about 700.000 tons per year production capacity. The purpose of the development of ammonia industry is to meet the needs of domestic and export markets of ammonia (if demand of domestic ammonia market is accomplished).

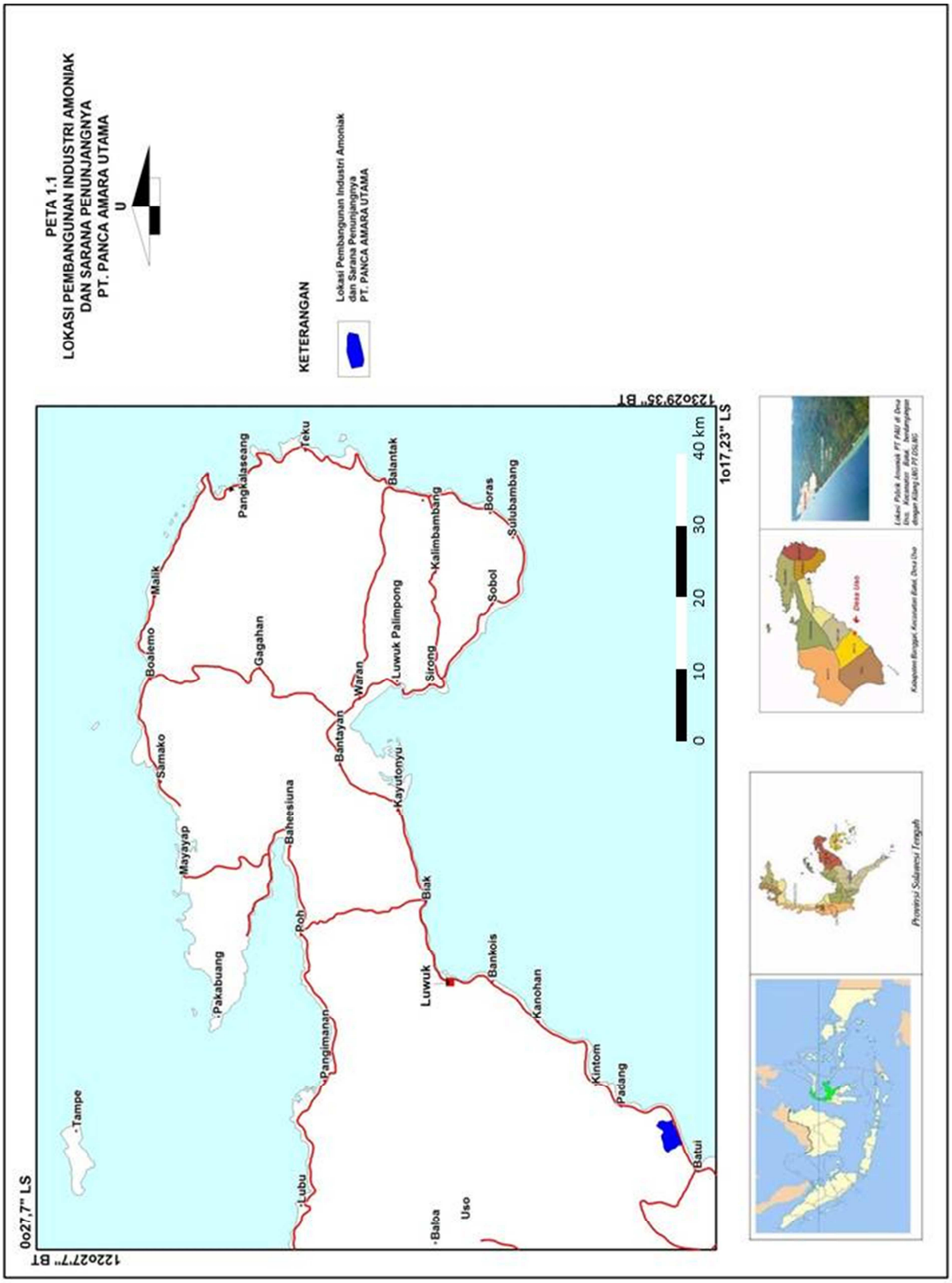
The development of this ammonia industry will increase the foreign exchange of nation while at province & district levels, the ammonia industry will support the mission of governments of Central Sulawesi Province and Banggai district in raising regional revenue and employment either directly or indirectly and accelerate the growth of industries in Banggai District.

According to the Environment Ministry Decree no. 05/2012 pertaining the business plan and/or activities equipped with a mandatory Environmental Impact Assessment (EIA) for Petrochemical Industry and construction of Industrial development in rural areas with an area ≥ 30 hectares must be accompanied by EIA/AMDAL (Environmental Impact Assessment) documents that includes the Environmental Impact Analysis (ANDAL), Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL). Considering the fact that ammonia industry and supporting facilities initiated by PT Panca Amara Utama to be built on land with an area of about 200 hectares, PT Panca Amara Utama needs to make the EIA document as per the environment ministry decree no. 05/2012.

Basically in 2006, EIA (Environmental Impact Assessment) for industrial development plan for Ammonia and its supporting facilities by PT Panca Amara Utama was approved by the agency, BAPEDALDA for Regional Environment Impact Control of Central Sulawesi Province through Environmental Impact Assessment / AMDAL – which is consist of Environmental Impact Analysis, Environmental Management Plan and Environmental Monitoring Plan, with the decree no. 660.I/0145/Bapedalda dated 03 March 2006.

However, with respect to the delay of the government decision pertaining to the allocation of gas supply to PT Panca Amara Utama for its ammonia industry, the company has not been able to commence the activities at the site.

Map 1.1 PT Panca Amara Utama Ammonia Industrial Development Location



In early 2011, PT Panca Amara Utama had received a letter related to natural gas allocation based on the letter of Minister of Energy and Mineral Resources no. 3288 K/15/MEM/2010 dated 31 December 2010. Furthermore, based on this Ministerial Decree, PT Panca Amara Utama in the mid-2011 restarted investment plan for ammonia industry and it is expected that in the fourth quarter of 2012, the company shall be able to execute the land preparation for construction of ammonia industry and its supporting facilities.

Based on article 50 paragraph (2) 'a' and 'e' Government Regulation No. 27/2012 pertaining the Environmental Permits, the previous EIA (Environmental Impact Assessment) / AMDAL of PT Panca Amara Utama approval, shall be considered expired due to Project activities has been non-active for the period of more than three years since the issuance of EIA Approval.

With reference to article 50 paragraph (4) 'a', the PT Panca Amara Utama have to make an updated version of AMDAL / EIA (Environmental Impact Assessment) of Ammonia Industry without changes in the type of product, technology, capacity and location.

1.2 Aim and Benefit

Ammonia industry development and its supporting facilities are purposed to produce ammonia. While in the scope of national and regional, it is expected to be able to give benefit by growing national economy through value-added increase of natural gas as well as the additional foreign exchange in the country by exporting the surplus ammonia production after domestic needs are met. The development of ammonia industry also shall offer benefits to regional government viz. increasing regional revenue, providing jobs and motivating the industrial development in Banggai District.

1.3 Laws Related to Business Plan and/or Activities and Environment

Valid laws with relationship to activity plan, environmental impact and main issues are as follows:

No.	Laws	Relationship
Laws		
1	Law of the Republic of Indonesia No. 5/1960 on Basic Regulation of Agrarian Mains	Related to land authority and rights to land and waters
2	Law of the Republic of Indonesia No. 5/1990 on Conservation of Natural Bio-Resources and Ecosystems	Related to activities plan at the embankment of river
3	Law No. 22/2001 on Oil and Gas	In relation to exploitation or production of natural resources that are strategic

4	Law No. 13/2003 on Manpower	Related to recruitment of workforce and Working condition
5	Law No. 2/2004 about Industrial Relations & Dispute Settlement	Related to industrial relationships and settlement of industrial disputes
6	Law No. 7/2004 on Water Resources	Related to activity plan at the area covering a river or tributary
7	Law of the Republic of Indonesia No. 22/1999 and Law No. 32/2004 on Regional Government	Related to governmental activity program for the interest of the people and supporting the Regional Government's program
8	Law No. 40/2004 concerning social security	Related to social security of workforce
9	Law No. 38/2004 about Roads	Related to system, function, status and class of road at the across and surrounding of the project area (EIA study border region)
10	Law of the Republic of Indonesia No. 26/2007 on Spatial Master Plan	Related to Regional Spatial Master Plan of Central Sulawesi Province and Banggai Regency and spatial use plan at the project area
11	Law of the Republic of Indonesia No. 18/2008 on waste treatments	Associated with waste treatment / processing
12	Law of the Republic of Indonesia No. 22/2009 on Traffic and Public Transportation	Related to activities that use heavy equipment transportation through the surrounding road
13	Law of the Republic of Indonesia No. 32/2009 on Environment Conservation and Management	Related to activities that may result in various impacts on space environment component and need an environmental management.
14	Law of the Republic of Indonesia No. 36/2009 on Health	Associated with the health of workers in the project activities, public health impact due to the various activities and also related to the role of society/private in improving health of the local people

Government Regulation/Presidential Decree		
1	Government Regulation of Indonesia No.35/1991 on the River	Related to activities plan (project area) covering a tributary
2	Government Regulation of Indonesia No.41/1993 on Road Transportation	Related to activities that use heavy equipments to transport material and equipment
3	Government Regulation of Indonesia No.43/1993 concerning Infrastructure and Road Traffic.	Related to activities that use heavy equipments to transport material and equipment
4	Government Regulation of Indonesia No.41/1999 on Air Pollution Control	Related to activities that have an impact in the form of increased levels of dust during various stages of activities
5	Government Regulation of Indonesia No.38/2007 concerning Government and Province Authorities as an Autonomous Region	Related to a part of governmental authority at city/ district level
6	Government Regulation of Indonesia No. 85/1999 about amendments over Regulation No. 18/1999 on hazardous waste treatment	Related to hazardous waste treatment
7	Government Regulation of Indonesia No.150/2000 on Land Damage Control for Biomass Production	Related to efforts to control the land clearing for the planned activities which can result in the impact on biomass-
8	Government Regulation of Indonesia No.82/2001 concerning Water Quality Management and Water Pollution Control	Related to the efforts for surface water (river water) quality management as a result of planned activities-
9	Government Regulation of Indonesia No.38/2007 concerning Government Affair Division	Related to government affairs division in environment conservation and management
10	Government Regulation No.15/2010 concerning Spatial Plan	Related to spatial planning implementation at the project area and its surroundings
11	Government Regulation of Indonesia No.27/2012 on Environmental License	Related to pre-requisites for the companies to obtain Business License & mandatory EIA
Ministerial Decree/Ministerial Regulation		
1	Environment Ministry Decree No. 35/1993 concerning Motor Vehicle Exhaust Gas Emissions Standard	Related to exhaust gas from a no. of heavy equipment vehicles used by the project.

2	Decree of the Head of the Agency for Environmental Impact Control No. KEP-056/1994 concerning Guidelines for significant impact	Related to assess important and unimportant impacts from the various planned activities
3	Environment Ministry Decree No. KEP-51/MENLH/10/1995 concerning liquid Effluents Standard for Industrial Activity	Related to liquid effluents generated from the process of ammonia industry
4	Environment Ministry Decree No. KEP-48/MENLH/11/1996 concerning Noise Standards	Related to noise impact on surroundings from the operation of no. of vehicles and heavy equipments used by the project.
5	Environment Ministry Decree No. KEP-49/MENLH/11/1996 concerning Vibration Standards	Related to impact of vibrations as a result of operation of no. of vehicles and heavy equipments used by the project
6	Environment Ministry Decree No. KEP-50/MENLH/11/1996 about standard on odor levels	Associated with standard on odor levels. The quality standard is used to determine the level of odor at baseline and predicted impacts
7	Decree of the Head EIA Agency No. KEP-225/BAPEDAL/08/1996 concerning Systems and Requirements for Storing and Collecting used Lubricating Oils	Related to systems and requirements for storing and collecting used lubricating oils
8	Decree of Environment Ministry/Head of EIA Agency No. KEP-299/11/1996 concerning Technical Guidelines for study of Social aspects in EIA	Related to technical guidelines for the study of socio-economic and cultural aspects in EIA
9	Decree of the Head of EIA Agency No. 124/1997 concerning Guidance for Study of public health aspects in EIA Compilation	Related to preparation of technical guidelines for study of public health aspects in EIA.
10	State Ministry for Agrarian Affairs / Head of National Land Affairs Agency regulation No. 21/1999 concerning Procedure of Land Purchasing for Company Investment	Related to land acquisition for the planned activities
11	Decree of the Head of EIA Agency No. 08/2000 concerning Society Participation and Information Openness in EIA Process	Related to the proposed activities and EIA process that requires involvement / participation of the society
12	Decree of Health Ministry of the Republic of Indonesia No. 876/ MENKES/SK/VIII/ 2001 concerning Technical Guidelines for Environmental Health Impact Analysis	Related to technical guidelines pertaining to public health aspects in EIA

13	Environment Ministry Decree No. 37/2003 concerning Method of Surface Water Quality Analysis and Surface Water Sampling	Related to procedure & method of analysis of surface water quality sampling
14	Environment Ministry Decree No. 51/ 2004 on quality standards for sea water	Associated with better quality of sea water at baseline and after the activity
15	Ministry of Health of the Republic of Indonesia Regulation No. 416/MENKES/ Per/IX/1990 about Water Quality Requirements	Associated with water quality requirements to describe the water quality at baseline
16	Regulation of the Head of National Land Affairs Agency No. 2/1993 on the Procedure for obtaining location license and land rights to the Company	Related to land acquisition by the company
17	Environment Ministry Regulation No. 01/2006 on Technical Guidelines to establish Water Classification	Related to determination of water classification in the study
18	Environment Ministry Regulation No. 03/2006 on Program Towards Green Indonesia	Related to efforts for re-forestation (Program Green) at activity location
19	Environment Ministry Regulation No. 08/2006 concerning Guidelines for EIA	Related to technical guidelines for EIA
20	Environment Ministry Regulation No. 30/2009 on the implementation of licensing and supervision of hazardous & toxic waste management as well as recovery from pollution	Related to licensing, supervision and management of recovery from waste pollution
21	Environment Ministry regulation No. 05/2012 concerning the Type of Business Plan and/or Activity that must be equipped with EIA	Related to the planned activities that must conduct study of EIA (Environmental Impact Analysis, Environmental Management Plan and Environmental Monitoring Plan)
22	Regulation of Health Ministry of the Republic of Indonesia No. 492/MENKES/Rev/2010 on terms and Control of Drinking Water Quality	Related to activity plan covering a spring for fulfilling operational necessities and also related to quality control of water drinking consumed by society.
23	The decree of Head EIA Agency (Bapedal) No. 01/Bapedal/09/1995 on procedures and technical requirements of the storage and collection of hazardous and toxic waste	associated with the collection of hazardous and toxic

Regional Regulation / Governor's decree of Central Sulawesi Province		
1	Regional Regulation of Central Sulawesi Province No. 4/1985 on Environment Management and Conservation in Central Sulawesi	Related to environment management and conservation
2	Regional Regulation of Central Sulawesi Province No. 2/2004 on Spatial Plan of Central Sulawesi Province	Related to space allocation plan in the study
3	Decree of the Governor of Central Sulawesi Province No. 465/1995 on Air and Water quality Standards in Central Sulawesi	Related to the quality of water and air

CHAPTER II

BUSINESS AND/OR ACTIVITY PLAN

2.1. Identification of Initiator and Composer, EIA

2.1.1. Initiator

The initiator of development of Ammonia Industry and Supporting facilities in the village Uso, Sub-district Batui, District of Banggai, Central Sulawesi Province is:

Project Initiator	:	PT Panca Amara Utama
Address	:	Menara Kadin Indonesia, 16th Floor
	:	Jl. H. R. Rasuna Said Blok X-5 Kav 2-3
	:	Jakarta 12950, Indonesia
	:	Tel. +62 21 5274516
Person In-Charge	:	Garibaldi Thohir
Title	:	President Director

2.1.2. Composer, EIA Study

The composer of EIA Report for the development of Ammonia Industry and Supporting facilities in the village Uso, Sub-district Batui, district Banggai, Central Sulawesi Province is:

Composer	:	PT WIDYA CIPTA BUANA
Address	:	Metro Office Complex
	:	Jl. Venus Barat Kav.15, Margahayu Raya, Bandung
	:	Tel. (022) 7302736, Fax: (022) 7302736
Person In-Charge	:	Drs. Azis Rahman
Title	:	Director

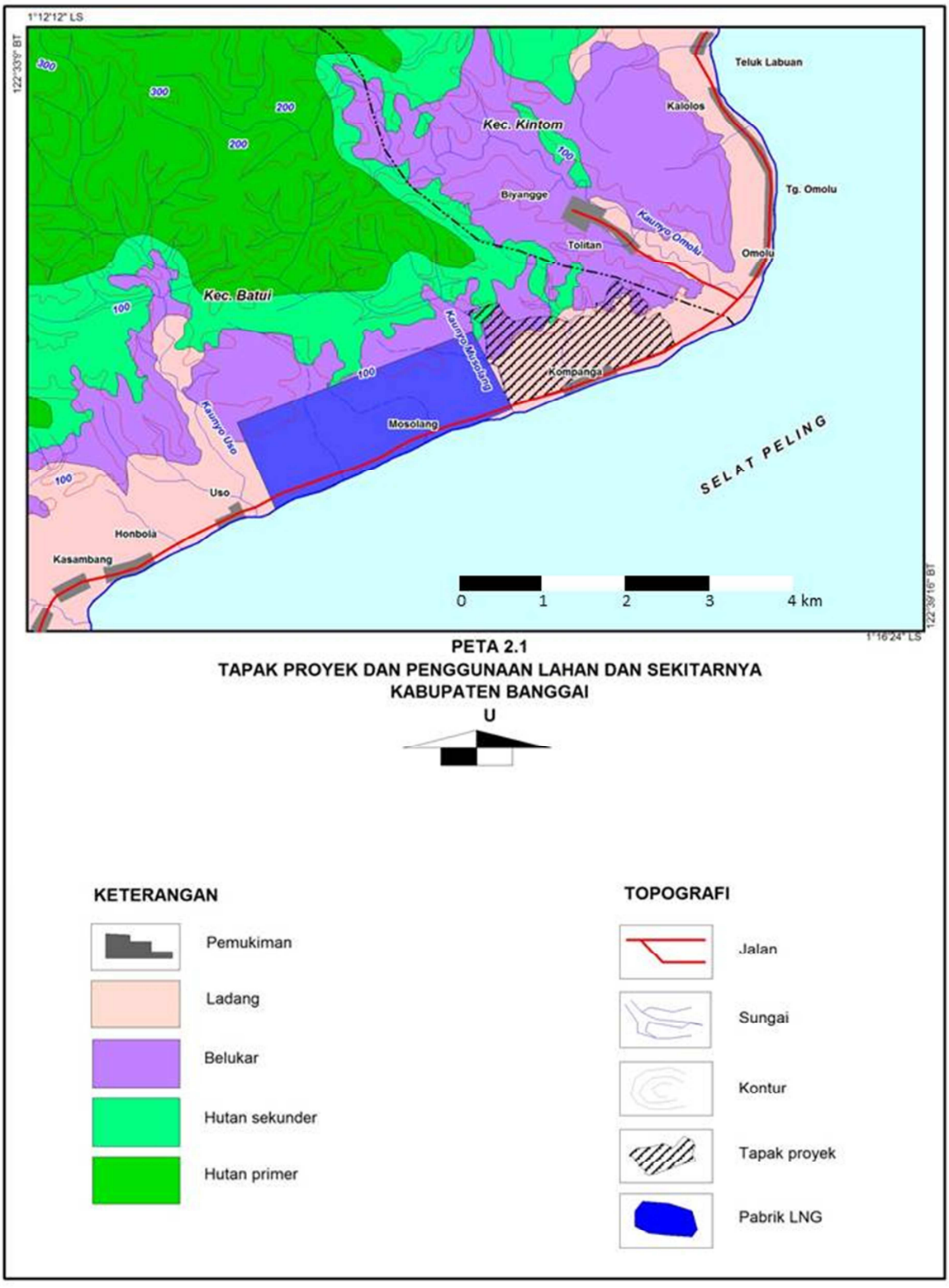
Composition of Team:

Team Leader	: Dr. Eddy Winarno (Competency Certificate)
Person In-Charge, Physics-Chemistry	: Ari Pritria Indrayana ST. (SKA)
Expert, Chemical Engineering	: Hendriyana ST, MT.
Expert, Geology	: Ir. Dadang ZA MT. (EIA Appraiser)
Expert, Hydrology	: Ir. Dedi Heradi Bisri, Diploma WM.MT. (EIA Appraiser)
	: Ir.Iwa Herlambang
Expert, Hydro-Oceanography	: M. Furqon Azis Ismail S.Si. M.Sc.
Person In-Charge, Biology	: Drs. Bambang Kusharyadi (SKA)
Expert, Biology	: Drs. Kusnadi Yusaputra MS (EIA A)
Person In-Charge, Socio-Economy And culture	: Drs. Mochsin Mahendra (SKA)
Expert, Socio-Economy and Culture	: Drs. Moh. Djufri R. Diko, MM
	: Drs.Muhammad Arief Ramadhan
Assistant	: Aep Saepudin
	: Jhon Matulesi

2.2. Description of Development Plan of Ammonia Industry and Supporting Facilities

2.2.1. The boundaries of land to be used directly for the development of Ammonia industry and supporting facilities

As described in Chapter I that the land to be used for the development of Ammonia Industry and Supporting Facilities PT PAU is located in the Desa (village) Uso, Sub-district Batui, District Banggai, Central Sulawesi. The boundaries of the land to be used for ammonia industry and supporting facilities shall be referred as the project site as shown in Map 2.1. Also seen in Map 2.1 are other lands such as LNG plant, forest, agriculture and human settlements.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Tg. Omolu
Biyangge
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Tolitan
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Kec. Batui
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Kompanga
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PETA 2.1
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KABUPATEN BANGGAI
U
KETERANGAN
Pemukiman
Ladang
Belukar
Hutan sekunder
Hutan primer
TOPOGRAFI
Jalan
Sungai
Kontur
Tapak proyek
Pabrik LNG

2.2.2. The relationship between the location of ammonia industry and supporting facilities with natural resources / human resources

2.2.2.1. Water Resources

Surface water resources located around the project site is Musolang River, with a flow of 5.2 liters/second as examined at the time of study in May 2012. According to the information, the flow of river Musolang decreases during the dry season but still running at the estuary parts. This overflow water comes from an aquifer that is truncated watershed aquifers located in the layer between the rock limestone and conglomerates.

2.2.2.2. Biological Resources

Biological resources located on the project site are agricultural crops such as coconut (cocos nucifera), chocolate (Theobroma cacao), hazelnut (Aleurites moluccana), cashew (Anacardium occidentale), clove (Syzugium aromaticum) and coffee (Coffea arabica). Outside the project site are forest resources having other plants such as, resin pig (Dacryodes rostrata), palapi (Herietia javanica), resin (Agathis dammara), jelutung (Dyera costalata), nyamplung forest (Callophylum celebicum), gopasa (Vitex cofassus), kolaka (Parinaria corymbosa), omboyuan (Metrosideros petiolata), koti-koti (Lindera sp.), dihi (Planchonella obovata) and longori (Santiria laevigata).

2.2.3. Layout of Business and/or activities

Based on the plan of plant site, the layout for ammonia industry and supporting facilities can be seen in Figure 2.1. The areas of various plant units are:

Figure 2.1 Plant Site

THE AREA OF PLANT SITES

Ammonia Plant	32.600 m²
Power Generator and Sub-station	12.850 m²
Supporting Utilities	10.450 m²
Warehouse and workshop	10.800 m²
Office premises and parking	9.000 m²
Fire extinguishing unit	500 m²
Ammonia tank area	22.500 m²
Waste Water Treatment Plant (WWTP)	3.000 m^2
Lay down Area	20.000 m²
Road and parking area at the factory	40.000 m²
Water Intake	1.500 m²
Green Open Area	300.000 m²
Retention Pond	23.000 m²
Shipping Dock	15.000 m²
TOTAL AREA	**501.200 m²**

2.2.4. Description of Planned Activity Implementation Stage

The development of Ammonia industry and supporting facilities is categorized into 4 (four) stages viz. Pre-construction, Construction, Operation and Post-Operation. The description of each stage of the activity is as follows:

2.2.4.1. Pre-Construction Stage

Location Permit

The ammonia industry and supporting facilities have obtained permission from the district Banggai Government vide issue of permission letter Regent Banggai No: 503/857/Bag.Tapem dated 18th July, 2005 and renewed by the Regent Banggai Permit No. 503/180/Bag. Adm. Land dated 24 April 2012 concerning Location Permit for PT Panca Amara Utama (PAU) for Business Purposes in the field of Petrochemical Industry and natural gas in the village Uso, Sub-district Batui, District Banggai with an area of ± 200 Ha (Location permit can be seen in Appendix 2-1).

Public Consultation

Public Consultation or often called the EIA Socialization on development of Ammonia Industry and Supporting Facilities of PT PAU has been implemented in accordance with the Decree of the Head of Environment Impact Management Agency No. 08/2000 about Community Involvement and disclosure of Information in the process of EIA (Environment Impact Assessment).

Public consultation associated with the EIA for Ammonia Industry and Supporting Facilities (PT PAU) has been carried out 2 (two) times, the first held in January 2006 in the Desa Uso, Sub-district Batui, District Banggai during the first EIA preparation process. The second Public Consultation was held on 25 April 2012 at the same place (i.e. village Uso).

The second Public Consultation in the process of preparing EIA was attended by officials such as the Head of Environment Management Agency (BPLH), district Banggai, Head Batui, Head Kintom, Police Chief Batui, Police Chief Kintom, Koramil Batui, Village Head Uso, Village Head Hombola & Village Head Kasambang in Sub-district Batui, Village Head Kalolos, Sub-district Kintom, Community leaders and chairman of people & the community around the project site. Socialization summary EIA (Public consultation) with 52 numbers of attendees / participants can be seen at Attachment '3' & '4' respectively.

Land Acquisition

Land to be acquired for ammonia industry and supporting facilities PT PAU covers land with an area of about 200 Ha (hectares), the most of which (approximately 90%) has been acquired. The land-owners are not only the community of village Uso, even most of the land is owned by communities of village Mendono and village Nambo, Sub-district Kintom. Buy and sell transactions were done by direct agreement between the Proponent and Community as outlined in the Deed of "Sale and Purchase Deed" and witnessed by the Village Head of Uso and Camat Batui.

The land purchased by PAU has resulted from voluntary land transactions where the seller was not obliged to sell. No expropriation or other compulsory procedures sanctioned by the legal system were applied during the land acquisition process.

Mobilization of Pre-Construction Manpower

Pre-construction stage includes various activities viz. installation of peripheral fence, site preparation, excavation, cut & fill of land and land leveling (land grading).

For manpower required for the Pre-construction work, priority shall be given to the people from village where the project site is located (i.e. village Uso) and villages around village Uso e.g. village Hombola and village Lamo in Sub-district Batui and village Tangkiang, village Babang Buyangge, village Kalolos in Sub-district Kintom. If qualified manpower required for the said job is not available, recruitment of manpower will be done from other areas. The number of manpower required for Pre-Construction stage is about 200 people as per the details given in Table 2.1:

Table 2.1 Pre-Construction Manpower

No.	Education	Persons
A.	**Land preparation and maturing**	
1.	Supervisor	5
2.	Dozer, grader, compactor, loader & backhoe Operators	30
3.	Dump truck operator	45
4.	Laborer	50
Total A		**130**
B.	**Construction of peripheral fence**	
1.	Supervisor	2
2.	Brick layer	13
3.	Labourer	55
Total B		**70**
Total A + B		**200**

Source: PT Panca Amara Utama, 2012

Mobilization of Pre-Construction Equipment

Transportation (mobilization) of equipment and materials will be done using the National Road that connects the Luwuk City (capital of district Banggai) with Batui (capital of Sub-district Batui). The state road is 6 meters wide with 4 meters paved traveled way (for motors) and 1 meter shoulders each side. The types of tool / equipment for Pre-Construction activities can be seen in Table 2.2.

Table 2.2 Equipments in Pre-Construction Stage

No.	Type of Equipment	Unit
1.	Bulldozer	5
2.	Wheel loader	1
3.	Grader	1
4.	Vibro Compactor	3
5.	Dump Truck	40
6.	Backhoe	9
7	Water Tank Truck	3

Source: PT Panca Amara Utama, 2012

Construction of Base Camp

Base camp will be used for workers accommodation, storage of materials or building material, workshop and parking lots for vehicles / heavy equipment. The base camp will be equipped with septic tank, waste bins, and temporary place to accommodating used oil.

Land Preparation, Cut & Fill, Land Grading and Peripheral Fencing

Use of land at the project site is ex community vegetation, mainly coconut tree. Land clearing is initiated by cutting of coconut trees, and other trees such as some cocoa and coffee trees which grow between coconut trees. Relatively old Coconut timber with a height of more than 10 meters will be used for various needs. With such consideration these coconut trees were cut down into three parts. Lower part e.g. from the root-neck up to 1-2 meters, central and the higher parts from the tree point to 1 – 2 meters below.

The mid part is the part which will be used for various requirements. The lower part and higher part are the coconut tree parts which will be thrown away.

If these parts are not benefited by the community for instance for fire-wood, will be piled up at the land location which is not used for factory building. Cutting of coconut trees and other relatively big trees will be carried out by using saw mill.

During land surface peeling, humus layer is cleared by clearing the land surface, by using bulldozer and placed on the land which was planned also as green belt, or open green space, further land leveling is carried out. The aim of land peeling containing this humus is that land underneath which will be constructed as building foundation base or will be made land fill, will become land surface free of organic material like remainder of big trees, remaining plants will be placed at land location which will not be developed, after being dug in advance further land fill will be carried out.

In big outline, site grading for ammonia industry and its supporting facilities area is divided into 2 (two) height levels e.g.: first level will form office premises, access road, and parking lot. This level has a height of approx. 10 meters above sea level (MSL). Second level, forms the zone where plant, electric generator, warehouse, workshop, water processing and waste processing will be developed. This second level has a height of approx. 15 meters above sea level (MSL).

Site grading plan will be arranged in such way so that land being excavated will be as small as possible, and the amount equal to landfill, e.g. by arranging height of surface of most land used for plant area, based on topographical map already made.

Equipment needed in land leveling (cut and fill) and land grading shall be as indicated in Table 2.2 while the period of implementation is estimated to be 6 – 8 months.

Drainage development

Drainage to drain run-off of the project site vis-a-vis topography is gushed into three retention ponds / rainwater harvesting (rainfall pond) in steps. Run-off from the last rainfall ponds shall be discharged to the sea through the drainage channel.

Construction of Peripheral Fence

Peripheral fence will be constructed around the acquired land. The fence adjacent to the Public Road and Settlements is pre-casted concrete fence which serves only as a barrier while border of the land-owned uses Wire Fence.

Overall pre-casted concrete fence and wire fence will be covered with plants such as Bamboo, Mahogany etc. giving high aesthetic value and for green environment, thus improving the air quality, soil erosion and can hold ground water better.

2.2.4.2. Construction Stage

The construction stage includes development of construction jetty, plant foundations, equipment support structures, ammonia storage tanks, ammonia cargo ship harbor and buildings (plant, power plant, workshop, offices, warehouses, water treatment & waste treatment plants etc.). The implementation of this construction will require a ± 2.5 year after site preparation job is completed. The construction work shall require labor mobilization in steps which at its peak can be as maximum as ± 2,000 labors. Description of each of these activities is as follows:

Development of Construction Jetty

The heavy weight plant equipments which will be brought by sea transport (using barges) and unloading of equipments will use construction jetty to be built by PT PAU. Furthermore, the equipment will be transported to the plant area without going through the public road.

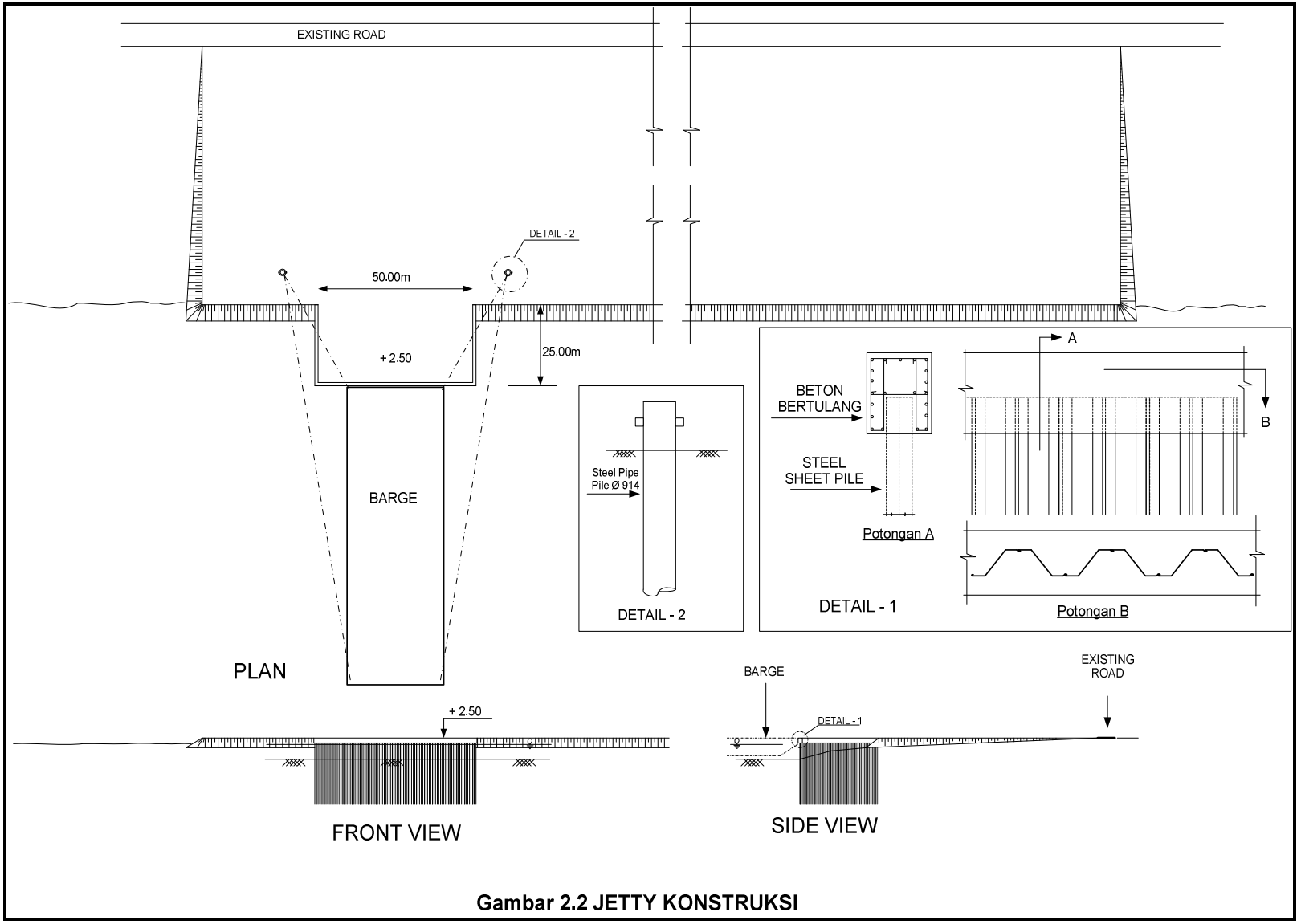
The construction jetty will be developed on the east side of river Musolang considering that the location is just opposite the access road to the plant site and loading & unloading activities in the future will not interfere with the shipment activity of product ammonia.

The construction jetty will be constructed by construction sheet pile with land leveling and compacting the soil. The dimension of jetty to be constructed approximately 50 meters X 25 meters, with a sea depth of 5 meters. The construction jetty will be equipped with land stacking while Lay Down area for the project equipments with a size of 50 meters x 400 meters.

The buildup of land will be leveled and compacted in order to be able to support the heavy equipments stacked for a short while before it is moved to the project site.
The equipment to be used to build the sheet pile is Crane equipped with pile hammer whereas for casting, concrete mixer truck will use a concrete pump. The pictures of Construction Jetty can be seen in Figure 2.2.

Ammonia Shipping Jetty

For shipment of product ammonia, facilities will be developed for mooring ships and loading facilities to transport ammonia through refrigerated liquid cargo ships. The ship shall be capable to harbor a payload capacity of up to ± 44,000 tones of ammonia. For this size of vessel, the ship will require a minimum water depth of 13 meters so that the ammonia shipment facility will be developed at a distance of ± 70 meters from the sea-coast to reach a sea depth of about 15 meters. The ammonia shipment facility will be made of concrete whereas the pile foundation will be made of steel or concrete so as to attain enough supporting capacity. In addition to Port Facility, other office facilities will also be planned such as for administration office, customs and surveyor. Also, fire extinguishing facilities and access road for the ship crews shall be built. The picture of ammonia shipping jetty could be seen in Figure 2.3.



Gambar 2.2 JETTY KONSTRUKSI

Figure 2.2 Construction Jetty

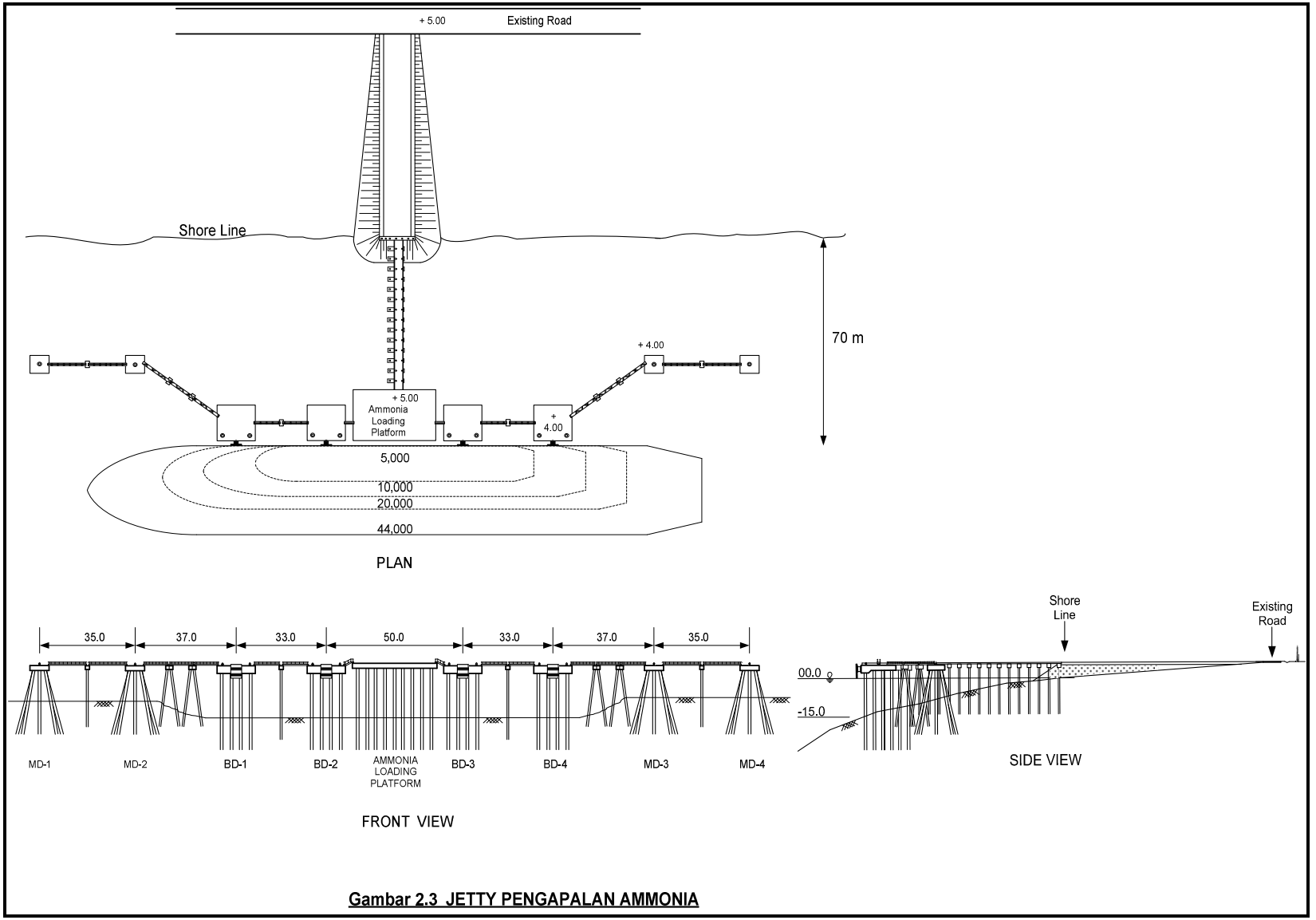


Figure 2.3 Ammonia Cargo Ship Jetty

Gambar 2.3 JETTY PENGAPALAN AMMONIA

Construction of Plant foundations

The plant foundations would be a shallow foundation with reinforced concrete slab and deep foundation using concrete piles.

Construction of Equipment support structure

Equipment support structures shall be made of concrete or steel or a combination of both. Implementation of concrete structural work will require equipment such as mixer truck, concrete pump and vibrator while the steel structure work will require cranes, welding machines and compressors for painting. For some paint job also an open space and equipment for sand blasting will be required. Sand blasting work is needed on the surfaces of steel profiles to be painted to make the surface clean of rust and dirt.

Plant construction

Ammonia industry and supporting facilities include ammonia plant, power plant, ammonia storage tank, workshop, offices, warehouses, water treatment & waste treatment and jetty. The layout of the plant and the building can be seen in the following description of site plan.

Green Belt Development

Green Belt (or, green open space) will be created around the plant. Green open space will serve as a sealing zone (buffer zone), ground water recharge, carbon sink and aesthetics. The species to be planted shall be fast growing local crops, leafy shade i.e. easier to maintain and can be used (e.g. crop-power) such as, mango (Mangifera indica), cashew (Anacardium occidentale), durian (Durio zibethinus), langsat (Lansium domesticum), kayu kambing (Garuga floribunda), Chrysolite (Michelia champaca), nyamplung (Callophyllum inophyllum), katapang (Terminalia catappa), tamarind (Tamarindus indica), walnut (Aleurites molucana), petai cina (Leucaena leucocephala), mara (Macaranga tanarius), bamboo (Gigantochloa sp) and cottonwoods (Ceida pentandra).

Demobilization of heavy equipments

After completion of construction activities equipment / heavy equipment used for the construction like Bulldozer, Wheel loader, Grader, Vibro compactor, Dump Truck, Backhoe and water tank truck will be demobilized. Demobilization of equipment shall be done through same national road connecting Luwuk and Batui which was used for the mobilization of equipment and materials.

2.2.4.3. Operation Stage

Mobilization of Operations Manpower

The number of workers (manpower) directly involved in the operations stage is approximately 300 workers. To reduce layoffs, the manpower on construction activities whose expertise required for the Operations stage will be continuously employed. With regard to the mobilization of labor in the construction phase as well as during the operation stage, priority will certainly be given to the villagers residing at the project site (i.e. village Uso) and surrounding villages. Table 2.3 below roughly shows the manpower plan for the operations stage based on types of jobs, education and the number of people required for each type of job.

Table 2.3. Manpower for Operations Stage

No.	Type of work (*)	Education	No. of Persons
1.	GM / Manager	Academician S1 or S2	10
2.	Superintendent	Academician S1, or Bachelor (D3)	30
3.	Supervisor & Foreman	Academician S1, Bachelor (D3) or High School	50
4.	Operator, Technician	High School / Vocational School / Equal degree	100
5	Outsourcing	High School / Vocational School / Junior High School / Equal degree	110
T o t a l			**300**

Source : PT Panca Amara Utama, 2012

(*) The manpower required for category 1, 2 and 3 are those having the expertise and longer working experience in Ammonia Plant, while for category 4 and 5, it may be filled by a combination of experienced and new workforce.

Ammonia Manufacturing Process

Ammonia is a chemical compound with the formula, NH_3. This compound is generally found in the form of liquid or solution. At room temperature conditions, ammonia is in the form of gas with a characteristics pungent odor (called ammonia smell). Ammonia has several uses such as feedstock for the manufacture of fertilizers and other chemical derivatives.

The commercial use of ammonia is known as anhydrous ammonia. This term indicates the absence of water in the material. Because the boiling point of ammonia is -33ºC at atmospheric conditions, the liquid ammonia at normal temperature should be kept under high pressure or stored at very low temperature -33ºC at an atmospheric pressure conditions.

Figure 2.4 Sample of Ammonia (Laboratory Grade)

The ammonia plant to be constructed shall have a capacity of 2,000 tons / day or ±700,000 tons/year. PT PAU intends to export the excess ammonia that is not absorbed by domestic market.

PT PAU ammonia industry will be set up in the village Uso, sub-district Batui, district Banggai, Central Sulawesi. The construction of plant at this location is based on the following considerations:

1. There are sources / sufficient availability of natural gas feedstock.
2. Plant location is on the coast side that facilitates the process of shipment of ammonia product.
3. From the economic perspective, with the establishment of plant it is expected to absorb the local manpower either directly or indirectly involved or will improve the economy of communities at plant surroundings.

Natural gas is the primary raw material for the production of ammonia in addition to water and air. Besides, natural gas is used as energy source for power plants. Steam reforming of natural gas is the most efficient process for ammonia production and is most widely used, about 70% of the whole existing ammonia production.

The technology for ammonia plant that PT PAU selects is the latest energy saving technology of steam reforming of natural gas.

Ammonia plant is equipped with support units such as power plant, water treatment unit & boiler feed water (for Boilers), steam generation plant, cooling water system, instrument air systems & utility air plant, ammonia storage tank, ammonia shipping jetty ports etc.

Description of Ammonia Manufacturing Process

Flow diagram of ammonia manufacturing process is shown in Figure 2.5 below.

Overall Process

The process reaction of conversion of methane (the major component of natural gas) to manufacture ammonia is given in the equation as follows:

$$0{,}88\ CH_4 + 1{,}26\ Air + 1{,}24\ H_2O \rightarrow 0{,}88\ CO_2 + N_2 + 3\ H_2 \quad (1)$$

$$N_2 + 3H_2 \rightarrow 2\ NH_3 \quad (2)$$

In normal condition, the process of Synthetic Gas production and purification is carried out at a pressure 25 – 35 bar. While for the ammonia synthesis process the pressure is in the range of 100 to 250 bar.

Desulphurization Process

Almost all catalysts used in the manufacturing of ammonia are very sensitive to sulphur and sulphur compounds. Natural gas normally contains sulphur compounds. The feed natural gas is preheated to 350-400 ºC, the heating is normally carried out in the convection zone of Primary Reformer furnace and further processed in a desulphurization vessel. The sulphur compound will be hydrogenated to become H2S using cobalt-molybdenum catalyst (CoMox). H2S compound formed so will then be adsorbed by ZnO catalyst.

$$R\text{-}SH + H_2 \rightarrow H_2S + RH \quad (3)$$

$$H_2S + ZnO \rightarrow ZnS + H_2O \quad (4)$$

With this process, the feed natural gas can be cleaned for sulphur content as low as 0.1 ppm. The hydrogen required for sulphur adsorption reaction usually comes from the recycle flow of synthesis unit.

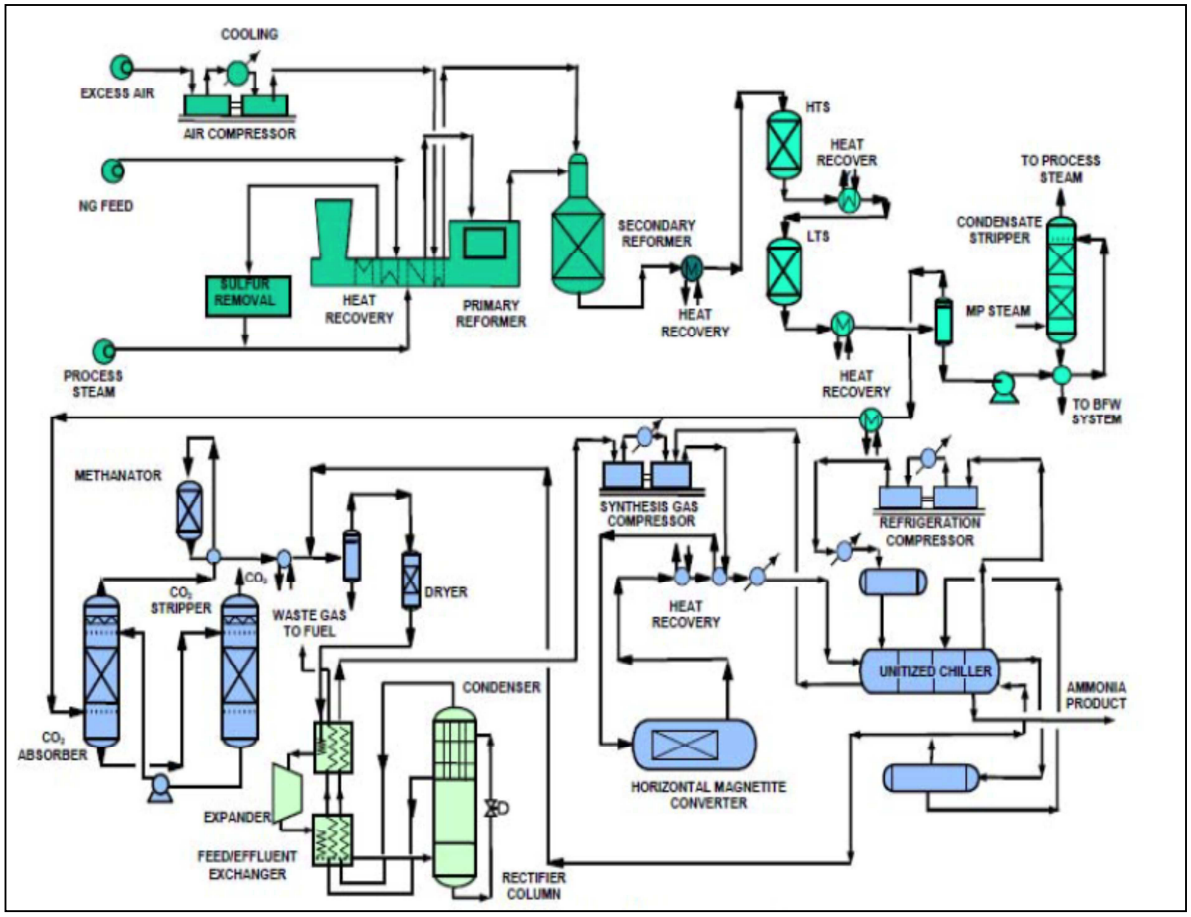


Figure 2.5 Flow diagram of Ammonia Manufacturing Process

Primary Reformer

The natural gas after removal of sulphur containing compounds is mixed with water vapor (steam). The mixed feed i.e. steam & natural gas is then heated to a temperature 500 – 600 ºC in the convection zone of Primary Reformer furnace prior to entering the Primary Reformer reactor.

The ratio of molar amount of steam and carbon (S/C) is normally about 3.2 to 3.4. Optimum steam/carbon ratio depends on several factors such as the quality of feed gas, purge gas recovery, Primary Reformer reactor capacity and steam balance of plant.

The Primary Reformer reactor consists of a nos. of tubes made from an alloy of nickel and chromium filled with catalyst containing nickel. The overall steam reforming reaction is endothermic requiring heat to reach reaction temperature of 780 – 830 ºC.

The composition of the gas exiting Primary Reformer reactor may be known through the chemical equilibrium thermodynamic approach by the following equation:

CH_4 (gas) + H_2O (vapor) → $3H_2$ + CO ΔH º298 = 206 kJ.mol-1 (5)

CO + H_2O → H_2 + CO_2 ΔH º298 = - 41 kJ.mol-1 (6)

The heat required for Steam Reforming process is supplied by the heat from combustion of natural gas in radiant zone. The flue gas exiting radiant zone has temperature more than 900 ºC. Thus, only 50 – 60 % heat of the value of burning fuel is used for the Steam Reforming reaction. The heat carried away by exhaust gases (waste heat) is utilized in the convection zone of Primary Reformer furnace to heat process flow and steam generation system. The fuel required in the process of Steam Reforming is about 40 – 50 % of total feed gas energy.

The flue gas exiting from the convection zone of Primary Reformer furnace has a temperature of 100 – 200 ºC and is a main source of plant emissions. The emissions mainly consists of N_2 (72.5% vol), CO_2 (6.8%), H_2O (19.3%), NOx (60 ppmv) with 3% vol. excess O_2, SOx : < 5 ppmv, CO : < 20 ppmv.

Secondary Reformer

Only 30 – 40 % of hydrocarbon feed is converted in the Primary Reformer reactor. This is caused by the reaction equilibrium has been reached on the actual operating condition. In order to increase the reaction conversion, the reaction temperature must be raised. The Secondary Reformer reactor consists of an internal combustion zone and the steam reforming zone. In the combustion zone, air is entered to provide oxygen for the combustion purpose and to supply nitrogen for ammonia synthesis process.

The process in the Primary Reformer is adjusted so that the air supplied to the Secondary Reformer is in accordance with the heat required in the secondary reformer vis-à-vis H_2/N_2 molar ratio as required by the ammonia synthesis unit.

The air fed into the Secondary Reformer reactor is pre-compressed and heated in the convection zone of Primary Reformer furnace up to a temperature of 600°C. The air is then mixed with the gas coming out from Primary Reformer and pass through the nickel catalysts in Steam Reforming zone. The outlet temperature of Secondary Reformer is around 1,000°C with methane content of about 0.2 – 0.3% (dry basis). Hydrocarbon conversion reached over 99%. The effluent reformed gas from Secondary Reformer is then cooled to 350 – 400 ºC in the Waste Heat Boiler unit (WHB) to produce steam.

Shift Conversion

Synthesis gas from Secondary Reformer contains 12 – 15 mol% CO (dry basis) and almost all the CO must be converted as per the following shift conversion reaction:

$$CO + H_2O = CO_2 + H_2 \qquad \Delta H^{o}298 = -41\ KJ.MOL^{-1} \qquad (7)$$

Shift conversion process is divided into two stages. First, the high temperature shift reaction (High Temperature Shift Converter, HTSC) wherein synthesis gas is passed through a catalyst bed FeO / CrO at a temperature of 400 ºC where CO remains as 3% (dry basis). Reaction at HTSC is limited by chemical thermodynamic equilibrium at the operating conditions. The process gas coming out from HTSC is then cooled before being fed into the second stage i.e. Low Temperature Shift Converter (LTSC).

LTSC reactor is filled with CuO / ZnO catalyst and operated at temperature 200 – 220 ºC. After reaction, the residual CO gas is about 0.2 to 0.4 % (dry basis). Low residual CO gas is very important for the efficiency of process.

CO_2 Removal

Gas exiting LTSC reactor consists of H_2, N_2, CO_2 and saturated water vapors (steam). The gas is cooled to condense all the water vapors before entering the CO_2 absorption system. The condensate normally contains 1,500 – 2,000 ppm ammonia and 800 – 1,200 ppm methanol. Similarly, other components in the condensate are amine, formic acid and acetic acid in very small amount. All these components should be stripped from condensate and / or, recycled in the process.

CO2 gas is absorbed by chemical or physical absorption process. Absorbent solution used in chemical absorption process is usually a solution of amines such as Mono Ethanol amine (MEA), activated Methyl Di-Ethanol amine (aMDEA) or a solution of potassium carbonate. The physical absorbent solution is di-methyl-ether glycol (Selexol), propylene carbonate and others. Process using MEA absorbent solution requires a considerable amount of energy in the regeneration process so it is not recommended.

After removal process, the CO_2 in the synthesis gas is still around 100 – 1,000 ppmv depending on the type and design of the absorption unit. However, with the present good design absorption unit, the CO_2 content in the synthesis gas can be achieved as low as 50 ppmv.

Methanation

Synthesis gas after CO_2 absorption process still contain a small amount of CO_2 and CO which can poison the ammonia synthesis catalyst and must be removed by converting it into CH_4 in the Methanator reactor as per the following reaction equation:

$$CO_2 + 4\ H_2 \rightarrow CH_4 + 2\ H_2O \quad \Delta H°298 = -206\ KJ.mol\text{-}1 \qquad (8)$$

$$CO + 3\ H_2 \rightarrow CH_4 + H_2O \qquad (9)$$

The reaction occurs at 300 ^oC temperature in the Methanator (reactor) containing nickel catalyst. Methane is an inert compound for the synthesis reaction of ammonia but the water vapors are to be separated before entering the synthesis of ammonia.

Gas exiting Methanator reactor is cooled and most of the water vapors are condensed & separated. Eventually, the rest of the water vapors are absorbed in the *make-up* gas dryer unit.

Compressed Gas and Ammonia Synthesis

Modern ammonia plant uses centrifugal compressors to compress the synthesis gas. The compressor is usually driven by steam turbines, where it is taken from the steam produced in the ammonia plant. The synthesis reaction of ammonia occurs in the Ammonia Converter using a catalyst of iron (Fe) in the operating pressure usually between 100-250 bar and temperature 350 – 550 ^oC.

$$N_2 + 3\ H_2 \rightarrow 2\ NH_3 \qquad \Delta H^o_{298} = -46\ kJ.mol\text{-}1 \qquad (10)$$

Conversion achieved in the ammonia synthesis reactor per pass is only 20–30 %. Ammonia formed by cooling or condensing is separated from the gas to be recycled and the amount of gas that has reacted replaced with make-up synthesis gas, thereby maintaining the pressure of synthesis loop. In addition, the ammonia synthesis process requires an effective heat exchange system, due to the exothermic nature of the reaction and the reaction temperature is quite higher in the loop.

The recent developed ammonia synthesis catalyst is ruthenium catalyst in graphite (support) having the per unit volume activity of catalyst much higher and has the ability to increase conversions with lower operating pressure.

Methanation as last step of the gas purification, process producing synthesis gas contains a small amount of inerts such as methane and argon which do not dissolve in the condensed ammonia. Most of these inert compounds are therefore removed by purge from the loop. The purged gas is absorbed first with water to absorb ammonia before being used as fuel or going to the hydrogen recovery unit.

Ammonia condensation process does not take place completely just by cooling with water or air. Therefore, the gas coming out of the ammonia reactor and make-up gas are further cooled with liquid ammonia, so that ammonia will condense and its amount in the gas to be recycled to the ammonia reactor shall be small.

The liquid Ammonia used as a coolant, turning into vapors during cooling process, is disbursed back by compressor.

Description of Utility Units

The utility unit operates as support facility for the ammonia unit. These utility units provide air, steam, electricity and water as supporting material for the ammonia manufacturing process. However, not all utilities for Ammonia plant requirements are fulfilled by the Utilities unit. Steam from the utility unit is required at the time of start-up only while in a normal plant operation, ammonia plant can meet the entire steam requirement on its own.

Utility unit include the following utilities:

1. Plant Air Supply Unit and Instrument Air Unit
2. Sea Water Cooling System Unit
3. Chlorination Unit
4. Sweet Cooling Water Unit
5. Desalination Unit and Polisher Unit
6. Power / Electric Generation Unit

Plant Air Supply Unit and Instrument Air Unit

In general, the air required by ammonia plant is of three types:

a. Process Air, is required as raw material (feedstock) in the ammonia plant
b. Plant Air, is used for miscellaneous utility services, such as cleaning of filters
c. Instrument Air, is used to derive most of the instrumentations in ammonia plant functioning with pneumatic principles.

Utility unit only supplies Plant air and Instrument air, while Process air requirements are fulfilled by the ammonia plant itself. Both Instrument Air & Plant Air are expected to meet the requirements of 8 kg/cm²g pressure, temperature 37°C and free of oil / grease (oil free). The composition of air fed is 78% Nitrogen, 21% Oxygen and the rest inert (Carbon Dioxide, argon, helium etc). While the moisture content is influenced by barometric pressure, temperature and environment conditions.

Before being used, the Instrument Air must be dried first to avoid corrosion to instrument equipments. Either dry or wet the air is marked by Dew Point or temperature where water available in the air is condensed. Once out of the dryer, instrument air is expected to have less Dew Point of -40°C or has a H_2O concentration of less than 128 ppm.

Seawater Unit

Seawater Unit serves as

- *Sweet Cooling Water* (SCW) in *Marine Plate Heat Exchanger* unit and turbine condensers
- Feed to Desalination unit
- Feed to Chlorination unit to produce NaOCl

Chlorination Unit

Chlorination unit is a unit where the sodium hypochlorite is produced from the seawater through electrolysis reaction. Sodium hypochlorite is then used in the initial injection of seawater at sea water intake to kill and inhibit the growth of ocean shells, sea fishes, sea weeds and other micro organisms. As described at sea water pump unit, there are two kinds of sodium hypochlorite injections namely, 1 ppm (continuous dozing) and 10 ppm (shock dozing).

Electrolysis reaction occurs in the electrolyzer cells in which anode and cathode are connected to an electric current in one direction from the rectifier. The reactions are as follows:

- At anode oxidation reaction occurs which causes the release of electrons

  $2NaCl \rightarrow Cl_2 + 2Na + 2e$ (3.1)
- At cathode reaction for receipt of electron takes place

  $2H_2O + 2e \rightarrow 2OH + H2$ (3.2)
- Further, Cl_2 gas and OH ions react to form hypochlorite ion, chlorite ion and water e.g.:

  $Cl_2 + 2OH \rightarrow OCI + Cl + H_2O$ (3.3)
- Overall, electrolysis reaction of seawater is :

  $NaCl + H_2O \rightarrow NaOCl + H_2$ (3.4)

***Sweet Cooling Water* (SCW) unit**

Sweet Cooling Water Unit is a cooling system which uses polished water as cooling media. Sweet Cooling Water is used by two types of user e.g.:

- *Major User*. SCW is used to cool the process gas in ammonia plant
- *Small User*. SCW is used to cool the lube oil (oil cooler) Compressor, Turbine and cooler generator at Gas Engine Electric Generator (or Steam Turbine Generator).

To cool SCW, seawater is required which is directly supplied from the sea water pump. The principle of Seawater as a Coolant is once through which after cooling the SCW, is directly discharged to sea through the *sea water out fall*. Whereas SCW (Sweet Cooling Water) uses the principle of close-loop, as SCW used is cooled by the sea water and then re-circulated as a cooling media. SCW loss that occurs in due course of operation is made-up by using polished water.

Desalination

Desalination unit consists of Sea Water Reverse Osmosis (SWRO) & Brackish Water Reverse Osmosis (BWRO). Reverse osmosis is the principle of separating water and other molecules which are reversible with the actual osmosis events. In normal osmosis, the solvent moves from low solute concentration area to an area of high solute concentration through membranes.

However, reverse-osmosis performs on reverse principle, i.e. movement of solvent from high solute concentration to low solute concentration with the help of pressure Thus in the desalination process, seawater containing high salts will be separated between water and salt.

SWRO and BWRO are connected with filter, pump, analyzer and buffer tank. Before the seawater is processed in BWRO, some stream is branched into drinking water treatment unit, service water system and fire extinguisher system. Desalination water from BWRO then flows to the polisher for further processing to become Boiler Feed Water (BFW).

Water Polishing Unit

Water Polishing Unit is intended to eliminate the minerals contained in the water for further use as Boiler Feed Water or Cooling Water (Sweet Cooling Water). The equipments in the demineralization unit are:

- RC Tank (Raw Condensate tank)
- Mixed Bed Polisher
- Polished Water Tank (Demineralized Water)
- Polished water Pump (for Polished water transfer to the Deaerator)

Mixed Bed Polisher functions to bind anions and cations present in the condensate water and produced desalination water. The water coming out of DM unit has a pH of 6.8 to 7.0

Power Unit

Power generation unit has function to meet the electricity requirements of ammonia plant, utilities, offices and housing. This unit consists of a number of generators using Gas Engine mover. Besides, there is also a back-up electric power generator that uses diesel engine and serves as an emergency generator.

Ammonia Storage Tank and Shipping

Liquid ammonia produced in ammonia plant is directly transferred to storage tank at a temperature of -33°C. Ammonia is stored in two Ammonia Tanks having capacity of 25,000 tons each, with a cooling system to maintain a temperature of -33°C in order to obtain a stable tank conditions at atmospheric pressure.

Design, construction, operation and good maintenance will avoid the possibility of leaks. Ammonia storage tank will be erected at a safe distance from the population residence / housing, schools, hospitals or other public places. Storage system with cooling at low pressure (atmospheric) is much safer for storage of liquid ammonia in larger amount than storing in the pressurized tank.

Types of construction for refrigerated liquid ammonia storage tank that are in line with the International Safety Standards and Codes are:

- Single containment tank with a single wall and insulated on the outside of the tank.
- Single containment double walled tank. This type of storage tank has two vertical walls. Between the two walls, there is insulation and roof rests on the outer wall of the tank. The inner walls are designed to be capable to withstand the entire weight of liquid ammonia in the tank.
- Double containment tank with double walls is designed for both walls to be able to withstand the entire load of liquid ammonia in the tank and the tank roof rests on the inner and outer walls of tank.

Ammonia storage tank to be constructed by PAU is single containment with double walled tank that have been proven safe for use by most of the ammonia plants including those in Indonesia.

Ammonia Shipping

Shipment of ammonia uses a special ship equipped with refrigeration system that is capable to maintain liquid ammonia temperature stable at -33°C and atmospheric pressure. For this reason, transfer of ammonia from storage tank to the ammonia transport ship (tanker) is done through piping system which is insulated and equipped with refrigerant system to maintain the temperature of ammonia stable at -33°C and to ensure the reliability & safety of operation of the ammonia transfer system from the tank to the ship.

Feed Stock

The natural gas requirement as feed stock for modern ammonia plant with conventional reforming technology is equivalent to 20.9 MMBtu / ton-NH_3.

Fuel

The assumption that ammonia plant is stand alone and without export & import of energy except raw material and fuel, the fuel required for the synthesis of ammonia with conventional reforming process is 6.8 to 8.5 MMBtu / ton-NH_3.

Water and Air

In the process of steam reforming, process steam is taken from the steam generating system, usually from the turbine-extraction. The consumption based on stoichiometry is 0.6 – 0.7 kg-steam/kg-NH_3 with total supply of steam to carbon (S/C) of 3.0 or about 1.5 kg-steam/kg-NH_3.

Supply of Process Air:

In the conventional Steam Reforming, the supply of nitrogen is equal to nitrogen content in ammonia coupled with in-purging nitrogen i.e. about 0.85 kg-N_2/kg-NH_3 or, about 1.1 kg–air/kg-NH_3.

Boiler Feed Water:

Assuming that all steam condensate is recycled & consumption of process steam only is to be replaced with make-up water, consumption of boiler feed water is as much as 0.7 – 1.5 kg/kg-NH_3.

Absorbent solution and Additive substance

Consumption of absorbent solution for absorbing CO_2 in the absorber unit usually ranges between 0.02 to 0.04 kg/ton–NH_3. Absorbent solution experience losses caused by the leak, if any.

The standard / general method is used for the preparation of boiler feed water. And the usual consumption of treatment additives and regeneration chemicals is used for resin regeneration.

Catalyst

The consumption of catalysts in an ammonia plant with conventional Steam Reforming process of natural gas feedstock with a capacity of 2,000 tons ammonia / day is presented in the following Table 2.4

Table 2.4 Catalyst requirement

Catalyst Type	Catalyst Volume (m3)	Catalyst Expected Life (year)
Hydro desulphurization	20	4
Sulphur absorption	70	2
Primary Reforming	33	6
Secondary Reforming	27	6
HTSC	59	4
LTSC	103	4
Methanation	37	8
Ammonia Synthesis	98	10

Source: PT Panca Amara Utama, 2012

Product Ammonia

Ammonia plant to be built has a capacity of 2,000 tons ammonia / day. The ammonia produced is in liquid form with purity of 99,9%.

Emissions and Waste

Emissions discharged into the air

The emissions released into the environment from ammonia plant are from:

- Flue gas from the primary reformer
- Gas effluent from the CO2 absorber unit
- Purge and flash gases from ammonia synthesis unit (used as a supplementary fuel for primary reformer unit)
- Non-Continuous emissions (venting and flaring)

Flue gas from the *Primary Reformer*

Flue gases from the ammonia plant with a capacity of 2,000 tons / day has a flow rate of approximately 257,870 kg/hour, with very low emission compositions of pollutant gases as shown in the following Table 2.5:

Table2.5. Emission Composition from *Primary Reformer*

Parameter		Concentration
1.	NOx	60 ppmv
2.	SOx	<5 ppmv
3	CO	<20 ppmv
4	CO2	28.387 Kg/hr

Source: PT Panca Amara Utama, 2012

In the ammonia plant to be built, NOx emissions from the Primary Reformer has been sought as low as possible by using the latest technology i.e. installation of Purifier and Reformer Exchanger units which are capable to reduce operating temperatures and increase the efficiency of the reaction in the Primary Reformer. SO_2 emission from the combustion of natural gas is very low because the natural gas being used is of very good quality due to very low sulphur content.

Gas Emission from the CO_2 Absorption Unit

The emissions from the CO_2 absorption unit of ammonia plant are released into the air by an amount of 100,872 kg / hour having following composition: CO_2 = 99.82% vol, N_2 = 0.02% vol, CH_4 = 0.01%vol and H_2 = 0.15% vol.

The emitted CO2 gas may be used as food grade CO_2 widely used in the beverage industry and as dry ice for food preservation and fisheries.

***Purge* and *Flash* Gas**

Purge and *flash* gases from the ammonia synthesis are normally washed using water to absorb the ammonia before off-gas is applied to the Primary Reformer fuel system. Off-gas is then used as a fuel and combustion gases resulting from the burning form part of the flue gas from the primary reformer furnace. Absorption of ammonia from the off-gases is very important for reducing NOx emissions.

Non-continuous Emissions

During start-up, shutdown or trip conditions of plant, gaseous emissions will occur that are drawn to the centralized flare stack system with sufficient height to reduce the impact of air pollution.

Liquid Waste

Liquid wastes from the plant during normal operating conditions consist of sources such as ammonia plant, chemical storage, ion exchangers and utilities. The amount and composition of each liquid-waste source can be seen in Table 2.6 below:

Table 2.6 Composition of Waste Effluent from Ammonia Process

Source	Discharge m^3/hour	pH	TSS mg/l	COD mg/l	NH_4^+ mg/l	Oil mg/l
Ammonia plant	4,7	6,5 - 9,5	5	29	3	0,2
Utilities	10,7	3 - 10	13	12	7	0,3
Total Waste	15,4*	6 - 9	5	17	6	0,3

Source: PT Panca Amara Utama, 2012

Whereas the composition for domestic liquid wastes from offices, housing, canteens, guest houses, religious facilities, clinics and other facilities in the factory and housing complex can be seen in Table 2.7 below.

Table 2.7 Composition of Domestic Wastes

Source	Discharge m^3/hour	TSS mg/l	TDS mg/l	COD mg/l	BODs mg/l	$NH4^+$ mg/l	N (Total) mg/l
Domestic liquid waste	5	50	30	100	50	30	30

Source: PT Panca Amara Utama, 2006

Besides domestic waste water, the ammonia plant also releases liquid waste from the once through sea water cooling water system and desalination unit. The maximum discharge from once through sea water is ± 22,000 m^3/hour whereas the composition of cooling water discharges and desalination effluents are balanced with the incoming.

Cooling water system used in the industry has been designed so that increase in the temperature of cooling water returning to the sea is less than 10°C.

The above mentioned liquid wastes are further processed in Waste Water Treatment facility that consists of:

- Screen, which is a filtering tool so that waste does not enter to Waste Water Treatment Plant.
- Oil Trap which has function to trap oil.
- Bulk of sediment sludge that serves to trap silt carried along with suspended solid matters so as to reduce it to minimum possible.
- Chemical injection that serves to neutralize the pH of the liquid waste.
- With the Waste Water Treatment Plant's facilities, the liquid waste water is processed properly to meet applicable environment quality standards.

Solid Waste

Ammonia plant to be built does not generate solid waste during operation. During turn-around of plant which is planned once every two years, the plant may produce solid waste in the form of catalyst which has completed its lifespan.

The spent catalyst will be returned to the catalyst manufacturer for processing for the catalyst recycling or for safe disposal of catalyst waste.

For provisional handling of spent catalyst, it is stored in accordance of laid out procedures. The containers used to temporarily store spent catalysts will be placed in the building to protect the containers from direct sunlight and rain-water. This building must be dry, have concreted floors and sufficient ventilation.

The area around this building must be marked as restricted area. The used catalysts have a high economic value so that economically viable for re-export. Management & handling of spent catalysts refers to the PP No. 85 of year 1999 and decree Bapedal Head, No. 01/Bapedal/09/1995. The catalysts have a variable amount and have a certain life-span for each stage of the process.

Further in the process of polishing unit for producing Boiler Feed Water, solid wastes generated are non-toxic and harmless i.e. resins of an amount of 25 – 30 m^3 with resin replacement time at an interval of approximately 5 years. Another source of solid waste is from the instrument air drying unit in the form of silica gel amounting to 2 m^3 per 5 years.

Management of Health, Safety and Environment (HSE)

Management of health, safety and environment (HSE) will apply: policies, HSE management programs, Standard Operating Procedure (SOP), response plan for emergency & disaster situations and training.

2.2.4.4. Post Operation

The production of Ammonia is a continuous activity. However, in the event of force-majeure condition, such as termination of gas supply, the operation of ammonia plant will stop and facilities owned by the ammonia plant will be utilized to the maximum possible extent according to the conditions in the future that are deemed most beneficial:

- Ammonia shipping jetty will be used as a special harbor to serve the loading & unloading of bulk liquid ships.
- Ammonia tank can be used as a storage tank for all kind of liquid products.

- The power plant can be used to cater the electricity needs of around locations ex ammonia plant.
- Office and warehouse premises may be used for other parts.
- Water treatment units can be used to cater the needs of the surrounding community.

2.3. Alternatives that will be assessed in the EIA

The EIA study of this Ammonia Industry Development, does not consider other alternatives because it is only updated and continuation of plan that has already been assessed in the previous EIA Studies where no change of any type occur such as location, type of product, capacity, process technology and supporting facilities.

2.4. Relationship between Business Plan and/or Activity with other Business Activities around

Activities in the vicinity of construction of ammonia industry and supporting facilities PT Panca Amara Utama are settlements, gardens, secondary forests and LNG plant owned by PT Donggi Senoro LNG (DSLNG) which is currently in the construction phase. The existence of this LNG project causes the increasing volume of traffic, employment and business opportunities for the surrounding communities as similar to the influence of project, Ammonia industry and supporting facility.

CHAPTER III

INITIAL ENVIRONMENT CONDITIION

3.1. Physic Chemical

3.1.1. Climate and Air Quality

3.1.1.1. Climate

- **Type of climate**

Based on Schmidt and Ferguson classification the type of climate in the study region belongs to A climate type e.g. value of Q < 0,143. Q value shows comparison between dry months and wet months (ratio of dry and wet months). The meaning of dry month if the average rainfalls less than 60 mm/month whereas wet month if the average rainfalls more than 100 mm/month.

- **Rainfall**

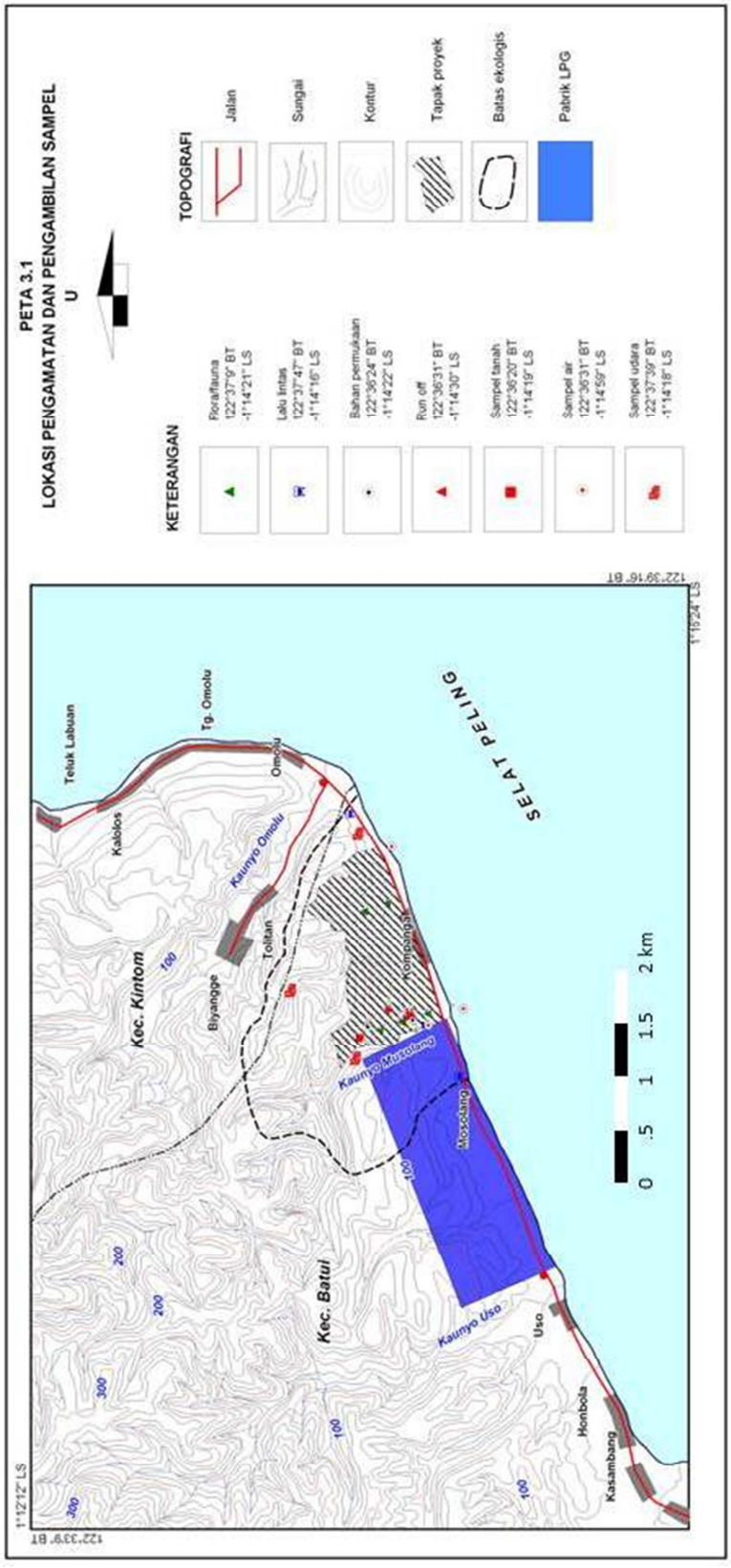
Rainfall in the study region is 1.485,9 mm/year, wet months (rainfall > 100 mm/month) occurs during January until August and December. Humid months (rainfall 60-100 mm) occur in September and November. While dry months (rainfall < 60 mm/month) occurs in October. For more information please see Table 3.1

- **Temperature and air humidity**

Air temperature average is 29.8℃, lowest air temper ature 26.4℃ and highest air temperature 31,4° C while air humidity range is 73 – 90 %.

3.1.1.2. Air Quality

In order to obtain Air Quality during initial condition (prior to development of Ammonia Plant), air samples are collected from 3 (three) locations, i.e. at the western side of project site (ST U-01), at the eastern side of project site (ST U-02) and at the project site (ST U-03). Further, the air samples are analyzed in the laboratory. Location of air sample collected can be seen on Map 3.1. Table 3.2 shows the laboratory analysis of the 3 (three) air samples obtained from the three locations and Table 3.3shows result of analysis of air sample at ANDAL previously.



Map 3.1 Location of Sampling Laboratory Analysis and Observation

Tabel 3.1. Curah Hujan Di Wilayah Studi Tahun 2000-2011

Tahun / Bulan	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Jumlah	Rata-rata
Jan	65	169	138	95	106	38	114,1	39,7	74,8	221,0	55,2	121,8	1.237,6	103,1
Feb	185	94	122	127	72	105	54,7	64,1	163,3	72,8	3,4	264,1	1.327,4	110,6
Maret	141	204	95	272	131	193	179,8	153,0	170,5	123,1	96,0	62,5	1.820,9	151,7
April	90	172	62	55	66	99	145,4	196,4	197,6	164,1	119,6	148,9	1.516,0	126,3
Mei	134	144	142	128	119	188	56,6	149,1	182,8	73,6	230,4	114,6	1.662,1	138,5
Juni	259	174	340	74	235	127	566,7	148,5	163,2	123,5	148,2	150,3	2.509,4	209,1
Juli	162	161	53	149	148	143	42,4	235,4	465,8	56,6	130,4	228,5	1.975,1	164,6
Agt	163	45	11	68	6	-	69,0	137,8	331,9	48,7	182,6	59,4	1.122,4	102,0
Sept	95	128	0	26	34	-	38,3	20,1	94,0	6,4	87,7	122,5	652,0	59,3
Okt	87	82	0	13	9	-	0,0	13,5	110,3	8,8	86,5	22,7	432,8	39,3
Nop	57	114	59	56	35	-	20,1	73,7	196,2	73,1	65,3	65,9	815,3	74,1
Des	44	58	181	102	90	-	116,7	129,1	119,2	54,1	284,9	95,0	1.274,0	115,8
Jumlah	1.482	1.545	1.203	1.165	1.051	893	1.403,8	1.360,4	2.269,6	1.025,8	1.490,2	1.456,2	16.345,0	1.485,9

Sumber : Stasiun Meteorologi Bubung-Luwuk, Badan Meteorologi Klimatologi dan Geofisika, 2000-2011.

Table3.2 Result of Measurement of Air Quality in the Study Location

No.	Parameter	Unit	ST U-01	ST U-02	ST U-03	Quality Standard
1.	**Climate**					
1.1.	Temperature	℃	31	31	31	
1.2.	Wind rate	m/second	1,6	3,4	1,5	
1.3.	Humidity	%	74	78	74	
2.	**Pollutant**					
2.1	NO_2	µg/Nm³	19,03	6,72	11,04	400 *
2.2	SO_2	µg/Nm³	24.18	10.64	14,61	900*
2.3	CO	µg/Nm³	182,9	92,1	136,7	30.000*
2.4	Dust	µg/Nm³	798,4	64,8	67,5	230*
2.5	Particulate Matter ($PM_{2,5}$)	µg/Nm³	003	0,003	0,01	150*
2.6	$PM_{2,5}$	µg/Nm³	-	-	-	65*
2.7	Leads	µg/Nm³	0,002	t t	0,001	2*
3	**Odor**					
3.1.	NH_3	ppm	0,001	t t	0,001	**2.00****
3.2.	H_2S	ppm	t t	t t	t t	**0,02****

Source : Primary data,2012

**) RI Government Regulation No. 41 of 1999 concerning Control of Air Pollution*

***) Decree State Minister of Environment No: Kep-50 /MENLH/11/1996 concerning quality of odor level*

From result of laboratory analysis the condition of air quality in the project site and its surroundings is described as follows:

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is a reactive compound and easily decomposed by sunrays, so that NO_2 concentration in the air will be influenced by their source intensity and meteorological factor, and also influenced by the intensity of sunrays radiation.

Measurement carried out at the project site (3 locations) during 1 hour shows that NO_2 concentration value is 6,72 – 19,03 g/Nm^{3,}, the lowest NO_2 is found on the project site 6,72 g/Nm^{3,} while the highest concentration at the eastern side of the project site with a concentration of 19,03 g/Nm^3. Value of this NO_2 if compared with the standard air quality based on Government Regulation No. 41 of 1999 for parameter of gas NO_2 = 400 µg/Nm^3 (measurement duration is 1 hour) and NO_2 = 150 µg/Nm^3 (measurement duration 24 hours), then the result of measurement carried out in 3 (three) locations still conform to those Government standard quality for NO_2.

Sulphur dioxide (SO_2)

The emission source of sulphur dioxide may derive from burning process of motorcycle fuel and from burnt garbage waste. On the atmosphere, due to humidity and rain water, the sulphur dioxide will be transformed into sulphuric acid which then fall down to the ground.

The measurement result of SO_2 gas carried out in 3 (three) locations during 1 hour is 10,64 – 24,18 µg/Nm^3. This sulphur dioxide concentration, if compared with standard quality of ambient air quality based on Government Regulation No. 41 of 1999, for parameter gas SO_2 which is respectively 900 µg/Nm^3 (measurement duration of 1 hour) and 365 µg/Nm^3 (measurement duration of 24 hours), then the result of measurement in 3 (three) locations at Plant Site still fulfill the standard air quality.

Carbon monoxide (CO)

Carbon monoxide gas in 3 (three) locations during 1 hour measurement shows that concentration of CO 92,1 µg/Nm^3 until 182,9 µ g/Nm^3, the lowest gas CO concentration is at project site while the highest CO concentration is at the eastern side of the project.

When compared with ambient air standard quality based on Government Regulation No.41 of 1999 concerning Control of Air Pollution, (for parameter of gas CO = 30,000 µg/Nm^3 – measurement of 1 hour) and gas CO = 10,000 µg/Nm^3 – measurement duration of 24 hours), then the gas CO concentration in 3 (three) locations still fulfills the standard air quality.

Dust

Measurement of dust content is carried out in three locations e.g. project site, eastern side of project site and western side of project site. Result of measurement og dust concentration at the study area during 1 hour ranges between 64,8 µg/Nm^3 until 79,4 µg/Nm^3. result of measurement of dust concentration compared with the standard quality based on Government Regulation No. 4 of 1999 concerning Control of Air Pollution (for dust parameter = 230 µg/Nm^3 for a duration of 24 hours), the dust concentration at the whole plant area still fulfill the base quality.

Particulate Matter 10 (PM_{10})

Result of concentration measurement PM_{10} at the plant site location during 1 hour is 0.03 µg/Nm^3 until 0,02 µg/Nm^3. Result of measurement of ambient air quality when compared with standard quality based on Government Regulation No. 4 of 1999 concerning Control of Air Pollution (for parameter PM_{10} = 150 µg/Nm^3 – measurement duration of 24 hours) the PM_{10} concentration at the Plant Site location still fulfill the standard quality.

Metal (Pb)

Metal content at the entire study location during 1 hour value was not detected (tt) until 0,002 g/Nm^3. Result of measurement of ambient air quality compared with standard quality based on Government Regulation No. 41 of 1999 concerning Control Of Air Pollution (for parameter Pb = 2 µg/Nm^3 – measurement duration of 24 hours), Pb concentration at the whole measurement location value still fulfill the standard quality.

Ammonia (NH3)

Measurement of ammonia concentration (NH_3) at the study location has not been detected (tt) – 0,001 ppm which shows that gas concentration at the study location is relatively small, and was predicted that at the study location not much solid waste has been produced

H_2S

H_2S concentration was not detected; this is probably because there is no organic waste disposal (solid waste and domestic waste) in the surrounding human settlements or house yards.

Noise

Measurement of noise intensity at the study location (its location is similar to the location of measurement of air quality, carried out in 3 (three) locations, e.g.at the western side of the project, at the eastern side of the project, and at the project site.

Based on the measurements it was understood that noise level is 49 – 69 dBA (Table 3.3). Further, based on the standard quality of noise according to Kep. MENLH No. 48 of 1996, noise at the study location still fulfill the standard quality, except at the project site, with a noise quality of 69 dBA. The high noise intensity is caused by the influence of passing vehicles. The location of noise measurement at the project site is carried out at people settlement in Kampung Musolang, which is located on the side of a State Road.

Table3.3 Result of Noise Intensity at the Study Location

No.	Measurement location	Minimum (dBA)	Maximum (dBA)	Standard Quality (dBA)
1	At the west side of the project	49	54	55
2	At the east side of the project	49	53	55
3	At the project site	51	69	55

Standard quality of noise : Kep MENLH No 48 year 1996

Source : Primary Data, 2012

3.1.2. Hydrology and water quality

3.1.2.1 Rainfall Catchment Area (DTH) and River Discharge

Rivers found in the study area forms a bifurcating flow pattern (dentifrice), flowing from the north-west to the south-west and finally drain at Selat Peling. Several main rivers e.g. Sungai (Kaunyo) Kayang, Sungai Bakung, Sungai Batui, Sungai Uso, Sungai Musolang, Sungai Omulu, Sungai Kinon, Sungai Mendono and Sungai Muntuan. Based on border at rainfall catchment area, where rainfall falls on the project site, and received in the river existing around is Sungai Musolang or rainfall Catchment Area Musolang. This Catchment Area Musolang is the ecological border for surface water. Debit of Sungai Musolang during the study (May 2012) is 5,2 liters/sec. According to information obtained from local people, during dry season, debit of Musolang River has sharply reduced, although at the lower downstream it is still watering. The source of water derived from the aquifer which is topography cut off i.e. at the aquifer located between limestone and conglomerate. Musolang River has not yet been used by the community for drinking water or agriculture.

3.1.2.2 Water Balance

Water Balance component covers rainfall, evapo-transpiration, run-off and infiltration. The amount of water balance component is as follows:

- **Rainfall**

Based on rainfall data obtained from the nearby Meteorology, Climatology and Geophysics Station of Bubung Luwuk, Agency of Meteorology, Climatology and Geophysics, 2000 – 2011) the monthly average rainfall and the number of day of rainfall, can be seen from Table 3.5. From this table, the amount of yearly rainy days could also be seen as 1.485,9 mm, the amount of yearly rainy days is 199 and average rain fall per day is 7.46 mm.

Table 3.4 Average Rainfall and Rainy Days During 2011.

Month	Amount of rains (mm)	Total amount of rainy days
January	103,1	15
February	110,6	12
March	151,7	19
April	126,3	21
May	138,5	19
June	209,1	20
July	164,6	19
August	102,0	22
September	59,3	14
October	39,3	9
November	74,1	12
December	115,8	17
T o t a l	1.485,9	199

Source : Bubung Luwuk Meteorological Station, Climatology and Geophysics Meteorology Agency, 2011

- **Evapo-transpiration**

Evapo-transpiration is a mix of evaporation and transpiration. Evaporation is a direct vaporizing of water, either water physically sticky on the vegetation or contained on land surface. Whereas transpiration is the water vaporizing through the plants vegetation.

Utilization of land at the project site was mostly as coconut trees). In order to understand coconut tree evaporation it is being carried out by comparing with forest evaporation, referring to comparison of land usage evaporation according to Engler (in Seyhan, 1977) e.g. that the ratio of **forest : agriculture : grass evaporation is 1 : 0.43 : 0.42.**

The amount of forest evaporation measured by using Turc formula is :

$$ET\ tahun = \frac{P}{\left[0{,}9 + \left(\frac{P}{ft}\right)^2\right]^{0,5}}$$

where:

ET = yearly forest evapo-transpiration

P = annual rainfall

Ft = temperature function =300 + 25t + $0{,}5t^{0,3}$, is the average annual temperature at Celsius degree.

The amount of annual rainfall at the study location is 2,485.9 mm with an average annual air temperature of 29,8℃, the amount of annual forest transpiration is 1,062.69 mm or 71,58% of the rainfall. Orchard evaporation (agriculture) was estimated by comparing with forest evaporation, refers to evaporation ratio of the land usage according to Engler (in Seyhan, 19767) e.g. that the ratio among forest: agriculture: grass is 1 : 0.43 : 0.42. By such annual evapo-transpiration of agriculture (coconut tree) is 456,95 mm or 30,75% of rainfall.

- **Run-off and Garden Infiltration**

Run-off is a surface flows from a high place to a lower place. While infiltration is the penetration of rain water into the soil. Generally, rain water enter into the soil (infiltration), filling the aquifer and further kept in the aquifer and comes out as spring. The amount of run-off from coconut field was understood through field measurement. Amount of infiltration counted based on water balance formula, e..g.

I = 100% - Cr – Cet.

Where,

I = infiltration (%), Cr = run-off coefficient (%) and Cet = Evapo-transpiration coefficient (%).

Refer to Drawing 3.1, run-off coefficient of the slope =< 8%, > 8 – 15 %, 15 – 30% and > 30% such as can be seen on Table 3.6.

Dwg. 3.1. Coefficient of Run-Off Coconut Tree

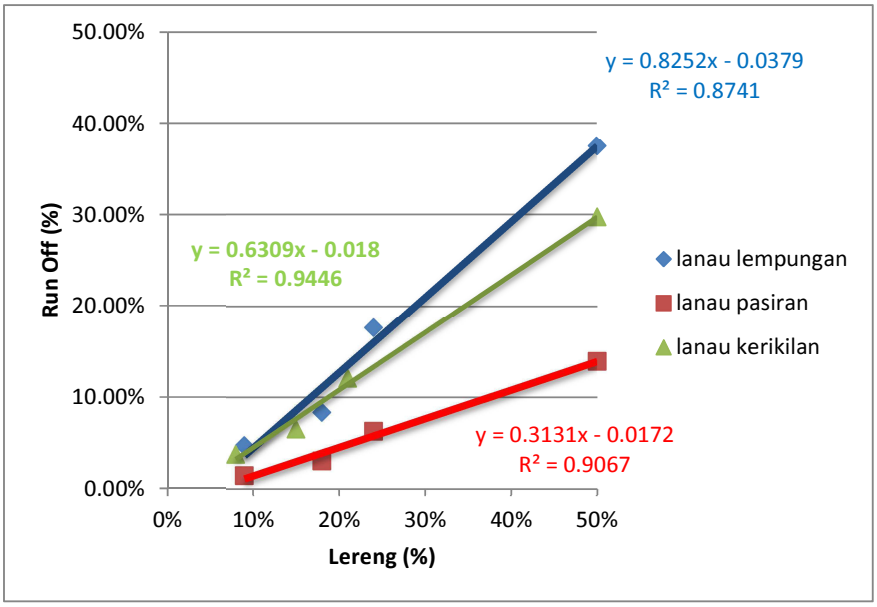


Table 3.5. Coefficient Run-off Coconut Trees at various Slope Zone and Surface Material

No.	Slope Gradient (%)	Coefficient Run-off (%)
Sand Mere		
1	≤ 8%	1,24
2	>8-15%	3,58
3	>15-30%	7,03
4	>30%	10,94
Graveled Silty		
1	≤ 8%	2,51
2	>8-15%	7,24
3	>15-30%	14,18
4	>30%	22,06
Silty Mere		
1	≤ 8%	3,28
2	>8-15%	9,49
3	>15-30%	18,60
4	>30%	28,96

Source: Primer Data, 2012

Table3.6 Coefficient of Coconut Infiltration at Several Slope Zones and Surface Material

No.	Slope gradient (%)	Infiltration coefficient (%)
Sand mire		
1	< 8%	68,01
2	< 8-15	65,67
3	> 15-30%	62,22
4	> 30%	58.31
Graveled silt		
1	< 8%	66,74
2	> 8-15%	62,01
3	> 15-30%	55,07
4	> 30%	47,19
Silty mire		
1	< 8%	65,97
2	> 8-15%	59,76
3	> 15-30 %	50,65
4	> 30%	40,29

Source : Primary Data, 2012

- **Initial water balance condition**

Water balance shows evaporation condition, run-off and infiltration at the project site. As understood this condition is being influenced by rain condition, type of soil, slopes and land usage. Average annual rainfall in the region of project site is 1,485.9 mm/year. The rate of evaporation and infiltration run-off, are estimated on each section of the land which reflect the difference of surface material, slope and land usage condition. The system of making sectional of land by overlap of each variable of surface material, slope and the land usage (Drawing 3.1), Surface Material Map (Map 3.2), Slope Map (Map 3.3), and Land usage Map (Map 3.4). Map 3.5 shows Project Site Land Sectional.

The amount of run-off and infiltration volume of every land section is counted by using the following formula :

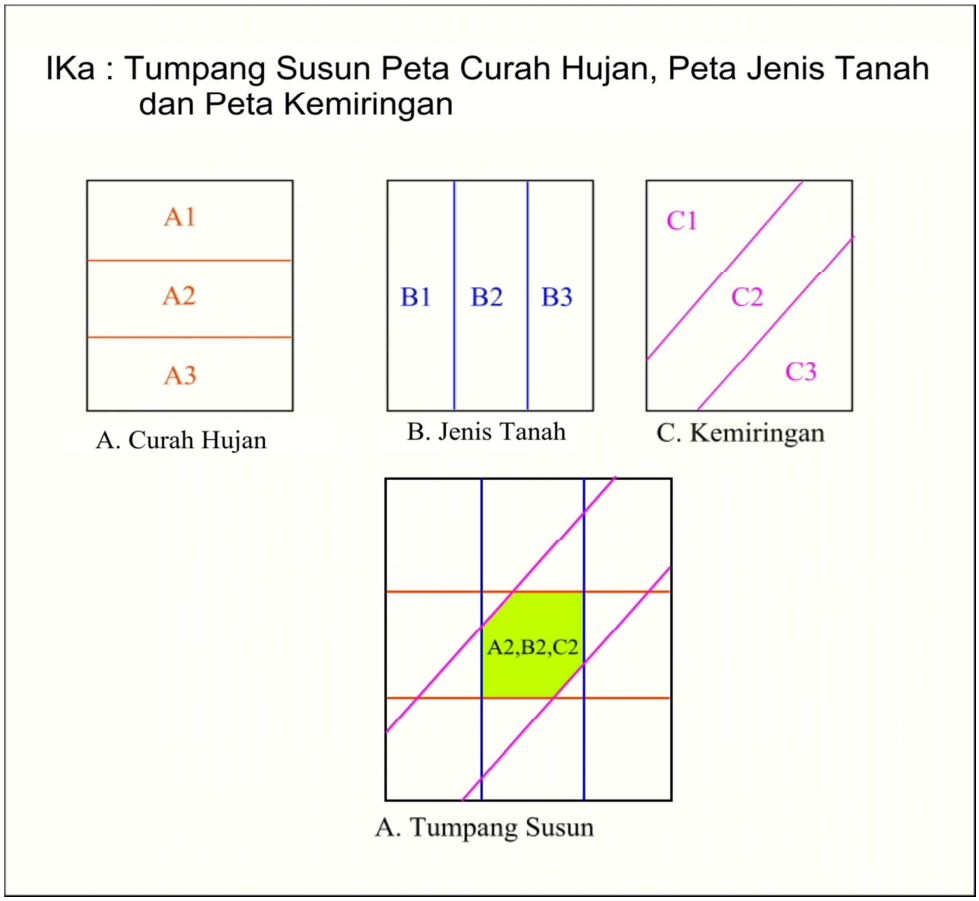
$$Vr = P \times L \times Cr$$

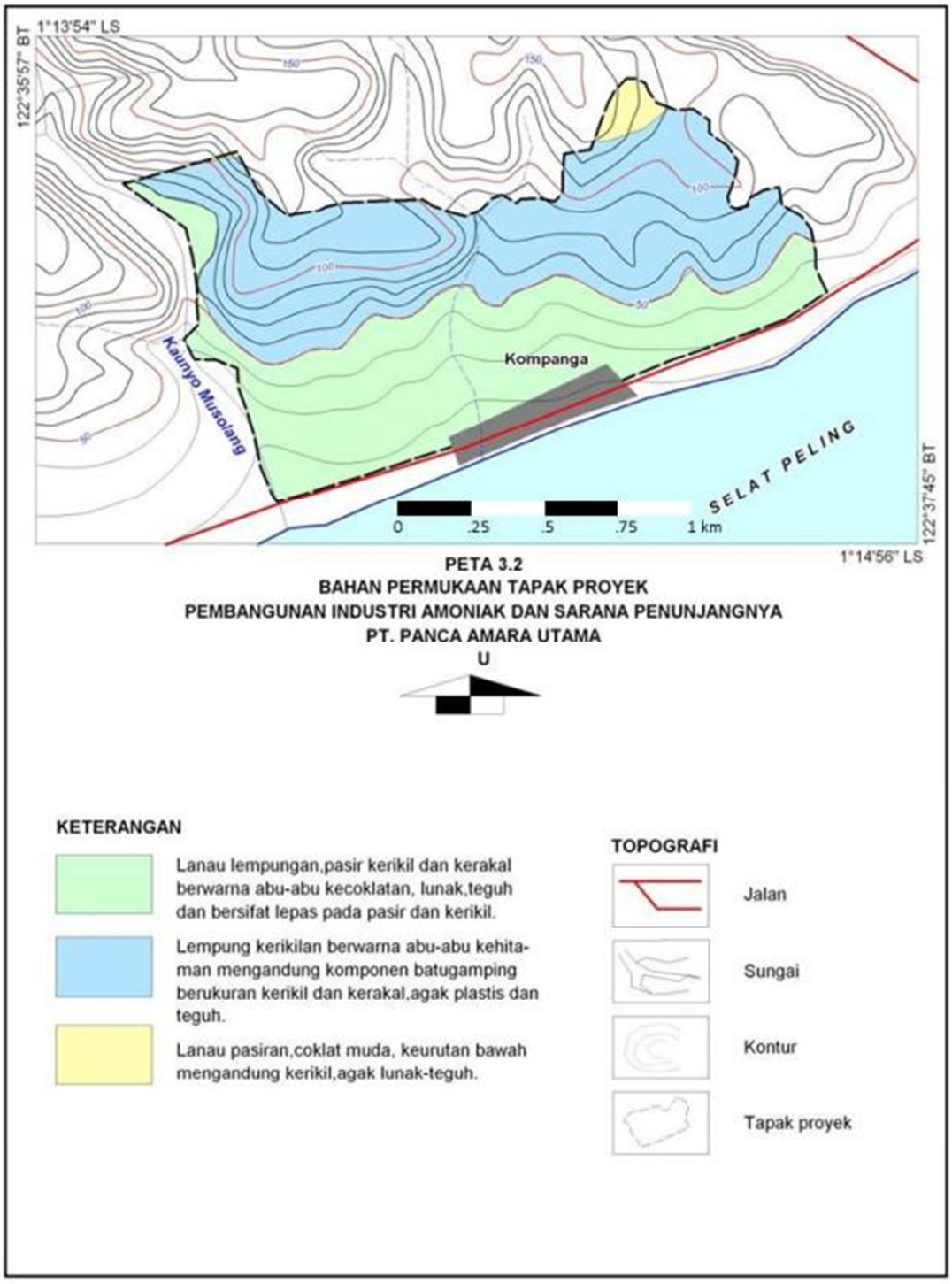
$$Vi = P \times L \times Ci$$

Where:

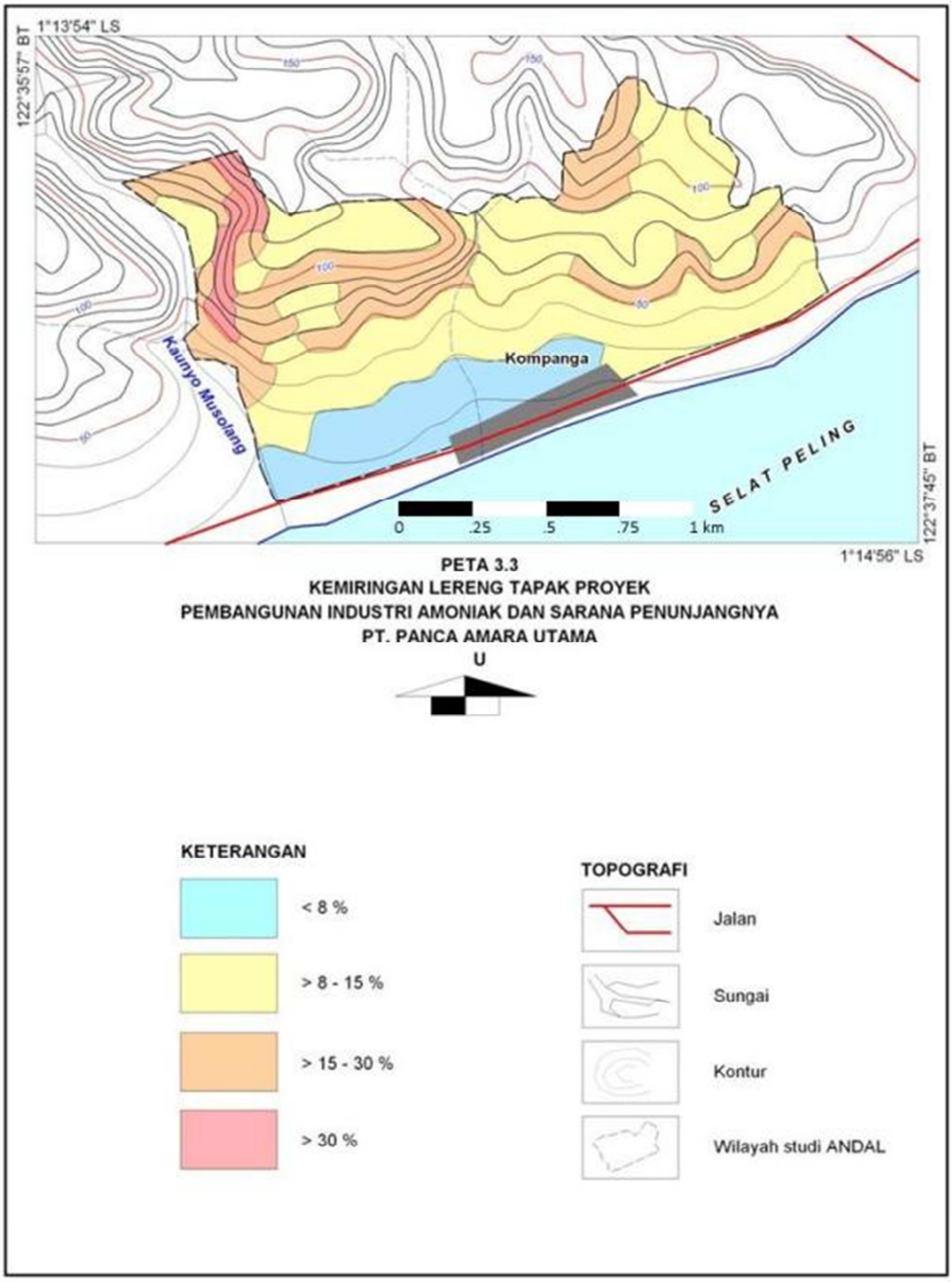
Vr = run-off volume of each sectional of land, $m^{3/}$year
Vi = infiltration volume of each sectional of land ,$m^{3/}$year
P = annual rainfall, e.g. 1,485.9 mm (1,4859 M)
L = width of each sectional of land ($m^{2)}$
Cr = run-off coefficient of each sectional of land (%)
Ci = infiltration coefficient of each land unit

Drawing 3.2. Methode Overlapping to provide Sectional Land

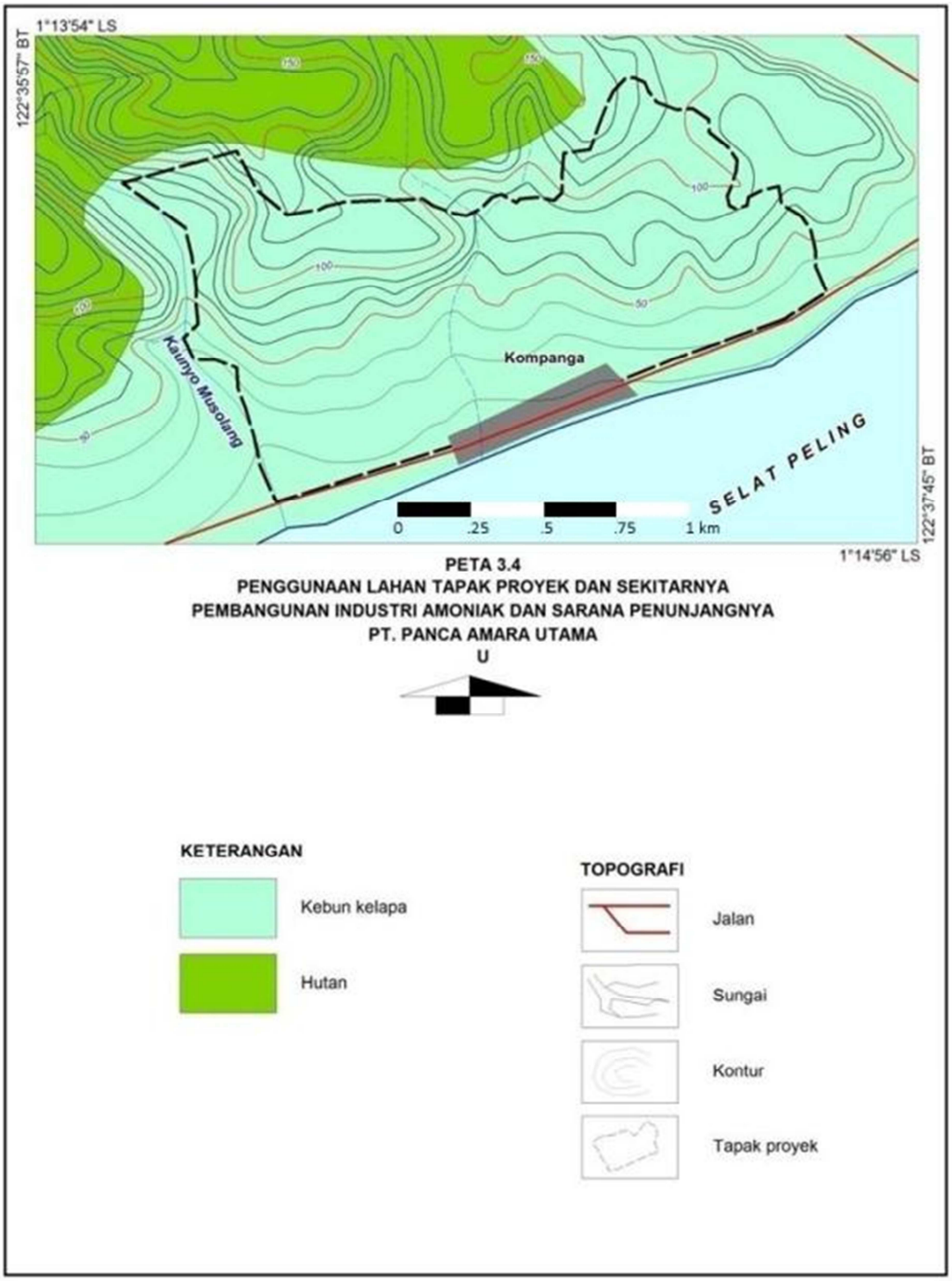




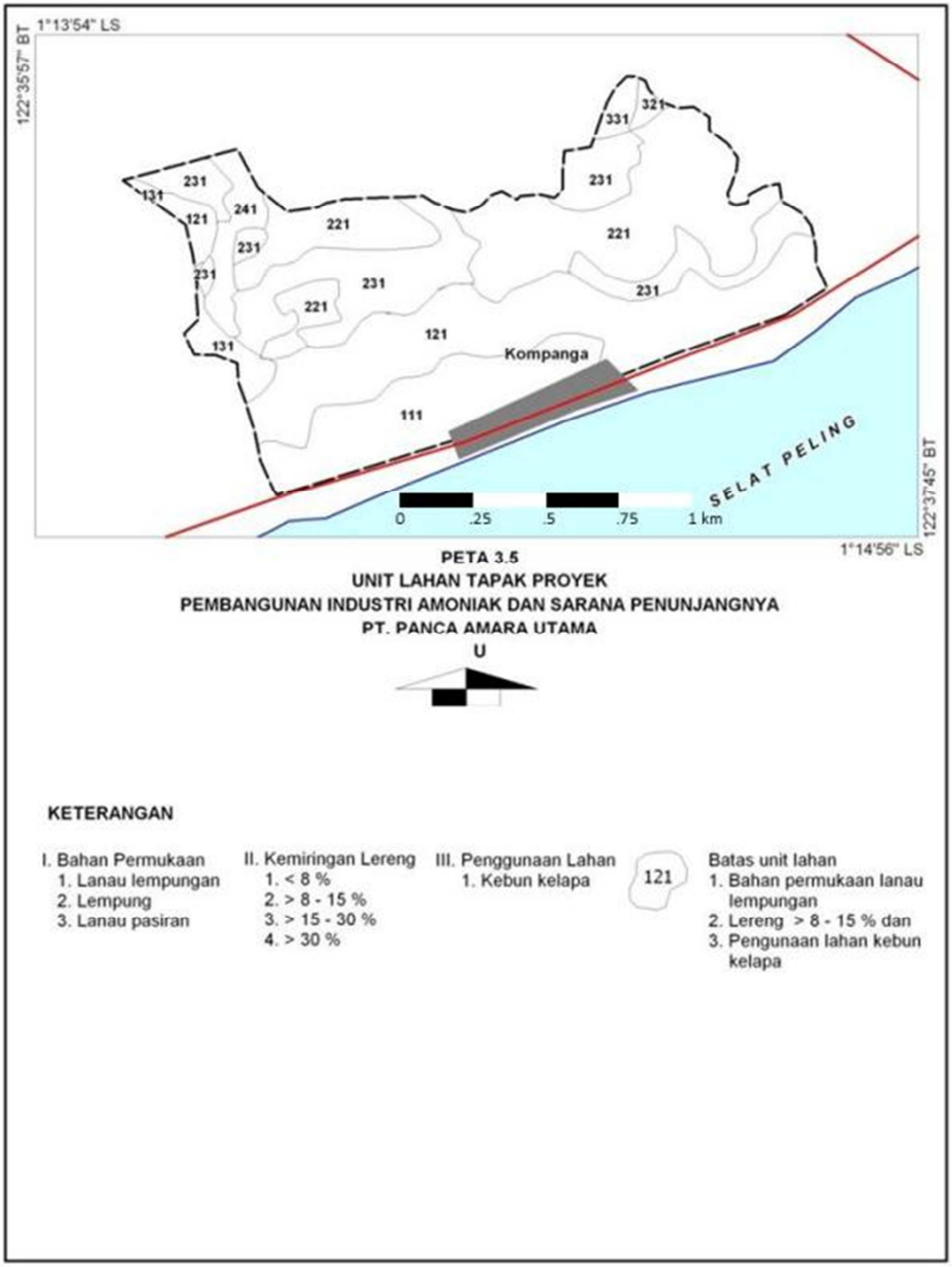
Map 3.2 Surface Material of the Project Site



Map 3.3 Contour of the Project Site



Map 3.4 Land Utilization of the Project Site



Map 3.5 Sectional Surface Material of the Project Site

Table 3.7 Width and Description of each Sectional of Land at the Project Site

Unit	Width m^2	Remarks
111	322.900	Surface material of silty mire, slope < 8% use of coconut ground
121	571.700	Surface material of silty mire, slope > 8 – 15 %, use of coconut ground
131	52.600	Surface material of silty mire, slope >15 – 30 %, use of coconut ground
221	553.600	Surface material of silty mire, slope >8 – 15 %, use of coconut ground
231	393.500	Surface material of silty mire, slope >15 – 30 %, use of coconut ground
241	72.600	Surface material of silty mire, slope > 30%, use of coconut ground
321	12.900	Surface material of silty mire, slope > 8 – 15 %, use of coconut ground
331	20.600	Surface material of silty mire, slope >15 – 30 %, use of coconut ground
Total	2.000.400	

Table3.8 shows run-off and infiltration volume result during initial condition or prior to ammonia industry development and of PT PAU.

Table3.8 Run-Off and Infiltration Volumes during Initial Condition (Prior to Existing Activities) at the Project Site

Land Section	Remarks on land unit	Width (m^2)	Rainfall (mm/yr)	Cr (%)	Vr (mm^3/yr)	Ci (%)	Vi (m^3/year)
111	Surface material of silty mire, slope <8%, use of coconut ground	322.900	1,485	3,28	15.272,.8	65,97	316.330,44
121	Surface material of silty mire, slope >8-15%, use of coconut ground	571.700	1,485	9,49	80.567,7	59,76	507.347,16
131	Surface material of silty mire, slope >15-30%, use of coconut ground	52.600	1,485	18,60	14.528,6	50,65	39.563,222
221	Surface material of graveled silt slope >8-15%, use of coconut ground	553.600	1,485	7,24	59.519,8	62,01	50.9781,73
231	Surface material graveled silt slope >15-30%, use of coconut ground	393.500	1,485	14,`8	82.860,5	55,07	321.800,17
241	Surface material of graveled silt slope >30%, use of coconut garden land	72.600	1,485	22,06	23.783,1	47,19	50.876,011
321	Surface material of sandy mire, slope >8-15%, use of coconut ground	12.900	1,485	3,58	685,8703	65,67	12.580,074
331	Surface material of sandy mire, slope <15-30%, use of coconut ground	20.600	1,485	7,03	2.`50,55	62,22	19.033,72
T o t a l		2.000.400		1,485	279.824500		1.777.312,50

Remarks : Cr= Run-Off Coefficient, Ci = Infiltration Coefficient, Vr = Run-Off Volume, Vi = Infiltration Volume.

From above table it may be understood that initial condition or prior to development of ammonia industry and supporting means PT PAU, run-off volume is 279.824 M^3/year and infiltration volume is 1.777.312 M^3/year.

3.1.2.3 Musolang river water quality

Result of laboratory test of water sample deriving from Sungai Musolang, may be observed from Table 3.9. From this table it may be seen that based on Government Regulation No.82 concerning Control of Water Quality and Control of Water Pollution, for category II shows that Sungai Musolang water quality has fulfilled the standard quality determined.

Table 3.9 Musolang river water laboratory analysis result

No.	Parameter	Unit	A1	A2	Quality Standard
	PHYSICS				
1	Temperature	(℃)	27,6	26,2	± 3
2	TSS (Total Suspended Solid)	Mg/L	2,0	12,68	50
3	TDS (Total Dissolve Solid)	Mg/L	280,0	258,40	1.000
	CHEMICAL				
1.	Ph	-	7,09	7,67	6-9
2.	BOD	mg/L	2,91	2,13	3
3.	COD	mg/L	8,03	22,05	25
4.	DO	Mg/L	4,0	6,7	>4
5.	NO_3-N	Mg/L	0,49	0,66	10
6.	NH_3-N	mg/L	0,65	1,06	-
7.	Cobalt (Co)	mg/L	0,09	<0,10	0,2
8.	Baron (B)	mg/L	0,71	<0,05	1
9	Cadmium (Cd)	mg/L	<0,03	<0,003	0,01
10.	Chrome VI (Cr^{5+})	Mg/L	0,11	<0,05	0,05
11.	Copper (Cu)	Mg/L	<0,02	<0,02	0,02
12.	Iron (Fe)	Mg/L	0,02	<0,10	-
13.	Lead(Pb)	mg/L	< 0,02	<0,02	0,03
14.	Mangan (Mn)	mg/L	<0,01	0,58	-
15.	Zinc (Zn)	mg/L	< 0,02	<0,02	0,05
16	Chloride (Cl)	mg/L	6,89	3,68	-
17	Fluoride {F)	Mg/L	0,30	0,23	1,5
18.	NO^2-N	Mg/L	< 0,01	0,66	0,06
19.	Sulfate (SO_4)	mg/L	4,41	7.20	-
20.	Chlorine	mg/L	09,02	<0,02	09,03
21	Sulfida	mg/L	<0,02	0,04	0,002
22	Oil and Grease	mg/L	0,71	037	1
23	MBAS	Mg/L	0,04	0,04	0,2
24	Phenol	Mg/L	<0,005	<0,005	0,001
25	Phosphate (PO_4)	Mg/L	0,15	0,19	0,2

*Remarks : *) Regulation Menkes No. 416/MENKES/Per/IX/1990 concerning requirements for clear water*

Total Suspended Solids (TSS)

Total Suspended Solids are the solids which remain as residue in a sample, if the sample is dried at a specific temperature. Measurements carried out at two locations on the river Musolang show the concentration of TSS as 2,0 and 12,68 mg/l. The quality standards as per Government Regulation No. 82/2001 grade II indicate the limit of TSS parameter to be 50 mg/l, thus presenting that the results of measurements at these two locations meet the environmental quality standards.

The degree of acidity (pH)

PH value of the water is used to express the condition of acidity (hydrogen ion concentration) of wastewater. The pH scale ranges from 1 to 14. It is acidic in nature for the range of pH values 1 to 7, alkaline for pH values 7 to 14 while the pH of 7 is neutral. Measurements carried out at two locations on the River Musolang show the pH values from 7.09 to 7.67. These pH values when compared to the standards of Government Regulation No. 82/2001 grade II for the limit of pH parameters 6 to 9, show them to be well within the environmental quality standards.

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand (BOD) is the amount of oxygen required by aerobic bacteria to decompose and stabilize the amount of organic matter through aerobic biological oxidation process. The greater the BOD in the water, lesser the availability of supply of dissolved oxygen and vice versa. BOD is influenced by the content and type of organic matter, temperature and the presence of plankton and microbe. BOD is very influential on the availability of dissolved oxygen and pH value. If a high BOD, it will lead to reduction of dissolved oxygen through the process of decomposition of organic matter hence, decreasing the pH of water. Measurements carried out at two locations on the river Musolang show that the concentration of BOD values from 2.13 to 2.91 mg/l. The quality standards as per Government Regulation No. 82/2001 grade II indicate the limit for parameter BOD as 3 mg/l, proves that the results of measurements made at these locations meet the environmental quality standards.

Chemical Oxygen Demand (COD)

Chemical Oxygen Demand is the amount of oxygen required to oxidize the organic matter present in water. COD is an indirect measurement of the amount of pollution that cannot be oxidized biologically in a sample of water. The higher the chemical oxygen demand (COD), the higher the amount of pollution in the test sample. Measurements carried out at two locations on the river Musolang show the COD concentrations from 8,03 to 22,05 mg/l. The COD value when compared to the standards of Government Regulation No. 82/2001 grade II which indicates the limit for COD parameter to be 25 mg/l, show that the results of measurements at these two locations fulfill the environmental quality standards.

3.1.3 Geology

3.1.3.1 Physiographic

Physiographical, the study area belongs to mountainous area of Pegunungan Lengan Timur (Drawing 3.3) which has a rough topography with their peaks e.g. G. Lokai (1,530 m), G. Pasini (2,050 m) and G. Tamponga (1,590 m). Types of Rocks on this mountains consists of Malian and ultrabasa rocks (ofiolit track), aging Mesozoikum, whereas other parts are fine-rough clastic rocks, and carbonate rocks, aging Tertiary.

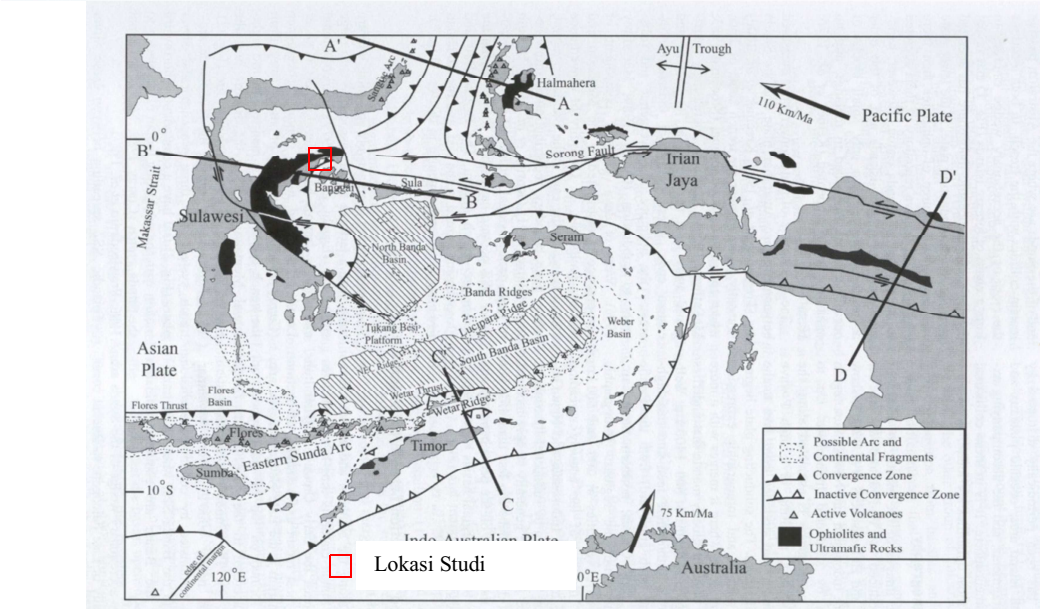


Fig. 3. Tectonic map of the eastern Indonesian region. Banda Sea marginal basins are shown in slanted stripes. Lines of section shown in Figure 4 are heavy black lines. (Modified from Hamilton, 1979)

Dwg. 3.3 **Mandala Banggai – Sula dan Jalur ofiolit Lengan Timur Sulawesi (Blackish)**

3.1.3.2 Geology Structure

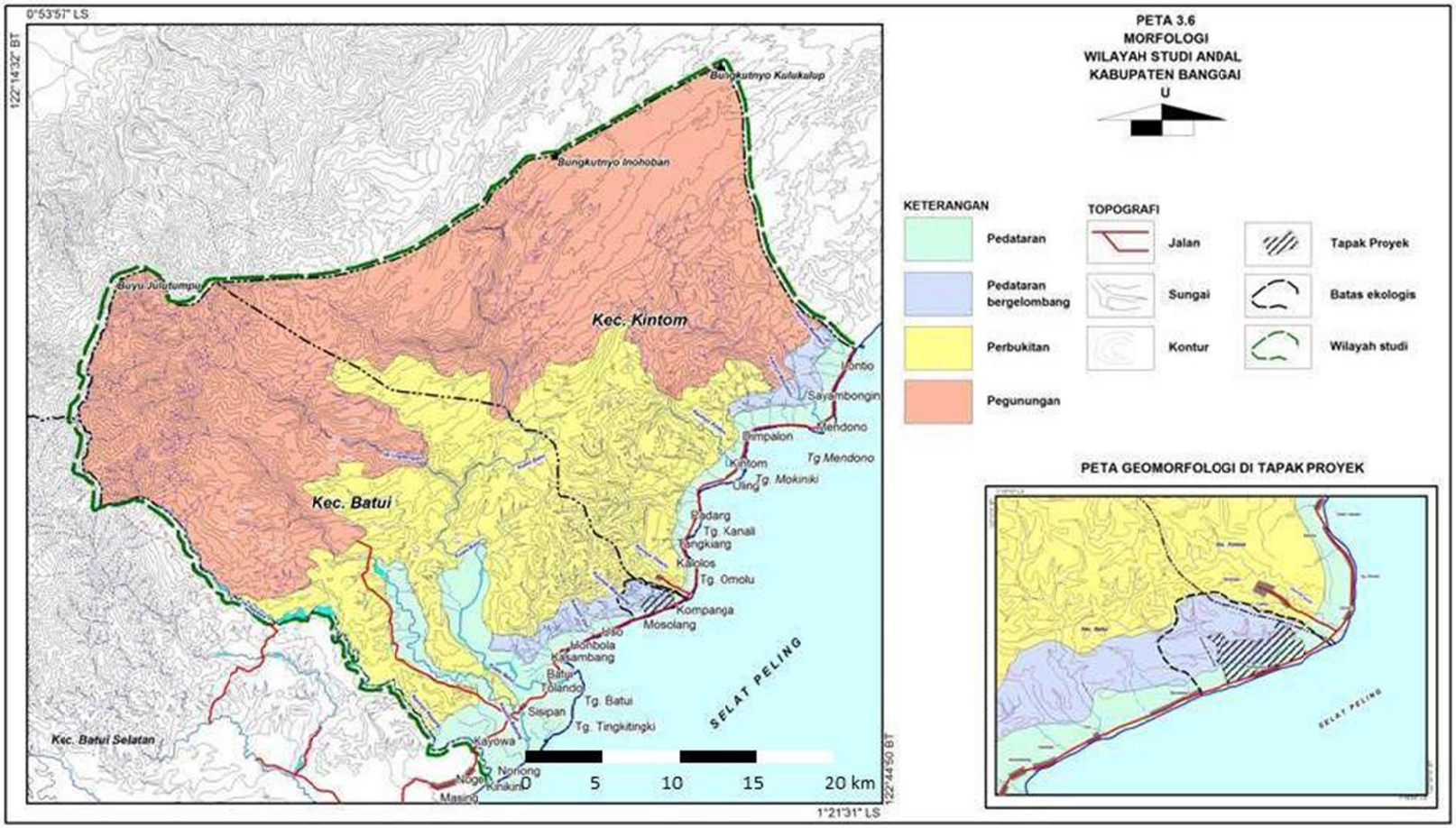
Geology structure in this regional, include into Mandala Platform Banggai – Sula and Ofiolit, eastern of Sulawesi (Surono, etc, 1994) which are described from oldest to youngest, i.e:

- Bongka formation (Tmpb): has been arranged by conglomerate, sand rocks, mire, clay, limestone rocks, took place at the southern mountainous area and Kintom formation aging Mio-Pliosen.
- Terumbu Koral Kuarter (QL), consisting terumbu limestone and a little clay, of dull color and greyish, a little hard, aging one quarter.
- Alluvium (Qa): forms the youngest deposit in form of a blend between sand, gravel and silt, Aging Holosen.

3.1.3.3 Morphology

Based on the topographical form, the gradient slope and differentiating height (natural span (morphology) of the study area, may be distinguished upon (Map 3.6)

- Plain land: occupying the southern part which is generally a coastal plain land occupying the southern area, with a relatively narrow span, while the distribution is lengthwise in accordance with the coastal length, The slope gradient < 3%, above sea level,.
- Wavy plain land: : this natural span is part of the lowest foot of hilly land with protruding hills having a slight slope some picture of small valley, distributed little by little. The slope slant > 3-8%, the height difference between the highest and lowest less han 199 m, the height ranging between 35 – 100 m above sea level..
- Hilly land: forms the middle slope until upper slope, with a wavy and heavy topographical characteristic the slope declivity, > 8 – 15% and >15 – 30%. The height difference between the lowest and highest place, is not more than 200m, slightly slanting until oblique valleys, are 100-300 m above sea level.
- Mountain, Mountain morphology occupies the utmost north area with an extensive distribution. The difference between the lowest and highest area > 200 m.
- The slanting slope is > 15 – 30% and > 40% Valleys are normally narrow and very steep, river stream pattern are semi dendrical with types of rivers which flows belonging to intermittent stream and perennial stream at the mkain river. The areal height ranges between 200 – 800 m asl (above sea level).



Map 3.6 Regional Morphology Map

3.1.3.4 Project Site Geology

The geological order of the project site was only arranged by three rock units (Map 3.7), with description from the oldest to the youngest are as follows:

- Bongka formation: consists of conglomerates, sand rocks, mires, clay, lime rocks. At the surface, it generally experiences medium – serious obsolescence, is of grayish brown until brown.
- Coral slime rock: is arranged by coral slime rock with clay insertion, at the revealed part, is white pale colour, having lots of openings, hard at the slime rock, and slightly soft at the conglomerates unit.

3.1.3.5 Surface Material

Surface material is surface material formed as result of residual rocks, transported or amixture between both, unconsolidated, arranged by very fine, fine, rough until very rough material. Based on field observation, and analysis as per undisturbed soil, the surface material which arranges the study area land, is as follows:

- **Sand mires**

This surface material is result of a conglomerate rock unit obsolescence, arranged by sandmires containing rock components of gravel and small rock sizes, from all types of rocks which normally has experienced further obsolescence, of light brown colour, slightly soft – solid, medium gradation, medium permeability except on the part which contains clay with low permeability until slightly tight. Thickness of the surface material ranges 0.8 until 1.7 m.

Result of soil mechanical testing for the soil material of sand mires, shows that in the granulation gradation (Ø 0,005 – 0.075 mm), of mires 32%, clay (Ø < 0.005 mm) is 11%, fine and medium size sand approx (Ø < 0.075 – 2 mm) approx 24%, medium rough sand (Ø > 2 mm) with content more than 36%, porosity 58.7%, water content 49.32,% ; Cohesion 0.129 kg/cm^2 and moving inter corner 20.64°. Based on Laboratory Analysis (see attachment), type of this surface material categorized as sand mires soil (ML) and according to Terzhagi Method, at the depth of foundation 1 m and width 0.5 m, the load capacity of shallow foundation i.e. 7.1 ton/m^2

- **Clay mires**

This type pf mire is result of slime rock unit obsolescence, in form of clay mires, of grey brownish colour and blackish, containing slime rock component of medium – rough size, graveland pebbles, distributed unevenly, is slightly soft, medium plasticity, low permeability. Thickness ranging between 0.45 – 1.20 m.

Mechanical test of slime clay has a granular gradation : clay (Ø – 0,005 mm) approx 58%, of mires, (Ø 0.05 – 0.075) is 33%, fine sand approx (Ø 0.075 – 0.42 mm) approx 8%, medium sand (Ø 0.42 – 2.0 mm) with content only approx 1%, porosity 60.18%, water content 53.92,% ; high plasticity (56.63%) ; Cohesion 0.238 kg/cm^2 and moving inter corner 10.67°. Based on Terzhagi Method, at the depth of foundation 1 m and width 0.5 m, the load capacity of shallow foundation only slighy lower compared to sand mire, i.e. 3.967 ton/m^2

- **Gravel mire**

This type of surface material forms transported material in form of the youngest deposit, consisting of clay mire, sand, gravel and pebbles of grey color until grey brownish. Based on domination of arrangement and distributing material, this surface material may be differentiated between:

- Claymire, of grey brownish colour, soft solid, low plasticity, thickness of layer ranges between 0.70- 1.50 m, normally forms a relatively plain and fine area (flat).
- Sand, gravel and pebbles of various rock components, very loose, of grey until brownish colour. The surface material dominated by course until very coarse clastica are found in river tracks, river terraces, and alongside the coast. Deposit of river terraces, which forms sand conglomerates, it appears that it may be used as building material source, such as road hardening material, is lying at the western side of project site. Thickness, ranges between 0.5 – < 3 m.

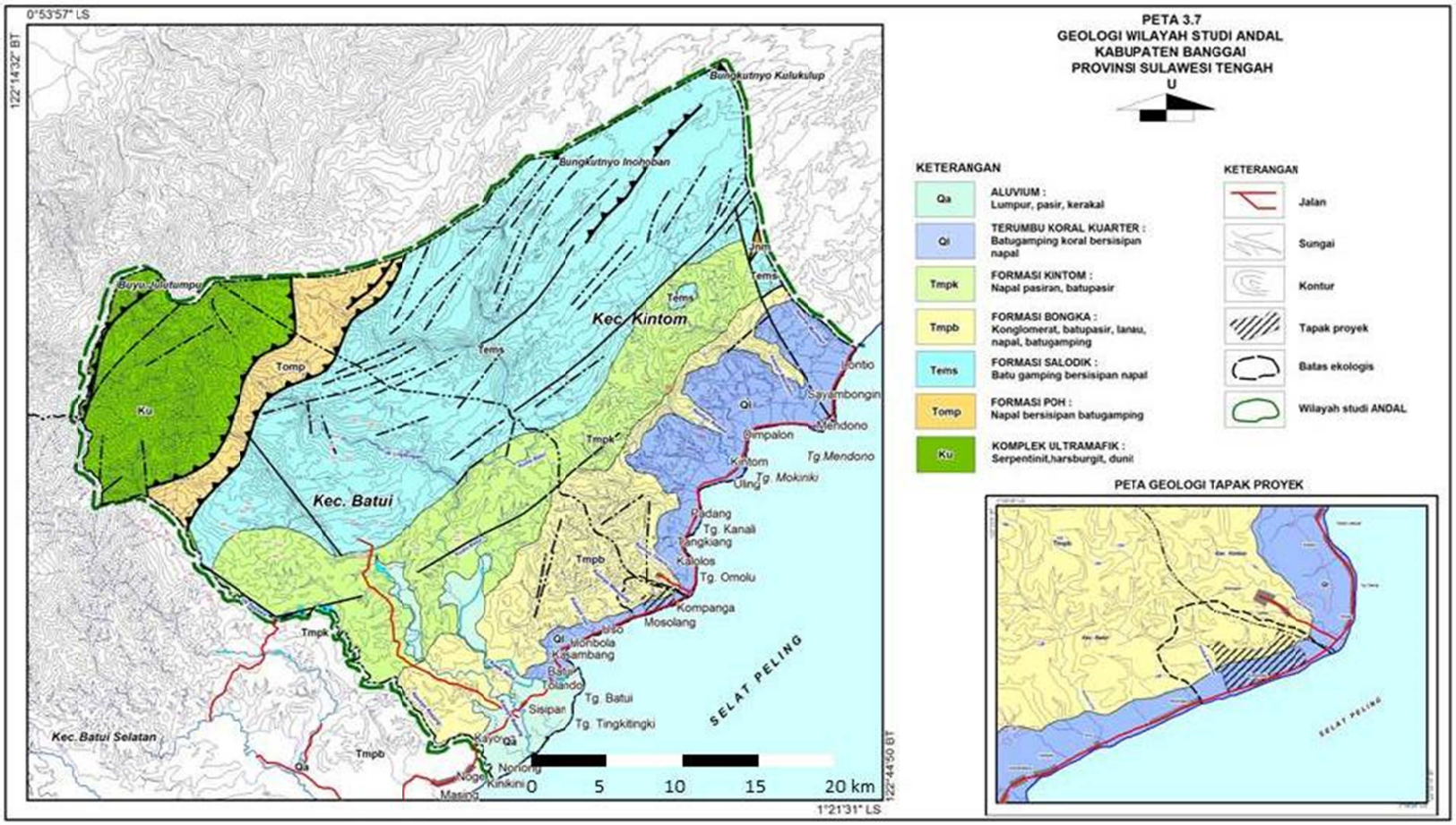
3.1.3.6 Geological structure

Geological structures found in the study area are normally in the form of cleavage or, better known by broken fragment (see map 3.7). Fragments are generally spread far enough in the north of the steep hills and mountains formed by ultramafic complex, Poh Formation and Salodik Formation. The types of fragments found are in the form of normal fault, thrust fault and lineament fault. While near the project site, there is only one fault i.e. normal fault cutting the conglomerate hills trending northsouth direction, but pelamparan stop at ecological boundary or, not crossing the project site. Based on the analysis of regional geological maps and observations in the field, no indication of active faults found around the project site that can cause damage to the building structures unless a triggering factor such as an earthquake of high intensity (> 6 on the Richter scale). Effect of faults and other micro structures like cracks in the rock serves as a conduit, water storage (water retention) or as a medium for water ingress into soil / rock (recharge area).

3.1.3.7 Hydrogeology

Based on regional hydro-geological map, ANDAL study area may be differentiated from three ground water area unit (Map 3.8) e.g.:

- Ground water area with local productive aquifer. This area occupies coastal plain areas until the foot of hilly areas.
- Ground water area with small productive aquifer. This area is distributed at hilly areas arranged by conglomerates and slime area units.
- Seldom water area. In general, water condition at this area cannot be expected, except for free water at obsolete part zones, or places which are more harmonious at limited amount.



Map 3.7 Regional Geological Map

Ground water quality

Result of water analysis received from population wells at the project site and surroundings, as can be observed from Table 3.10.

Table3.10. Quality of Water from Population Wells

No.	Parameter	Unit	SG1	SG2	Quality standard (*)
	PHYSICS				
1.	Temperature	(℃)	27,6	26,2	±3
2.	Odour	-	Odorless	Odorless	Odorless
3.	TDS	(mg/L)	592,0	757,60	1,500
4,.	Colour	(PtCo)	10,73	10,16	50
5.	Turbidity	(NTU)	0,7	0,73	25
6.	Conductivity	(µmhos)	796,0	1,140	-
	CHEMICAL				
1.	pH	-	6.85	7.11	6.5 – 9.0
2.	Nitrate (NO_3-N)	(mg/L)	0.89	2.08	10
3.	Nitrite (NO_2-N)	(mg/L)	0.03	<0.01	1
4.	Iron (Fe)	(mg/L)	<0.01	<0.10	1
5.	Fluoride (F)	(mg/L)	0.43	0.04	1,5
6.	Cadmium (Cd)	(mg/L)	< 0.01	<0.003	0.003
7.	Hardness ($CaCO_3$)	(mg/L)	365.6	346.00	500
8.	Chloride (Cl)	(mg/L)	57,0	137,94	600
9.	Chrom VI (C^{6+})	(mg/L)	0.02	0.07	0.05
10.	Mangan (Mn)	(mg/L)	0.01	<0.02	0.5
11.	Zinc (Zn)	(mg/L)	0.03	0.01	15
12.	Sulfat (SO_4)	(mg/L)	13.73	27.88	400
13.	Lead (Pb)	(mg/L)	0.02	< 0.02	0.05
14.	MBAS	(mg/L)	0.07	0.04	0.5
15.	Phenol	(mg/L)	< 0.005	< 0.005	0.01
16.	Organic substance ($KMnO_4$)	(mg/L)	6.01	14.70	10

*Remarks : *) Regulation Menkes No.4`6/MENKES/Per/IX/`990 concerning requirement of clean water.*

Based on Government Regulation number 82 concerning Control of Water Quality and Control of Waste Water Pollution, for category 1 shows that TSS, pH, Cd, Cu, Zn, Mn has fulfilled the quality standard determined, except for Organic substance ($KMnO_4$).

3.1.4 Space, Land and Soil

3.1.4.1 Space

- **Spatial Use Allocation Plan**

Plant location for ammonia industry development and its supporting unit (project site), was formerly situated in the Industrial Area, this was inline with the Spatial Master Plan of Central Sulawesi Province 2002 – 2018 (Map 3.8) e.g. belonging to Integrated Economy Development Area, whereas based on Spatial Master Plan of Local Government of Kabupaten Banggai, for period 2006 – 2018, the Plant Location belonging to Cultivation Area (Map 3.9).

- **Transportation**
  - **Road**

Roads in the study area is one track, e.g. national roads which connects Luwuk (capital of Kabupaten Banggai) and Batui (capital of Kecamatan Batui). Width of the road body is ± 4 meters, with the road shoulder 1 meter each side and road condition made of hot mix.

  - **Traffic volume**

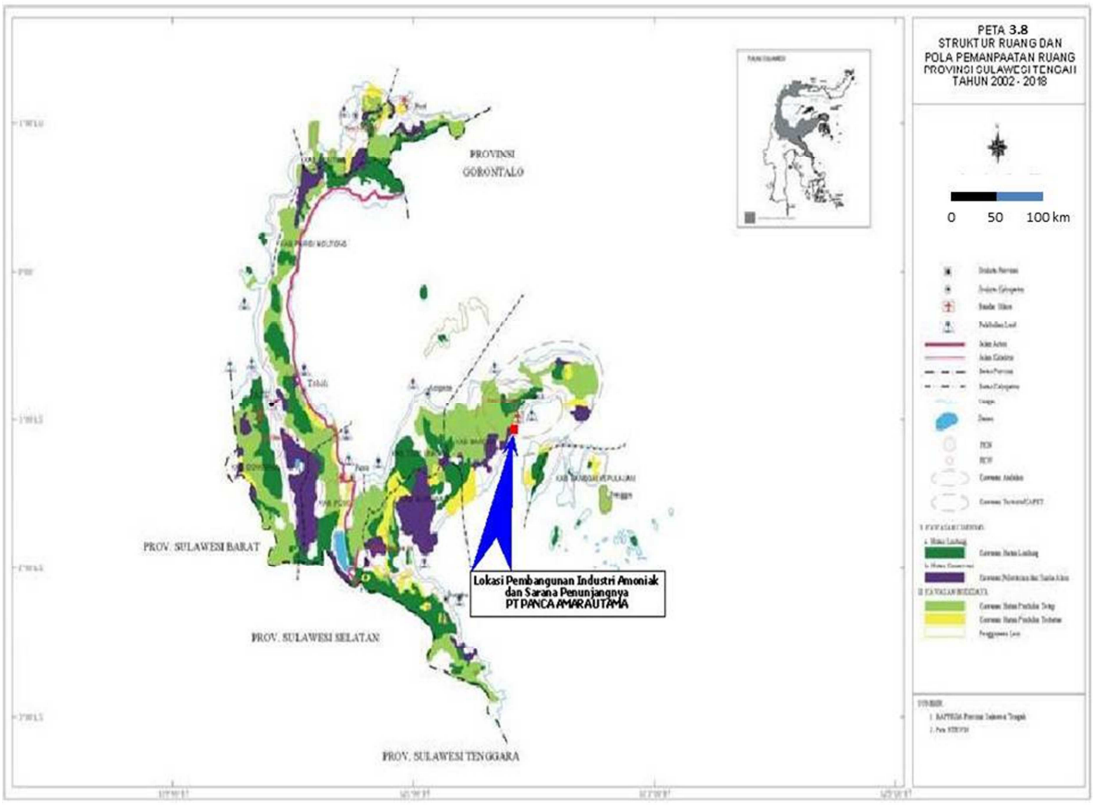
Survey result (May 2012) of national road at the study area, can be observed from Table 3.12. We can see from this Table 3.12 that the number of vehicles passing this National Road are 165 – 700 per hour, or 115.15 – 414.05 smp (unit of passenger vehicle) per hour.

The most vehicles are motorcycles (47.3 – 72.9%) and there is no bicycle passing (0%).

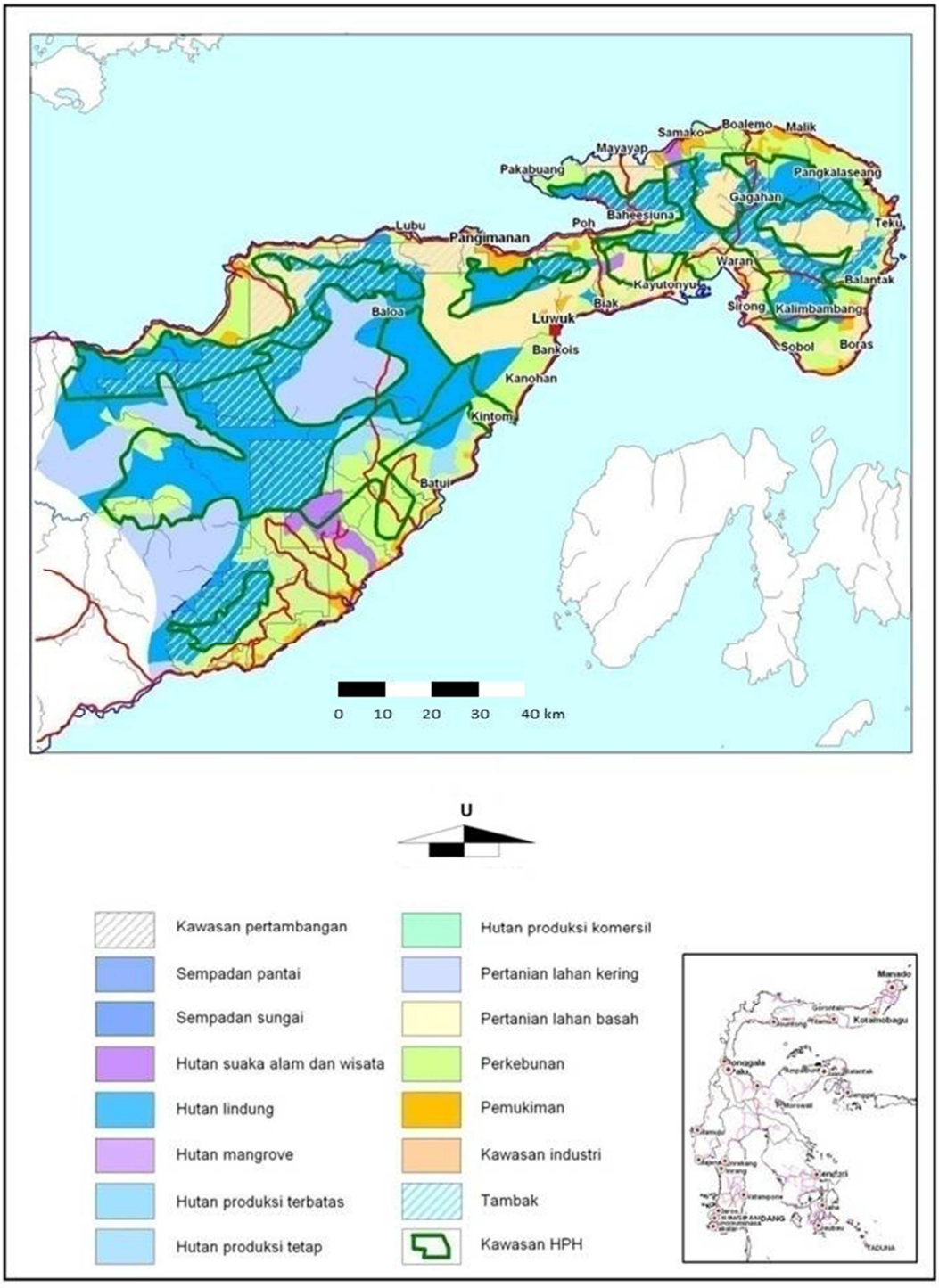
Table 3.11. Traffic Volume of National Road (Luwuk – Batui)

Time of survey	Number of vehicles / hour					Traffic composition				P	Q_P
	HV	LV	MC	UM	Total	HV%	LV%	MC%	UM%		
06.00-07.00 hr	32	33	175	0	240	13,3	13,8	72,9	0,0	0,48	115,15
07.00-08.00 hr	95	152	405	0	652	14,6	23,3	62,1	0,0	0,56	367,25
98.00-09.00 hr	37	73	`55	0	265	14,0	27,5	58,5	0,0	0,59	156,15
09.00-10.00 hr	0	75	148	0	223	0,0	33,6	66,4	0,0	0,50	112,00
19.00-11.00 hr	33	76	98	0	207	15,9	36,7	47,3	0,0	0,68	140,10
11.00-12.00 hr	25	55	85	0	165	15,2	33,3	51,5	0,0	0,64	06,25
13.00-14.00 hr	34	91	159	0	284	12,0	32,0	56,0	0,0	0,60	171,55
14.00-15.00 hr	35	91	135	0	261	13,4	34,9	51,7	0,0	0,64	166,75
15.00-16.00 hr	63	72	148	0	283	22,3	25,4	52,3	0,0	0,65	184,60
15.00-17.00 hr	53	67	155	0	275	19,3	24,4	56,4	0,0	0,62	169,35
17.00-18.00 hr	119	168	413	0	700	17,0	24,0	59,0	0,0	0,59	414,05

Remarks: HV=Heavy vehicle, LV= Light Vehicle, MC=Motor Cycle, UM=Unmotorized vehicle, P=smpfactor, Q_P=traffic Volume within smp



Map 3.8 Spatial Master Plan of Central Sulawesi Province 2002 – 2018



Map 3.9 Spatial Master Plan of Local Government of Banggai Regency 2006 – 2018

- **Road Service Level**

Road service level during initial condition was understood through counting of amount of Qp/C ratio or comparison of traffic volume (Qp) with road capacity (C). Amount of parameter to count road capacity (C) as can be observed from the following Table 3.12.

Table 3.12 Amount of Parameter for Counting Qp/C Ratio

Basic capacity (Co) SMP /hr	Factor of appropriate Road width capacity (FW)	Correction Factor of road shoulder capacity (Fks)	Correction Factor of direction split capacity (Fsp)	Correction Factor of side freedom capacity (Fsf)	Correction Factor of city dimension size (Fcs)
2.900	1,07	0,93	1,0	1,00	0,80

Road capacity (C) is determined by using the following formula:

C = Co x Fw x Fks x Fsp x Fsf x Fcs

= 2,900 x 1.07 x 0.93 x 1.0 x 1.0 x 0.8

= 2,308.6

The magnitude of Qp/C ratio in the study area is as shown in Table 3.13.

Table 3.13 The magnitude of Qp/C ratio of National Road (Luwuk – Batui)

Time	Qp	C	Qp/C
06.00-07.00 hours	115,15	2.308,6	0,05
07.00-08.00 hours	367,25	2.308,6	0,16
08.00-09.00 hours	156,16	2.308,6	0,07
09.00-10.00 hours	112,00	2.308,6	0,05
10.00-11.00 hours	140,10	2.308,6	0,06
11.00-12.00 houra	106,25	2.308,6	0,05
13.00-14.00 houra	171,55	2.308,6	0,07
14.00-15.00 houra	166,75	2.308,6	0,07
15.00-16.00 hours	184,60	2.308,6	0,08
16.00-17.00 hours	169,35	2.308,6	0,07
17.00-18.00 hours	414,05	2.308,6	0,18

Source : Primary Data, 2012

Reference to the characteristics of road service level according to Morlok (1997) as shown in Table 3.14 below, the level of service road in the study area has a value of Qp/C = 0,05 to 0,18 which belongs to service level – A i.e. free flow conditions to be able to select the desired speed. This shows that the volume of traffic is low compared with the existing service roads.

Table 3.14 Road Service Level, Characteristics of road as per V/C Ratio

Level of Service	Characteristics of roads	Qp/C
A	Free flow conditions to be able to choose the desired speed.	0,00 to 0,20
B	Stable flow but operational speed began to be restricted by traffic conditions. The motorists have sufficient freedom to choose the speed.	0,21 to 0,44
C	Stable flow but speed and movement of vehicles are controlled. The motorists have sufficient freedom to choose the speed.	0,45 to 0,74
D	Approaching unstable flow, but speed is still controlled, Qp/C can still be tolerated.	0,75 to 084
E	The volume of traffic approaching or is in an unstable flow capacity, speed of the vehicle is stalled.	0,85 to 1,00
F	Forced or jammed flow, low speed, roads capacity below volumes, long queues and there are major obstacles	> 1,00

3.1.4.2 Land

- **Form and use of land**

The land in the study location may be categorized into 4 (four) forms of land namely, plain, bumpy plain, hilly and mountainous. The landform at the project site is plain and bumpy plain. The uses of lands at the study location are human settlements, LNG plant, fields, ponds, plantation, swamp, and primary & secondary forests. The land at the project site itself is used for horticulture / plantation purpose (Map 3.9).

- **Type of soil**

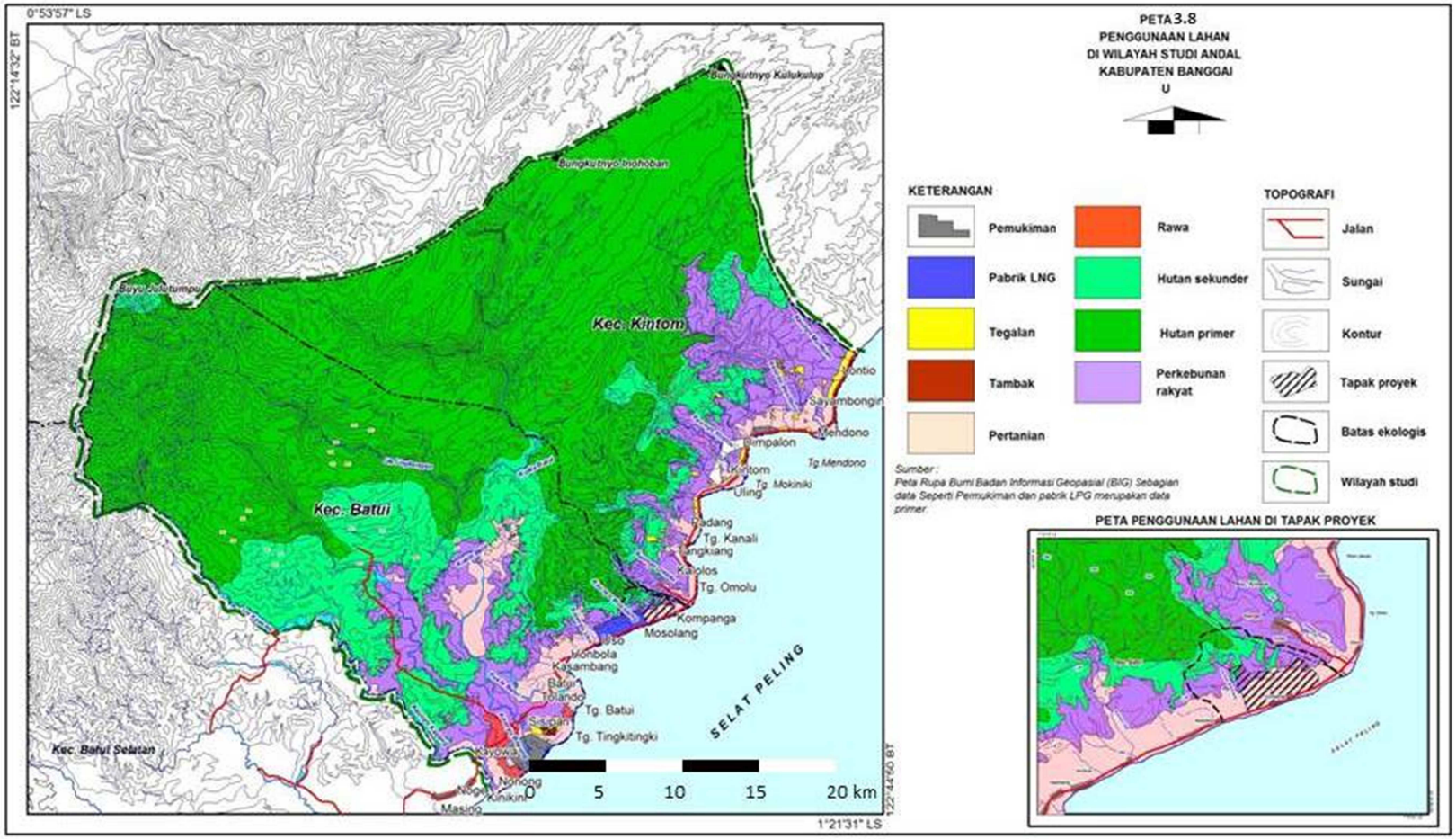
Based on Zone Map of Agro Ecology (PPTA, 1998) and field observations, the type of soil used for preparing the study region is grumosol. Grumosol type of soil forms plain and wavy morphology. The nature and characteristics of grumosol soils for effective depth are medium to deep depth (60 – 90 cm) namely, strong texture, loam and tougher sand clay, crumb structure and plasticity – solid medium to high.

3.1.4.3 Soil

- **Soil Erosion**

The soil erosion parameters studied include index of rain erosivity, soil erodibility, topography, vegetation and soil cultivation are applied (Terms of Reference – EIA for the development of ammonia industry and supporting facilities, PT Panca Amara Utama, 2012)

The average erosivity index at the project site during past 12 years (2000 – 2011) is as listed in Table 3.15. The table shows that the annual rainfall erosivity index is 1,501.37.



Map 3.10 Regional Land Utilization Map

Table3.15. Average Erosivity Index at Project site

Month	Rainfall 2000 – 2011 (mm)	Rain days 2000 – 2011	Maximum Rain (mm)	Erosivity
January	103,1	15	30,9	106,43
February	110,6	12	36,2	115,88
March	151,7	19	35,1	168,68
April	126,3	21	46,2	135,87
May	138,5	19	39,1	151,43
June	209,1	20	51,7	248,11
July	164,6	19	38,3	186,05
August	102,0	22	36,2	105,20
September	59,3	14	24,3	55,32
October	39,3	9	15,0	34,07
November	74,1	12	29,4	72,04
December	115,8	17	34,5	122,27
Total	1.485,9	198	51,7	1.501,37

Remarks : The values erosivity calculations,2012

The type of soil at the project site is grumosol, referring Syaripudin Syarif opinion (1978) for soil sensitivity towards erosion or erodibility, grumosol soil belongs to moderate. Further, referring to the classification of soil erodibility by Dangler and El-swaify (1976), the erodibility value is 0,21 to 0,32 or 0,26 as a middle value. The measurement of topographic index (Index LS) is conducted at the project site. The measurement location of Index LS is also the location for predicting soil erosion. Table 3.16 shows the Index LS at the project site with a value of 0.68 to 1.74.

Vegetation index (index C) referring Watershed Environmental Damage Management Guidelines, Directorate of Technical Affairs, Directorate General of Water Resources, Department of Settlements and Regional Infrastructure (2003), the plantation index C is 0,032 while index for the applied conservations or index P referring Arsyad opinion (1989), the index P fields or areas without conservation actions are 1.

Magnitude of Soil Erosion - Baseline

By using Universal Soil Loss Equation (USLE) **i.e.**

$$A = R \times K \times LS \times CP$$

Amount of soil erosion during initial condition (baseline) can be seen in Table 3.17. From the table it may be understood that amount of soil erosion at the project site at baseline is 7,62 to 21,74 ton / ha / year. Based on the classification of soil erosion by Ministry of Forestry and Plantations (1987) the soil erosion < 15 ton / ha / year comes under very low grade of erosion while soil erosion > 15 – 60 is low. Thus soil erosion 7.62 to 21,74 ton / ha / year at the project site belongs to the grade of soil erosion very low to low. This can be understood as land at the project site is used for coconut trees where the plantations are under growth..

Table 3.16 Topographic Index (LS) at the Project Site

No.	Slope length (meters)	Slope angle (degrees)	Topographic Index (LS)
1.	135,3	16	1,25
2.	98,4	22	1,22
3.	94,4	15	0,91
4.	135,3	16	1,25
5.	135,3	16	1,25
6	176,2	16	1,50
7.	193,0	14	1,69
8.	186,3	4	0,61
9.	292,7	12	1,71
10.	207,6	4	0,66
11.	196,6	7	0,89
12.	201,3	14	1,52
13.	121,8	4	0,43
14.	65,0	8	0,47
15	107,0	13	0,91
16.	204,8	17	1,74
17.	235,3	6	0,88
18.	123,9	11	0,99
19.	287,1	4	0,68
20.	170,8	8	0,86
21.	198,6	10	1,16
22.	249,8	8	1,11
23.	158,0	9	0,90
24.	196,6	7	0,89
25.	119,6	12	0,92
26.	222,4	6	0,85
27.	183,7	7	0,85
28.	132,4	10	0,88
29.	94,0	9	0,68
30.	67,3	7	0,84
31.	186,7	6	0,87

Source: Primary data, 2012

Table 3.17 Baseline Soil Erosion at Project Site

No.	R	K	LS	CP	Soil erosion (ton / ha / year)	Erosion category
1.	1.501,37	0,26	1,25	0,032	15,61	R
2.	1.501,37	0,26	1,22	0,032	15,24	R
3.	1.501,37	0,26	0,91	0,032	11,37	SR
4.	1.501,37	0,26	1,25	0,032	15,61	R
5.	1.501,37	0,26	1,25	0,032	15,61	R
6.	1.501,37	0,26	1,50	0,032	18,74	R
7.	1.501,37	0,26	1,69	0,032	21,11	R
8.	1.501,37	0,26	0,61	0,032	7,62	SR
9.	1.501,37	0,26	1,71	0,032	21,36	R
10.	1.501,37	0,26	0,85	0,032	10,62	SR
11.	1.501,37	0,26	0,89	0,032	11,12	SR
12.	1.501,37	0,26	1,52	0,032	18,99	R
13.	1.501,37	0,26	0,79	0,032	9,87	SR
14.	1.501,37	0,26	0,90	0,032	11,24	SR
15.	1.501,37	0,26	0,91	0,032	11,37	SR
16.	1.501,37	0,26	1,74	0,032	21,74	R
17.	1.501,37	0,26	0,88	0,032	10,99	SR
18.	1.501,37	0,26	0,99	0,032	12,37	SR
19.	1.501,37	0,26	0,68	0,032	8,49	SR
20.	1.501,37	0,26	0,86	0,032	10,74	SR
21.	1.501,37	0,26	1,16	0,032	14,49	SR
22.	1.501,37	0,26	1,11	0,032	13,87	SR
23.	1.501,37	0,26	0,90	0,032	11,24	SR
24.	1.501,37	0,26	0,89	0,032	11,12	SR
25.	1.501,37	0,26	0,92	0,032	11,49	SR
26.	1.501,37	0,26	0,85	0,032	10,62	SR
27.	1.501,37	0,26	0,85	0,032	10,62	SR
28.	1.501,37	0,26	0,88	0,032	10,99	SR
29.	1.501,37	0,26	0,68	0,032	8,49	SR
30.	1.501,37	0,26	0,84	0,032	10,49	SR
31.	1.501,37	0,26	0,87	0,032	10,87	SR

Remarks : R = Rain erosivity index, K = Erodibility index, LS = Topographic index, CP = Vegetation and conservation index, SR =very low

3.1.5 Hydro-Oceanography

3.1.5.1 The Coastal Topography Strait Peling

Analytical results of topographic data profiles in the coastal waters of the Strait Peling presented in Figure 3.4. indicate that the coastal waters of the Strait Peling generally have a topography which is very varied and relatively deep with a maximum depth of water as ± 1061.4 m and an average depth of approximately 507.5 m. Topography with exposure to shallow (shelf) was only found in around 0 to 1 km only from the shoreline, followed by a rather steep slope until it reaches a maximum depth (Figure 3.5). By reference to Van Zuidam (1983) the coastal waters of the Strait Peling and surroundings have the characteristics of base water type rather steep and steep.

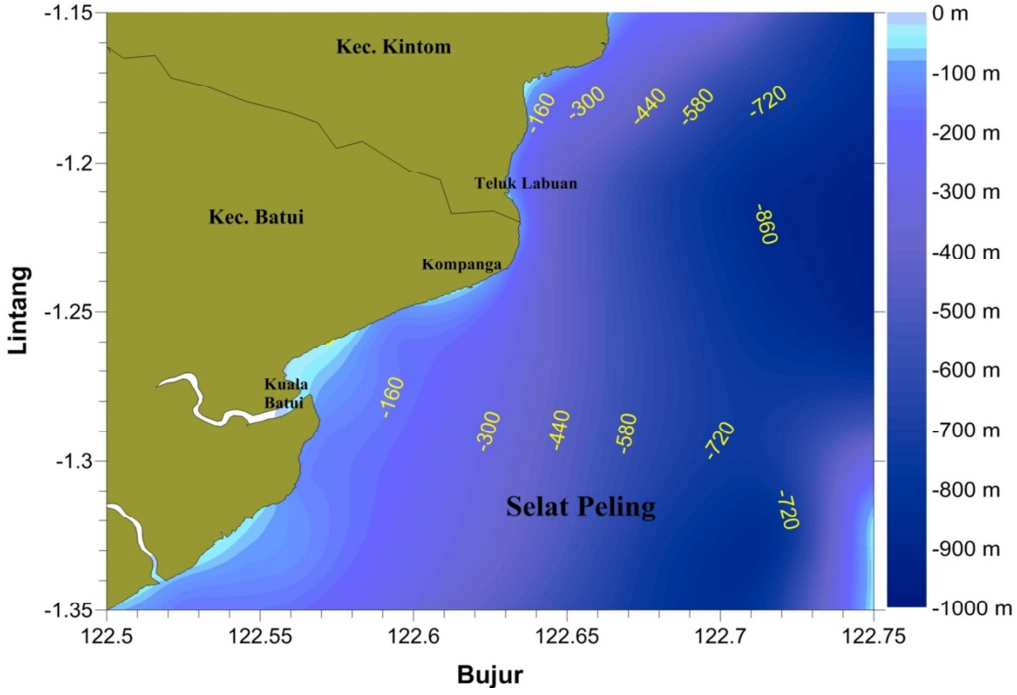


Figure 3.4 Topographic profile Strait Peling coastal waters – Central Sulawesi

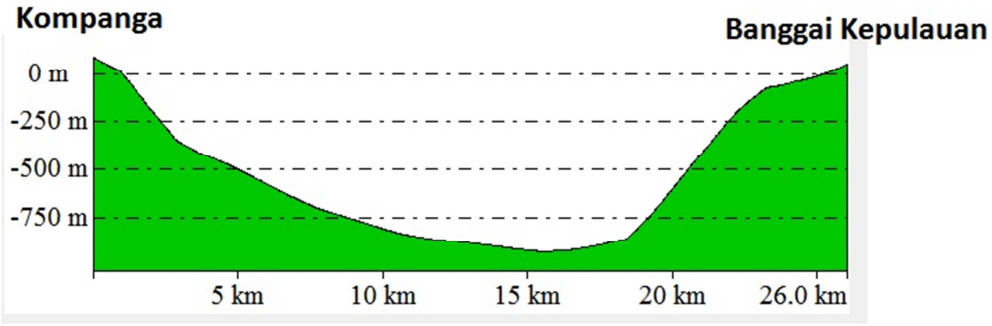


Figure 3.5 Vertical profile transverse topography of Strait Peling coast from village Uso - Banggai islands (Banggai Kepulauan)

3.1.5.2 The Coastal Tidal Strait Peling

The tidal conditions simulated at two locations for the EIA study are shown in Figure 3.6. The tide simulation results at two locations around Strait Peling coastal waters using FES2004 model program can be seen in Figure 3.7 and 3.8 with values of the amplitude and phase of each harmonic component of the tidal around the coast Strait Peling as shown in Table 3.18.

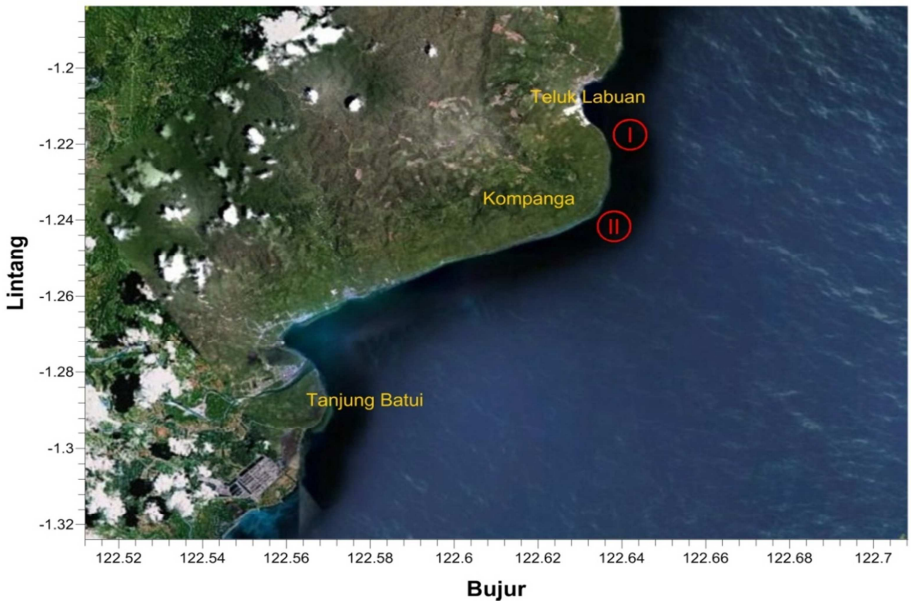


Figure 3.6 Tidal simulation location (red circles) around Strait Peling coast

Table3.18 Harmonic Constants of Tidal coastal water at Strait Peling

Tidal model location	Harmonic components	Amplitude (m)	Phase (°)	Highest tide (m)	Lowest fall (m)
122,641 BT 1,21753 LS	M2	0,33888	155,948	0,65	- 1.00
	S2	0,133764	120,363		
	K1	0,249266	174,002		
	K2	0,028485	136,433		
	N2	0,073331	123,905		
	O1	0,164343	157,882		
122,6381 BT 1,24168 LS	M2	0,353804	154,345	0,68	-1,03
	S2	0,135483	123,733		
	K1	0,252994	174,797		
	K2	0,029384	140,392		
	N2	0,976589	123,118		
	O1	0,166489	158,778		

The highest tidal range at Strait Peling coastal waters is known as 1.71 meter with the highest spring tide reaching 0,68 m and low tide of -1,03 m from the mean sea level average (figure 3.6), whereas the lowest tidal range is 1,66 m with the highest tide reaching 0,65 m and lowest tide reaching -1 m (Figure 3.5). In order to understand the location of tidal type, Formzahl number formulation study was used which is the ratio of the amplitudes of diurnal component to the semidiurnal component. Formzahl number of 0,87 is obtained from the results of the calculation of Strait Peling coastal waters, which indicates that the type of tide in the said area is predominantly mixed type twice a day (*mixed tide prevailing semidiurnal*) which means that there are two traverse in one day with a high and the time interval between transit moon and tides are not similar. This difference reaches maximum when the month has passed its maximum declination. The movement of sea surface in Strait Peling coasts is influenced by tidal propagation from the Banda Sea but it is also influenced by the input of large quantity of water from Maluku Sea.

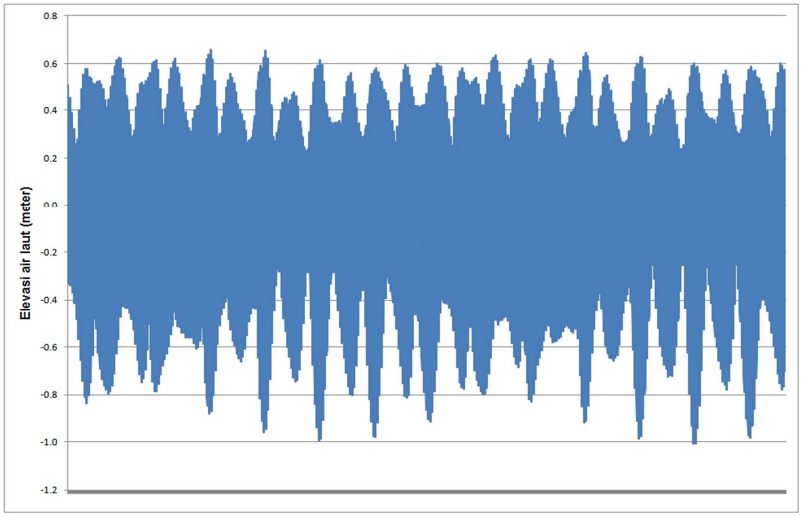


Figure 3.7 Changes in Sea level during 1 Year at location 1 at Strait Peling Coastal Waters

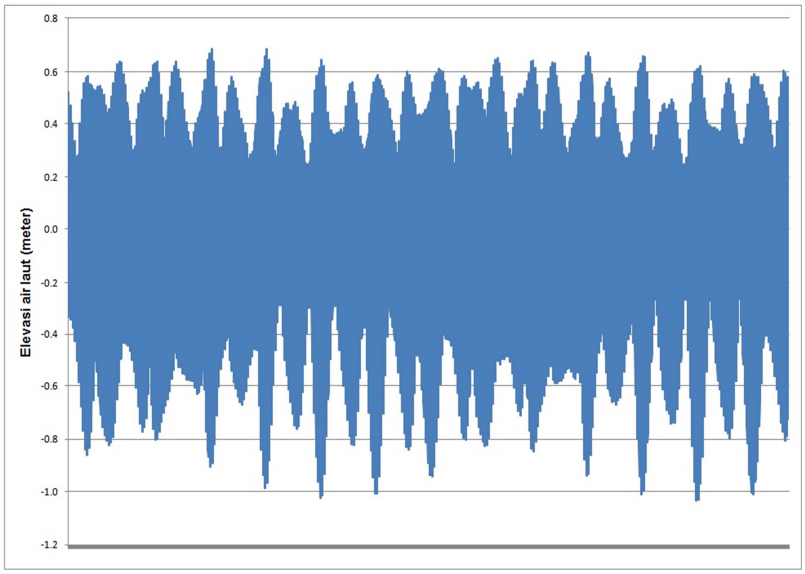


Figure 3.8 Changes in Sea level during 1 year at location 2 at Strait Peling Coastal Waters

3.1.5.3 The Coastal Waves Strait Peling

The average conditions of waves based on calculations (best estimate) in the form of roses wave at two locations around Strait Peling is presented in Figure 3.9 and the temporary change of the significant wave height in Figure 3.10. Conditions of ocean waves for Strait Peling coastal waters is dominated by waves coming from the southeast side which are primarily derived from the waves of the Banda Sea that extends into Strait Peling. The significant wave height at Strait Peling coastal waters varies from 0,35 to 1,78 m with an average wave height of approx. 0,83 m. Similarly, period of wave occurs in the range of 4,20 to 8,45 seconds with an average wave period of approx. 5,68 seconds.

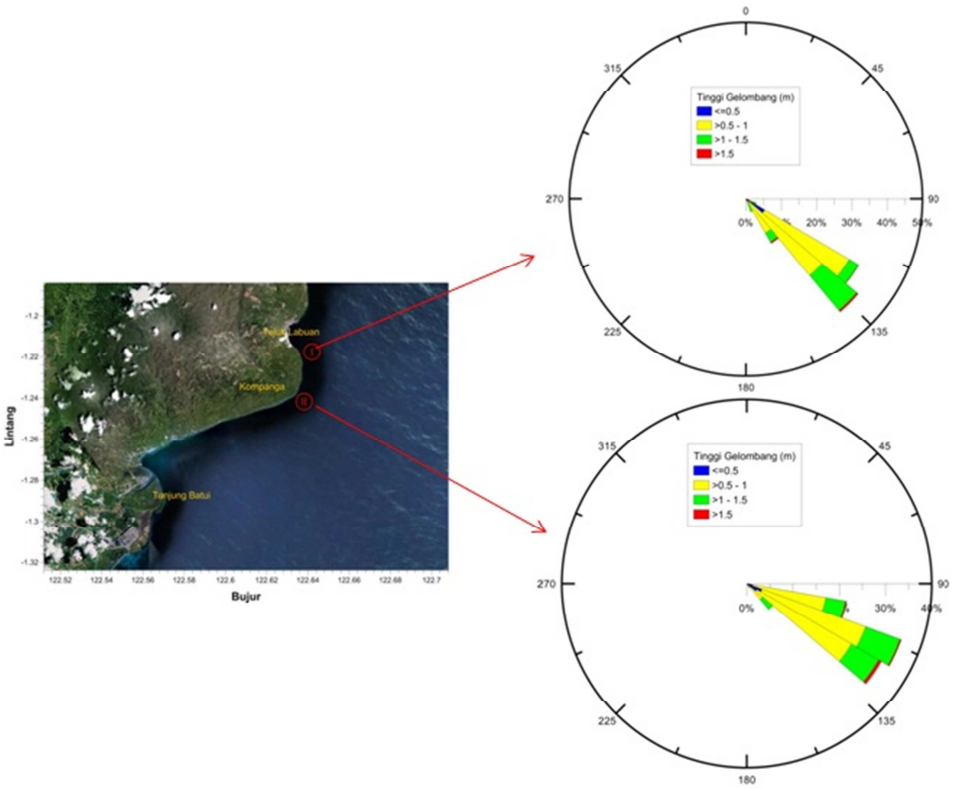


Figure 3.9 Distribution, direction and height of waves in the Strait Peling Coastal Waters

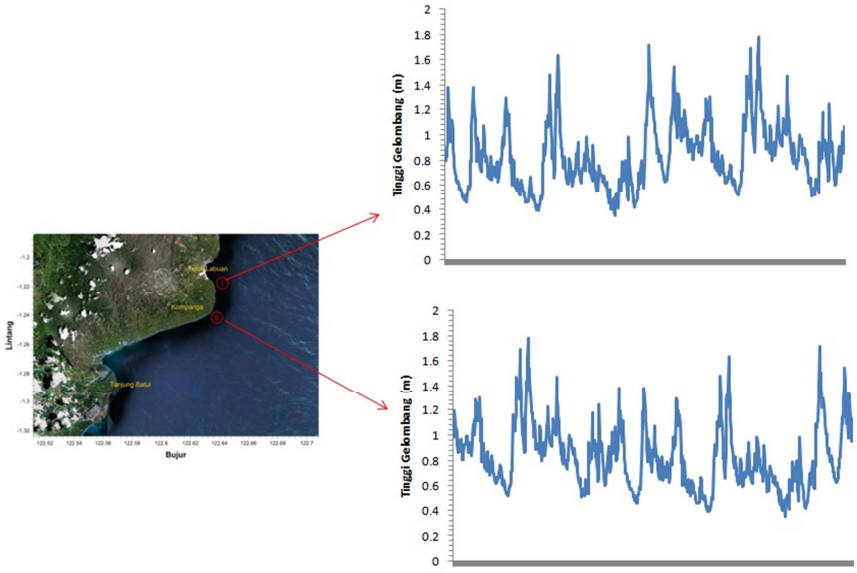


Figure 3.10 Changes in significant wave height during the month of May 2012 in the Strait Peling Coastal Waters

3.1.5.4 Sea currents at Strait Peling Coastal Water

The simulation results of flow pattern hydrodynamic model in the coastal waters of Strait Peling on each particular tidal condition are presented in Figure 3.11, 3.12, 3.13 and 3.14. The stream pattern at the highest tide (high water) shows a flow pattern dominated by the mass movement of water towards the west or approaching the coast with speeds ranging between 0,0003 m/s to 0,0009 m/s. In the southeastern coast of Kompanga water mass variation (Eddy) occurs heading for Banda Sea (Figure 3.11).The flow patterns during high tide towards low tide at Strait Peling coastal – Central Sulawesi generally shows that the current is dominated by the mass movement of water toward the east and then to southeast when it is mixed with the dominant water mass originating from the Maluku Sea.

The mixture of water mass then moves toward the Banda Sea (Figure 3.12). The flow velocity during ebb tide at Strait Peling are highly variable with a range between 0,01 m/s to 0,11 m/s.

The stream pattern resulting from the simulation results of hydrodynamics model in the coastal waters of the Strait Peling during lowest tide (low water) indicates orientation movement dominated by the mass movement of water toward the southeast at very low speeds ranging from 0,0002 m/s to 0,001 m/s (Figure 3.13). Figure 3.14 shows the flow pattern at low tide toward the tide (flood tide) which is dominated by the currents movement toward the west or approaching the coastal waters where most of the streams turn to southeast direction with a flow speed of 0,02 m/s to 0,13 m/s.

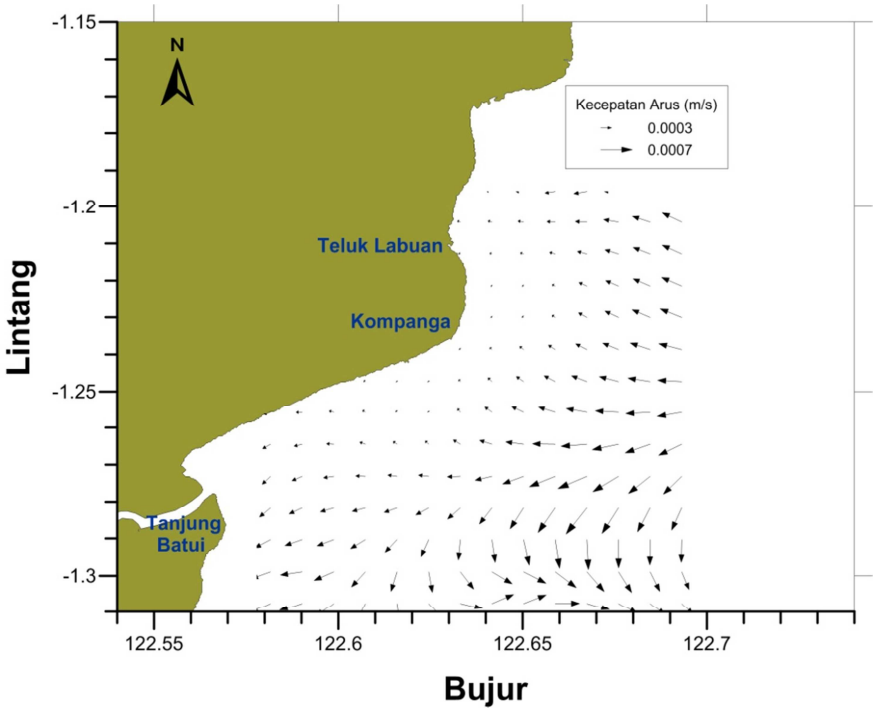


Figure 3.11 Stream pattern during the highest tides at Strait Peling Coastal Waters

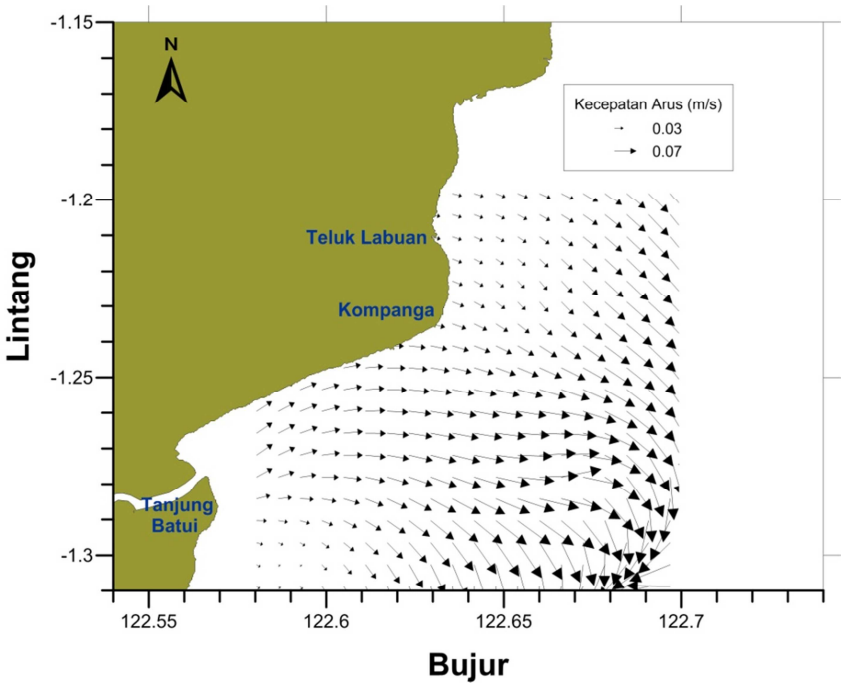


Figure 3.12 Stream pattern during ebb tide at Strait Peling Coastal Waters

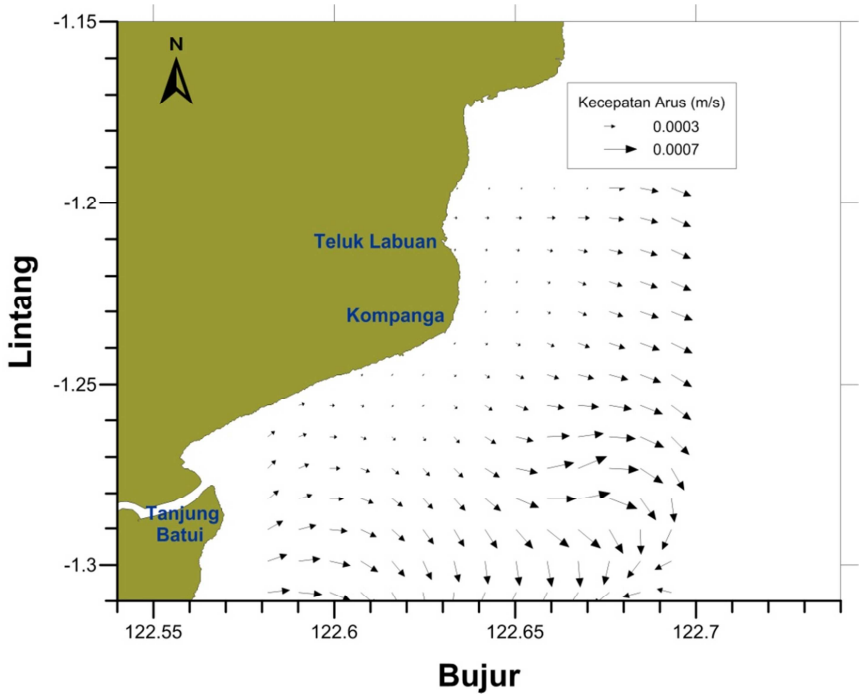


Figure 3.13 Stream pattern during the lowest tide at Strait Peling Coastal Waters

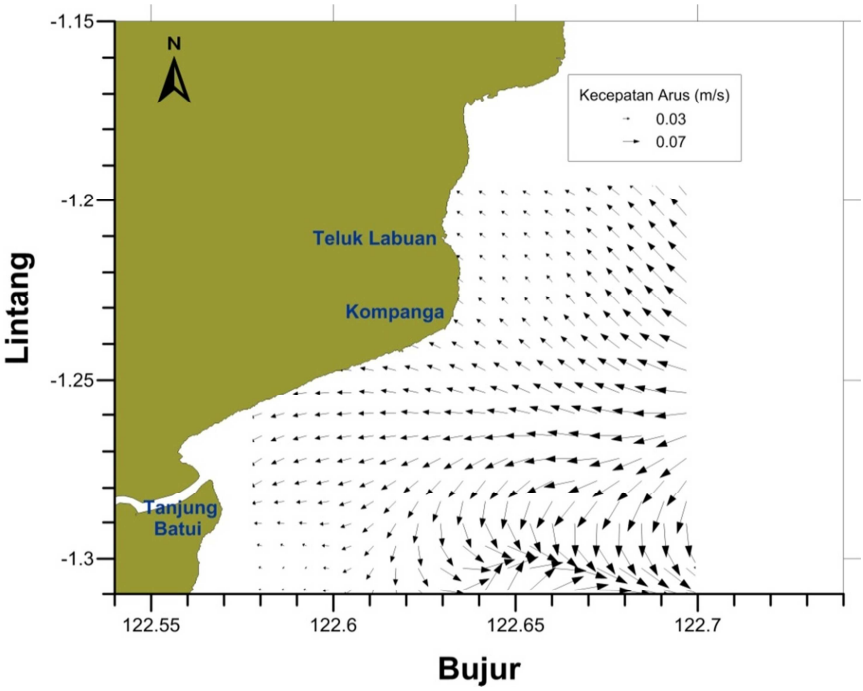


Figure 3.14 Stream pattern at low tide toward the flood tide at Strait Peling Coastal Waters

3.1.5.5 Sea Water Quality

Based on the results of laboratory analysis, the quality of sea water around the study area shows the parameters which are above the threshold value, as can be seen in Table 3.19.

Table3.19 Results of Sea Water Sample analysis around Study Area

No.	Parameter	Unit	Result	Quality standard
1.	Odour	-	Odourless	Natural
3.	Total suspended solids (TSS)	mg//L	0.4	Coral 20, Mangrove 29, Lamun 20
3.	Water temperature	℃	25	Natural
4.	pH	-	7.52	7,0 – 8,5
5.	Salinity	‰	3	Natural, Coral 33, Mangrove<34, Lamun 33 – 34
6.	Ammonia (NH_3-N)	mg/L	<0.03	0,3
7.	Phosphate (P04-P)	mg/L	<0.09	0,015
8.	Nitrate (NO3-N)	mg/L	0.09	0,008
9.	Sulphides (H_2S)	mg/L	<0.02	0,01
10.	Phenol total	mg/L	<0.06	0,002
11.	MBAS	mg/L	<0.02	1
12.	Oil & Grease	mg/L	<2	1
13.	Cadmium (Cd)	mg/L	<0.02	0,001
14.;	Copper(Cu)	mg/L	<0.03	0,008
15.	Lead (Pb)	mg/L	<0.03	0,008
16.	Zinc (Zn)	mg/L	<0.03	0,05

Note: Quality Standard KepMen LH No. 51 of 2004, - The sign < indicates results below the detection limit

3.2 Biology

3.2.1 Flora

3.2.1.1 Project site characteristics

The land for the development of ammonia industry and supporting facilities constitutes a community plantation area. The project site is located in the village Uso, Sub-district Batui, District Banggai, Central Sulawesi Province. The farm people are no longer maintained by the community since 2004, after the payment of land by the proponent. The area of land to be used for the development of ammonia industry and supporting facilities at this stage is about 50 ha.

3.2.1.2 Community Plant Vegetation

The remains of garden plants that were mainstay of the community before the land had been released by the initiator, could still be found growing mixed with natural plants in the form of trees or shrubs. Garden plants that were found at the time was Coconut (Cocos nucifera), cocoa (chocolate, Theobroma cacao), hazelnut (Aleurites moluccana), cashew (Anacardium occidentale), clove (Syzygium aromaticum) and coffee (Coffea arabica). Besides these garden plantations that are commercial cropss, the people also grow other types of fruit trees such as Mango (Mangifera indica), Embacang (Mangifera foetida), Durian (Durio zibethinus), tan (Iansium domesticum var Pubescens), Tamarind (Tamarindus indica) and Star fruit (Averhoea belimbi).

The natural types of plants that form the shrubs include palm grove (Arenga pinnata), wooden goat (Garuga Floribunda), renghas (Gluta renghas), bintinu (Melochia umbellate), katapang (Terminalia catappa), bamboo rope (Gigantochloa apus), mara (Macaranga tanarius), sea hibiscus (Hibiscus tiliaceus), chrysolite (Michelia champaca), lame (Alstonia scholaris) and kapok (Ceiba pentandra). The other natural shrubs are kirinyuh (Eupatorium inulifolium), saliara (Lantana camara), jarong (Stachytarpeta jamaicensis), honje hutan (Phoemeria speciosa), gamal (Gliricidia sepium) and shelled (Ixora javanica) whereas herbaceous plant species are sadagori (Sida rhombifolia), babadotan (Ageratum mexicanum), pulutan (Urena lobata), jarong lelaki (Hyptis brevipes) and rumput hutan Gahnia (Gahnia javanica).
Density, frequency and some dominant rate (SDR) of various plant species found in the project site can be seen in Table 3.20.

3.2.1.3 Coastal vegetation

Strait Peling coastline belonging to the project site is a sloping coast. Establishment of Mangrove community which is a reserved community was not found. Vegetation developments are the remnants of the Baringtonia structure whose land has been cultivated by the community to become mixed farms. The remainders of Baringtonia formation can still be found such as katapan, renghas, sea hibiscus and jarak pagar (Zatropa curcas). The types of crops cultivated/ planted by the people are cashew nuts, mango, coconut, guava stone (Psidium guajava) and guava (syzygium aqueum). The coastal natural plants which are shrubs and herbaceous include saliara, kirinyuh, jarong, sadagori, jarong lelaki, pulutan, putri malu (Mimosa invisa) and iles-iles (Amorphophallus campanulatus).

Outside the boundaries of the project site is primary forest that still is dominated by forest trees. The types of woods are dominated by Sulawesi endemic trees such as damar babi (Dacryodes rostrata), palapi (Herietia javanica), damar (Agathis dammara), jelutung (Dyera costalata), nyamplung hutan (Callophyllum celebicum), gopasa (Vitex cofassus), kolaka (Parinaria corymbosa), omboyuan (Metrosideros petiolata), koti-koti (Lindera sp.), dihi (Planchonella obovata), longori (Santiria laevigata) and gaharu (Aqularia cumingiana).

Table 3.20 List of frequency, density and Some Dominant Rate (SDR) of Plant species at the Project site

No.	Latin name	Local name	KR	FR	SDR
1	*Theobroma cacao*	Coklat	8,91	4,78	6,84
2	*Cocos Nucifera*	Kelapa	6,96	4,78	5,83
3	*Eugenia Aromatica*	Cengkeh	6,68	4,78	5,73
4	*Eupatorium Inulifolium*	Kirinyuh	4,68	4,79	5,74
5	*Ceiba Pentandra*	Randu	5,84	4,78	5,31
6	*Anacardium occidentale*	Jambu monyet	5,29	4,78	5,05
7	*Leucaena leucocephala*	Petai cina	5,29	4,78	5,03
8	*Coffea Arabica*	Kopi	5,57	4,30	4,93
9	*Stachytarpeta jamaicensis*	Jarong	5,29	4,30	4,79
10	*Lantana camara*	Saliara	5,29	3,82	4,55
11	*Glirisida sepium*	Gamal	4,73	4.30	4,51
12	*Mangifera indica*	Mangga	3,34	4,30	3,82
13	*Lansium domesticum var. pubescens*	Kokosan	3,06	4,30	3,68
14	*Aleurites molucana*	Kemiri	2,78	4,30	3,,54
15	*Gigantochloa apus*	Bambutali	3,06	3,34	3,20
16	Durio zibethinus	Durian	2,22	3,82	3,02
17	*Macaranga tanarius*	Cemara	2,50	3,34	2,92
18	*Mangifera fuetida*	Embacang	2,50	3,34	2,92
19	*Garuga floribunda*	Kayu kambing	1,94	2,87	2,40
20	*Hibiscus macrosinensis*	Kembang wera	1,39	2,39	1,89
21	*Michela champaka*	Bunga cempaka	1,39	2,39	1,89
22	*Alstonia sholaris*	Lame	1,39	2,39	1,89
23	*Arenga pinnata*	Aren	1,39	2,39	1,89
24	*Melochia umbellata*	Bintinu	1,39	2,39	1,89
25	*Gluta renghas*	Renghas	1,11	1,91	1,51
26	*Terminalia katappa*	Katapang	1,11	1,91	1,51
27	*Calophyllum celebicum*	Nyamplung hutan	1,11	1,91	1,51
28	*Tamarindus indica*	Asam	1,11	1,43	1,27
29	*Averhoea carambola*	Belimbing	0,55	0,95	0,75

Source: Primary Data, 2012
Notes : KR = Relative Density, FR = Relative Frequency, SDR = Some Dominant Rate

3.2.2 Fauna

Recording of wildlife to the area of study was carried out by traverse inventory based method (Sigi) and interviews with residents. The habitats of wildlife animals are observed to occupy their fields, coastal vegetation and primary forest vegetation. Terrestrial species found in the project site locations are relatively very rare. From the observations and population tales / stories, the animals recorded are of the following groups:

3.2.2.1 Mammals

There are only six species of mammals in the project site and surrounding areas. These types of animals are black macaques (Macaca tonkeana), forest cat (Macrogalidia musshenbroekii), squirrel (Sciurus vulgaris), squirrel (Callosciurus notatus), bats (Pteropus edulis) and rat (Rattus, rattus). These animals occupy shrub vegetation habitats, coastal vegetation and forest vegetation outside the project site.

3.2.2.2 Aves / Birds

Unlike land animals, the types of birds are relatively much discovered. A species of bird groups are easily found during field observations. As many as 19 species can be straight as a bird inventory like kacamata bird (Zosterops consobrinorum), honey birds (Nectarina aspasia), turtledoves (Streptopelia chinensis), cekakak sungai (Halcyon fumebris), kepinis (Apua affinis), crows (Corvus enca), gereja (Passer montanus), sea hawk (Halistur Indus) and Sulawesi hawk (Spilornis rutipectus).

Other bird species as seen by the local community footprint across the project site include jalak (Scissirostrum dubium), julang Sulawesi (Rhiticeros casidik), kuntul (Egretta alba), ayam hutan (Gallus gallus), grey hawk (Ichtyophaga ichtyaetus), serindit (Loriculus galgulus) and srigunting (Dicrurus montanus). Families of these bird species can be seen in Table 3.21

Table 3.21 List of bird species in the Region

No.	Name of area	Latin Name	Family
1	Kacamata/jumeli	*Zosterops consobrinorum*	Zosteropidae
2	Burung madu/oli	*Nectarine aspasia*	Nectarinidae
3	Tekukur/tagoo	*Streptopelia chinensis*	Columbidae
4	Cekakak sungai/tengko	*Halcyon fumebris*	Alcedinidae
5	Kepinis rumah	*Apus affinis*	Apodidae
6	Gagak banggei (hawk)	*Corvus unicolor*	Corpidae
7	Burung gereja	*Paser montanus*	Plocidae
8	Elang bondol / bomboliano	*Haliastur indus*	Accipritridae D
9	Elang Sulawesi / konka	*Spizaetus lanseolatus*	Accipitridsae D
10	Jalak/kuluri	*Scissirostrum dubium*	Sturnidae
11	Julang Sulawesi/alio	*Rhiticeros casidik*	Bucerotidae
12	Kuntul putih	*Egretta alba*	Ardeidae
13	Ayam hutan/manukakaju	*Gallus gallus*	Phasianidae D
14	Elang abu-abu/toeya	*Ichtyophaga ichtianetus*	Accipicidae D
15	Srindit / pinisi	*Loriculus galgulus*	Psitacidae
16	Srigunting/ntaki	*Dicrurus montanus*	Dicruridae
17	Setgunggung/kongkak Ranting	*Cuculus saturatus*	Cuculidae
18	Bubut sulawesi/kunku	*Centropus celebensis*	Cuculidae
19	Elang ular/mahanggo	*Spilornia rutipectus*	Accipitridae D
20	Bondol taruk/tiksovo	*Lonchura molucca*	Plocidae
21	Caladi Sulawesi/balotutu soyo	*Dendrocopus temminckii*	Picidae
22	Wali kembang/pune	*Tinilopus melanuspila*	Columbidae

Source : Primary Data 2012 ; Notes : D = Reserved (Protected by legislation) / Endemic

3.2.2.3 Reptiles

There are only 10 species of reptiles group recorded in the study area namely, biawak / monitor lizards (Varanus salvator), kadal / lizards (Mabouia multifasciata), water snakes/ular air (Natrix piscator), ular sanca/python (Phyton molurus), ular hijau/ green snakes (Trimesurus albolabris), ular belang/ striped snake (Bungarus fascitus), ular sendok/cobra (Naya sputatrix), cecak (Hemidactylus frenatus) and bunglon/ chameleon (Calotes jubatus).

3.2.2.4 Amphibians

Amphibians are not much found in this study. There are only 4 types amphibians found during field observations namely, Kodok budug / budug toad (Bufo melanostictus), bangkong / kuhl (Bufo bifurcatus**),** katak sawah/rice frog (Rana calconota) and katak pohon/ tree frogs (Polypedates leucomystax).

3.2.3 Aquatic biota

3.2.3.1 Nekton

The results of fish inventory in the river Musolang records that there are only seven types of fish e.g. ikan lele / catfish (Clarias batrachus), bogo (Chana striata), betok (Anabas testudineus), udang/shrimp (Macrobrachium sp.), belut/Eel (Monopterus albus), sisili (Mastacembelus erythrotaenia) and tompil. In the vicinity of the project site only one river is found which is relatively small and shallow.

Results of fish inventory in the sea shows the number of species and number of fish populations which are numerous and varied including ikan lemuru (Sardinella lemuru), tembang (Sardinella brachysoma), talang-talang (Selar tol), belanak/mullet (Mugi cephalus), cakalang (Katsuwonus pelamis), layur (Trichiurus sp.), kakap merah (Lates camphechanus), kakap putih (L.calcalipr), baronang/rabbit fish (Siganus guttatus), kerapu balong (Ephinephelus merra), teri (stolephorus sp.), and ekor kuning (Calsio cuning). More details can be seen in Table 3.22.

3.2.3.2 Plankton

Plankton are organisms that float in the water. The field observations do not find any dominant plankton. Each type of plankton found at one particular location only. From the type of phytoplankton, Coscinodiscus marginatus is a type whose population is more compared with other types whereas the number of this type of zooplankton populations of the three species namely, Centropyxis arcelloides, Cyclops sp., and Oithona sp. are equally spread.

The numbers of findings of plankton are generally, more diverse than the benthos. This is so because of quite a lot of rainfall there. The high rainfalls may result in benthos habitat taken away by water flow in the form of silt causing damage to habitats. Similarly, the siltation of water mass may result in damage and death of the organism benthos.

Table3.22 List of Sea Fish in / around Study area

No.	Species	Name of area	Family
1	Lolosi biru	*Caesio caerulaurea*	Caesionidae
2	Ekor kuning	*Caesio cuning*	Caesionidae
3	Selar	*Alepes djeddaba*	Carangidae
4	Kwee	*Caranx melampygus*	Carangidae
5	Layang deles	*Decapterus macrosoma*	Carangidae
6	Talang-talang	*Selar tol*	Carangidae
7	Selar kuning	*Selaroides leptolepis*	Carangidae
8	Kakap putih	*Lates calcaliper*	Centropomidae
9	Kakap merah	*Lates campechanus*	Centropomidae
10	Kakap kuning	*Lutjanus bengalensis*	Centropomidae
11	Bawal putih	*Pampus argenteus*	Bramidae
12	Bawal hitam	*Formio niger*	Bramidae
13	Tembang	*Sardinella brachysoma*	Clupeidae
14	Lemuru	*Sardinella lemuru*	Clupeidae
15	Ikan napoleon	*Cheilinus undulatus*	Labridae
16	Belanak	*Mugi chepalus*	Mugilidae
17	Cakalang	*Katsuwonus pelamis*	Scrombridae
18	Kembung	*Rastrelliger brachysoma*	Scrombridae
19	Tenggiri	*Scromberomorus commersson*	Scrombridae
20	Tongkol abu-abu	*Thunnus tonggol*	Scrombridae
21	Baronang	*Siganus guttatus*	Sernanidae
22	Kerapu balong	*Ephinephelus merra*	Sernanidae
23	Layur	*Trichiuris spp.*	Trichiuridae
24	Ikan sebelah	*Psettodes erumei*	Psettotidae
25	Ikan terbang	*Cypselurus spp.*	Exocoitidae

Notes : Primary Data, 2012

3.2.3.3 Benthos

The three types of benthos organisms found at this study are Arcitectonica sp., Dentallium sp., Melanoides sp. The high rainfalls may cause benthos habitat floating and taken away by water flow in the form of silt resulting in damage to the habitat. Likewise, the siltation of water mass may result in damage and death of the organism benthos.

3.2.3.4 Coral Fish

In the sea water surrounding the project site, overall 60% and 78% of the total coral fish species are found throughout the transect. This shows the unequal distribution of coral fish species in the observation location. The Table 3.23 presents Domination Index and Shannon Index of Coral Fish in the birds' observation area by LIT Method.

Table3.23 Domination Index and Shannon Index of Coral Fish by LIT method

Location identity	No of species	C = Index Domination	H = Index Shannon	E= Evenness index
1	146	0,0275	4,2883	0,8605
2	139	0,0190	4,3743	0,8865
3	112	0,0285	4,0243	0,8529
4	120	0.0331	4,0284	0,8414

Source: PT Panca Amara Utama, 2006

3.2.3.5 Coral Composition

The observations of coral cover and other macro benthos colony at the free coast location of ammonia industry are presented in Table 3.24. Overall, the coral cover appears better at observation points towards the west (Batui) than towards the east side (Luwuk). Average coral cover in the free sea base is 52.64%. This shows quite important function of the coral colony in the sustainable ecosystem. The existence of algae in coral habitat is a unit within the coral reef ecosystem. The percentage of algae on average 15,4% is sufficient to invite the presence of marine biota especially eating the sea weeds.

Table 3.24 The percentage of Coral Cover and other benthic fauna at transect location

Bentik fauna	Coverage percentage			
	1	2	3	4
Acropora	5,47	0,63	9,17	0,17
Non-acropora	69,93	27,10	53,00	45,07
Dead Scleractinia	6,07	18,67	14,03	22,70
Algae	10,90	18,93	19,03	13,17
Other fauna	7,30	6,30	3,27	9,59
Abiotic	0,33	28,37	1,50	9,33

Source: Panca Amara Utama 2006

3.2.3.6 Seawater Plankton Composition

Diatomae group belonging phytoplankton has 8 genus and Dinoflagelata group of as much as 7 genus while the group of zooplankton is recorded with 18 genus consisting of Copepoda, Crustacea, Mollusca and Polychaeta (Table 3.25).

Table 3.25 Bentik Fauna Population and Habitat description at transect location

Location identity	Benthos	Total	Environmental record
1	Coral mushroom	422	The coast consists of gravels, vegetation, nyamplung and coconut. Coral growth up to -20 m and dominated by Acropora sp. and interspersed hydroids. Reef flat short ±20m and is dominated by macro algae (Turbinaria sp.) and massive corals (Poritidae and Faviidae). Transects at -5m.
	Linkiasp	6	
	Tridacnasopp.	4	
	Acanthaster planci	7	
	Culcita novaeguinea	1	
2	Coralmushroom	47	Coast consists of gravel, vegetation, nyamplung and coconut. Corals up to -10m. Continued sand levels and ramps ½ steep. Reef flat ±20m, dominated by macro algae (Turbinaria sp.), steep slope. Dominance hydroid, coral slope angle of 60?ubble. Directions Reef flat is dominated by Por ites cylindrica and Porites lutea. Transects at -5m.
	Linkia sp-.	32	
	Tridacna spp.	5	
	Acanthaster planci	4	
	Culcita novaeguyinea	2	
3	Coral mushroom	51	Coast river having stones and white sand, palm vegetation. Reef ±50m, the dominance of macro algae (Turbinaria sp.) followed by coral slope angle 40° slightly slanting , coral growth up to 7m, slope to the bottom is slightly slanting consisting coral rubble and patches and dominated by hydroids, Porites cylindrica, and Porites lutea. Transects at -5m.
	Linkia sp.	39	
	Tridacna spp.	7	
	Hipoppus ap.	1	
	Acanthaster planci	3	
	Diadema sp.	2	
4	Coral mushroom	383	Coast having gravels, vegetation ketapang, coconut, crystal clear water. Reef flat ±25 m dominance of massive corals (Poritidae and Faviidae) interspersed. Acropora cytherea and Acropora robusta and macro algae (Sargassum sp.). Growth at coral slope up to -15m further to the sand levels. Transects at -5m.

Source : PT Panca Amara Utama ,2006

3.3 Community Social Economy And Culture

3.3.1 Demography

3.3.1.1 Population Number and Density

The ammoniac industrial development location plan and its supporting facilities PT Panca Amara Utama, lies at Uso village Kecamatan Batui. The location is on the side of provincial road which is an access from Luwuk to Batui. The villages around the factory which are assumed to be influenced are amongst others Desa Hombola and Desa Lamo at Kecamatan Batui, Desa Buyangge, Kalolos and Desa Tangkiang at Kecamatan Kintom.

Level of population density at the study location is still relatively low. If observed at village level, the most dense village is in Desa Babang Buyangge at Kecamatan Batui, e.g. 21 persons/km². Further, population with the lowest density is Uso village at Kecamatan Batui, e.g. 8 persons/km². For more information concerning village extent and its population density may be seen from Table.3.26 below.

Seen from the number of households/Family Heads at every Desa, the highest Family Head number is at Desa Lamo, Kecamatan Batui which is 435 Family Heads, compared with other villages at the study location.

Table 3.26 Demographic Condition at Study Location

No.	Desa	Population			Average number of family member (persons)	Number of Family	Extent of area	Population density
		Men	Women	Total				
I. Kecamatan Batui								
1	Uso	543	506	1,049	4	275	126,4	8
2	Hlombola	446	412	858	4	192	123,3	7
3	Lamo	861	793	1.654	4	435	113,0	15
Total I		**1.850**	**1.711**	**3.561**	**4**	**902**	**362,6**	**10**
II. Kecamatan Kintom								
4	Kalolos	196	179	375	3	113	40,5	9
5	Tanglang	401	408	809	3	258	40,5	20
6	Babang Bayungge	212	206	418	3	129	29,0	21
Total II		**809**	**793**	**1.602**	**3**	**500**	**191**	**16**
Total number		**2.659**	**2.504**	**5.162**	**4**	**1.402**	**464**	**22**

Source: BPS, Kecamatan Batui and Kintom in figures, 2011

The average number of householders KK, is relatively similar, e.g. 4 persons except for villages in Kecamatan Kintom, the family members are averagely 3 persons. This means that every household or KK consists only averagely parents and two children only. This fact may be translated that there is indication that new couples are still expecting to separate from their parents or their mother's house.

Further, seen from the household livelihood the relatively small household, are profitable for developing they relatively small economic livelihood, may become an obstacle for the relative household to build a good or sufficient economic life. It may be assumed that their economic life condition very much depends in the Family Head and or the labor force in the household is relatively small. Besides, labor force other factors which influence the opportunity to, develop household economy is quality of Human Resources, business opportunity / working opportunity inside or outside the village.

3.3.1.2. Population Educational Level

Quality of population human resources at the study location is relative not good enough, as can be seen from Table3.27. In this table population education level at the study location, could be seen. In general, the mostly respondent (Family Head) at the study location have elementary school education (38,1%) further education level which could be reached by respondents of this village is Junior High School SMP/equal degree 29,5 and High School / SMA/equal degree 22,9%.

Table 3.27. Respondents Level of Education

Respondent education level		Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Elementary school not finished	Total	13	1	0	0	0	0	4
	%	12,0	4,8	0	6	0	0	3,8
Graduated elementary school	Total	4	10	8	6	8	4	40
	%	16,0	47,6	40,0	40,0	53,3	44,4	38,1
Junior High School not finished	Total	1	1	0	0	0	0	2
	%	4,0	4,8	0	0	0	0	2
Junior High School graduated	Total	10	5	5	3	4	4	31
	%	40,0	23,8	25,0	20	26,7	44,4	29,5
High School not graduated	Total	0	0	0	1	0	0	1
	%	0	0	0	6,7	0	0	1,0
High School graduated	Total	5	3	7	5	3	1	24
	%	20,0	14,3	35,0	33,3	20,0	11,1	12,9
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data 2012

Further when observed farther, result of survey shows that 1% female child are still continuing education at the university (Table 3.29). From above description it is observed that parents motivation to educate their children to higher level at the examination area, are relatively clear. This fact could e seen from lots of respondents children who have education of SLTP and SLTA, and University (Table 3,28 and Table 3.29).

This picture shows that population at survey location are urged to provide their children high education in order be able to enter better working opportunities compared with their parents

Table 3.28 Highest Education of Son within Household

Highest education of son		Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
No School yet	Total	1	4	0	6	2	1	14
	%	4,0	19,0	0	4,0	13,3	11,1	13,3
Elementary School Not Finished	Total	0	0	0	1	0	0	1
	%	0	0	0	6,7	0	0	1
Elementary School (on going)	Total	3	2	5	1	1	1	13
	%	12	9,5	25,0	6,7	6,7	11,1	12,4
Elementary School (graduated)	Total	1	0	1	0	0	0	2
	%	4,0	0	5	0	0	0	1,9
Junior High School (on going)	Total	2	4	1	1	0	0	8
	%	8,0	19,0	5,0	6,7	0	0	7,6
Junior High School (graduated)	Total	3	1	0	0	1	0	5
	%	12,0	4,8	0	0	6,7	0	4,8
High School (on going)	Total	2	2	3	1	1	1	10
	%	8,0	9,5	15,0	6,7	6,7	11,1	9,5
High School (graduated)	Total	2	3	1	0	4	1	11
	%	8,0	14,3	5,0	0	26,7	11,1	10,5
Not valid	Total	11	5	9	5	6	5	41
	%	44,0	23,8i	45,0	33,3	50,0	55,6	39,0
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data 2012

Table 3.29 Highest Education of Daughter within Household

Highest education of a daughter		Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Bujangge	
No School yet	Total	3	3	3	0	0	2	11
	%	12,0	14,3	15,0	0	0	22,2	10,15
Elementary School Not Finished	Total	7	3	6	2	2	3	23
	%	28,0	14,3	30	13,3	13,3	33,3	21,9
Elementary School (on going)	Total	2	0	1	0	0	0	3
	%	8	0	5	0	0	0	2,9
Elementary School (graduated)	Total	1	0	0	0	0	0	1
	%	4	0	0	0	0	0	1
Junior High School (on going)	Total	3	3	0	0	0	0	6
	%	12,0	14,3	0	0	0	0	5,7
Junior High School (graduated)	Total	0	0	0	0	1	0	1
	%	0	0	0	0	6,7	0	1,0
High School (on going)	Total	0	2	1	0	3	0	1,0
	%	0	9,5	5,0	0	13,3	0	5
High School (graduated)	Total	4	0	0	0	1	0	4,8
	%	16,0	0	0	0	6,7	0	5
University (on going)	Total	0	0	0	1	0	0	4,8
	%	0	0	0	6,7	0	0	1
University (graduated)	Total	1	0	0	0	0	0	1,0
	%	4,0	0	0	0	0	0	1
Not valid	Total	4	10	9	12	9	4	48
	%	16,0	47,6	45,0	90,0	60,0	44,4	45,7
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: primary data 2012

3.3.1.3. Population Mobility

The assessment of horizontal mobility can be used as an indicator of socio-economic state of the villagers. In general, employment opportunities and businesses in the villages are limited, so it will encourage villagers to venture out of the village. Likewise, growing employment and business opportunities, will bind villagers to stay in the villages unless they are able to accumulate wealth and then invest the surplus wealth out of village. This happens when the opportunities to invest in their villages is relatively limited.

The level of population mobility in this area seems relatively low, as can be seen from the number of commuters outside the village. The mobility level is 3.9% which is measured by family members including children as shown in Table 3.30. The highest mobility is to other villages within same Sub-district,then to villages of other sub-district.

Access roads and public transports viz. cars, motorcycles are available to go to the sub-district Batui (city) or, to the capital city, Luwuk.

Family members		Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Husband	Total	0	0	1	0	0	0	1
	%	0	0	5.0	0	0	0	1.0
Children	Total	2	0	0	0	0	0	2
	%	8	0	0	0	0	0	1.9
Husband & Wife	Total	0	0	1	0	0	0	1
	%	0	0	5.0	0	0	0	1.0
Unavailable	Total	23	21	18	15	15	9	101
	%	92.0	100	90.0	100	100	100	96.2
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Data Primary, 2012

Based on survey result at the examination location, the aim of family mobility is outside Kecamatan and another small amount are carrying our mobility outside the Desa. The reason for mobilization was carried out by the family heads and family members who have work outside Desa (Table 3.31)

Table 3.31 Reason for Respondents Not Carrying-out Horizontal Mobility

Reason for non available mobility in the family	Total	Desa						total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Not necessary	Total	3	3	6	1	4	3	20
	%	12,0	14,3	30,0	6,7	26,7	343,3	19,0
No opportunity	Total	0	1	2	1	4	1	9
	%	0	4,8	10,0	6,7	26,7	1,11	8,6
Have no money	Total	0	1	4	0	0	2	7
	%	0	4,8	20,0	0	0	22,2	6,7
Work is in Desa	Total	18	13	6	13	7	3	60
	%	72,0	61,9	30,0	86,7	46,7	33,3	57,1
No family	Total	1	1	0	0	0	0	2
	%	4,0	4,8	0	0	0	0	1,9
Already old	Total	2	2	0	0	0	0	4
	%	8,0	9,5	0	0	0	0	3,8
Not valid	Total	1	0	2	0	0	0	3
	%	4,0	0	10,0	0	0	0	2,9
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data 2012.

3.3.2. Social Economy

3.3.2.1. Occupation of the Community at the Study Location

The main and side occupation at the study location is seen from various main and side occupation of the entire members' if respondents household. The main occupation of the Family Head at the study location are various occupation in the agricultural, sea fishery, sector private workers and factory / mining workers existing around their Desa.

Various activities apart from this agricultural sector are mostly non-skilled work, such like laborer. Whereas activities being persevered outside the Desa is generally skilled work.

At the study location, population who rely their living on agriculture 57,4%)'on **sea** fishery 21,0%). In detail types of main and side may be seen from Table 3.32 and Table 3.33.

In this village, only a small part of Family Heads (10,5%) have additional (side) jobs. Their side jobs are still in the sectors of fishermen and agriculture, around their human settlements.

Table 3.32 Population Main Occupation at the Study Area

Main job of Family	Total Number / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Fishermen	Total	5	1	0	0	1	0	7
	%	20,0	4,8	0	0	6,7	0	6,7
Project laborer	Total	1	0	1	0	0	0	2
	%	4,0	0	5,0	0	0	0	2
Farmer	Total	9	14	9	5	9	9	55
	%	36,0	66,7	45,0	33,3	60,0	100	52,4
Private employee	Total	7	0	0	3	1	0	22
	%	28,0	0	0	13,3	6,7	0	21,0
Own business	Total	0	0	0	1	0	0	1
	%	0	0	0	6,7	0	0	1,0
Agricultural worker	Total	0	0	0	4	1	0	5
	%	0	0	0	26,7	6,7	0	4,8
Driver	Total	0	0	0	0	2	0	2
	%	0	0	0	0	13,3	0	,9
Pension	Total	0	0	0	0	1	0	1
	L%	0	0	0	0	6,7	0	1,0
Not valid	Total	3	3	1	3	0	0	10
	%	12,0	14,3	5,0	20,0	0	0	9,5
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

Table3.33 Population Additional Job at the Study Location

Additional job	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Fishermen	Total	4	0	0	0	0	0	4
	%	16,0	0	0	0	0	0	3,8
Farmer	Total	1	2	0	0	0	0	3
	%	4,0	9,5	0	0	0	0	2,9
Private employee	Total	0	1	0	0	0	0	`
	%	0	4,8	0	0	0	0	1,0
Own business	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
Security	Total	2	0	0	0	0	0	2
	%	8,0	0	0	0	0	0	1,9
Not available	Total	18	17	20	15	15	9	94
	%	72,0	81,0	100	100	100	100	89,5
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

3.3.2.2. Ownership and Control of Land Resources

It has been forwarded in the previous section that population occupation in agricultural sector is relatively dominant. The amount of dependency on agricultural sector could also be seen from ownership and control of productive, dry lands and gardens / fields. Gardens in this area are normally planted by coconuts, candlenut, chocolate, and durian. Ownership of gardens in Desa of study location, are approximately 34,3%. In general, the extent of ownership < 2,0 Ha .besides garden,8,6% population who own dry land / field, are usually grown by seasonal plants, such as vegetables, sweet potatoes and nuts Table 3.34 and Table 3.35)

Owners of rubber, chocolate, coconuts, or candlenut plantations which will be changed into ammoniac industry and its supporting means PT PAU are generally owned by population of Uso village and Desa Kalolos.

Table 3.34 Ownership and Control of Land (Garden)

Extent of owned garden	Total %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Bujangge	
0,0	Total	11	19	14	11	10	4	69
	%	44,0	90,5	70,0	73,3	66,7	44,4	65,7
0,5	Total	2	0	2	1	1	1	7
	%	8,0	0	10.0	6,7	6,7	11,1	6,m7
1,0	Total	4	2	1	1	0	1	9
	%	16,0	9,5	5,0	6,7	0	11,1	8,6
1,5	Total	1	0	0	1	1	0	3
	%	4,0	0	0	6,7	6,7	0	2,9
2,0	Total	6	0	2	0	0	2	1
	%	24,0	0	19,0	0	0	22,2	10,5
3,0	Total	1	0	0	0	2	1	4
	%	4,0	0	0	0	13,3	11,1	3,8
5,0	Total	0	0	0	0	1	0	1
	%	0	0	0	0	6,7	0	1,0
5,5	Total	0	0	1	0	0	0	1
	%	09	0	5,0	0	0	0	1,0
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

Table 3.35 Table of Land Ownership and Authority

Extent of garden ownership	Total /%	Desa						
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	Total
0,0	Total	25	13	19	15	15	9	96
	%	100	61,9	95,0	199	100	100	91,4
0,5	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
2,0	Total	0	3	1	0	0	0	4
	%	0	14,3	5,0	0	0	0	3,8
4,0	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
6,0	Total	0	2	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
8,0	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
10,0	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012.

3.3.2.3. Population House Facilities

Description concerning population house facilities in the study location shows population household living is relatively good. Table 3.36 tries to show housing condition and facilities owned inside population house. As can be seen on Table 3.36, most pat (43,8%) population houses in the study location consist of non-permanent houses..

Table3.36 Respondents House Ownership and Condition at the Study Location

Condition of respondents house	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Permanent own house	Total	10	4	5	7	10	0	36
	%	40,0	19,0	25,0	46,7	66,7	0	34,3
Permanent stay with other people	Total	0	0	0	4	3	0	7
	%	0	0	0	26,7	20,0	0	6,7
Semi permanent own house	Total	2	0	3	1	0	3	9
	%	8,0	0	15,0	6,7	0	33,3	8,6
Semi permanent stay with other people	Total	0	0	1	0	0	1	2
	%	0	0	5,0	0	0	11,1	1,9
Non permanent own house	Total	12	14	11	2	2	6	46
	%	48,0	66,7	55,,0	13,3	13,3	55,6	43,8
Non permanent rental	Total	1	1	0	0	0	0	2
	%	4,0	4,8	0	0	0	0	1,9
Non permanent stay with other people	Total	0	2	0	6,7	0	0	3
	%	0	9,5	0	16			2,9
Total	total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012.

Most of the houses has used electricity directly from PLN, while 44,8% others have already got electricity from PLN though their neighbors, and another 3,9% have no electricity facilities at their houses. (Table 3.37).

Table 3.37 Electricity Facilities at Respondents Houses at the Study Location

House electricity facilities	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Own electricity, PLN	Total	15	11	10	7	9	2	54
	%	60,0	52,4	50,0	46,7	60,0	22,2	51,4
Electricity from another house	Total	7	9	10	8	6	7	47
	%	28,0	42,9	50,0	53,3	40,0	77,8	44,8
Personal genset	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Oil lamp	Total	2	1	0	0	0	0	3
	%	8,0	4,8	0	0	0	0	2,9
Total	Total	25	21	20	15	15	9	105
	%	00	100	100	100	100	100	100

Source: Primary Data, 2912

Most of respondents' houses have TV and DVD as information and entertaining means (Table 3.38). besides those equipment, there are population whom owns motorcycle as transportation means (Table 3.39). The number of households, who own various kinds of household and transportation facilities, illustrates that their living condition levels are relatively good.

Table3.38 Population Information and Entertainment Ownership and at the Study Location

Information and entertainment means	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
TV, cassette, VCD & Newspaper	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
TV	Total	12	5	11	5	6	1	41
	%	48	23,8	55,0	33,3	46,7	11,1	39,0
TV and VCD	Total	8	4	0	0	0	1	13
	%	32,0	19,0	0	0	0	11,1	12,4
Don't Have	Total	5	11	9	10	8	7	50
	%	20,0	52,4	45,0	66,7	53,3	77,8	47,6
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

Table 3.39 Population Ownership of Transportation Vehicles at the Study Location

Transport means	Total/%	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Motorcycle	Total	21	5	6	4	5	2	43
	%	84,0	23,8	30,0	26,7	33,3	22,2	41,0
Motorcycle and bicycle	Total	1	1	0	0	0	0	2
	%	4,0	4,8	0	0	0	0	1,9
Ship	Total	0	1	1	0	0	0	2
	%	0	4,8	5	0	0	0	1,9
Don't have	Total	3	14	13	10	10	7	58
	%	12,0	66,7	65,0	66,7	66,7	77,8	55,2
Total	Total	25	21	20	15	15	9	105
	%	100	199	100	100	100	100	100

Source: Primary Data, 2012

3.3.3. Social Culture

3.3.3.1 Community Characteristic

The bond amongst community members is clearly seen at population who are bound at the village area. This happens because the population generally at each village have kinship relationship. The community highly has obedience towards formal and informal community prominent figures. The majority peoples religion are Moslem, urges them to put Moslem Leader (ulama / ustad) and also Ethnic Culture Leader (Bosanyo) have to be followed. The social lives with religious, is also reflected in daily lives, such as praying activities, which are very often carried out by the community members.

Such activity reflects the close relationship between the communities, as is also reflected in daily interactions which is shown by helping each other.

The close relationship between the communities is supported by the kinship relationship between one family with another. However, they still avoid themselves in their association in order them for not to arise problem to each others, so that social conflicts which arise may be over-come by themselves. In such cases the role of informal leader, especially religious leaders, are very essential.

At the study location, Saluan ethnic group are the majority population, besides other ethnic groups from Kabupaten Banggai and Banggai Island are Banggai and Balantak ethnic groups (Babasal = Banggai Balantak Saluan). Historically, those three ethnic groups have very tight relationship. Whereas ethnic groups from other areas in Sulawesi Main Island are Bugis, Kaili, Bajo, Poso and Pamona. Marriages amongst ethnic groups in this area, has already occurred since long time ago, especially marriage between Saluan and Bugis ethnic groups.

3.3.3.2 Social Relationship between Neighbors, Kin and Community Members

In order to understand peoples relationship or interactive pattern, interaction between relatives, neighborhood relationship and concurrent bond as village members has been observed. This patterns are measured from community members meetings and their motivation.

Community in this area are also characterized by degree of cooperation between community members, are relatively high. This matter could be seen from existing activities or community meetings in the form of prayers, celebration, ethnic ceremonies (such as “tumpe” ceremony carried out once in a year), collective contribution and taking turns of financial help in social gathering (arisan), PKK activities, collectively building or taking care of general facilities, youth and other activities.

According to result of interviews with prominent community leaders and some people, show that visits among neighbors still very often, either just for telling tales / silaturahmi, or for other necessities. This matter shows that the level of community association (paguyuban) surround the project location is still good.

Togetherness bond amongst relatives, neighbors and village members such as seen from Table 3.40, shows that the routine meetings between population are relative frequently held by the respondent / peoples following community members meetings The number of attendants of these meetings are always large although there also many members who are seldom to attend members meetings with several reasons due to their business.

However they are of the same opinion that it is necessity to follow any kind of members meetings, in order to maintain the close relationship, helping each other in economic difficulties, foods or other difficulties and maintain brotherhood them.

Table 3.40 Members Meeting Activities at the Study Location

Types of Community Meetings	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Praying	Total	5	0	1	0	0	0	6
	%	20.0	0	0	0	0	0	5.7
Praying and arisan	Total	4	0	0	2	0	0	6
	%	16.0	0	0	13.3	0	0	5,7
Praying, arisan and youth	Total	0	0	0	1	2	0	3
	%	0	0	0	6.7	13.3	0	2.9
Praying, youth and women activities	Total	0	0	0	0	0	0	1
	%	0	0	0	0	0	0	1.0
Youth activities	Total	0	0	0	0	1	0	1
	%	0	0	0	0	6.7	0	1.0
Members meetings	Total	15	15	9	9	9	22.2	1
	%	60.0	71.4	45.0	60.0	60.0	0	1.0
Meetings and arisan	Total	0	6	3	0	2	0	1
	%	0	28.6	15.0	0	13.3	4	1.0
Youth and meetings	Total	1	0	0	3	0	44.4	2
	%	4.0	0	0	20.0	0	0	1.9
Arisan and women organization	Total	15	0	1	0	0	0	59
	%	60.0	0	5.0	0	0	0	56.2
Praying and meetings	Total	0	0	0	0	0	0	11
	%	0	0	0	0	0	0	10,5
Not Specific / don't know	Total	0	0	0	0	0	3	7
	%	0	0	0	0	0	33.3	6.7
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

The close relationship between community members supported by the near kinship between one family and another. Besides, marriage between one village member and neighboring village often taken place in this area, so that it forms a bigger family. However, they still avoid themselves in their association in order not to cause problems to each others. Social conflicts which may arise will be tackled by themselves. In such cases, informal prominent figures such like Ethnic Culture Leader and religious leaders are very protruding.

3.3.3.3 Leadership Pattern

The existing community social class, is not as simple as described in the following, such as can be seen from Table 3.41, Informal Leaders, Ethnic Culture Leader (Bosanyo and their staff) and religious figures (Ulama / ustadz for Moslems and Priest for the Christians) and Chairman of neighborhood RT/RW and formal leaders such like Village Head, are considered as community members with high social positions. Besides acknowledged to their knowledge or skill, wealth factor is also important for this social classes.

According to the community, wealth prosperity of someone may also be seen from agricultural land properties, level of education of their children, or the amount of the worker employed in their business. Rich people are placed equal to the above mentioned prominent persons. Leadership orientation in general is based on neither formal leader nor informal leaders.

Formal leaders are such as Village Head, while informal leaders are Ethnic Culture Leader (Bosanyo and staff) and religious leaders in this area. Both types of leaders have influence in the community activities, or in overcoming existing social problems.

Informal leaders existing in the community forms a part of leadership in Desa level who are very influential in making decisions at Desa levels. Informal leaders who have much influence are generally traditional leaders who are direct descendents of the previously Banggai Kingdom.

Types of conflicts being overcome by this prominent figure are traditional conflicts, or family conflicts.

If such a dispute could not be overcome, this conflict will be further tackled by Village Head or Head of Kecamatan (Camat). However, according to community leaders in this area, conflicts tackled by Village or Kecamatan Heads are seldom because traditional figures or Heads of RT/RW may well be able to overcome such these problems.

Table 3.41. Leadership / Prominence Pattern in the Community

Community figures and reason for prominency	Total/%	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Religious leader as they are authoritative	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Village Head as they are chosen by members	Total	18	14	2	0	0	0	34
	%	72,0	66,7	10,0	0	0	0	32,4
Village Head as they are government representative	Total	3	2	4	0	3	3	21
	%	12,0	9,5	29,0	40,0	20,0	33,3	20,0
Village Head and traditional leaders as they have respons-ibility and takes care	Total	0	3	14	40,0	12	6	44
	%	0	14,3	70,0	9	80,0	66,7	41,9
Don't know	Total	3	2	0	60,0	0	0	5
	%	12,0	9,5	0	0	0	0	4,8
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: primary Data ,2012

3.3.3.4. Populations Opinion Concerning Ammonia Industrial Development Plan of PT PAU

The development plan of ammonia industry of PT PAU in this area has been known by most population who are living in the project village site and village neighboring to Desa Uso and Desa Buyangge (Table 3.42). Most part of respondents understand this development plan from AMDAL Public Socialization and tales in the community and some others knows from Village Officials who previously measured the land for the ammonia industry development.

Table 3,42 Respondents Attitude towards Ammonia PT PAU Industrial Development Plan

Knowledge concerning ammonia industry development plan	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Yes, we know	Total	15	5	7	0	1	5	33
	%	60,0	23,8	35,0	0	6,7	55,6	31,4
Don't know	Total	9	13	13	12	14	4	65
	%	36,0	61,9	65,0	80,0	93,3	44,4	61,9
Don't answer	Total	1	3	0	34	0	0	7
	%	4,0	14,3	0	20	0	0	6,7
Total	Total	25	21	20	15	15	9	105
	%	100	1003	100	100	100	100	100

Source: Primary Data, 2012

Table 3.43 shows most part of the respondents at the study location (74.3%) states that they "*do not have any objection*' towards the existence of development plan of "Ammonia Industry and Its Supporting Facilities of PT PAU' which will be developed nearby their human settlements. In general, the reason for 'no objection' is because "Ammonia Industry of PT PAU' will open working employment opportunity (40.0%),.as it is for public interest (14.3%) and (11.4%) in accordance with the government program. Whereas there are no respondents who states 'no objection' to the development plan of Ammonia Industry of PT PAU'" in their area.

Table 3.43 Respondents Attitude towards Development Plan of Ammonia Industry of PT PAU

Attitude towards development plan of Ammonia Industry PT PAU	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Yes, no objection as it is in line with Government program	Total	11	0	0	0	0	1	12
	%	*44,4*	*0*	*0*	*0*	*0*	*121,1*	*11,4*
Yes, no objection as it is for public interest	*Total*	*1*	*1*	*7*	*11*	*22*	*3*	*1515*
	%	*4,0*	*4,8*	*35,0*	*6,7*	*13.3*	*33,3*	*14,3*
Yes, no objection as it does not disturb health	Total	0	0	2	0	0	2	4
	%	0	0	10,0	0	0	22,21	3,8
Yes, no objection as it opens work opportunity	Total	6	12	2	22	9	2	42
	%	24,0	57,1	109,0	73,3	60,0	22,2	4o0,0
Yes, no objection to make Desa more advantageous	Total	0	2	1	0	1	0	4
	%	0	9,5	5,0	0	6,7	0	3,8
Yes, no objection if it does not suffer loss to the community	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Its up to you we don't care about your plan	Total	4	1	7	3	3	1	19
	%	16,0	4,8	35,09	20,0	20.0	11,1	18,1
Don't answer	Total	2	5	1	0	0	0	8
	%	8,0			0	0	0	7,6
Total	Total	25	21	20	15	15	9	105
	%	100	199	100	100	100	100	100

- **Benefit of development of Ammonia Industry of PT PAU for the Surrounding Community**

In general, development of Ammonia Industry of PT PAU is considered by the population as create profit for them. Table 3.34 shows that most part of the respondents (63.8%) considers that the development will be beneficial for them / community in general. Generally the population relates this profit with the additional working opportunities in ammonia industry (51.5%) and increase the population houses hold income (20.0%) if ammonia industry of PT PAU has been put into operation.

Table 3.44 Profit From Development Plan of "Ammonia Industry of PT PAU"

Benefit of development of Ammonia Industry of PT PAU	Total	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Opening of working opportunities	Total	14	6	3	0	3	2	28
	%	56,0	28,6	15,0	0	20,0	22,2	26,7
The area will be more busy	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
The community income will increase	Total	0	1	1	0	0	0	2
	%	0	4,8	5,0	0	0	0	1,9
The company will consider jobless people	Total	0	0	5	0	0	2	7
	%	0	0		0	0	22,2	6,7
Jobless condition will improve	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Population will join working	Total	2	0	3	0	0	0	5
	%	8,0	0		0	0	0	4,8
Opportunity of employment and income arise	Total	1	1	6	8	2	3	21
	%	4,0	4,8	30	53,3	13,3	33,3	20,0
Development of public facilities at Desa	Total	0	0	1	0	0	0	1
	%	0	0	5,0	0	0	0	1,0
Desa will grow	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Not provide benefit	Total	1	0	0	0	0	0	1
	&	4,0	0	0	0	0	0	1,0
Don't know	Total	5	12	1	7	10	2	37
	%	20,0	57,1	5,0	46,7	66,7	22,2	35,2
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

- **Anxiety Concerning Development of "Ammonia Industry of PT PAU**

Development plan of "Ammonia Industry of PT PAU", on one side is considered will benefit the surrounding community. Table 3.45 shows that most part (96.2%) does not feel anxious with the plan, and only 3.0% respondents are anxious of the development plan of Ammonia Industry of PT PAU at their area.

Table 3.45 Respondents Anxiety towards Development Plan of Ammonia Industry of PT PAU

Anxiety towards development of ammonia industry of PT PAU	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Bujangge	
Pollution will increase	Total	0	0	0	0	0	1	1
	%	0	0	0	0	0	11,1	1,0
Could not be assured yet	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Agricultural land will be taken by company	Total	0	1	0	0	1	0	2
	%	0	4,8	09	0	6,7	0	1,9
No anxiety	Total	24	20	209	15	14	8	101
	%	96,0	95,2	100	100	93,0	88,9	96,2
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

- **The Community expectations towards development plan of Ammonia Industry of PT PAU**

Due to the development plan of Ammonia Industry of PT PAU in this area gives much expectations to the population at the study location, such as can be seen from Table 3.46. an amount of 14.2% respondents expects that development of Ammonia Industry of PT PAU will absorb local manpower and 36.2% respondents expect that there will be an increase to their economy, and their Desa will be more advanced. The respondent's expectations in detail will be observed from Table 3.46.

Table 3.46 Respondent Expectations toward Ammonia Industry Development Plan of PT PAU

Expectations towards development of ammonia industry of PTPAU	Total / %	Desa						Total
		Uso	Hombola	Lamo	kalolos	Tangkiang	Buyangge	
Accommodate more local manpower	Total	3	6	1	0	5	0	15
	%	12,0	28,6	5,0	0	33,3	0	14,3
The children may also work	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Desa to advance and economy to increase	Total	15	4	6	7	4	2	38
	%	60,0	19,0	30,0	46,7	26,7	22,2	36,2
Will be able to join working	Total	2	0	2	1	0	2	7
	%	8,0	0	10,0	6,7		22,2	6,7
Clean water should be paid attention to	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,0
Community health facilities	Total	3	9	9	7	6	2	35
	%	12,0	38,1	45,0	46,7	40,6	22,3	33,3
Don't answer	Total	24	20	20	15	14	8	101
	%	96,0	95,2	100	100	03,3	99,9	96,2
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source : Primary Data,2012

Besides, several community prominent leaders expects that development and operation of Ammonia industry of PT PAU may open new employment opportunity for them. According to several community prominent leaders, their living may increase if the Management of PT PAU will involve local people in the job available at the project, during construction as well as operational stages.

However, they are aware that the level of people education in this area is relatively low. That is why for the people whose education are low will be involved in the work in accordance with the project requirement and the qualifications. Whereas the youth who have higher education (Junior High School / SLTA) and University will be more consideration and if possible, a course / vocational training will be provided which further support operational activities of Ammonia Industry of PT PAU. In this consideration, during recruitment of manpower, the Company is expected to coordinate with Kecamatan, Desa and local prominent leader.

Further, community prominent leaders, who have been interviewed, expects that PT PAU as the Owner of Ammonia Industry will have a good response if there are complaints from the community during operation of the industry later on. Also PT PAU is expected to build better relationship with the surrounding population, such as participation on community meetings, contribute to religious infra-structure such as musholla at the project site, participate in traditional ceremony such as “Tumpe”. In their opinion, this good relationship is importantly to be set-up since the beginning of activities, such as accomplishing compensation for community lands acquired for the project, until the operation of the ammonia plant later on. During construction and operational stages, several community prominent leaders and the community members are expecting that there will be a forum or communication media between the community and the Company. Through this forum, it is expected that each complaint from the community or any information from the Company will be managed well and properly

3.4. Community Health

3.4.1. Environmental Sanitation

Environmental sanitation is one of the indicators used to understand the quality of community health (see Table 3.47). If sanitation facilities within the community is sufficiently good, their health condition will relatively be better. On the contrary, if their sanitation facilities are poor or it is not sufficient, it may be ascertained that their health condition will also be worsen.

Table 3.47 Ownership of Family Toilets at the Study Location

Ownership of family toilet	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Personal toilet	Total	14	10	10	8	12	0	54
	%	56,0	47,6	50,0	53,3	80,0	0	51,4
Public or joint toilet	Total	1	0	0	0	0	0	1
	%	4,0	0	0	0	0	0	1,01
Cubluk	Total	0	0	0	0	0	1	1
	%	0	0	0	0	0	11,1	1.0
Garden	Total	0	0	0	0	0	1	1
	%	0	0	0	0	0	11,1	1,0
River	Total	5	0	3	0	0	2	10
	%	20,0	0	15,0	0	0	22,2	5
Sea	Total	2	0	0	0	0	0	03
	%	8,0	0	0	0	0	0	2,9
Total	Total	25	21	20	15	15	9	105
	%	100	29	100	100	100	100	100

Source: Primary Data, 2012.

The condition of environmental sanitation available in the study location based on survey result data shows that: 84.7% of family (KK) have their own clean water supply at their houses, 51.4% have their own bathroom. The treatment of household solid waste in general (41.0%) are carried out by collecting at the garden, and then be burnt.

Table 3.48 Source of Clean Water for Use at the Study Location

Clean water source	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Pipe line water	Total	1	2	2	0	0	33	8
	%	4,0	9,0	10,0	0	0	33,3	7,6
Pump water	Total	8	5	4	6	4	0	27
	%	32,0	23,8	20,0	40,0	26,7	0	25,7
Pail Well water	Total	16	12	9	7	7	3	54
	%	64,0	57,1	45,0	46,0	46,7	33,3	51,4
Pail Well Public Container water	Total	0	2	5	2	4	2	15
	%	0	9,5	25,0	13,3	26,7	22,2	14,3
Mountain / spring water	Total	0	0	0	0	0	1	`1
	%	0	0	0	0	0	11,1	`1,0
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source : Primary Data, 2012

Table 3.49 Source of Clean Water for Bathing – Washing at the Study Location

Source of clean water for bathing-washing	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Pipe water	**Total**	**0**	**2**	**2**	**0**	**0**	**3**	**7**
	%	0	9,5	10,0	0	0	33,3	6,7
Pump water	Total	9	5	4	6	5	6	29
	%	36,0	23,8	20,0	40,0	33,3		53
Pail well water	Total	16	12	9	7	6	3	
	%	64,0	57,1	45,0	46,7	40,0	33,3	53
Public Box well/ water	Total	0	2	5	2	4	2	
	%	0	9,5	25,0	33,3	26,7	22,2	15
Mountain / spring water	Total	0	0	0	0	0	1	1
	%	0	0	0	0	0	11,1	1,0
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

Table 3.50 System of Throwing Solid Waste at the Study Location

System of throwing waste	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Collect and burnt	**Total**	**16**	**7**	**8**	**7**	**1**	**4**	43
	%	64,0	33,3	40,0	46,7	6,7	4	41,0
Collect and burnt collectively	Total	0	0	2	0	2	1	5
	%	0	0	120,0	0	13,3	11,1	1
Taken away by official	Total	0	0	0	0	1	0	1
	%	0	0	0	0	6,7	0	1,0
Thrown into the ditch	Total	1	7	4	6	10	4	32
	%	4,0	33,3	20,0	40,0	66,7	44,4	30,5
Thrown away at random	Total	1	0	2	2	0	0	5
	%	4,0	0	10,0	13,3	0	0	4,8
Thrown into the sea	Total	7	7	4	0	1	0	19
	%	28,0	33,3	20,0	0	6,7	0	18,1
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary Data, 2012

3.4.2. Health Facilities

Along with public sanitation, it is also very important to develop the community health facilities. Based on health data available at Local Public Health Center (Puskesmas) Kecamatan Batui and Kintom, public health facilities available is such as seen from Table 3.51 below

Table 3.51. Public Health Facilities at Kecamatan Batui and Kecamatan Kintom, District of Banggai

No.	PublicHealth Facilities	Kecamatan Batui	Kecamatan Kintom
		Total	Total
1.	Puskesmas (Local Public Health Center)	1	1
2.	Pustu (Branch of Puskesmas)	5	4
3.	Polides (Clinic Village)	6	2
4.	Posyandu (Clinic Services Unit)	14	16
T O T A L		26	23

Source: Puskesmas Kecamatan Batui and Kecamatan Kintom, 2012

Table 3.52 Number of Public Health Physician at Kecamatan Batui and Kintom

No.	Public Health Physician	Kec Batui	Kec Kintom
1	General Medical Doctor	1	1
2	Dentist	1	0
3	Mid-wifery	14	7
4	SPPH	5	2
5	Dukun Bayi	-	15

Source : Puskesmas Kecamatan Batui dan Kecamatan Kintom, 2012

3.4.3. Health Condition

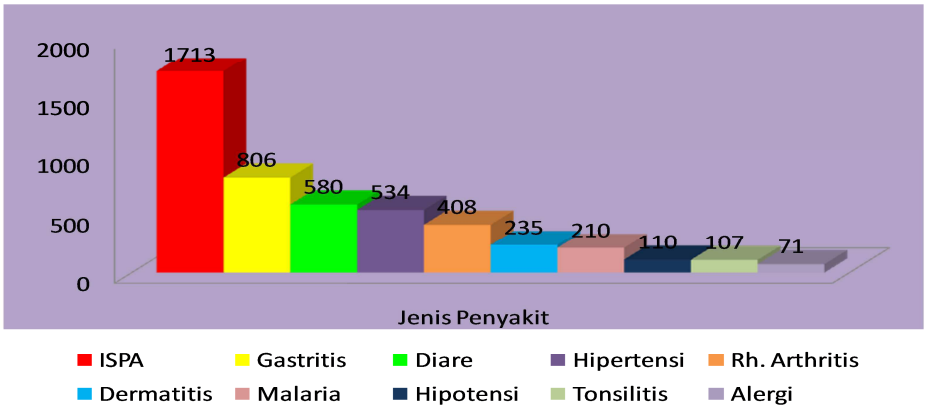
Based on data taken from Puskesmas available in Kecamatan Batui and Kecamatan Kintom during 2011, type of disease taken-place in the community at the study location may be observed from Table 3.53 below.

Table 3.53 Ten Big Diseases at Puskesmas Batui During 2011

Ranking	Type of disease	Total	%
1	ISPA	1,903	41,8
2	Gastritis	760	16,7
3	High blood pressure	446	9,8
4	Diarrhea	437	9,6
5	Allergy	393	8,6
6	Muscle and network of blood vessels	295	6,5
7	Bronchitis	116	2,5
8	Tonsillitis	113	2,5
9	Accident / compulsion	69	1,5
10	Conjunctivitis	26	0,6
Total		4.558	100,0

Source: Puskesmas Kecamatan Batui, 2011

Table 3.54 Ten Big Diseases during 2011 at Puskesmas Kintom



Source: Puskesmas Kecamatan Kintom, 2011

Table 3.55 Diseases Suffered by Adult Population Respondents

Type of disease	Total/%	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Cough	Total	5	3	2	0	1	3	14
	%	20,0	14,3	10,0	0	6,7	33.3	13,3
Influenza	Total	13	7	5	4	6	4	36
	%	52,0	333,3	25,.0	26,7	40,0	11,1	34,3
Rheumatic	Total	1	0	3	0	0	1	5
	%	4,0	0	15,0	0	0	11,1	4,8
High blood pressure	Total	2	4	2	1	2	0	11
	%	8,0	19,0	1,0	6,7	13,3	0	10,0
Short winded	Total	1	1	1	0	0	0	3
	%	4,0	4,8	5,0	0	0	0	2,9
TBC	Total	0	1	0	0	1	0	2
	%	0	4,8	0	0	6,7	0	1,9
High fever	Total	2	2	2	2	0	4	12
	%	8,0	9,5	10,0	13,3	0	44,4	11,4
Stomach	Total	0	2	4	5	5	0	15
	%	0	9,5	20,0	33,3	33,3	0	15,2
Never	Total	7	7	4	0	1	0	19
	%	28,0	33,3	20,0	0	6,7	0	18,1
Total	Total	25	21	20	15	16	9	105
	%	100	1070	100	100	100	100	100

Source: Primary Data, 2012

Table 3.56. Disease Suffered by Children (February – July 2012)

Type of Disease	Total / %	Desa						Total
		Uso	Hombola	Lamo	Kalolos	Tangkiang	Buyangge	
Cough	Total	3	3	4	0	2	3	15
	%	12.0	14,33	20,0	0	13,3	33,3	14,3
High fever	Total	12,0	7	5	7	3	2	33
	%	9	33,3	25,0	46,7	20,0	22,2	31,4
Itching	Total	36,0	0	1	0	0	0	1
	%	0	0	5,0	0	0	0	1,0
Diarrhoea	Total	0	1	0	0	0	0	1
	%	0	4,8	0	0	0	0	1,0
Malaria	Total	0	2	3	4	5	2	15
	%	0	4,8	15	26,7	33,33	22,2	14,3
Never	Total	0	1	3	4	5	2	15
	%	0	4,8	15,0	26,7	33,3	22,2	33,3
Others	Total	13	7	4	4	5	2	35
	%	52,0	33,3	20,0	26,7	33,3	22,2	33,3
Total	Total	25	21	20	15	15	9	105
	%	100	100	100	100	100	100	100

Source: Primary data, 2012

CHAPTER IV
SCOPE OF STUDY

4.1. Studied Significant Impact

Significant impact studied in Environmental Impact Analyses (ANDAL) is based on the result of coverage in Frame of Reference of Environmental Impact Analyses (KA-ANDAL). The coverage includes potential impact identification, potential impact evaluation, hypothetic significant impact and impact priority and classification. The Frame of Reference of Environmental Impact Analyses has been agreed by the Head of Space Environment Board of Central Sulawesi Province through the Decree of Frame of Reference of Environmental Impact Analyses for the Development of Ammonia Industry PT Panca Amara Utama (PT PAU) No. 660/07.87/BLHD (SKKA enclosed).

4.1.1. Potential Impact Identification

Potential impact identification was conducted to understand the entire space environment impact as a result of the development of Ammonia industry and its supporting facilities PT PAU. The method used in this activity are impact identification matrix (Table 4.1) and impact diagram (Figures 4.1, 4.2, 4.3 and 4.4) to find out the type of activity resulted in the impact on the environment component.

Table 4.1 Potential Impact Identification from Development of Ammonia Industry and its Supporting Facilities of PT Panca Amara Utama

Activity Plan Environmental Component/Environmental Impact	Pre-Construction					Construction					Operation			Post-Operation
A. PHYSICAL-CHEMICAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Climate and Air Quality														
a. Air quality				v	v								v	
b. Noise intensity				v	v								v	
2. Hydrology														
a. Surface water (run off)							v		v					
b. Surface water/river water quality														
c. Land inflitrasion										v				
3. Geology														
a. Groundwater quantity														
b. Soil susceptibility/subsidence								v						
4. Space, Land ad Soil														
a. Aesthetics										v				
b. Road damage				v										
c. Transportation				v										
d. Soil erosion					v									
5. Hydro oceanography														
a. Sea water quality												v	v	
b. Coral reef														
B. BIOLOGY														
Flora					v					v				
Fauna					v									
Aquatic biota														
C. SOCIAL, EKONOMY, CULTURE AND PUBLIC HEALTH														
Public participation	V													
Job/business opportunity			v			v					v			
Social conflict		v	v			v					v			
Social unrest														
Public income		v	v			v					v			
Livelihood														v

Notes: 1 = License and public consultation, 2 = Land release, 3 = Manpower mobilization in Pre-Construction, 4 = Equipment mobilization, 5 = Land clearing, 6 = Construction manpower mobilization, 7 = Drainage, 8 = Support structure & foundation, 9 = Building development, 10 = Green Space, 11 = Opeeation manpower mobilization, 12 = Cooler water, 13 = Ammonia making process, 14 = Termination

Figure 4.1 Diagram of Potential Impact in Pre-Construction Stage

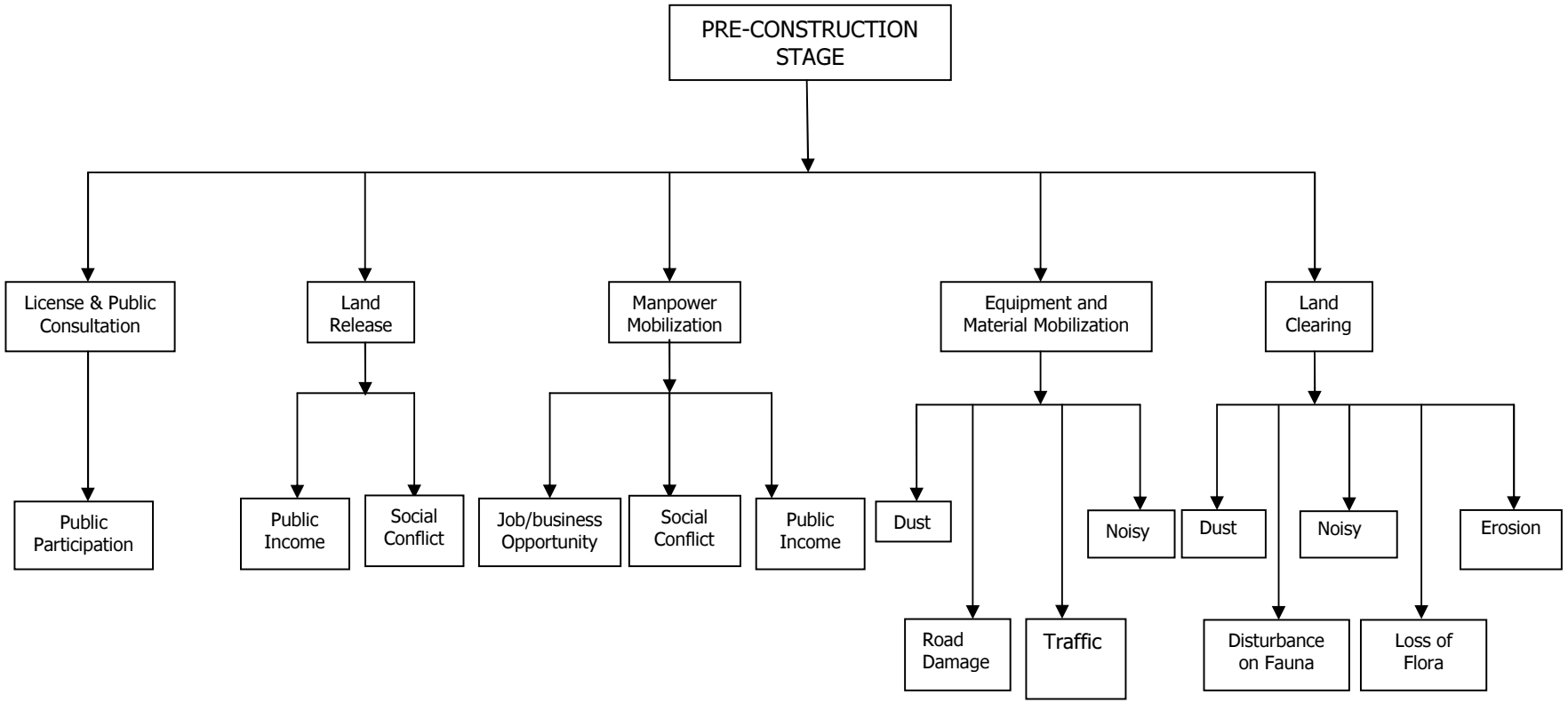


Figure 4.2. Diagram of Potential Impact in Construction Stage

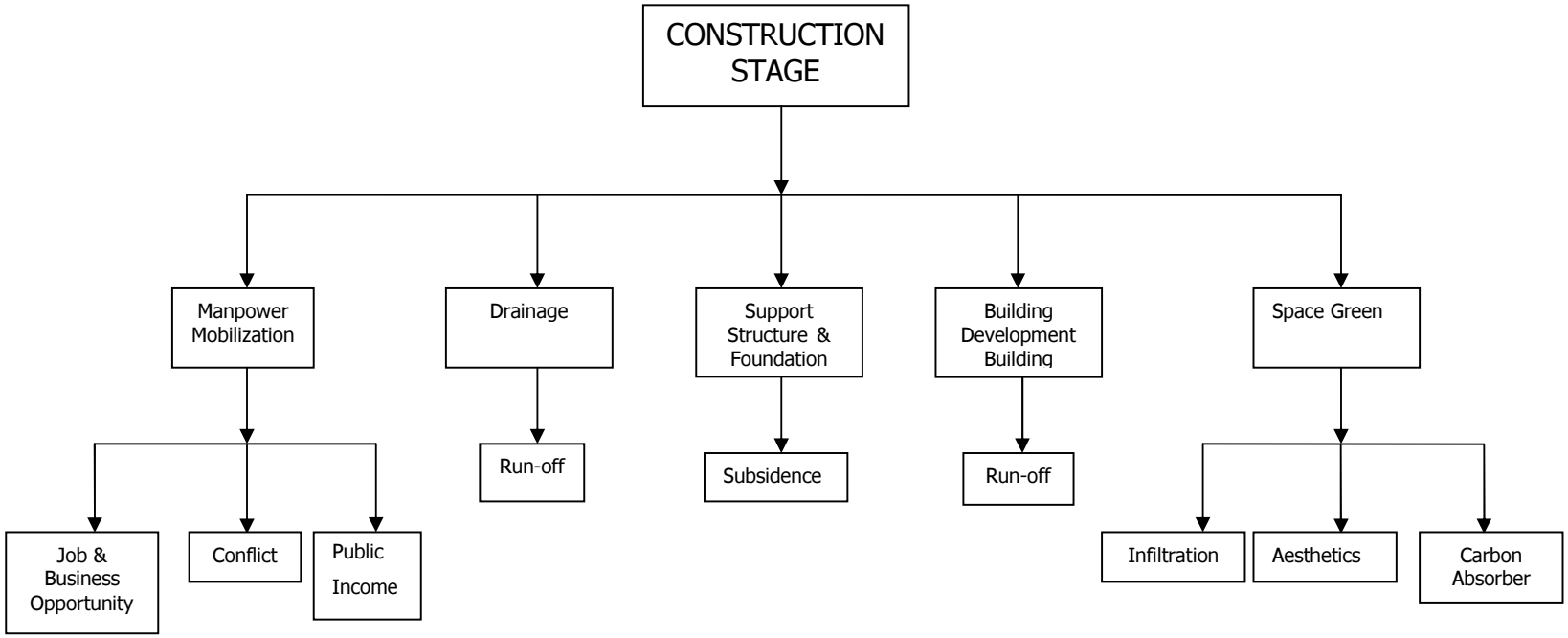


Figure 4.3. Diagram of Potential Impact in Operation Stage

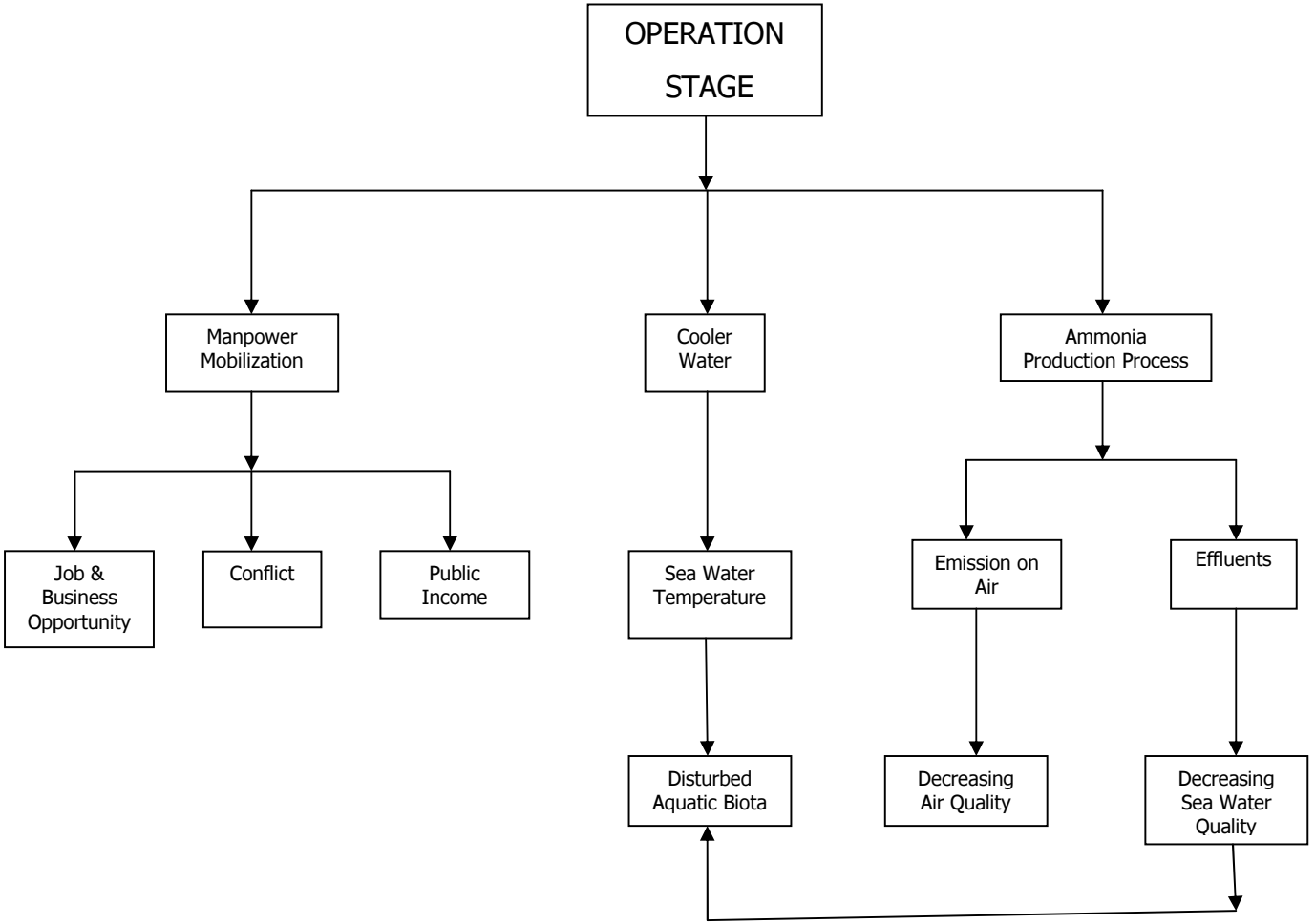
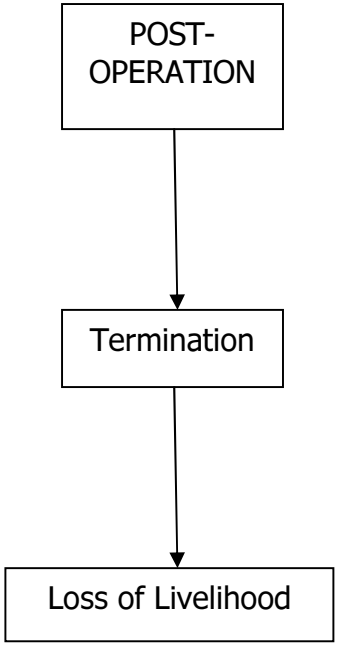


Figure 4.4 Diagram of Potential Impact in Post-operation Stage



Based on the impact identification matrix and the impact diagram, potential impact resulted from the development of Ammonia industry and its supporting facilities of PT Panca Amara Utama beginning from Pre-Construction, Construction, Operation and Post-Operation stages can be seen in Table 4.2.

Table 4.2 Potential Impact resulted from Development of Ammonia Industry of PT Panca Amara Utama

Stages of Activity	Impact Cause Activity	Affected Environment Component/Sub-component	Type of Impact
Pre-Construction	License and Public Consultation	Social, economy and culture	1. Public participation
	Land release	Social, economy and culture	2. Public income
		Social, economy and culture	3. Social conflict
	Manpower mobilization	Social, economy and culture	4. Job/business opportunity
		Social, economy and culture	5. Social conflict
		Social, economy and culture	6. Public income
	Equipment and material mobilization	Air quality	7. Increasing dust particulate on air
		Noise	8. Noisy
		Transportation	9. Traffic disturbance
		Road	10. Road damage
	Land clearing	Air quality	11. Increasing dust particulate on air
			12. Increasing noise
		Space, land and soil	13. Soil erosion
		Flora	14. Loss of flora
			15. Disturbance on fauna

Continued

Stages of Activity	Impact Cause Activity	Affected Environment Component/Sub-component	Type of Impact
Construction	Manpower mobilization	Social, economy and culture	16. Job/business opportunity
		Social, economy and culture	17. Social conflict
		Social, economy and culture	18. Public income
	Drainage	Hydrology	19. Controlled run-off
	Support structure and foundation	Geology	20. Subsidence
	Building development	Hydrology	21. Run-off
	Green Space	Air quality	22. Carbon absorber
		Hydrology	23. Infiltration
		Aesthetics	24. Increasing aesthetics
Operation	Manpower mobilization	Social, economy and culture	25. Job/business opportunity
		Social, economy and culture	26. Conflict
		Social, economy and culture	27. Public income
	Cooler water	Hydro-oceanography	28. Increasing sea water temperature
	Ammonia production process	Air quality	29. Decreasing air quality
		Hydro-oceanography	30. Decreasing sea water quality
Post-Operation	Termination	Social, economy and culture	31. Job/business opportunity (Loss of livelihood).

Referring to potential impact identification, the development of Ammonia industry and its supporting facilities of PT Panca Amara Utama leads to 31 potential impacts.

4.1.2. Potential Impact Evaluation

Potential impact evaluation is aimed at understanding wether a potential impact is hypothetic significant or hypothetic insignificant impact. Table 4.3 shows the result of potential impact evaluation in the forms of hypothetic significant and insignificant impacts. Hypothetic significant impact will be furthermore assessed in Environmental Impact Analyses (ANDAL).

Table 4.3 Hypothetic Significant and Insignificant Impact resulted from the Development of Ammonia Industry

Type of Impact	Evaluation
1. Public participation	Public consultation is to aware the society of their role in Environmental Impact Analyses compilation. Public participation is indicated by a lot of responds such as suggestions and ideas related to the activity and environment at the time of public consultation was being run. Public participation is connected with all concerned people who live at Uso village and surrounding villages and also environment observer. This impact is categorized as **hypothetic significant impact** and will be assessed in Environmental Impact Analyses (ANDAL).
2. Public income	Land release will increase public income as a direct impact of the activity besides due to the rise in land price because of the execution of the activity. This impact is related to land owners at the site and its surroundings and is considered as **hypothetic significant impact** and will be assessed in Environmental Impact Analyses (ANDAL).
3. Social conflict	Social conflict will happen when there is a land overlapping, dispute over legacy land, indefinite borders of land, and unfair land release. This impact is related to land owners at the site and its surroundings, hence, it is included to **hypothetic significant impact** that will be assessed in Environmental Impact Analyses (ANDAL).
4. Job/business opportunity	Job and business opportunity as a result of manpower mobilization in Pre-Construction stage is a **hypothetic significant impact** because there are many impacted people. This impact is furthermore assessed in ANDAL.
5. Social conflict	Unclear manpower recruitment may results in social unrest that leads to disturbance on public order and safety. This impact is categorized as **hypothetic significant impact** since it has direct relationship to society. It is then assessed in Environmental Impact Analyses (ANDAL).
6. The increase of public income	Job and business opportunity will improve public income. This impact is only for Pre-Construction stage but it is directly felt, hence, it is also categorized as **hypothetic significant impact** and will be assessed in ANDAL.

7. Increasing dust particulate	The increase of dust particulate is resulted from equipment and material mobilization to the site. This impact does not run for long time (during equipment mobilization), hence, it is categorized as **hypothetic insignificant impact** which is not assessed in ANDAL.
8. Increasing noise	The increase of noise intensity resulted from equipment and material mobilization is a **hypothetic insignificant impact** because the audible noise by the local people is relatively small in a short time. This impact is not assessed in ANDAL.
9. Traffic disturbance	Equipment and material mobilization will increase traffic volume but does not decrease road services. The traffic will be disturbed when the vehicle turns to the site. It is a temporary disturbance, therefore, can be classified as **hypothetic insignificant impact** and need not to assess in ANDAL.
10. Road damage	Overweight of the vehicle transporting equipment and material will lead to damage of the road, because the strength of the road is not in accord. This impact is a permanent one, irreversible and some people as the users of the road become the impacted party. This impact, therefore, included to **hypothetic i significant impact** and will be assessed in ANDAL.
11. The increase of dust particulate on air	The increase of dust particulate as a result of land clearing belongs to **hypothetic Significant impact** because it goes for long enough time and covering a wide area about 50 hectares. This impact will be assessed in ANDAL.
12. Increasing noise	The increase of noise intensity as a result of land clearing is a **hypothetic significant impact** because it goes for long enough time, during land clearing, and relatively close to governmental road (the southern part of the site). This impact will be assessed in ANDAL.
13. Soil erosion	Land clearing resulted in loss of vegetation and raining water and run-off will increase soil erosion, whereas eroded soil particles running to river and sea. This impact is categorized as **hypothetic i significant impact** since the eroded area is wide enough and there are also other impacted components such as river water and sea water. The impact of land clearing on soil sub-component in the form of soil erosion will be assessed in ANDAL.
14. Loss of flora	Land clearing will be started by felling of trees and vegetation/overburden stripping. The land was formerly an artisanal plantation (coconut plantation) which covers about 50 hectares area, hence, it is supposed that some conserved floras found at the area. Considering the fact, loss of flora is categorized as **hypothetic significant impact** and will be assessed in ANDAL.

15. Disturbance to fauna	Loss of vegetation will result in disturbance to fauna. The wide of fauna habitat is around 50 hectares, therefore, land clearing impact on fauna is categorized as **hypothetic significant impact** and will be assessed in ANDAL.
16. Job/business opportunity	Job and business opportunity as a result of manpower mobilization in Construction stage is considered as **hypothetic significant impact** because there are many impacted people. This impact will be assessed in ANDAL.
17. Social conflict	Unclear manpower recruitment may results in social unrest that leads to disturbance on public order and safety. This impact is categorized as **hypothetic significant impact** since it has direct relationship to society. It is then assessed in Environmental Impact Analyses (ANDAL).
18. The increase of public income	Job and business opportunity will improve public income. This impact is only for Pre-Construction stage but it is directly felt, hence, it is also categorized as **hypothetic significant impact** and will be assessed in ANDAL.
19. Controlled run-off	Drainage channel is used in surface run-off to anticipate land clearing. Run-off control is continuously conducted, hence, it is categorized as **hypothetic significant impact** and will be assessed in ANDAL.
20. Subsidence	Building structure and foundation which does not conform to soil condition will result in a subsidence. This impact is a permanent and dangerous one and can be categorized as **hypothetic significant impact** for its relationship to totality of plant building and its supporting facilities and will be assessed in ANDAL.
21. Run-off	Significant increase of run-off volume as a result of the development of the plant and its supporting facilities is a **hypothetic significant impact** caused it covers a wide area of about 50 hectares, there are also other impacted components for long time. Considering the fact, this impact will be assessed in ANDAL.
22. Carbon absorber	Planting at a green space will result in carbon dioxide absorption. It is considered as a continuous impact and covering a wide area. Therefore, this impact is categorized as **hypothetic significant impact** and will be assessed in ANDAL.
23. Infiltration	The availability of Green Space will increase infiltration. It is also a continuous impact which covers a wide area. This impact may be categorized as **hypothetic significant impact** and will be assessed in ANDAL.
24. Aesthetics	Green Space will increase the aesthetics (embellish the environment of the plant). This continuous impact covers a wide area. This impact is categorized as **hypothetic significant impact** and will be assessed in ANDAL.

25. Job/business opportunity	Job and business opportunity as a result of manpower mobilization in Operation stage is considered as **hypothetic significant impact** because there are many impacted people. This impact will be assessed in ANDAL.
26. Conflict	Unclear manpower recruitment may results in social unrest that leads to disturbance on public order and safety. This impact is categorized as **hypothetic significant impact** since it has direct relationship to society. It is then assessed in Environmental Impact Analyses (ANDAL).
27. The increase of public income	Job and business opportunity will improve public income. This impact is directly felt during Operation stage, hence, it is also categorized as a **hypothetic significant impact** and will be assessed in ANDAL.
28. The increase of sea water temperature	Sea water which is utilized as cooler media for plant machinery is then run to the sea. It will increase the temperature of sea water and disturb oceanic biota living. It goes continuously during Operation stage, hence, this impact is categorized as **hypothetic significant impact** and will be assessed in ANDAL.
29. The decrease of air quality	Ammonia production process will result in the decrease of air quality especially CO_2, NOx and SOx content. This condition goes continuously during the Operation stage and can impair public health, hence, it can be categorized as **hypothetic significant impact.** The impact of Ammonia making on the air in the form of decreasing air quality will be assessed in ANDAL.
30. The decrease of sea water quality	Ammonia production process will result in the decrease of sea water quality which furthermore damage oceanic biota. This condition goes continuously during the Operation stage, therefore, it can be categorized as **hypothetic significant impact.** The impact of Ammonia making on the air in the form of decreasing air quality will be assessed in ANDAL.
31. Loss of job/business opportunity (loss of livelihood)	Ammonia industry closure will be followed by termination, hence, it will lead to the loss of job/business opportunity. This impact belongs to **hypothetic significant impact** because it has connection with the impacted people. The impact of termination on social economy component of the society in the form of loss of job/business opportunity will be assessed in ANDAL.

Based on the result of potential impact evaluation, the 31 potential impacts above can be summarized to 28 hypothetic significant impacts. Diagrams of hypothetic significant impact can be seen in Figures 4.5, 4.6, 4.7 and 4.8.

Figure 4.5. Diagram of Hypothetic Significant Impact in Pre-construction Stage

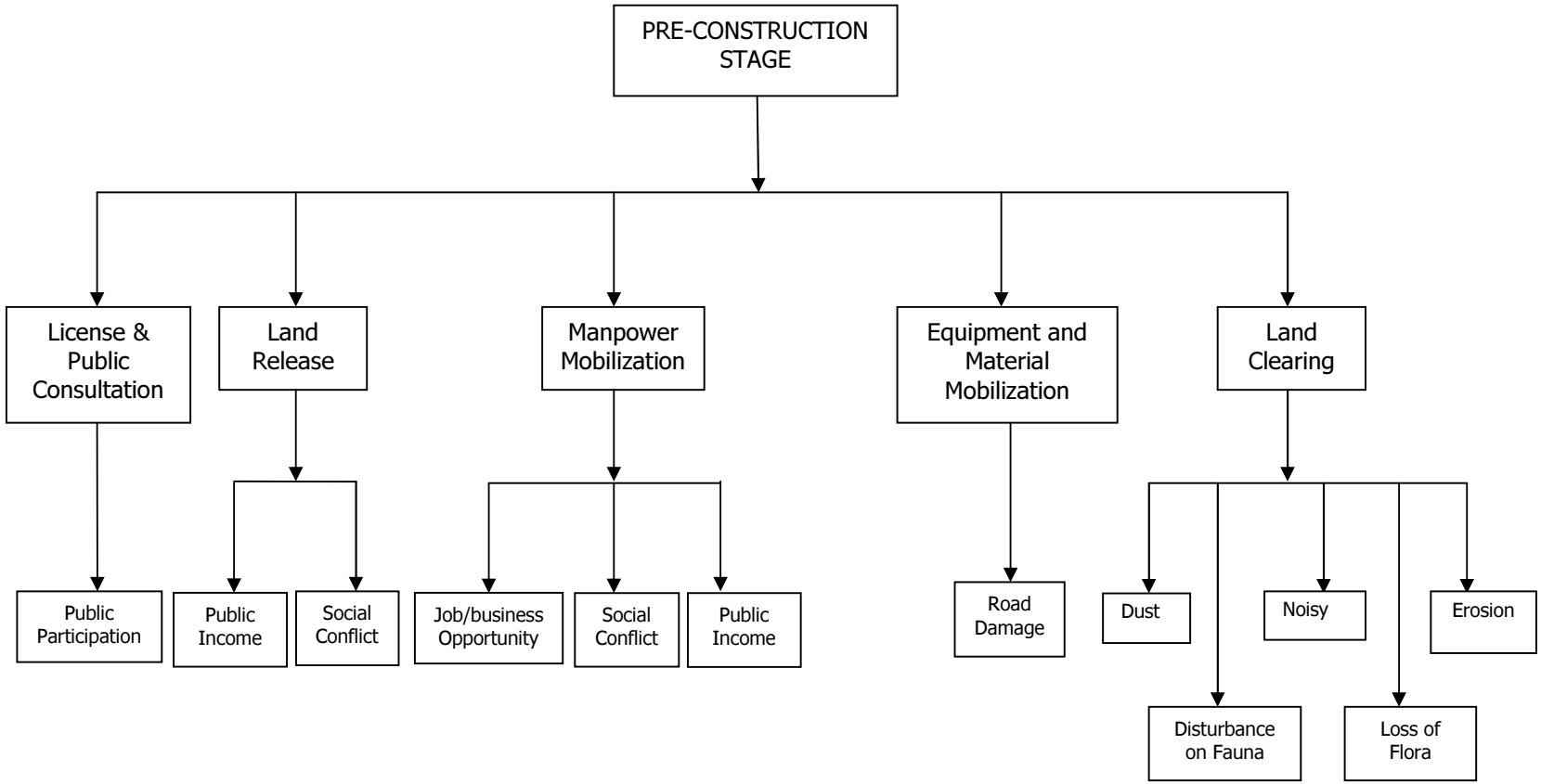


Figure 4.6. Diagram of Hypothetic Significant Impact in Construction Stage

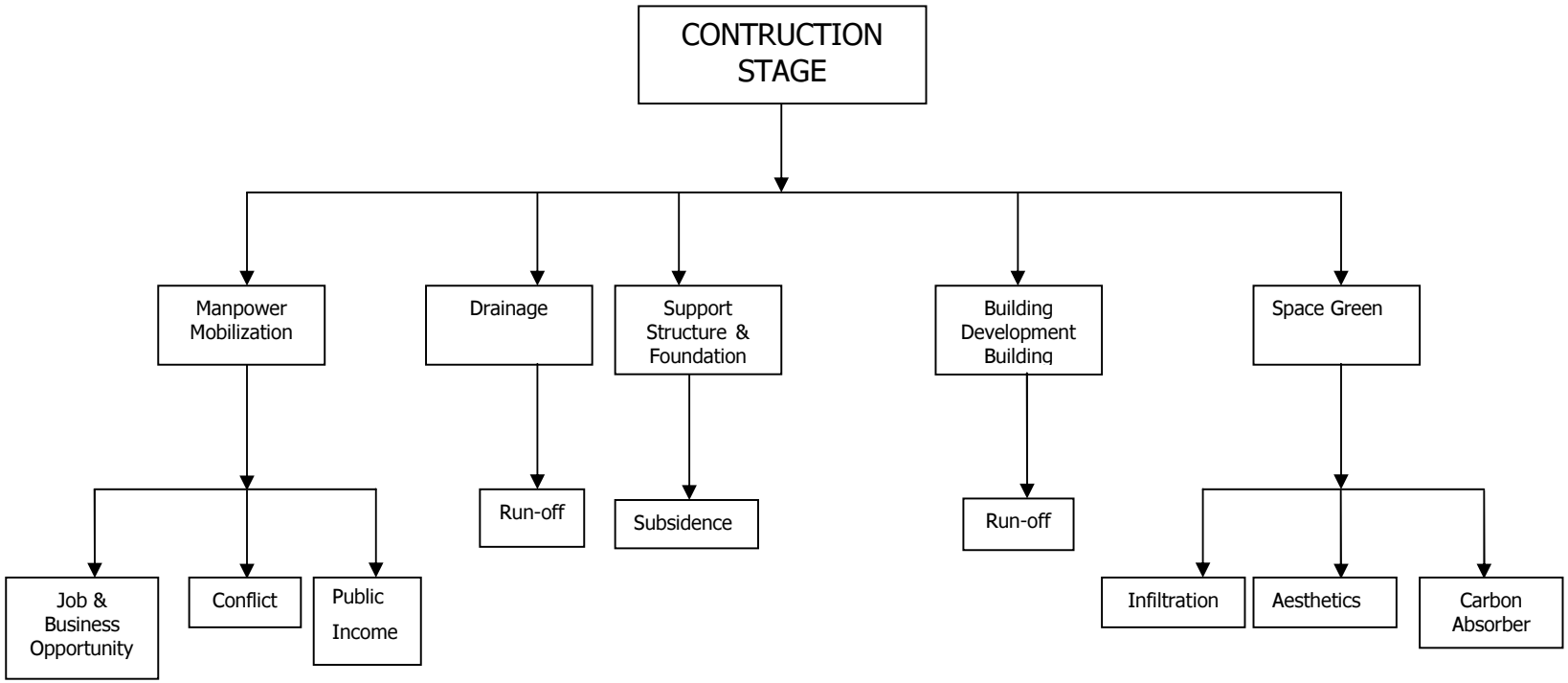


Figure 4.7. Diagram of Hypothetic Significant Impact in Operation Stage

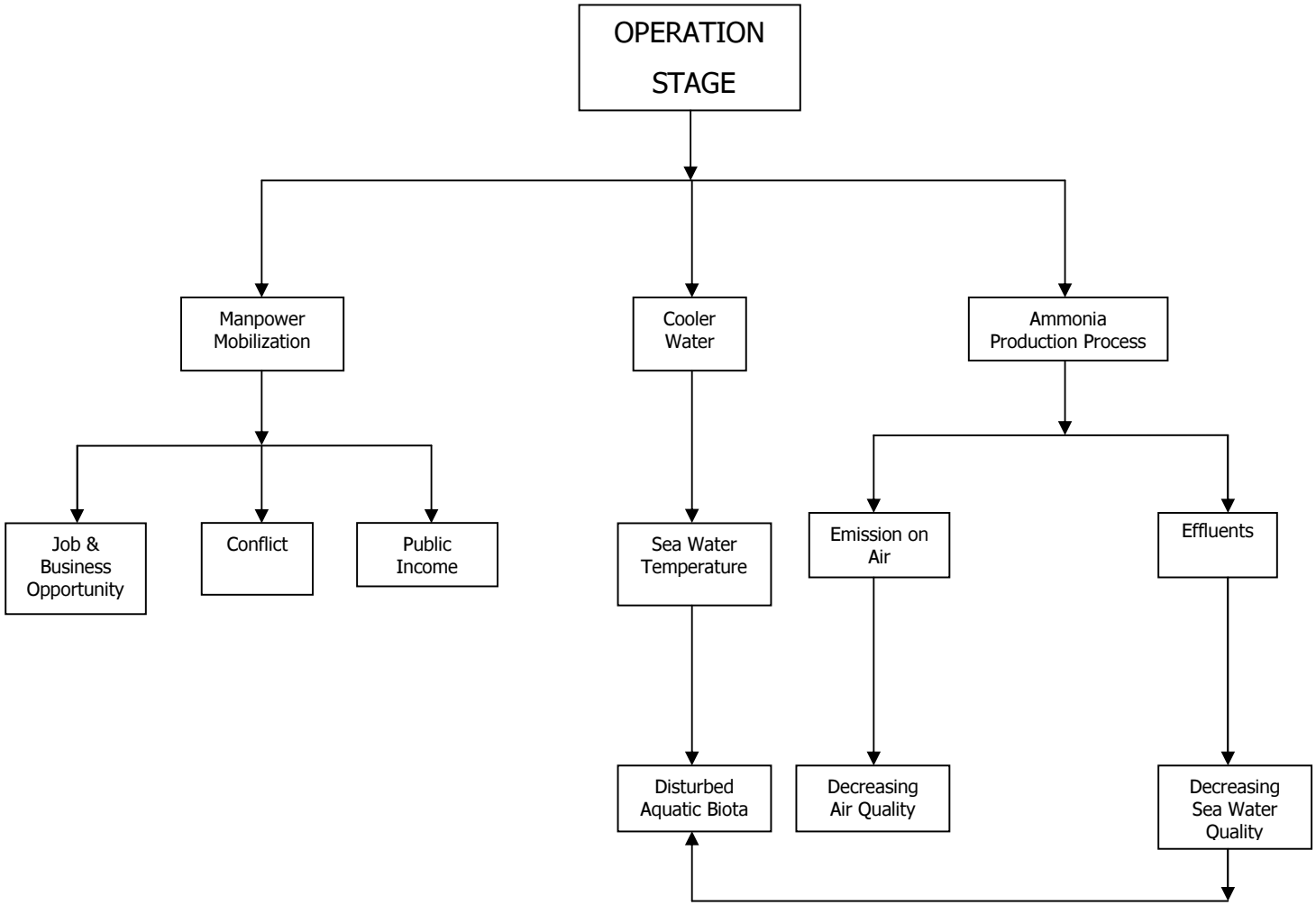
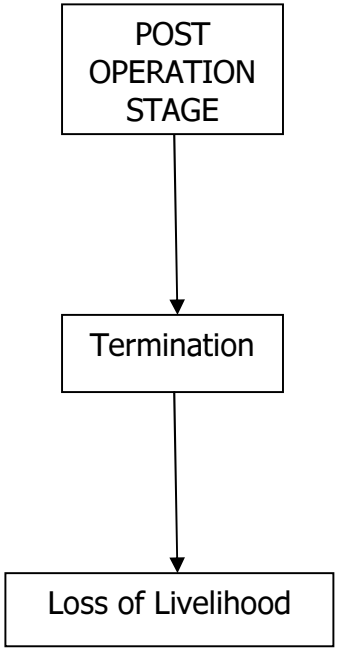


Figure 4.8. Diagram of Hypothetic Significant Impact in Post-operation Stage



4.1.3. Hypothetic Significant Impact

Based on the result of potential impact evaluation, there are 28 hypothetic significant impacts. Hypothetic significant impact, affected environmental component and source of impact are indicated in Table 4.4.

Table 4.4 Hypothetic significant impact, affected environmental component and source of impact

Hypothetic Significant Impact	Environmental Component	Source of Impact
1. Public participation	Social, economy and culture	License and Public Consultation
2. Public income	Social, economy and culture	Land release
3. Social conflict	Social, economy and culture	Land release
4. Job/business opportunity	Social, economy and culture	Construction manpower mobilization
5. Social conflict	Social, economy and culture	Construction manpower mobilization
6. Society income	Social, economy and culture	Construction manpower mobilization
7. Road damage	Road	Equipment and material mobilization
8. The increase of dust particulate on air	Air quality	Land clearing
9. The increase of noise	Noise	Land clearing
10. Soil erosion	Soil	Land clearing
11. Loss of flora	Flora	Land clearing
12. Disturbance on fauna	Fauna	Land clearing
13. Job/business opportunity	Social, economy and culture	Construction manpower mobilization
14. Social conflict	Social, economy and culture	Construction manpower mobilization

15. Public income	Social, economy and culture	Construction manpower mobilization
16. Controlled run-off	Run-off	Drainage
17. Subsidence	Geology	Support structure and foundation
18. Run-off	Run-off	Building development
19. Carbon absorber	Air quality	Green Space
20. Infiltration	Hydrology	Green Space
21. The increase of aesthetics	Space	Green Space
22. Job and business opportunity	Social, economy and culture	Manpower mobilization
23. Conflict	Social, economy and culture	Manpower mobilization
24. Public income	Social, economy and culture	Manpower mobilization
25. The increase of sea water temperature	Sea water quality	Cooler water
26. The decrease of air quality	Air quality	Ammonia production process
27. The decrease of sea water quality	Sea water quality	Ammonia production process
28. Job and business opportunity (Loss of livelihood)	Social, economy and culture	Termination

4.1.4. Impact Priority and Classification

Hypothetic significant impact priority and classification is a priority of the study. The basis of determination of hypothetic significant impact priority and classification is expert discussion including suggestion, idea and respond from the people when Public Consultation was being carried out. Considering the fact, Table 4.5 shows hypothetic significant impact priority and classification.

Table 4.5 Hypothetic Significant Impact Priority and Classification

Hypothetic Significant Impact	Source of Impact
1. Public participation	License and Public Consultation
2. Public income	Land release
3. Job/business opportunity	Construction manpower mobilization
4. Job/business opportunity	Pre-construction manpower mobilization
5. Public income	Construction manpower mobilization
6. Public income	Pre-construction manpower mobilization
7. Job/business opportunity	Operation manpower mobilization
8. Public income	Operation manpower mobilization
9. Social conflict	Land release
10. Social conflict	Construction manpower mobilization
11. Social conflict	Pre-construction manpower mobilization
12. Social conflict	Operation manpower mobilization
13. The decrease of sea water quality	Ammonia production process
14. The decrease of air quality	Ammonia production process
15. The increase of sea water temperature	Cooler water
16. Loss of conserved flora	Land clearing
17. Disturbance on fauna	Land clearing
18. Soil erosion	Land clearing
19. Subsidence	Support structure and foundation
20. Loss of livelihood	Termination in Post-operation stage
21. Controlled run-off	Drainage
22. Road damage	Equipment mobilization for Construction
23. The increase of dust particulate	Land clearing
24. The increase of noise	Land clearing
25. Run-off	Building development
26. Infiltration	Green Space
27. Aesthetics	Green Space
28. Carbon absorption	Green Space

4.2. Study Area Coverage and Time Limit of Assessment

4.2.1. Study Area Boundary

The area for study of Environmental Impact Analyses is determined based on resultant of 4 area boundaries, i.e. activity boundary (site boundary), ecological boundary, social boundary and administrative boundary (Map 4.1). More information on the study area of Environmental Impact Analyses (ANDAL) of the development of Ammonia industry and its supporting facilities of PT Panca Amara Utama at Uso village, Batui Sub-district, Banggai Regency, Central Sulawesi Province is as follows:

4.2.1.1. Site Boundary

Site boundary is based on physical boundaries of the area where Ammonia industry and its supporting facilities of PT Panca Amara Utama will be developed.

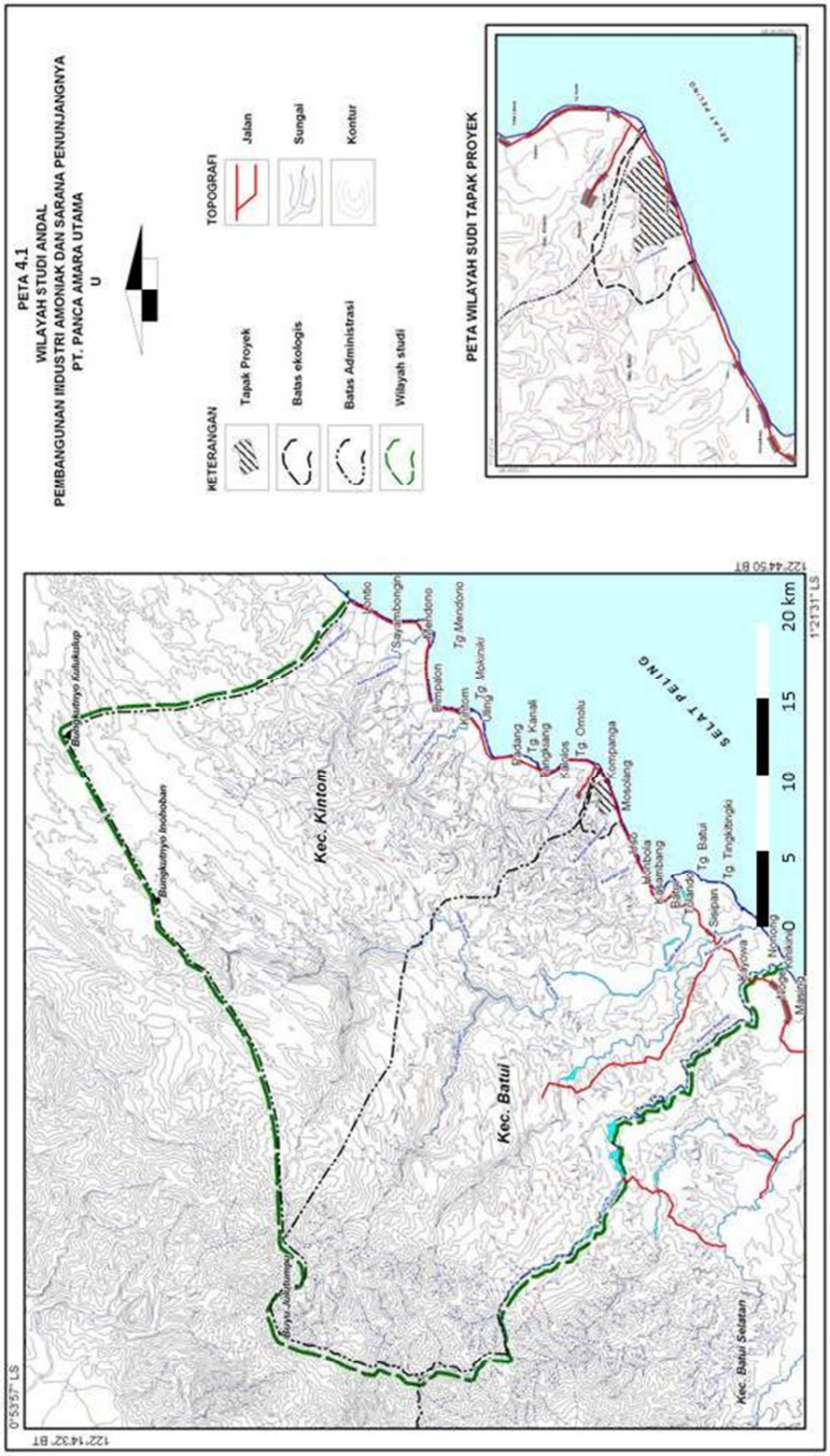
4.2.1.2. Ecological Boundary

Ecological boundary is based on impacted and natural ecosystem boundary especially impact distribution resulted from environmental component change of biogeophysical-chemical, water regimen boundary (hydrology), water quality, air quality, noise and transportation. Ecologically, activity area includes DTH Musolang. DTH boundary is then used as ecological boundary for the study of Environmental Impact Analyses.

4.2.1.3. Social Boundary

Social boundary in the development of Ammonia industry and its supporting facilities of PT Panca Amara Utama is indicated by the availability of a space at the site which was used as a place for social interaction according to social dynamics of society group. Social interaction of the local people was shown by a cooperative activity in land management covering Uso village, Hombola village, Lamo, Batui Sub-district and Kalolos village, Tangkiang village, Babang Buyange village, Kintom Sub-district, Banggai Regency, Central Sulawesi Province.

Map 4.1 Boundaries of Study Area Coverage of Environmental Impact Analyses



4.2.1.4. Administrative Boundary

Administrative boundary is the boundaries covering Uso village, Hombola village, Lamo, Batui Sub-district and Kalolos village, Tangkiang village, Babang Buyangge village, Kintom Sub-district, Banggai Regency, Central Sulawesi Province. Data on villages boundaries are not available, hence, administrative boundary of Batui Sub-district and Kintom Sub-district, Banggai Regency are utilized to determine the study area.

4.2.2. Time Limit of Assessment

Time limit of assessment of Environmental Impact Analyses is based on duration of impact. If the impact runs during Pre-construction stage only, time limit of assessment is also for Pre-construction stage. Whereas, if the impact started from Pre-construction stage until the end of Operation stage, assessment is also conducted during that period of time. This time of limit is only utilized for primary impact, whereas secondary impact is not assessed. Time limit of assessment for each hypothetic significant impact is shown in Table 4.6.

Table 4.6 Time Limit of Assessment of Environmental Impact Analyses

No.	Impact	Cause of Impact	Duration of Impact	Time of Impact Assessment
1.	Public participation	License and Public Consultation	At the time of Public Consultation	Pre-construction stage
2.	Public income	Land release	At the time of land release	Pre-construction stage
3.	Social conflict	Land release	At the time of land release	Pre-construction stage
4.	Job/business opportunity	Pre-construction manpower mobilization	After manpower mobilization until Pre-construction stage	Pre-construction stage
5.	Social conflict	Pre-construction manpower mobilization	At the time of Pre-construction manpower mobilization	Pre-construction stage
6.	Public income	Pre-construction manpower mobilization	At the time of Pre-construction manpower mobilization	Pre-construction stage

7.	Road deterioration	Equipment and material mobilization	At the time of equipment and material mobilization	Pre-construction stage
8.	The increase of dust particulate	Land clearing	At the time of land cultivation	Pre-construction stage
9.	The increase of noise	Land clearing	At the time of land cultivation	Pre-construction stage
10.	Soil erosion	Land clearing	At the time of land cultivation	Pre-construction stage
11.	Loss of flora	Land clearing	At the beginning of land cultivation	Pre-construction stage
12.	Disturbance on fauna	Land clearing	At the beginning of land cultivation	Pre-construction stage
13.	Job/business opportunity	Construction manpower mobilization	At the time of construction manpower mobilization	Construction stage
14.	Social conflict	Construction manpower mobilization	At the time of construction manpower mobilization	Construction stage
15.	Society income	Construction manpower mobilization	At the time of construction manpower mobilization	Construction stage
16.	Controlled run-off	Drainage	During the drainage act	Construction stage
17.	Subsidence	Support structure and foundation	After support structure and foundation construction	Construction stage
18.	Run-off	Building development	After building construction (continuously, when it is no organized	Construction stage
19.	Carbon absorber	Green Space	After revegetation (continuously)	Construction stage
20.	Infiltration	Green Space	After revegetation (continuously)	Construction stage
21.	The increase of aesthetics	Green Space	After revegetation (continuously)	Construction stage
22.	Job/business opportunity	Manpower mobilization	After manpower mobilization until Operation stage	Operation stage

23.	Conflict	Manpower mobilization	At the time of operation manpower mobilization	Operation stage
24.	Public income	Manpower mobilization	After manpower mobilization until operation stage	Operation stage
25.	The increase of sea water temperature	Cooler water	At the time of cooler water disposal to the sea (continuously, when it is no organized)	Operation stage
26.	The decrease of air quality	Ammonia production process	At the time of Ammonia production process (continuously, when it is no organized)	Operation stage
27.	The decrease of sea water quality	Ammonia production process	At the time of Ammonia production process (continuously, when it is no organized)	Operation stage
28.	Job/business opportunity (loss of livelihood)	Termination	After termination process	Post-operation stage

CHAPTER V
SIGNIFICANT IMPACT FORECAST

Development of ammonia industry and its supporting facilities at Desa Uso, Kecamatan Batui, Kabupaten Banggai, Central Sulawesi Province initiated by PT Panca Amara Utama (PT PAU) is forecasted to arise impact towards living environments. Impact forecast of the development of ammonia industry and its supporting facilities, is identified by use of matrix and impact flow which shows the occurrence of impact, resulting from activities, either activities during Pre-Construction, Construction, Operational And Post Operation (may be seen in Chapter IV).

In this chapter forecast of impact Magnitude and level of interest of impact will be described, for each type of significant impact hypothesis.

Magnitude of impact

The magnitude of impact is calculated by using formal and informal methods. Environmental condition caused by each stage activities (Pre-Construction, Construction, Operation and Post-Operation) towards geo-physic-chemical component, is forecasted by formal method; for biologic component is forecasted by formal and non-formal (Professional Judgment), also, for social component and community health is forecasted by formal and informal methods (Professional Judgment).

Environmental condition initial data for each environment component and environment condition at this component, after the project is available, which is result of forecast, is further entered into the score of environmental quality. This matter is meant to simplify giving a clearer illustration. Therefore, the impact is the difference of environment quality before and after the activities. Impact forecast is the different environment condition as may be illustrated as follows:

Forecast of Impact Magnitude= $Kl_p - Kl_{rla}$.

where KL_P = environment quality during (project) activities

KL_{RLA} = environment quality during environment initial condition (prior to project)

Therefore, the magnitude obtained, ranges between 1 (one) up to 4 (four), with the following criteria:

- Difference of environment quality (+/-) 1 = positive/negative impact small
- Difference of environment quality (+ /-) 2 = positive/negative impact medium
- Difference of environment quality (+/-) 3 = positive/negative impact big
- Difference of environment quality (+/-) 4 = positive/negative impact very big

Determination of Impact Significant Characteristic

The impact significant characteristic will be determined in accordance with the guidance of RI Government Rule No. 27-1999 concerning Analysis of Environmental Impact. Big and significant impact is one understanding of a significant impact. Hence, those big impacts should not always be considered as significant impact; but small impacts may possibly have a significant characteristic. The level of significance will be determined for each hypothetic impact by referring to significant impact criteria, in accordance with Government Regulation No. 27 of 1999 concerning Analysis of Environment Impact e.g.:

1. Number of human beings affected by an impact
2. Extent of impact distribution
3. Intensity and duration of impact
4. Number of other components which will be affected by the impact
5. Cumulative characteristics of an impact
6. Reversibility or non-reversibility of an impact

Table 5.1 Level of Significant Impact Interest Level

No.	Percentage value P (%)	Class	Level of impact importance
1	**0 – 20**	**1**	**Level of importance very low**
2	**21 – 40**	**2**	**Level of importance low**
3	**41 – 60**	**3**	**Level of importance medium**
4	**61 – 80**	**4**	**Level of importance high**
5	**81 – 100**	**5**	**Level of importance very high**

Following is result of forecast of impact level of importance of each environment component affected by a certain activity during Pre-Construction, Construction, Operation and Post-Operation stages**.**

5.1. Pre-construction stage

5.1.1. Permission and Public Consultation

5.1.1.1. Community Participation

Before development of ammonia industry and its supporting facilities, Public Consultation shall have been carried out and the all required Government Permit shall have been obtained. The Public Consultation was presented by many participants from Desa Uso and its surrounding community, consisting of various community component, such as traditional prominent people, religious leaders, village leader, Camat and the others general community. This matter shows that the Public Consultation have an positive impact on the community participation in order to give more attention towards their living environment.

Number of human beings potentially in increasing participation towards better living environment are mostly people who stayed at the surrounding of Project Site e.g. Desa Uso, and 5 (five) other villages which are nearest to the Project activities. Seeing the large number of people participating in Public Consultancy and its extensive impact distribution, this impact is categorized as ***Significant Positive Impact,*** as it involves a large number of populations not only from Desa Uso, but also from villages surrounding Desa Uso.

5.1.2. Land Acquisition

5.1.2.1. Public Income

During the EIA / AMDAL field investigation, the land acquisition has already completed ± 180 Ha or about 90% of targeted land acquisition. The incomes from selling the land have been used by some people for increase its private business, education for its children and also for pilgrimage.

The impact of Land Acquisition to the people surrounding towards social and economic aspects are **significant positive impact** due to the magnitude of people affected and wide spread – not only at Desa Uso, but also cover the several surrounding villages.

5.1.2.2. Social Conflict

The development of surrounding Project Site as industrial area brings positive impact for the increase of land price in this location. However, on the other side, this land price increase makes some landowners try to sell his land at much more higher price as possible. These Land-owners ask for much bigger compensation compared with the previous compensation already paid before to other previous Land-owners. This situation causes the Initiator face difficulties and dilemma in acquiring rest of the land which price has already been very high compared with normal market price. It may potentially arise a negative impact like restlessness at the landowners group whose land had not been acquired because there is no certainty as yet about land acquisition price, as required by them.

From the number of human beings may affected by social restlessness impact, which may arise social conflicts between the land-owner whose land has not been acquired and landowners whose land, has already been acquired, and the extent of impact distribution and other possible impacts which might be happened, the PAU as Project Initiator shall pay enough attention in order to prevent such ***significant negative impact*** towards project.

5.1.3. Mobilization of Pre-Construction Man-power

Ammonia industry development activities will provide working opportunity, for local native people as well as outsider. Use of local man-power, will open working opportunity and at last will increase household income. Whereas non-skilled man-power from outsiders will have a significant positive impact on increase of business activities, but on the other hand may have potential conflicts with local people.

5.1.3.1. Employment and Business Opportunities

Mobilization of man-power activities, is foreseen to give a positive impact towards social, economic and cultural aspects in the form of employment opportunities, e.g. during site preparation. However, due to level of local people education in general are very low (mostly Elementary School graduate) and therefore the local population will mostly be able to work for non-skill types of work and a small part at semi-skilled work (like trucks drivers, and heavy equipment operators)

During Pre-Construction stage, man-power mobilization will need skilled and non-skilled workers at a number approximately of 130 persons / man-powers. The skilled man-power consist of experts in civil works, heavy equipment operators, and non-skilled workers will be required in various kinds of this work (helper / worker).

As mentioned in the activities description during site preparation stage, non-skilled labor will prioritize local man-power. For man-power who needs special expertise, which are not available in the area surrounding the project site, will be employed from outside Banggai area.

From the view of the number of the man-power required is considerable big at a relatively long time, (until 8 months), the opportunity of employment is categorized as a significant ***positive impact.***

Business opportunity during pre-construction stage, are rental of accommodation and growth of restaurants**,** shops for main necessities and sundries, transportation etc. Opportunity for rent a house to outsiders, are relatively big, as the man-power from outside Uso either skilled or non-skilled, involved in pre-construction are foreseen as relatively significant either in number or their intense working time.

The opportunity of opening a shop / kiosk is foreseen big, as the number of restaurants and sundries which are now exist at the surroundings of the Ammonia industry project, are relatively small, hence there will be widely open the opportunity to serve all project workers, either from the outside areas, or those from Kecamatan Batui and Kecamatan Kintom itself.

Considering the numbers of human beings who will be affected by the impact are relatively big and then the impact process has a linear characteristic and also its impact has no side effect accumulation on the other living aspects, therefore the opening of business opportunity is categorized as ***significant positive impact.***

5.1.3.2. Social Conflicts

Although there will be a positive impact of this activity, employment opportunity and new business opportunity, tough competition potentially occur. Experiences from the similar project activities shows that local people and local business strongly request for the job in the project.

On the other side, the national / bona-fide contractor normally has already regular partner as its sub-contractor This may potentially cause social tension among the local people / local business with the Project Initiator, Main Contractor and Sub-contractor, therefore may potentially influence the progress of the project activities. Considering this the potential human being who are affected and the impact intensity is relatively big, then the employment for the project activity shall give priority to local people which in accordance with its capabilities and the requirements of the Project, therefore the potency of social envy will be eliminated. The social impact due to man-power mobilization is categorized as ***Significant Negative Impact.***

5.1.3.3. Community Income

Workforce requirement at Pre-construction stage are estimated approximately 200 persons, 130 manpower for site preparation and 70 man-power for build surrounding fences. This man-power recruitment will directly increase the community income e.g. from the wages salary received by the worker, and indirectly from the opening of small shops, rental of accommodation facilities, motorcycle transport and others. This impact is foreseen will be continuously during Pre-construction stage. Considering that human beings potentially affected and the impact intensity is relatively big, and also the duration relatively long, therefore the impact to the Community Income which is caused by the mobilization of man-power, is categorized as ***Significant Positive Impact.***

5.1.4. Mobilization of equipment and material

5.1.4.1. Road deterioration

Mobilization of equipment / material during Ammonia Project activity may potentially will influence towards road condition, due to the intensity and the load of the vehicle. In case the axel load of the vehicle trailer is more than 10 tons as the limit of the National Road classification category IIB, it may potentially cause deterioration of such road, This impact has a permanent effect, non-reversible, and obstruct the community and road user, therefore the Road Deterioration may be caused by the mobilization of equipment and material for the Project is considered as Significant Negative Impact

5.1.5. Site Preparation

5.1.5.1. Vegetation Disappearance

Site Preparation will be initiated by land clearing, i.e. cutting – majority of coconut trees and other trees such as cocoa trees, coffee trees etc which are growing between coconut trees The. Impact of land clearing is the disappearance of vegetation, which may cause continuous impact in form of increasing run-off and land erosion because of the loss of vegetation function for capture and infiltration of rain water.

Disappearance of vegetation due to land clearing may be categorized ***Insignificant Negative Impact,*** because those vegetation which disappeared are not the kind of rare plant species and therefore is not categorized as protected plants by the law. The land used for the ammonia industry also does not a conservation land, but grown by coconut only.

5.1.5.2. Increase of Dust Particulate in the Air.

Site preparation may release dust suspension in the air which caused by shearing of vehicle tires with dry land peeling. Dust emission caused by this re-suspension may be estimated by use a mathematical model approach. Silt at an open area of 30% with emission rate of 2,065 mg/seconds, the distribution of dust at various distances may be observed from the following Table.

Table 5.2 Estimation of Dust Pollution Parameter at Pre-Construction Activity in January

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	38.925	118.325	230
200	769.4	19.449	98.849	230
300	79.4	10.747	90.147	230
400	769.4	6.658	86.058	230
500	79.4	4.492	82.625	230
600	769.4	3.225	81.825	230
700	79.4	2.425	81.289	230
800	769.4	1.889	80.912	230
900	769.4	1.238	80.638	230

Source : Result of Analysis, 2012

Table 5.3 Estimation of Dust Pollution Parameter at Pre-Construction Activity in February

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	50.6890	130.090	230
200	79.4	25.374	104.774	230
300	79.4	14.027	93.427	230
400	79.4	8.691	88.091	230
500	79.4	5.864	85.264	230
600	79.4	4.210	83.610	230
700	79.4	3.166	82.566	230
800	79.4	2.465	81.865	230
900	79.4	1974	81.374	230
1000	79.4	1.617	81.17	230

Source: Result of Analysis, 2012

Table 5.4. Estimation of Dust Pollution Parameter at Pre-Construction Activity in March

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	48,813	128.213	230
200	79.4	24.434	103.834	230
300	79.4	13.508	92.908	230
400	79.4	8.369	87.769	230
500	79.4	5.647	85.047	230
600	79.4	4.054	83.454	230
700	79.4	3.048	82.448	230
800	79.4	2.374	81.774	230
90-0	79.4	1.901	81.301	230
1000	79.4	1.557	80.957	230

Source: Result of Analysis, 2012

Table 5.5 Estimation of Dust Pollution Parameter at Pre-Construction Activity in April

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	52.718	132.128	230
200	79.4	26.389	105.789	230
300	79.4	14.588	93.988	230
400	79.4	9.039	88.439	230
500	79.4	6.099	85.499	230
600	79.4	4.379	83.779	230
700	79.4	3.292	82.692	230
800	79.4	2.564	81.964	230
900	79.4	2.053	81.453	230
1000	79.4	1.681	81.081	230

Source: Result of Analysis, 2012

Table 5.6. Estimation of Dust Pollution Parameter at Pre-Construction Activity in May

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	41.186	120.596	230
200	79.4	20.616	100.016	230
300	79.4	11.397	90.797	230
400	79.4	7.061	86.461	230
500	79.4	4.765	84.165	230
600	79.4	3.421	82/821	230
700	79.4	2.572	81.972	230
800	79.4	2.003	81.403	230
900	79.4	1.604	81.004	230
1000	79.4	1.314	80.714	230

Source: Result of Analysis, 2012

Table 5.7. Estimation of Dust Pollution Parameter at Pre-Construction Activity in June

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	38.763	118.163	230
200	79.4	10.727	98.804	230
300	79.4	6.646	90.127	230
400	79.4	4.485	86.046	230
500	79.4	3.220	83.885	230
600	79.4	2.421	82.620	230
700	79.4	1.885	81.821	230
800	79.4	1.5109	90.910	230
900	79.4	1.2356	80.636	230

Source: Result of Analysis, 2012

Table 5.8 Estimation of Dust Pollution Parameter at Pre-Construction Activity in July

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	34,683	114.083	230
200	79.4	17.361	96.761	230
300	79.4	9.598	88.998	230
400	79.4	5.946	85.346	230
500	79.4	4.013	83.413	230
600	79.4	2.881	82.281	230
700	79.4	2.166	81.566	230
800	79.4	1.687	81.087	230
900	79.4	1.351	80751	230
1000	79.4	1.106	80.506	230

Source: Result of Analysis, 2012

Table 5.9 Estimation of Dust Pollution Parameter at Pre-Construction Activity in August

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	32.949	112.349	230
200	79.4	16.493	95.893	230
300	79.4	9.118	88.518	230
400	79.4	5.649	85.049	230
500	79.4	3.812	83.212	230
600	79.4	2.737	82.137	230
700	79.4	2.058	81.458	230
800	79.4	1.603	81.003	230
900	79.4	1.283	80.683	230
1000	79.4	1.051	80.451	230

Source: Result of Analysis, 2012

Table 5.10 Estimation of Dust Pollution Parameter at Pre-Construction Activity in September

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	34.683	114.083	230
200	79.4	17.361	96.761	230
300	79.4	9.598	88.998	230
400	79.4	5.946	85.346	230
500	79.4	4.013	83.413	230
600	79.4	2.881	82.281	230
700	79.4	2.166	81.566	230
800	79.4	1.687	81087	230
900	79.4	1.351	80.751	230
1000	79.4	1.106	80.506	230

Source: Result of Analysis, 2012

Table 5.11 Estimation of Dust Pollution Parameter at Pre-Construction Activity in October

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	38.763	118.163	230
200	79.4	19.404	98.804	230
300	79.4	10.727	90.127	230
400	79.4	6.646	86.046	230
500	79.4	4.485	83.885	230
600	79.4	3.220	82.620	230
700	79.4	4.421	81.821	230
800	79.4	1.885	81.285	230
900	79.4	1.510	80.910	230
1000	79.4	1.236	80.636	230

Source: Result of Analysis, 2012

Table 5.12 Estimation of Dust Pollution Parameter at Pre-Construction Activity in November

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	50.690	130.090	230
200	79.4	25.374	104.774	230
300	79.4	14.027	93.427	230
400	79.4	8.691	88.091	230
500	79.4	5.864	85.264	230
600	79.4	4.210	83.610	230
700	79.4	3.166	82.566	230
800	79.4	2.465	81.865	230
900	79.4	1.974	81.374	230
1000	79.4	1.617	81.017	230

Source: Result of Analysis, 2012

Table 5.13 Estimation of Dust Pollution Parameter at Pre-Construction Activity in December

Radius (m)	Initial condition (g/m3)	Dust emission contribution (g/m3)	Final condition (g/m3)	Quality standard (g/m3)
100	79.4	54.914	134.314	230
200	79.4	27.489	105.889	230
300	79.4	15.196	94.596	230
400	79.4	9.415	88.815	230
500	79.4	6.353	85.753	230
600	79.4	4.561	83.961	230
700	79.4	3.429	82.829	230
800	79.4	2.671	82.071	230
900	79.4	2.139	81.539	230
1000	79.4	1.751	81.151	230

Source: Result of Analysis, 2012

Based on dust distribution estimation which at the distance of 500 meters or longer (Kampung Kompanga), dust emission caused due to Pre-construction activities still below the limit threshold of air quality standards determined by RI Government Regulation no. 41 of 1999 concerning Air Pollution Control. Therefore, it is concluded that Dust Emission Impact from Project Site Preparation is categorized ***Insignificant Impact***

5.1.5.3. Increase of Noise

Project Site Preparation will use heavy equipment which might increase the noise level. According to Environmental Engineering, Gerald Kiely 1996, the noise level arising from heavy equipment activities is about 85 dBA at a distance of 15 meters.

Based on literature data, it may be calculated that noise level caused by this vehicle at various radius is as seen from Table 5.14 below.

Table 5.14 Noise Level from Heavy Equipment at a Radius of 100 – 1,000 Meters

Distance (m)	Noise Level (dBA)	Quality standard
100	68.52	55
200	62.50	55
300	58.98	55
400	56.48	55
500	54.54	55
600	52.96	55
700	51.62	55
800	50.46	55
900	49.44	55
1,000	48.52	55

Source: Result of calculation, 2012

The nearest inhabitant / residential area to the Project Site is Kampong Kompanga, with a distance is about 500 meter. Based on result of calculation (Table 5.14) noise intensity arising from the heavy equipment activities which reaches Kampung Kompanga (500 meter distance) is just only 54,54 dBA. According to State Minister of Environmental regulation Number: KEP48/MENLH/11/1996 concerning quality standard for Noise Level for human settlements, is 55 dBA for a period of exposure 24 hours and 85 dBA for exposure during16 hour. Therefore, by such noise intensity caused by heavy equipment, at 500 meter distance 54,54 dBA is just below of the noise level allowable by Government Regulation, so the impact of Site Preparation to the Noise Level may be concluded as ***Insignificant Negative Impact.***

5.1.5.4. Soil Erosion

Site Preparation for ammonia plant and its facilities will change parameter condition of soil erosion e.g. topographical index and vegetation. Site preparation for ammonia plant, electric generator and its sub-station unit, warehouse and workshop, office premises and parking lot, fire-fighting equipment, ammonia tank area, waste water treatment plant (WWTP), temporary lay-down area, road and parking lot at the plant, sea water intake, green open space, and rain water retention pond, morphology becoming plain or existing at plain morphology. Although the land becomes not vegetative, however because its morphology is relatively flat, the rate of erosion is low.

Soil erosion will increase significantly at undulating area which is cut off the slope corner which is averagely 45° with a length of slope 2,75 – 3,0 meters or topographical index (LS) = 0,23 – 0,25. By using module USLE (Universal Soil Loss Equation), the amount of erosion at the cut down location is 1.501,37 x 9,26 x 0,23 x 1,0 = 89,78 tons/ha/year up to 1.501,37 x 0,26 x 0,25 x 1,0 = 97,59 tons/ha/year.

According to soil erosion classification from Department of Forestry (989), the soil erosion above mentioned, belongs to medium range of > 60 – 180 tons/ha/year, which is soil erosion occurs from very low to low (7,5662 – 21,74 tons/ha/year) becoming medium (89,79-97,59 tons/ha/year) or increasing 1 – 2 classes. The difference of environment quality sinks 1 to 2 levels, by such figure, the magnitude of impact belongs to between small until medium.

In order to understand the importance of impact, Government Regulation No. PP No. 27 of 1999 is used such as can be seen from the following Table 5.15. :

Table 5.15. Significant Impact Characteristic Analysis

No.	Criteria	Impact
1	Number of human being affected by an impact	
2	Extent of area of impact distribution	
3	Intensity of duration of impact is going on	-P
4	Number of other component to be affected by an impact	-P
5	Cumulative characteristic of an impact	-P
6	Reversible or irreversible impact	
T o t a l		3(-P)
Percentage		

Regarding soil erosion due to Site Preparation will cover a relatively in-extensive area (800 m²), intensity is going on a relatively long time, e.g. 7 – 8 months, there may be another impact towards other environment component e.g. water quality (sea and river), this impact may be accumulated with similar impacts, at another occasion in the similar rain catchment area, when calculated it becomes 3 (-P) or 60% categorized as ***significant negative impact*** with ***medium significant level.***

5.1.5.5. Disturbances to Fauna

Project activities during land clearing may have impact on the disappearance to fauna lives in the Project Site.

Result of observation of type of fauna at the region of examination study there are 22 birds group, 11 types of reptiles and 3 types of amphibian have successfully been inventoried.

Although land clearing activities will arouse obstacles to animals in this area, however this obstacle is foreseen will not cause wiping out of all wild animals because all birds, mammalian and amphibian are able to run and avoid from land clearing area to a safer place in the Plant Green Belt Area and the area surrounding the Project Site which has full of vegetation for the fauna lives . Especially birds groups which have high mobility, and flying quickly faraway to avoid the area where activities are occurred. For types of animals with small bodies such as chameleon, hap-hap, lizard, frogs, and snake types, most probably these animals could not go away / could not go far away. However, because these animals are not included as the animals protected by the law and its population is abundant in nature, therefore the impact of land clearing towards animals are considered as ***Insignificant Negative Impact.***

5.2. Construction

5.2.1. Mobilization of Man-power

5.2.1.1. Working and Business Opportunities

Man-power mobilization activities during construction stage is foreseen will give positive impact towards social, economic and culture in form of working opportunity, e.g. during construction is going on.

However, due to level of local people education in general are very low (mostly Elementary School graduate) and therefore the local population will mostly be able to work for non-skill types of work and a small part at semi-skilled work (like civil building construction, trucks drivers, and heavy equipment operators)

During Construction stage, man-power required, skilled and non-skilled will about 2,000 persons, for a period of 24 months. Skilled man-power covers experts in the field of welding, mechanical erection and inspection, instrument & DCS Installation and Inspection, electrical installation and inspection civil foundation & piling etc.

Non-skilled workers will be employed mainly from the area surrounding Plant Site, i.e. from Kecamatan Batui, Kecamatan Kintom, and all other Kecamatan in Banggai District.

As described in the activity description during preparation stage, non-skilled workers will prioritize local man-power. For man-power whose special expertise which are not available in the area surround the project location will be mobilized from elsewhere else.

Regarding of relatively large amount of man-power requirement, i.e. up to 2,000 man-powers at the peak and the duration relatively long (until 24 months), then the employment opportunity is categorized as ***Significant Positive Impact.***

Business opportunity during Construction stage will be grown-up such as renting of houses / accommodation, growth of food shops, shop of basic-needs and sundries, transportation sector etc. These small business opportunities should have good prospects, as the number of workers from outside Desa Uso, either skilled or non-skilled who will be involved during Construction stage is predicted relatively large and also because of the existing food and sundries stalls around the Project Site are still relatively few compared to the amount of the whole Project workers, either locally from Kecamatan Batui and Kecamatan Kintom nor from the rest of Batui and elsewhere.

Considering the number of human beings affected by the impact is relatively large, at a considerable duration, and also the impact process has a linear characteristic and its impact would not further be accumulated to other components, then the opening of business is categorized as ***Significant Positive Impact.***

5.2.1.2. Social Conflict

Although there will be a positive impact of this activity, employment opportunity and new business opportunity, tough competition may potentially occurred. Experiences from the similar project activities shows that local people and local business strongly request for the job in the project.

On the other side, the national / bona-fide contractor normally has already regular partner as its sub-contractor This may potentially cause social tension among the local people / local business with the Project Initiator, Main Contractor and Sub-contractor, therefore may potentially influence the progress of the project activities. Considering this the potential human being who are affected and the impact intensity is relatively big, then the employment for the project activity shall give priority to local people which in accordance with its capabilities and the requirements of the Project, therefore the potency of social envy will be eliminated. The social impact due to man-power mobilization is categorized as ***Significant Negative Impact***

5.2.1.3. Community Income

Mobilization of man-power at Construction stage is foreseen will give positive impact towards the community income, due to large number of working employment opportunity (totally at peak +/- 2.000 man-power) and the growth of business opportunity (stalls, house rental, motorcycle transport sub-contractor etc.).

Considering potential human beings affected by the impact and its intensity are relatively big, and also the duration relatively long (until 24 months), then the impact of community income caused by mobilization of man-power is categorized as ***Significant Positive Impact.***

5.2.2. Drainage and Retention Pond

5.2.2.1. Control of Run-Off

Drainage and necessary retention pond will be made in advance, before land clearing. The aim is to control of run-off so that it will not flood into human settlements location and the public road which may located at the lower level of land (south of the project site).

Land clearing will cause increase of run-off rain water. As already described in initial environment condition, rain water run-off at the project site by covered by coconut garden is 279.814,00 m^3/year. Rainfall at the project site is 1.485 mm/year at land extents of 2.000.400 m^2; the rain volume is calculated as 2.970.574 m^3/year. Therefore, run-off volume in the project site, is 9,41% or almost very low. Land clearing is only carried out at the land area of 40 ha., and the most part of 160 Ha will stay as the initial environment condition. The estimated volume of rain water run-off caused by acquisition of land of 40 Ha, can be seen from Table 5.16.

Table 5.16. Run-Off Volume Caused by Land Clearing.

Land unit	Remarks about land unit	Extent (m^2)	Rain fall (mm/year)	Cr (%)	Vr (m^3/year)
111	Material silty mud surface, slope 8%, Open land	322,900	1,485	9,01	43.203,54
121	Material silty mud surface, slope > 8 -15 Open land	571.700	1,485	26,52	225.148,04
131	Material silty mud surface, slope > 8 -15 %, Open land	52.600	1,485	52,609	41.086,39
221	Material gravel mud surface, slope > 15 – 30 % Open land	553.600	1,485	21,68	178.230,41
231	Material gravel mud surface, slope > 8 – 15% Open land	393.500	1,485	41,05	239.874,65
241	Gravel silty mud surface, slope > 30% Open land	72.600	1,485	66,01	71.165,04
321	Sandy mud surface, slope > 8 – 15%, Open land	12.900	1,485	9,25	1.77198
331	Sandy mud surface, slope >15 – 30 %, Open land	20.600	1,485	321,02	6.430,23
T o t a l		2.000.400			806.911,27

The amount of run-off caused by open soil due to land clearing is estimated approximately 806.911 m^3/year, the magnitude of this run-off belongs to low level (27.16%). When compared with initial condition of environment where rate of rain fall per year is about 2,970,594 m^3/year, then the run-off increase of 806.911,27 m^3/years is classified as low and the quality of environment is decreased only one level class, hence the magnitude of the Impact is categorized as small.

In order to understand the significance of impact characteristic, Government Regulation of No. PP-27-1999 is used, such as can be seen from Table 5.17 below:.

Table 5.17. Analysis of Significant Impact Characteristic

No.	Criteria	Impact
1.,	Number of human beings affected by an impact	
2.	Extent of impact distribution area	-P
3.	Intensity and period of impact occurrence	-P
4.	Number of other component to be affected by an impact	-P
5.	Cumulative impact characteristic	-P
6.	Reversible or irreversible impact	
To t a l		3 (-P)
Percentage		60%

Regarding the increase of run-off caused by Site Preparation, which cover a relatively extensive area (50 Ha), impact intensity may going on a long time, there will be further impact towards other environment component e.g. river discharge, the impact may be accumulated with similar impact at another location in similar rain catchment area, hence the sum-up of all criteria will give result of the impact 3 (-P) or 60% and categorized as Significant Negative Impact at Medium Interest Level. However, this negative impact will be managed and eliminated by provide necessary channel and then collected in the Rain Water Pond which the over-flow will be flown into the sea. Therefore, the impact of Drainage and Rain Water Collecting Pond will be Significant Positive Impact with medium interest level.

5.2.3. Foundation and Support Structure

5.2.3.1. Soil Subsidence

Soil subsidence such as movement of soil surface or rocks which may occur slowly or quickly. Occurrence of soil subsidence is caused by many factors and very complex.

From various data, information and literature known, it may be concluded that the cause of soil subsidence is mainly due to:

a) excessive extraction of ground water which caused porosity in the soil;
b) lowering the soil naturally due to excessive load at the surface, the existing soil layer soil decline of natural soil/land consolidation, caused by burden at the land surface, availability of land/rocks which have high compressibility below land surface;
c) formation of voids on the rocky soil bed contains limestone due to water dissolution of its soluble material.

Based on the type of rocks in the Project Site region (see Map 3.7 Geology Map), it is estimated that soil subsidence due to geologic impact may possibly occurred most probably due to formation of voids on the rocky soil bed contains limestone as the ground water continuously dissolve of its soluble material.

Based on identification of the type of rocks in the study coverage area, it is revealed that the holes formed on the leached limestone rocks have round shape or rectangular shape with diameter range from 10 cm to 60 cm.

It is very difficult to determine the Magnitude of impact, and the significant characteristic of the impact of the foundation of the ammonia plant using quantitative method as described in Pages V-1 and V-2, therefore professional judgment has been used which stipulate that although the soil subsidence may be occurred, however its impact will only locally affected, and dangerous, therefore it is categorized as ***Significant Negative Impact.***

5.2.3 Construction of Building.

5.2.3.2. Run-Off

Buildings for ammonia industry and its supporting facilities may increase rain water run-off. This is due to the conversion of land use which was formerly agriculture (mostly coconut) becomes industrial complexes including warehouse, workshop, office premises and parking lot, ammonia storage tank area, Waste Water Treatment Plant (WWTP), etc.

Basically, the land (except Green Belt Area - RTH) will be covered by buildings which increase the run-off coefficient of coconut cultivated area (run-off coefficient = 3,28 – 22,6%) will become building run-off coefficient.

Building infiltration coefficient is zero (0%), with this coefficient of run-off building is 100% evaporation coefficient.

In according to examination of Directorate Environmental Geology (1980), building evaporation is 1 mm during one time rain. Rainfall rate in this region 1.485,9 mm annually, rainy days 199 days annually, hence by such one day rain 1.482,9 mm/199 = 7,46 mm.

Therefore the building Evaporation Coefficient becomes: 1 mm / 7.46 mm x 100% or 13.4% and then the Building Coefficient Run-off becomes: 100% – 13,4% = 86,6%.

The amount of run-off after ammonia plant has been built can be seen in Table 5.18.

Table 5.18 Rain Water Run-off in Ammonia Plant and Its Facilities.

No.	Type of building	Area (m^2)	Rainfall (mm/year)	Cr (%)	Vr (m^3/year)
1.	Ammonia Plant	32.600	1.485	86,6	41.923,93
2.	Electric generator and sub-station	12.850	1.485	86,6	16.525,23
3.	Utility Unit	10.450	1.485	86,6	13.438,80
4.	Warehouse and workshop	10.800	1.485	86,6	13.888,91
5.	Office premises and parking lot	9.000	1.485	86,6	11.574,089
6,	Fire Fighting	500	1.485	86,6	643,01
7.	Ammonia Storage	22.500	1.485	86,6	28.935,23
8.	Waste Water Treatment Plant (WWTP)	3.000	1.485	86,6	3.858,03
9.	Lay-down area	20.000	1.485	86,6	25.720,20
10.	Road and Parking lot	40.000	1.485	86,6	61.440,40
11.	Sea Water Intake	1.500	1.485	86,6	1.929,02
12.	Green Open Space	300.000	1.485	4,4	1.960,20
13.	Retention Pond	23.000	1.485	86,6	29.578,23
T o t a l		501.200	1.485		211.837,03

The amount of run-off in Ammonia Plant and Supporting facilities is estimated 211.837 m^3/year.

Rainfall at the Region of Plant Site 1.485 mm/year, then the volume of rain water at Plant Site is 1.485 mm/year x 501.200 m^2 = 744.282 m^3/year. Percentage of rain water run-off is 211.837/744.282 x 100% = 28,46%.

This run-off volume belongs to category of low (>20 – 40%). When compared with initial environment condition, there will be an increase of 211.827 m^3 run-off from originally 2.970.594 m^3/year (for all 200 Ha) or only 7.13% which is categorized as very low becomes low or decline of environment quality of one level, therefore the Magnitude of Impact is considered as small.

In order to understand the Significance of the Impact characteristic in the view of Government Regulation No. PP-27/1999, see the following Table 5.19:

Table 5.19 Analysis of Significance of Impact Characteristic

No.	Criteria	Impact Score
1.	Number of human beings affected by an impact	-
2.	Extent of impact distribution area	-P
3.	Intensity and period of impact occurrence	-P
4.	Number of other component to be affected by an impact	-P
5.	Cumulative impact characteristic	-P
6	Reversible or irreversible impact	-P
T o t a l		4 (-P)
Percentage		

Regarding the increase of run-off will covers a relatively extensive area (50Ha), impact intensity is continuing, there may be other environment aspects which will be affected e.g. river water debit, this impact might be accumulated with another impact at adjacent location in the same rain catchment area, then the total score become 4 (-P) or 66% which is categorized as ***Negative Impact*** with ***High Interest Level.***

5.2.5. Green Belt Area

5.2.5.1. Carbon Absorption

Carbon dioxide gas (CO_2) is one of Green House Gases (GHG), which might give effect to global warming and change of climate. GHG effect will be so called the Green House Effect in which thermal radiation from a planetary surface is absorbed by greenhouse gases, and, it results in an increasing global warming. Green Belt Area will be grew by various vegetation which can absorbs CO_2 gases from the air i.e. during photosynthesis process, and transform it as organic carbon in the form of leaves, trees, roots, of the vegetation.

The capability of vegetation to absorb CO_2 is strategically very important in reducing Global Warming. Therefore, the development of Green Belt Area of approximately 150 Ha will contribute to reduce the Global Warming as along as to improve green scenery and panorama / landscape of the Plant Site

Result of observation carried out by PT INHUTANI in the secondary forest which was burnt in 2006 at Batu Ampar – East Kalimantan, CO_2 element contained in the tree with a height > 1.5 m is recorded as much as18,41 tons/ha/annually. One tree of *Cassia sp*. has been observed able to take the Carbon as high as 5.25 kg/year and after observation in 1,000 m2 of Green Open Area, there are 21 species of plants with total population of tree approximately 198 trees. Therefore within 1 Ha, there will be 1,980 trees. If it is assumed that each tree in the Green Open Area is the same capability to absorb as 5,25 kg/year as *Cassia sp* described above, then the amount of Carbon taken by the trees in the 150 ha Green Open Area, will be : 150 ha x 1,980 trees / ha x 5.25 kg/year or 1.561.023 kg/year. The impact of Green Belt Area to the Carbon absorption is considered as ***Significant Positive Impact.***

5.2.5.2. Infiltration

Development of Green Belt Area or Ruang Terbuka Hijau (RTH) grown with various plant trees which consist of high, medium and lower strata and cover crop, will increase the coefficient of infiltration which will further increase the water infiltration.

Green Belt Area with flat leveling will also increase the coefficient of infiltration. Study carried-out in 1995 by Directorate of Environmental Geology, coefficient infiltration is 88.2%. the following Table 5.20 show the comparison of infiltration volume at initial condition and after Green Belt Area has been developed.

Table 5.20. Volume of Infiltration during Initial Condition vs After Green Belt

Area (m^2)	Rainfall (mm/year)	Intial Condition		After Green Belt	
		Ci (%)	Vi (m^3/year)	Ci (%)	Vi (m^3/year)
1.500.000	1.485	68,01	1,514,920	88,2	1,964,650

Source: Result of calculation, 2012. C_i = Coefficient of infiltration, V_i = volume of infiltration

From Table 5.20 it can be seen that there will be increasing of infiltration volume from 1,514,920 m3/year on initial condition (infiltration rate 68% - high) to 1,964,650 m3/year after Green Belt Area developed (infiltration rate 88.2% - very high), hence increment 1 level or may considered as small impact.

In order to understand the Significance of the Impact characteristic in the view of Government Regulation No. PP-27/1999, see the following Table 5.21:

Table 5.21 Analysis of Significance of Impact Characteristic

No.	Criteria	Impact Score
1.	Number of human beings affected by an impact	-
2.	Extent of impact distribution area	+P
3.	Intensity and period of impact occurrence	+P
4.	Number of other component to be affected by an impact	+P
5.	Cumulative impact characteristic	+P
6	Reversible or irreversible impact	
T o t a l		4 (+P)
Percentage		

Regarding the increase of Coefficient of Infiltration will covers a relatively extensive area (150Ha), impact intensity is continuing, there may be other environment aspects which will be affected e.g. river water debit, this impact might be accumulated with another impact at adjacent location in the same rain catchment area, then the total score become 4 (-P) or 66% which is categorized as ***Significant Positive Impact*** with ***High Interest Level.***

5.2.5.3. Aesthetic Improvement

Development of Green Belt Area or Ruang Terbuka Hijau (RTH) grown with various plant trees will become a buffer zone which still maintain its hydrology function and produce oxygen beside giving fresh air, natural, green, and improve the aesthetic of environment. The Green Belt Area is considered as Significant Positive Impact

5.2.5.4. Cooling Water

5.2.5.5. Increment of Sea Water Temperature

Ammonia Plant will use sea water as direct cooling media, where the temperature difference of cold water and hot water returned to the sea will be kept within 10°C at flow rate ± 22.000 m³/hour. The composition of the Sea Water itself will not be changed after cooling the plant.

The quality standard of Hot Water returned to the Sea specifically for the Ammonia Plant has not been released yet by the Government, however for this purpose, it can use the quality standard issued for Electric Power Generation as per regulation of State Minister of Environment No. 08-2009 which determine the limit of hot water returned to the sea shall be 40°C.

Due to the temperature of fresh sea water to be used will be +/- 30 ^{o}C and the cooling system in Ammonia Plant will be designed of maximum 10°C temperature increase, hence it is categorized as ***Insignificant Negative Impact***.

5.2.6. Process of Ammonia Production.

5.2.6.1. Impact on Air Quality

Flue gas emitted from primary reformer stack result from burning of fuel natural gas consist of various gases such as $SO_{2,}$, NO_X, and CO. SO_2 is produced as a result of Sulphur (S) compound contained in natural gas, meanwhile NOx, and CO are produced from burning process of fuel gas with air which contain mostly Nitrogen gas.

Gas dispersion

Mathematical model of Effluent Gas dispersion into the surrounding atmosphere towards pollutant which is emitted from the stack height, is schematically illustrated in accordance with Equity 1 and *Gauss Model,* as follows:

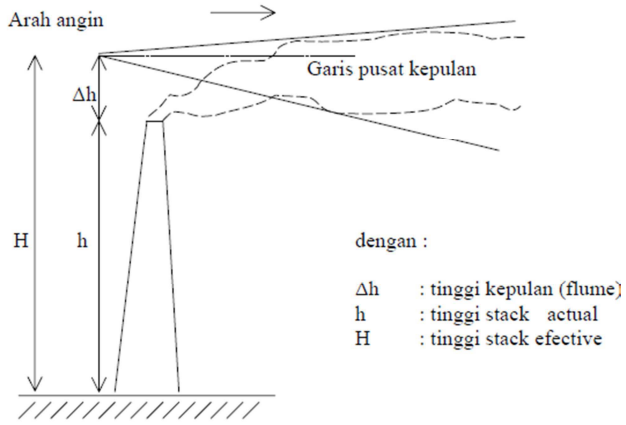
$$C(x,y,z) = \frac{Q}{\pi\mu\sigma_y\sigma_z} exp\left[\frac{-0.5H^2}{{\sigma_z}^2}\right] \qquad \textbf{(1)}$$

where:

C(x,y,z) : gas concentration at axis (x,y,z), µg/m³
Q : gas emission flow rate, m/sec
Π : constant with value 3,14
µ : average wind rate, m/sec
σ_y & σ_z : constant of standard deviation vertical and horizontal dispersion which is determined based on atmospheric stability, unit (m)
H : effective stack height (actual stack + height of plume), m

Height of Plume

Vertical Plume movement from its source which heads for the roof, becomes horizontal is understood as "height of plume".



Drawing 5.1. Gauss plume model

Due to plume risen, in Gauss model actual plume height cannot be used, then in this model the height of plume shall be added (h) to the height of the stack. Therefore, the effective height of stack is calculated from the plume height (Δh) plus the actual stack height (h) i.e. H = Δh + h.

Albert H. Holland has developed calculation of height of plume, e.g. that plume height will decline with wind rate, or another words height of plume (h) reversibly in proportion to wind rate. By calculating momentum and heat emitting from the plume, the height of plume calculation (h) follows the following equity:

$$\Delta h = \frac{V_s d}{\mu}\left(1,5 + 2,68.10^{-3}.P\left(\frac{T_s - T_o}{T_s}\right)d\right) \qquad \textbf{(2)}$$

With:

Vs : gas rate emitting from the plume, m/sec

d : diameter top of plume, m

μ : wind rate in the plume, m/sec

P : atmosphere pressure, mBar (1atm = 1.103 mBar)

Ts : gas temperature emission from the plume, ºK

To : atmosphere air temperature (ambient), ºK

The above equation is for atmospheric condition with neutral stability level (C or D class), while for stable atmospheric condition (A or B class), the above result (equation-2) is multiplied by 1,14 and if unstable (E or F class) result of equation-2 is multiplied by 0,85.

Wind rate correction

Generally, wind rate data derived from secondary data measured by BMG (Meteorological Agency and Geophysics) which using height standard for measurement of wind rate by use of Anemometer is 10 meter above from the land surface. Whereas the requirement for wind rate for modeling shall be in accordance with plume height, e.g. for PT PAU is 120 m (assumption), so that wind rate for modeling must be corrected.

Wind rate correction is based on height by using Sutton equation (1974) as follows:

$$\mu_t = \mu_o \left(\frac{T_o}{T_t}\right)^P \quad \textbf{(3)}$$

Where :

Mo = wind rate at standard height

μt = wind rate at desired height (e.g. 120 m)

Tt = height of measuring equipment anemometer (for instance 10 m)

To = height of wind rate desired (for instance 120 m)

P = constant determined based on atmosphere stability, such as class B is 0,53 and D class is 0,72

Parameter which is measured

Parameter of air quality which will be measured covers: gas SO_2, NO_X, and CO, their parameter is measured because ammonia plant operation will emit an amount of gas caused by incineration of natural gas.

Illustration of Plume and Emission Technical Data

Technical data related to emission gas of primary fireplace, is presented in Table 5.22 below:

Table 5.22.Technical Data Primary Reformer Fireplace Plume

Remarks	Value	Unit
Amount of chimneys	1	Unit
Height of actual chimney	32,7	Meter
Rate of emission gas flow	6,93	m/second
Gas flow discharge	313,149	m^3/hour
Diameter at the upper part of chimney	4	M
Atmosphere pressure	1	Atm
Gas temperature in the stack	423	K
Average Atmosphere temperature	303	K

Based on result of calculation at emission gas flow discharge, 313.149 m³/hour or 87 m³/second, the emission rate (gram/second) of each pollutant can be seen from the following table:

Table 5.23 Primary Reformer Furnace Gas Emission

No.	Parameter	Maximum concentrate (mg/m³)	Maximum Emission rate Q (gram/sec)
1	NO_2	123.14	7.25
2	SO_2	< 14.28	0.84
3	CO	< 24.98	1.47

Height of plume

Before entering modeling stage, emission distribution from chimney towards ambient air, the effective chimney height has to be determined, e.g. through adding up between actual chimney height and the height of plume. Based on climatology data, especially air temperature, wind rate and sun rays, it has been concluded that the average stability of atmosphere is class "B" is unstable. The height of maximum plume during January and December is as high as 100,43 m, whereas the lowest occurred during August e.g. as high as 60,26 m. In general the height of plume for each month is variable. Calculation result plume height for each month was presented in Table 5.24.

Table 5.24 Monthly Effective Height of Plume Stack

Month	Rate of gas flow (m/sec)	Stack diameter (m)	Chimney temperature (K)	Average temperature of ambient	Pressure	Wind rate (m/sec)	Height of Stack
January	6,93	4	403	303	1013	1,83	100,43
February	6,93	4	403	303	1013	1,99	92,70
March	6,93	4	403	303	1013	2,06	89,27
April	6,93	4	403	303	1013	1,91	96,4`1
May	6,93	4	403	303	1013	2,45	75,32
June	6,93	4	403	303	1013	2,60	70,89
July	6,93	4	403	303	1013	2,90	63,43
August	6,93	4	403	303	1013	3,06	69,26
September	6,93	4	403	303	1013	2,90-	63,43
October	6,93	4	403	303	1013	2,60	79,89
November	6,93	4	403	303	1013	1,99	92,70
December	6,93	4	403	303	1013	1,83	100,43

Effective chimney height

Height of effective chimney is the adding up of actual chimney height with height of plume, so that their characteristic is similar to the height of plume. The higher effective chimney height. then the better spreading of emission distribution towards ambient air.

Table 5.25 Monthly Effective Height of Stack

Month	Height of actual Stack (m)	Height of Stack (m)	Effective Height of Stack (m)
January	32,7	100,43	133,13
February	32,7	92,70	125,40
March	32,7	89,27	121,97
April	32,7	96,41	129.11
May	32,7	75,32	108.02
June	32,7	70,89	103.59
July	32,7	63,43	96.13
August	32,7	60,26	92.96
September	32,7	63,43	96,13
October	32,7	70,89	103.59
November	32,7	92,70	125.40
December	32,7	100,43	133.13

Emission distribution from the chimney towards ambient air

Mathematics calculation in form of modeling of emission distribution from primary reformer fireplace with natural gas as fuel, towards air quality, is to predict coverage areas to be affected, so the evaluation may be carried out in the framework of to manage and monitor the impact. Result of this evaluation may become the basis for making a environment management program and monitoring, so that impact towards aesthetics, health, growth of plants and restlessness may be minimized as low as possible.

Modeling is depend on input of various data, either primary data or secondary data, so that the accuracy are really dependent on the quality of data availability. Result of modeling is presented in form of table which shows the function of distance towards concentration. This table represent result of modeling for each parameter of gas SO_2, NO_X and CO for a period of 1 day, and at every month for full year (12 Tables). The following is the description of each parameter for each month

Table5.26 Average Daily Increment of Emission Concentration in January

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	10.900	1.613	2.825	21.540	8.333	94.925
600	22.721	3.363	5.889	33.361	10.083	97.989
700	31.961	4.731	8.283	42.601	11.451	100.383
800	36.958	5.471	9.579	47.598	12.191	101.679
900	38.495	5.698	9.977	49.135	12.418	102.077
1000	37.824	5.599	9.803	48.464	12.319	101.903
1100	35.938	5320	9.314	46.578	12.040	101.414
1200	33.509	4.960	6.685	44.149	11.680	100.785
1300	30.936	4.579	8.018	41.576	11.299	100.118
1400	28.411	4.205	7,363	39.051	10.925	99.463
1500	26.030	3.853	6.746	36,670	10.573	98.846
1600	23.836	3.528	6.178	34.476	10.248	98.278
1700	21.839	3.233	5.660	43.479	9.953	97.760
1800	20.035	2.966	5.192	30.675	9.686`	97.292
1900	18.412	2.725	4.772	29.052	9.445	96.872
2000	16.954	2.509	4.394	27.594	9.229	96.494
2100	15.644	2.316	4.055	26.284	9.036	96.155
2200	14.468	2.141	3,750	25.108	8.861	95.850
2300	13.409	1.985	3.475	24.049	8.705	95.575
2400	13.409	1.844	3.228	23.095	8.564	95.328
2500	12.455	1.716	3.004	22.233	8.436	95.104
2600	11.593	1.600	2.802	21.453	8.320	94.902
2700	10.107	1.496	2.619	20.745	8.216	94.719
2800	9.462	1.401	2.452	20.102	8.121	94.552
2900	8.876	1.314	2.300	19.516	8.034	94.400
3000	8.341	1.235	2.162	18.981	7.955	94262
3500	6.260	0.027	1.633	116.900	7.647	93.722
4000	4.859	0.719	1`.259	15499	7.647	93.359
4500	3.876	09.574	1.005	14.516	7.296	92.105
5000	3.162	0.468	0.819	13.802	7.188	92919
5500	2.627	0.389	0.681	13.267	7.109	92.781
6000	2.216	0.328	0.574	112.856	7.048	92.674
6500	1.894	0.280	0.491	12.534	7.000	92.591
7000	1.638	0.242	0,424	12.278	6.962	92.524
7500	1.430	0.212	0.371	12.070.	6.932	92.471
8000	1.259	0.186	0.326	11.899	6.906	92.426
8500	1.117	0.165	0.289	11.757	6.885	92.389
9000	0.998	0.148	0.259	11.638	6.868	92.359
9500	0.896	0.133	0.232	11.536	6.853	92.332
10000	0.810	0.120	0.210	11.450	6.840	92.310

Table 5.27 Average Daily Increment of Emission Concentration in February

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	54.45	0.659	1.154	15.095	3.379	93.254
600	7.178	1.062	1.860	17,818	7.782	93.960
700	89.352	1.236	2.165	18.992	7.956	94.265
800	8.319	1.231	2.156	18.959	7.951	94.256
900	7.663	1.134	1.986	18.303	7.854	94.086
1000	6.782	1.004	1.758	17.422	7.724	93.858
1100	5.752	0.851	1.491	16.392	7.571	93.591
1200	4.480	0.716	1.254	15.480	7.436	93.354
1300	4.076	0.603	1.056	14.716	7.323	93.156
1400	3.443	0.510	0.892	14.083	7.230	92.992
1500	2.922	0.433	0.757	13.562	7.153	92.857
1600	2.493	0.369	0.646	13.133	7.089	92.746
1700	2.139	0.317	0.554	12.779	7.037	92.654
1800	1.845	0.273	0.478	12.485	6.993	92.578
1900	1.601	0.237	0.415	12.241	6.957	92.515
2000	1.396	0.207	0.362	12.036	6.927	92.462
2100	1.224	0.181	11.864	11.864	6.901	92.417
2200	1.078	0.160	0.279	11.718	6.880	92.379
2300	0.954	0.141	0.247	11.594	6.861	92.347
2400	0.848	0.125	0.220	11.488	6.845	92.320
2500	0.756	0.112	0.196	11.396	6.832	92.296
2600	0.677	0.100	0.176	11.317	6.820	92.276
2700	0.609	0.090	0.158	11.249	6.810	92.258
2800	0.549	0.081	0.142	11.289	6.802	92.242
2900	0.497	0.074	0.129	11.137	6.794	92.229
3000	0.451	0.067	0.117	11.091	6.787	92.217
3500	0.289	0.043	0.075	10.929	6.763	92.175
4000	0.196	0.029	0.051	10.836	6.749	92.151
4500	0.39	021	0.036	10.779	6.741	92.136
5000	0.102	0.015	0.026	10.742	6.735	92.126
5500	0.077	0.011	0.020	10.717	6.731	92.120
6000	0.059	0.009	0.015	10.699	6.729	92.115
6500	0.047	0.007	0.0`1	10.687	6.727	92.112
7000	0.038	0.006	0.010	10.678	6.726	92.110
7500	0.031	0.005	0.008	10.671	6.725	92.108
8000	0.025	0.004	0.007	10.665	6.724	92.107
8500	0.021	0.003	0.005	10.661	6.723	92.105
9000	0.018	0.003	0.005	10.658	6.723	92.105
9500	0.015	0.002	0.004	10.655	6.7822	92.104
10000	0.013	0.002	0.003	10.653	6.722	92.103

Table 5.28 Average Daily Increment of Emission Concentration in March

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	5.039	0.746	1.3061	16.679	7.466	93.406
600	7.704	1.140	1.997	18.344	7.860	95.097
700	8.690	1.286	2.252	`9.330	8.006	94.352
800	8.486	1.256	2.199	19.126	7.976	94.299
900	7.714	1.142	1.999	18.354	7.862	94.099
1000	6.765	1.001	1.753	17.405	7.721	93.853
1100	5.699	0.844	1.477	16.339	7.564	93.577
1200	4.772	0.706	1.237	15.412	7.426	93.337
1300	4.004	0.593	1.038	14.644	7.313	93.138
1400	3.372	0.499	0,674	14.012	7.219	92.974
1500	2.855	0.423	0.740	13.495	7.143	92.840
1600	2.431	0.360	0.630	13971	7.080	92.730
1700	2.083	0.308	0.540	12.723	7.028	92.640
1800	1.795	0.266	0.465	12.435	6.986	92.565
1900	1.555	0.230	0.403	12.195	6.950	92.503
2000	1355	0.201	0.351	11.995	6.921	92.451
2100	1.187	0.176	0.308	11.827	6.896	92.408
2200	1.045	0.155	0.271	11.685	6.875	92.371
2300	0.924	0.137	0.239	11.857	6.857	92.339
2400	0.821	0.121	0.213	11.461	6.841	92.313
2500	0.732	0.108	0.190	11.372	6.828	92.290
2600	0.655	0.097	0.170	11.295	6.807	92.253
2700	0.589	0.087	0.153	11.229	6.807	92.253
2800	0.531	0.079	0.138	11.171	6.799	92.238
2900	0.480	0.071	0.124	11.120	6.791	92.224
3000	0.436	0.065	0.113	11.076	6.785	9222.213
3500	0.279	0.041	0.072	10.919	6.761	92.172
4000	0.189	0.028	0.049	10.829	6.748	92.149
4500	0.134	0.020	0.035	10.774	6.740	92.135
5000	0.0989	0.015	0.025	10.738	6.735	92.125
5500	0.074	0.011	0.019	10.714	6.731	92.119
6000	0.057	0.008	0.015	10.697	6.728	92.115
6500	0.04555	0.007	0.012	10.6185	6.727	92.112
7000	0.036	0.005	0.009	10.676	6.725	92.109
7500	0.,030	0.004	0.008	10.670	6.724	92.108
8000	0.024	0.004	0.006	10.664	6.724	92.106
8500	0.020	0.003	0.005	10.660	6.723	92.105
9000	0.017	0.003	0.004	10.657	6.723	92.104
9500	0.015	0.002	0.004	10.655	6.722	92.104
10000	0.013	0.002	0.003	10.653	6.7822	92.103

Table 5.29 Average Daily Increment of Emission Concentration in April

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	3.874	0.573	1.004	14.514	7.293	93.104
600	6.617	0-.979	1.715	117.257	7.699	93.815
700	7.790	1.190	2.066	18.610	7.900	94.166
800	8.114	1.201	2.103	18.754	7.921	94.203
900	7.585	1.123	1.966	18.225	7.843	94.066
1000	6.783	1.004	1.758	17.423	7.724	93.858
1100	32.598	4.825	8.449	43.238	11.545	100.549
1200	21.975	3.253	5.695	32.615	9.973	97.795
1300	15.666	2.319	4.060	26.306	9039	96.160
1400	11.614	1.719	3.010	22.254	8.439	95.110
1500	8.868	1.313	2.298	19.508	98.033	94.398
1600	6.932	1.026	1.797	17.572	7.746	93.897
1700	5.524	0.818	1.432	16.164	7.538	93.532
1800	4.474	0.662	1.160	15.114	7.382	93.260
1900	3.675	0.544	0.952	14.315	7.264	92.052
2000	3.055	0.452	0.792	13.695	7.172	92.892
2100	2.567	0.380	0.665	13.207	7.100	92.765
2200	2.177	0.322	0.564	12.817	7.042	92.664
2300	1.862	0.276	0.483	12.502	6.996	92.583
2400	1.605	0.238	0.416	12.245	6.958	92.516
2500	1.393	0.206	0.361	12.033	6.926	92.461
2600	1.217	0.180	0.315	11.857	6.900	92.415
2700	1.069	0.158	0.277	11.7098	6.878	92.377
2800	0.944	0.140	0.245	11.584	6.860	92.345
2900	0.838	0.124	0.217	11.478	6.844	92.317
3000	0.747	0.111	0.194	11.387	6.831	92.294
3500	0.608	0.090	0.158	11.248	6.810	92.258
4000	0.503	0.074	0.130	11.143	6.794	92.230
4500	0.421	0.062	0.109	11.061	6.782	92.209
5000	0.357	0.053	0.093	10.997	6.773	92.193
5500	0.306	0.045	0.079	10.946	6.765	92.179
6000	0.264	0.039	0.068	10.904	6.759	92.168
6500	0.178	0.026	0.046	10.818	6.746	92.146
7000	0.126	0.019	0.033	10.766	6.739	92.133
7500	0.093	0.014	0.024	10.733	6.734	92.124
8000	0.070	0.010	0.018	10.710	6.730	92.118
8500	0.055	0.008	0.014	10.695	6.728	92.114
9000	0.043	0.006	0.011	10.683	6.726	92.111
9500	0.035	0.005	0.009	10.675	6.725	92.109
10.000	0.029	0.004	0.007	10.669	6.724	92.107

Table 5.30 Average Daily Increment of Emission Concentration in May

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	7.807	1.156	2.023	18.447	7.876	94.123
600	9.791	1.449	2.537	20.431	8.169	94.637
700	9.823	1.454	2.546	20.463	8.174	94.646
800	8.904	1.318	2.308	19.544	8.038	94.408
900	7.699	1.140	1.995	18.399	7.860	94.095
1000	6.518	0.965	1.689	17.158	7.685	93.789
1100	30.115	4.458	7.805	40.755	11.178	99.905
1200	19.726	2.920	5.112	30.366	9.640	97.212
1300	13.755	2.036	3.565	24.395	8.756	95.665
1400	1o.022	1.483	2.597	20.662	8.203	94.697
1500	7.547	1.117	1.956	18.187	7.837	94.056
1600	5.834	0.864	1.512	16.474	7.584	93.612
1700	4.607	0.682	1.194	15.247	7.402	93.294
1800	3.703	0.548	0.960	14.343	7..268	93.060
1900	3.022	0.447	0.783	24.663	7.267	93.883
2000	2.499	0.370	0.648	13.139	7.090	92.748
2100	2.090	0.309	0.542	12.730	7.029	92.642
2200	1.765	0.261	0.458	12.405	6.981	92.558
2300	1.505	0.223	0.390	12.145	6.943	92.490
2400	1.293	0.191	0.335	11.933	6.911	92.435
2500	1.120	0.166	0.290	11.760	6.886	92.390
2600	0.976	0.144	0.2253	11.616	6.864	92.353
2700	0.855	0.127	0.222	11.495	6.847	92.322
2800	0.754	0.112	0.195	11.394	6.832	92.295
2900	0.668	0.099	0.173	11.308	6.819	92.273
3000	0.595	0.088	0.154	11.235	6.808	92.254
3500	0.482	0.071	0.125	11.122	6.791	92.225
4000	0.397	0.059	0.103	11.037	6.7879	92.203
4500	0.332	0.049	0.086	10.972	6.769	92.186
5000	0.281	0.042	0.073	10.921	6.762	92.173
5500	0.240	0.036	0.0-62	10.880	6.756	92.1623
6000	0.207	0.031	0.054	10.847	6.751	92.154
6500	0.140	0.021	0.036	10.780	6.741	92.136
7000	0.099	0.015	0.026	10.739	6.735	92.126
7500	0.073	0.011	0.019	10.713	6.731	92.119
8000	0.055	0.008	0.014	10.695	6.728	92.114
8500	0.043	0.006	0.011	10.683	6.726	92.111
9000	0.034	0.005	0.009	10.674	6.726	92.109
9500	0.027	0.004	0.007	10.667	6.724	92.107
10000	0.022	0.003	0.006	10.662	6.723	92.106

Table 5.31 Average Daily Increment of Emission Concentration in June

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	8.776	1.299	2.275	19.416	8.019	94.375
600	10.387	1.537	2.692	21.027	8.257	94.792
700	10.070	1.491	2.610	20.710	8.211	94.710
800	8.931	1.322	2.315	19.571	8.042	94.415
900	7.610	1.126	1.972	18.250	7.846	94.072
1000	6.378	0.944	1.653	17.018	7.664	93.752
1100	29248	4.328	7.580	39.888	11.049	99.680
1200	19.055	2.820	4.939	29.695	9.540	97.039
1300	13.232	1.959	3.429	23.872	8.679	95.529
1400	9.610	1.422	2.491	20.250.	8.1422	94.591
1500	7.218	1.068	1.871	17.858	7.788	93.971
1600	5.568	0.824	1.443	16.208	7.544	93.543
1700	4.389	0.650	1.138	15.029	7.730	93.238
1800	3.523	0.521	0.913	14.163	7.241	93.013
1900	2.872	0.425	0.744	13.512	7.q45	92.844
2000	2.372	0.351	0.615	13.012	7.071	92.715
2100	1.982	0.293	0.514	12.622	7.013	92.614
2200	1.673	0.248	0.434	12.313	6.968	92.534
.2300	1.425	0.211	0.369	`11.065	6.932	92.469
2400	1.224	0.181	0.317	11.864	6.901	92.417
2500	1.059	0.157	0.275	11.699	6.877	92.375
2600	0.923	0.137	0.239	11.563	6.857	92.339
2700	0.809	0.120	0.210	11.449	6.840	92.310
2800	0.713	0.105	0.185	11.353	6.825	92.285
2900	0.631	0.093	0.164	11.271	6.813	92.264
3000	0.562	0.083	0.146	11.202	6.803	92.246
3500	0.454	09.067	0.228	22.094	6.787	92.218
4000	0.374	0.055	0.097	11.014	6.775	92.197
4500	0.313	0.046	0.081	10.953	6.766	92.181
5000	0.265	0.039	0.069	10.905	6.759	92.169
5500	0.226	0.033	0.059	11866	6.753	92.159
6000	0.195	0.029	0.051	10.835	6.749	92.151
6500	0.132	0.020	0.034	10.772	6.740	92.134
7000	0.093	0.014	0.024	10.7333	6.734	92.124
7500	0.069	0.010	0.018	10.709	6.730	92.118
8000	0.052	0.008	0.013	10.692	6.728	92.113
8500	0.040	0.006	0.010	10.680	6.726	92.110
9000	0.032	0.005	0.008	10.672	6.725	92.108
9500	0.026	0.004	0.007	10.666	6.724	92.107
10000	0.021	0.003	0.005	10.661	6.723	92.105

Table 5.32 Average Daily Increment of Emission Concentration in July

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	10.415	1.542	2.699	21.055	8.262	94.799
600	11.242	1.664	2.914	21.882	8.384	95.014
700	10.321	1.528	2.675	20.961	8.248	94 .775
800	8.843	1.309	2.292	19.483	8.029	94.392
900	7.362	1.090	1.908	18.002	7.810	94.008
1000	6.070	0.898	1.573	16.710	7.6718	93.673
1100	27.510	4.072	7.130	38.150	10.792	99.230
1200	17.770	2.639	4.605	28.410	9.350	96.7805
1300	12.259	1.815	3.177	22.899	8.535	95.277
1400	8.857	1.311	2.295	19.497	8.031	94.395
1500	6.626	0.981	1.717	17.2 66	7.701	93.817
1600	5.094	0.754	1.320	15.734	7.747	93.420
1700	4.004	0.593	1.038	14.644	7.313	93.138
1800	3.207	0.475	0/.831	13.847	7.195	92.931
1900	2.609	0.386	0.676	13.249	7.106	92.776
2000	2.252	0.328	0.558	23.792	7.038	92.658
2100	1.795	0.266	0.465	12.435	6.986	92.565
2200	1.514	0.224	0.392	12.154	6.944	92.492
2300	1.288	0.191	0.334	11.928	6.911	92.434
2400	1.106	0.164	0.287	11.746	6.884	92.387
2500	0.956	0.141	0.248	11.596	6.861	92.348
2600	0.832	0.123	0.216	11.472	6.843	92.316
2700	0.729	0.108	0.189	11.369	5.828	92.289
2800	0.642	0.095	0.166	11.282	6.815	92.266
2900	0.568	0.084	0.147	11.208	6.804	92.247
3000	0.505	0.075	0.313	11.145	6.795	92.231
3500	0.408	0./060	0.106	11.048	6.780	92.206
4000	0.336	0.050	0.087	10.976	6.770	92.187
4500	0.280	0.041	0.073	10.920	6.761	92.173
5000	0.2337	0.0335	0.061	10.877	6.755	92.161
5500	0.1203	0.030	0.053	10.843	6.750	92.153
6000	0.175	-0.026	0.045	10.815	6.746	92.145
6500	0.118	0.017	0.031	10.758	6.737	92.131
7000	0.084	0.012	0.022	10.724	6.732	92.122
7500	0.061	0.009	0.016	10.701	6.729	92.116
8000	0.047	0.007	0.012	10.687	6.727	92.112
8500	0.036	0.005	0.009	20.676	6.725	92.109
9000	0.029	0.004	0.007	10.669	6.724	92.107
9500	0.023	0.003	0.006	10.663	6/723	92.106
10000	0.019	0.003	0. 005	1 0.659	6.723	92.105

Table 5.33 Average Daily Increment of Emission Concentration in August

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	11.084	`.641	2.873	21.724	8.361	94.973
600	11.530	1.707	2.988	22.170	8.427	95.088
700	10356	1.533	2,684	20.996	8.253	94.784
800	8.750	1.295	2.268	13.390	8.015	94.368
900	7.216	1.068	1.870	17.856	7.788	93.970
1000	5.911	0.875	1.532	16.551	7.595	93.632
1100	26.665	3.947	6.911	37305	10.667	99.011
1200	17.165	2.541	4.449	27805	9.261	96.549
1300	11.819	1.748	3.061	22.450	8.468	95.161
1400	8.515	1.260	2.207	19.155	7.980	94.307
1500	6.359	0.941	1.648	16.999	7.661	94.748
1600	4.882	0.723	1.265	15.522	7,443	93.365
1700	3.834	0.567	0.994	14.474	7.287	93.094
1800	3.068	0.454	0.795	10.708	7.174	92.895
1900	2.494	0.369	0.646	13.134	7.089	92.746
2000	2.055	0.304	0.533	12.695	7.024	92.633
2100	1.714	0.254	0.444	12.354	6.974	92.544
2200	1.445	0.214	0.374	12.085	6.934	92.474
2300	1.229	0.182	0.318	11.869	6.902	94.418
2400	1.054	0.156	0.273	11.694	6.876	92.353
2500	0.911	0.135	0.236	11.551	6.855	92.336
2600	0.793	0.117	0.205	11.433	6.837	92.305
2700	0.694	0.103	0.180	11.334	6.823	92.280
2800	0.611	0.090	0.158	11.251	6.810	92.258
2900	0.541	0.080	0.140	11.181	6.800	92.240
3000	0.;481	0.071	0.125	11.121	6.791	92.225
3500	0.388	0.057	0.101	11.028	6.777	92.201
4000	0.319	0.047	0.083	10.959	6.767	93.183
4500	0.267	0.039	0.069	20.907	6.759	92.169
5000	0.225	0.033	0.058	10.865	6.753	92.158
5500	0.193	0.029	0.050	10.833	6.749	92.150
6000	0.166	0.025	0..043	10.806	6.745	92.143
6500	0.112	0.017	0.029	10.752	6.737	92.129
7000	0.079	0.012	0.021	10.719	6.732	92.`1`
7500	0.058	0.009	0.015	1-0.698	6.729	92.115
8000	0.044	0.007	0.011	10.684	6.727	92.111
8500	0.034	0.005	0.009	10.674	6.725	92.109
9000	0.027	0.004	0.007	10.667	6.724	92.107
9500	0.002	0.003	0.006	10.662	6.723	92.106
10000	0.018	0.003	0.005	10.658	6.723	92.105

Table 5.34 Average Daily Increment of Emission Concentration in September

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	Q10.415	1.547	2.699	21.055	8.262	94.799
600	11.242	1.664	2.914	21.882	8.384	95.014
700	10.321	1.528	2.675	20.961	8.248	94.775
800	8.843	1.309	2.292	19.483	8.029	94.392
900	7.382	1.090	1.908	18.002	7.810	94.008
1000	6.070	0.898	1.573	16.710	7.618	93.673
1100	27.510	4.072	7.130	38.150	10.792	00.230
1200	17.770	2.630	4.605	28.410	9.350	96.705
1300	12.259	1.815	3.177	22.899	8.535	95.277
1400	8.857	1.311	2.295	19.497	8.031	94.395
1500	6.626	0.981	1.717	17.266	7.701	93.817
1600	5.094	0.754	1.320	15.734	7.474	93.420
1700	4.004	0.593	1.038	14.644	7.313	93.138
1800	3.207	0.475	0.831	13.847	7.195	92.931
1900	2.609	0.386	0.676	13.249	7.106	02.776
2000	2.151	0.318	0.558	12.791	7.038	92.658
2100	1.795	0.166	0.465	12.435	6.986	92.565
2200	1.514	0.224	0392	12.154	6.944	92.492
2300	1.288	0.191	0.334	11.928	6.911	92.434
2400	1.106	0.164	0.287	11.746	6.884	92.387
2500	0.956	0.141	0.248	11.596	6.861	92.348
2600	0.832	0.123	0.216	11.472	6.843	92.116
2700	0.729	0.108	0.189	11.369	6.828	92.289
2800	0.642	0.095	0.166	11.282	6.815	92.266
2900	0.568	0.084	0.147	11.208	6.804	91.147
3000	0.505	0.075	0.131	11.145	6.795	92.231
3500	0.408	0.060	0.106	11.048	6.780	92.206
4000	0.336	0.050	0.087	10.976	6.770	91.187
4500	0.280	0.04`	0.073	10.920	6.761	92.173
5000	0.237	0.035	0.061	10.877	6.755	92.161
5500	0.203	0.030	0.053	10.843	5.750	92.153
6000	0.175	0.026	0.045	10.815	6.746	92.145
6500	0.118	0.017	0.021	10.758	6.737	92.131
7000	0.084	0.012	0.022	10.724	6.732	92.122
7500	0.061	0.009	0.016	10.701	6.729	92.116
8000	0.047	0.007	0.012	10.687	6.727	92.112
8500	0.036	0.005	0.009	10.676	6.725	92.109
9000	0.029	0.004	0.007	10.669	6.724	92.107
9500	0.023	0.003	0.006	10.663	6.723	92.106
10000	0.019	0.003	0.005	10.659	6.723	92.105

Table 5.35 Average Daily Increment of Emission Concentration in October

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	8.776	1.299	2.275	19.416	8.019	94.375
600	10.387	1.537	2.692	21.027	8.257	94.791
700	10.070	1.491	2.610	20.710	8.211	94.710
800	8.931	1.322	2.315	19.571	8.042	94.415
900	7.610	1.126	1.972	18.250	7.846	94.072
1000	6.378	0.944	1.653	17.018	7664	93.753
1100	29.2248	4.329	7.580	39.888	11.049	99.680
1200	19.055	2.820	4.939	29.695	9.540	97.039
1300	13.232	1.959	3.429	23.872	8.679	95.529
1400	9.610	1.422	2.491	20.250	8.142	94.591
1500	7.218	1.068	1.871	17.858	7.788	93.971
1600	5.568	0.824	1.443	16.208	7.544	93.543
1700	4.389	0.650	1.138	15.029	7.370	93.328
1800	3.523	0.521	0.913	14.163	7.241	93.013
1900	2.872	0.425	0.744	13.512	7.145	92.844
2000	2.372	0.351	0.615	13.012	7.071	92.715
2100	1.982	0.293	0.514	12.622	7.013	92.614
2200	2.673	0.248	0.434	12.313	6.968	92.534
2300	1.425	0.211	0.369	12.065	6.931	92.469
2400	1.224	0.181	0.317	11.864	6.901	92.417
2500	1.059	0.157	0.275	11.699	6.877	92.375
2600	0.923	0.137	0.239	11.563	6.857	92.339
2700	0.809	0.120	0.210	11.449	6.840	92.310
2800	0.713	0.105	0.185	11.353	6.825	92.285
2900	0.631	0.093	0.164	11.271	6.813	92.264
3000	0.562	0.083	0.146	11.202	6.803	92.246
3500	0.454	0.067	0.118	11.094	6.787	92.218
4000	0.374	0.055	0.097	11.014	6.775	92.197
4500	0.313	0.046	0.081	10.953	6.766	92.181
5000	0.265	0.039	0.069	20.905	6.759	92.159
5500	0.226	0.033	0.059	10.866	6.753	92.159
6000	0.195	0.029	0.051	10.835	6.749	92.151
6500	0.132	0.020	0.034	10.772	6.740	92.134
7000	0.093	0.014	0.024	10.733	6.734	92.124
7500	0.069	0.010	0.018	10.709	6.720	92.118
8000	0.052	0.008	0.013	10.692	6.728	94.113
500	0.040	0.006	0.010	10.680	6.726	92.110
9000	0.032	0.005	0.008	10.672	6.725	92.108
9500	0.026	0.004	0.007	10.666	6.724	92.107
10000	0.021	0.003	0.005	10.661	6.723	92.105

Table 5.36 Average Daily Increment of Emission Concentration in November

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	4.455	0.659	2.254	25.095	7.379	93.254
600	7.718	1.062	1.860	17.818	7.782	93.960
700	8.352	1.236	2.165	18.992	7.956	94.265
800	8.319	1.231	2.156	18.959	7.951	94.256
900	7.663	1.134	1.986	18.303	7.854	94.086
1000	6.782	1.004	1.758	17.422	7.724	93.858
1100	32.3512	4.789	87.385	42.992	11.509	100.485
1200	21.691	3.211	5.622	32.331	9.931	97.722
300	15.399	2.279	3.991	26.039	8.999	96.091
1400	11.379	1.684	22.949	22.019	8.404	95.049
1500	8.666	1.283	2.246	19.306	8.003	94.346
1600	6.760	1.001	1.752	17.400	78.721	93.852
1700	5.378	0.796	1.394	16.018	7.516	93.494
1800	4.349	0.644	1.127	14.989	7364	93.227
1900	3.568	0.528	0.925	14.208	7.248	93.025
2000	2.963	0.439	0.768	13.603	7.159	92.868
2100	2.487	0.368	0.645	13.127	7.088	92.745
2200	2.108	0.312	0.546	12.748	7.032	92.646
300	1.802	0.267	0.467	12.442	6.987	92.567
2400	1.553	0.230	0.402	12.193	6.950	92.502
2500	1.347	0.199	0.349	11.987	6.919	92.449
2600	1.176	0.174	0.305	11.816	6.894	92.405
2700	1.033	0.153	09.268	11.673	6.873	92.368
2800	0.912	0.135	0.236	11.552	6.855	91.336
2900	0.809	0.120	0.210	11.449	6.840	92.310
3000	0.721	0.107	0.187	11.361	6.827	92.287
3500	0.586	0.087	0.152	11.226	6.807	92.252
4000	0.484	0.072	0.126	11.124	6.792	92.226
500	0.406	0.060	0.105	11.046	6.780	92.205
5000	0.344	0.051	0.089	10.984	6.771	92.189
5500	0.294	0.044	0.076	10.934	6.764	92.176
6000	0.254	0.038	0.066	10.894	6.758	92.166
6500	0.172	0.025	0.045	10.812	6.745	92.145
7000	0.122	0.018	0.032	10.762	6.728	92.132
7500	0.089	0.013	0.023	10.729	6.733	92.123
8000	0.058	0.010	0.018	10.708	6.730	92.118
8500	0.053	0.008	0.014	110.693	6.728	92.114
9000	0.042	0.006	0.011	10.682	6.726	92.111
500	0.034	0.005	0.009	10674	6.725	92.109
10000	0.028	0.004	0.007	10.668	6.724	92.107

Table 5.37 Average Daily Increment of Emission Concentration in December

Distance	Emission Contribution			Final condition		
	SO_2	NO_2	CO	SO_2	NO_2	CO
500	3.305	0.489	0.857	13.945	7.209	92.957
600	6.025	0.892	1.562	116.665	7.612	93.662
700	7.542	1.116	1.955	18.182	7.835	94.055
800	7.869	1.165	2.039	`8.509	7.885	94.139
900	7.477	1.107	1.938	18.117	7.827	94.038
1000	6.764	1.001	1.753	17.404	7.732	93.853
1100	32.779	4.582	8.495	43.419	11.571	100.595
1200	22.231	3.291	5.762	32.871	10.011	97.862
1300	15.922	2.357	4.126	26.562	9.077	96.226
1400	11.847	1.754	3.070	22.487	8.474	95,179
1500	9.072	1.343	2.351	19.712	8,063	94.451
1600	7.109	1.652	1.842	17.749	7.772	93.942
1700	5.676	0.840	1.471	16.316	7.560	93.571
1800	4.605	0.682	1.193	15.245	7.402	93.293
1900	3.787	0.561	0.981	14.427	7.281	93.081
2000	3.152	0.467	0.817	13.792	7.187	9.97
2100	2.651	0.392	0.687	13.291	7.112	92.787
2200	2.250	0.333	0.583	12.890	7.053	92.683
2300	1.926	0.285	0.499	12.566	7.005	92599
2400	1.661	0.246	0.431	12.301	6.966	92.531
2500	1.443	0.214	0.374	12.083	6.934	92.474
2600	1.261	0.187	0.327	11.901	6.901	92.427
2700	1.108	0.164	0.287	11.748	6.884	92.387
2800	0.979	0.145	0.254	11.619	6.865	92.354
2900	0.869	0.129	0.225	11.509	6.849	92.325
3000	0.775	0.115	0.201	11.415	6.845	92.301
3500	0.632	0.094	0.164	11.272	6.814	92.264
4000	0.523	0.077	0.135	11.163	6.797	92.235
4500	0.438	0.065	0/.114	11.078	6.785	92.214
5000	0.371	0.055	0.096	11.011	6.775	92.196
5500	0.318	0.047	0.082	10.958	6.767	92/182
6000	0.275	0.041	0.071	10.915	6.761	92.171
6500	0.186	0.027	0.048	10.926	6.739	92.148
7000	0.132	0.019	0.034	`0.772	6.739	92.134
7500	0.097	0.014	0.025	10.737	6.734	92.125
8000	0.073	0.011	0.019	10.713	6,731	92.119
8500	0.057	0.008	0.015	10.697	6.728	92.115
9000	0.045	0.007	0.012	10.685	6.727	92.112
9500	0.036	0.005	0.009	10.676	6.725	92.109
10000	0.030	0.004	0.008	10.670	6.724	92.108

The emission will spread out in accordance with dominant wind direction as follows**:**

Table 5.38 Monthly Dominant Wind Directions at Luwuk Region during 2006 – 2011

No.	Month	Wind direction
1	January	West / East West
2	February	West / East
3	March	West / South West / East
4	April	West / East West / South East
5	May	West / South
6	June	West / South
7	July	West / South East / South
8	August	West / East West / South East / South
9	September	West / South
10	October	West / South
11	November	West
12	December	West / East West

Based on calculation result emission distribution SO_2, NO_2, and CO at a distance of 500 meter (Kampung Kompanga) may be seen from the following table:

Table 5.39 Emission distribution of SO_2, NO_2, and CO at a distance of 500 meter

Month	SO_2 (gr/m³)	NO_2 (gr/m³)	CO (gr/m³)
January	21,540	8.333	94.925
February	15,095	7.379	93.254
March	15,679	7.466	93.406
April	14,514	7.293	93.104
May	18,447	7.867	94.123
June	19.416	8.019	94.375
July	21.055	8.262	94.799
August	21.724	8.361	94.973
September	21.055	8.262	94.799
October	10.416	8.019	94.375
November	15.095	7.379	93.254
December	13.945	7.209	92.957

When compared with initial condition, SO_2, NO_2, and CO content at Kampung Kompanga is SO_2,= 10.64 g/m³, NO_2= 6,72 g/m³, CO = 92,1 g/m³ during January until December, there will be an increment of concentration of emissions. However, when compared with Government Regulation for ambient air quality standard as per PP No. 41 - 1999 concerning Air Pollution Control i.e. for SO_2= 900 g/m³, NO_2,= 400 g/m³ and CO = 30.000 g/m³ , gas emission still fulfill the quality standard. Therefore, impact of ammonia production towards air quality is considered as ***Insignificant Negative Impact.***

5.2.6.2. Impact on Seawater Quality

Ammonia Plant activities will produce liquid waste to be treated before finally sent into the sea through pipe and or concrete channel. As the result, sea water may be affected as per specific water quality such as DO (Dissolved Oxygen), BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) are parameters which are normally used for water quality standard.

DO reflect the oxygen availability dissolved in water which is very significant in the degradation process by micro-organism. Whereas BOD and COD reflect the oxygen requirement in degrading organic material contained in the water, in other words, BOD and COD illustrate organic material content.

Besides, suspended solid is a significant parameter which shows fine particulate contained in the water which could be settled. This parameter is correlated with the tendency of sedimentation in the outfall discharge to the sea.

Liquid waste from the ammonia plant during normal operation consists of several sources such as ammonia plant itself, chemicals, ion exchanger unit, warehouse, and storm water to guard retention pond. The amount of liquid waste and its composition of each source may be seen in Table 5.40 below:

Table 5.40 Composition of Liquid Waste of Ammonia Production Process

Source	Discharge m³/hour	pH	TSS mg/l	COD mg/l	NH_3 mg/l	Oil mg/l
Ammonia factory	4,7	6,5-9,5	5	29	3	0,2
Utility	10,7	3-10	13	12	7	0,3
Total	15,4	6-9	11	17	6	

Domestic liquid waste generated from offices, housing, canteen, guesthouse, school, public facilities etc and other building in the PT PAU land and properties, is estimated as the following Table 5.41.

Table 5.41 Domestic Waste Composition

Source	Dischargem³/hour	TSS mg/l	TDS mg/l	COD mg/l	BOD5 mg/l	NH^+ mg/l	N_{Total} mg/l
Domestic liquid waste	5	50	30	100	50	30	30

Notes: maximum continuous discharge = 22 m³/hour

Based on mass balance sheet assessment, the rate and total waste composition is as seen from Table 5.42 below:

	Discharge m³/hour	pH	TSS mg/l	TDS mg/l	COD mg/l	BOD mg/l	N_{tot} mg/l	Oil mg/l
Total Plant liquid waste	20,40	6-9	20,56	7,35	37,34	12,25	19,24	0,23

As the above total liquid waste produced by Ammonia Plant and its Complexes to be compared with the Indonesia Government Standard as per Environment State Minister Regulation No. Kep-51/MENLH/10/1995,, then it should use the same Unit Measurement as per the following Table 5.43

Table 5.43 Comparison of Overall Plant Liquid Waste to the Government Standard

	Discharge m³/ton	pH	TSS Kg/ton	TDS Kg/ton	COD Kg/ton	BOD Kg/ton	N_{Total} Kg/ton	Oil Kg/ton
Total Plant liquid waste	0,245	6 – 9	0,005	0,0018	0,009	0,003	0,0047	0
Quality Standard	15	6 – 10	0.15	–	0.30	–	0,30	0,03

As per comparison above, it can be seen that the Ammonia Plant Liquid Effluent shall be complied with the Government Effluent Standard specifically for Ammonia Plant as per Environment State Minister Regulation No. Kep-51/MENLH/10/1995). Therefore, liquid waste effluent of Ammonia Plant to be built by PT PAU should be categorized as ***Insignificant Negative Impact.***

5.3. Post Operation Stage

5.3.1. Broken Off Working Employment (PHK)

5.3.1.1. Working And Business Opportunity (Disappearance of Occupation)

Closure of Ammonia Plant is followed by termination of working employment either skilled labor or unskilled labor. It is foreseen that the worst impact will be felt by non-skilled labor because they have difficulties to find new job or start new business in another place. While for skilled workers it is not so difficult as they have expertise so that it is easier to find new job or start new business in other places. Termination of working employment post ammonia plant closure is foreseen to affect the further impacts on social restlessness.

Based on total population affected by termination work employment are relatively big and will influence to their family lives, also for population who are normally to work in factories, has an influence towards their spiritual condition. Therefore, impact of termination of work employment towards social and economy components is Significant ***Negative Impact***

When the plant activity has been stopped, it will indirectly influence towards community businesses, such as house rental, food stalls, coffee shop, and public transportation business. Closure of ammonia plant has an impact to loss of their income. However, they are aware that the execution of ammonia plant is long enough and the population involved in working or part of them in business are large in amount, therefore that impact of termination of employment is considered will be significant.

CHAPTER VI
EVALUATION OF SIGNIFICANT IMPACT

6.1. Study of Significant Impact

The development of ammonia industry and its supporting facilities is considered to bring about significant impacts on environmental issues either physical, chemical, biological, social, economic, cultural and public health aspects.

Whereas, the impacts on environmental issues regarding air quality, effluent water quality and increased sea water temperature which are affected from ammonia process production, waste water effluent and the returned cooling water and the air emission from ammonia plant – after further mitigation investigation – mainly due to ammonia process technology to be used is an latest advanced technology which is friendly to environment, will be eliminated or decreased to fulfill environment standard quality as regulated by Indonesian Government (see Chapter-V). Therefore these Environmental Impacts will not be considered as *Significant Impacts*.

Considering the fact, there are 25 significant impacts which had been foreseen may arise from the activities of Pre-construction, Construction, Operation and Post-operation stages. The description of these foreseen impacts is described below.

6.1.1. Significant Impact during Pre-Construction Stage

- Government Official Permits and Public Consultation forum regarding AMDAL/EIA may have impact on social, economic, and cultural components in the form of public participation. The EIA / AMDAL Public Consultation was attended by various components of society surrounding the Plant Site, such as : prominent leader of society, religion, young generation, village leader, Batui sub-district chief, Batui Police Officer, NGO and peoples surrounding the Plant location. The EIA Public Consultation result shows that the impressive of the public to the Ammonia Project is good and enthusiastic participation.
- Land acquisition has impact on the increasing of ex Land Owner income by selling its land. Some peoples utilize their money to increase the capital of its business, or for financing the education of their children and or for pilgrimage.

The development of Ammonia Plant has increase the land price at the surrounding of the Plant Site. However, some land owners whose land are not acquired yet, try to sell their land at unreasonably very high price compared to the previous acquired land price.

- They demand for more compensation very much higher than the previously agreed price to other land owner. Because the land price is very high, the Originator (Owner) could not acquire / release the whole land very quickly. This condition may result a negative impact in the form of social unrest which may then potentially become a conflict.
- Manpower mobilization activity is considered to lead to positive impact on social, economic and cultural aspects in the form of job opportunity during land clearing stage. However because of low education (most of graduate from elementary school) of the local people, they only work as unskilled labor and some of them work as driver and may be as heavy equipment operator.
- Although there are positive impacts resulted from manpower mobilization, job and business opportunity competition potential still remain. The previous experience from other company in the similar project activity indicates that the local people and local small contractor demanding for a partnership. On the other side, the national / big contractor normally has already regular partner as its sub-contractor. In addition, the ex-landowner may demand his family to be employed in the Project activities, therefore PAU shall manage carefully this situation to anticipate and prevent such social unrest between the local people and the big contractor which may then potentially become a conflict.
- Equipment and material mobilization to the project field activities may affect the condition of the public road related to excessive vehicle load capacity as well as the weight of equipment. According to the regulation of Governmental Road, for the Road Standard Class IIB, maximum vehicle axel load allowable is 10 tons, hence, equipment and material mobilization shall be arranged well to prevent such road damage.

- Land clearing and site preparation will change parameter condition of land erosion such as topographical and vegetation indexes which may leads to increasing land erosion. However, it is estimated that compared with the existing land erosion at the original site condition, there may be an increase of land erosion from very low-low to medium only.

6.1.2. Significant Impact in Construction Stage

- Manpower mobilization activity in construction stage is considered to bring a positive impact on social, economic, and cultural aspects in the form of job opportunity. However, because of low education (majority graduated from elementary school) of the local people, they only work mostly as unskilled labor and some of them work as driver, labor, helper and some may be as heavy equipment operator.
- Although there are positive impacts resulted from manpower mobilization, job and business opportunity competition potential still remain. The previous experience from other company in the similar project activity indicates that the local people and local small contractor demanding for a partnership. On the other side, the national / big contractor normally has already regular partner as its sub-contractor. In addition, the ex land owner may demand his family to be employed in the Project activities, therefore PAU shall manage carefully this situation to anticipate and prevent such social unrest between the local people and the big contractor which may then potentially become a conflict.
- Prior to land clearing, drainage and sedimentation pond should be constructed for controlling run-off that does not flow into the settlement and Public Road in the downstream area (southern part of the site). Rain-water run-off will be collected in the sedimentation pond through drainage.
- Based on rock composition at the plant site which contains limestone, the impact of the development of ammonia industry on geological aspect is the soil/rock subsidence as dissolution of limestone may result of cavity or hollow formation in the soil / rock.

- The building for ammonia industry and its supporting facilities is considered to increase run-off due to the change of land use from coconut plantation to the ammonia plant and its supporting facilities.
- Green Barrier with various plants will increase carbon absorption, rain water catchment / infiltration and will improve the environmental aesthetics.

6.1.3. Significant Impact in Operation Stage

- Manpower mobilization and employment during operation stage can result in positive impact in the form of participation of local people in this activity. To meet the demand for unskilled labors, the worker from the adjacent villlages has potential to participate. The employment in a relatively long time during the life-time of the ammonia plant will also bring a positive impact because of the more income and benefit that can be obtained.
- Local people may possibly unsatisfied in case more job opportunity will be taken by external labor. The more external labor will potentially cause the more unsatisfied to the local people. Furthermore, sense of unsatisfied of the local people may leads to further impacts such as the disturbance on public order and social unrest.

6.1.4. Significant Impact in Post-Operation Stage

Ammonia plant closure which will be followed by termination of the employment, either skilled and unskilled labors. The most serious impact will be suffered by unskilled labors because of more difficult for getting other job or business. Whereas, the skilled labors is easier in getting other alternative job in the similar industry.

6.2. Best Alternative of Choice

The development of ammonia industry and its supporting facilities has no alternative envisaged either in pra-construction, construction and operation stages or in post-operation stage. Therefore, there is no alternative choice to consider as the best alternative.

6.3. Significant Impact should be Managed

Based on the mitigation of the significant impact, the efforts of environmental management conducted in each significant impact can be concluded as follows:

- The impact of Government Permits and EIA/AMDAL Public Consultation activity on social, economic, and cultural components in the form of public participation, have to be managed to increase positive impact and reduce potential of negative impact of the Project. Manpower mobilization in pre-construction, construction, and operation stages will bring about impact of job and business opportunity and increasing the income of local people, besides may leads to a social conflict. Whereas, post-operation impact is loss of livelihood / employment. This manpower mobilization impact will be managed carefully with the aim of developing positive impact and minimizing negative impact.
- Environmental impact on physical-chemical aspects may comprises road damage, land erosion, controlled run-off, and subsidence.
- Environmental impact on biological component which is considered may happen, will be furthermore managed by developing Green Barrier in order to increase of carbon absorption, the increase of rain-water infiltration and improve environmental aesthetics.

6.4. Recommendation of Environmental Assessment

The development of ammonia industry and its supporting facilities at Uso Village, Batui Sub-district, Banggai Regency, Central Sulawesi Province, has been envisaged by PT Panca Amara Utama using advance technology and environmental approach. Hence, gaseous emission resulted from ammonia making process, rain water run-off, returned cooling sea-water and waste disposal has been anticipated and designed to fulfill environmental standard quality given by Indonesian Government and World Bank Guidelines. Neverheles, the impact on environmental aspects will be resolved using the best ammonia technology available and the cost of such mitigation has been allocated in the Project Cost and also will be allocated in the routine Operating Cost.

ATTACHMENT - 1 : Location Permit issued 2005 by Banggai Regent

BUPATI BANGGAI

REGENT BANGGAI PERMIT
NUMBER: 503/857/Bag.Tapem

ABOUT
LOCATION PERMIT TO PT PANCA AMARA UTAMA (PT PAU)
FOR BUSINESS IN PETROCHEMICAL AND NATURAL GAS INDUSTRY
IN USO VILLAGE, BATUI SUB-DISTRICT
BANGGAI REGENCY

BANGGAI REGENT

Considering

1. Circular of State Minister of Agrarian / Head of National Land Agency Number: 460-572-DII-1995 on the guidelines on the Implementation of the granting of Location Permit, Warning and Reporting;
2. Letter of PT Panca Amara Utama (PT PAU) Number: 011/PAU/VII/2005 dated July 6, 2005 Location Permit Application to PT Panca Amara Utama for petrochemical and natural gas industry takes up an area of ± 200 ha. With the coastline ±1000 meter located in Uso village, Batui;

TO ALLOW:

To :
Name : Dr.Ir. ANWAR K. JOESOEF
Director of PT Panca Amara Utama.
For :

a. Setting Location for Business activity of Petrochemical and Natural Gas Industry in the Uso Village at km. 46-48 Batui;
b. The granting of licenses referred to in letter a comes with conditions as follows:
    1. Acquisition of land should be made directly between the stakeholders, namely through Sale Deed or by waiver conducted by making the Deed of Sale before PPAT or Deed of Release before the Sub-district Head / Head of the Banggai Land Office and by making compensation that the form and amount determined by consensus;
    2. Payment of compensation of land and crops and buildings thereon or other items owned by holders of Rights to Land, is not justified to be held through an intermediary in any form or name, but should be made directly to the beneficiary;
    3. Acquisition of land referred to in letter b number 1 should be completed from the date issued and the permit may be extended maximum of 12 (twelve) months;

4. For land that has been acquired, the holder shall apply for Land Rights to the competent authority;
5. This permit is only for the business in petrochemical and natural gas industry and its facilities and infrastructure buildings in it;
6. License holders are required to provide progress reports of acquisition and utilization of land stated in the location permit every 3 (three) months from the Banggai Regent and copies to the Head of the Banggai Land Office;
7. License Holder is forbidden to cover accessibility of the community around the site;

c. This Permit is valid from the date issued.

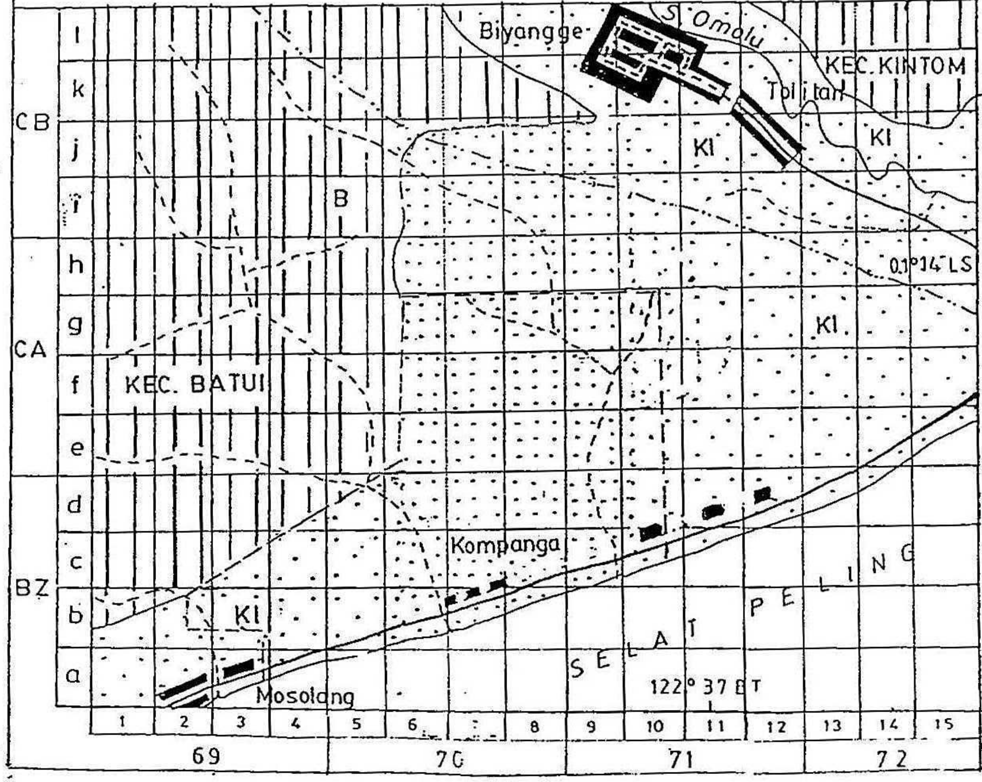
Issued in Luwuk
on 18 July 2005

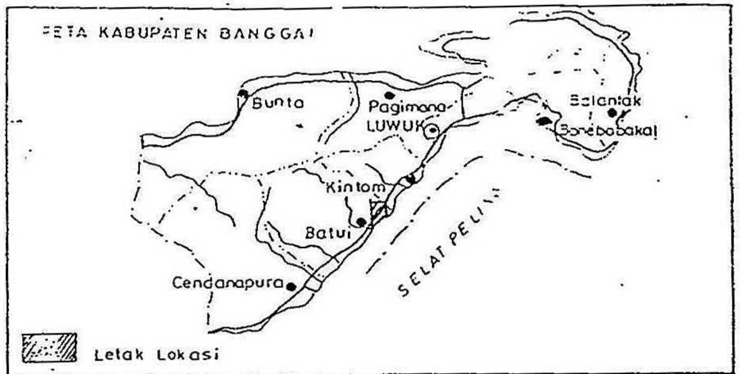
BANGGAI REGENT
SUDARTO

Copies to with respects:
1. Governor of Central Sulawesi in Palu
2. Head of National Land Agency Regional Office of Central Sulawesi in Palu
3. Head BAPPEDA Central Sulawesi in Palu
4. Head BAPPEDA Banggai in Luwuk
5. Head of Regional Infrastructure of Banggai in Luwuk
6. PPL and the Department of City Planning of Banggai in Luwuk
7. Head of Forestry of Banggai in Luwuk
8. Head of the Department of Agriculture of Banggai in Luwuk
9. Head BAPEDALDA of Banggai in Luwuk
10. Head of the Banggai Land Office in Luwuk
11. Sub-district Head of Batui in Batui
12. Uso village chief in place

Peta 1:
Lampiran Keputusan Bupati Banggai
Izin Lokasi Nomor : 503 / 857 / Bag. Tapem

AREAL YANG DITETAPKAN UNTUK	:	INDUSTRI PETROKIMIA DAN GAS BUMI
ATAS NAMA	:	PT. PANCA AMARA UTAMA
DESA	:	USO
KECAMATAN	:	BATUI
KABUPATEN	:	BANGGAI
PROVINSI	:	SULAWESI TENGAH
LUAS	:	± 200 Ha
SKALA	:	1 : 25.000





KETERANGAN

- Ibukota Desa
- JALAN : 1. Aspal, 2. Batu
- Sungai
- Kampung
- KI Kelapa
- B Belukar

	PARAF / TANGGAL	
DIGAMBAR OLEH KASI PGT	[signature]	15-7-2005
DIPERIKSA OLEH KEPALA KANTOR	[signature]	16-7-2005

Luwuk, 18 Juli 2005

KEPALA KANTOR PERTANAHAN
KABUPATEN BANGGAI

Drs. LALU ASAAT
NIP : 010 093 480

ATTACHMENT - 2 : Extension of Location Permit issued 2012 by Banggai Regent

BUPATI BANGGAI

BANGGAI REGENTS CONSENT LETTER
Number: 503/18O/Bag. Adm. Pertanahan

ABOUT
EXTENSION OF BANGGAI REGENT PERMIT LETTER NUMBER: 503/857/BAG. TAPEM
DATED 18 JULI 2005 ON GRANTING LOCATION PERMIT TO
PT PANCA AMARA UTAMA FOR BUSINESS IN THE
PETROCHEMICAL AND GAS INDUSTRY IN THE USO VILLAGE BATUI SUB-DISTRICT BANGGAI REGENCY

BANGGAI REGENT,

Considering

1. Decree of the President of the Republic of Indonesia Number 34 Year 2003 on National policy in the field of Land;
2. Head of National Land Agency's decision No. 2 of 2003 on Norms and Standards Authority of mechanisms of procedures in the field of Land undertaken by the Government of Regency / City;
3. State Minister of Agrarian Affairs / Head of National Land Agency No. 2 of 1999 regarding Location Permits;
4. State Minister of Agrarian Affairs / Head of National Land Agency Number: 2 Year 2011 on Guidelines for the Issuance of Land Technical Advisory Location Permit, Determination of Location and Land Use Permit Amendment
5. Circular of the State Minister of Agrarian Affairs / Head of National Land Agency Number: 460/572/D11/1995 on Guidelines implementation of the granting of Location Permit, warning and reporting;
6. Banggai Regency Regulation No. 16 Year 2007 regarding Organization and Working Procedure of the Regional Secretariat, Expert Staff of Regents and the Parliament Secretariat;
7. Banggai Regency Regulation No. 9 of 2008 on the Authority Banggai Regency;
8. Banggai Regent Decree No. I of 2009 on Duties and Functions Description of the Regional Secretariat, Expert Staff of Regents and the Parliament Secretariat Banggai Regency;
9. Banggai Regent Permit Number: 503/857/Bag. Tapem dated July 18, 2005 on the Location Permit for PT PANCA AMARA UTAMA (PT PAU) for business in Petrochemical and Natural Gas Industry in Uso village Batui sub-district Banggai Regency;
10. Banggai Regent Permit No: 503/198/BPN about Banggai Regent Permit Renewal No: 503/857/Bag. Location Permit Tapem about the PT PANCA AMARA UTAMA (PT PAU) for business purposes in the field of Petrochemical and Gas Industry in Uso village Batui sub-district Banggai Regency;
11. Recommendations Related Agencies Year 2012

TO ALLOW

To:

Name Garibaldi Thohir as the President Director of PT PANCA AMARA UTAMA (PT PAU) address Gudang Peluru Blok E/139 RT/RW 002/003 Kelurahan Kebun Baru, Tebet Jakarta Selatan

To

1. Location Permit granted an extension for purposes of business in Petrochemical and Gas industry in Uso village Batui sub-district Banggai Regency. Location Size: ± 200 Hectares

2. Permit referred to in point 1 is equipped with the following conditions:
3. Land acquisition must be made directly between the parties concerned, namely through the Sale and Purchase Deed or Deeds before PPAT Waiver before the Head of the Land Office Banggai with an indemnity form and amount determined by consensus.
4. Payment of compensation as well as plants and soil or existing buildings on it or other items owned by holders of rights on land, carried out through an intermediary is not justified in any form and name, but should be done immediately to the right.
5. Land acquisition should be adjusted within the license location.
6. The land was acquired for the purposes of including the location of business in Petrochemical and Gas industry within the area of other uses, the permit holder shall apply for the location of land to the authorities.
7. This permit is only for business purposes in the field of Petrochemical and Gas industry and its facilities and infrastructure facilities.
8. Location Permit holders are required to provide progress reports on land acquisition and utilization of Licensed Locations which have been obtained every 3 (three) months of the Banggai and the Regent or the Head of Banggai Sub-district Land Office.
9. Location license holder is prohibited from closing accessibility of community around the site.
10. This location does not permit reducing the civil rights of owners of land located within the site.
11. Location license holder cannot change the design of roads that have been there before.
12. This location permits canceled by itself when switched / or transferred to another party.
13. Location Permit is valid for 1 (One) year from the date of enactment.
14. That the procurement of land for business purposes in the field of Petrochemical and Gas industry will be willing to hold a replacement if there is an area of land affected and or used by the permit holder.

Defined in: Luwuk
On Date: 24 April 2012

BANGGAI REGENT
M. SOFHIAN MILE

Copies to with respects:

1. Governor of Central Sulawesi in Palu
2. Head of Office of the National Land Agency Prov. Central Sulawesi in Palu
3. Head BAPPEDA Prov. Central Sulawesi in Palu
4. Head BAPPEDA Banggai Regency in Luwuk
5. Head of Mining and Energy Banggai Regency in Luwuk
6. Chief of the Forest Service Banggai Regency in Luwuk
7. Head of Estates Banggai Regency in Luwuk
8. Head BPLH Banggai Regency in Luwuk
9. Head of Human Settlements and Spatial Banggai Regency in Luwuk
10. Head of Office of National Land Agency Banggai Regency in Luwuk
11. Head of Integrated Services Licensing Banggai Regency in Luwuk
12. Head of Dept. Land Administration Banggai Regency Secretariat in Luwuk
13. Head of Dept. Law and Legislation Banggai Regency Secretariat in Luwuk
14. Batui Sub-district Chief in Batui
15. Uso village chief in Uso

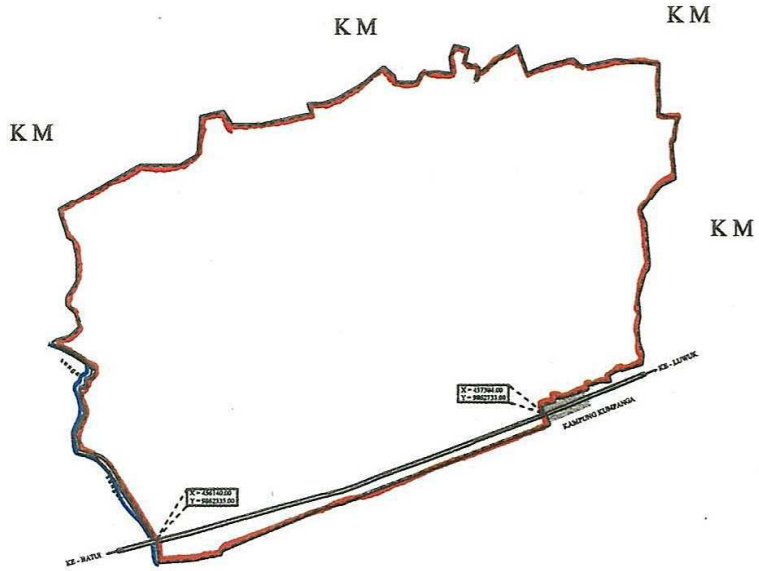
ATTACHMENT - 2 : Extension of Location Permit issued 2012 by Banggai Regent

LAMPIRAN KEPUTUSAN BUPATI BANGGAI
IZIN LOKASI NOMOR :

AREAL YANG DITETAPKAN UNTUK : USAHA DIBIDANG INDUSTRI PETROKIMIA DAN GAS BUMI

ATAS NAMA	: PT.PANCA AMARA UTAMA
DESA	: USO
KECAMATAN	: BATUI
KABUPATEN	: BANGGAI
LUAS	: 2000000 M2
SKALA	: 1 : 20000

SKET LOKASI



KAMPUNG

JALAN ASPAL

SUNGAI

K M KEBUN MASYARAKAT

BATAS LOKASI DIMOHONKAN

LUWUK , ... APRIL 2012

BUPATI BANGGAI

H.M.SOPHIAN MILE

ATTACHMENT - 3 : Minutes of Meeting Public Socialization related with PAU Ammonia Plant

SOCIALIZATION TO THE PUBLIC IN CONNECTION WITH THE PLAN OF PT PANCA AMARA UTAMA TO ESTABLISH AMMONIA PLANT IN USO VILLAGE, BATUI SUB-DISTRICT, BANGGAI REGENCY

Briefing

Who gave the briefing:

1. Batui Sub-district Head
2. Head of Environmental Management of Banggai
3. Members of Parliament of Banggai
4. Kintom Sub-district Head
5. Batui Chief of Police

Briefing Points:

- In principle, all the elements of leadership in Banggai (Regency, Sub-district, Village) support PAU plans to establish an ammonia plant in Uso village Batui sub-district Banggai Regency.
- Elements of Leadership of the Sub-district expects the ammonia plant establishment can provide benefits in all areas of the Uso village Batui Sub-district, Kintom sub-district and Banggai in general.
- It is expected that there will be no negative impacts whatsoever to the villagers of Uso, Batui Sub-district, Kintom sub-district and Banggai Regency as a whole, with the establishment of this ammonia plant.
- That all people in the Uso village Batui Sub-district, Kintom sub-district and Banggai can provide positive support for the ammonia plant development plan.
- It is expected that PR / Representative PAU is always quick to respond and coordinate with local government officials to anticipate the completion of all the problems that arise so that problems that often occur in DSLNG will not be repeated at PAU

Presentation

Presentation made by PT Widya Cipta Buana, which is appointed by PAU as EIA Consultant.

The contents of the presentation:

- Explains the PAU plans to establish an ammonia plant in the Uso village Batui sub-district Banggai Regency,
- Impacts that may arise and how to overcome them.
- Asking for community feedback on the proposal of PAU.

ATTACHMENT - 3 : Minutes of Meeting Public Socialization related with PAU Ammonia Plant

Questions and Answers

1. **Arfan Hapari - Community Leader Kintom Sub-district, former civil servant of Transportation**
   - *Communication*: From the beginning, PAU should foster good communication with the surrounding community, in association with PAU plans to build an ammonia plant in Uso village.
   - *Land*: PAU will have to free and pay compensation for all the necessary land (200 ha), before starting physical activity in the field.
   - *Social Impact*: Social impacts which disturb the peace and endanger the public are not to occur.
   - *Labor*: PAU should have a good and open recruitment system and prioritize workforce in location surrounding the plant. This must be based on MOU and a one door policy in coordination with the Sub-district Head
   - *EIA*: EIA in its formulation should involve the local community.
   - Kintom community ready to help PAU

Answer:

- Promoter shall pay the full land acquisition, of course will be based on the price agreement, verification of the status of the land and clear fixed boundaries.
- The impact of disturbing the public will be analyzed in the EIA (Environment Impact Analysis). The Management plan will be included in the document RKL (Environmental Management Plan) and monitoring will be included in the RPL (Environmental Monitoring Plan). For example, the noise will be calculated how much noise is due to the mobilization of equipment and construction is calculated and maintained so as to meet the quality standard of 55 dBA in the settlement.
- The impact in the form of direct disturbance to the communities will also be analyzed in the EIA, such as increasing the amount of surface runoff, will be managed. How to manage documents included in RKL (Environmental Management Plan).
- Labor recruitment will prioritize community around the project in accordance with the needs of the Company and skills required. Distribution of the number of recruitment will be adjusted to the proximity to the project site and distributed to every village around the project site. The comparison in each village will be coordinated with Batui sub-district head as Coordinator (One Door Policy).

2. **H. Haris Aziz – Traditional Leader, Former State Owned Bank Employee**
   - *Social Culture*: PAU should appreciate and respect the local culture and to contribute to its preservation. In order for the case of a clash of cultures with Foreign workers in DSLNG case do not repeat
   - *Labor*: PAU do not make categorize unskilled jobs to be skilled jobs. PAU to try to empower communities within its capabilities.
   - *Employee Recruitment*: PAU to prioritize to recruit people from around the plant site.

Answer:

- Social and cultural issues will be analyzed or studied in the EIA. Social and cultural environment is one of the components
- Recruitment of Manpower will prioritize people in community around the project in accordance with the needs of the company and skills, depending on the readiness and skills of workforce in the villages surrounding the project site. PAU will cooperate with local Training Center

3. **Ipo Danun - Kintom Sub-district Community Leaders**
   - *Protection*: the existence of PAU should protect all interests of the community around the plant site.
   - *Transparency*: PAU should already have all the necessary licenses

- Do not pollute the environment around the plant site, especially the sea / beach that is the source of livelihood of fishermen who live near the plant at this time.

Answer:

- One of the goals of socialization or public consultation is to protect the public interest. Community is a partner of the Promoters. Suggestions, opinions and community feedback will be considered.
- The company will complete all licenses
- The entire environmental impacts will be managed, including the impact to the sea such as continuous management of solid waste (domestic waste) and domestic wastewater treated in the Waste Treatment Plant Facilities. Those facilities include: (1) screen that is a filtering tool to trap garbage before coming in Wastewater treatment Plant, (2) oil trap that serves as an oil trap, (3) mud screen serves as mud trap, (4) striping tower that functions to release ammonia from wastewater and (5) chemical injection that serves to neutralize the pH of the wastewater.

4. **Fuad - Kintom Sub-district Community Leaders, Former Bureaucrat**
   - Fully support PAU plans to establish a plant in the village Uso ammonia.
   - Labor recruitment, local officials do not abuse the provision of local ID to Outside Workers
   - PAU to pay attention to things that have been delivered earlier questioner.

Answer:

- PAU will pay attention to the recruitment system in coordination with the Head Batui

5. **M. Waris Kutawali - Balangkang Village Chief**
   - *Compensation*: PAU to consider compensation for Chiefs of villages around the plant site, because indirectly they also receive an additional burden as a result of industrial activities near their village. For example, the community rallies etc.
   - *Urbanization*: the impact of immigrants that disrupt the surrounding villages, such as prostitution.
   - *Assistance to the community*: PAU to contribute to the cost associated with religious activities.

Answer:

- PAU will pay attention to compensation and assistance to the community, including the field mental and spiritual development and its facilities to be agreed upon

6. **Kudrat - Former Lamo Village Chief**
   - Involved in the preparation of previous EIA. The negative impact of the previous EIA to be minimized. Lapindo case not to be repeated, for example, pipe leak.
   - *Flora and fauna*: not to be disturbed.
   - *Labor*: If the project is already committed, It is to be implemented immediately.
   - *Food supply*: To prioritize what is available locally, do not bring in from outside.

Answer:

- PAU ensures the plant is built with the latest technology that can prevent gas leakage. Society does not need to worry because the ammonia plant has many operations in Indonesia and does not cause significant disruption to the community and the flora and fauna around the plant
- PAU will observe local food supply

7. **Sofian – Village Chief**
   - *Land*: DSLNG Land matters are still unfinished. Not to let happened at PAU.
   - *Labor*: PAU should have programs so that manpower that become permanent staff come from project manpower prepared for the operation and come from manpower surrounding the plant.

Answer:
- PAU will resolve the land issue as soon as possible in accordance with the agreement

8. **Rosdiana - Uso Village Secretary**
   - *Labor*: Up to that day, DSLNG still had not hired female workers who were promised cleaning-service jobs.
   - *Social and traditional assistance*: That assistance from DSLNG is still lacking.

Answer:
- PAU will pay attention to issues of women workers after considering to the characteristics and needs of labor
- PAU will offer assistance

9. **Rafiah – Lamo Village**
   - *Temporary teachers*: Some teachers of kindergarten, elementary, junior high and high school became employees of companies around Luwuk for a much higher salaries. The establishment of the new company around Luwuk disrupts education.

Answer:
- PAU will pay attention to issues of basic education around the plant site

10. **Muin**
    - *Ammonia*: What is Ammonia?. Is it dangerous to humans?
    - Information materials, such as reading materials or CDs made by PAU to be distributed to the public. So that people understand about ammonia.

Answer:
- Ammonia is a basic chemical use is mainly for the manufacture of various types of fertilizers such as urea, ZA, NPK, Ammonium Nitrate etc.
- Ammonia in high concentrations would interfere with the respiratory system. But the ammonia plant uses high technology and has sophisticated control systems so that it will not cause a nuisance to the surrounding community, it will not even cause a nuisance for plant operators who are working in the plant.
- PAU will pay attention to the problem of socialization on ammonia plant through brochures etc.

11. **Iwan - Uso Youth**
    - *CSR*: DSLNG and Nickel Mine were not open about the amount they provide. PAU is expected to open to the public about the amount of CSR provided and where it is distributed.

Answer:
- PAU will coordinate with local government officials about the CSR program needed by society in a transparent manner, but of course will be adjusted to the ability of the company which is different during construction period and once the plant is operational.

ATTACHMENT - 3 : Minutes of Meeting Public Socialization related with PAU Ammonia Plant

Photo 1. Public consultation was attended by the Promoter, Leaders of Kintom Sub-district and Batui Sub-district, and the community

Photo 2. Banggai BPLH Head opens Public Consultation

Photo 3. Batui Sub-district Head gives speech

Photo 4. Consultant explained the purpose of public consultation, the role of the community in the preparation of the EIA and ammonia industry and supporting facilities development plans of PT Panca Amara Utama

Photo 5. Community leader provides advice and input to environmental management

Photo 6. Traditional Leader gives reminder of the importance of the social and cultural aspects of the EIA.

Photo 7. The Ladies are not less active than the Gentlemen. Mdm. Rafiah declares that vacancy of kindergarten teachers to high school teachers occurs because teachers choose to move work to the LNG project.

Photo 8. Village staff expressed support large enterprises in Uso village for village development was minimal

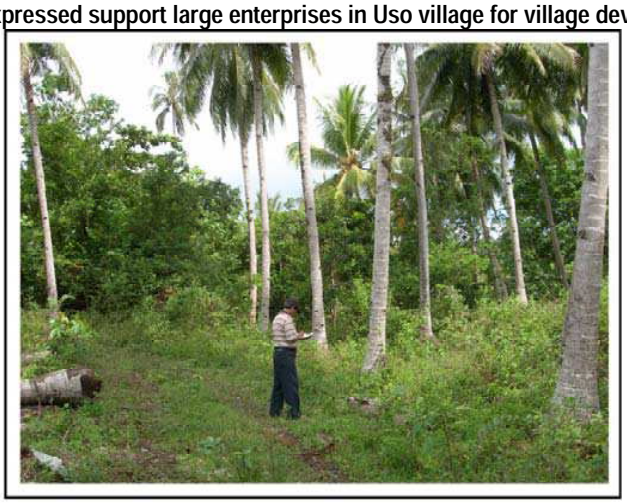


Photo 9. Type of plantation community located on the project site. Flora expert was seen to list plant types.

Photo 10. Musolang River. This river flows from north to south and ends into the Peling Strait. Musolang River is a body of water that is in the project site.

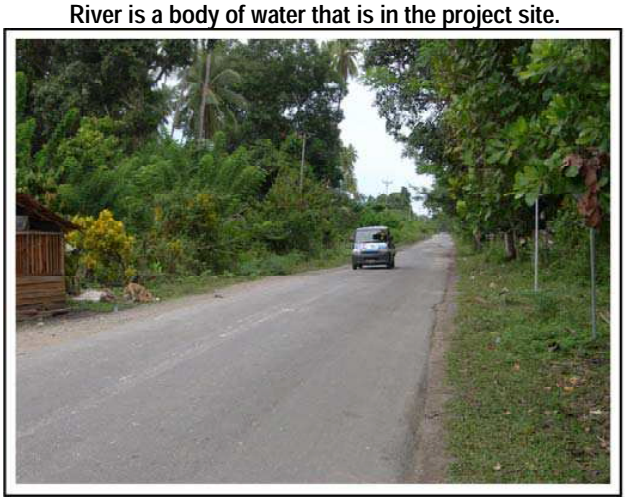


Photo 11. Conditions of State Road that connects Luwuk – Batui

Photo 12. Preview Peling Strait sea, with activities at the beach.

Photo 13. Shows outcrop of limestone reef containing cracks and cavities as a result of condensation

Photo 14. Conglomeratic sandstone outcrops that have undergone weathering but still hard enough

ATTACHMENT - 4 : Attendance List of Public Socialization

ATTENDANCE LIST: SOCIALIZATION TO THE PUBLIC THE PLAN TO ESTABLISH AMMONIA PLANT AND SUPPORTING FACILITIES OF PT PANCA AMARA UTAMA IN USO VILLAGE BATUI SUB-DISTRICT BANGGAI REGENCY

NO.	NAMA	INSTANSI/JABATAN/Asal Desa	TANDA TANGAN
1	SOFYAN H	KADUS II DESA USO	
2	ROSIDANA	SEK-BPD DESA USO	
3	SURIADI K.	Staf kantor Camat Kintom	
4	Yuswy Eopihato	—	
5	NURHAYA HASAN	Kasi Pem / KTR Camat Kintom	
6	HASRI ARWAN	STAF KANTOR CAMAT KINTOM	
7	SURAIT. SALIM	KADUS USO	
8	SUAIB K.	Ds. Kalolos / BPD Kalolos	
9	JAKIR. A.	KETUA. BPD. DS. USO	
10	Hendrik Manaseh	Aparat Desa Honbola	
11	Moh. Rahman Abdullah	Sekdes	
12	Kusno J. S.Pd.	Tokoh Masy. Luwuk	
13	MARYAM S. GALALI	Sekretaris FKK Kel. Luwuk	
14	BAKIR .T. LUBIAN	BPD DESA USO	
15	KORERSI KATAMA	BPD DESA B. Buyangge	
16	ABSON · MIDA	BPD DESA B. BUYANGGE	
17	Rusida Ahmad	BPLH	
18	RUDI LOLAMU	KADES. BABANG BUYANGGE	
19	MA. WARIS PETTALOLI	LURAH- BALANTANG .	
20	NUR 'ATMI	Luwuk	
21	NURHIDAYAH Lopo	LUWUK	
22	Rig. Mundan	Toko Agama Uso	
23	Ah Stile	BPD Uso	
24	H. ARIFIN UKA	SEKDES USO	
25	RAFI'AN, S.Pd.	TOKOH MASY. KEL. LAMO.	
26	FATMI	PLT. Lurah Lamo	
27	MARGARETHA .T	PJS. SEKDES HONBOLA	
28	ZAINAL ..... T.	KTR CAMAT BATUI	
29	SYAIFUDDIN MUID	Masyarakat Kec. Batui	
30			

ATTACHMENT - 4 : Attendance List of Public Socialization

NO.	NAMA	INSTANSI/JABATAN	TANDA TANGAN
31			
32	H. ARIS APDK		
33			
34			
35	IDOH DJAKUN		
36			
37			
37	YOSPIAN. NAOMJA	KEPALA DESA HONBOLA	
39	KURNADI Y	TIM AHLI / KONSULTAN	
40	Dodang Z.A	"	
41	Hendriyana	"	
42	ICMA	KMPG.	
43	ISRAWATI D.	ANGG. BPD	
44			
45			
46			
47			
48			
49			
50	HARY KARTONO	KAPOLSEK RATUL	
51			
52	MOH DJUFRI R DAKO	DPRD	
53			
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ATTACHMENT - 5 : Laboratory Analysis of Air Samples

UNIVERSITAS PADJADJARAN
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
JURUSAN KIMIA
LABORATORIUM KIMIA FISIK
Jalan Raya Bandung-Sumedang km 21 Tlp. (022) 7794931 Jatinangor 45363

ANALYSIS RESULTS

Customer : PT. PANCA AMARA UTAMA .
Customer Address
Sample Type : Udara Ambien
Sampling Location : Ds. Uso, Kec. Batui - Kab. Banggai - Sulteng.
Number of Samples : 3 (tiga)
Sample Code : PA U01, PA U02, PA U03,
Date Received : Juli 2012
Validation Date : 27 Juli 2012

Parameter	Units	Analysis Results				Standard*
		PA U01	PA U02	PA U03		
1. Climatic						
1.1. Temperature	°C	31	31	31		
1.2. Wind Speed	m/detik	1,6	3,4	1,5		
1.3. Wind Direction	derajat	-	-	-		
1.4. Humidity	%	74	78	74		
1.5. Cloudiness	octav	-	-	-		
2. Noise	dB(A)	49 - 53	51 - 69	49 - 54	-	
3. Pollutant						
3.1. NO_2	µg/m^3	19,03	6,72	11,04		400
3.2. SO_2	µg/m^3	24,18	10,64	14,61		900
3.3. CO	µg/m^3	182,9	92,1	136,7		30.000
3.4. Debu	µg/m^3	79,4	64,8	67,5		230
3.5. PM_{10}	µg/m^3	0,03	0,003	0,01		150
3.6. $PM_{2,5}$	µg/m^3	-	-	-		65
3.7. Timbal	µg/m^3	0,002	tt	0,001		2
4. Odor						
4.1. NH_3	ppm	0,001	tt	0,001		2,00**
4.2. H_2S	ppm	tt	tt	tt		0,02**

* Government Regulation No.41 Year 1999 on Pollution Control
** Decree of State Minister of Environment No.50 year 1996

Remarks : tt = Undetected
- = Unspecified

Location:
PA U01 - Desa Uso
PA U02 - Pantai Desa Uso
PA U03 - Desa Uso Dusun 3

Jatinangor, 27 Juli 2012
Koordinator

SOLIHUDIN, M.Si.

Laporan hasil uji ini hanya berlaku bagi contoh yang diuji

ATTACHMENT - 6 : Laboratory Analysis of River Water

BINALAB
LABORATORIUM PENGUJIAN KUALITAS LINGKUNGAN
BANDUNG : Jl. Venus Barat No. 15 Margahayu Raya, Bandung (40286)
Tel. 022-7561407; 022-7561503; Fax. 022-7561324, email : binalab@bdg.pacific.net.id

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP – 412 – IDN

HASIL ANALISIS / *ANALYSIS RESULT*

No. Referensi/*Ref* : 57/AS/BINA/VII/2012
Pemohon/*Costumer* : **PT. PANCA AMARA UTAMA**
Lokasi Proyek/*Location of Project* : Desa Uso Kec. Batui Kab. Banggai, Provinsi Sulawesi Tengah
Jenis Sampel/*Type of Sample* : Air Sungai
Lokasi Sampel/*Location of Sampling* : Air Sungai Musolang

No.	Parameter	Unit	Results	Standards	Methods
	PHYSICAL				
1	Temperatur	°C	26,2	± 3	SNI 06-6989.23-2005
2	TSS (Total Suspensi Solid)	mg/L	12,68	50	SNI 06-6989.3-2004
3	TDS (Total Disolve Solid)	mg/L	258,40	1000	SNI 06-6989.27-2005
	CHEMICAL				
1	pH	mg/L	7,67	6 – 9	SNI 06-6989.11-2004
2	BOD	mg/L	2,13	3	APHA 5210 B 2005
3	COD	mg/L	22,05	25	SNI 06-6989.73-2009
4	DO	mg/L	6,7	>4	APHA 4500 O-G 2005
5	NO_3 – N	mg/L	0,66	10	SNI 06-6989.79-2011
6	NH_3 –N	mg/L	1,06	-	SNI 06-6989.52-2005
7	Cobalt (Co)	mg/L	<0,10	0,2	APHA 3111 B 2005
8	Boron (B)	mg/L	0,50	1	APHA 4500-B B 2005
9	Cadmium (Cd)	mg/L	<0,003	0,01	APHA 3111B 2005
10	Chrom VI (Cr^{6+})	mg/L	<0,05	0,05	APHA 3500 D 2005
11	Copper (Cu)	mg/L	<0,02	0,02	APHA 3111 B 2005
12	Iron (Fe)	mg/L	<0,10	-	APHA 3111 B 2005
13	Lead (Pb)	mg/L	<0,02	0,03	APHA 3111 B 2005
14	Mangane (Mn)	mg/L	0,58	-	APHA 3111 B 2005
15	Zink (Zn)	mg/L	<0,02	0,05	APHA 3111 B 2005
16	Chloride (Cl)	mg/L	3,68	-	SNI 06-6989.19-2004
17	Fluoride (F)	mg/L	0,23	1,5	SNI 06-6989.29-2005
18	NO_2 – N	mg/L	0,66	0,06	SNI 06-6989.9-2004
19	Sulfate (SO_4)	mg/L	7,20	-	SNI 06-6989.20-2004
20	Chlorine (Cl_2)	mg/L	<0,02	0,03	APHA 4500-Cl B 2005
21	Sulfida (S^-)	mg/L	0,04	0,002	APHA 4500-S^{2-} D 2005
22	Oil and Grease	mg/L	0,37	1	SNI 06-6989.10-2004
23	MBAS	mg/L	0,04	0,2	SNI 06-6989.51-2005
24	Phenol	mg/L	<0,005	0,001	SNI 06-6989.21-2004
25	Phosfate (PO_4)	mg/L	0,19	0,2	SNI 06-6989.31-2005

Remarks:
- Standards of Government Regulation No.82 Year 2001 Class II
- < shows that result below detectable limit

Bandung, 30 Juli 2012
Kepala Laboratorium

BINALAB
Dra. Ijah Hadijah

ATTACHMENT - 7 : Laboratory Analysis of Clean Water

BINALAB
LABORATORIUM PENGUJIAN KUALITAS LINGKUNGAN
BANDUNG : Jl. Venus Barat No. 15 Margahayu Raya, Bandung (40286)
Tel. 022-7561407; 022-7561503; Fax. 022-7561324, email : binalab@bdg.pacific.net.id

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP – 412 – IDN

HASIL ANALISIS / *ANALYSIS RESULT*

No. Referensi/*Ref* : 166 AB/BINA/VI/2012
Pemohon/*Costumer* : **PT. PANCA AMARA UTAMA**
Lokasi Proyek/*Location of Project* : Desa Uso Kec. Batui Kab. Banggai, Provinsi Sulawesi Tengah
Jenis Sampel/*Type of Sample* : Air Bersih
Lokasi Sampel/*Location of Sampling* : Air GS Ds. Musolang

No.	Parameter	Unit	Results	Standards	Methods
	PHYSICAL				
1	Temperatur	°C	27,6	± 3	SNI 06-6989.23-2005
2	Bau (Odor)	-	No Smell	No Smell	APHA 2150B-2005
3	TDS (Zat Padat Terlarut)	mg/L	592,0	1.500	SNI 06-6989.27-2005
4	Warna (Colour)	PtCo	10,73	50	APHA 2120.B 2005
5	Kekeruhan	NTU	0,7	25	APHA 2130.B 2005
6	Conductivity	µmhos	796,0	-	APHA 2132.B 2005
	CHEMICAL				
1	Iron(Fe)	mg/L	0,03	1	APHA 3111 B 2005
2	Fluoride (F)	mg/L	0,43	1,5	SNI 06-6989.29-2005
3	Cadmium (Cd)	mg/L	<0,001	0,003	APHA 3111 B 2005
4	Hardnes ($CaCO_3$)	mg/L	365,6	500	SNI 06-6989.12-2004
5	Clorida (Cl)	mg/L	57,0	600	SNI 06-6989.19-2004
6	Chrom VI (Cr^{6+})	mg/L	0,02	0,05	APHA 3500 D 2005
7	Mangan (Mn)	mg/L	0,01	0,5	APHA 3111 B 2005
8	Nitrate (NO_3-N)	mg/L	0,89	10	SNI 06-6989.79-2011
9	Nitrite (NO_2-N)	mg/L	<0,01	1	SNI 06-6989.9-2004
10	pH	-	6,85	6,5 – 9,0	SNI 06-6989.11-2004
11	Zink (Zn)	mg/L	0,03	15	APHA 3111 B 2005
12	Sulfat (SO_4)	mg/L	13,73	400	SNI 06-6989.20-2004
13	Lead (Pb)	mg/L	0,02	0,05	APHA 3111 B 2005
14	MBAS	mg/L	0,07	0,5	SNI 06-6989.51-2005
15	Phenol Total	mg/L	<0,005	0,01	SNI 06-6989.21-2004
16	Zat Organik ($KMnO_4$)	mg/L	6,01	10	SNI 06-6989.22-2004

Remarks:
- Regulation of Minister of Health No.416 year 1990 on Requirements of Clean water Quality
- < shows that result below detectable limit

Bandung, 30 Juli 2012
Kepala Laboratorium

BINALAB
Dra. Ijah Hadijah

ATTACHMENT - 8 : Laboratory Analysis of Well Water

BINALAB
LABORATORIUM PENGUJIAN KUALITAS LINGKUNGAN
BANDUNG : Jl. Venus Barat No. 15 Margahayu Raya, Bandung (40286)
Tel. 022-7561407; 022-7561503; Fax. 022-7561324, email : binalab@bdg.pacific.net.id

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP – 412 – IDN

HASIL ANALISIS / *ANALYSIS RESULT*

No. Referensi/*Ref* : 57/AB/BINA/VII/2012
Pemohon/*Costumer* : **PT. PANCA AMARA UTAMA**
Lokasi Proyek/*Location of Project* : Desa Uso Kec. Batui Kab. Banggai, Provinsi Sulawesi Tengah
Jenis Sampel/*Type of Sample* : Air Bersih
Lokasi Sampel/*Location of Sampling* : Air Baku Sumur GS. Musolang

No.	Parameter	Unit	Results	Standards	Methods
	PHYSICAL				
1	Temperatur	°C	26,0	± 3	SNI 06-6989.23-2005
2	Bau (Odor)	-	No Smell	No Smell	APHA 2150B-2005
3	TDS (Zat Padat Terlarut)	mg/L	757,60	1.500	SNI 06-6989.27-2005
4	Warna (Colour)	PtCo	10,16	50	APHA 2120.B 2005
5	Kekeruhan	NTU	0,73	25	APHA 2130.B 2005
6	Conductivity	µmhos	1140	-	APHA 2132.B 2005
	CHEMICAL				
1	Iron(Fe)	mg/L	<0,10	1	APHA 3111 B 2005
2	Fluoride (F)	mg/L	0,04	1,5	SNI 06-6989.29-2005
3	Cadmium (Cd)	mg/L	<0,003	0,003	APHA 3111 B 2005
4	Hardnes ($CaCO_3$)	mg/L	346,00	500	SNI 06-6989.12-2004
5	Clorida (Cl)	mg/L	137,94	600	SNI 06-6989.19-2004
6	Chrom VI (Cr^{6+})	mg/L	0,07	0,05	APHA 3500 D 2005
7	Mangan (Mn)	mg/L	<0,02	0,5	APHA 3111 B 2005
8	Nitrate (NO_3-N)	mg/L	2,08	10	SNI 06-6989.79-2011
9	Nitrite (NO_2-N)	mg/L	<0,01	1	SNI 06-6989.9-2004
10	pH	-	7,11	6,5 – 9,0	SNI 06-6989.11-2004
11	Zink (Zn)	mg/L	0,01	15	APHA 3111 B 2005
12	Sulfat (SO_4)	mg/L	27,88	400	SNI 06-6989.20-2004
13	Lead (Pb)	mg/L	<0,02	0,05	APHA 3111 B 2005
14	MBAS	mg/L	0,04	0,5	SNI 06-6989.51-2005
15	Phenol Total	mg/L	<0,005	0,01	SNI 06-6989.21-2004
16	Zat Organik ($KMnO_4$)	mg/L	14,70	10	SNI 06-6989.22-2004

Remarks:
- Regulation of Minister of Health No.416 year 1990 on Requirements of Clean water Quality
- < shows that result below detectable limit

Bandung, 30 Juli 2012
Kepala Laboratorium

Dra. Ijah Hadijah
BINALAB

ATTACHMENT - 9 : Laboratory Analysis of Sea Water

Certificate No. 27351/DBBPAF
Date: December 17, 2012

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP - 024 - IDN

SUCOFINDO
Issuing Office:
Jl. Arteri Tol Cibitung No. 1, Cibitung Bekasi 17520, Indonesia
Phone/Facs: +62 21 88321176/88321166
Email: jum.cbt@sucofindo.co.id

REPORT OF ANALYSIS

CLIENT	:	PANCA AMARA UTAMA, PT Desa Uso, Kecamatan Batui, Kabupaten Banggai Propinsi Sulawesi Tangah
TYPE OF SAMPLE	:	SEA WATER
DATE RECEIVED	:	07/12/2012
DATE OF ANALYSIS	:	10/12/2012 to 17/12/2012
TESTED FOR	:	Physical and Chemical analysis
DESCRIPTION OF SAMPLE	:	Sample was submitted by client Packing : Unsealed plastic bottle
SAMPLE IDENTIFICATION	:	Sample : 1

Parameter	Unit	Test Results	Method *) Part Number
Ammoniac	mg/L	< 0.03	4500-NH_3-F
Cadmium	mg/L	< 0.02	3113 B
Copper	mg/L	< 0.03	3120 B, 3030 E
Lead	mg/L	< 0.03	3113 B
Nitrate	mg/L	0.08	4500-NO_3-E
Odour	-	Odourless	2150 B
Oil & Grease	mg/L	< 2	5520 B
pH	-	6.44	4500-H^+-B
Phenol	mg/L	< 0.06	5530 C
Phosphate	mg/L	< 0.09	3120 B, 3030 E
Salinity as NaCl	mg/L	31985	2520 B
Sulfide	mg/L	0.35	4500-S^2-D
Surfactants Anionic as MBAS	mg/L	< 0.02	5540 C
Temperature	°C	25	2550 B
Total Suspended Solid	mg/L	2	2540 D
Zinc	mg/L	< 0.03	3120 B, 3030 E

*) Standard Methods, 22nd Edition 2012, APHA-AWWA-WEF
< = Less than the detection limit indicated

Registered as Environmental Laboratory at Ministry of Environment Republic of Indonesia No. 0036/LPJ/LABLING-1/LRK/KLH

SBU General Services

Yuli Purwanto

CBT.36.5290.12.30.01

ATTACHMENT - 9 : Laboratory Analysis of Sea Water

Certificate No. 27352/DBBPAF
Date: December 17, 2012

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP - 024 - IDN

SUCOFINDO
Issuing Office:
Jl. Arteri Tol Cibitung No. 1, Cibitung Bekasi 17520, Indonesia
Phone/Facs: +62 21 88321176/88321166
Email: jum.cbt@sucofindo.co.id

REPORT OF ANALYSIS

CLIENT	:	PANCA AMARA UTAMA, PT Desa Uso, Kecamatan Batui, Kabupaten Banggai Propinsi Sulawesi Tangah
TYPE OF SAMPLE	:	SEA WATER
DATE RECEIVED	:	07/12/2012
DATE OF ANALYSIS	:	10/12/2012 to 17/12/2012
TESTED FOR	:	Physical and Chemical analysis
DESCRIPTION OF SAMPLE	:	Sample was submitted by client Packing : Unsealed plastic bottle
SAMPLE IDENTIFICATION	:	Sample : 2

Parameter	Unit	Test Results	Method *) Part Number
Ammoniac	mg/L	< 0.03	4500-NH_3-F
Cadmium	mg/L	< 0.02	3113 B
Copper	mg/L	< 0.03	3120 B, 3030 E
Lead	mg/L	< 0.03	3113 B
Nitrate	mg/L	0.06	4500-NO_3-E
Odour	-	Odourless	2150 B
Oil & Grease	mg/L	< 2	5520 B
pH	-	7.60	4500-H^+-B
Phenol	mg/L	< 0.06	5530 C
Phosphate	mg/L	< 0.09	3120 B, 3030 E
Salinity as NaCl	mg/L	32704	2520 B
Sulfide	mg/L	< 0.02	4500-S^2-D
Surfactants Anionic as MBAS	mg/L	< 0.02	5540 C
Temperature	°C	25	2550 B
Total Suspended Solid	mg/L	0	2540 D
Zinc	mg/L	< 0.03	3120 B, 3030 E

*) Standard Methods, 22nd Edition 2012, APHA-AWWA-WEF
< = Less than the detection limit indicated

Registered as Environmental Laboratory at
Ministry of Environment Republic of Indonesia
No. 0036/LPJ/LABLING-1/LRK/KLH

SBU General Services

Yuli Purwanto

CBT.36.5290.12.30.02

ATTACHMENT - 9 : Laboratory Analysis of Sea Water

Certificate No. 27353/DBBPAF
Date: December 17, 2012

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP - 024 - IDN

SUCOFINDO

Issuing Office:
Jl. Arteri Tol Cibitung No. 1, Cibitung Bekasi 17520, Indonesia
Phone/Facs: +62 21 88321176/88321166
Email: jum.cbt@sucofindo.co.id

REPORT OF ANALYSIS

CLIENT : PANCA AMARA UTAMA, PT
Desa Uso, Kecamatan Batui, Kabupaten Banggai
Propinsi Sulawesi Tangah

TYPE OF SAMPLE : SEA WATER

DATE RECEIVED : 07/12/2012

DATE OF ANALYSIS : 10/12/2012 to 17/12/2012

TESTED FOR : Physical and Chemical analysis

DESCRIPTION OF SAMPLE : Sample was submitted by client
Packing : Unsealed plastic bottle

SAMPLE IDENTIFICATION : Sample : 3

Parameter	Unit	Test Results	Method *) Part Number
Ammoniac	mg/L	< 0.03	4500-NH_3-F
Cadmium	mg/L	< 0.02	3113 B
Copper	mg/L	< 0.03	3120 B, 3030 E
Lead	mg/L	< 0.03	3113 B
Nitrate	mg/L	0.10	4500-NO_3-E
Odour	-	Odourless	2150 B
Oil & Grease	mg/L	< 2	5520 B
pH	-	7.80	4500-H^+-B
Phenol	mg/L	< 0.06	5530 C
Phosphate	mg/L	< 0.09	3120 B, 3030 E
Salinity as NaCl	mg/L	32265	2520 B
Sulfide	mg/L	< 0.02	4500-S^2-D
Surfactants Anionic as MBAS	mg/L	< 0.02	5540 C
Temperature	°C	25	2550 B
Total Suspended Solid	mg/L	0	2540 D
Zinc	mg/L	< 0.03	3120 B, 3030 E

*) Standard Methods, 22nd Edition 2012, APHA-AWWA-WEF
< = Less than the detection limit indicated

Registered as Environmental Laboratory at
Ministry of Environment Republic of Indonesia
No. 0036/LPJ/LABLING-1/LRK/KLH

SBU General Services

Yuli Purwanto

CBT.36.5290.12.30.03

ATTACHMENT - 9 : Laboratory Analysis of Sea Water

Certificate No. 27354/DBBPAF
Date: December 17, 2012

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP- 624 - IDN

SUCOFINDO
Issuing Office:
Jl. Arteri Tol Cibitung No. 1, Cibitung Bekasi 17520, Indonesia
Phone/Facs: +62 21 88321176/88321166
Email: jum.cbt@sucofindo.co.id

REPORT OF ANALYSIS

CLIENT : PANCA AMARA UTAMA, PT
Desa Uso, Kecamatan Batui, Kabupaten Banggai
Propinsi Sulawesi Tangah

TYPE OF SAMPLE : SEA WATER

DATE RECEIVED : 07/12/2012

DATE OF ANALYSIS : 10/12/2012 to 17/12/2012

TESTED FOR : Physical and Chemical analysis

DESCRIPTION OF SAMPLE : Sample was submitted by client
Packing : Unsealed plastic bottle

SAMPLE IDENTIFICATION : Sample : 4

Parameter	Unit	Test Results	Method *) Part Number
Ammoniac	mg/L	< 0.03	4500-NH_3-F
Cadmium	mg/L	< 0.02	3113 B
Copper	mg/L	< 0.03	3120 B, 3030 E
Lead	mg/L	< 0.03	3113 B
Nitrate	mg/L	< 0.01	4500-NO_3-E
Odour	-	Odourless	2150 B
Oil & Grease	mg/L	< 2	5520 B
pH	-	7.79	4500-H^+-B
Phenol	mg/L	< 0.06	5530 C
Phosphate	mg/L	< 0.09	3120 B, 3030 E
Salinity as NaCl	mg/L	32272	2520 B
Sulfide	mg/L	< 0.02	4500-S^2-D
Surfactants Anionic as MBAS	mg/L	< 0.02	5540 C
Temperature	°C	25	2550 B
Total Suspended Solid	mg/L	0	2540 D
Zinc	mg/L	< 0.03	3120 B, 3030 E

*) Standard Methods, 22nd Edition 2012, APHA-AWWA-WEF
< = Less than the detection limit indicated

Registered as Environmental Laboratory at Ministry of Environment Republic of Indonesia No. 0036/LPJ/LABLING-1/LRK/KLH

SBU General Services

Yuli Purwanto

CBT.36.5290.12.30.04

ATTACHMENT - 9 : Laboratory Analysis of Sea Water

Certificate No. 27355/DBBPAF
Date: December 17, 2012

KAN
Komite Akreditasi Nasional
Laboratorium Penguji
LP - 024 - IDN

SUCOFINDO
Issuing Office:
Jl. Arteri Tol Cibitung No. 1, Cibitung Bekasi 17520, Indonesia
Phone/Facs: +62 21 88321176/88321166
Email: jum.cbt@sucofindo.co.id

REPORT OF ANALYSIS

CLIENT : PANCA AMARA UTAMA, PT
Desa Uso, Kecamatan Batui, Kabupaten Banggai
Propinsi Sulawesi Tangah

TYPE OF SAMPLE : SEA WATER

DATE RECEIVED : 07/12/2012

DATE OF ANALYSIS : 10/12/2012 to 17/12/2012

TESTED FOR : Physical and Chemical analysis

DESCRIPTION OF SAMPLE : Sample was submitted by client
Packing : Unsealed plastic bottle

SAMPLE IDENTIFICATION : Sample : 5

Parameter	Unit	Test Results	Method *) Part Number
Ammoniac	mg/L	< 0.03	4500-NH_3-F
Cadmium	mg/L	< 0.02	3113 B
Copper	mg/L	< 0.03	3120 B, 3030 E
Lead	mg/L	< 0.03	3113 B
Nitrate	mg/L	0.22	4500-NO_3-E
Odour	-	Odourless	2150 B
Oil & Grease	mg/L	< 2	5520 B
pH	-	7.96	4500-H^+-B
Phenol	mg/L	< 0.06	5530 C
Phosphate	mg/L	< 0.09	3120 B, 3030 E
Salinity as NaCl	mg/L	32072	2520 B
Sulfide	mg/L	< 0.02	4500-S^2-D
Surfactants Anionic as MBAS	mg/L	< 0.02	5540 C
Temperature	°C	25	2550 B
Total Suspended Solid	mg/L	0	2540 D
Zinc	mg/L	< 0.03	3120 B, 3030 E

*) Standard Methods, 22nd Edition 2012, APHA-AWWA-WEF
< = Less than the detection limit indicated

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SBU General Services

Yuli Purwanto

CBT.36.5290.12.30.05

ATTACHMENT - 10 : Laboratory Analysis of Geology Samples

PUSAT SUMBER DAYA AIR TANAH DAN GEOLOGI LINGKUNGAN
BIDANG GEOLOGI TEKNIK
SUB BIDANG INVENTARISASI GEOLOGI TEKNIK
(LABORATORIUM MEKANIKA TANAH DAN BATUAN)
JL. DIPONEGORO NO. 57 BANDUNG 40122
Telp. 022 7274676, 022 7174677, Ext. 107

KLIEN :
PROYEK :
Location : Ds. Musolang

No. Laboratorium										
Location Code / Sample No.			TS.1	TS.2						
Location		m								
Coordinate	X									
	Y									
Land Classification based on USCS			CH	ML						
WEIGHT-VOLUME CHARACTERISTIC										
Water Content	w	%	53.92	49.32						
Specific Gravity	Gs	-	2.651	2.664						
Bulk Density	γ	g/cm^3	1.625	1.660						
Dry Density	γ_d	g/cm^3	1.056	1.112						
Saturated Density	γ_{sat}	g/cm^3	1.657	1.694						
Porosity	n	%	60.18	58.27						
Void Ratio	e	-	1.51	1.40						
Degree of Saturation	S_r	%	94.60	94.10						
PLASTICITY CHARACTERISTIC										
Liquid Limit	LL	%	85.12	48.26						
Plastic Limit	PL	%	28.49	30.46						
Plastic Index	PI	%	56.63	17.80						
Shrinkage Limit	SL	%								
Shrinkage Index	SI	%								
Activity	A_c	%								
Liquidity Indeks	LI	%								
GRAIN GRADATION CHARACTERISTIC										
	< 0.002 mm	%								
Clay	< 0.005 mm	%	58.00	11.00						
Silt	0.005 - 0.075 mm	%	33.00	32.00						
Fine Sand	0.075 - 0.420 mm	%	8.00	21.00						
Medium Sand	0.420 - 2.000 mm	%	1.00	36.00						
Coarse Sand	2.000 - 4.750 mm	%								
Pebbles	> 4.750 mm	%								
Uniformity Coeff.	C_u	-								
Curve Coeff.	C_c	-								
FLOW CHARACTERISTIC										
Permeability Coeff.	k	cm/dt								
Capillary Height	h_c	cm								
Effective Porosity	n_e	%								
CONSOLIDATION CHARACTERISTIC										
Compressibility Coeff.	a_v	cm^2/g								
Comp. Vol. Coeff.	m_v	cm^2/g								
Compression Index	C_c	-								
Swelling Index	C_s	-								
Consolidation Index	c_v	cm^2/dt								
Pre-consolidation Tension	P_c	kg/cm^2								
STRENGTH CHARACTERISTIC										
Cohesion	c	kg/cm^2	0.238	0.129						
Angle of Repose	ϕ	o	10.67	20.64						
Residual Cohesion	c_r	kg/cm^2								
Res. Angle of Repose	ϕ_r	o								
Unconf. Comp. Str.	q_u	kg/cm^2								
Elasticity Modulus	E_s	kg/cm^2								
COMPACTION & CBR CHARACTERISTIC										
Maximum Density	$\gamma_{d\,maks}$	g/cm^3								
Optimum Water Cont.	w_{opt}	%								
Relative Compactness	D_r	%								
CBR	CBR	%								

Catatan : CH = High Plasticity Clay
MH = High Plasticity Silt
CL = Sandy Clay
ML = Sandy Silt
SP = Poorly Graded Sand
SM = Silty Sand
SC = Clay Sand
GW = Pebble Sand

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PHYSICAL PROPERTIES

KLIEN :
PROYEK :
Location : Ds. Musolang
KEDLMN. :

Done by : Dd
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : HS

Sampling Location	TS.1	TS.2						
Depth of Sampling (m)								
Mass of Sample G1 (g)	109.40	111.74						
Volume of Sample V1 (cc)	67.314	67.314						
Density of Sample G1/V1 (g/cc)	1.625	1.660						
Water Content w (%)	53.92	49.32						
Dry Density γ_d. g/(1+w) (g/cc)	1.056	1.112						
Specific Gravity G_s	2.651	2.664						
Pore Number e_o $(G_s-g_d)/g_d$.	1.51	1.40						
Porosity n $e_o/(e_o-1)$ (%)	60.17	58.27						
Degree of Saturation $(wxG_s)/e_o$. S_r (%)	94.62	94.09						
Saturated Density γ_{sat}. $(e_o+G_s)/(e_o+1)$ (g/cc)	1.658	1.694						
Sub Density γ_{sub}. γ_{sat}.-1 (g/cc)	0.658	0.694						

Lokasi Contoh								
Kedalaman Contoh								
Berat Contoh Asli G1 (g)								
Volume Contoh V1 (cc)								
Berat Isi Asli γ. G1/V1 (g/cc)								
Kadar Air w (%)								
Berat Isi Kering γ_d. $\gamma/(1+w)$ (g/cc)								
Berat Jenis G_s								
Angka Pori e_o $(G_s-g_d)/g_d$.								
Porositas n $e_o/(e_o+1)$ (%)								
Derajad Kejenuhan $(wxG_s)/e_o$. S_r (%)								
Berat Isi Jenuh γ_{sat}. $(e_o+G_s)/(e_o+1)$ (g/cc)								
Berat Isi Sub γ_{sub}. γ_{sat}.-1 (g/cc)								

ATTACHMENT - 10 : Laboratory Analysis of Geology Samples

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Telp. 022 7274676, 022 7174677, Ext. 107

WATER CONTENT

KLIEN :
PROYEK :
Location : Ds. Musolang
KEDLMN. :

Done by : Dd
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : Jk

Sampling Location	TS.1		TS.2					
Depth of Sampling)								
Sample No	37	31	90	205				
Mass of Sample + Dish = G1 (g)	55.46	43.06	53.16	50.25				
Dry Mass of Sample + Dish = G2 (g)	39.43	31.14	39.01	37.87				
Water Content G3 (g)	9.87	8.91	9.94	13.09				
Water Mass G1 - G2 = G4 (g)	16.03	11.92	14.15	12.38				
Dry Sample Mass G2 - G3 = G5 (g)	29.56	22.23	29.07	24.78				
Water Content G4/G5 x 100 = w (%)	54.23	53.62	48.68	49.96				
Average w (%)	53.92		49.32					

Lokasi Contoh								
Kedalaman (m)								
Nomor Tara								
Berat Contoh Asli + Tara = G1 (g)								
Berat Cnth Kering + Tara = G2 (g)								
Berat Tara G3 (g)								
Berat Air G1 - G2 = G4 (g)								
Berat Cnth Kering G2 - G3 = G5 (g)								
Kadar Air G4/G5 x 100 = w (%)								
w rata-rata (%)								

Lokasi Contoh								
Kedalaman (m)								
Nomor Tara								
Berat Contoh Asli + Tara = G1 (g)								
Berat Cnth Kering + Tara = G2 (g)								
Berat Tara G3 (g)								
Berat Air G1 - G2 = G4 (g)								
Berat Cnth Kering G2 - G3 = G5 (g)								
Kadar Air G4/G5 x 100 = w (%)								
w rata-rata (%)								

ATTACHMENT - 10 : Laboratory Analysis of Geology Samples

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Telp. 022 7274676, 022 7174677, Ext. 107

BERAT JENIS

KLIEN :
PROYEK :
Location : Ds. Musolang
KEDLMN. :

Done by : Dd
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : HS

Sampling Location	TS.1		TS.2					
Depth of Sampling								
Pycnometer No	27	28	21	6				
Mass of Pycnometer G1 (g)	36.56	41.19	46.06	47.58				
Mass of Pycnometer + Water (temp=25°C) G2 (g)	136.25	145.4	149.5	151.04				
Volume of Pycnometer (G2-G1)/gw = V1 (cc)	99.69	104.21	103.44	103.46				
Mass of Sample G3 (g)	10.61	10.92	11.12	12.48				
Pycnometer+Sample+Water G4 (g)	142.85	152.21	156.45	158.83				
Vacuum Period								
Pynometer+Water G4-G3 = G5 (g)	132.24	141.29	145.33	146.35				
Water G6= G5-G1 (g)	95.68	100.1	99.27	98.77				
Water Volume G6/gw = V2 (cc)	95.68	100.1	99.27	98.77				
Sample Volume V1-V2 = V3 (cc)	4.01	4.11	4.17	4.69				
Specific Gravity (G3/V3)/gw = Gs	2.646	2.657	2.667	2.661				
Average Gs	2.651		2.664					

Kode Contoh								
Kedalaman Contoh								
Nomor Piknometer								
Berat Piknometer G1 (g)								
Berat Piknometer + Air (temp=25°C) G2 (g)								
Volume Piknometer (G2-G1)/gw = V1 (cc)								
Berat Contoh Tanah G3 (g)								
Piknometer+Tanah+ Air G4 (g)								
Lama di Vacuum								
Piknometer+Air G4-G3 = G5 (g)								
Air G6= G5-G1 (g)								
Volume Air G6/gw = V2 (cc)								
Volume Tanah V1-V2 = V3 (cc)								
Berat Jenis/Svc.Gvt. (G3/V3)/gw = Gs								
Gs rata-rata								

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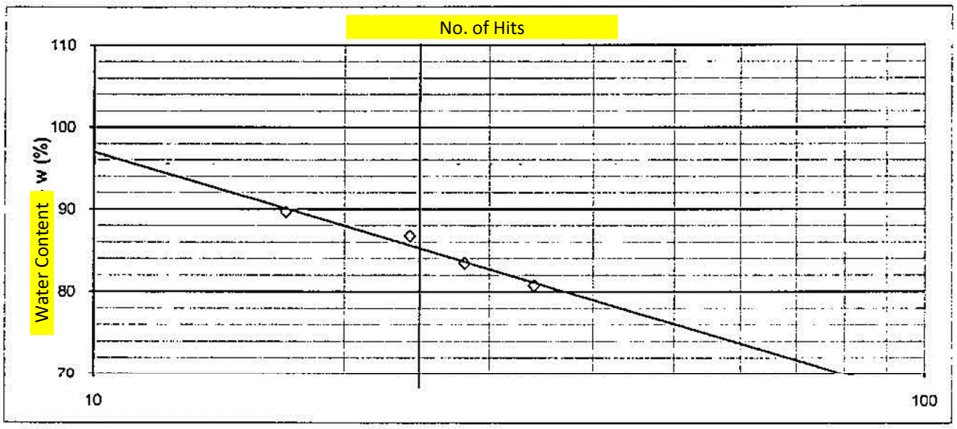
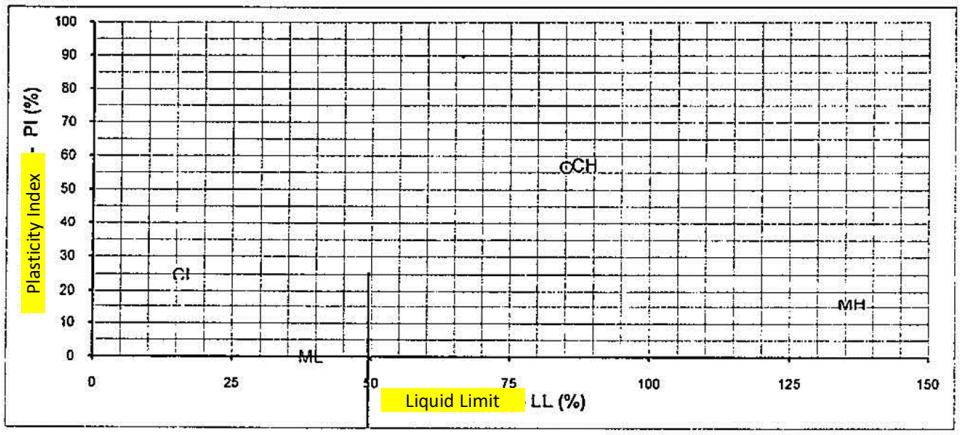
ATTERBERG LIMITS

KLIEN :
PROYEK :
Location : TS.1 / Ds. Musolang
KEDLMN. :

Done by : KJY
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : AS

		Batas Cair					Batas Plastis	
0		1	2	3	4	5	6	7
Dish No.		259	285	269	273		285	176
No. of Hits		34	28	24	17			
Damp Sample + Dish	(g)	44.51	43.56	43.09	42.77		35.06	31.16
Dry Sample + Dish	(g)	31.46	28.79	28.27	29.95		30.68	27.79
Dish	(g)	15.30	11.09	11.18	15.65		15.35	15.93
Water	(g)	13.05	14.77	14.82	12.82		4.38	3.37
Dry Sample	(g)	16.16	17.70	17.09	14.30		15.33	11.86
Water Content	(%)	80.75	83.45	86.72	89.65		28.57	28.41





Plastic Limit -pl (%)	Liquid Limit -wl (%)	Plasticity Index -Ip(%)	Group Symbol
28.49	85.12	56.63	CH

ATTACHMENT - 10 : Laboratory Analysis of Geology Samples

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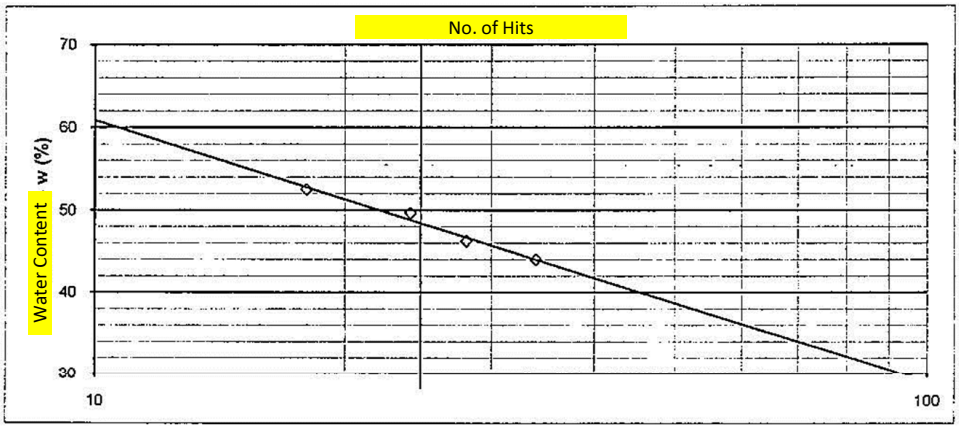
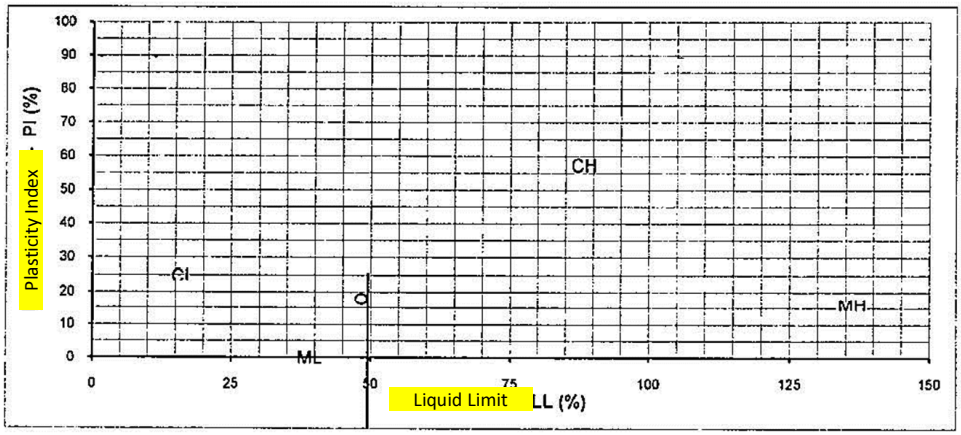
ATTERBERG LIMITS ANALYSIS

KLIEN :
PROYEK :
Location : TS.2 / Ds. Musolang
KEDLMN. :

Done by : KJY
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : AS

0		Batas Cair					Batas Plastis	
		1	2	3	4	5	6	7
Dish No.		259	285	269	273		285	176
No. of Hits		34	28	24	18			
Damp Sample + Dish	(g)	50.86	50.44	49.10	49.14		33.74	31.85
Dry Sample + Dish	(g)	38.74	38.00	37.87	37.71		29.49	28.11
Dish	(g)	11.18	11.09	15.24	15.94		15.53	15.84
Water	(g)	12.12	12.44	11.23	11.43		4.25	3.74
Dry Sample	(g)	27.56	26.91	22.63	21.77		13.96	12.27
Water Content	(%)	43.98	46.23	49.62	52.50		30.44	30.48





Plastic Limit pl (%)	Liquid Limit wl (%)	Plasticity Index Ip(%)	Group Symbol
30.46	48.26	17.80	ML

ATTACHMENT - 10 : Laboratory Analysis of Geology Samples

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GRAIN SIZE ANALYSIS

KLIEN :
PROYEK :
Location : TS.1 / Ds. Musolang
KEDLMN. :

Done by : Jk.
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : HS

Filtering Analysis

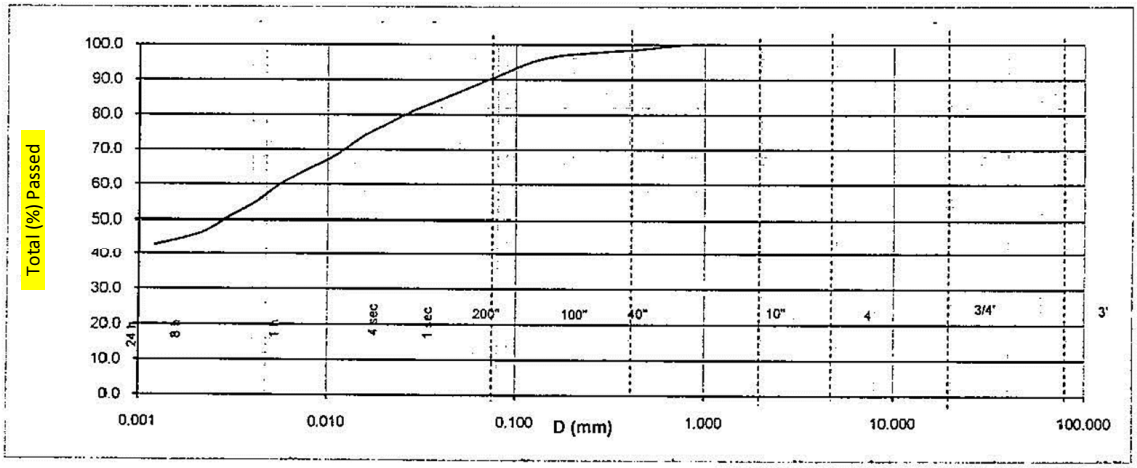
Dry Sample Mass : 50 g
Mass Trapped by No.4 : 0.00 g
Mass passed thru No.200 : 45.23 g

Filter No	Trapped Mass (g)	Net Trapped (g)	Percentage Trapped (%)	Cumulative Percentage (%)	Diameter D (m)	Fine Cumulative (%)
3/4	0.00	0.00	0.00	0.00	19.100	100.00
3/8	0.00	0.00	0.00	0.00	9.520	100.00
4	0.00	0.00	0.00	0.00	4.760	100.00
10	0.00	0.00	0.00	0.00	2.000	100.00
20	0.00	0.00	0.00	0.00	0.850	100.00
40	0.76	0.76	1.52	1.52	0.420	98.48
100	1.07	1.07	2.14	3.66	0.149	96.34
200	2.94	2.94	5.88	9.54	0.075	90.46
Pan	45.23	45.23	90.46			
Jumlah	50.00	50.00	100.00			

Hydrometer

Combined Correction -0.3
Meniscus Correction 3.3
Specific Gravity Gs : 2.651
M or K constants : 0.0042
Cumulative % Factor : 3.2114
Jar Base Area : 27.00

Time t (min)	Hydrometer Reading Rh'	Comb. Corr. Rh	Effective Hydrometer Height L (cm)	Meniscus Reading Correction R	Diameter D (m)	Fine Cumulative (%)
1	29.5	29.2	8.586	26.2	0.0391	84.14
2	28.5	28.2	8.851	25.2	0.0281	80.93
4	27.3	27.0	9.168	24.0	0.0202	77.07
8	26.0	25.7	9.512	22.7	0.0146	72.90
15	24.5	24.2	9.909	21.2	0.0109	68.08
30	23.3	23.0	10.226	20.0	0.0078	64.23
60	22.0	21.7	10.570	18.7	0.0056	60.05
120	20.3	20.0	11.020	17.0	0.0040	54.59
240	19.0	18.7	11.363	15.7	0.0029	50.42
480	17.7	17.4	11.707	14.4	0.0021	46.24
1440	16.7	16.4	11.972	13.4	0.0012	43.03



Clay %	Silt %	Fine Sand %	Med. Sand %	Psr Ksr	Krkl Hls%	Krkl Ksr %	Kkal %
58	33	8	1				

D_{10} (mm): D_{30} (mm): D_{60} (mm): C_u : C_c :

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GRAIN SIZE ANALYSIS

KLIEN :
PROYEK :
Location : TS.2 / Ds. Musolang
KEDLMN. :

Done by : Jk.
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : HS

Filtering Analysis

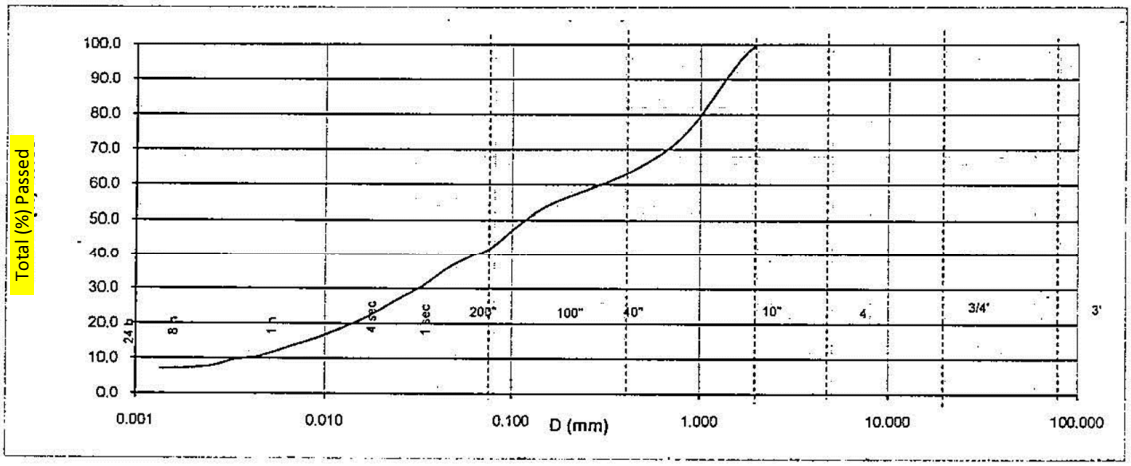
Dry Sample Mass : 50 g
Mass Trapped by No.4 : 0.00 g
Mass passed thru No.200 : 20.79 g

Filter No	Trapped Mass (g)	Net Trapped (g)	Percentage Trapped (%)	Cumulative Percentage (%)	Diameter D (m)	Fine Cumulative (%)
3/4	0.00	0.00	0.00	0.00	19.100	100.00
3/8	0.00	0.00	0.00	0.00	9.520	100.00
4	0.00	0.00	0.00	0.00	4.760	100.00
10	0.00	0.00	0.00	0.00	2.000	100.00
20	12.50	12.50	25.00	25.00	0.850	75.00
40	5.76	5.76	11.52	36.52	0.420	63.48
100	4.99	4.99	9.98	46.50	0.149	53.50
200	5.96	5.96	11.92	58.42	0.075	41.58
Pan	20.79	20.79	41.58			
Jumlah	50.00	50.00	100.00			

Hydrometer

Combined Correction : -0.3
Meniscus Correction : 3.3
Specific Gravity Gs : 2.664
M or K constants K : 0.0042
Cumulative % Factor : 3.2019
Jar Base Area : 27.00

Time t (min)	Hydrometer Reading Rh'	Comb. Corr. Rh	Effective Hydrometer Height L (cm)	Meniscus Reading Correction R	Diameter D (m)	Fine Cumulative (%)
1	14.7	14.4	12.501	11.4	0.0470	36.50
2	13.0	12.7	12.950	9.7	0.0338	31.06
4	11.7	11.4	13.294	8.4	0.0242	26.90
8	10.3	10.0	13.664	7.0	0.0174	22.41
15	9.3	9.0	13.929	6.0	0.0128	19.21
30	8.3	8.0	14.193	5.0	0.0091	16.01
60	7.5	7.2	14.405	4.2	0.0065	13.45
120	6.7	6.4	14.617	3.4	0.0046	10.89
240	6.3	6.0	14.722	3.0	0.0033	9.61
480	5.7	5.4	14.881	2.4	0.0023	7.68
1440	5.5	5.2	14.934	2.2	0.0014	7.04



Clay %	Silt %	Fine Sand %	Med. Sand %	Psr Ksr	Krkl His%	Krkl Ksr %	Kkal %
11	32	21	36				

D_{10} (mm): D_{30} (mm): D_{60} (mm): C_u : C_c :

ATTACHMENT - 10 : Laboratory Analysis of Geology Samples

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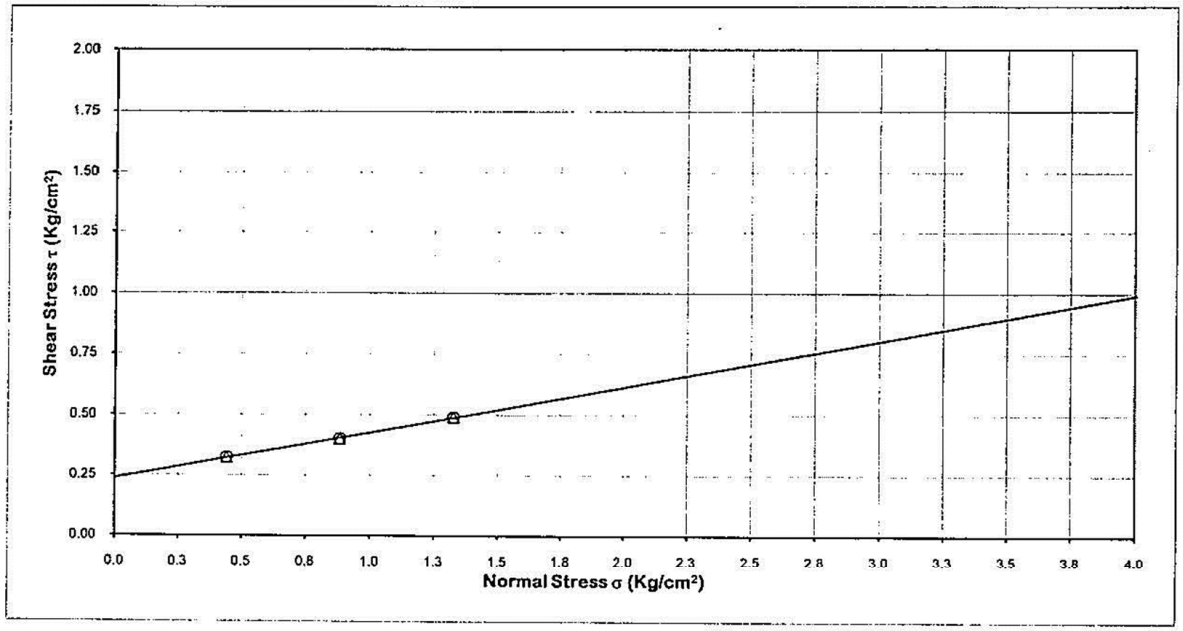
JL. DIPONEGORO NO. 57 BANDUNG 40122
Telp. 022 7274676, 022 7174677, Ext. 107

DIRECT FRICTION

KLIEN :
PROYEK :
Location : TS.1 / Ds. Musolang
KEDLMN. :

Done by : Irz
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : HS



Specimen No.	Peak Stress		Residual Stress		Remarks
	σ. (kg/cm2)	τ. (kg/cm2)	σ. (kg/cm2)	τ. (kg/cm2)	
1	0.4423	0.3234			
2	0.8846	0.4018			
3	1.3270	0.4901			

cp. (kg/cm²)	ϕp. (...,°)	cr. (kg/cm²)	ϕr. (...,°)
0.238	10.67		

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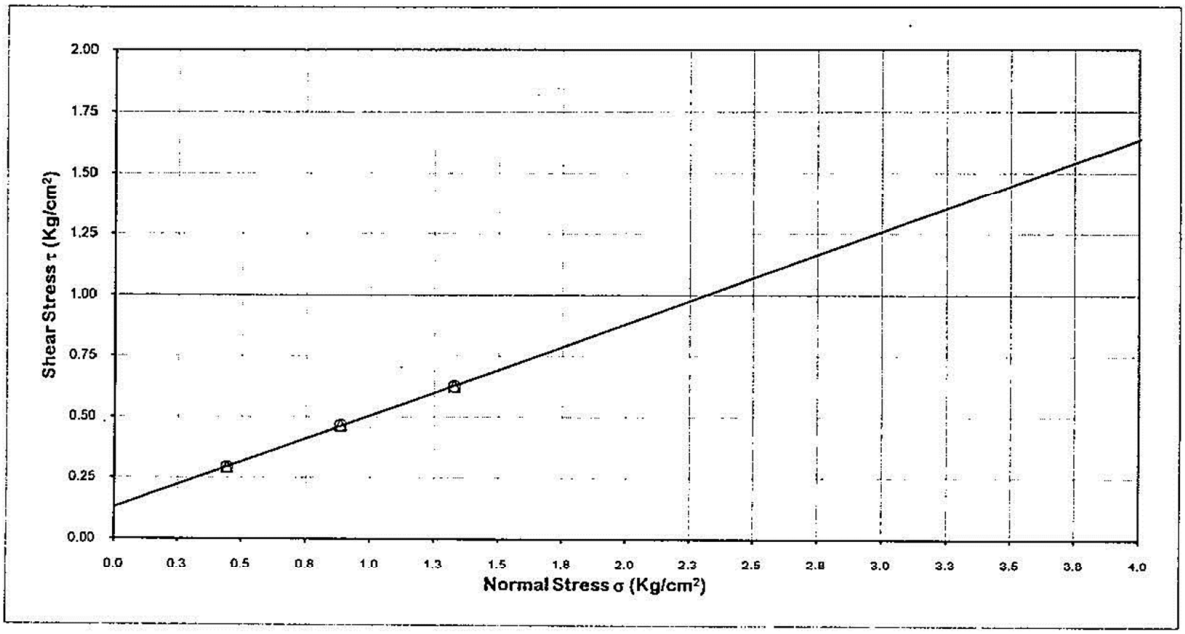
Telp. 022 7274676, 022 7174677, Ext. 107

DIRECT FRICTION

KLIEN :
PROYEK :
Location : TS.2 / Ds. Musolang
KEDLMN. :

Done by : Irz
Start Date : Mei 2012
Finish Date : Mei 2012
Checked by : HS



Specimen No.	Peak Stress		Residual Stress		Remarks
	σ. (kg/cm2)	τ. (kg/cm2)	σ. (kg/cm2)	τ. (kg/cm2)	
1	0.4423	0.2940			
2	0.8846	0.4656			
3	1.3270	0.6273			

cp. (kg/cm²)	ϕp. (..., °)	cr. (kg/cm²)	ϕr. (..., °)
0.129	20.64		

ATTACHMENT - 11 : Letter of Agreement of EIA by Bapedalda issued 2006

PROVINCIAL GOVERNMENT CENTRAL SULAWESI
REGIONAL ENVIRONMENTAL IMPACT CONTROL BOARD
(BAPEDALDA)
JALAN MANGUNSARKORO NO. 31 PHONE / FAX (0451) 456 833, PALU

Palu, March 3, 2006

Number	660.1/0145/Bapedalda	To
Attachment	-	Director PT Panca Amara Utama
About	Environmental Feasibility Approval of ANDAL, RPL and RKL Ammonia Industry and Supporting Facilities Development Plan in Uso Village, Batui District, Banggai Regency	at
		Jakarta.

In relation to Environmental Feasibility Approval of Terms of Reference (KA-ANDAL) Ammonia Industry and Supporting Facilities Development Plan in Uso Village Batui District Banggai Regency number: 660.l/0295/Bapedalda dated October 28, 2005, and the letter of PT Panca Amara Utama number: 063/PAU/II/2006 dated 13 February 2006 regarding the Request of Presentation of Study Results of ANDAL, RKL and RPL, then based on the results of the discussion and assessment of the EIA Commission of Central Sulawesi Province held on Thursday, 23 February 2006, the Commission EIA Central Sulawesi, hereby:

1. States that all the documentary material Environmental Impact Assessment (EIA), Environmental Management Plan (RKL) and Environmental Monitoring plan of (RPL) of Ammonia Industry and supporting facilities development plans in Uso Village, Batui District, Banggai Regency of Central Sulawesi, which is:

   1.1. Submitted by:

a.	Company Name	PT Panca Amara Utama
b.	Company Leader	Dr. Ir Anwar K. Joesoef.
c.	Address	Mayapada Tower Penthouse 20th 21st Floor Jl. Jenderal Sudirman Kav, 28 Jakarta.
d.	Telephone	+62-21-5253301
e.	Fax	+62-21-5213480

   1.2. Prepared by:

a.	Consultant Name	Institute of Environmental Technology Agency for the Assessment and Application of Technology
b.	Address	Building 412 Puspitek Serpong, Tangerang 15314, Banten Province.
c.	Phone	021-7560919
d.	Fax	021-7563116
e.	Head of Institute	Dra. Titiresmi Adyananto, MS

   Is in compliance to all environmental feasibility requirements, as required by Regulation Legislation in force;

2. Have approved to all documents of Environmental Impact Assessment (EIA), Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL) Ammonia Industry and supporting facilities development plan in Uso Village Batui District Banggai Regency Central Sulawesi, as referred to in point 1 (a) page 1 (one) of this environment feasibility approval letter, to serve as a base reference in all stages of development of Ammonia Industry is all stages of Pre Construction - Construction - Operation and Post-Operation stage.

Hence, the feasibility principle approval is to be carried out as it should.

HEAD BAPEDALDA PROVINCE
CENTRAL SULAWESI
AS
CHAIRMAN OF EIA COMMISSION PROVINCE
CENTRAL SULAWESI,

Drs. H. AWAD SAID MH
Trustees Vice Officer
NIP. 010078349

Copies delivered with respect to:
1. Governor of Central Sulawesi (as reported), in Palu
2. Deputy of EIA Ministry of Environment RI, in Jakarta
3. Banggai Regent, in Luwuk
4. Head of Industry, Trade and Cooperatives Department Central Sulawesi, in Palu
5. Head of Transport Department Central Sulawesi, in Palu
6. Head of Settlement and Regional Infrastructure Department Central Sulawesi, in Palu
7. Head of the Investment Coordinating Board of Central Sulawesi, in Palu,
8. Head of Fisheries and Marine Resources Department of Central Sulawesi, in Palu.
9. Chief Executive of Kapet Batui Management Agency, in Luwuk.

GOVERNMENT OF CENTRAL SULAWESI PROVINCE
REGIONAL ENVIRONMENT AGENCY

Address: No. 11 Jalan Raja Moili Tel / Fax (0451) 456 833 PALU
Website: http://blhd.suLteng.go.id Email: amdalsulteng@yahoo.co.id

DECISION OF THE HEAD OF REGIONAL ENVIRONMENT
CENTRAL PROVINCE SULAWESI
NUMBER: 660/07.87/BLHD

ABOUT
TERMS OF REFERENCE ENVIRONMENTAL IMPACT ASSESSMENT (KA-ANDAL)
DEVELOPMENT OF AMMONIA INDUSTRY AND SUPPORTING FACILITIES IN USO VILLAGE
BATUI DISTRICT, BANGGAI REGENCY, CENTRAL SULAWESI PROVINCE
BY PT PANCA AMARA UTAMA

HEAD OF REGIONAL ENVIRONMENT AGENCY OF CENTRAL SULAWESI PROVINCE

Keeping in mind

a. that the Ammonia Industry and supporting facilities Development Plan in the Uso village Batui District Banggai Regency Central Sulawesi by PT Panca Amara Utama is an activity that must be completed by the Environmental Impact Assessment;
b. that the Terms of Reference for Environmental Impact Analysis (KA-ANDAL), Ammonia Industry and supporting facilities Development Plan in Uso village Batui District Banggai Regency Central Sulawesi by PT Panca Amara Utama as one part of the study of Environmental Impact Assessment must obtain a decree based on the assessment results of the Technical Team / EIA Appraisal Committee of Central Sulawesi Province;
c. keeping in mind a and b above, there should be of Decision Head of regional environment agency Central Sulawesi province on the Terms of Reference Environmental Impact Analysis (KA-ANDAL the Ammonia Industry and supporting facilities Development Plan in the Uso village Batui District Banggai Regency Central Sulawesi by PT Panca Amara Utama.

Considering

1. Law Number 13 Year 1964 concerning Stipulation of Government Regulation in Lieu of Law Number 2 Year 1964 on the establishment of Regencies in Central Sulawesi and Regencies in Southeast Sulawesi by amending the Law Number 47 Prp of 1960 on the establishment of Regencies in North-Central Sulawesi and Regencies in South- Southeast Sulawesi (State Gazette of the Republic of Indonesia Year 1964 Number 7), into Law (Republic of Indonesia Year 1964 Number 94, Supplement to State Gazette of the Republic of Indonesia Number 2687);
2. Law Number 32 Year 2004 on Regional Government (State Gazette of the Republic of Indonesia Year 2004 Number 125, Supplement to State Gazette of the Republic of Indonesia Number 4437) as amended by Law No. 12 of 2008 on the Second Amendment to Law Number 32 Year 2004 on Regional Government (State Gazette of the Republic of Indonesia Year 2008 Number 59, Supplement to State Gazette of the Republic of Indonesia Number 4844);

3. Law Number 26 Year 2007 on Spatial Planning (State Gazette of the Republic of Indonesia Year 2007 Number 68, Supplement to State Gazette of the Republic of Indonesia Number 4725);
4. Law Number 32 of 2009 on the Protection and Environmental Management (State Gazette of the Republic of Indonesia Year 2009 Number 140, Supplement to State Gazette of the Republic of Indonesia Number 5059);
5. Government Regulation No. 27 Year 2012 on Environmental Permit (State Gazette of the Republic of Indonesia Year 2012 No. 48);
6. Regulation of the Minister of Environment No. 08 Year 2006 on Guidelines for Environmental Impact Assessment;
7. Regulation of the Minister of Environment Number 05 Year 2008 concerning the work of the Commission Impact Assessment Environment;
8. Regulation of the Minister of Environment No. 24 Year 2009 on guidelines on Assessment of documents of Environmental Impact Analysis;
9. Regulation of the Minister of Environment No. 07 Year 2010 on Competency Certification of Document Organizer of Environmental Impact Assessment and Requirements of Competency Training Institute of Document Organizer of Environmental Impact Assessment.
10. Regulation of the Minister of Environment No. 05 Year 2012 on Types of Business Plan and / or Activity Which Has Mandatory Environmental Impact Assessment.

Noticing

Meeting Results of Commission / EIA Technical Assessment Team of Central Sulawesi in Palu on June 5, 2012 regarding document assessment of the Terms of Reference Environmental Impact Analysis (KA-ANDAL) the Ammonia Industry and supporting facilities Development Plan in the Uso village Batui District Banggai Regency Central Sulawesi by PT Panca Amara Utama.

TO DECIDE:

To Set

DECISION OF THE HEAD OF REGIONAL ENVIRONMENT AGENCY OF CENTRAL SULAWESI PROVINCE ON THE TERMS OF REFERENCE ENVIRONMENTAL IMPACT ASSESSMENT (KA-ANDAL) THE AMMONIA INDUSTRY AND SUPPORTING FACILITIES DEVELOPMENT PLAN IN THE USO VILLAGE BATUI DISTRICT BANGGAI REGENCY CENTRAL SULAWESI BY PT PANCA AMARA UTAMA.

FIRST

Terms of Reference for Environmental Impact Analysis (KA-ANDAL) the Ammonia Industry and supporting facilities Development Plan in the Uso village Batui District Banggai Regency Central Sulawesi by PT Panca Amara Utama.

SECOND

Terms of Reference for Environmental Impact Analysis (KA-ANDAL) Action Plan referred to in dictum FIRST agreed that the scope of Environmental Impact Assessment (EIA) for the event is referred to in the Meeting Minutes of Commission / EIA Technical Team Assessment of Central Sulawesi Number 33/BA/SetKomdal/VI/2012 dated June 5, 2012 and the TOR Document Environmental Impact Analysis (KA-ANDAL) attached.

THIRD

Terms of Reference for Environmental Impact Analysis (KA-ANDAL) Action Plan referred to in the FIRST Dictum shall be used as a reference for the study of Environmental Impact Assessment (EIA), Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL).

FOURTH

This decision is effective on the date specified.

Defined in Palu
On July 16, 2012
SYAHRIAL LABELO SO M.Si
Trustees Vice Officer
NIP 19590116 198903 1010

Copies to with respects:

1. Minister of the Environment in Jakarta;
2. Governor of Central Sulawesi in Palu (as report);
3. Head of Center for Management of Ecoregion Sumapapua in Makassar;
4. Chairman of the Parliament Central Sulawesi province in Palu;
5. Central Sulawesi Regional Police Chief in Palu;
6. Inspector of Regional Inspectorate of Central Sulawesi province in Palu;
7. Head of Regional Head of Energy and Mineral Resources of Central Sulawesi province in Palu;
8. Banggai Regent in Luwuk;
9. Head of Banggai Environmental Management Agency in Luwuk;
10. Head of Banggai Mining and Energy Department in Luwuk.

GOVERNMENT OF CENTRAL SULAWESI PROVINCE
REGIONAL ENVIRONMENT AGENCY
Address: No. 11 Jalan Raja Moili Tel / Fax (0451) 456 833 PALU
Website: http://blhd.sulteng.go.id Email: amdalsulteng@yahoo.co.id

MINUTES OF MEETING
MEETING OF EIA TECHNICAL ASSESSMENT TEAM SULAWESI CENTRAL PROVINCE
REGARDING THE EVALUATION OF ANDAL, RKL-RPL OF
DEVELOPMENT OF AMMONIA INDUSTRY AND SUPPORTING FACILITIES
IN USO VILLAGE, BATUI DISTRICT, BANGGAI REGENCY, CENTRAL SULAWESI PROVINCE
BY PT AMARA PANCA UTAMA

Number: 63/BA/Set-Komdal/VIII/2012

- Day / Date: Thursday, August 30, 2012
- Venue: Meeting Room BLHD Office of Central Sulawesi Province
  Jalan Raja Moili No. II Palu
  Tel / Fax 0451-456833
- Promoter PT Panca Amara Utama
- Person In Charge Saut Poltak H. Simanjuntak
- Occupation Director by Power of Attorney
- Consultant PT Widya Cipta Buana
- Meeting Chairman Head of the Regional Environment Agency Central Sulawesi
  as Chairman of EIA Appraisal Committee Central Sulawesi Province

1. Members of the Commission / Technical Team Assessment EIA Central Sulawesi province in attendance were:
   1) EIA Technical Team Central Sulawesi
      - Ir. Muhlis Lamboka
      - Drs. Dahlan H. Hasan, M.Si
      - Moh. Mirzan, S.Si, M.Si
      - Dr. Joseph Patadungan, MP
      - Ir. Jurair Patunrangi, MT
      - Ir. Aris Bulo Pasaru, MM
      - Ir. Syafiudin Natsir, M.Si
      - Ir. Idham Munandar
      - Nurmina AP, SKM
      - Sumaryo, BSc

   2) The EIA Appraisal Committee Central Sulawesi Province
      - Head of BLHD Central Sulawesi (Chairman of EIA Appraisal Committee Central Sulawesi Province);
      - Head of Research and Development of the EIA (Secretary of EIA Appraisal Committee Central Sulawesi Province);
      - Representative Department of Cooperative MSME Trade and Industry Central Sulawesi;
      - Representative from Promotion and Investment Agency Central Sulawesi;
      - Representative from the Department of Transmigration and Manpower Central Sulawesi;
      - Head of Department of Transportation Communications and Information Technology Central Sulawesi;
      - Representative from the Bureau of Development Administration and Natural Resources Regional Secretariat of Central Sulawesi;
      - Head of PPLH Tadulako State University;
      - Director of NGO Katopasa Palu;

- Secretary of BLHD Central Sulawesi;
- Head of Capacity Building, Data and Institutional BLHD Central Sulawesi;
- Head of Monitoring and Environmental Organization BLHD Central Sulawesi;
- Representative from UPTD Environmental Laboratory BLHD Central Sulawesi;
- Head of Environmental Management Banggai;
- Head Batui District;
- Uso village chief;
- Uso Rural Community Leaders;
- Batui District Community leaders;
- Kintom District Community leaders;
- NGO Environmental Care Banggai.

2. Meeting of the Commission / EIA Technical Assessment Team Central Sulawesi to discuss ANDAL and RKL-RPL of Ammonia Industry and supporting facilities Development Plan in the Uso village Batui Sub-district Banggai Regency Central Sulawesi, the promoter agreed to do some revision and improvement as follows:
   a. Elaborating on the local geological structure and the type of rock fault structures in order to determine its effect on plant building;
   b. To record notation of geological structures (eg faults) on the information map 3.7;
   c. To revise the axis of vehicles maximum 10 to be used, while based on the Decree of the Minister of Transportation No. KM 13 Year 2001 on the Establishment of the classes of roads in Sulawesi, it was determined that the Luwuk - Batui road is of Class IIIB, which means that the motor vehicle, including the cargo, which is allowed to pass has width of not more than 2,500 millimeters, length not more than 12,000 millimeters and heaviest axis payload (MST) of eight (8) tons;
   d. Adding an explanation of the product, whether half-finished or in packaged form;
   e. Adding product transportation system (weekly - monthly) and demobilization post construction, post-operation;
   f. Improve monitoring institutions, to be adjusted to their authority;
   g. To make discussion consistent, as in Chapter III discusses the components of public health while in the next chapter it is no longer discussed;
   h. Adding a public health component of the discussion on:
      - Scope of Study
      - Estimates of Significant Impacts
      - Evaluation of Significant Impacts
      - RKL-RPL Documents
   i. To clarify description of the handling of solid waste management and monitoring of retention ponds in the RKL-RPL;
   j. Outline the parameters of water quality;
   k. To mention clearly location of Musolang river water sampling point at two locations (A1 and A2), sampling downstream or upstream;
   l. To revise air quality parameters unit, as most do not correspond to the laboratory analysis results table (Table 3.2);
   m. To change the parameters of public participation in the scoping process into the attitudes and perceptions of the people which are significant impacts that must be predicted, evaluated, managed and monitored at every stage of activity;
   n. Conduct special studies of the impact will occur to the fishing communities around the location of the activity;
   o. Completing the map of the flow of liquid waste with the name of the river / creeks that are passed through before going into the sea to facilitate direction and control of the management and monitoring of the environment by the Government (District and Province);

p. To socialize information regarding of wages / salaries to be paid to every worker, especially for daily labor;
q. To give priority to hiring local labor at the time of admission as long as that they meet the requirements / specification required;
r. To plan for community programs (community development) according to the aspirations and needs of local communities and the potential of the region, based on the agreement and to coordinate its implementation with the local government;
s. To review referred, recent and relevant legislation in connection to action plans and their impacts;
t. To review and improve editorial typos.

3. Suggestions, input and feedback in detail are as attached to the minutes and an integral part of the minutes of meeting.
4. Of various input and feedback suggestions, promoter said it would follow up and make improvements all the entries submitted by the participants.
5. ANDAL and RKL- RPL documents Ammonia Industry and supporting facilities Development Plan in Uso village Batui Sub-district Banggai Regency Central Sulawesi, the revised will be submitted by the promoter to the Commission on EIA Appraisal Central Sulawesi province at the latest 14 (fourteen) days after the minutes accepted.
6. Minutes of Meetings of the Commission / EIA Technical Assessment Team Central Sulawesi as a basis / reference for the issuance of Recommendation of Environmental Feasibility Approval and Environmental Permit.

These minutes were made in good faith.

Person in Charge	HEAD OF REGIONAL ENVIRONMENT AGENCY CENTRAL SULAWESI As Chairman of EIA Appraisal Committee Central Sulawesi Province
Saut Poltak H. Simanjuntak Director by Power of Attorney PT. Panca Amara Utama	SYAHRIAL LABELLO, SH, M.Si Civil Servant Level IV/d NIP 19590405 198903 1 012

REVISION OF AMDAL DOCUMENT

No	Page	Question / Feedback	Revision
Drs. Dahlan H. Hasan, M.Si **Vice Chairman of the Technical Team, Member Sosekbud (Social, Economy and Cultural) Sector**			
1		To change the parameters of public participation in the scoping process into the attitudes and perceptions of the people which are significant impacts that must be predicted, evaluated, managed and monitored at every stage of activity	The addition of the attitudes and perceptions parameter has been added in the document Andal, RKL and RPL
Moh. Mirzan, S.Si M.Si (Chemistry)			
2	I-4	It is better that decrees of Minister of Environment on levels on Raw odor, decrees of Minister of Environment on Sea Water Quality Standard and Regulation of Minister of Health on terms and Water Quality Monitoring is also included, as in the Environment field these are used as reference	Has been added to the EIA document Chapter I, page I-7.
3	III-3	It is mentioned that Table 3.3 shows the results of the analysis of air samples in the previous EIA , while actually Table 3.3 shows measurements of noise intensity	It has been corrected. Table 3.3 should show the results of the measurement noise intensity. (EIA Chapter III page III-3).
4	III-6	Errors in the writing measured parameter values PM_{10} that do not match analysis table (Table 3.2)	It has been corrected. It should be 0.003 to 0.03 $\mu g/m^3$ (EIA Chapter III page III-6).
5	III-20 to III-21	• Government Regulation No. 82 no year mentioned • Table 3.9 no year mentioned • Previously mentioned water quality analysis is based on the Government Regulation No 82 but the description of Table 3.9, Its quality is based on Regulation of Minister of Health No.416/MENKES/IX/1990.	• It has been corrected, Government Regulation No. 82 Year 2001. (EIA Document Chapter III, page III-21). • Primary Data, 2012. It has been noted in ANDAL Chapter III page III-22. • For water, it is based on Regulation of Minister of Health No.416/MENKES/IX / 1990, on the advice of the EIA Commission.

No	Page	Question / Feedback	Revision
		• Should be mentioned clearly Musolang stream sampling at 2 sites (A1 and A2) and in which section (upstream or downstream or coordinate point) • Should describe some of the parameters similar to the air quality analysis	• A1 and A2 in the downstream. The coordinates are shown in the sampling locations (map 3.1 EIA Chapter III page III-4) • Some parameters such as TSS, pH, COD, BOD has been described (EIA Chapter III page III-21 s / d III-24).
6	III-29	• In Table 3.10 description it is mentioned that it is based on Regulation of Minister of Health No.416/MENKES/IX/1990 about water quality requirements, but the parameters of TDS, color and turbidity quality value do not match those in the regulation. • The table does not mention its source • Description of the sample location was not mentioned (SG1 and SG2)	• TDS value, color and turbidity are in accordance with Regulation of Minister of Health No.416/MENKES/IX/1990 • Primary Data, 2012. This has been noted (ANDAL Chapter III, Table 3.10 page III-33) • SG1 is at the southwestern part of the project and SG2 is located in the southern part of the project site. Has been added (EIA Chapter III, Table 3.10 page III-33).
7	III-31	It is mentioned again based on Government Regulation no 82 Group 1 but the description Table III-10 based on Regulation of Minister of Health No.416/MENKES/IX/199	It should be Regulation of Minister of Health No.416/MENKES/IX/1999. It has been revised (EIA Chapter III page III-32).
8	III-49	• Table 3-19 presents only one temporary location on the map location of samples but based on laboratory analysis there are 2 locations. • The table does not mention its source. • Some values of the quality standard parameter does not comply with Environment ministerial decree No. 51 of 2004 Annex I on harbor waters, why annex I because locations for seawater sampling are where it would be functioned for Jetty or ports which will be as ammonia vessel route	• Have included 2 locations (EIA, Chapter III page III-54) • Tables source has been mentioned (EIA, Chapter III page III-54) • Quality Standards refer to the Minister of Environment Decree No. 51 Year 2004 on Marine Water Quality Standards. Quality standard used is Attachment III for marine biota because of its location on the harbor waters are not open to public. PT PAU will only build jetty (private port).
9	IV-2	• It should be IV-2 but it says it II-2 • Table 4.1 seawater quality is unchecked for operations No 12 and 13, however this activity has the potential to impact the marine water quality degradation, as shown in Figure 4.3 page IV-5.	• It should be IV-2, has been revised • According to figure 4.3 the sea water quality is checked

No	Page	Question / Feedback	Revision
10	V-52	Some air quality parameters do not match the results of the laboratory analysis as shown in Table 3.2	It has been revised
11	Attachment	Bio data of EIA authors incomplete and should include competency certification (only that of the team leader is included)	Bio data is included in TOR-EIA
12	Whole Document	Question: Why are parameters such as NH_3 and H_2S odor untouched in this document when the results of laboratory analysis of these parameters and the measured value of NH_3 are detected in multiple locations. Logically, this is an ammonia industrial development in which there is Desulfurization that produces H_2S, is it possible that this work will not increase the value of odor (NH_3 and H_2S)? Why were estimated and calculated impact parameter only SO_2, NO_2 and CO although eventually classified as unimportant negative impact so it does not need to be assessed in the RKL and RPL?	In ammonia plant, the gas emission does not include NH_3 and H_2S
Dr. Ir. Yosep Patadungan, MP (Land)			
13		• Perform harvest rainfall on open space area, rain with a "Bio pore" system so that all rain water that falls on the RTH into the ground and none goes into the surface drainage. • To clarify in the RKL-RPL on the handling of solid waste from retention pond	• Efforts for harvesting rainfall using biopori system will be implemented in several possible places in the area the plant and in the area of Housing and Public Facilities • Sewage sludge from Retention pond will be periodically dredged and transported to a low location.
Ir. Jurair Patunrangi, MT (Civil Transport)			
14	II-8	Statement: Ammonia production of 2,000 tons / day or 700,000 tons / year • Is it the intermediate product or already in packaged form • Have not mentioned the transport system of production (per week - per month) • What is the impact on fishermen around the project area suggestion: • Need explanation (add) • Transport distribution system (add) • How about this (add)	• The final product was stored in liquid Ammonia Tank Container. • Ammonia production were loaded into the ship through the system piping • Impact on fishermen do not exist because the frequency of arrival of the vessel only 1-3 times per month and fishing boat are not banned from passing around Ammonia Ship

No	Page	Question / Feedback	Revision
15	II-9	Statement: State Road width of 4 meters and road width of 1 meter. Suggestion, maybe the shoulder is 1 meter	It has been revised in page II-9
16	III-4	Statement: The plan to relocate the state road on the sampling map and other maps (+ 12.340 km) Suggestion: To revise relocation trace on every map	Road relocation map is in map no. II State road relocation trace has been plotted in some thematic maps
17	III-34	Statement: Still no projected use of the road over the years. Suggestion: Add	State Road will be cut adjacent to areas of the project site and LNG Plant and it will be diverted away from the Project site so public transport is no longer using the road that crosses the Project site.
18	IV-2	Statement: • Table 4.1 page II-2 • Check matrix potential impacts, plan activities (foundation and supporting structure) and 9 (building...) • Demobilization post construction equipment • Transportation of products to distribute? • Post-construction demobilization Suggestion: • Table 4.1 page IV-2 • Check matrix potential impact, (to add) • Demobilization post construction equipment • To add	• Revised • Demobilization of tools is not included as potential impact (as per Terms of Reference EIA), as they only pass Batui-Luwuk State Road once. • Demobilization of equipment at the end of the construction phase has been added on page II-16.
19	RKL-RPL	Mobilization of equipment and materials (road damage) Supervisors, to match authorized agency (to revise)	Has been revised in the RKL document page III-14 and RPL documents page II-12 and II-13.
Ir. Aris Bulo Pasaru, MM (Geology)			
20	I-4	• Law no. 7/2004 is not about watering but about water resources • Add Law no 22/2001 on oil and gas exploration in relation to exploitation or production of natural resources which are strategic in nature	• Revised in Chapter I EIA page I-4 • Added in Chapter I EIA page I-4

No	Page	Question / Feedback	Revision
21	I-5	Government Regulation 38/2007 on the division of governments territory, provincial governments with sub-district and city governments	Revised in Chapter I EIA page I-6
22	III-4 Map3.1	Add a sampling point of society in the villages around the project area.	Sampling point of society added
23	III-27	Structure as a field site to be detailed as rod structure and the structure / types that can affect plant building	Added in Chapter III EIA page III-28 and III-30
24	III-28	Write down the notation of location structure (Eg. fractures) in remarks	It is in map 3.7 (EIA Chapter III page III-28).
25	IV-2 Table 4.1	Identification of social impacts Suggestion: Components of physical-chemical level, (Geology): In the first column of construction activities columns 8 and 9 should be checked as they relate to the structure, as well as an environmental component to the quality of construction hydro-oceanography column 8 should be checked as it relates to foundations and structure of the jetty support	Column 9 is in relation with land cover buildings. Jetty support is not a potential impact to hydro-oceanography because the foundations are built using pile system in a few places (localized)
26	Additional Regulations	- Regulation of the Minister of Environment No. 19 of 2010 on Waste Water Quality Standards for Oil and Gas Business/Activities where the raw material is gas • Regulation of the Minister of Environment No. 13 of 2009 on energy quality standards for oil and gas business and / or activities	This business activity is not included in the oil and gas business Sector because Ammonia industry is an oil and gas downstream sector.
Sumaryo BSc (Bidang Pertanahan)			
27		• After reading the documents, we believe that land acquisition has been carried out in accordance with the procedures set forth in the data of purchase completed. But the village chief and sub-district head ... and also had permits from the Banggai Regent. From land sector point of view everything has been done in accordance with existing regulations, so much from land sector	

No	Page	Question / Feedback	Revision
28	I-1 and I-2	• The results of an evaluation of the location of Ammonia Industry and supporting facilities Development Plan on behalf of PT PANCA AMARA UTAMA based on map of Designation of Forest and Water Area in Central Sulawesi province, is that the location of development is located outside the Forest Area or Area for Other Uses (APL) • Further it is suggested to solve the problems of land where there are third parties rights or other people in the location of industry development plan in order to avoid future problems of land	• - • Impact of land acquisition is managed as described in the RKL document page III-3 and III-4.
29	III-38	Narration: Soil erosion is very low - low but it is recommended to the company to still consider the principles of development around the river so that it is consistent with applicable regulations to minimize erosion	The impact due to the maturation of land that is the increase in soil erosion is managed as presented in RKL page III-15.
30	III-53	Narration: the phrase Primary forests is to be revised to be heavily forested areas	Revised in EIA page III-53
Ir. Idham Munandar (Site Planning)			
31	II-5	EIA Document (figure 2.1) Figure shown has not meet cartography principles. Please revise in accordance State Minister of Environment regulation No. 24 of 2009 Annex I	Map 2.1 has met the rules of cartography such as map title, scale, compass directions, coordinates and map legend. State Minister of Environment regulation No. 24 of 2009 is about the evaluation guidelines of Environmental Impact Assessment Document.
32	II-7 Public Consultation	It is stated that public consultation of ammonia industry and supporting facilities development have been done in 2 (two) meetings which are in January 2006 and April 2012. The second meeting it is mentioned that it was attended by the heads BPLH Banggai, Batui Head, Kintom Head, police chief, village chief Hombola, traditional leaders, community leaders, and so forth, among the 52 participants. It is stated that photos and list of attendees can be seen in the attachment, but the attachment only include photos, there is no list of participants which is an important evidence that public consultation activities actually carried on.	List of attendance is attached Announcement attached in TOR-EIA of Ammonia Industry and Supporting Facilities Development Plan by PT Panca Amara Utama Curriculum vitae list, a statement the chairman and each member of the team are attached to the TOR-EIA of Ammonia Industry and Supporting Facilities Development Plan by PT Panca Amara Utama.

No	Page	Question / Feedback	Revision
32	II-7 Public Consultation	1. Also the evidence of announcements documentation which is an obligation of the promoter in accordance with regulations regarding community involvement and information disclosure is not in the EIA document 2. Curriculum Vitae (last diploma) of the compilers and a statement that the chairman and each member of the team really put together EIA document which was signed on the stamp paper was not attached to the document. This is not in accordance with the State Minister of Environment regulation No. 24 of 2009, annex IIV. Please revise in accordance with existing regulations	List of attendance is attached Announcement attached in TOR-EIA of Ammonia Industry and Supporting Facilities Development Plan by PT Panca Amara Utama Curriculum vitae list, a statement the chairman and each member of the team are attached to the TOR-EIA of Ammonia Industry and Supporting Facilities Development Plan by PT Panca Amara Utama.
33	II-8	Pre-Construction Manpower Mobilization It is expected that it can be realized not only on paper only but in the field later. To try to recruit at least half of the labor required from the local community so as to avoid any jealousy in the community around the study area	Recruitment of manpower will prioritize local labor as explained in EIA document chapter II page II-8
34	Maps in Document	According to the State Minister of Environment regulation No. 24 of 2009 Annex VII, general maps to be included in the document are: • Map of Layout (missing) • Map of Land use • Map of the study area (social boundary, ecological and administration map) (missing). • Map of test sampling • Map of the planned location geological map topographical map • Some maps in the document do not have source of map. Each map source must be included in the map. The formats of the map are also not uniform • To revise and complete the maps in the document (the legend, notation, maps, etc.) according to the rules of good and right cartography	• Map of Layout added in EIA document chapter III page III-33 and III-34 • Map of land use/ map of use of land in the project site and surrounding area is there in EIA document chapter II page II-3 • Map of the study area (social boundary, ecological and administration map) added. EIA document chapter IV page IV-21 • Map of test sampling is in EIA document chapter III page III-4 • geological map is in EIA document chapter III page III-28 • Map scales are not uniform to follow the scale of map sources • Maps are in accordance of rules of cartography: Title, cardinal direction, scale, coordinate, legend.

No	Page	Question / Feedback	Revision
35	III-82	Environmental sanitation Environmental sanitation conditions in Table 3.47 to 3.50 which result from a survey, can add to the data from the relevant authorities to describe: • sanitary conditions in project site area, some indicators to observe are access to clean water, waste treatment location and sewage system. • Evaluating the community in project area for clean and healthy life behavior before and after the operations phase.	All data on the Batui and Kintom Sub-districts Public Health been collected through field surveys, but no data that include information on Environmental Sanitation.
36	III-82 to III-87	Components of Public Health In Chapter III of Environment, it is discussed about public health in the subsequent chapters it is not discussed again The discussion of public health should be added to components: • The scope of the study • Estimated significant impact • Evaluation of the significant impact • RKL-RPL It is a monitoring in the reduction in the quality of public health due to the operations one example is the emergence of variety of diseases	The impacts that affect public health such as dust, noise, emissions, degradation of water quality have been assessed and are not of significant impacts. Therefore, no further evaluation done and are not discussed in RKL and RPL.
Bambang (Department of Industry, trade and cooperatives Central Sulawesi)			
37		To add controller from related institutions	Controller and reporting from related institutions. RKL page III-4, III-8, III-11, III-18, III-20, III-22, III-33, III-35, III-37 and III-39. RPL page II-4, II-6, II-9, II-11, II-13, II-17, II-19, II-31, II-33 and II-35.
38		• Regulation relating to the business plan. Employment basis not included • Advice: To add Law no 13 year 2003 know about Manpower, Law No. 3 year 1992 on Social Security, Disputes Law no 2 year 2004 about the Settlement of Industrial Relations • Source of demonstration: Socialization regarding labor wage must be good and intense among the unskilled labor • The pay should be close Regency or Province Minimum Wage	• Added Law No. 13 of 2003 on Employment, Law No. 3 of 1992 on Labor and Social Security, Law No. 2 of 2004 on Industrial Relations Dispute Settlement. Document EIA Chapter I page I-4. • Workers' wages will be implemented in accordance with the Regency or Province Minimum Wage for Banggai.

No	Page	Question / Feedback	Revision
Mansur M (Investment Coordinating Board of Central Sulawesi)			
39		How far the company can improve the welfare of society	The company will pay attention to Environmental Public Welfare through CSR programs in coordination with relevant agencies
40		Natural gas is self-produced or from other companies? What is the connection with Donggi Senoro	PAU obtained Natural gas from Gas Manufacturers JOB Pertamina-Medco. PAU does not have anything to do with PT DSLNG.
41	III-60	The research was conducted in only 6 villages while there are 12 villages mentioned on page II-7 Labor used 1000 people hence a chance to improve the livelihoods. Local residents to be prioritized	Villages affected by the forecasted covers 6 villages as presented in Chapter III EIA document page III-60. Page II-17 does not mention 12 villages.
42		CSR discussion missing (2.5 percent of the profits), to reduce the socio-economic impact during operation	The company will implement CSR by coordinating with related agencies and in accordance with the conditions of the Company. Terms CSR 2.5% of profits applies only to state owned enterprises
43		In relation to investment, sectoral licensing authorization have been transferred to the regions	-
44		Quarterly report to be submitted	The company have been submitting progress reports to BKPM in accordance to the regulations
Ir. Bambang Sunaryo, M.Eng. Sc (Department of Transport, Communication and Information Central Sulawesi)			
	RKL III-13	3.1.4.4 Road Damage	
45		Point 5 Environmental management, it is written that maximum axel load of vehicles is 10 ton	
46		To revise while based on the Decree of the Minister of Transportation No. KM 13 Year 2001 on the Establishment of the classes of roads in Sulawesi, it was determined that the Luwuk - Batui road is of Class IIIB, which means that the motor vehicle, including the cargo, which is allowed to pass has width of not more than 2,500 millimeters, length not more than 12,000 millimeters and heaviest axis payload (MST) of eight (8) tons	It has been revised to 8 tons. EIA Chapter V page V-7. RKL chapter III page III-13

No	Page	Question / Feedback	Revision
Ir Ucik N Sangkalia (Bureau of development administration and natural resources administration Central Sulawesi)			
47	Table Marine Animals	In the species name column should be region name, In the region name column should be Latin name	It has been revised in EIA document chapter III page III-59
48	RKL III-28	To No. 8 it should be added the Bureau of development administration and natural resources administration Central Sulawesi	It has been added Bureau of development administration and natural resources administration Central Sulawesi. RKL document page III-28
No	**Page**	**Question / Feedback**	**Revision**
49	Others	• Appreciation to consultant and promoter, BLDH to note that the consultant can be recommended for other EIA compilation • Things documented to be implemented	Thank you, hopefully we can maintain trust. This document is as a result of good cooperation with the promoter (PT PAU).
50	II-3	To write Figure 2.1 (not Map 2.1)	We differentiate between maps and figures. Maps must adopt cartographical principles such as scale and coordinates. Figures do not.
51	III-3	• Source of data to include which laboratory performing the analysis • Line 7 from top should be: Table 3.3 analyzes the results of measurements of the intensity of the noise, not the analysis of the amount of air in the previous EIA	• It has been added in EIA document chapter III page III-3 regarding which laboratory performing the analysis of the air sample • Revised in EIA document chapter III page III-3
52	III-21	To add source (Laboratory) performing the analysis of the data (data of Table 3.9)	It has been added in EIA document chapter III page III-22 regarding which laboratory performing the analysis of the water sample from Musolang river
53	III-29	To add the Laboratory source regarding DO, BOD, COD. Not mentioned in the analysis	It has been added in EIA document chapter III page III-29 regarding which laboratory performing the analysis of the well water sample (ground water)
54	Chapter I	Need to elaborate the uses of ammonia (NH3)	It is described in chapter II
Alimuddin Pada (NGO Katopasa Palu)			
55	For Supporting Facilities	What have been managed and what is to be managed. Need to be stated in this document such as: whether the port is included in this document	For the environmental impact of the port will be reviewed in the Ports UKL and UPL
56	II-19 Paragraph two	The phrase ‘and others’ to be specified	‘And others’ has been deleted because the details regarding the supporting facilities are plenty

No	Page	Question / Feedback	Revision
57	III-23 Morphology	To observe that the morphology of the study site has slope of > 40% and elevation of 800 meters then public education is required	Administrative boundaries of the study area with slope> 40% with an elevation of up to 800 meters. Project site itself is of flat and flat corrugated morphology (Chapter III EIA document page III-34). Slope of the project site is generally> 8-15%, only a small area has slope> 30% (Map 2.3 EIA page III-16).
58	Figure 3.4	Caption of figure to be added	Figure caption has been added below
59	I-3 and III-50	Land size in I-3 (200 Ha) and in page III-50 (50 Ha) which one is right?	Location Permit 200 Ha EIA Chapter I, page I-3. Ammonia industry and supporting facilities development at this stage only requires land area of 50 hectares EIA Chapter III page III-50.
60	III-68	Rubber farms, does that really exist?	According to the team there are some rubber plants, but not a farm
61		Land for industry, community farms might be inside, people have to meet their needs, what is to be done	Impacts due to land acquisition have been studied in EIA Chapter V. This land acquisition will have a positive impact of increasing incomes and the negative impact of conflict. These impacts are managed in RKL. The people whose lands have been acquired are prioritized to work at PAU according to their needs and abilities.
62	Need to add	The consequences if ammonia is in contact with human, land area, etc.	Ammonia is stored in tanks at a temperature of -33°C so it is safe for the environment including the operator working in the plant as described in Chapter II EIA document.
Ir. Eva Rantung (Monitoring and Natural Resources Conservation Department BLHD Central Sulawesi)			
63	RKL III-31 – 35	RKL should also include cooling water (seawater temperature increases) and the process of making ammonia (reduced air quality and reduction in quality of sea water) as described in the EIA document.	It is described in EIA Chapter V that rising sea temperatures, reduced air quality and water quality are negative but not essential, as emissions, waste water and rising sea temperatures can meet the quality standards. Therefore management is not done / not included in RKL.

No	Page	Question / Feedback	Revision
64	RPL II-27 30	RPL should also include cooling water (increase of seawater temperature) and the process of making ammonia (reduced air quality and reduction in quality of sea water) as has been detailed in EIA document.	After review, the impact is not significant hence not included in the RPL.
65	To add	To complete the map of the flow of liquid waste with the name of the river / creeks that are passed through before going into the sea to facilitate direction and control of the management and monitoring of the environment by the Government (Sub-district and Province)	Liquid waste is not directly discharged into the river, but processed to meet the quality standard and then discharged to the sea(See Chapter V EIA document).
66	Page 4 Basic Legal Regulation	Need to add: • Law No. 18 of 2008 on waste management • State Minister of Environment Regulation No. 30 of 2009 concerning the implementation of the licensing and supervision of B3 waste management and recovery from B3 pollution • Government Regulation No 18/1999 on the management of toxic waste	Law No. 18 of 2008 on Waste, State Minister of Environment Regulation No 30 Year 2009 concerning the implementation of the licensing and supervision of B3 waste management and recovery from B3 pollution have been added (EIA Chapter I page I-7)
67	II-6 - 7	• For the remaining land not freed or to be freed to refer NJOP or prices prevailing in the market. • At the time of labor mobilization to actually take the local workforce from the villages nearby the project site according to the type of labor to be used • During land clearing to really pay attention to unused material so that it is located in one place to be processed or transported elsewhere • To complete all licenses in relation with ammonia industry and supporting facilities development	• The remaining land to be freed will refer to NJOP or prices prevailing in the market • The required labor will be recruited in first priority from the village where the project site is located (Uso village) and the surrounding villages (EIA Chapter II page II-8) • Plants cleared from the land planned for the Project site, will be collected on low land in green open space (EIA Chapter II page II-10). • Permits for Ammonia Plant construction will be met by the PAU in accordance with the applicable regulations
68	II-11	• The development should really pay attention to the environmental aspects of the affected surrounding • To observe WWTP construction waste processing and storage / storage of B3 waste in accordance with laws and regulations • To prioritize local labor and local contractors according to type of job	• The promoter will observe environmental management according to RKL. • Liquid and solid waste treatment will be carried out according to the rules (EIA Chapter II pages II-35 to II-37. • The promoter will prioritize local labor and contractors in accordance with the needs and capabilities

No	Page	Question / Feedback	Revision
69	Operation Stage	• Labor used during operation stage is a local workforce that has been trained in accordance to expertise • Problem of waste from offices and housing really is really managed according to the rules and to cooperate with government and communities in the management of waste to make compost • CSR and CD (Community Development) should be in the form of coaching and capital to community groups gathered in one (1) body that is a cooperative that can prepare the needs of the company / plant	• The promoter will prioritize local labor in accordance to their needs and abilities • Management of waste into compost will be considered and may be included in the CSR program if approved and deemed beneficial to the environment • Will be considered in accordance with the condition of the Company.
70	Post Operation Stage	In the post operation stage to refer to the known EIA document	The company will carry out what are covered in the EIA documents.
M. Yunus (Batui Sub-district Head)			
71		• Local labor to be noted, during pre-construction stage labor should be local. • To have a local labor skills improvement program such as schooling • CSR to be coordinated with local institutions • C gravel companies that do not have permits are not to be employed	• The promoter will prioritize local labor in accordance to their needs and abilities • The promoter will perform in accordance with the applicable provisions of the Company. • The promoter will coordinate with relevant agencies. • The promoter will work with the C gravel Company with permits.
Surait Salim (Uso Village Chief)			
72		• To prioritize local workforce • Local contractor also to be prioritized	The promoter will prioritize local labor and contractors in accordance with the needs and capabilities
Jamhur Hakim (Community Leader)			
73		• Sub-district Heads and village chiefs should not only be utilized during pre-construction stage • What is the definition / perception of local? Is it the sub-district, the province? • To clarify local workers around the project site	• The promoter will always work with sub-district Heads and village chiefs in accordance to their authority. • The sequence is started from the village, sub-district, Banggai regency and Central Sulawesi. • In accordance with the proximity to the project site

No	Page	Question / Feedback	Revision
74		• Health environmental impacts. Preliminary data shows ISPA disease is an impact of LNG	
75		• The potential labor conflicts to be noted • Sub-district heads should be involved in the recruitment and local contractors	• Already included in the estimated impacts, EIA Document Chapter V. Afterwards, to be managed and monitored in the RKL / RPL. • Hiring of labor and local contractors will be prioritized according to their ability and Company's needs and to be coordinated with the sub-district head with Community Leaders.
Kintom Community Leader			
76		Labor especially unskilled labor around the project site to be prioritized	The promoter will prioritize labor from around the project site according to the company's needs and their skills
Batui Community Leader			
77		To pay attention to the social relation with the public	The promoter will pay attention to the social relation with the public
78		Recruitment of Ring I and Ring II workforce to be from local	The promoter will observe that the recruitment of Ring I and Ring II workforce to be from local according to the company's needs and their skills
Moh . Irfan (Public Information Group Batui Sub-district)			
79		• There are many violations by investors. Primarily by sub-contractors and main contractors. Many labor trafficking from Java • Sub-contractors also are to obey EIA documents	• The promoter will prohibit the Contractor and Sub-contractors from committing violations and labor trafficking. • The promoter will present the main relevant points of the content of the EIA documents to be complied by the Contractor and Subcontractor.

ATTACHMENT - 14 : Government Certification for EIA Consultant

000028

KEMENTERIAN NEGARA LINGKUNGAN HIDUP

No. Registrasi Kompetensi : **0002/LPJ/AMDAL-1/LRK/KLH**

SERTIFIKAT TANDA REGISTRASI KOMPETENSI
LEMBAGA PENYEDIA JASA PENYUSUN DOKUMEN AMDAL

KEMENTERIAN NEGARA LINGKUNGAN HIDUP DENGAN INI MENYATAKAN BAHWA :

PT. WIDYA CIPTA BUANA

TELAH MEMENUHI SEMUA PERSYARATAN DAN KETENTUAN REGISTRASI KOMPETENSI SESUAI PERATURAN PERUNDANG-UNDANGAN :

PERATURAN MENTERI NEGARA LINGKUNGAN HIDUP NOMOR. 11 TAHUN 2008 TENTANG PERSYARATAN KOMPETENSI DALAM PENYUSUNAN DOKUMEN AMDAL DAN PERSYARATAN LEMBAGA PELATIHAN KOMPETENSI PENYUSUN DOKUMEN AMDAL

DITETAPKAN DI JAKARTA

TANGGAL : **12 JANUARI 2010**

DEPUTI MENTERI BIDANG PEMBINAAN SARANA TEKNIS DAN PENINGKATAN KAPASITAS

KEMENTERIAN NEGARA LINGKUNGAN HIDUP • REPUBLIK INDONESIA •

SUDARIYONO

Masa berakhir registrasi :
11 JANUARI 2013