

# CHAPTER I

## INTRODUCTION

---

### 1.1 Background

The rapid growth of development and economy in Bali, especially in tourism sector, service and agriculture have been driving significant impact on the increase of per capita income and the general prosperity of the community, by the Bali community even more some of the community outside Bali. The growth of new economic sectors as the multiplier effect of Bali development, has been placing Bali into a destination for job searching, therefore the migration/urbanization (migration to the city) to Bali is very high. Such condition, certainly, must be followed by the development of supporting facility and infrastructure of community's life. For example, the need of water supply to serve community's activity and service to the tourists, as well as the other socio-economic cultural development.

On the other hand, Bali as a small island ecosystem, especially those regions which are facing rapid development as Southern Bali; facing problem or lack of water resources. Most of the reserves of water resources in Bali Province depend on the forest area as the water resources support which are stretching out from on the middle to the west and to the east of Bali Island. From the hilly and mountainous area there are  $\pm$  401 rivers and  $\pm$ 162 estuaries which flow and spread around Bali's coastal areas and belong to one river basin (SWS 03.01 Bali Penida). The need of water resource to meet the need of community's demands and development of tourism sector, service and economic as what have been producing the imbalance between supply and demand, so that it causes rare water supply and not optimum service of water supply to the community, particularly to the basic facilities such as water supply for household, office, and hotels. On the other side, Bali has quite abundant water resources potential, however most of it is throwing away to the sea or it is not optimally managed.

Hence, it is the time and it requires developing a weir or dam to keep, store and use the potential in order to fulfill the needs of water supply, irrigation, and other usages as agriculture, livestock, fishery and socio-cultural activities by considering the availability of time, space, amount, and quality.

By looking at the climatology and hydrology factors, as well as the potential of water resources, particularly at the upstream and catchments area at Badung and Gianyar Regency, Bali Province, therefore the plan activity of Ayung River Dam development becomes one of alternatives to solve the problem of water resources supply in Bali Province.

### 1.1.1 Purpose and Benefit of Project

Generally, Plan of Ayung River Dam Development is addressed to:

- 1) Use surface water potential (river) that usually abundant on the rainy season and scarce in the dry seasons.
- 2) Building a dam in Ayung River to increase water supply and hydraulic electricity power

Benefits of the project are:

- 1) To fulfill the need of raw water at 3.6 m<sup>3</sup>/sec (for potable water, sanitation and city flushing)
- 2) To stabilize irrigation water supply for 9.542 ha in Subak Kedewatan, Mambal, Singempel, Peraupan and Oongan.
- 3) To generate hidro-electropower at 12.3 MW of capacity.
- 4) To protect upland from erosion, flood control and water resources development di Bali Province.

### 1.1.2 Regulations

Composition of the Environmental Impact Analysis study of this Ayung Dam is based on following regulations:

- 1) Law No 5 , 1990 considering Biological Resources and Ecosystem Conservation. It is related to dam development impact that potentially disturb rivers course ecosystem.
- 2) Law No. 24, 1992 considering Spatial Order. It is related to appropriate selected site in spatial plan.
- 3) Law No. 23, 1997 considering Environment Management. It is related to management of the project impact for the environment balance.
- 4) Law No. 22, 1999 considering Local Governmental. It is related to site project that potentially creates big and important impact.
- 5) Government Regulation No. 22, 1982 considering Water Regulation Order. It is related to provide water resources facilities.
- 6) Government Regulation No. 35, 1991 considering River. It is related to Ayung River
- 7) Government Regulation No. 27, 1991 considering Swam. It is related to possibilities of water inundation forming
- 8) Government Regulation No. 27, 1999 considering Environment Impact Analysis. It is related to procedure, management, committee of evaluation, guidance, monitoring, and others related to EIA.
- 9) Government Regulation No. 41, 1999 considering Air Pollution Control. This regulation arrange the noisy level permitted on a certain activities

- 10) Government Regulation No. 25, 2000 considering Central Government Authorities and Provincial Government Authorities as an Autonomous Area. It is related to authority of the government who will evaluate the EIA.
- 11) Government Regulation No. 77, 2001 considering Irrigation. It is related to irrigation existence in surround project site.
- 12) Government Regulation No. 82, 2001 considering Water Quality Management and Water Pollution Control, related to change of water quality.
- 13) Decree of Minister of Environmental No 02, 2000 considering the Guidelines of EIA Document Evaluation, and Decree of Bapedal Head No 09, 2000 considering the Guidelines of EIA Composition, with the reason of this certainty will become reference of EIA composition.
- 14) Decree of Minister of Environmental No. 40, 2000 considering Guidelines of EIA Evaluation Committee System by Provincial AMDAL committee
- 15) Minister of Environmental Affairs Decree No. 17, 2001 considering Sort of Business or Activities that should be completed with EIA. This regulation determine the structure and water discharge involve on the Activities that should be completed with EIA.
- 16) Head of Bapedal Decree No. 056, 1994 date of March 18<sup>th</sup>, 1994 about Guidance on Scaling Important Impact. It is related to important impact determination for this project's EIA.
- 17) Head of Bapedal Decree No. 08, 2000 about Community Participation and Openness Information on EIA Process. This regulation determines the procedure of publication and proposal screening, suggestion, and objection launched by community toward the project.
- 18) Governor of Bali Province Decree No. 515, 2000 about Standard on Environment Quality. This regulation determines various Standard Quality of the waste water, noisy, smelly, emission of vehicle, and others that should be carried out on this project.

All those regulations stated above oblige the initiator to implement EIA study. Moreover, those regulations are also set to be guidance on organizing Environment Management Plan and Environment Monitoring Plan.

### **1.1.3 National, Regional, Local and Company Policy**

Law number 23 year 1997 about environment management states that the development should go to sustainable development with environmental perspective. This development is a conscious and planned effort which combines the environment including the resources into the development process to guarantee the ability, prosperity and live quality of present and future generation.

Thus the environmental consideration must be implemented since the development planning, implementation and its evaluation so that the development is able to realize the

preservation of environment's supporting power optimally. It is also able to realize the balance among economic, socio-cultural and the environmental interests itself.

Government Regulation No 27, 1999 considering EIA and Decree of Minister of Environmental No 17, 2001 considering Sort of Business and/or activity which must be completed with EIA. To realize it, therefore EIA study as one of the feasibility studies must be implemented, especially to the activities which are predicted to cause big and important impact, therefore the impact occurred in the pre-construction phases, construction and post construction, then it is able to be avoided and anticipated as early as possible, through Plan of Environment Management Plan and Environment Monitoring Plan.

Balinese community has a very wise philosophy in managing the environment called **Tri Hita Karana** which is a realization of balance between human and God, human with human and human and the environment. The balance system has been organizing the space usage concept becoming areas functioned as protector at the upstream as well as settlement locations and economy at the middle part.

Related to it, so that in the planning of Ayung Dam development plan, principles of spatial plan, aesthetic, local community involvement, environment friendly technology, honor the local culture, concerning the environment quality standard, also cooperation with local institution and personals harmoniously, are required to be realized to balance the activity plan in order to make sustainable and harmonious situation.

#### **1.1.4 The Relation between Activity Plan with Big and Important Impact as Environment's Main Issues**

Plan of Ayung River multifunction dam development related to big and important impact towards the environment at impacted area, therefore several environment's main issues are formulated as followed:

##### **1. Main Issue in Pre-Construction Phase**

- a. Various community's attitudes and perceptions to the purpose, advantage, location selecting, design and Ayung Dam Project's impact
- b. Perception of the existence of holy places (Tangluk Temple, Beji Air Jeruk Temple, Subak Temple) Persepsi terhadap keberadaan tempat suci (Pura Tangluk, Pura Beji Air Jeruk, Pura Subak) will not be disturbed (inundated)
- c. Negative perceptions to the project from the owners and workers of tourism, particularly rafting companies
- d. Perception of tunnel existence at Subak Selat, so that it will not be broken due to the dam development
- e. The outside workers and their activities should be appropriate with the demography administration, and obvious contribution to the village.
- f. The increase of community's socio-economy potential

## **2. Main Issue in Construction Phase**

- a. The outside workers related to demography administration, contribution to the village and sanitation during their existence in base camp will rise restlessness among the local community.
- b. Increase of security disturbance and orderliness due to Terjadinya peningkatan gangguan keamanan dan ketertiban akibat banyaknya tenaga kerja dari luar daerah menetap di lokasi proyek
- c. Increase of air pollution and noise due to heavy equipments operation.
- d. Increase of traffic jam during the dam development material transportation.
- e. Increase of public infrastructure damage especially on the roads to the project location due to imbalance of conveyance's weight.
- f. Increase of water inundation on some particular areas which are really impacted the existence of holy place and community's land.
- g. Disturbance of flora and fauna's life around the project location due to the construction activities.
- h. Increase of job opportunities for community.
- i. Decrease of water quality to the downstream.
- j. Increase of public infrastructure rehabilitation, house of worship, landscapes around the location.

## **3. Main Issues in Operational Phase**

- a. Alteration of landscape and micro climate which influencing the community's activity and land.
- b. Increase of land use/area around the project.
- c. Possibility of flood if there is damage on the dam structure.
- d. Increase of community's economy potential.
- e. Increase of job opportunities.
- f. Increase of water potential and water supply level.
- g. Increase of new economy sources potential/diversification.
- h. (nature tourism).

## 1.2 Purpose and benefit of Study

Purpose of conducting Andal study of Ayung Multifunction Dam Development Plan:

- 1) Identify the activity plan which will be implemented especially those which will cause big and important impact to the environment
- 2) Identify the existing environment, particularly for those which will basically changed due to the activity plan
- 3) Predict the impact and evaluate the plan activity which will cause big and important impact to the environment
- 4) Formulate the Environment Management Plan and Environment Monitoring Plan

Benefit of this study:

- 1) As a material for regional development plan, especially for water resources development in Bali, as a basic to make a rational development decision
- 2) Avoid the design and location selection which will damage the environment
- 3) Help in making a decision determining the feasibility/unfeasibility of the activity plan investigated from the environmental aspect
- 4) Integrate the environmental consideration on the planning phase of Ayung Dam development in detail, particularly for the sensitive area, local values as well as cultural policy in the development area ,
- 5) Empower the community, government and initiator to consider the desires of stakeholders, especially the local community to be involved, since the activity planning in order to increase the feeling of owning and avoid such conflict in the future.
- 6) As the guidelines for management activities and environment monitoring.

## CHAPTER II SCOPE OF STUDY

---

### 2.1 Scope of Activity Plan which will be Analyzed

#### 2.1.1 Plan Activity of Impact Cause

Plan of Ayung River multifunction dam development, with the dam site of Ayung River's fragment at Banjar Buangga Getasan Village Petang Subdistrict badung Regency at the west, and Melinggih Village, Payangan Subdistrict Gianyar Regency at the east as well as inundation area cover a quite wide area (Figure 2.1)

##### 1) Activity Type and Scale

The activity plan is a big scale activity, involving two regencies (Badung and Gianyar Regency). Development of Ayung Dam is predicted will be useful for agriculture water supply for 9.542 ha which increase agriculture production from 4.23 ton/ha into 4.74 ton/ha. Beside that, these activities will increase raw water from 600 lt/sc into 3,600 lt/sc and generate hydro-electricpower into 12.3 MW.

Development of Ayung Dam will cover river basin area  $\pm 218.41 \text{ km}^2$  wide, 73.17 ha of inundation of dam water surface, reserve 10,562,600  $\text{m}^3$  of water at normal elevation water level  $\pm 377,00 \text{ m}$  and maximum elevation flood water level at  $\pm 377,70 \text{ m}$ .

Main Dam is made of concrete gravity with maximum high 104,00 m from the bottom of the structure. River bed elevation is 280,00 m with free board 2.40 m. Length of the crest 221,25 m, with peak dam elevation + 380.10 m. Width of the crest 6.00 m with filled volume 356,709.95  $\text{m}^3$  and foundation grouting 3.90 m at the up-stream slope vertical and downstream slope 1: 0.8

Spillway type of this planned dam is ogee complemented with gate in crest width 3 x 8 m. Spillway crest elevation + 367.00 m with upstream slope 1 : 1 and downstream slope 1 : 0.8

Intake structure type is Vertical Sliding Gate with gate dimension 2.5 x 2.5 m, inlet ground elevation + 355.90 m, penstock length 120 m with steel construction and tunnel dimension 2.00 m.

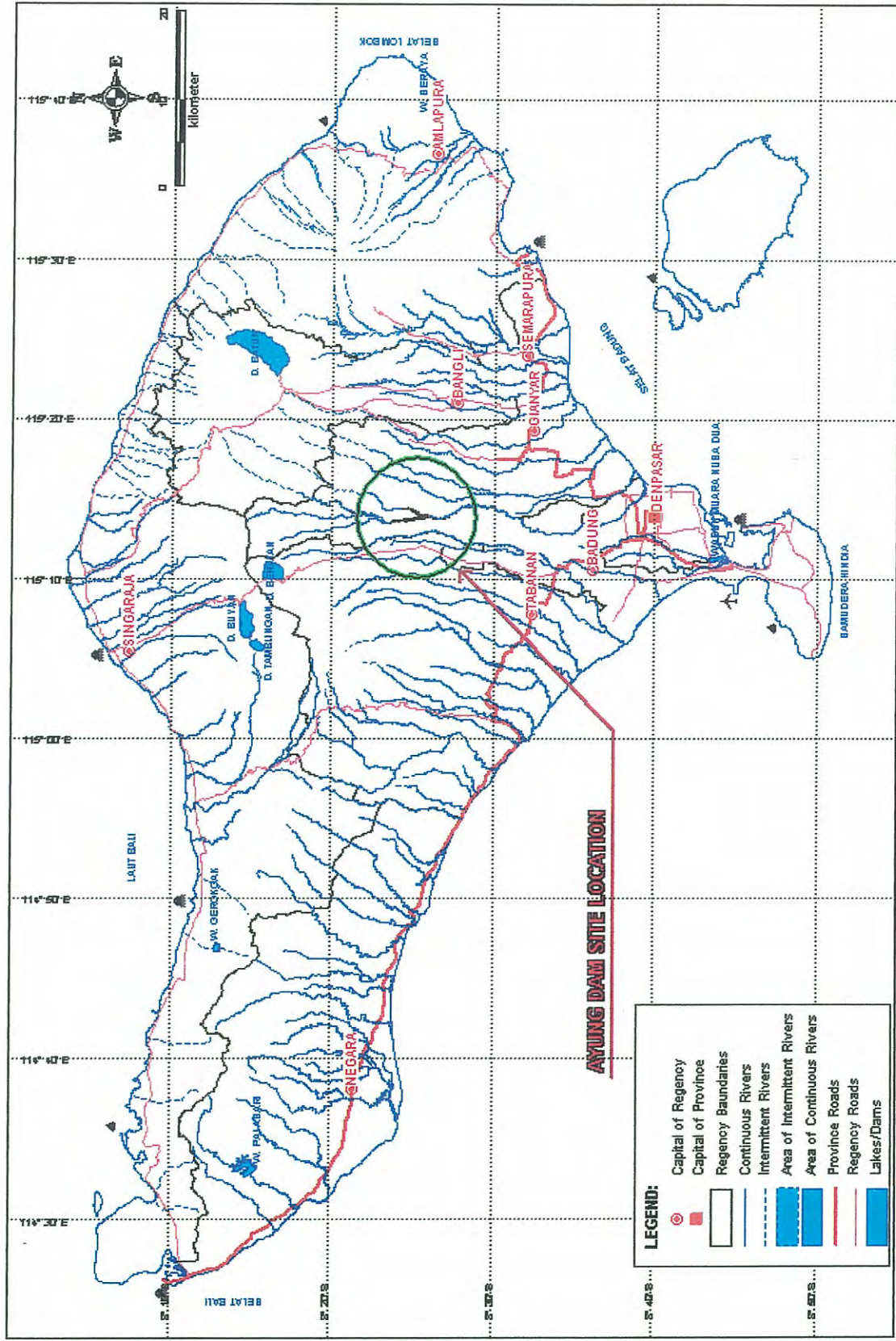


Figure 2.1 Map of Ayung Dam Development Activity Plan Location



## 2) Activities Phase

### (1). Pre-construction Phase

On this phase, socialization is made to inform following subject:

- Determination of plan activity location borders by field measurement
- Land acquisition that will be used for Ayung Dam development activities.
- Socialization about plan of activity implementation phases such as pre-construction, construction and post construction phase.
- Erection of information board for construction planning and announcement on local media about EIA study
- Finishing of environment feasibility document and other documents which support the activities

### (2). Construction Phase

On this construction phase, the activities are:

- Equipment, material and manpower (employee) mobilization.
- Access road making,
- Base camp erection
- Land clearing and stripping
- Cut and filled for cofferdam, maindam, and spillway,
- Grouting,
- Stone composing and concrete,
- Earth material transporting in or out from the site
- Quarry management including material cutting in the river bodies out of project site, and
- Dam instrument installation.
- Construction high-voltage power.
- Equipment and manpower (employee) demobilization.

### (3) Post Construction/Operational Phase

On the post-construction/operational phase, activities which will be implemented are:

- Cut off plugging canal and reservoir impounding
- Dam / intake gate operation which consists of water distribution for irrigation and water supply.
- Maintaining the structure function, such as sediment excavation, mechanical oiling, broken equipment exchange when it is broken, and others.
- Conservation area maintaining for ecological, drainage, ergonomic and esthetic purpose.
- Recreation services. As commonly water structure and wide water view are always interesting for the people for recreation and family entertainment.
- Administration services consist of dam operation and maintaining purpose, for young people education purpose, even for recreation services.

- Security guardiance of dam structure and area from crime, sabotage, and visitor security or orderlines of the visitor.

### 2.1.2 Existing Activities around Project Location

Location of Ayung River Multifunction Dam development plan and its surroundings are a mixture area (natural and cultivation) which have beautiful view, wavy topography of land, steep ravine and intersting terrace. Some main activities around the location which should be considered in analysing the environment impact include:

- Ricefield and dry land agricultural activities. Agricultural activities are dominant in the area around dam site, particularly at the upstream and catchments area of the dam. The high activity portion is predicted will give significant impact to the dam ecosystem after inundation. Agricultural wastes as nutrient element (Total Nitrogen, Total Phosphorous, organic wastes, pesticide, and sedimentation Total Suspended Solid and Total dissolved solid), directly or indirectly will be in and stored at the dam through the flow of Ayung and Siang River and the estuaries at the catchments area.
- Tourism activities take the advantage of Ayung River's flow. There are seven rafting companies at Petang Subdistrict (Bali Fantasi Rafting, Mary Rafting, Bali Adventure Rafting, Bahama rafting, Mega Rafting, BMR Rafting, Ayung Resort Rafting) and one at Payangan Sub district (Sobek Rafting) that use the flow of Ayung as the main part tourism attraction provided. This tourism activity is closely related and will be disturbed even its sustainability will be in danger due to the dam development activities. Most of the predicted impact is some rafting activities at the upstream of dam cannot be operated because of the inundation and disturbance during construction as well as temporary ceasing of activity on the inundation, especially for the rafting companies at the downstream of dam site
- Activities of tourism service as Trekking, hiking or bicycle riding through paths in the villages. Several travel agents in Denpasar and Badung have tourism package as going through the village and river side of Ayung. The relation between this activity with the project is relatively small. There will only be a bit disturbance on traffic, noise and tourism comfort.
- Community's religious activities which are using the flow of Ayung as well as its campuhan, such as *melasti/mekiyis*. This problem related to the activities of the project is quite complex. It needs to do accurate approaches to formulate the solution toward the disturbed local values, even there will be removal of certain elements.

### 2.1.3 Scope of Early Environment

The existing main environments at the study area are forest, ricefields, plantation, settlement and Ayung River. Apart from it, the existing environment of socio-economy, culture and community's health (existence of ancient cemetery, *pesucian*, temple or cultural sites, etc.)

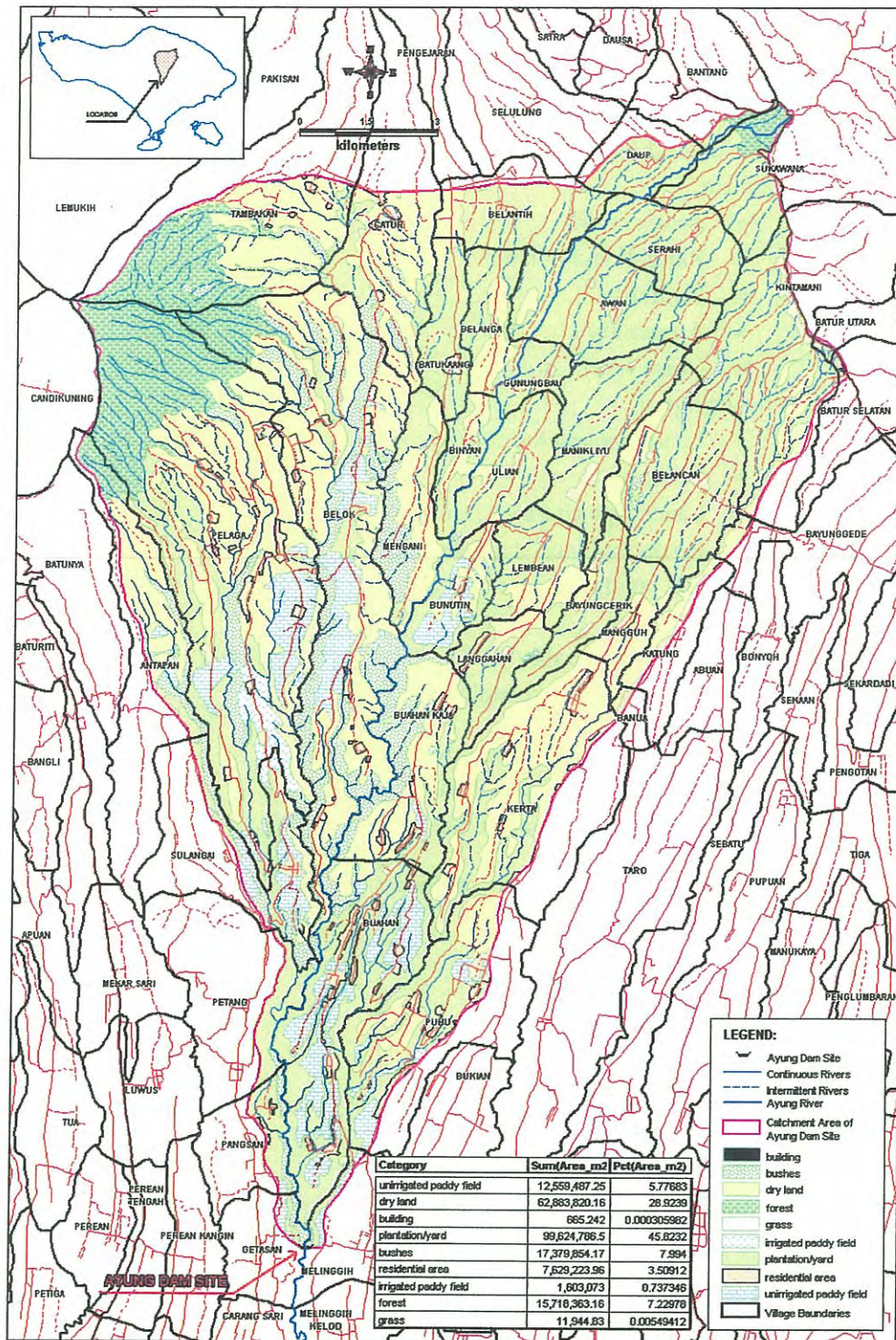


Figure 2.2 Land Use of Ayung River Watershed

#### **2.1.4 Analyzed of Early Environment**

The existing environments which are predicted to be impacted are physic-chemical environment, biology and socio-cultural at the dam site. The main environment components which are studied are as followed:

##### **1) Geo-physic and Chemical Component, includes:**

1. Climate :
  - Temperature
  - Rainfall and rain day
  - Humidity
  - Air quality
  - Noise level
2. Physiography
  - Land topography
  - Geology
  - Landscape characteristic
  - Rocks and land characteristic
3. Space, soil, and land usage
- 4 Hydrology
  - River water quality
  - Water resources potential

##### **2) Biologic Environment Component, includes:**

- Terrestrial flora and fauna
- Aquatic flora and fauna

##### **3) Social Environment Component, includes:**

1. Demography
  - Demography
  - Age structure
  - Education
2. Community's socio-economy
  - Household's economy
  - Community's income
  - Land ownership
  - Local and regional economy
  - Public facility
3. Socio-cultural
  - Tradition, cultural norm and value
  - Kinship system in the community, and social institutional
  - Culture's heritage
  - Social and institutional stratification
  - Community's attitude and perception
4. Community's health
  - Sort of dominant and specific disease
  - Sanitation



## **2.2. Scope of Study Area**

### **2.2.1 Project Area Borders**

The project borders cover the activities site determined based on space and land used for Ayung Dam development, those are multifunctions weir and its supporting facilities, including access road purposed for the access from the left side of Banjar Buangga or right side of Payangan Village. Geographically, the dam location is on coordinate of 8 23'30" South Latitude – 8 26'00 South Latitude dan 115 13'30" East Longitude – 115 14' 30" East Longitude.

### **2.2.2 Administration Borders**

The administration borders of the project determined by the borders of the villages, those are Getasan Village in the West and Payangan also Buahah Village in the East. However, the impact spread implicates the larger administrative areas, such as Denpasar City, Badung regency, Gianyar Regency and other regions which are indirectly impacted by the development and operational of the planned dam.

### **2.2.3 Ecologic Borders**

Ecologic borders determined based on the consideration of important impact and wide of spread area ecologically, indicated by the landscape as river, or even topography form of land around the project location. Ecologic areas are the borders of Ayung river basin, where at the upstream there is forest, around the project location are agriculture and plantation land, while at the downstream are settlement and tourism activities centre, commerce, governmental and education (at Gianyar Regency, Badung Regency and Denpasar City) which still belong to Ayung river basin. Natural components in these ecologic borders are able to interact with each other and having chance to get stimulant change which will affect the existence of natural components in the future.

### **2.2.4 Technical Borders**

Technically, the borders of this environment investigation include the investigation towards influencing aspects of environment component on design planning borders. As the consequence of the planning and development, therefore recovering acts or plan of creating new balance are needed, in so that the pressure toward the previous natural balance is no longer exist.

Specifically those technological limits are : 1) River basin area  $\pm 218.41 \text{ km}^2$  of wide, 73.17 ha of inundation of dam water surface, reserve 10,562,600  $\text{m}^3$  of water 2) Normal elevation water level  $\pm 377,00 \text{ m}$  and maximum elevation flood water level at  $\pm 377,70 \text{ m}$ .

The borders of AMDAL study area of Ayung Dam Development Plan are shown on Figure 2.3 to Figure 2.4.

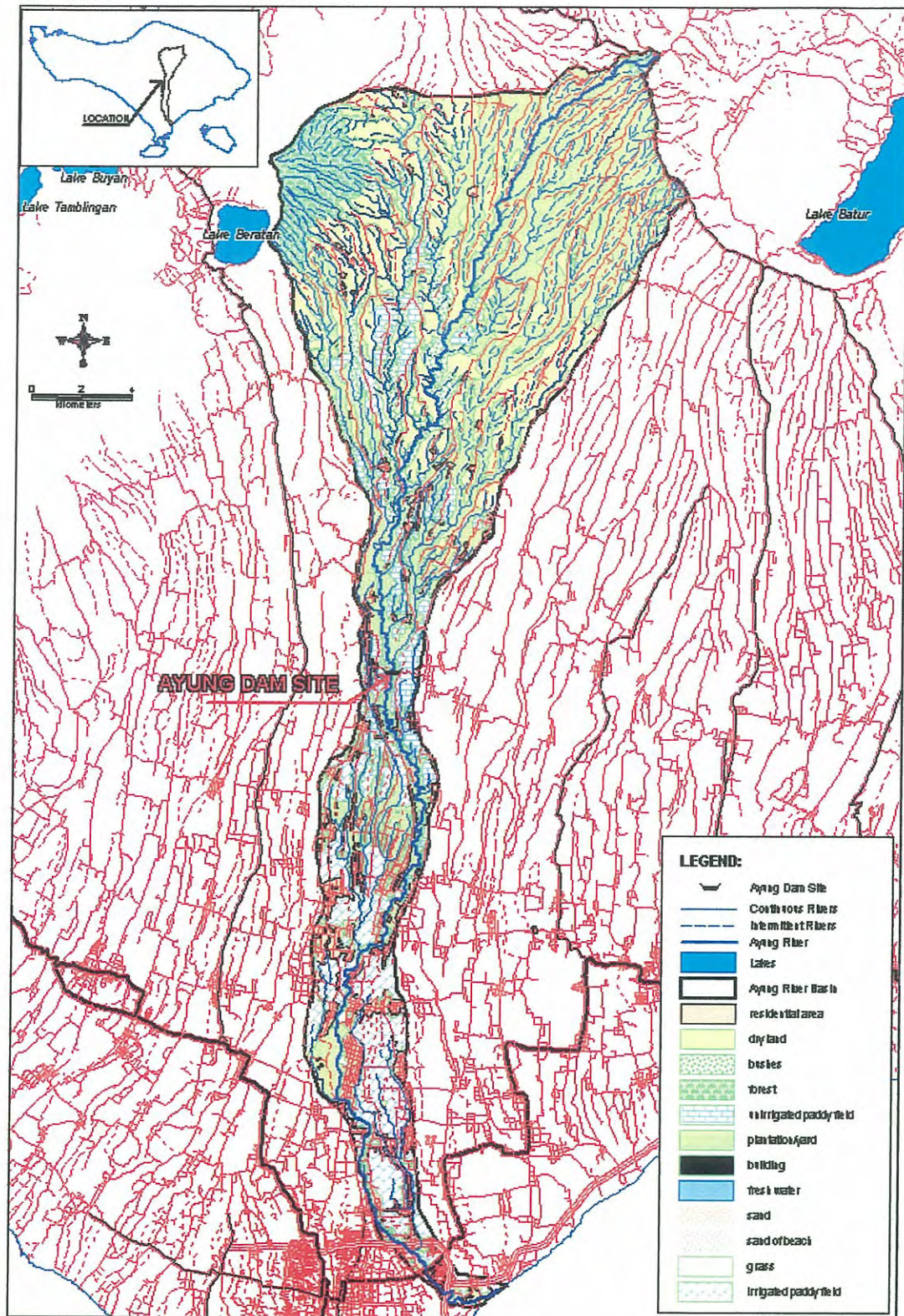


Figure 2.3 Project Area and Ecological Borders



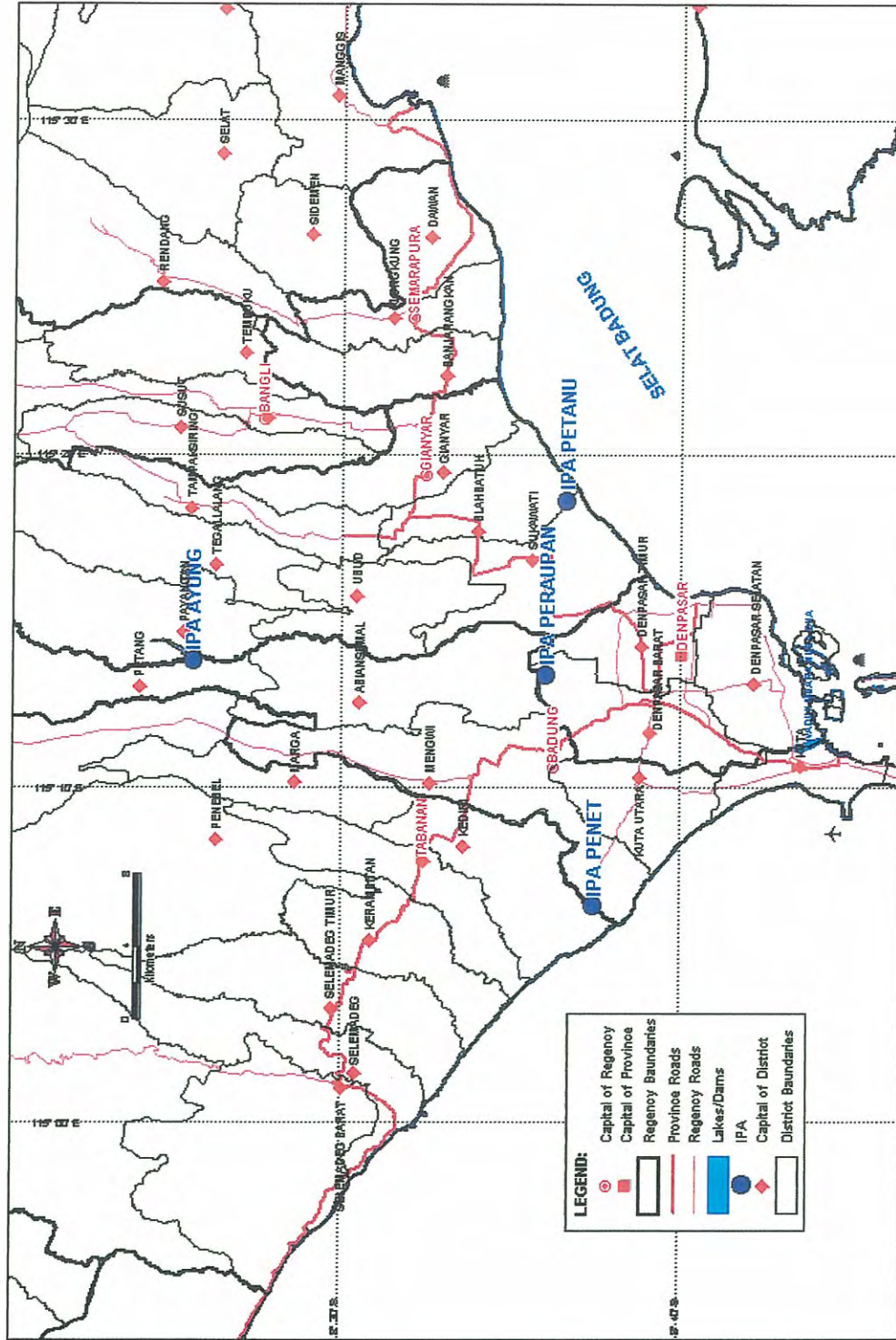


Figure 2.4 Administration Borders