

### Rafflesia

The habitats are rather mountainous areas. The world's most spectacular parasitic plant is found in the tropical forests of Borneo, Sumatra and Java. There is a special Rafflesia reserve at Batu Palupuh near Bukittinggi in Sumatra. It has no leaves but derives all its energy from the tissues of the ground-trailing vines it parasitizes. Cabbage-like buds burst out of the vine and eventually open as enormous Rafflesia flowers, colored in livid splashes of brown, red and white.

### Amorphophallus

This plant adopts a similarly parasitic life and pollination strategy. There are several species of this aroid plant which is common in lowland forests. The most impressive is the rare Amorphophallus titanum of Sumatra whose giant flowering spike grows rapidly. It gives off a stench which attracts small flies and beetles.

## 2.4 Wildlife

Research reports on large mammals were intensively collected because the Kampar river basin is said to be their important habitat. Some reports mention the characteristics of Riau Province with vast rain-forest, a haven for animals. It is estimated that there are between 1,100 and 1,700 elephants, 400 tigers, plus a few rare Sumatran rhinos.

### Asian Elephant

The Newsletter published by IUCN/SSC (1990) summarizes the condition of elephants in Riau as follows. Although West Sumatra and Riau provinces support the largest number of elephants (between 1,100 and 1,700) in 11 groups with 65.4 million ha of forest area (Blouch & Simbolon, 1985), there is still not a single reserve set aside for their conservation. Much of Riau Province is flat and the elephants do not even have a refuge in the hills to go to when development activities invade their traditional habitats. The Nature Conservation Bureau (PHPA) has embarked on the capture of chronic crop raiding elephants from the view to domesticating them at the settlement effectively using them in forestry and tourism. The observed mortality rate among captured elephants has been high 37% (Santiapillal & Widodo, 1989). These loss of elephants is mainly due to poor veterinary care and management under captivity.

The Nature Conservation Bureau in Riau Province informed that the population of elephants was few and it is estimated at 1,100. In 1992, 31 elephants were transferred to the Game Siak Kecil Reserve from the Kotapanjang hydropower project site. According to previous studies, the number of elephants has been estimated as below.

- 225 heads in Kampar regency;
- 45 heads in Indragiri Hilir regency; and
- 190 heads in Indragiri Hulu regency.

### Sumatran Tiger

It is estimated that there are 400 tigers in Riau Province, but there are no data available on West Sumatra Province. The Sumatran Tiger is quite small in relation to the other races, and quite diminutive compared with the enormous Siberian Tiger. Tigers do most of their hunting by night, and they travel up to 30 km in a single night searching for food.

Sumatran tigers live at very low densities - typically one in every 50 km<sup>2</sup>. They can be found in all forested habitats, from lowland swamps to the high altitude. Since the range of male territory is rather large to feeding and breeding, at least 750 km<sup>2</sup> would be needed to maintain a reasonable population.

### Sumatran Rhinoceros

Although in the past, 11 rhinos were captured, its population is very few in Riau Province at present.

Two species of rhinoceros are found in Indonesia. The one-horned jawan rhinoceros, now found only in Ujung Kulon reserve in Java Island, is one of the world's rarest mammals. The Sumatran rhino has two horns and is the smallest living rhinoceros.

Today rhinoceros are found only in small scattered populations living in rugged terrain like the Mt. Leuser Reserve in North Sumatra Province. They regularly visit favorite mud wallows and this habit has made them especially vulnerable to poachers and hunters seeking the valuable horn.

### Other Valuable Species in this area

Sun bear, Tapir and some apes are valuable species in the study area. Valuable apes in the study area include the Orangutans which are found only in Borneo and North Sumatra nowadays, and White-handed gibbon and Agile gibbon.

## **2.5 Valuable Aquatic Fauna**

Some scientists have mentioned some influence by dam construction on the life cycle of migrant fishes breeding in the rivers. Although the ecological habit of migrant fishes breeding in the big rivers of Kampar and Indragiri has not been clarified, some information were collected from the interview with some fishery scientists as follows:

### Tapah

This species is said to go up the rivers and find the puddle, which is usually made by a flood, for their spawning spot. Their spawning season is between September and December. Artificial flood control with dam may lose the puddle, resulting in the loss of habitat for spawning.

### Patin

This species has been ordered for conservation by the Local Government because of its commercial importance and serious decrease in number. Patin fish lives in the estuary (salinity: 20 - 25 permil) at young stage. When they grow up, they go up the rivers for spawning. They need a rather deep pool of 3 to 5 m for incubating their spawn. Their spawning habitat is between Danaubingkuang and Muaramahat in the Kampar River.

### Freshwater Shrimp

This species spawn in the estuary (salinity: 5 - 12 permil) a few miles from the seacoast. They go up rivers with their growth as far as Rantauberangin in the Kampar River. It was found 7 species in this study area of Kampar River and Indragiri River:

### Freshwater Shark

Three species of freshwater shark is found in only the Indragiri River. They are listed as one of the endangered species and the population is very low. The freshwater sharks live as far as Rengat and spawn in the sea.

### Leptobarbus Fish Species

Leptobarbus fishes spawn at upper reaches of rivers. They are delicious and are cultivated at some places using the natural fry of fish. Although the population is high especially in the Kampar and Siak rivers, the population has been decreasing recently because of its commercial importance.

## **CHAPTER 3 PROPOSED STRUCTURES AND STUDY AREA FOR AMDAL**

### **3.1 Proposed Structures of Preliminary Study for ANDAL**

The following are proposed as the major structures for the Overall Development Plan:

- (1) **Kampar River Basin**
  - **Kampar Kiri No. 1 Dam**
  - **Kampar Kiri No. 2 Dam**
  - **Kuok Intake Weir and Irrigation Canal**
  - **River Improvement Works for Kampar River System**
- (2) **Indragiri River Basin**
  - **Kuantan Dam**
  - **Lubukjambi Intake Weir and Irrigation Canal**
  - **River Improvement Works for Indragiri River System**

### **3.2 Study Area of Preliminary Study for ANDAL**

General information and data on environmental components on the study area have been collected over the whole Kampar and Indragiri river basins.

#### **(1) Study Area**

The study area is within the watershed boundaries of the Indragiri and Kampar rivers.

#### **(2) Ecological Boundary**

The ecological boundary of this study is the aquatic ecosystem in the catchment areas.

#### **(3) Administrative Boundary**

The administrative area includes parts of West Sumatra and Riau provinces.

### **3.3 Proposed Structures for ANDAL Study**

The main features of the priority projects proposed for feasibility study are as given in the following subsections.

### 3.3.1 Kampar River Basin

(1) Kuok Intake Weir

- Weir Crest : EL 40 m
- Weir Height : 3.7 m
- Weir Lengths : 161.6 m

(2) Irrigation Canal

The left bank channel is 44 km long and the right bank channel is 40 km. They will irrigate an area of 14,215 ha.

(3) Embankment

The flood protection dikes extend downstream from the intake weir.

- Length : 49 km of both sides
- Dike Width : 8 - 10 m
- Dike Height : 2 - 3 m

### 3.3.2 Indragiri River Basin

(1) Kuantan Dam

- Location : 5 km from Lubukkambacang
- Dam Height : 73.5 m
- Normal Water Level : EL 120 m.
- Catchment Area : 6,377 km<sup>2</sup> (excluding Singkarak lake basin)
- Gross Storage Capacity : 1,570×10<sup>6</sup>m<sup>3</sup>
- Reservoir Area : 91.5 km<sup>2</sup>
- Access : about 11 km from Lubukambacang.

(2) Lubukjambi Intake Weir and Irrigation Canal

(a) Dimensions of Weir

- Weir Crest : EL 60 m
- Weir Height : 5.7 m
- Weir Length : 132.6 m

(b) Dimensions of Irrigation Canal

The left bank channel is 76 km long. It will irrigate 9,376 ha.

(3) Rengat Ring Dike and Pumping Station

Embankment is planned around Rengat.

- Dike Length : about 25.4 km
- Dike Width : less than 19 m
- Dike Height : less than 4 m

- Pumping Station : 3 m<sup>3</sup>/s design discharge (with retarding basin)

### 3.4 Study Area of ANDAL

The ANDAL study area has been identified based on the proposed construction activities, ecological boundary, social boundary, administrative boundary and technical boundary.

#### 3.4.1 Kampar River Basin

##### (1) Construction Site

The following areas related to construction activities are included:

- Kuok Intake Weir site;
- Rantauberangin Irrigation Canal;
- Bangkinang Area River Improvement Works, including embankment; river channel excavation; construction of sluices, revetments and groins; and reconstruction of bridges.
- Temporary access roads to construction sites; and
- Quarry and borrow areas.

##### (2) Ecological Boundary

The ecological boundary has the following objective areas:

- The weir and irrigation canal at Rantauberangin; and
- The upper and lower reaches of the Kuantan Intake Weir.

##### (3) Social Boundary

In this ANDAL study, the regional boundary has been clarified according to the scale of socio-economic and socio-cultural activities related to the project activities.

##### (4) Administrative Boundary

The project site of Kuok Intake Weir belongs to Kec. Bangkinang of Kab. Kampar. The project site of the Rantauberangin irrigation canal belongs to Kec. Bangkinang and Kec. Kampar of Riau Province. The boundaries are shown in Fig. V.3.1.

##### (5) Technical Boundary

This boundary is formed in consideration of the problems of each project stage such as time, labor, accessibility and sampling.

### 3.4.2 Indragiri River Basin

#### (1) Construction Site

- Kuantan Dam: Kuantan Dam at Kuantan River is located at around 5 km in the upper reaches of Lubukkambacang. Its catchment area is about 6,377 km<sup>2</sup> and its reservoir area is estimated at 91.5 km<sup>2</sup>, where the major part occupies Sawahlunto Sijunjung in West Sumatra Province. Temporary access road to the dam is from Lubukambacang and Lubukjambi.
- Lubukjambi Intake Weir site
- Lubukjambi Irrigation Canal
- Rengat Area Flood Protection Works

#### (2) Ecological Boundary

- The Kuantan Dam catchment area of 6,377 km<sup>2</sup> and the lower reaches of the dam;
- Lubukjambi Intake Weir and irrigation canal; and
- The area in and around Rengat.

#### (3) Social Boundary

In this ANDAL study, the regional boundary has been clarified according to the scale of socio-economic and socio-cultural activities related to the project activities.

#### (4) Administrative Boundary

The dam and intake weir sites belong to Kab. Sijunjung, West Sumatra Province and Kab. Indragiri Hulu, Riau Province. The administrative boundaries are as shown in Fig.V.3.2.

The Rengat area for ring dike construction belongs to Kec. Rengat, Kab. Indragiri Hulu, as shown in Fig.V.3.3.

The area of the irrigation canal belongs to Kec. Kuantan Mudik, Kec. Kuantan Tengah, Kec. Kuantan Hilir, Kec. Cerenti, Kec. Peranap and Kec. Rengat of Riau Province.

#### (5) Technical Boundary

This boundary is formed in consideration of the problems of each project stage such as time, labor, accessibility and sampling.

### 3.4.3 In-Between Area

There is no proposed project in the area in-between the two river basins.

## CHAPTER 4 PRELIMINARY STUDY FOR ANDAL

### 4.1 Objectives of Preliminary Study

The preliminary study for ANDAL is an informal study to be done before the ANDAL study with the following objectives:

- (1) To study the present environmental conditions of the location;
- (2) To provide information for the selection of appropriate projects from the overall plan;
- (3) To determine environmental components to be studied in the ANDAL study; and
- (4) To prepare the Terms of Reference for ANDAL.

### 4.2 Natural Environmental Condition

Climate and hydrology, topography, geological and soil mechanical conditions are presented in SECTOR I and SECTOR IV. Other natural environmental conditions are described in this section.

#### 4.2.1 Water Quality

Data on water quality is compiled in the DATA BOOK.

##### (1) Kampar River Basin

Data on water quality at Rantauberangin in the Kampar Kanan River and the Singingi, Teso and Take rivers of the Kampar Kiri River have been collected. The water quality of both Kampar Kanan and Kampar Kiri rivers have been classified as category B, which means that the water is suitable for drinking after boiling.

##### (2) Indragiri River Basin

Since past data on water quality is few, sampling of water and laboratory tests have been conducted in this study. Sampling of water was conducted at Kualacinaku, Kualaperanap and Talukkantan in the Kuantan and Indragiri rivers. The results of the laboratory tests show that the water of both Kuantan and Indragiri rivers belong to category B, which means that the water is suitable for drinking after boiling.



## 4.2.2 Terrestrial Flora and Fauna

### Forestry

#### (1) Types of Forest

Forest in the Kampar and Indragiri river basins can be classified into nine categories, as shown in Table V.4.1. From the upper to the lower reaches along the Kampar and Indragiri rivers, forest types change successively from mountain forest, high plain forest, low plain forest, swamp forest and to mangrove forest at the seacoast, the eastern part of the river basin. Table V.4.2 shows the distribution of forest types in the study area.

#### (2) Classification of Forest Function

The functions of forests in the study area are classified as follows:

• Natural Preservation Forest and Tourism (HSA-W)	:	220,083 ha
• Protected Forest (HL)	:	333,832 ha
• Production Forest (HP)	:	25,766 ha
• Limited Production Forest (HPT)	:	239,607 ha
Total	:	819,288 ha

Generally, natural preservation forests (HSA-W) are distributed along the Barisan mountains. These are very important forests and should be preserved. Fig. V.2.1 shows the distribution of forest functions.

### Terrestrial Flora

Table V.4.3 shows the total number of species found in the study area in Kampar and Indragiri river basins with emphasis on economic and biological importance. From the field observation and data collection, 33 species of flora were found in the Kampar river basin and 51 species in the Indragiri river basin. The protected species mentioned are as follows:

- Kulim
- Tembusu
- Meranti Putih
- Keruing
- Kantong Semar

### Terrestrial Fauna

The number of species and protected ones are shown in Table V.4.4 and summarized below.

Terrestrial Fauna	Kampar River Basin	Indragiri River Basin
Mammal	17 species	21 species
Birds	14 species	19 species
Reptile	7 species	7 species
Amphibia	3 species	3 species

Total number of species found were 41 species, and 20 of them are protected species. The inventory of fauna in the study area is compiled in the DATA BOOK.

### 4.2.3 Aquatic Flora and Fauna

#### Fish

The number of fish species found in the study area are shown in Table V.4.5 and summarized below. The inventory of fishes found in the study area is compiled in the DATA BOOK.

#### (1) Kampar River Basin

##### (a) Rantauberangin Intake Weir in Kampar Kanan River

Nine orders of fish were found in the study area of Kampar Kiri River such as Ostariophysi, Batoidei, Synbranchioidea, Labyrinthisi, Plectognathi. The rare species are, Riu-riu, Kayangan and Patin. Patin fish is said to be still found in areas such as Teratak Buluh village, but it is very difficult to see patin fish at the upper reaches beyond Empatbalai village of the Kampar Kanan River.

##### (b) Kampar Kiri No. 1 Dam in Kampar Kiri River

The 9 orders of fish were found in Kampar Kiri River, same as the ones at Rantauberangin project area. Patin fish is not found beyond Gema village.

##### (c) Kampar Kiri No. 2 Dam in Kampar Kiri River

The rare species is parang-parang, Kujam, Selimang Juaro, Patin and Geso.

#### (2) Indragiri River Basin

##### (a) Kuantan Dam in Kuantan River

There were 6 orders of fish found in the area such as Ostariophysi, Labyrinthisi, Synbranchioidea, Plectognathi, and Opisthomi. Some species have a discontinuous distribution such as Sepimping, Olang, Lelan and Patin fish.

#### Aquatic Mammals and Reptiles

Table V.4.6 shows the distribution of aquatic mammals and reptiles in the study area. Aquatic mammals and reptiles found in the study area are Crocodiles, Monitor Lizards, Water Snakes, Otters, and Freshwater Turtles. Crocodile is not found anymore in the Sinamar and Sukam rivers. In Kuantan River, crocodile is so rarely found, but local people still believe their existence.

### Aquatic Flora

There are 16 species of aquatic plants found in the study area.

### Plankton

The planktons (phyto- and zoo-) found in the study area are as follows:

- (1) Zooplankton
  - Crustaceae;
  - Insecta;
  - Protozoa; and
  - Trochelminthes.
- (2) Phytoplankton
  - Bacillariophyceae
  - Cyanophyceae
  - Chlorophyceae
  - Copepoda

## **4.3 Socioeconomic Conditions**

The provinces, kabupatens and kecamatans related to the proposed facilities are given in Table V.4.7. Population and economic structure in the study area are described in SECTOR II and land use in SECTOR III.

### Mining

No active mining works were found in and around the proposed facilities. Inactive gold mining and coal mining were found near the sites of Kampar Kiri No. 2 Dam and Kuantan Dam, respectively. The mining concession in the study area is as plotted in Fig. V.4.1.

### River Water Use

Inhabitants of towns and villages along the Kampar and Indragiri rivers use river water for domestic use, agriculture (including fishpond), waterborne transportation and industry. Along the Kampar River, 45% of households use river water for the above purposes and 49% along the Indragiri River.

### Infrastructure and Public Facilities

#### (1) Roads

National and provincial roads in the study area are kept in good condition, while local roads are in poor condition.

(2) Public Schools

There are 431 units and 743 units of public schools near the proposed facilities in Kampar and Indragiri river basins, respectively. These public schools consist of elementary, junior high and high schools.

(3) Health Care Facilities

There are 35 units and 130 units of hospitals and clinics around the proposed facilities in the Kampar and Indragiri river basins, respectively.

Historical Assets and Cultural Properties

The list of historical assets and cultural properties is compiled in the DATA BOOK. As representative historical assets, there is an old mosque called Jamik Mosque at Air Tiris, six old cemeteries (graveyards) and two units of traditional buildings. As cultural properties, Seni Rebana (playing a traditional tambourine to accompany a song) and Balimau (bathing in water soaked with aromatic substances such as flowers and leaves, done by moslems some days before the month of fasting) are known. There are also two recreation facilities in the study area, a swimming pool and a fishing pond. These historical assets and cultural properties are not affected by the implementation of the project.

4.4 Study Results

The project will bring negative as well as positive impacts to the environment. From the study on the present environmental conditions of the study area, it is concluded that the socioeconomic component should be studied with special concern.

Other components such as physical and chemical components may be less significant compared to the socioeconomic component in terms of impact on the environment. Natural and social components necessary to be studied in the ANDAL study have been decided as discussed in Section 5.3 of CHAPTER 5, TERMS OF REFERENCE FOR ANDAL.

## CHAPTER 5 TERMS OF REFERENCE FOR ANDAL

The Terms of Reference (TOR) for -ANDAL was prepared based on the results of the preliminary study. The TOR-ANDAL was submitted to KOMPUS- PU (Central Committee of Environment, Ministry of Public Works, Jakarta) in March, 1995.

### 5.1 Introduction

#### Background

The study area of this project is situated in the central part of Sumatra Island occupying approximately 51,400 km<sup>2</sup> of a part of West Sumatra and Riau provinces. Due to the insufficient flow capacity of the river channels in the upper reaches and due to the low and flat topographical conditions in the middle and lower reaches, the areas along both rivers suffer from habitual inundation during rainy seasons.

Pekanbaru City, the capital of Riau Province, and other cities in the study area also suffer from the chronic shortage of water supply during dry seasons, particularly, municipal and industrial water supply. The problem of the water shortage will be further aggravated by the concentration of population in the urban areas and transmigration Java Island.

Appropriate remedies against flood damage and shortage of water supply is planned by constructing weirs, embankment and irrigation channels as a general scheme. Considering that most of the study area is in populous residential and rich nature area, realization of the proposed projects may cause an environment impact. Government Regulation (PP) No. 51, 1993, stipulate the need to conduct an environmental impact assessment (AMDAL) before implementation of the projects.

#### Laws and Regulations in Effect

The government laws and regulations in effect are given in Section 1.2.

#### Countermeasures for Environmental Management

The government of Indonesia had decided to implement development projects with due consideration on the environment and the efficient utilization of natural resources. The General Principles of National Policies (GBHN) summarizes that natural resources in Indonesia must be developed in a rational way. The abundant natural resources should be utilized without destructing the life environment system and with much consideration on all measures and the future generation.

Based on the above matters, the Directorate General of Water Resources Development, Ministry of Public Works shall implement environmental management, to reduce the negative impacts and to increase the positive impacts on the environments of the study area, as follows:

- (1) The plan of development projects such as the exploitation of natural resources and the construction of facilities followed by clearing forest shall follow the management guidance based on the conservation principle of natural resources.
- (2) The importance of economy should be well-balanced with the ecosystem. That is, advantage of some areas in Kampar-Indragiri river basin developed by facilities should contribute to realizing stable prosperity in those areas giving attention to their society. In resettlement, life level of local society should be improved and advanced giving attention to sustainability and capacity of the environment.

Activities of the implementation of projects may bring some impacts to various kinds of environment components at the following construction stages:

- Pre-Construction Stage;
- Construction Stage; and
- Post Construction Stage.

Projects are not supposed to cause serious impacts. Even then, the Ministry of Public Works dose not preclude any possibility of negative impacts against the environment in the project areas. Project activities such as excavation, transportation, mobilization of laborers and construction materials, and quarrying may cause some disturbances to local society, flora and fauna and water use.

#### Objectives of ANDAL study

The general objectives of the ANDAL study are as follows:

- To identify the major activities of project which may potentially cause serious impacts against environment;
- To identify the components of life environment which may be subjected to the impacts;
- To estimate the extent, intensity, quality of impacts, and its important level based on the agreed criteria;
- To use the results for deciding project implementation;
- To integrate the balance between each plan of project activity and environments; and
- To formulate the Environmental Management Plan (RKL) and the Environmental Monitoring Plan (RPL) with due consideration on the results of the ANDAL study.

## **5.2 Scope of Project Activities to be Studied**

### Activity Plan of Project Causing Impact

The activity plan of project causing the impact is described in Section 3.2.

### Components of Project Activities

The project activities in each stage which is necessary to be covered in the ANDAL Study are as follows;

- (1) Pre-Construction Stage
  - Survey and investigation activities.
  - Activity to purchase the forest or land owned by local society.
- (2) Construction Stage
  - (a) Land preparation: open and prepare the land for proposed facilities.
    - possibility of extinction of the protected endangered vegetation,
    - destruction of the economical plantation possessed by local society,
    - possibility of inducing erosion,
  - (b) Mobilization and demobilization of labor force, construction equipment and material
    - increase of noise and dust, and degradation of roads.
  - (c) Temporary diversion of river course
    - increase of mud in river water due to soil erosion shall disturb water use in the lower stream.
  - (d) Construction of proposed facilities
    - disposal of wastes of construction materials and others (woods, oil, paint, drum can and others).
- (3) Post Construction Stage
  - disturb water use in the lower stream.
  - decreasing the reserve function for fishery at the lower reaches.
  - change of cropping method in the newly irrigated area.

### **5.3 Scope of ANDAL Study**

The following environmental components need the ANDAL study.

#### Physics and Chemistry

##### (1) Climate

To analyze the rainfall characteristics and other climate factors in relation with water balance, flood, erosion and landslide.

##### (2) Hydrology (including water use)

- To analyze characteristics of water balance and rivers in the catchment area.

- To study the characteristic of water balance during rainy and dry seasons using monthly and annual average.
  - Water demand, water use and amount at the lower reaches.
  - Sediment and morphology of rivers.
- (3) Geology and Topography
- Description on topography of the project area, roads and irrigation areas.
  - Relation between soil stability and characteristics of geology and topography.
  - Location of borrow and quarry areas.
- (4) Landscape, Soil and Land Use
- Soil categories and characteristics in the study areas
  - Soil fertility in the study areas
  - Land use situation
  - Landscape: Attractive place for national park and sightseeing
- (5) Water Quality
- Change of water quality influence directly to aquatic organisms and life of lower reaches. To carry out laboratory test of physical and chemical properties.
- (6) Air Pollution
- Dust and smut
  - Noise

#### Biology

- The endangered or conserved terrestrial and aquatic fauna and flora which is specified legally.
- Situation of the conservation forest and protection forest covering the upper and lower reaches of river at the project site.
- Integrated characteristics of vegetation which is classified by richness, economical value, conserved value and social importance.

#### Socioeconomy and Culture

(1) Human population

The following data of inventory of human population are needed to study all administrative districts to be affected by impacts.

- Total population of each administrative district.
  - General strata of population, occupation, education and age strata.
- (2) Land ownership and land use
- Land ownership and land use of residents and farmers at the project site.
- (3) Economic structure
- Agriculture
  - Industries
  - Crop plantation/estate



- (4) Infrastructure and public facilities
  - Facilities related to transportation, education, economy, health and sanitation.
  - Traffic network
- (5) Historical assets and cultural properties

#### 5.4 Study Area of ANDAL

The study area of ANDAL is described in Section 3.4.

#### 5.5 Method of Study

##### Data Collection and Analysis

##### (1) Data Collection

##### (a) Primary Data

The primary data to be collected should cover the environmental components of physics and chemical, biology and socioeconomy and culture. Data are to be collected through field observation, measurement and hearing.

- Samplings of river water for quality test shall be made at several points as shown in Figs. V.5.1 and V.5.2.
- Field study for terrestrial flora shall be carried out at several points near project sites in a method of transect plot from hill ridge to foot, measuring trees more than 20 cm in diameter.
- Field study for terrestrial fauna shall be carried out by checking animal signs and interviewing local people.
- Field study for aquatic fauna shall be carried out at the same points of water sampling.

##### (b) Secondary Data

Secondary data shall be obtained from relevant institutes, previous relevant studies and investigations.

##### (2) Data Analysis

Data shall be processed qualitatively and quantitatively by proper methods in accordance with data types. Laboratory test is to be authorized by the related institutes. The results should be shown in figures, tables, flow-chart, map and photograph.

The primary data and secondary data to be studied are as follows:

- physical and chemical components in soil, hydrology, water quality and microclimate.
- wildlife of terrestrial and aquarium organisms.
- social components of demography, socioeconomy, socio-culture and social public health.

#### Method for Prediction and Identification of Impacts

##### (1) Identification of Impacts

Impacts are to be identified using the systematic method of interaction matrices between the project activities and environmental elements to focusing on the matrices of AMDAL of Public Works.

##### (2) Estimation of Impacts

Impacts are to be estimated by formula (analysis and mathematical) and experienced prediction of experts.

##### (3) Evaluation of Impacts

Potentially hazardous impacts should be determined according to the regulation of Kep. Kepala BAPEDAL No. 056/1994 regarding measuring important impacts. The factors to be determined as important impact are:

- Number of people subject to impacts
- Extent of the impacts
- Impact duration
- Impact intensity
- Other components of environment which are affected by the impact
- Cumulative extent of the impacts
- Irreversible impacts

##### (4) Formulation of RKL and RPL

(a) The Environmental Management Plan (RKL) shall consist of the following guidance:

- kinds of activities which potentially cause impacts.
- kinds of environments which may be affected by impacts.
- repeated measurement and impact weight.
- alternative management for impacts.
- the project owner and related institution to have duty and responsibility in the management implementation.
- description for time, location and frequency of management implementation of impact.
- budget and financing institution.

(b) The Environmental Monitoring Plan (RPL) shall consist of the following guidance:

- Type of environmental component that shall be monitored.

- Duty and responsibility of the project owner and related institution in the monitoring implementation.
- Approach of arrangement, control and monitoring of the environment
- components, location, period/duration and responsible agency.
- budget and financing institution.

## 5.6 Implementation of ANDAL Study

The ANDAL study shall be implemented as follows:

### (1) Study Team of ANDAL

The study team shall consist of professional personnel who are qualified and have expertise in ANDAL, RKL and RPL.

- (a) The leader of the study team shall have experience to manage ANDAL study related to dam construction and have AMDAL-B Certification. The leader is required to submit his curriculum vitae and certificate of AMDAL.
- (b) The leader of the study team has to be an expert on dam or irrigation, with experience in his/her technical field of more than 10 years and in AMDAL of more than 3 years.
- (c) The experts of the study team are required to have experience in their technical fields of expertise of more than 5 years and shall have attended seminars, courses and special meetings on AMDAL.

### (2) Period of Study

The ANDAL study shall be carried out in one hundred thirty (130) days divided into two stages. The first stage is from December 1, 1994 to March 10, 1995 and the second stage is from mid-May to mid-June, 1995.

### (3) Financing

This ANDAL study is to be financed by the Japan International Cooperation Agency (JICA) study team for the "The Kampar-Indragiri River Basin Development Project", that is, the aid program of Japan.

## 5.7 Reporting

Reports shall be prepared and submitted in accordance with the Government Regulation, KLH No. 14/MENLH/3/1994. The study team is required to submit the following reports.

(1) Inception Report

The report shall consist of the results of previous studies and literature study, the schedule of the AMDAL study, and the proposed framework of the final report within one month after agreement is made on this TOR. The study team shall submit ten (10) copies of the Inception Report.

(2) Interim Report

The report shall consist of the current results of field study and identification of impacts within three (3) months after commencement of the study. The study team shall submit ten (10) copies of the Interim Report.

(3) Draft Final Report

This report shall include all parts of the study required by this TOR. The report shall be submitted in the early part of the 4th month for presentation to the Central Commission of AMDAL in the Ministry of Public Works after passing evaluation by the Local Commission and Technical Team. The study team shall submit twenty (20) copies of the Draft Final Report, containing the following:

- Summary
- Main Report
- RKL and RPL
- Appendix

(4) Final Report

The Final Report shall be the revised Draft Final Report after the evaluation of the Team from the Central Commission of AMDAL. The study team shall submit twenty (20) copies of the Final Report containing same reports as the Draft Final Report.

## CHAPTER 6 ENVIRONMENTAL IMPACT ANALYSIS (ANDAL)

### 6.1 Present Environmental Condition of Priority Project Area

#### 6.1.1 Physical Conditions

The conditions of climate, hydrology, soil mechanics and geology of the Kampar river basin are described in SECTOR I AND SECTOR III.

##### (1) Spatial Plan

According to the maps of the Riau Province Spatial Land Use Development Plan (Scale: 1:250,000) and the Sawalunto/Sijunjung Spatial Land Use Development Plan (Scale: 1:100,000), it was identified that the Kuok Intake Weir and the Rantauberangin Irrigation Canal belong to the area of plantation development while the Bangkinang Area River Improvement Works belongs to a buffer zone. On the other hand, in the Indragiri river basin, the Kuantan reservoir area belongs to the protected zone, cultivation zone and buffer zone. The Lubukjambi Intake Weir and Irrigation Canal belongs to four zones: agriculture development zone, husbandry and agro-industry development zone, plantation development zone, and other development and river buffer zone.

##### (2) Land Use

The present land use of the sites of proposed priority projects are classified into four categories: settlement/homeyard, paddy/upland field, plantation and forest.

##### (3) Soil Type

###### (a) Kuok Intake Weir and Rantauberangin Irrigation Area

Based on the field observation, the soil type found in this study area is Podzols developed from alluvial deposits which were sedimented in the river. Podzols was found in the wavy area (the upper river terrace) of the Kampar River and alluvial deposit was found in the lower terrace.

###### (b) Kuantan Reservoir Area

Soil types in this area are Latosol, Podzol, Litosol from sediment crust and other types of Podzol originating from alluvial sediment. Latosols, Podzols and Litosols are normally found in the hilly area, while other types of Podzol are found in plain or wavy places.

The simple field test using Soil Test Kit indicate that the fertility of soils is low.

(c) Lubukjambi Intake Weir and Irrigation Area

Soil types in this area are Podzols formed from alluvium materials which are found in the wavy area at the upper part of the Indragiri River, while Alluvial soils are seen in the lower part of the river. Soil fertility is from low to medium.

(d) Rengat Area

Field observation showed that soil types at Rengat area are Alluvial soil originated from river deposits and Gleysols and Organosols. Soil fertility is low to medium.

### 6.1.2 Biological Conditions

(1) Terrestrial Flora

(a) Forest Classification

The protection forest and the forest reserve are not adjoined with the work sites of Kuok Intake Weir and Bangkinang Area as shown in Fig. V.2.1. The site of the Kuok Intake Weir and Irrigation Canal is near the limited production forest.

The Kuantan reservoir belongs to the area of Protected Forest, but the forest near the riverside were actually changed into the secondary forest or converted into the extensive plantation of rubber trees. The major part of reservoir area is covered by production forest and limited production forest, and the small patches of forest were other land use.

The major land area along the Kuantan River downstream from Lubukambacang is conservation forest. The Protection Forest is left as two small patches on the left side of the river from Lubukjambi down to Taluk. Limited production forest still remains over the right side of the river, but the large exploitation of oil palm plantation is also developed as indicated on Other Land Use in Fig.V.6.1.

(b) Species Composition of Forest

Field survey was carried out in the forest near the Kuok Intake Weir site, and inventory of tree flora is compiled in the DATA BOOK.

A number of 31 tree species were found, but any endangered and protected species were not included. Some wild trees are currently utilized by local people as building and furniture material.

The very common plantation trees of Rubber are found throughout the forest. It means the forest is almost a kind of secondary forest which has been exploited intensively or extensively. Distribution of primary forest are very limited. No endangered and protected flora were found. Some

wild plants are currently being utilized by local people as building and furniture material.

(2) Terrestrial Fauna

Eighteen (18) species of mammals, 21 species of birds, 9 species of reptiles, 4 species of amphibians and 13 species of insects were found around the Kuok Intake Weir and the irrigation canal. A half of the mammals are protected species.

In the Kuantan reservoir and Lubukjambi irrigation areas, 24 species of mammals, 21 species of apes, 9 species of reptiles, 4 species of amphibians and 13 species of insects were found through the field observation and interview survey. Harimau (Sumatran tiger), beruang madu (Malayan bear), and gadjaja (Asian elephant) are designated as protected fauna.

(3) Aquatic Fauna

(a) Fishes

In the Kampar and Indragiri rivers, at least 20 families and 91 species of fishes are listed, and these rivers have an abundant species and enough resource of fishes. The registered rare species are Arowana and Patin Kunyit fish. Both of fishes are not found in the upper reaches of rivers near the project site.

(b) Plankton

In the Kampar River, four classes of zooplankton (Tricoptera and Annelida) and macrozoobenthos (Diptera and Tricoptera) were identified. In the Indragiri River, two classes of zooplankton (Copepoda, Crustacea), and macrozoobenthos (Diptera and Tricoptera) were identified.

(4) Aquatic Flora

According to the field observation and interview survey with people living nearby the river, macroaquatic flora has never been detected in the area. In the Indragiri River, five classes of phytoplankton, chrolophyceae, bacillariophyceae, cyanophyceae, rhodophyceae and charophyceae were found by sampling tests.

### 6.1.3 Socioeconomic and Cultural Conditions

(1) Population

Population in the study area is discussed in SECTOR II, SOCIO-ECONOMY.

(2) Land Ownership

In general, land ownership in the study area follow local customs and traditions. Basically, land do not belong to a single individual but to the community. Therefore, resettlement and compensation for land acquisition take the local custom and tradition into consideration and the community leader is very important for negotiation.

(4) Economic Structure

Agriculture, industry and plantations are the important sectors in the economy of the priority project areas. In upland areas, agriculture and home industry are the main source of income of households. There is no specific cultural asset in the areas related to the priority projects.

## 6.2 Identification of Environmental Impacts

The important environmental impacts were identified using an interaction matrix which is a method to clarify and cover all relationships between project works and environmental components. The relation between them are described below and shown in Tables V.6.1 and V.6.2. The identified impacts are discussed in accordance with project implementation, pre-construction stage, construction stage and post construction stage.

### 6.2.1 Pre-Construction Stage

The activities at the pre-construction stage cover the following socio-economic components.

- (1) The survey and Investigation, causing impacts on:
  - public attitude/perception
- (2) Compensation/land acquisition, causing impacts on:
  - Public attitude/perception;
  - Job opportunities/means of livelihood;
  - Land ownership;
  - Local people's income; and
  - Public facilities.

### 6.2.2 Construction Stage

(1) Mobilization of Heavy Equipment

This activity will have impacts on the environmental components:

- Air quality/noise
- Public health



- Environmental aesthetic value
- Public facilities

(2) Recruitment of Labor

This activity will cause direct and indirect impacts on social, economic and cultural components:

- Public perception
- Customs and traditions
- Means of livelihood/employment opportunities
- Local people's income

(3) Land Opening and Clearing (work barracks, access road and construction site)

These activities will cause impacts on the following environmental components:

(a) Geophysical-Chemical

The environmental aspects to be affected by impacts are:

- air quality and noise;
- physiography and geology;
- water quality; and
- land use system.

(b) Biological

The environmental aspects to be affected by impacts on this component are:

- diversity of terrestrial flora
- diversity of terrestrial fauna

(c) Socioeconomic and Cultural

The environmental aspects to be affected by impacts on this component are:

- environmental aesthetic value
- public health

(4) Temporary Diversion of River Course

The construction activities which will potentially cause impacts are as follows. The environment aspects to be affected by the impacts in this component are:

(a) Geophysical-Chemical

- air quality/noise
- physiography and geology
- river flow pattern
- water quality

- (b) Biological
    - diversity of aquatic biota
  - (c) Socio-economic and Cultural
    - public health
- (5) Main Construction of Intake Weir and Irrigation Canal

This activity will have impacts on the following environmental components:

- (a) Geophysical-Chemical

The environmental aspects to be affected by the impacts in this component are:

- air quality/noise
  - physiography and geology
- (b) Socioeconomic and Cultural
    - public health

### 6.2.3 Post Construction Stage

At the post construction stage, activities which may cause impacts are:

- (1) Operation and Maintenance of Weir and Irrigation Ssystem

These activities will have impacts on the following environmental components:

- (a) Geophysical
  - chemical
  - Physiography and Geology
- (b) Socioeconomic and Cultural
  - Employment opportunities and means of livelihood
  - Local people's income
  - Public health as an indirect impact

- (2) Operation and Maintenance of Dike and Appurtenant Structures

This activity will give impacts on the socio-economy:

- income
- public health
- environmental aesthetic value

### 6.3 Evaluation of Environmental Impacts

The important environmental components identified in the previous section shall be predicted quantitatively to determine the intensity and size of arising negative and positive impacts. The impacts shall be evaluated by comparing the conditions before and after construction. In the evaluation of arising impacts, the degree of significance of impact shall be determined according to the seven main criteria specified in the Decree of the Minister of Population and Environmental Affairs No. 49, 1987.

The evaluation results for the Kampar and Indragiri river basins are shown in Tables V.6.3 and V.6.4, respectively.

### 6.4 Conclusion of ANDAL Study

#### 6.4.1 Kampar River Basin

In the Kampar river basin, the Kuok Intake Weir, the Rantauberangin Irrigation Canal and the Bangkinang Area River Improvement were proposed as priority projects. The ANDAL study for priority projects concluded that the construction of facilities proposed in the priority projects in the Kampar river basin will not present any serious damage to the natural and social environments.

##### (1) Land Acquisition and House Evacuation

The area of land acquisition and number of house evacuation for priority projects in the Kampar river basin are tabulated below. According to the interview survey, there is no strong objection among the inhabitants in the project site. Therefore, land acquisition and evacuation of inhabitants can proceed with reasonable compensation for inhabitants' losses and with assurance of firm countermeasures for the resettlement of people.

Priority Project	Land Acquisition (ha)	House Evacuation (unit)
Kampar Kanan Water Supply Project	220	430
Bangkinang Area River Improvement Works	197	300
Total	417	730

##### (2) Natural Environment

Impacts on the natural environment by the construction of proposed facilities were judged to be little.

##### (3) Social Environment

No important historical assets and cultural properties were found in the project area.

### 6.4.2 Indragiri River Basin

In the Indragiri river basin, the Kuantan Dam, the Lubukjambi Intake Weir and Irrigation Canal and the Rengat Flood Protection Works were proposed as priority projects. It was concluded through the ANDAL study that among the priority projects proposed in the Indragiri river basin, the Lubukjambi Intake Weir and Irrigation Canal and the Rengat Flood Protection Works will not bring any serious impact on the social and natural environments. However, construction of the Kuantan Dam will bring negative impacts to people living in the reservoir area who have to be evacuated, as well as the terrestrial and aquatic fauna and flora.

#### (1) Land Acquisition and House Evacuation

The area of land acquisition and number of house evacuation for priority projects in the Indragiri river basin are tabulated below. According to the interview survey, about 80% of the respondents are willing to sell their land. Therefore, land acquisition and evacuation of inhabitants can proceed with reasonable compensation and with provision of countermeasures for the resettlement of people to assure livelihood measures and income after evacuation.

Priority Project	Land Acquisition (ha)	House Evacuation (unit)
Kuantan River Multipurpose Development Project	2,700	1,700
Rengat Area Flood Protection Works	40	20
Total	2,740	1,720

#### (2) Terrestrial Fauna

Terrestrial large mammals are distributed in the reservoir area, including 19 protected species such as tigers, tapir and bear. However, large mammals are considered to be able to escape from the reservoir area following the water level rising, and extermination of these species is considered not to take place.

#### (3) Aquatic Fauna

A protected species of Patin Kunyiit is found in the Indragiri River except the upper reaches from the damsite. Therefore, construction of the dam will not affect this protected species.

#### (4) Other Flora and Fauna

Serious negative impacts on the other flora and fauna is not identified with the construction of the dam.

(5) Other Environmental Impacts

Although negative impacts to air and water quality, public health, and historical assets and cultural properties are expected, such impacts are considered to be small, and construction of the dam will not bring any serious damage to these factors.

## **CHAPTER 7 PREPARATION OF ENVIRONMENTAL MANAGEMENT PLAN (RKL)**

### **7.1 Schedule of RKL**

Environmental management shall commence from the beginning of project implementation through the operation and maintenance period. In general, the environmental management shall be implemented according to the purposes and type of activities. If a preventive action is required, it shall be done before the activity, and if a curative action is required, it shall be done when the action takes place. The relation among the types of activities causing impacts, management location and management schedule are presented in Tables V.7.1 and V.7.2.

### **7.2 Environmental Management Approach**

This shall consist of technical, economical and institutional approaches based on the ANDAL Study.

#### **7.2.1 Technical Approach**

The technical approach aims to control or prevent the negative impacts that may arise in project activities.

- Efforts shall be made to eliminate erosion/sedimentation problems resulting from the project or environmental conditions such as dredging of river channel and land clearance. These problems can be solved during implementation, for instance, by appropriate arrangement of river flow when the river channel is being dredged.
- Efforts shall be made to eliminate erosion originating from land clearance by the rehabilitation of existing critical land and construction of check dam at the river course with significant sediment load.
- Efforts shall be made to decrease impacts of air quality and noise. The impacts are found in the project site and the transportation line. Efficient methods to decrease those impacts are to arrange the schedule and number of vehicle operations and to regulate the speed of vehicles.
- Efforts shall be made to rehabilitate flora and fauna lost by the project.

#### **7.2.2 Economical Approach**

Efforts shall be made to control social, economic and cultural problems:

- To create job opportunities for people therearound in the pre-construction, construction, as well as the operation and maintenance stages, considering their experience and skill.
- To prevent or minimize impacts which may arise from approaching prominent historical assets.
- To promote public security with the participation of local agencies and local people in maintaining order and preventing nuisance which may arise during the project activities.

### **7.2.3 Institutional Approach**

In cooperation with the agencies related to environmental management, efforts shall be made in training, preventing pollution and making regression under the coordination of the Population and Environmental Affairs Bureau (BKLH) of District Level I, Riau and West Sumatra provinces, as formulated under:

- (1) Law No. 4, 1982, Republic of Indonesia, regarding the provisions of Environment Management Principles; and
- (2) Government Regulation No. 51 of 1993 on Environment Impact Analysis.

The agencies related to the above-said environmental management are as follows:

- District Level II Government of the Regencies of Kampar
- District Level II Health Service of the Regencies of Kampar
- District Level II BPN of the Regencies of Kampar
- The police and DLLAJR Level II of the Regencies of Kampar
- District Level II Public Works Service (DPU) of the Regencies of Kampar
- District Level II Agricultural Service of the Regencies of Kampar
- Sub-Bureau of Land Rehabilitation and Conservation (BRLKT) of Kampar River Basin
- Office of Forest Management II (KPH) of the Regencies of Kampar
- District Level II Ministry of Manpower of the Regencies of Kampar
- District Level I Irrigation of DPU of West Sumatra Province and Irrigation Sub-Service of DPU of District Level I of Riau Province

### **7.3 Resettlement of Inhabitants**

Countermeasures for the resettlement of inhabitants to be evacuated from project sites are very important and indispensable for the smooth implementation of projects. Since the biggest number of inhabitants to be evacuated is at the Kuantan reservoir area, countermeasures for resettlement of inhabitants in the Kuantan reservoir is discussed here as a representative example (refer to Figs. V.7.1 and V.7.2).

(1) Public Perception about the Project

According to the interview survey at the Kuantan reservoir area, about 47% of the inhabitants will approve the project, while only 1% will be against. The remaining 52% of inhabitants are neutral. This ratio will change according to the compensation amount; therefore, reasonable compensation for land acquisition and evacuation of inhabitants is necessary.

(2) Possible Site for Resettlement

The following three sites were identified as alternative resettlement areas for inhabitants to be evacuated:

- The first alternative is located at about 5 km southeast of the UPT Timpeh V transmigration resettlement area in Tanjung Gadang District. This is flat with an area of 45 km<sup>2</sup> and suitable for agricultural use. It is possible for all people (8,187 persons) in the reservoir area to move into this area. The West Sumatra Office of the Ministry of Transmigration also has a plan to expand the Timpeh V resettlement area to that place.
- The second alternative is located in the vicinity of Kunangan Village, near the reservoir area, around 7 km southwest of Batangkaring Village, also in Tanjung Gadang District. The place is somewhat undulated and near the concession of coal mining. Access to the Trans-Sumatra road is convenient.
- The third alternative is located 22 km eastward from the UPT Timpeh V transmigration resettlement area, between Tanjung-kambing Hill and Jao Village, very near the provincial boundary in Kota Baru District. The place is flat and suitable for agricultural use.

(3) Management after Resettlement

Living conditions and income level of evacuated inhabitants shall be maintained by providing necessary facilities and infrastructures in resettlement areas.

## 7.4 Implementation of RKL

(1) Managing Institution

The RKL of this project shall be carried out systematically by the related agencies or services, as follows:

- The Project Initiator shall be responsible for preparing the document of planning and the physical implementation.
- The Performing Contractor shall act as the performer of physical works and supplementary structures until completion. It shall also provide safety control and employment of local labor in the project.



- The Research Sector of the Regional Office of Public Works of West Sumatra and Riau provinces shall act as the manager of water supply and flood control for all interested groups, technically and administratively.
  - The Forest Management Office of the Regencies of Kampar shall prevent and control critical lands.
- (2) Structure, Scope and Work System of the Organization
- (a) Organization for Environmental Management
- To use human resources efficiently, the RKL does not make a new organization, but increases the role of the existing organization.
  - The scope of tasks and relevant responsibilities of some units will be increased to handle the environmental problems.
  - The environmental problems being wide and complex requires cross-sectoral and coordinated management.
- (b) Scope and Work System of the Organization
- To establish a coordinating institution as a management team which shall be responsible for planning, implementation and completion of the environmental management program.
  - To carry out management activities separately and collectively with the related institutions and agencies.
  - The initiator shall continuously carry out the agreed environmental management activities, namely, the preparation of action plan and other supporting documents, submitting them to the agencies or work units.
  - The roles of other related agencies and/or work units such as the Irrigation Service, BRKLT, Agricultural Service and Public Works Service are directed to complete and stabilize the program and the action plan according to their condition.

## 7.5 Funds

The initiator is the Directorate of Irrigation Program Development of the Ministry of Public Works, which will allocate the funds for the required environmental management, covering:

- The costs for land acquisition, including the costs for collection or dissemination of information, discussion meetings with local people, etc.
- The compensation costs for house evacuation.
- The costs for planning, supervision, implementation and operation tests of intake and other facilities.

The Performing Contractor shall allocate the funds related to health and safety of project workers and people like cost for showering, as well as masks and ear mufflers for workers.

The District Government shall allocate the funds for supervising the landscape implementation.

The Ministry of Public Works shall allocate the funds for providing guidance on planting system and method to increase the efficiency of water consumption and costs of supervision.

The Ministry of Forestry shall allocate the funds for planning, supervision and implementation of reforestation in critical lands and for the construction of check dams in river courses with potential to cause sediment load.

The Ministry of Agriculture shall allocate the funds for guidance and performance of reforestation.

#### **7.6 Supervision of Environmental Management Implementation**

- (1) Environmental management implementation will be supervised by supervising institutions, as follows:
  - The District Government, the National Land Affairs Agency of the Regencies of Kampar, Sawalunto/Sijunjung and Indragiri Hulu shall supervise the implementation of compensation for land acquisition and house evacuation to be carried out by the initiator.
  - The District Government, the National Land Affairs Agency together with the Transmigration Service shall supervise and arrange the implementation of resettlement to new locations to be carried out by the initiator.
  - The Health Service in related regencies in cooperation with the Ministry of Labor shall supervise the management of work safety, as well as public and project workers' health like the water showering in locations where the dust content is high and the use of ear muffles and masks which are to be carried out by the contractor.
  - The District Government and BRKLT (Land Conservation Training Centre) shall supervise the planning and reforestation.
  - The District Government shall supervise the implementation of household industrial training to be carried out by the Industrial Service.
- (2) Supervision of Implementation

The supervision of environmental management shall be carried out in the following manner:

*V Environmental Analysis*

- Study and evaluation of materials for RKL, i.e., the technical conditions of physical work implementation, the operation standards, and the system maintenance.
- Study and evaluation of preparations for environmental management activities, for instance, the reservoir operation plan, the rubbish disposal to the reservoir, and the landscape implementation in the project area.
- Study and evaluation of preparations made by the related agencies carrying out environmental management activities like one made by the Forestry Service and the Agricultural Service in charged of the reforestation of critical lands.
- Study and evaluation of information delivered to the project, as well as from related agencies, regarding environmental management, in the form of letters, minutes of meeting, reports on job implementation and other related reports.

## CHAPTER 8 PREPARATION OF ENVIRONMENTAL MONITORING PLAN (RPL)

### 8.1 Environmental Monitoring Components

#### 8.1.1 Related Institutions

##### (1) Project Initiator

For the Project Initiator, environmental monitoring is used for evaluating the consistency of RPL with those specified in the RKL with the following purposes:

- To decrease claims from other groups affected by the Kampar River Basin Development Plan Project at the pre-construction, construction and post construction stages;
- To make use of funds, manpower and time effectively by adequate environmental management; and
- To predict significant impacts which are otherwise difficult to identify.

##### (2) Government and Initiator of Activities

In these two institutions, the objectives of preparing the RPL are:

- To consolidate the implementation of Law No. 4 of 1982 on the Main Conditions of Environmental Management and Government Regulation No. 29 of 1986 on Environmental Impact Assessment (AMDAL).
- To consolidate the implementation of Government Regulation No. 35 Chapter III, paragraph (2) of 1991 on rivers, where "River" is defined in paragraph (2) as a water source and as one of the natural sources having multipurpose functions for human life and existence. A river should be managed to increase its function and benefits, and its destructive power to the environment should be controlled.
- To develop positive impacts and to overcome activities with potential to cause negative impacts in Kampar River Basin Development Plan Project, and to provide simultaneous supervision and evaluation.
- To control environmental quality, increase social economy and regional income, assist in stabilizing the implementation of tourism program in compliance with the development program, and the Regional Layout General Plan (RUTRD).

#### 8.1.2 Environmental Monitoring Approach

Based on the Environmental Impact Analysis (AMDAL) and the Environmental Management Plan (RKL) for the project, the RPL is prepared. As described in CHAPTER 1, the purpose of the RPL is to supervise and control the implementation of RKL in each activity at each project stage.

The RKL is conducted periodically and continuously according to the tendency of occurring impacts. Results of monitoring by institutions shall be submitted to related agencies or institutions for getting feedbacks. The purpose of this kind of coordination is to have an agreement in selecting the best alternative to control the environmental impacts. The environmental monitoring approach shall be made by reporting, supervision, monitoring and unexpected inspections.

(1) Reporting

The reporting shall cover the notification on the schedule of project activities and implementation, compensation, monitoring and other relevant information, as well as minutes of meetings on the approval of designated activities for irrigation system maintenance, plant pattern, reforestation program, farm operation pattern, landscape work, health program, public industrial development, etc. Periodical reports (daily, weekly or monthly) on supervision activities shall be prepared and submitted.

(2) Supervision

The supervision shall cover:

- Supervision on the implementation of land acquisition.
- Supervision on the implementation of irrigation system and dike as well as non-physical works which are assumed to have a potential to cause impacts.
- Supervision on the implementation of road showering and the use of masks and ear muffers.
- Supervision on the operation of irrigation channel, application of planting pattern and water allocation.
- Supervision on reforestation of critical land areas.

(3) Monitoring

Monitoring shall cover the evaluation of the environmental management being implemented to examine whether it is appropriate or recommendable to implement field monitoring of environment factors affected by impacts, and periodical sampling for laboratory study.

(4) Unexpected Inspection

Unexpected inspection is to inspect the actual work implementation unexpectedly, particularly when a deviation in the environmental management implementation is indicated.

## 8.2 Description of RPL

Environmental factors to be monitored in the Environmental Impact Analysis for the Project are described by stage and type of work, as below.

### 8.2.1 Pre-Construction Stage

#### (1) Environmental Components to be Monitored

##### (a) Survey and Investigation

The environmental factors to be monitored are the social unrests brought about by the project.

##### (b) Compensation

Compensation for land acquisition, types of livelihood, and the number of people evacuated shall be monitored.

The increase or decrease of income, how compensation money is spent, and the change of income by resettlement shall be monitored.

Type and the number of transport facilities for local people which will be affected by the project shall be monitored.

When land is acquired, the condition of public order, as well as public reaction and aspiration, shall be monitored.

#### (2) Impact Measuring Item

The measuring item for social unrest is the development of rumors and the number of questions related to the project at site and surrounding areas.

#### (3) Monitoring Location and Monitoring Period

##### (a) Survey and Investigation

Monitoring of impacts of social unrest is to be carried out at project sites and the reservoir area two times every month during the pre-construction stage.

##### (b) Land Acquisition

Monitoring of impacts of loss of land ownership is to be carried out at project sites every month during the pre-construction stage.

- Monitoring of impacts of loss of livelihood is to be carried out.
- Monitoring of change of income structure is to be carried out every six months.
- Monitoring of impacts of loss of transportation means and facilities is to be carried out.
- Monitoring of impacts on the condition of public order is to be carried out twice every month during the pre construction stage.

(c) Resettlement of People

- Monitoring of impact of nuisance of people evacuated and traffic order is to be carried out along roads related to project activities during the pre-construction period.

8.2.2 Construction Stage

(1) Environmental Factors to be Monitored

(a) Mobilization of Construction Materials and Heavy Equipment

Environmental factors to be monitored are:

- Change of air quality, marked by the increase of dust in the air.
- Increase of noise.
- Public order, marked by work accidents.
- Traffic order, marked by accidents and traffic jams and violations.
- Public health, marked by the level of health condition.
- Quality of environmental aesthetic values.
- Condition of means and facilities, marked by the existence of damaged means and facilities.

(b) Mobilization of Manpower

Environmental factors to be monitored are:

- Public order, marked by work accidents.
- Traffic order, marked by accidents and traffic jams and violations.
- Public health, marked by the condition of health level.
- Nuisance to local customs and traditions and cultural values, marked by complaints of local people.

(c) Land Clearance

Environmental factors to be monitored are:

- Change of air quality.
- Increase of noise.
- Diversity of terrestrial flora and fauna.
- Condition of public health, marked by the change of health level.
- Condition of environmental aesthetic values.

(d) Construction of Access Roads

Environmental factors to be monitored are:

- Change of surface water quality.
- Unconformity of land function.
- Diversity of terrestrial flora and fauna.
- Traffic order which is marked by accidents, traffic jams and violations.

- Condition of public health which is marked by the change of health level.
- Condition of environmental aesthetic values.

(e) Construction and Operation of Labor Camp

Environmental factors to be monitored are:

- Public health, marked by the decline of health level.
- Environmental aesthetic values.

(f) Management of Quarry and Borrow Area

Environmental factors to be monitored are:

- Change of air quality.
- Increase of noise.
- Physiographical and geological changes.
- Change of surface water quality.
- Diversity of terrestrial flora and fauna.
- Public health by monitoring the change of health of people around borrow area.
- Public order.
- Traffic order.

(g) Construction of Diversion Facilities

Environmental factors to be monitored are:

- Change of air quality.
- Increase of noise.
- Physiographical and geological changes.
- Change of surface water quality.
- Change of river flow regime in the up and downstream.
- Change of sediment load pattern in the up and downstream.
- Change of geological stability of the river channel in the upstream.

(h) Construction of Cofferdam

Environmental factors to be monitored are:

- Change of river flow regime in the up and downstream.
- Change of sediment load pattern in the upstream.
- Change of geological stability at the river channel in the upstream.
- Change of surface water quality in the upstream.
- Condition of public health.

(i) Construction of Main Dam

Environmental factors to be monitored are:

- Physiographical and geological changes.
- Change of geological stability of river channel at the damsite.
- Health condition of people in the downstream, marked by the change of health level.



(2) Impact Measuring Items

- (a) Impact measuring items with regard to mobilization of materials and heavy equipment
- Change of air quality, as examined from the spreading condition of cough and respiratory tract diseases.
  - Increase of noise, as examined from the frequency of hypertension.
  - Nuisance to public security and order, as checked from the frequency of work accidents.
  - Traffic condition, as measured from the frequency of traffic jams and violation of traffic regulations.
  - Health condition of the people, as measured from the level of public health like number of specific diseases after the project.
  - Condition of transport facilities, as viewed from the length of damaged roads.
- (b) Impact measuring items with regard to manpower mobilization
- Nuisance on public security and order, as seen from work accident rate.
  - Traffic condition, as measured from the frequency of traffic jams and violation of traffic regulations.
  - Health condition of the people, as measured from the increase of specific diseases after the project.
  - Environmental aesthetic quality, as measured from the frequency of people's complaints.
- (c) Impact measuring items with regard to land clearance
- Change of air quality, referring to indicators such as frequency of people's complaints, frequency of spread of cough and respiratory tract disease.
  - Increase of noise compared to air quality standard, with reference to the frequency of people's complaints and the spread of hypertension.
  - Diversity of land flora, as measured by the decline of diversity and density of types.
  - Diversity of land fauna, as measured by the decline of diversity and density of wild fauna which is of low mobility.
  - Public health, as measured from the increase of number of people who suffer from ISPA disease after the project.
  - Environmental aesthetic value, as measured from the frequency of people's complaints.
- (d) Impact measuring items with regard to the construction of access road
- Change of surface water quality compared to Class C water quality standard by using the indicator of water turbidity.
  - Traffic condition, as seen from the rate/frequency of traffic accidents and traffic jams.

- Diversity of land flora, as seen from the decline of diversity and density of types.
  - Diversity of land fauna, as seen from the decline of diversity and density of wild fauna which is of low mobility.
  - Public health, as measured from the increase of the number of people who suffer from ISPA disease after the project.
  - Environmental aesthetic value, as measured from the frequency of people's complaints.
- (e) Impact measuring items with regard to the construction and operation of barracks
- Public health, as measured from the increase of the number of people who suffer from ISPA disease after the project.
  - Environmental aesthetic value, as measured from the frequency of people's complaints.
- (f) Impact measuring items with regards to the management of quarry and borrow areas
- Change of air quality, as compared to the air quality standard, referring to the frequency of people's complaints and the frequency of spread of cough and respiratory tract disease.
  - Change of noise, as compared to the air quality standard, like the frequency of people's complaints.
  - Change of surface water quality, as compared to Class C water quality standard such as water turbidity, flow velocity and degradation.
  - Change of sediment load pattern in the upstream, as observed from the sediment concentration in the upstream.
  - Change of geological stability of the river channel in the upstream, as seen from landslide width and length by observing the number of locations of riverbank slide.
- (g) Impact measuring items with regard to the construction of cofferdam
- Change of river flow regime in the upstream.
  - Change of river flow regime in the downstream.
  - Change of sediment load pattern in the upstream as seen in the sediment concentration at the upstream.
  - Change of geological stability of river channel as seen in the number of riverbank slides at riverbanks.
  - Change of surface water quality as compared with the water quality standard of Class B, referring to the indicator of water turbidity.
  - Public health, as measured from the increase in number of people suffering from specific illness during the activity.
- (h) Impact measuring items with regard to the construction of main dam
- Physiographical and geological changes, as seen in slide width and length and the number of locations.

- Change of geological stability of river channel in the damsite as seen from slide width and length using the indicator of number of locations of riverbank slide.
- Health condition of people, as measured from the increase in number of people suffering from specific illness after the project.

(3) Monitoring Location and Period

(a) In material and heavy equipment mobilization

- Change of air quality at the project site and along transportation lines are to be monitored during the construction period.
- Increase of noise at the project site and along transportation lines are to be monitored during the construction period.
- Monitoring of impact of nuisance to public security and order is to be carried out at the project site every week.
- Traffic is to be monitored along the regency road every week.
- Public health is to be monitored in the project site every week.
- Public quality is to be monitored in the project site every week.
- Environmental aesthetic quality is to be monitored in the project site, borrow and quarry areas every month.
- Condition of means and facilities along regency roads is to be monitored every two months.

(b) In manpower mobilization

- Monitoring the impact of nuisance to public security and order is to be carried out in borrow and quarry areas and the project site every week.
- Traffic is to be monitored along regency roads every week.
- Public health is to be monitored in the project site every week.
- Environmental aesthetic quality is to be monitored in the project site, borrow and quarry areas every month.

(c) In land clearance

- Change of air quality at the project site is to be considered during the construction period.
- Increase of noise at the project site is to be considered during the construction period.
- Land condition in the project site is to be considered during the construction.
- Diversity of terrestrial flora and fauna is to be monitored every six months during the construction period.
- Public health is to be monitored in the project site during the construction.
- Environmental aesthetic quality is to be monitored in the project site, borrow and quarry areas every month during the construction period.

- (d) In the construction of access road
  - Change of surface water quality is to be around the project location every month during the construction.
  - Diversity of terrestrial flora and fauna is to be monitored in the project site every six months during the construction period.
  - Traffic is to be monitored along regency roads every six months during the construction period.
  - Public health is to be monitored in the project site every week.
  - Environmental aesthetic quality is to be monitored in the project site, borrow and quarry areas every month during the construction period.
- (e) In the construction and operation of work barracks
  - Public health is to be monitored in the project site every week.
  - Environmental aesthetic quality is to be monitored in the project site, borrow and quarry areas every month.
- (f) In quarry and borrow management
  - Change of air quality is to be monitored in the project site every month during the construction period.
  - Increase of noise is to be monitored in the project site every month during the construction period.
  - Physiographical and geological changes are to be monitored in the project site every month during the construction.
  - Change of surface water quality is to be monitored around the project sites every month during the construction period.
  - Diversity of terrestrial flora and fauna is to be monitored in the project site every six months during the construction period.
  - Public health is to be monitored in quarry and borrow areas every week.
  - Nuisance to public security and order are to be observed from the frequency of work accidents.
  - Impacts on traffic condition are to be measured from the frequency of accidents and traffic jams, and violation of traffic regulations.
- (g) In the construction of diversion facilities
  - Change of air quality is to be monitored in the project site every month during the construction period.
  - Change of noise is to be monitored in the project site every month during the construction period.
  - Physiographical and geological changes are to be monitored in the project site every month during the construction period.
  - Change of surface water quality is to be monitored around project locations every month during the construction period.
  - Change of upstream river flow regime is to be monitored in the rivers every month during the construction.
  - Change of downstream river flow regime is to be monitored in the rivers every month during the construction period.

- Change of upstream sediment load is to be monitored in the rivers every month during the construction period.
  - Impacts of geological stability of river channels are to be monitored in the upstream of rivers every month during the construction period.
- (h) In the cofferdam construction
- Change of upstream river flow regime is to be monitored in the upstream of the Indragiri River every month during the construction period.
  - Change of downstream river pattern is to be monitored in the Indragiri River every month during the construction period.
  - Change of upstream sediment load pattern is to be monitored in the Indragiri River every month during the construction period.
  - Change of geological stability of the upstream river channel is to be monitored in the Indragiri River around the project location every month during the construction period.
  - Change of surface water quality is to be monitored in Indragiri River around the project location every month during the construction period.
  - Public health is to be monitored in the project location.
- (i) In the main dam construction
- Physiographical and geological changes are to be monitored in the project location.
  - Change of geological stability of the river channel in the dam location is to be monitored in the project location every month during the construction period.
  - Health condition of people is to be monitored around the project location.

### 8.2.3 Post Construction Stage

(1) Environment Factors to be Monitored

- (a) In the reservoir
- Change of microclimate.
  - Change of river flow pattern in the downstream.
  - Change of sediment load pattern in the upstream.
  - Change of water quantity in the downstream.
  - Change of geological stability of the river channel in the upstream.
  - Health condition of people around reservoir areas..
- (b) In dam operation and maintenance
- Change of river flow pattern in the downstream.
  - Change of geological stability of the river channel in the downstream.

(2) Impact Measuring Items

The impact measuring item in reservoir areas are:

- Change of microclimate (air temperature and moisture) is to be monitored referring to people's complaints.
- Change of river flow regime in the downstream is to be monitored as to nuisance to water consumption in the downstream.
- Change of sediment load pattern is to be monitored from sediment concentration which indicates sediment concentration and the degree of erosion in the dam.
- Change of water debit (quantity) in the downstream is to be monitored from nuisance to the dam operating pattern.
- Change of geological stability of the river channel in the upstream is to be monitored from riverbank slide width and length at locations of slide.
- The measuring item for terrestrial flora diversity is the decline of diversity and density of types.
- The measuring item for aquatic flora diversity is the increase of diversity and density of the wild fauna types having low mobility. The measuring item for aquatic fauna diversity is the increase of diversity and density of fish types.
- The measuring item for public health is the increase of the number of people suffering from illness caused by mosquitoes.

(3) Monitoring Location and Period

Monitoring location and period in reservoir areas are:

- Change of micro climate is to be monitored in the location of dam reservoir very week.
- Change of river flow regime in the upstream is to be monitored in the rivers every month.
- Terrestrial flora and fauna are to be monitored in the reservoir area once a month during flooding.
- Aquatic flora and fauna are to be monitored in the reservoir area once every six months during the dam operation.

***TABLES***

***V ENVIRONMENTAL ANALYSIS***

Table V.4.1 FOREST TYPES IN STUDY AREA

	Indonesian Abbrev.	Forest Type	Definition
1	Hr	Low plain forest	with elevations less than 1000 m above sea level.
2	Ht	High plain forest	with elevation between 1000 and 2000 m above sea level.
3	Hp	Mountain forest	with elevation more than 2000 m above sea level.
4	Hm	Mangrove forest	
5	Hs	Swamp forest	
6	Lktp	Unproductive dry land	consist of brushwood, underwood, and empty land.
7	Lbtp	Unproductive wet land	consist of brushwood and underwood.
8	Ptn	Productive food crops land	consist of dry farms, and paddy fields.
9	Lkb	Productive plantation land	

Table V.4.2 DISTRIBUTION OF FOREST TYPES IN STUDY AREA

	Project sites	Forest type								
		Hr	Ht	Hp	Hm	Hs	Lktp	Lbtp	Ptn	Lkb
	Kampar river basin									
a	Kuok Intake Weir	v	-	-	-	v	-	v	v	v
b	Kampar Kiri No.1 Dam	v	-	-	-	v	-	-	v	v
c	Kampar Kiri No.2 Dam	v	-	-	-	v	-	-	v	v
	Indragiri river basin									
d	Kuantan Dam	v	-	-	-	-	-	-	v	v
e	Lubukjambi Intake Weir	v	-	-	-	-	-	-	v	v

Note v : exist, - : not exist



Table V.4.3 NUMBER OF SPECIES OF TERRESTRIAL FLORA IN STUDY AREA

Project area	Number of species			
	Total in the area	Economic Value	Protected	Endangered
Kampar river basin				
(a) Kuok Intake Weir	29	19	3	1
(b) Kampar kiri No.1 Dam	24	14	3	1
(c) Kampar kiri No.2 Dam	22	18	4	0
Indragiri river basin				
(a) Kuantan Dam	26	20	5	?
(b) Lubukjambi Intake Weir	22	17	8	?

Table V.4.4 NUMBERS OF SPECIES OF TERRESTRIAL FAUNA IN STUDY AREA

Project area	Number of species							
	Mamals		Birds		Reptiles		Amphibia	
		P		P		P		P
Kampar river basin								
(a) Kuok Intake Weir	10	5	4	0	4	1	1	0
(b) Kampar kiri No.1 Dam	16	9	14	6	4	2	3	1
(c) Kampar kiri No.2 Dam	10	6	3	2	7	3	1	0
Indragiri river basin								
(a) Kuantan Dam	10	6	3	2	7	3	1	0
(b) Lubukjambi Intake Weir	10	6	3	2	7	3	1	0

Table V.4.5 NUMBER OF FISH SPECIES IN STUDY AREA

Project area	Number of species					
	Name of Order					
	Ostario-physi	Batoidei	Synbran-choidea	Labyrin-thysi	Plectong-athi	Opistho-mi
Kampar river basin						
(a) Kuok Intake Weir	88	1	1	24	1	1
(b) Kampar Kiri No.1 & No.2 Dams	88	1	1	24	1	1
Indragiri river basin						
(a) Kuantan Dam & Lubukjambi Intake Weir	69	1	1	17	1	1
(b) Middle Reaches of Pasirpenyu River	72	1	1	17	1	1

Table V.4.6 DISTRIBUTION OF AQUATIC MAMMALS AND REPTILES IN KAMPAR AND INDRAGIRI RIVERS

No.	Local name	Kampar			Indragiri			
		BNK	SIH	KKI	SNM	SKM	LAB	TLK
1	Buaya(Crocodile)	x	x	x	-	-	x	x
2	Biawak(Monitor Lizards)	xx	xx	xx	xx	xx	xx	xx
3	Ular Air(Water snake)	xx	xx	xx	xx	xx	xx	xx
4	Berang-berang(Otter)	xx	xx	xx	xx	xx	xx	xx
5	Labi-labi(Turtle)	xx	xx	xx	xx	xx	xx	xx

BNK = Kec. Bangkinang

SIH = Kec. Siak Hulu

KKI = Kec. Kampar Kiri

SNM = Sinamar

SKM = Sukam

LAB = Lubukkambacang

TLK = Seberangtaluk

Legend

x x = many

x = few

- = none

Table V.4.7 ADMINISTRATIVE REGENCIES RELATED TO STUDY AREA

Project area	Sub-regency (Kecamatan)	Regency (Kabupaten)	Province
1. Kuok Intake Weir	Bangkinang	Kampar	Riau
	Kampar	Kampar	Riau
	Siak Hulu	Kampar	Riau
2. Kampar Kiri No.1 Dam	Kampar Kiri	Kampar	Riau
3. Kampar Kiri No.2 Dam	Singingi	Indragiri Hulu	Riau
4. Kuantan Dam	Tanjung Gadang	Sawahlunto/Sijunjung	West Sumatra
	Kuantan Mudik	Indragiri Hulu	Riau
5. Lubukjambi Intake Weir	Kuantan Mudik	Indragiri Hulu	Riau
	Kuantan Tengah	Indragiri Hulu	Riau
	Kuantan Hilir	Indragiri Hulu	Riau
	Cerenti	Indragiri Hulu	Riau
	Peranap	Indragiri Hulu	Riau
	Pasir Penyu	Indragiri Hulu	Riau

Table V.6.1 MATRIX OF IMPACT IDENTIFICATION FOR KAMPAR RIVER BASIN

ACTIVITY COMPONENTS		PRE-CONSTRUCTION		CONSTRUCTION				POST-CONSTRUCTION	
		1	2	3	4	5	6	7	8
ENVIRONMENTAL COMPONENTS									
GEO-	Micro Climate								
PHYSICS-	Air Quality/Noise			--		--	--		
CHEMICAL	Physiography and Geology					--	--	--	
	Water Quality					--			
	Land Use System					--			
BIOLOGY	Variety of Land Biota					--			
	Variety of Water Biota					--			
SOCIO-	Public Perception/Attitude	--	--		--				
ECONOMY	Employment Opportunity/		--		+			+	+
CULTURE	Means of Livelihood								
	Land Ownership		--						
	Local People's Income		+		+			+	+
	Customs & Traditions				--				
	Public Health			--		--	--	+	+
	Environment Convenience			--		--			+
	Public Facilities		--	--					

NOTES OF CRITERIA:

(+) = Indication of Positive Impact

(-) = Indication of Negative Impact

NOTES OF ACTIVITY COMPONENTS

1. Survey, Investigation and Ownership Inventory-taking
2. Compensation ( for land acquisition and people resettlement )
3. Mobilization of Heavy Equipment and Materials
4. Mobilization of Manpower
5. Land Clearing ( at the project site, construction of access road and construction of work barracks )
6. Construction of proposed facilities
7. Operation/ Maintenance of intake weir and Irrigation System ( water requirement : irrigation, domestic, industry, etc. )
8. Operation/ Maintenance of the Dike ( flood protection )

Table V.6.2 MATRIX OF IMPACT IDENTIFICATION FOR INDRAGIRI RIVER BASIN

ACTIVITY COMPONENTS		PRE-CONSTRUCTION		CONSTRUCTION					POST-CONSTRUCTION		
		1	2	3	4	5	6	7	8	9	10
ENVIRONMENTAL COMPONENTS											
GEO-	Micro Climate								-		
PHYSICS-	Air Quality/Noise			-		-	-	-			
CHEMICAL	Physiography and Geology					-	-	-	-	-	
	River Flow Regim								+		
	Water Quality					-	-		+		
	Land Use System					-			-		
BIOLOGY	Variety of Land Biota					-			-		
	Variety of Water Biota					-	-		+		
SOCIO-ECONOMY CULTURE	Public Perception/Attitude	-	-		-						
	Employment Opportunity/ Means of Livelihood		-		+				+	+	
	Land Ownership		-								
	Local People's Income		+		+				+	+	+
	Customs & Traditions				-						
	Public Health			-		-	-	-	+	+	+
	Environment Convenience			-		-					
	Public Facilities		-	-					+		+

NOTES OF CRITERIA:

- (+) = Indication of Positive Impact
- (-) = Indication of Negative Impact

NOTES OF ACTIVITY COMPONENTS

1. Survey, Investigation and Ownership Inventory-taking
2. Compensation ( for land acquisition and people resettlement )
3. Mobilization of Heavy Equipment and Materials
4. Mobilization of Manpower
5. Land Clearing ( at the project site, construction of access road and construction of work barracks )
6. Temporary Diversion of River course ( construction of coffer dam and diversion tunnel Kuantan dam )
7. Construction of proposed facilities
8. Operation/Maintenance of dam ( reserving water and flood control )
9. Operation/ Maintenance of the Dam, intake weir and Irrigation System ( water requirement : irrigation, domestic, industry, etc. )
10. Operation/ Maintenance of the Dike ( flood protection )

Table V.6.3 EVALUATION OF SIGNIFICANT IMPACTS IN KAMPAR RIVER BASIN

ACTIVITY COMPONENTS		PRE-CONSTRUCTION		CONSTRUCTION				POST-CONSTRUCTION	
		1	2	3	4	5	6	7	8
ENVIRONMENTAL COMPONENTS									
GEO-	Micro Climate								
PHYSICS-	Air Quality/Noise			-1		-1	-1		
CHEMICAL	Physiography and Geology					-1	-2		-3
	Water Quality					-1			
	Land Use System					-1			
BIOLOGY	Variety of Land Biota					-2			
	Variety of Water Biota								
SOCIO-	Public Perception/Attitude	-2	-2		-2				
ECONOMY	Employment Opportunity/		-3		+2			+3	+3
CULTURE	Means of Livelihood								
	Land Ownership		-3						
	Local People's Income		+3		+2			+3	+3
	Customs & Traditions				-2				
	Public Health			-2		-2		+3	+3
	Environmental Convenience			-1		-2			
	Public Facilities		-2	-2			-2		+3

NOTES OF ACTIVITY COMPONENTS

1. Survey, Investigation and Land Inventory-taking
2. Compensation
3. Mobilization of Heavy Equipment and Materials
4. Mobilization of Manpower
5. Land Clearing
6. Construction of proposed Facilities
7. Operation/ Maintenance of the intake weir and Irrigation System
8. Operation/ Maintenance of the Dike

NOTES OF CRITERIA:

- +1 = Positive, less significant impact
- +2 = Positive, somewhat significant impact
- +3 = Positive, significant impact
- +4 = Positive, more significant impact
- +5 = Positive, very significant impact
  
- 1 = Negative, less significant impact
- 2 = Negative, somewhat significant impact
- 3 = Negative, significant impact
- 4 = Negative, more significant impact
- 5 = Negative, very significant impact

Table V.6.4 EVALUATION OF SIGNIFICANT IMPACTS IN INDRAGIRI RIVER BASIN

ACTIVITY COMPONENTS		PRE-CONSTRUCTION		CONSTRUCTION					POST-CONSTRUCTION		
		1	2	3	4	5	6	7	8	9	10
<b>ENVIRONMENTAL COMPONENTS</b>											
GEO-	Micro Climate										-1
PHYSICS-	Air Quality/Noise			-1		-2	-2	-1			
CHEMICAL	Physiography and Geology					-1	-2	-2			-3 -3
	River Flow Pattern							-2			+3
	Water Quality					-2	-2				+3
	Land Use System					-2					-3
BIOLOGY	Variety of Land Biota					-2					-2
	Variety of Water Biota					-2	-2				+3
SOCIO-	Public Perception/Attitude	-2	-2		-2						
ECONOMY	Employment Opportunity/		-3		+2						+3 +3
CULTURE	Means of Livelihood										
	Land Ownership		-3								
	Local People's Income		+2		+2						+3 +3 +3
	Customs & Traditions				-2						
	Public Health			-3		-2	-2	-2			+3 +3 +3
	Environmental Convenience			-2		-2					
	Public Facilities		-2		-2						+3 +3

**NOTES OF ACTIVITY COMPONENTS**

1. Survey, Investigation and Land Inventory-taking
2. Compensation
3. Mobilization of Heavy Equipment and Materials
4. Mobilization of Manpower
5. Land Clearing
6. Temporary Diversion of River Course
7. Construction of proposed Facilities
8. Dam Operation/Maintenance
9. Operation/ Maintenance of the Dam, intake weir and Irrigation System
10. Operation/ Maintenance of the Dike

**NOTES OF CRITERIA:**

- +1 = Positive, less significant impact
- +2 = Positive, somewhat significant impact
- +3 = Positive, significant impact
- +4 = Positive, more significant impact
- +5 = Positive, very significant impact
- 1 = Negative, less significant impact
- 2 = Negative, somewhat significant impact
- 3 = Negative, significant impact
- 4 = Negative, more significant impact
- 5 = Negative, very significant impact

Table V.7.1.(1/2) ENVIRONMENTAL MANAGEMENT LOCATION OF KAMPAR RIVER BASIN

No.	Component	Management Location	Schedule of Management Implementation
<b>I. GEOPHYSICAL CHEMICAL ASPECT</b>			
1.	Air quality and noise	<ul style="list-style-type: none"> <li>— Around the activity location during the construction</li> <li>— Around the quarry and borrow areas</li> </ul>	During the activities of : <ul style="list-style-type: none"> <li>— Mobilization of materials and heavy equipment</li> <li>— Land opening and clearance</li> <li>— Management of quarry and borrow areas</li> <li>— Construction of diversion tunnel</li> </ul>
2.	Physiography and geology	<ul style="list-style-type: none"> <li>— Around the activity location during the construction</li> <li>— Location of access road construction</li> </ul>	<ul style="list-style-type: none"> <li>— Management of quarry and borrow areas</li> <li>— Construction of diversion tunnel</li> </ul>
3.	River flow pattern	<ul style="list-style-type: none"> <li>— The upstream of Indragiri river</li> </ul>	<ul style="list-style-type: none"> <li>— Construction of diversion tunnel</li> </ul>
4.	Water quality	<ul style="list-style-type: none"> <li>— Kampar river in the location of activity</li> </ul>	<ul style="list-style-type: none"> <li>— Construction of access road</li> <li>— Construction of labor camp and its operation</li> <li>— Construction of quarry and borrow areas</li> </ul>
<b>II. BIOLOGICAL ASPECT</b>			
1.	Variety of terrestrial biota	<ul style="list-style-type: none"> <li>— Location of activity during the construction</li> <li>— Location of construction of access road</li> <li>— Location of quarry and borrow areas</li> </ul>	<ul style="list-style-type: none"> <li>— Land opening and clearance</li> <li>— Construction of access road</li> <li>— Construction of quarry and borrow areas</li> </ul>
2.	Variety of aquatic biota	<ul style="list-style-type: none"> <li>— Location of activity</li> </ul>	<ul style="list-style-type: none"> <li>— Land opening and clearance</li> <li>— Construction of access road</li> </ul>



Table V.7.1.(2/2) ENVIRONMENTAL MANAGEMENT LOCATION OF KAMPAR RIVER BASIN

No.	Component	Management Location	Schedule of Management Implementation
<b>III. SOCIO ECONOMICAL AND CULTURAL ASPECT</b>			
1.	Public Perception	— Location of activity during the pre-construction	— Survey and investigation
2.	Means of livelihood	— Location of activity	— Land acquisition
3.	Land ownership	— Location of activity	— Land acquisition
4.	Customs & traditions and Cultural Value	— Location of activity	— Mobilization of manpower
5.	Public Health	— Location of activities for the irrigation canal	— Mobilization of materials and heavy equipment
		— Location of quarry and borrow areas	— Mobilization of manpower
			— Land opening and clearing
			— Construction of access road
			— Construction of labor camp and its operation
			— Management of quarry and borrow areas
6.	Environment Convenience	— Location of activities for the irrigation canal	— Mobilization of materials and heavy equipment
			— Land opening and clearance
			— Construction of access road
			— Construction of labor camp and its operation
7.	Public Facilities	— Location of the activity	— Land acquisition
			— Mobilization of materials and heavy equipment

Table V.7.2.(1/2) ENVIRONMENTAL MANAGEMENT LOCATION OF INDRAGIRI RIVER BASIN

No.	Component	Management Location	Schedule of Management Implementation
<b>I. GEOPHYSICAL CHEMICAL ASPECT</b>			
1.	Air quality and noise	<ul style="list-style-type: none"> <li>— Around the activity location during the construction</li> <li>— Around the quarry and borrow areas</li> </ul>	During the activities of : <ul style="list-style-type: none"> <li>— Mobilization of materials and heavy equipment</li> <li>— Land opening and clearance</li> <li>— Management of quarry and borrow areas</li> <li>— Construction of diversion tunnel</li> </ul>
2.	Physiography and geology	<ul style="list-style-type: none"> <li>— Around the activity location during the construction</li> <li>— Location of access road construction</li> </ul>	<ul style="list-style-type: none"> <li>— Management of quarry and borrow areas</li> <li>— Construction of diversion tunnel</li> <li>— Construction of main dam</li> </ul>
3.	River flow pattern	<ul style="list-style-type: none"> <li>— The upstream of Indragiri river</li> </ul>	<ul style="list-style-type: none"> <li>— Construction of diversion tunnel</li> <li>— Construction of coffer dam</li> </ul>
4.	Water quality	<ul style="list-style-type: none"> <li>— Indragiri river in the location of activity</li> </ul>	<ul style="list-style-type: none"> <li>— Construction of access road</li> <li>— Construction of labor camp and its operation</li> <li>— Construction of quarry and borrow areas</li> <li>— Operation and maintenance of the dam</li> <li>— Construction of coffer dam</li> </ul>
<b>II. BIOLOGICAL ASPECT</b>			
1.	Variety of terrestrial biota	<ul style="list-style-type: none"> <li>— Location of activity during the construction</li> <li>— Location of construction of access road</li> <li>— Location of quarry and borrow</li> <li>— Location of reservoir area</li> </ul>	<ul style="list-style-type: none"> <li>— Land opening and clearance</li> <li>— Construction of access road</li> <li>— Construction of quarry and borrow areas</li> <li>— Operation and maintenance of the dam</li> <li>— Reserving water</li> </ul>
2.	Variety of aquatic biota	<ul style="list-style-type: none"> <li>— Location of reservoir area</li> </ul>	<ul style="list-style-type: none"> <li>— Land opening and clearance</li> <li>— Construction of access road</li> </ul>

Table V.7.2.(2/2) ENVIRONMENTAL MANAGEMENT LOCATION OF INDRAGIRI RIVER BASIN

No.	Component	Management Location	Schedule of Management Implementation
<b>III. SOCIO ECONOMICAL AND CULTURAL ASPECT</b>			
1.	Public Perception	— Location of reservoir area during the pre-construction	— Survey and investigation
2.	Means of livelihood	— Location of reservoir area and location of activity	— Land acquisition
3.	Land ownership	— Location of reservoir area and location of activity	— Land acquisition
4.	Customs & traditions and Cultural Value	— Location of activity	— Mobilization of manpower
5.	Public Health	— Location of activities for the dam and dike	— Mobilization of materials and heavy equipment
		— Location of quarry and borrow areas	— Mobilization of manpower
			— Land opening and clearance
			— Construction of access road
			— Construction of labor camp and its operation
			— Management of quarry and borrow areas
			— Construction of coffer dam
			— Construction of main dam
			— Reserving water
6.	Environment Convenience	— Location of activities for the dam and dike	— Mobilization of materials and heavy equipment
			— Land opening and clearing
			— Construction of access road
			— Construction of labor camp and its operation
7.	Public Facilities	— Reservoir area	— Land acquisition
			— Mobilization of materials and heavy equipment
		— Location of activity	— Land acquisition