

ANNEX VII  
ENVIRONMENT

**The Feasibility Study  
on  
Integrated Agricultural and Rural Development  
in  
Highland Area in the Republic of Indonesia**

**ANNEX VII ENVIRONMENT**

**Table of Contents**

|           |                                                                                                                | <u>Page</u> |
|-----------|----------------------------------------------------------------------------------------------------------------|-------------|
| Chapter 1 | General .....                                                                                                  | VII-1       |
| Chapter 2 | Environmental Legislation and Institutional Framework in Indonesia....                                         | VII-2       |
| 2.1       | Environmental Institutional Framework .....                                                                    | VII-2       |
| 2.1.1     | Environmental Impact Management Agency (BAPEDAL) .....                                                         | VII-2       |
| 2.2       | Environmental Legislation in Indonesia .....                                                                   | VII-2       |
| 2.2.1     | Environmental Law (Law No. 4 of 1982 regarding Basic Provisions for the Management of Living Environment)..... | VII-2       |
| 2.2.2     | Environmental Impact Assessment System in Indonesia .....                                                      | VII-3       |
| 2.2.3     | Environmental Management and Monitoring Procedures (UKL and UPL).....                                          | VII-5       |
| Chapter 3 | Present Environmental Condition in and around the Study Area.....                                              | VII-7       |
| 3.1       | Administrative situation .....                                                                                 | VII-7       |
| 3.2       | Natural Condition in and around the Study Area .....                                                           | VII-7       |
| 3.2.1     | National Forestland .....                                                                                      | VII-7       |
| 3.2.2     | Vegetation (Flora).....                                                                                        | VII-8       |
| 3.2.3     | Wildlife (Fauna) .....                                                                                         | VII-8       |
| 3.2.4     | Soil Erosion Condition .....                                                                                   | VII-8       |
| 3.2.5     | Watershed Condition .....                                                                                      | VII-13      |
| 3.2.6     | Water Quality of Drinking Water .....                                                                          | VII-13      |
| 3.2.7     | Use of Agro-inputs (Fertilizer and Agrochemical) .....                                                         | VII-14      |
| 3.3       | Social Condition .....                                                                                         | VII-16      |
| 3.3.1     | Health Condition .....                                                                                         | VII-16      |
| 3.3.2     | Water Use Condition .....                                                                                      | VII-17      |
| 3.3.3     | Historical and Religious Sites .....                                                                           | VII-18      |
| 3.4       | Present Environmental Problems (including Possible Environmental Problems under Present Condition) .....       | VII-18      |
| 3.4.1     | Health Hazard caused by High Dosage of Agrochemical .....                                                      | VII-19      |
| 3.4.2     | Water Pollution in Groundwater and Drainage.....                                                               | VII-20      |
| 3.4.3     | Soil Erosion and Land Slide .....                                                                              | VII-21      |
| 3.4.4     | Social Conflict in Water Users in the Area.....                                                                | VII-21      |
| Chapter 4 | Future Environmental Impacts and Mitigation Plan.....                                                          | VII-22      |

|           |                                                                        |        |
|-----------|------------------------------------------------------------------------|--------|
| 4.1       | Outlines of the Proposed Projects.....                                 | VII-22 |
| 4.2       | Screening and Initial Scoping.....                                     | VII-23 |
| 4.3       | Environmental Conservation Plan (Environmental Mitigation Measures)... | VII-25 |
| 4.3.1     | Construction Stage.....                                                | VII-26 |
| 4.3.2     | Operating Stage.....                                                   | VII-27 |
| Chapter 5 | Environmental Monitoring Plan.....                                     | VII-32 |
| 5.1       | Water Quality of Drainage and Groundwater.....                         | VII-32 |
| 5.2       | Other Effects induced by the Agrochemical Application.....             | VII-33 |
| Chapter 6 | Comments and Recommendations.....                                      | VII-34 |
| 6.1       | Requirement of EIA Study.....                                          | VII-34 |
| 6.2       | Recommendations.....                                                   | VII-34 |

### **List of Tables**

|             |                                                                                       |          |
|-------------|---------------------------------------------------------------------------------------|----------|
| Table VII-1 | Preliminary Estimation of Annual Soil Erosion Rate in and around the Model Sites..... | T-VII-1  |
| Table VII-2 | Results of Interview Survey in the Model Areas regarding Agro-input Dosage.....       | T-VII-2  |
| Table VII-3 | List of Agro-chemicals often utilized in and around the Study Area.....               | T-VII-3  |
| Table VII-4 | Results of IPM Program for the Last Decade (1990 - 1999).....                         | T-VII-4  |
| Table VII-5 | Number of Medical Facilities and Personnel in and around the Model Areas.....         | T-VII-5  |
| Table VII-6 | Assessment of Probable Environmental Impacts and Recommended Mitigation Measures..... | T-VII-6  |
| Table VII-7 | Recommended Grasses and Tree Crops for Soil Conservation.....                         | T-VII-14 |

### **List of Figures**

|              |                                           |         |
|--------------|-------------------------------------------|---------|
| Figure VII-1 | Organizational Structures of BAPEDAL..... | F-VII-1 |
| Figure VII-2 | Outline of AMDAL Process.....             | F-VII-2 |

### **Attachments**

|               |                                           |         |
|---------------|-------------------------------------------|---------|
| Attachment-I  | Basic Assumption for USLE Estimation..... | A-VII-1 |
| Attachment-II | Result of Screening and Scoping.....      | A-VII-3 |

## CHAPTER 1 GENERAL

This annex describes the institutional framework and legislation of environmental systems in Indonesia, present environmental condition of each model area, present environmental issues, results of the initial environmental examination (IEE), and environmental conservation and monitoring plans for each model project. The description of the present environmental condition covers mainly those that are not stated in other study reports. The study largely relies on the secondary data collected during the field survey period. Field reconnaissance was also conducted in the study to grasp the natural and social condition in and around the model areas and to know the beneficiary's perception of the Project.

The assessment of the probable environmental impact was carried out considering the present condition of the model areas and the proposed activities of each model areas. A detailed survey to make quantitative and qualitative projection of the impacts was not undertaken because of insufficient work schedule.

This report is composed by six chapters and two (2) attachments as shown below.

|                |                                                                    |
|----------------|--------------------------------------------------------------------|
| Chapter 1:     | General                                                            |
| Chapter 2:     | Environmental legislation and institutional framework in Indonesia |
| Chapter 3:     | Present Environmental Condition                                    |
| Chapter 4:     | Future Environmental Impacts and Mitigation Measures               |
| Chapter 5:     | Environmental Monitoring Plan                                      |
| Chapter 6:     | Recommendation                                                     |
| Attachment I:  | Basic assumption for USLE estimation                               |
| Attachment II: | Results of Screening and Scoping                                   |

## **CHAPTER 2 ENVIRONMENTAL LEGISLATION AND INSTITUTIONAL FRAMEWORK IN INDONESIA**

### **2.1 Environmental Institutional Framework**

#### **2.1.1 Environmental Impact Management Agency (BAPEDAL)**

Environmental Impact Management Agency (BAPEDAL) was established in 1990 by transferring the responsibilities of Ministry of Population and Environment. BAPEDAL is a Non Ministerial Government Agency subordinated and directly responsible to the President. The principal mandate of BAPEDAL is to assist the President in management of environmental impacts including prevention of and control over pollution and environmental damage, and rehabilitation of environmental quality. In order to implement the principal mandate, BAPEDAL has the following functions.

- i) to stipulate technical policy on prevention of and control over pollution and environmental damage, and rehabilitation of environmental quality,
- ii) to develop institutions and improve environmental impact management capacity,
- iii) to control technical policy on prevention of and control over pollution and environmental damage, and rehabilitation of environmental quality,
- iv) to implement the prevention of and control over pollution which may arise from any particular plans and rehabilitate the relevant environmental quality,
- v) to implement technical guidance to prevention of and control over pollution and environmental damages, and rehabilitation of environmental quality,
- vi) to manage Environmental Impact Assessment (AMDAL) and develop technical ability to control environmental impacts.

BAPEDAL consists of the regional BAPEDALs and three (3) technical directorates, such as i) Institutional and Capacity Improvement, ii) Pollution Control, and iii) Environmental Impact Assessment and Technical Development. The present organization structures of BAPEDAL in central level and in West Java province are shown in Figure VII-1.

### **2.2 Environmental Legislation in Indonesia**

#### **2.2.1 Environmental Law (Law No. 4 of 1982 regarding Basic Provisions for the Management of Living Environment)**

The Environmental Law was enacted in 1982 as the fundamental law for

environmental management of the country. In the article 16 in the Law, the requirement of environmental impact assessment is stipulated as shown below.

“Any proponents of the proposed activities or businesses which have the greatest potential to significantly affect the environment shall conduct an environmental impact assessment (EIA) study. The process of EIA study will be stated in the governmental regulation.”

### 2.2.2 Environmental Impact Assessment System in Indonesia

Following the environmental law, the environmental impact assessment system in the country was originally established in the government regulation No. 29 of 1986. This regulation is called the AMDAL (Analisis Mengenai Dampak Lingkungan) in the country. AMDAL, and then, was revoked in 1993 and replaced by the government regulation No.51 of 1993. The regulation stipulates the definition of target projects, the process of EIA (named ANDAL: Analisis Dampak Lingkungan), the documents to be submitted, and the required process for permission and licensing, with the following supporting guidelines.

- KEP-10/MENLH/3/1994 Concerning Cancellation of Decrees
- KEP-11/MENLH/3/1994 Concerning the Types of Businesses or Activities Required to Prepare an Environmental Impact Assessment
- KEP-12/MENLH/3/1994 Concerning General Guidelines for Environmental Management Procedures and Environmental Monitoring Procedures
- KEP-13/MENLH/3/1994 Concerning Guidelines for Membership and Working Procedures for AMDAL Commissions
- KEP-14/MENLH/3/1994 Concerning General Guidelines for the Preparation of an Environmental Impact Assessment
- KEP-15/MENLH/3/1994 Concerning Establishment of an Environmental Impact Assessment Commission for Integrated/Multi-spectral Activities
- KEP-16/MENLH/3/1994 Concerning Guidelines for the Determination of Significant Impact

Out of the guidelines, the KEP-11/MENLH/3/1994 defines criteria for the projects to be required to conduct an EIA study. As for the agricultural development project, the criteria are set up as follows:

(a) Activities requiring EIA

Public Work Sector (activities related with irrigation)

- Construction of dams or embankment: Height  $\geq$  15 m or Impound area  $\geq$  100 ha
- Irrigation area development: Irrigated area  $\geq$  2,000ha

Agriculture Sector

- Shrimp/fish culture: Area  $\geq$  50 ha
- Development of rice field in forest area: Area  $\geq$  1,000ha
- Plantations: Area  $\geq$  10,000ha
- Cash crop farms: Area  $\geq$  5,000ha

(b) Protected Areas

- Forest protection areas
- Peat areas
- Water catchment areas
- Coastal edges
- River edges
- Areas surrounding lakes and reservoirs
- Areas surrounding springs
- Nature conservation areas
- Marine and freshwater conservation areas
- Coastal mangrove areas
- National parks
- Recreation parks
- Nature parks
- Cultural reserve and scientific research areas
- Areas susceptible to natural hazards

For projects that fall within the above criteria, project proponents must follow the AMDAL system. As the first step, the proponents must prepare a Terms of Reference (TOR) for EIA study (KA-ANDAL), which describes the scope of the study, results of scoping, major possible issues predicted to arise in the project, and methods of the study. After preparation, KA-ANDAL is submitted to the AMDAL commission, which consists of relevant and multi-spectral agencies in order to review the KA-ANDAL technically. The KA-ANDAL is reviewed within 12 working days after submission. After review works, the proponent must then carry out an EIA as defined in the KA-ANDAL, and prepare the impact

assessment report in the form of the ANDAL document. In addition to the ANDAL document, the proponent must prepare an Environmental Management Plan (RKL) and an Environmental Monitoring Plan (RPL). The RKL specifies all environmental management techniques, which must be implemented to reduce or eliminate the predicted significant environmental impacts. On the other hand, the RPL specifies the technical details of the monitoring that must be carried out to ensure that the environmental management procedures are indeed implemented and are effective in mitigating the impacts. The ANDAL, RKL and RPL documents must be all submitted at the same time and together to the AMDAL commission.

The general AMDAL procedures are shown in the Figure VII-2.

### 2.2.3 Environmental Management and Monitoring Procedures (UKL and UPL)

In case projects do not fall within the criteria, projects will be evaluated whether the Environmental Management Procedures (UKL) and the Environmental Monitoring Procedures (UPL) are required or not, based on the technical guideline of responsible Ministries. Project proponents must prepare the UKL and UPL and submit to responsible agency and BAPEDAL when they are required. The contents of the UKL and UPL documents generally include the following five (5) items:

- Proposed project activities,
- Environmental condition and natural resources situation,
- Predicted impacts,
- Environmental Management Procedures,
- Environmental Monitoring Procedures.

The Ministry of Agriculture has an own technical guideline for the UKL and UPL with the required document form. (Decree of Ministry of Agriculture No. 752: Technical Guideline for the Environmental Management Procedures (UKL) and the Environmental Monitoring Procedures (UPL)). According to the Decree No. 752, the following projects are required to formulate the UKL and UPL in case of the upland agricultural development projects.

- 1) Development of rice field in forest area:  $500 \text{ ha} \leq \text{Area} < 1,000\text{ha}$
- 2) Development of rice field outside forest area:  $500 \text{ ha} \leq \text{Area}$



- 3) Plantation development  $5,000 \text{ ha} \leq \text{Area} < 10,000\text{ha}$
- 4) Cash crop farms (horticulture) development  $500 \text{ ha} \leq \text{Area} < 5,000\text{ha}$
- 5) Plantation in upland and watershed area:  $500 \text{ ha} \leq \text{Area} < 5,000\text{ha}$
- 6) Cash crop farms in upland and watershed area:  $25 \text{ ha} \leq \text{Area} < 5,000\text{ha}$

## CHAPTER 3      PRESENT ENVIRONMENTAL CONDITION IN AND AROUND THE STUDY AREA

### 3.1      Administrative situation

The model areas are located over West Java Province and are located into five (5) districts and eight (8) sub-districts. Administrative information of the Study area is summarized in the following table.

**Administrative Jurisdiction of the Study Area**

| Model area   | Sub-district  | District | Area (ha) |
|--------------|---------------|----------|-----------|
| Mekarjaya    | Arjasari      | Bandung  | 100       |
| Tugumukti    | Cisarua       | Bandung  | 50        |
| Langensari   | Lembang       | Bandung  | 72        |
| Gekbrong     | Warungkondang | Cianjur  | 50        |
| Cisurupan    | Cisurupan     | Garut    | 300       |
| Tanjungkarya | Samarang      | Garut    | 80        |
| Mekarmukti   | Buhadua       | Sumedang | 167       |
| Cisantana    | Cigugur       | Kuningan | 250       |

### 3.2      Natural Condition in and around the Study Area

#### 3.2.1      National Forestland

National forestland is directly managed by the Ministry of Forestry and Estate Crop, and it is clearly distinguished from village land at present. The National Forestland is classified into four (4) categories, such as:

- i) Conservation Forest;
- ii) Protection Forest;
- iii) Production Forest; and
- iv) Recreation Forest.

Out of the forest areas, the conservation and production forests are located in the vicinity of the model areas and/or also related villages as shown below.

**Categories of Forests in and around the Study Area**

| Model areas  | Location of forestland      | Category                                      |
|--------------|-----------------------------|-----------------------------------------------|
| Mekarjaya    | Adjacent to the Study area  | Production forest (Conservation forest)       |
| Tugumukti    | 5 km upper from the village | Production forest (Conservation forest)       |
| Langensari   | 2 km upper from the village | Production forest (Conservation forest)       |
| Gekbrong     | Adjacent to the Study area  | Conservation forest                           |
| Cisurupan    | Adjacent to village         | Production, Protection & Conservation forests |
| Tanjungkarya | Adjacent to village         | Production, Protection & Conservation forests |
| Mekarmukti   | 3 km upper from the village | Production forest (Conservation forest)       |
| Cisantana    | Adjacent to the village     | Production forest (Conservation forest)       |

Source: District Offices of Ministry of Forest and Estate Crops

### 3.2.2 Vegetation (Flora)

Most of the lands of the villages are presently used for agriculture and/or miscellaneous. Some parts of the village leave the woodlands as the secondary forest or tree crops farm. Mahogany (*Swietenia mahogani*), Lamtoro gung (*Leucaena leucocephala*), Petai (*Parkia spesiosa*), Avocado (*Persea sp.*), etc. are found in the secondary forest and tree crops farms. In fact, forests with certain ecological and commercial values do not exist in the model areas.

On the other hand, pine tree (*Pinus sp.*) is major tree specie in the production forest, and those in the conservation forest are Rasamala (*Altinghia excelsa*), Rattan (*Rattan sp.*), Pasang (*Quercus sp.*), Puspa (*Puspa Noronhoe*), etc.

### 3.2.3 Wildlife (Fauna)

Wildlife particularly mammals are rarely observed in the model areas due to human intervention. In addition, no endanger species of animals also habit in the model areas. To the contrary, it is reported that several large mammals inhabit in central parts of the conservation forest, such as tigers, antelopes, monkeys, wild pig, etc.

### 3.2.4 Soil Erosion Condition

#### (1) Present Land Condition

Based on the interview survey to farmers and field observation, it is considered that farmers have an intention to prevent soil erosion occurring in their fields. In fact, bench terrace is extensively disseminated over the model areas as a soil conservation measure, especially in existing paddy fields and irrigated vegetable cropping area. The following table shows the present conservation measures adopted in each model area.

**Present Soil Conservation Measures in the Study Area**

| Model area   | Ave. slope (%) 1/ | Present Conservation Condition                |
|--------------|-------------------|-----------------------------------------------|
| Mekarjaya    | 5 – 50%           | Bench terrace, Contour bunds, No conservation |
| Tugumukti    | 0 – 10%           | Bench terrace, Strip row, Contour bund        |
| Langensari   | 0 – 8%            | Bench terrace, Strip row, Contour bund        |
| Gekbrong     | 1 – 6%            | Strip row, Contour bunds                      |
| Cisurupan    | 0 - 8 %           | Bench terrace, Contour bund                   |
| Tanjungkarya | 0 - 15%           | Bench terrace, Contour bund                   |
| Mekarmukti   | 10 - 50%          | Bench terrace, Agroforestry, Contour bund     |
| Cisantana    | 10 - 25%          | Bench terrace, Contour bund                   |

Remarks: 1/ : Slope was identified based on the topographic map and field observation.

In Mekarjaya, however, the sloping lands without conservation measures are observed through the field survey. On the other hand, denuded sloping lands without conservation measures are used for vegetable cultivation in Gekbrong, Langensari, and Tugumukti, although the slope is generally gentle. It is also speculated that the fields are rather susceptible to soil erosion since the fields are exposed to heavy rainfall in rainy season.

To the contrary, sloping lands without soil conservation measures extend outside the model areas (upper reach of the model areas or the marginal area of the related villages). In the marginal areas, farmers grow maize, banana, and fruit trees under rainfed condition.

(2) Limitation for Adoption of Soil Conservation Measures

In this way, some of the lands still remain as the sloping land without conservation measures since the measures, especially bench terrace, require the significant money and labor force. The research results in Citanduy watershed in West Java indicate that a heavy workload (500-700 man-days/ha) is required for construction of bench terrace as shown below:

**Work Load for Soil Conservation**

| Soil conservation types | Work load (man-day/ha) | Remarks                             |
|-------------------------|------------------------|-------------------------------------|
| Bench terrace           | 500 – 700              | applied on the slope over 20%       |
| Contour hedge-row       | 50                     | width of row is 50 cm               |
| Mulching                | 10 – 15                | 5 ton/ha of rice straw is utilized. |

Source: Contour grass strip as a low cost conservation practice, Sofijah Abujamin, et. al. (1985)




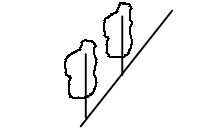
On the other hand, it is often found that the edge and slope of bench terrace are left denuded. In addition, hollows (the farm ridges) in the field on terrace land is often formed vertical way (along the slope). These might also induce a kind of sheet erosion and/or collapse of terrace. It is judged that there is still some of room for improvement in the farm fields.

(3) Present Extension Activities for Soil Conservation in the Study Area

Extension works for soil conservation are the charge of the District Forest and Soil Conservation Service Office (Dinas-Perhutanan dan Konservasi Tanah). District extension workers (PKLs) of the Office have a responsibility for the field extension. Major work items for PKLs are to promote the soil conservation measures in the fields and to assist in implementation of social and agroforestry programs. The following table

shows the existing standard of recommended soil conservation measures:

#### Recommended Soil Conservation Measures

| Slope(%) | Recommended measures                                                                                                                                                                                                                                    | Shape of lands                                                                      |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 0 - 8    | <b>Contour bund 1:</b> This is the initial stage of the bench terrace. The bund is constructed along contour line to prevent soils from flowing down.                                                                                                   |  |
| 8 - 15   | <b>Contour bund 2:</b> Large bunds are constructed at interval of 20 – 30 m, and the small (ordinal) bunds are constructed between the large bunds at shorter interval than the above practice.                                                         |  |
| 15 - 45  | <b>Bench terrace:</b> This is the most common practice in the area. Level or adverse slope terrace is constructed with ridge on the edge and watercourse on the unslope side.                                                                           |  |
| over 45  | <b>Forestland including fruit trees:</b> This is the main conservation measure in “Social-agroforestry Program”. Perennial crops, including fruit trees (durian, juck fruit, bread trees, etc.) are planted in the slope to cover the surface of lands. |  |

Source : Interview survey to PKL (Forestry Extension Service) staff, JICA Study Team

In addition to the ordinal extension activities in the farm fields, a social and agroforestry program has been conducted in slope lands in and around the model areas in order to reduce soil erosion possibility. The activities that are being and will be carried out around the Study areas are listed up as shown below.

#### Present Extension Activities for Soil Conservation

| Title                          | Outline                                                                                                                                                  | Related village                                                   |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1. Social agroforestry         | - Supply of seedings of fruit and other profitable trees<br>- Technical assistance for establishment of forest                                           | Mekarjaya<br>Mekarmukti<br>Langensari                             |
| 2. Model Micro Watershed (MMD) | - Establishment of demonstration plot for soil conservation, which includes reforestation, check dam, drop structures, bench terrace, agroforestry, etc. | Mekarjaya<br>Langensari<br>Tanjungkarya<br>Cisurupan<br>Cisantana |

#### (4) Possibility of Soil Erosion

##### (a) Existing Research and Observation Data

In the Study area, there is no research and observation data of soil erosion. However, the observation and research data that had been conducted in West Java and Indonesia were collected through the field survey. The research data indicate that soil conservation measures are effective for land protection.

Annual soil erosion rates for each soil conservation measures are summarized as follows:

**Annual Soil Erosion Rates**

| Soil conservation   | Soil type                                        | Slope (%) | Soil erosion rate (ton/ha/yr.) |
|---------------------|--------------------------------------------------|-----------|--------------------------------|
| Bench Terrace       | Ultisols, Alfisols, Entisols, Oxisols, Vertisols | 3 - 38    | 0.6 – 15.5                     |
| Ridge Terrace       | Alfisols, Entisols, Oxisols, Vertisols           | 3 - 38    | 0.5 – 18.5                     |
| Contour hedgerow    | Oxisols                                          | 13 - 22   | 10.6 – 41.9                    |
| Mulching            | Ultisols, Oxisols                                | 3 - 17    | 0.3 - 28                       |
| Alley cropping      | Alfisol, Oxisols, Inceptisols                    | 10 - 15   | 0.1 – 11.9                     |
| Contour Cultivation | Regosols                                         | 10        | 43.5                           |
| Vegetable cropping  | Regosols                                         | 10        | 43.5                           |
| Bare land           | Ultisols, Alfisols, Entisols, Oxisols,           | 3 - 22    | 98 - 452                       |

Source : Fagi and Mackie, 1987

The conservation effect is higher in bench terrace, ridge terrace and alley cropping as 0.1 to 19 ton/ha/yr. On the contrary, the effect in the contour hedgerow varies depending on the slope from 11 ton/ha/yr. – 42 ton/ha/yr.

#### (b) Preliminary Estimation of Soil Erosion Possibility

Referring the above data, the soil erosion rate is preliminary estimated by using USLE (Universal Soil Loss Equation) formula, based on the Indonesian and other country's standard factors of USLE. The assumption for estimation and each factor are explained in Attachment I. The results of preliminary estimation are presented in Table VII-1, and summarized as follows:

**Preliminary Estimate of Annual Soil Erosion Rates**

| Model areas  | Slope (%) | Crop types        | Conservation Type                             | Annual loss (ton/ha/yr.) |
|--------------|-----------|-------------------|-----------------------------------------------|--------------------------|
| Mekarjaya    | 10-40     | Vegetables        | Contour bund and Terrace (level)              | 32-410                   |
| Tugumukti    | 0 – 15    | Vegetables        | Strip row, Contour bund and Terrace (level)   | 8 – 33                   |
| Langensari   | 0 – 8     | Vegetables        | Strip row, Contour bund and Terrace (level)   | 8 – 33                   |
| Gekbrong     | 0-8       | Vegetables        | Strip row and Contour bund                    | 16 – 33                  |
| Mekarmukti   | 3 – 40    | Paddy & upland    | Contour bund, Terrace (reverse), Agroforestry | 0.5 – 59                 |
| Cisurupan    | 0 – 15    | Vegetables        | Terrace (level)                               | 8 – 39                   |
| Tanjungkarya | 0 – 15    | Vegetable & Paddy | Terrace (level) and (reverse)                 | 2 – 39                   |
| Cisantana    | 10 –15    | Vegetables        | Terrace (level)                               | 39                       |

Since this is a preliminary estimation, it does not precisely indicate the amount of soil loss in the fields. This, however, can indicate the tendency of soil erosion in and outside the model areas. Annual soil loss is estimated low to moderate in the model areas, which generally ranges from 0.5 to 39 ton/ha/yr. As for the Mekarjaya area, the value of annual loss is considered

relatively high, since the soil conservation measures are still not adopted well.

On the contrary, the possibility of soil erosion outside the model area, such as upper reaches or marginal area of the villages, is estimated quite high. The values of annual loss range from 22 to 948 ton/ha/yr. as shown in Table VII-1. The high potential area is generally located on steep slope, and the completed conservation measures are not applied yet in the area. It is essential to promote to adopt a proper soil management on these lands and make farmers operate farming activities in a sustainable way. This will also be effective for avoiding further encroachment to forest and watershed area.

#### (5) Constraints on the Present Extension Activities

According to the PKLs, the extension works of soil conservation are conducted to same farmer's groups with the agricultural extension works, and they have a periodical meeting with PPL (agricultural extension workers) to exchange the opinions and progress about the target groups. However, the frequency of PKL's visiting is unstable and insufficient. In fact, farmers often complain the shortage of visiting.

The following matters are listed by the PKLs as the constraints on the extension activities:

- Lack of transportation measures,
- Shortage of number of staff (by comparison with coverage area),
- Low farmer's educational level,
- Low ability of extension workers,

(Shortage of opportunity to get latest information and technology).

In addition to the above constraints, it is also assumed that less coordination with agricultural extension services is one of the causes for ineffective extension activities, even PKLs reported they have had a periodical meeting with PPLs. The soil conservation approach is closely related with agronomic field management. For example, presently farmers form the farm ridge along slope because they think that the farm ridge against slope will cause poor drain and growth of vegetables. Thus, a comprehensive advice, which covers not only agronomic but also soil conservation matters, is required to make possible the sustainable and profitable land management.

### 3.2.5 Watershed Condition

Proper watershed management is one of the essential factors for ensuring the sustainability of the irrigation project. As described in section 3.2.1, the national forestlands are located in the upper reaches of the model areas. The conservation forests are presently protected and maintained as natural forest. But parts of the production forests, especially in Tanjungkarya and Mekarjaya, have been deteriorated due to the encroachment of surrounding villagers. The degraded watershed areas in both areas are to be established for ensuring sustainability of the areas. At present, the following rehabilitation program, which involves the surrounding villagers, is conducted in the production forests.

|                   |                                                                                                                                                                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Program:          | Rehabilitation in forestland by villagers                                                                                                                                                                                                       |
| Purpose:          | Rehabilitation and restoration of the Production forest                                                                                                                                                                                         |
| Outline:          | Government permits villagers to cultivate the fields for three years in the national forestlands. In stead of getting cultivation right, farmers have to replant typical species in to the forest area and manage the seedling for three years. |
| Related villages: | Mekarjaya, Tanjungkarya,                                                                                                                                                                                                                        |

### 3.2.6 Water Quality of Drinking Water

#### (1) Water Supply System in the related villages

The following table shows the present water supply system and main water sources in each village.

**Main Water Sources and Water Supply Facilities in the Study Area**

| Model area   | Water sources       | Water Supply means (% of occupation)                                 |
|--------------|---------------------|----------------------------------------------------------------------|
| Mekarjaya    | Spring, Small river | 1. No supply system (75%), 2. Piped water (15%), 3. Well water (10%) |
| Tugumukti    | Small springs       | 1. Piped water (100%), (but not enough for domestic use)             |
| Langensari   | Dug well, SEKE 1/   | 1. Well water (40%), 2. Piped water (40%), 3. No supply system (10%) |
| Gekbrong     | Spring              | 1. piped water (100%)                                                |
| Cisurupan    | Spring, Dug well    | 1. No supply system (46%), 2. Piped water (43%), 3. Well water (11%) |
| Tanjungkarya | Spring, Dug well    | 1. No supply system (92%), 2. Well water (8%)                        |
| Mekarmukti   | Spring              | 1. Piped water (100%)                                                |
| Cisantana    | Spring              | 1. Piped water (100%)                                                |

Remarks: 1/ : SEKE : Small spring water along river course.

Source: Interview survey to the chief of village by JICA study team

As shown in the above table, the drinking water for villages in the model areas mainly depends on the spring water. Since the water supply system is not fully established in all the areas of the villages, some of villagers in the villages (Cisurupan, Tanjungkarya and Mekarjaya) are presently obliged to



fetch water at the springs. This causes sometimes villages to take and use water of the irrigation canal. On the other hand, open-dug wells are the main water source in the village Langensari.

## (2) Water Quality of Drinking Water

Results of water quality analyses on existing drinking water source are presented in Annex V, and they show that most of water sources are suitable for drinking water. However, the water quality of the dug wells indicates high contamination of the colon bacillus and other bacteria. In addition, water quality of dug well indicates the presence of nitrate (NO<sub>3</sub>-N) and nitrite (NO<sub>2</sub>-N). This might be associated with high application of nitrogen fertilizer (Urea, Ammonium Sulfate) into the farmlands.

### 3.2.7 Use of Agro-inputs (Fertilizer and Agrochemical)

#### (1) Present Use

According to interviews to farmers, they presently apply significant amount of agro-inputs for vegetable cultivation as shown in Table VII-2 and in the following summary table.

**Present Use of Fertilizers and Agrochemicals**

| (Unit : kg or lit./ha) |      |       |        |        |
|------------------------|------|-------|--------|--------|
| Agro-inputs            | Unit | Min.  | Max.   | Ave.   |
| 1. Fertilizers         |      |       |        |        |
| 1.1 Manure             | kg   | 1,400 | 40,000 | 15,000 |
| 1.2 Nitrogen 1/        | kg   | 0     | 528    | 181    |
| 1.3 Phosphate 2/       | kg   | 0     | 1,080  | 233    |
| 1.4 Potassium 3/       | lit. | 0     | 180    | 43     |
| 2. Insecticides        | lit. | 1     | 60     | 10     |
| 3. Fungicides          | kg   | 2.3   | 125    | 43     |

Remarks : Dosage in wet season

1/ : Urea and Ammonium Sulfate

2/ : TSP

3/ : KCL

Source : Interview survey to farmers in the model areas by JICA Study Team

It can be expected that the high dosage of agrochemical and fertilizer may induce several adverse issues from the environmental viewpoint, which finally will worsen the farmer's life.

- Shortage of land productivity caused by soil degradation,
- Economic collapse of farm household,
- Contamination of agro-input into the groundwater,
- Sever health damage by using agrochemical.

## (2) Agrochemical Use

The dosage of agrochemical, especially of herbicides, is quite high in the model areas. The following are considered as the reasons for high application of agrochemical:

- High infection of pests and diseases,
- No concern for environmental issue,
- Insufficient knowledge for plant protection.

In fact, high infection of pests and diseases with vegetables compels farmers to apply agrochemical for many times. The continuous repeated cropping of same crop in a plot is considered as one of reasons for high infection of diseases and pests.

## (3) High Toxic Agrochemical

In 1996, the Government reduced the numbers of authorized agrochemical substantially as stipulated in the Ministry Regulation No. 473/kpts/TP. 270/6/96. In this regulation, 28 ingredients and 53 products were banned to produce and trade in the country.

Through the field survey, however, the restricted products, such as Dursban 20 EC, was confirmed in market and farmer's use. Further, farmers in the model areas presently use several toxic chemicals classified "highly hazardous" based on the WHO classification (1992). Table VII-3 shows the list of agro-chemicals often utilized in and around the model areas.

## (4) Existing Extension Service for Reduction of Agrochemical Use

The district agricultural service offices have conducted IPM (Integrated Pest Management) program since 1990. The program was just terminated at September 1999. The program is mainly composed by two (2) activities, such as TOT (Training of Trainers) and FFS (Field Farmers' School). FFS is a kind of demonstration farm to train farmers the IPM techniques. The course of FFSs consists of three kinds of crops (paddy, palawija and vegetables). Results of the program for the last decade are presented in Table VII-4, and summarized as follows:

| Types of IPM      | Ave. in related Kab. | Ave. in related Kec. | Ave. in related villages |
|-------------------|----------------------|----------------------|--------------------------|
| FFS of Paddy      | 2,001                | 145                  | 2                        |
| FFS of Palawija   | 87                   | 7                    | 0                        |
| FFS of Vegetables | 124                  | 44                   | 1                        |

Remarks: 1/ : FFS : Field Farmers' School

Source: Interview survey to the chief of village by JICA study team

In five (5) model areas such as Langensari, Tugumukti, Mekarmukti, Cisurupan and Tanjungkarya, a farmer's group has gotten the FFS in the course of the program. In fact, present application level of the farmers who have attended the FFS is relatively lower than others. However, it is assumed that the techniques and concepts of IPM are well disseminated in the farmers of village.

### 3.3 Social Condition

#### 3.3.1 Health Condition

##### (1) Water-related Diseases in the Study Area

According to the district health clinics in each sub-district, no vector-borne diseases such as malaria disease, schistosomiasis, filariasis and encephalitis are not found in and around the Study area. In this connection, there is less possibility of an outbreak of vector-borne diseases caused by the implementation of irrigation project, unless the outsiders who have a potential of the diseases migrate to the model areas. The major diseases observed in each village are summarized as follows:

##### Major Diseases in the Study Area

| Model area   | 1 <sup>st</sup> major disease | 2 <sup>nd</sup> major disease | 3 <sup>rd</sup> major disease |
|--------------|-------------------------------|-------------------------------|-------------------------------|
| Mekarjaya    | Diarrhea                      | None                          | None                          |
| Tugumukti    | Fever                         | Diarrhea                      | ISPA 1/                       |
| Langensari   | Fever                         | Diarrhea                      | Rheumatism                    |
| Gekbrong     | Fever                         | Diarrhea                      | Others                        |
| Cisurupan    | Diarrhea                      | None                          | None                          |
| Tanjungkarya | Diarrhea                      | None                          | None                          |
| Mekarmukti   | ISPA <1                       | Eye sickness                  | Diarrhea                      |
| Cisantana    | Fever                         | Diarrhea                      | Abdominal pain                |

Remarks: 1/ ISPA:

Source: District Health Clinic Offices in Each District

Some of the model areas show a high incidence of diarrhea. It might be associated with the water quality of drinking water or availability of safe water. In fact, the areas without a piped water supply system indicate a relatively high tendency for the diarrhea. According to the staff of district

health clinic, the villagers who have no water supply system often fetch water directly from irrigation canals.

(2) Medical Facilities in and around the Study Area

Numbers of medical facilities and personnel related with the facilities are compiled in Table VII-5 and summarized below.

**Medical Facilities in the Study Area**

| Model areas  | Medical facility (No. of facility) |        |            | Medical staff (Persons) |       |         |
|--------------|------------------------------------|--------|------------|-------------------------|-------|---------|
|              | Hospital                           | Clinic | Sub-clinic | Doctor                  | Nurse | Midwife |
| Mekarjaya    | 0                                  | 0      | 0          | 0                       | 0     | 1       |
| Langensari   | 0                                  | 0      | 1          | 0                       | 0     | 1       |
| Tugumukti    | 0                                  | 0      | 0          | 0                       | 0     | 1       |
| Gekbrong     | 0                                  | 1      | 1          | 1                       | 6     | 6       |
| Cisurupan    | 0                                  | 0      | 1          | 1                       | 2     | 1       |
| Tanjungkarya | 0                                  | 0      | 0          | 0                       | 0     | 1       |
| Mekarmukti   | 0                                  | 0      | 1          | 0                       | 0     | 1       |
| Cisantana    | 0                                  | 0      | 1          | 0                       | 0     | 1       |

Source : District Health Clinic Offices in Each District

(3) Domestic Waste

At present, there is no domestic waste facility in the Study area. It is often found in the model areas, especially in Cisantana, that wastes from villages are dumped in and around the river. This causes the degradation of water quality and may associate with the increase of diarrhea disease in the area and also in the downstream reaches. A sort of health education activity is required for proper and sustainable management of water resource.

3.3.2 Water Use Condition

Through the interview survey to village chiefs, several existing users of the water resources in each model area are confirmed as shown below.

### Water Resources and Their Users in the Study Area

| Model areas  | Water resource       | Other users (purpose)                    | village in down reach (purpose) |
|--------------|----------------------|------------------------------------------|---------------------------------|
| Mekarjaya    | Citiis               | Boros & Arjasari (Irrigation)            | 2 RW in Mekarjaya               |
|              | Cikuya spring        | - Absent -                               | - Absent -                      |
|              | Ciremes              | - Absent -                               | Boros & Mangunjaya (Irrigation) |
| Tugumukti    | Situ Lembang         | 6 villages (Irrigation)                  | 2 villages (Irrigation)         |
| Langensari   | Cilukang             | - Absent -                               | 1 RW in Langensari (Irrigation) |
| Gekbrong     | Cibeleng             | - Absent -                               | Songgom (Irrigation, Drinking)  |
| Cisurupan    | Ciburial             | - Cisero (Irrigation, Drinking)          | Tanbakbaya (Irrigation)         |
|              | Ciharemas            | - P.T. Aqua (Drinking)                   | Balewangi (Irrigation)          |
| Tanjungkarya | more than 10 springs | - Sukawangi (at Cilembang: Irrigation)   | Smarang (Irrigation)            |
|              |                      | - Sukakarya (at Bojongsirua: Irrigation) | Sukarasa (Irrigation)           |
| Mekarmukti   | Ciliang spring       | - Karangbunga (Drinking)                 | - Absent -                      |
| Cisantana    | Cipager              | - P.T. Aqua (Drinking)                   | Cipager (Irrigation),           |
|              |                      | - P.T. Presti (Drinking)                 | Cileuleuy (Irrigation)          |

Source: Interview survey to Village Chiefs

Since the existing use of water source is considered a sort of the vested right, significant attention should be paid on the project formulation in order to avoid any social conflicts.

#### 3.3.3 Historical and Religious Sites

There is no archeological and/or historical site in the model area. In Tanjungkarya, there is a grave of historical ancestor outside the model area. Further, since cemeteries of villages are generally located in higher position than the farm fields, it is not considered there will be any disturbance by the irrigation development, except for Cisantana. In Cisantana, some of graves are located in the individual farm plot. However, the replacement of graves will not occur by the implementation of the project directly, and this matter will basically depend on individual sense of the values.

#### 3.4 Present Environmental Problems (including Possible Environmental Problems under Present Condition)

Based on the results of the field survey, the following five (5) environmental issues are identified as the present environmental issues, including possible environmental issues which may occur in future if the situation is left as it is.

### Present and Future Environmental Issues

| Environmental Issues                      | MK  | TG     | LG     | GK     | MR     | TJ | CR | CS     |
|-------------------------------------------|-----|--------|--------|--------|--------|----|----|--------|
| 1. Health hazard caused by high dosage    | +   | +++    | +++    | +++    | +      | ++ | ++ | ++     |
| 2. Water pollution into groundwater       | -   | + - ++ | + - ++ | + - ++ | -      | +  | +  | + - ++ |
| 3. Water pollution into down stream       | -   | -      | +      | -      | -      | ++ | ++ | +++    |
| 4. Soil erosion in and around model areas | +++ | +      | + - ++ | ++     | + - ++ | ++ | +  | ++     |
| 5. Social conflict among the villagers    | -   | -      | -      | -      | -      | -  | ++ | ++     |

Remarks : +++ : major, ++ : moderate, + : minor, - : none

#### 3.4.1 Health Hazard caused by High Dosage of Agrochemical

Present agrochemical dosage is high in the model areas as mentioned in 3.2.7. So far, there have not been any severe health damages caused by improper agrochemical use. According to farmers, however, they have experienced headache and skin ailment on the using. Most of them do not put a musk and grove when they apply the chemical. In addition, used bottles and packages were often found in the farm lots in the model areas. Therefore, mishandling of agrochemical and improper disposal of used containers may cause any health hazards, although farmers have much experience in the usage of agrochemical. In order to minimize the possibilities, the following items should be instructed to the farmers by the extension works:

- 1) To promote proper handling
  - Safety agrochemical usage (dilution, spraying, keeping)
  - Necessity and methods of proper disposal
  
- 2) To reduce the opportunity of agrochemical use
  - Effective agrochemical usage (suitable time in a day and condition)
  - Less input crop management (IPM, crop rotation, proper spacing)

As an indirect adverse effect, a long-term accumulation in human body caused by the high residual agrochemical in vegetables might result in future health damage. Other than this, water pollution by agro-inputs is also important issues to be considered and dealt with.

### 3.4.2 Water Pollution in Groundwater and Drainage

This issue is not clearly obvious at present. Since the present application level of agro-inputs (fertilizer and agrochemical) is relatively high, it may induce the agro-input contamination into drainage and groundwater. At present, almost all the farmers pay no attention to prevent water pollution caused by the agro-input use.

#### (1) In Groundwater

Many literatures have reported the possibility of nitrogen (nitrate: NO<sub>3</sub>-N and nitrite: NO<sub>2</sub>-N) contamination from farm to groundwater. The water pollution in groundwater is closely related with the overuse of agro-inputs (fertilizer and agrochemical) and leaching through soils. Unless any measures are taken to reduce agrochemical use, the water quality of groundwater might be deteriorated due to the contamination. It is essential to promote a proper farming management and also to conduct a periodical water quality monitoring of the groundwater in order to avoid any adverse impacts.

#### (2) In Drainage water

Contamination of polluted water into drains mainly occurs in paddy production area, since the drain water will function as the medium for pollutant. It is assumed that the drainage water in Tanjungkarya, Cisantana, and Cisurupan are presently polluted by agricultural activities, such as fertilizing, spraying, livestock waste, etc. The water pollution in Cisantana is most progressive among the other areas, although no chemical analysis has been carried out. It is also considered that one of the pollutant sources is the domestic waste dumped in the river and river bunk. The water pollution in Cisantana is not limited only for drainage water but also for irrigation water. As described in section 3.3.1, the number of diarrhea cases in Cisantana is relatively high among the related sub-districts. In addition, the number of the cases in the downstream village, named Cileuleuy, is higher than Cisantana. This phenomenon is considered as a piece of evidence that indicates the progress of water pollution. To minimize the adverse effect, the following activities should be considered as the options:

- Extension of environmental friendly farming practice,
- Promotion of communication between the related villages of water

- resource to understand the importance of water quality management,
- Health education for improvement of sanitation condition.

### 3.4.3 Soil Erosion and Land Slide

The potentiality of the soil erosion in the Mekarjaya is higher than other model areas, since it has moderate to steep sloping and the soil conservation measures are not adopted on all the sloping lands. Especially, the area along Ciremasu river of Mekarjaya has steep slope about 30 to 40 %, and the area is presently cultivated only with strip row or contour bund measures. In addition, the landslide occurs every year on the slope area along the Ciremasu river. According to farmers, the length of slide area is reported as about 50 m.

It is assumed that the land fertility of the upper reaches of the model areas is lowered since the adaptation of soil conservation measures is limited. Social agro-forestry program is to be applied in parts of the critical area. To promote soil conservation into the upper reaches of the model areas is considered effective to properly manage the watershed and to reduce further encroachment into the watershed area of the model area.

### 3.4.4 Social Conflict in Water Users in the Area

The Cisantana area has an existing irrigation system, which does not fully function due to the deterioration of system at present. Irrigation water is not distributed to all the villagers, therefore, water users in down and middle reaches in the village Cisantana often complain of shortage of irrigation water. These discontents in the area might be an obstacle for the development of the entire village. Therefore, this should be solved in the earliest stage through the close communication among villagers. However, the water users organization have not functioned sufficiently. It is essential to activate the organization and to have a consensus of water distribution through discussion among the members of the organization.

On the other hand, a water supply system in Cisurupan is not fully developed in all the households of the village. Some of the households in the model area have been installed water supply system by the private mineral water company before. According to farmers, it has also resulted in discontent of the farmers outside the model area.



## **CHAPTER 4. FUTURE ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

### **4.1 Outlines of the Proposed Projects**

The followings are basic outlines of the proposed projects in the model areas, although there are some differences among the model areas.

- (a) Irrigation and rural infrastructure development
  - to improve irrigation system including construction of small-scale weir
  - to establish/ improve the on-farm irrigation system
  - to improve domestic water supply facilities
  - to improve rural road condition
  
- (b) Agriculture development
  - to promote horticulture (vegetable) production through sustainable way
  - to operate a farmers trial farm for disseminating of improved vegetable production technology
  
- (c) Farmers' organization
  - to activate farmers' organizations in agricultural development
  - to train farmers organizations on (i) O&M of irrigation facility, (ii) Joint purchase of farm input and tools, (iii) Joint collection and delivery of vegetable products, (iv) better post-harvest handling and packaging, (v) credit management and (vi) improved production technology
  
- (d) Farmers supporting system
  - To train PPLs on vegetable farming and on-farm water management
  - To improve PPLs transportation means
  
- (e) Market improvement development
  - to improve collection facilities,
  - to train farmers on market-oriented crop planning based with involvement of private sector.

In addition to the above outlines, the followings are considered as the pre-condition and/or a kind of giving condition:

- to protect existing water right (to keep the present water utilizing level of all the water users),
- to promote sustainable agricultural development,
- to involve the beneficiary into the project on the implementation.

#### 4.2 Screening and Initial Scoping

Environmental screening and scoping were carried out to identify and assess the potential adverse impacts on the environment by using environmental checklist as shown in Attachment II. As results of the screening and scoping, the following six (6) matters are considered as potential environmental issues and/or effects: The prospective impacts without mitigation measures are assessed as shown below.

**Result of Initial Environmental Examination**

| Environmental Issues                          | MK  | TG  | LG  | GK  | MR  | TJ  | CR  | CS  |
|-----------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| 1. Forest disturbance                         | +   | -   | -   | ++  | -   | -   | -   | +   |
| 2. Health hazard                              | ++  | +   | +   | +   | ++  | +   | +   | +   |
| 3. Water pollution into drain and groundwater | ++  | +   | +   | +   | ++  | +   | +   | +   |
| 4. Social conflict                            | -   | +   | +   | +   | -   | +   | ++  | -   |
| 5. Improvement of living condition            | +++ | ++  | ++  | ++  | +++ | +++ | ++  | ++  |
| 6. Improvement of economic situation          | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ |

Remarks : +++ : major, ++ : moderate, + : minor, - : none

##### (1) Forest Disturbance in the forestland

The intake sites of Gekbrong, Mekarjaya and Cisantana are located in the conservation forest or production forest of the national forestlands. On the implementation of the projects, the disturbance in the present forestland may occur through cutting tree and inundation of the forestland at the construction of intake facilities. The following table shows the present condition of the intake sites and the outlines for the proposed improvement plans of these model areas.

**Categories of Forests at Intake Sites**

| Areas     | Forestland          | Forest condition | Outline of tentative plans                                          |
|-----------|---------------------|------------------|---------------------------------------------------------------------|
| Mekarjaya | Production forest   | Grass land       | Construction of farm ponds (Cikuya river)                           |
| Gekbrong  | Conservation forest | Natural forest   | Construction of concrete intake (Height:1-2m, Length: 7m, Width:3m) |
| Cisantana | Production forest   | Pine forest      | Rehabilitation of existing intake                                   |

Since the development activities of the areas will center on the rehabilitation and/or improvement of existing facilities, it is assumed that the disturbance size into and effects to the forest will be small. This will be a reasonable trade-off between decrease of forest area and reduction of further encroachment through stabilization of farm economy, if the proper management activities will be conducted on the construction stage against the over cutting, improper disposal, etc. Although, an EIA study might be required according to the regulation, the development activity in the conservation forest is small. It can be judged that a further detailed study (EIA) is not required for obtaining the development permission in consultation with BAPEDAL in West Java.

(2) Health hazard and water pollution by high application of agro-inputs

As mentioned section 3.4.2, this problem is one of the potential problems in the most of the areas, if the present condition is left as it is. Therefore, it is essential to conduct an extension work for proper handling of agrochemical and reduction of agrochemical dosage. In Mekarjaya and Mekarmukti, especially, the dosage level of agrochemical is relatively lower due to the limitation of farm capital and irrigation water. Therefore, it is possible to say that both areas have a potential to increase the agrochemical dosage drastically from the present level. The potential for the misusing and mishandling is assumed higher in Mekarmukti, since the area will change the cropping system from paddy cultivation to vegetable cultivation (horticulture cropping). If the proper extension works will be conducted in the model areas, it can be expected that the potential for the adverse impacts will be mitigated by reasonable level. Hence, it is essential to promote the environment-friendly agriculture through strengthening the agricultural extension service.

(3) Water pollution into drainage water and groundwater

It is also one of the present environmental problems for the most of the model areas. By the same reason for the above item, it is considered that the water pollution is accelerated by high application of agro-inputs through introduction of intensive horticulture farming. Since both of Mekarjaya and Mekarmukti have paddy fields in the down reach, the polluted water might be distributed to other villages and cause adverse effects in the villages, such as increase of incidence of diarrhea disease. Therefore, the

promotion of environment-friendly agriculture is important for mitigating the water pollution.

(4) Social conflict in village

Most of the model areas just cover parts of the village. Especially in Langensari, Tugumukti and Cisurupan, the direct beneficiary of the project is limited since the project activities are limited into the parts of the villages. On the other hand, the proposed project in Mekarmukti and Cisantana covers almost the area of village. Limiting beneficiaries among the villages may induce a social conflict among villagers. As for Cisurupan, villagers outside the model area presently complain those of the model area because of the unequal support as mentioned in section 3.4.4. In this connection, the discontent might be accelerated by the implementation of the project, unless any attention will be paid for the villagers outside the model area in village Cisurupan.

(5) Improvement of living condition of rural life

Farm income will directly increase through stabilization of farm product and improvement of marketing system. In addition, the accessibility to domestic water will directly contribute to improvement of living condition in the model areas. The purpose of the project is set up as “To improve living standard through increase of farmer’s income”, as clearly defined in the PDMs attached in Main Report.

(6) Improvement of regional economic situation

The project works will generate incremental employment of a casual labor at the construction stage, though not permanently. In addition, the increase in agricultural production will induce economic activities in other sectors through linkage effect. The secondary and tertiary benefits will accrue in any sectors related to agriculture, such as traders and wholesalers.

#### **4.3 Environmental Conservation Plan (Environmental Mitigation Measures)**

The objectives of the environmental conservation plan are to mitigate any environmental adverse impacts caused by the implementation of the project and to ensure the sustainability of the project. Therefore, the plan is formulated based on the present and future environmental issues. Consequently, the following are

recommended as the basic concept for environmental conservation plan for each development stage.

Construction stage:

- |     |                                                |           |
|-----|------------------------------------------------|-----------|
| i)  | Application of proper construction works       | All areas |
| ii) | Slope protection of road and canal embankments | All areas |

Operation stage:

- |      |                                                    |                                          |
|------|----------------------------------------------------|------------------------------------------|
| i)   | Promotion of environment-friendly agriculture      | All areas                                |
| ii)  | Distribution of project benefit to non-beneficiary | Cisurupan,                               |
| iii) | Soil conservation (by on-farm management)          | All areas                                |
| iv)  | Soil conservation (by land management)             | Tanjungkarya,<br>Cisurupan,<br>Mekarjaya |

The prospective impacts of the present and future issues with and without the mitigation measures are tabulated in Table VII-6 and the outline of the plans are explained as follows.

#### 4.3.1 Construction Stage

(1) Application of proper construction works

The construction activities for rehabilitation/improvement of irrigation system and rural road in rainy season may cause soil erosion and finally deterioration of water quality due to the inflow of eroded soil. Improper construction methods which leave soil exposed unnecessarily might also cause soil erosion. The mitigation measures to be taken for avoiding any soil erosion are that:

- i) construction would be undertaken by employing proper construction methods; and
- ii) disposal of cut and fill materials would be made in a right way.

(2) Slope protection of road and canal embankments

In the Mekarjaya, Mekarmukti and Cisurupan areas, soil erosion from embankment of canal is one of causes for inefficiency of irrigation system. In addition, as for the rural road improvement activities, the slope protection works should also be taken to avoid soil erosion and to ensure sustainability

of the roads. Considering the cost effective, the re-vegetation by seeding on slope and utilization of surface soil for fill material are recommended as the protection measures to be applied for slope protection.

#### 4.3.2 Operating Stage

##### (1) Promotion of Environment-friendly Agriculture in the model areas

Promotion and implementation of environment-friendly agriculture is essential to ensure the sustainable land management through reduction of dosage of chemical inputs. It can be expected not only to improve the environmental condition but also to achieve stabilization of farm economy through reduction of production costs. The following matters are recommended for the techniques of environment-friendly agriculture:

- i) Introduction of Integrated Pest Management (IPM) system,
- ii) Utilization of slow-acting fertilizer (eg. coating fertilizer),
- iii) Introduction of crop rotation and mix cropping,
- iv) Utilization of bio-chemical and organic fertilizer,
- v) Improvement of farming practices (eg. crop spacing, fertilizing, grafting, etc.).

To achieve the environment-friendly agriculture in the model areas, the following activities are recommended to show farmers its contribution to farm economy and their healthy life:

- i) to continue IPM training focusing on the vegetable farming in the model areas,
- ii) to reinforce agricultural extension services specially focusing on the model areas,
- iii) to disseminate farming techniques by establishment of demonstration plots.

As for the items of ii) and iii), the details are noted in Annex II (Agriculture). As for the item of i), the outlines are shown as below.

#### Box 4.3.1: Outline of IPM program

1. Title of Training: Training of farmer's Group by Field Farmer's School
2. Purpose: Field training on vegetable cultivation using IPM methods  
Training core farmers and increase number of core farmers (TOT)
3. Number of target farmers: 30 persons/FFS/area/season
4. Required cost and staff (Example: 2 areas around Bandung District)

(1) Cost:

| <u>Items</u>                             | <u>Amount (Rp)</u> |
|------------------------------------------|--------------------|
| Transportation Cost for PHP, PPL, others | 1,200,000          |
| Per diem for governmental staff          | 1,020,000          |
| Required cost for TOT                    | 3,780,000          |
| Cost for materials                       | 1,000,000          |
| <u>Total</u>                             | <u>7,000,000</u>   |

Source: District Agricultural Service Office in Bandung District

(2) Staff: PHP: 2 persons, PPL: 2 persons, KCD: 2 persons, PL2: 2 persons

#### (2) Distribution of project benefit

The following direct benefits can be expected for the outsiders through the project implementation:

- increase of employment opportunity for casual labor on construction stage,
- increase of employment opportunity for farm labor in dry season.

In addition, rural development activities will contribute to mitigating the discontent of the outside area. If it is possible for rural infrastructure of the whole village, such as water supply systems and rural roads, to be developed from technical and economic view points, it will be quite effective to mitigate the discontent among villagers in village. In this connection, if the water supply systems in model areas of Langensari, Tugumukti and Tanjungkarya will be incorporated into the development components, the social conflicts in these areas are considered minor or neglected.

In order to prevent and improve the situation, especially in Cisurupan, it is recommended to establish a stock fund to secure the capital for future development through the following procedures, since it is difficult to cover whole of village by rural development components:

- i) to deepen the perception of the project and make a consensus among villagers,
- ii) to discuss the development priority for other parts of village,
- iii) to discuss the capital source for the development.

The box shown below presents the way to establish the stock fund.

**Box 4.3.2: Way to establish the Stock fund for non-beneficiaries**

- i) Establishment of two stocks fund for beneficiary and non-beneficiary
- ii) Involvement of villagers into the construction works as casual labor
- iii) Depositing some parts of labor wage in the funds, respectively
- iv) Utilizing the fund of non-beneficiary for any development activities for village

As an option for rural development in the Cisurupan, the following water supply development is considered for upper reach of the village.

**Box 4.3.3: Water Supply System Development in Cisurupan**

Target households: 700 H.H.(5 Kampongs)  
 Water source: Citiis river  
 Present condition: Villagers in upper reach of village desire to develop the water supply system by utilizing Citiis river. In fact, they constructed a pond in the upper area and purchased the PCV pipes in 1998 according to them. Because of lack of capital, the activities stagnate at present.

(3) Promotion of Soil Conservation

The following matters are considered as future issues in the model areas regarding soil erosion:

- i) Soil erosion in farmlands due to improper application of conservation measures,
- ii) Soil erosion in riverbank and embankment of canals.

Although these issues will not be induced directly by the project, they will affect the sustainability of the project. Therefore, they have to be dealt with and mitigated in the project activities. The conservation measures for them are considered as follows:

- (a) Promotion of soil conservation with proper farm management

To promote soil conservation measures for the area, it is recommended that



the following steps be taken depending on the present conservation level:

**Proposed Soil Conservation Plan**

| Present level                                            | Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Model areas               |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| No conservation / Primitive methods on slope land        | Contour bund and strip row are recommended for the soil conservation measures at initial stage for farmers to easily introduce the measures. One of the constraints for introduction of strip row is that farmers think the strip row cause the poor growth of crops by the crop competition. Therefore, useful crops for soil management and farmers economy should be selected and presented for them. Table VII-7 shows recommended crops for strip row and terrace cover. In case the slope is steep, it is desirable that tree crops such as fruit trees, profitable trees, etc. are introduced as much as possible.                                                                                                                                                                                               | Mekarjaya<br>Tanjungkarya |
| No conservation / Primitive methods on gentle slope land | Contour bund or strip row is recommended as the soil conservation measures for sustainable management. Recommendable crops for strip row are listed up in Table VII-7. It is also recommended to introduce contour cropping to reduce the soil erosion in combination with the strip row.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Gekbrong                  |
| Terrace land (but insufficient)                          | As mentioned in section 3.2.4, most of the terrace land cannot completely protect the soil erosion, since the present bench terrace adopted in the areas is incomplete. One of the cases is that farmers form the hollows (or field ridges) along slope and cut the edge of terrace to drain water through hollow. It is closely connected with agronomic technology. Therefore, it is essential to present them another means to drain water from the fields in sustainable way. The reverse bench terrace, recommended by PKLs to adopt fields at present, is most useful method for improvement of drainability and prevention of soil erosion.<br>In addition, it is also important to promote introduction of cover crops (see Table VII-7) on the edge of terrace for ensuring sustainable management of terrace. | All areas                 |
| Others                                                   | Mulching measure is rarely found in the model areas. It is considered that the situation is related with availability of mulching material.<br>In stead of mulching, the introduction of cover crops is more utilizable and realistic in the model areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | All areas                 |

At present, the extension works for soil conservation are conducted by the forestry extension workers (PKLs) rather than agricultural extension workers (PPLs). However, the farmers preference against the conservation measures are closely connected with their farming situation. Techniques and skills for soil conservation measures are to be incorporated into the agricultural extension works.

In this connection, it is recommended to build up the collaborative relationship between agricultural and forestry services in order to attain the comprehensive supporting service. Reinforcement of the rural extension center's function in each sub-districts is one of the options for the

improvement.

(b) Re-vegetation and/or tree cropping in canal bank and intake site

At present, the soil erosion from canal bank is observed in the Cisurupan and Mekarmukti areas. Farmers in both areas have also recognized it adversely affect to the canal systems because they are compelled to clean canal every year. The soil erosion on the bank is caused for the following reasons:

- i) poor vegetation or denudation on the slope of bank,
- ii) land slide of bank caused by farming activities (such as poor drain system, over cultivation, etc.) on the top of bank.

As for the Mekarjaya area, the sloping area around the proposed intake site of Cikuya spring and river course of Cremes river are not covered by vegetation. Unless any erosion protection measures are adapted on these areas, sedimentation into irrigation systems (canals, intake, ponds, etc.) may occur in future. In this connection, the following protection measures should be taken on the above areas to improve present situation:

- i) Re-vegetation and plantation of tree crops (such as fruit trees),
- ii) Restriction of utilization of top of bank and establish tree crop area,
- iii) Establishment of drainage system on the top of bank.

These activities are to be conducted by the farmers, who are the beneficiaries of the project, to ensure the sustainability of irrigation system.

## CHAPTER 5 ENVIRONMENTAL MONITORING PLAN

From the environmental point of view, the followings are to be monitored through the project:

- 1) Water pollution in drainage and groundwater by agro-inputs,
- 2) Other effects induced by the agrochemical application.

The outlines of monitoring plans for both issues are noted below. However, since it describes only the outlines in this report of the present stage, it is required to conduct a further study to formulate a detailed environmental monitoring plan. The further study will clarify the items to be monitored, the baseline of indicators, and institutional framework for monitoring activities.

### 5.1 Water Quality of Drainage and Groundwater

In the downstream of the model areas, drainage water is used for not only the irrigation purpose but also the domestic purpose, especially in Cisantana, Gekbrong, Tanjungkarya and Mekarjaya. Therefore, the management of water quality of runoff water from the project areas is essential for securing the people's life in the downstream. In addition to the surface water, groundwater is also a common water source for domestic purpose in the model area and also in the down reaches, such as Cisurupan, Langensari, Tugumukti, and Tanjungkarya. It may also be affected by high dosage of agrochemical. However, the following monitoring works are recommended:

#### (1) Sampling methods

##### 1) Water Sampling from:

- Dugwell: in villages using groundwater in down reaches of model areas
- Drainage (river water): in villages using surface water in down reaches of model areas

##### 2) Frequency of Sampling: at least once a crop season (2 to 3 times per year)

#### (2) Survey items

- Physio-chemical substances (pH, EC, SS, DO)
- Organo-chemical substances (COD, NH<sub>4</sub>-N, NO<sub>2</sub>-N, NO<sub>3</sub>-N, T-N, T-P)
- Agro-chemicals

(3) Implementing agency of monitoring

The sampling will be carried out by district agricultural service office, generally. However, the analysis will be entrusted to other institutions, such as BALITSA (Balei Punelithian Sayuran).

## 5.2 Other Effects induced by the Agrochemical Application

Other than the water pollution, several adverse effects might be induced by the high application of agrochemical. To prevent any adverse effects beforehand, it is recommended to take the following monitoring works:

(1) Monitoring items

- i) Residual level of agrochemical in vegetables,
- ii) Accumulation level of agrochemical in the soil,
- iii) Farmers intention and agrochemical application level,
- iv) Cases of health hazard caused by agrochemical use.

(2) Sampling activities

To grasp the relationship between farming practice and affected levels, an interview survey has to be conducted in the fields of sampled area of items i) and ii). The activities are:

- i) Sampling of several kinds of vegetables,
- ii) Sampling of surface soils in the same area with sampled area of vegetable,
- iii) Interview survey to farm household (the cultivators on the sampled area) to grasp the application level and intention of agrochemical usage, and
- iv) Interview to health clinic and chief of villages.

(3) Monitoring period and frequency

Periodic monitoring should be conducted as least twice a year

(4) Implementing agency of monitoring

These activities will also be carried out mainly by district or provincial agricultural service office. However, the analysis works for agrochemical accumulation level in soils and vegetables will be entrusted to the BALITSA (Balai Punelithian Sayuran).

## CHAPTER 6 COMMENTS AND RECOMMENDATIONS

### 6.1 Requirement of EIA Study

As for the proposed project, the proposed development areas range from 50 to 300 ha as noted in section 3.1. Therefore, it is not required to conduct an EIA study for the proposed project in terms of the development size. Some of the model areas are adjacent to the protection area (conservation forest). In Gekbrong, especially, the existing intake site is located in the conservation forest. An EIA study might be required for the Gekbrong area if improvement activities for intake site will be large and a significant impact can be predicted. So far, since the development activity in the conservation forest is small as described in Annex V, it is judged that a further detailed study (EIA) is not required for obtaining the development permission. This judge was made in consultation with BAPEDAL in West Java. Other than the Gekbrong area, any project activities will not disturb the environmental sensitive areas listed in AMDAL Guideline (Guideline: KEP-11).

However, if the project activities and components will be changed drastically, the judgement may also be changed. In this connection, it is recommended that provincial agricultural service, who will be the project proponent, should contact with BAPEDAL and have a consultation from it before implementation of the Project.

In addition, all the proposed projects are required to prepare the UKL and UPL. Therefore, the Provincial agricultural service office should also prepare the UKL and UPL before the project is implemented based on the Decree of Ministry of Agriculture No. 752 (Technical Guideline for the UKL and UPL).

### 6.2 Recommendations

Because the development plan puts the emphasis on improving the present adverse issues such as high application of agro-inputs and also minimizing negative environmental impacts while maintaining expected positive impacts, there is no major environmental impacts resulting from implementation of the development plan. However, execution of mitigation measures and employment of proper construction methods must be emphasized to ensure not to harm the environment. Followings are recommendations for attainment of sustainable agriculture as well as the preservation of the environment:

- Maximum attention should be paid to construction method and disposal of construction material.
- Agricultural development should be based on the sustainable and environment-friendly development.
- Required extension activity for soil conservation should be conducted not only by the PKLs but also PPLs. It is recommended to conduct the activity jointly.
- Farmers' participation should be encouraged at the detailed design and implementation stages in order to ensure their active cooperation to the project implementation.
- Monitoring and evaluation of the environmental effect by agrochemical use should be carried out periodically.

Tables

**Table VII-1 Preliminary Estimation of Annual Soil Erosion Rate in and around the Model Sites**

**(1) In the model site**

| Model sites  | Annual rainfall | Slope | Crop          | Conservation                   | R     | K    | LS   | C    | P    | Adjust | E (ton/ha/yr.) |
|--------------|-----------------|-------|---------------|--------------------------------|-------|------|------|------|------|--------|----------------|
| Gekbrong     | 2,000           | 0-3   | Vegetable     | Strip row                      | 2,323 | 0.40 | 0.19 | 0.30 | 0.30 | 1.00   | 15.89          |
|              | 2,000           | 3-8   | Vegetable     | Contour bund with strip row    | 2,323 | 0.40 | 0.52 | 0.30 | 0.25 | 0.90   | 32.62          |
| Mekarjaya    | 2,000           | 10-15 | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 1.40 | 0.30 | 0.15 | 0.55   | 32.20          |
|              | 2,000           | 15-25 | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 3.10 | 0.30 | 0.15 | 0.43   | 55.75          |
|              | 2,000           | 25-40 | Vegetable     | Contour bund with strip row    | 2,323 | 0.40 | 6.80 | 0.30 | 0.45 | 0.48   | 409.50         |
| Tugumukti    | 2,000           | 0-3   | Vegetable     | Strip row                      | 2,323 | 0.40 | 0.19 | 0.30 | 0.30 | 1.00   | 15.89          |
|              | 2,000           | 3-8   | Vegetable     | Contour bund with strip row    | 2,323 | 0.40 | 0.52 | 0.30 | 0.25 | 0.90   | 32.62          |
|              | 2,000           | 0-3   | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 0.19 | 0.30 | 0.15 | 1.00   | 7.95           |
|              | 2,000           | 3-8   | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 0.52 | 0.30 | 0.15 | 0.75   | 16.31          |
|              | 2,000           | 8-15  | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 1.40 | 0.30 | 0.15 | 0.55   | 32.20          |
| Langensari   | 2,000           | 0-3   | Vegetable     | Strip row                      | 2,323 | 0.40 | 0.19 | 0.30 | 0.30 | 1.00   | 15.89          |
|              | 2,000           | 3-8   | Vegetable     | Contour bund with strip row    | 2,323 | 0.40 | 0.52 | 0.30 | 0.25 | 0.90   | 32.62          |
|              | 2,000           | 0-3   | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 0.19 | 0.30 | 0.15 | 1.00   | 7.95           |
|              | 2,000           | 3-8   | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 0.52 | 0.30 | 0.15 | 0.75   | 16.31          |
| Mekarumukti  | 2,000           | 10-15 | Paddy         | Terrace (complete)             | 2,323 | 0.40 | 1.40 | 0.01 | 0.04 | 0.67   | 0.35           |
|              | 2,000           | 3-8   | Uplands       | Contour bund                   | 2,323 | 0.40 | 0.40 | 0.40 | 0.50 | 0.80   | 59.48          |
|              | 2,000           | 15-25 | Paddy         | Terrace (complete)             | 2,323 | 0.40 | 3.10 | 0.01 | 0.04 | 0.55   | 0.63           |
|              | 2,000           | 25-40 | Banana, Maize | agroforestry with poor terrace | 2,323 | 0.40 | 6.80 | 0.05 | 0.35 | 0.48   | 53.08          |
| Cisarupan    | 2,000           | 0-3   | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 0.19 | 0.30 | 0.15 | 1.00   | 7.95           |
|              | 2,000           | 3-8   | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 0.52 | 0.30 | 0.15 | 0.75   | 16.31          |
|              | 2,000           | 10-15 | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 1.40 | 0.30 | 0.15 | 0.67   | 39.23          |
| Tanjungkarya | 2,000           | 0-3   | Vegetable     | Terrace (complete)             | 2,323 | 0.40 | 0.19 | 0.30 | 0.04 | 1.00   | 2.12           |
|              | 2,000           | 3-8   | Vegetable     | Terrace (complete)             | 2,323 | 0.40 | 0.52 | 0.30 | 0.04 | 0.75   | 4.35           |
|              | 2,000           | 0-8   | Paddy         | Terrace (complete)             | 2,323 | 0.40 | 0.40 | 0.01 | 0.04 | 1.00   | 0.15           |
|              | 2,000           | 8-15  | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 1.40 | 0.30 | 0.15 | 0.67   | 39.23          |
| Cisantana    | 2,000           | 10-15 | Vegetable     | Terrace (moderate)             | 2,323 | 0.40 | 1.40 | 0.30 | 0.15 | 0.67   | 39.23          |

**(2) Outside of the model site (High Potential area for Soil Erosion)**

| Model sites  | Annual rainfall | Slope | Crop             | Conservation                   | R     | K    | LS   | C    | P    | Adjust | E (ton/ha/yr.) |
|--------------|-----------------|-------|------------------|--------------------------------|-------|------|------|------|------|--------|----------------|
| Gekbrong     | 2,000           | 3-8   | Vegetable        | Contour bund with strip row    | 2,323 | 0.40 | 0.40 | 0.30 | 0.25 | 0.90   | 25.09          |
| Mekarjaya    | 2,000           | 15-25 | Vegetable        | Strip row (No conservation)    | 2,323 | 0.40 | 3.10 | 0.30 | 0.50 | 1.00   | 432.14         |
|              | 2,000           | 25-40 | Vegetable        | Strip row (No conservation)    | 2,323 | 0.40 | 6.80 | 0.30 | 0.50 | 1.00   | 947.91         |
| Tugumukti    | 2,000           | 8-15  | Vegetable        | Strip row                      | 2,323 | 0.40 | 0.19 | 0.30 | 0.75 | 0.66   | 26.22          |
| Langensari   | 2,000           | 15-25 | Vegetable        | Strip row or Terrace (poor)    | 2,323 | 0.40 | 3.10 | 0.30 | 0.45 | 0.58   | 225.57         |
|              | 2,000           | 25-40 | Uplands          | Strip row or Terrace (poor)    | 2,323 | 0.40 | 6.80 | 0.40 | 0.45 | 0.52   | 591.50         |
| Mekarumukti  | 2,000           | 25-40 | Banana, Maize    | agroforestry with poor terrace | 2,323 | 0.40 | 6.80 | 0.05 | 0.35 | 1.00   | 110.59         |
|              | 2,000           | 25-40 | Pperennial crops | agroforestry with poor terrace | 2,323 | 0.40 | 6.80 | 0.01 | 0.35 | 1.00   | 22.12          |
| Cisarupan    | 2,000           | 15-25 | Vegetable        | Contour bund with strip row    | 2,323 | 0.40 | 3.10 | 0.30 | 0.45 | 0.58   | 225.57         |
|              | 2,000           | 25-40 | Vegetable        | Contour bund with strip row    | 2,323 | 0.40 | 6.80 | 0.30 | 0.45 | 0.52   | 443.62         |
| Tanjungkarya | 2,000           | 15-25 | Vegetable        | Contour bund with strip row    | 2,323 | 0.40 | 3.10 | 0.30 | 0.45 | 0.58   | 225.57         |
|              | 2,000           | 25-40 | Vegetable        | Contour bund with strip row    | 2,323 | 0.40 | 6.80 | 0.30 | 0.45 | 0.52   | 443.62         |
| Cisantana    | 2,000           | 15-25 | Vegetable        | Contour bund with strip row    | 2,323 | 0.40 | 3.10 | 0.30 | 0.45 | 0.58   | 225.57         |



**Table VII-2 Results of Interview Survey in the Model Areas regarding Agro-input Dosage**

**(1) Vegetables**

| Inputs      | Unit   | Chines Cabbage |           | Green Onion |           |            | Tomao     |            |            |           |           | Potato    | Cauliflower | Min. | Max.  | Ave. |
|-------------|--------|----------------|-----------|-------------|-----------|------------|-----------|------------|------------|-----------|-----------|-----------|-------------|------|-------|------|
|             |        | TG-1           | CP-1      | CT-1        | CT-2      | MG-1       | Gk-1      | LS-1       | CP-1       | TG-2      | TJ-1      | TG-1      | LS-1        |      |       |      |
| Manure      | ton/ha | 40             | 5.3       | 30          | 6.2       | 14         | 20        | -          | 11         | 2.9       | 1.4       | 40        | 24          | 1    | 40    | 15   |
| N           | kg/ha  | 528            | 161       | 0           | 276       | 286        | 126       | -          | 70         | 50        | 129       | 528       | 228         | 0    | 528   | 181  |
| P           | kg/ha  | 1,080          | 0         | 473         | 81        | 63         | 180       | -          | 158        | 0         | 63        | 1,080     | 203         | 0    | 1,080 | 233  |
| K           | kg/ha  | 0              | 0         | 0           | 0         | 84         | 180       | -          | 0          | 0         | 126       | -         | 180         | 0    | 180   | 43   |
| Insecticide | lit/ha | 12             | 1.8       | 6           | 5         | 2.3        | 60        | 1          | 4          | 2         | 2.8       | 5         | 1           | 1    | 60    | 10   |
| (Freqebcy)  | times  | (1time/w)      | (1time/w) | (4 times)   | (6 times) | (2 times)  | (1time/w) | (10 times) | (1time/w)  | (1time/w) | (1time/w) | (1time/w) | (4 times)   | -    | -     | -    |
| Fungicide   | kg/ha  | 10             | 7         | 2.25        | -         | 5          | 125       | 100        | 105        | 8.6       | 28        | 10        | 4           | 2.25 | 125   | 43   |
| (Freqebcy)  | times  | (1time/w)      | (1time/w) | (3 times)   | -         | (12 times) | (1time/w) | (25 times) | (2times/w) | (1time/w) | (1time/w) | (1time/w) | (2 times)   | -    | -     | -    |

Remarks: The abbreviated word, such as "TG-1", indicate sampling number in each model site.

**(2) Upland crops and Paddy**

| Inputs      | Unit   | Chilly   | Onion     | Paddy     |             | Min. | Max. | Ave. |
|-------------|--------|----------|-----------|-----------|-------------|------|------|------|
|             |        | MM-1     | CT-2      | TJ-1      | MM-2        |      |      |      |
| Manure      | ton/ha | 2        | 8.5       | 0         | 0           | 0    | 8.5  | 3    |
| N           | kg/ha  | 34       | 0         | 97        | 92          | 0    | 97   | 56   |
| P           | kg/ha  | 26       | 95        | 32        | 23          | 23   | 95   | 44   |
| K           | kg/ha  | 32       | -         | 84        | 0           | 0    | 84   | 39   |
| Insecticide | lit/ha | 1.8      | 4         | 7         | 1           | 1    | 7    | 3    |
| (Freqebcy)  | times  | (1 time) | (5 times) | (8 times) | (1-2 times) | -    | -    | -    |
| Fungicide   | kg/ha  | 0        | 0         | 0         | 0           | 0    | 0    | 0    |
| (Freqebcy)  | times  | -        | -         | -         | -           | -    | -    | -    |

Remarks: The abbreviated word, such as "TG-1", indicate sampling number in each model site.

**Table VII-3 List of Agro-chemicals often utilized in and around the Study Area**

| Use         | Common Name          | Traded Name     | Chemical type<1 | Physical type<2 | Concentration | WHO classification <3 | LD 50 (mg/kg) |
|-------------|----------------------|-----------------|-----------------|-----------------|---------------|-----------------------|---------------|
| Insecticide | Carbofuran           | Furadan 3 G     | C               | G               | 30 g/kg       | Class 1b              | 8             |
|             | Chlorpyrifos         | Dursban 20 EC   | OP              | L               | 20% w/v       | Class II              | 135           |
|             | Profenofos           | Curacron 500 EC | OP              | L               | 50% w/v       | Class II              | 358           |
|             | Fenvalerate          | Sumicidin 5 EC  | PY              | L               | 44.5 w/v      | Class II              | C450          |
|             | Deltamethrin         | Clecis 2.5 EC   | PY              | L               | 25% w/v       | Class II              | C135          |
|             | Deltamethrin         | Dechis 2.5 EC   | PY              | L               | 25% w/v       | Class II              | C135          |
|             | Methidathion         | Supracide       | OP              | L               | 420 w/v       | Class 1b              | 25            |
|             | Kurstaki strain HD-7 | Dipel WP        | -               | L               | 16% w/v       | -                     | -             |
|             | Lamda sihalotrin     | Matedor 25 EC   | -               | L               | 25% w/v       | -                     | -             |
|             | Betasiflutrin        | Buldok 25 EC    | -               | L               | 25% w/v       | -                     | -             |
| Fungicide   | Propineb             | Antracol 70 WP  | TC              | P               | 70% w/v       | less hazard           | 8,500         |
|             | Maneb                | Pilaram 80 WP   | TC              | P               | 80% w/v       | less hazard           | 6,750         |
|             | Mancozeb             | Dithane M 45    | TC              | P               | 80% w/v       | less hazard           | 8,000         |
|             | Tembaga hydrocide    | Kocide 77 WP    | -               | P               | 77% w/v       | -                     | -             |
|             | Mancozeb             | Manzate 200     | TC              | P               | 83% w/v       | less hazard           | 8,000         |
| Herbicide   | Glyphosate           | Round up        | -               | L               | 48% w/v       | less hazard           | 4,230         |
|             | Glyphosate           | Polaris         | -               | L               | 48% w/v       | less hazard           | 4,230         |

Source: Inventroy Survey in KIOS and farmers made by the JICA Study Team.

Remarks : <1 Chemical Type : C: Carbamate, OP: Organophosphorus compound, PY: Pyrethroid, TC: Thiocarbamate

<2 Physical Type : L: Liquid, P: Powder, G: Granule, F: Flowable, D: Dust, SL Souluble Liquid.

<3 WHO Classification : Class 1a "Extremely Hazardous", Class 1b "Highly Hazardous", Class II "Moderately Hazardous", Class III "Slightly Hazardous"

**Table VII-4 Results of IPM Program for the Last Decade (1990 - 1999)**

| Kabupaten, Kecamatan<br>DESA              | Field Farmers School (No. of schools) |           |            | Training of Trainers<br>(persons) |
|-------------------------------------------|---------------------------------------|-----------|------------|-----------------------------------|
|                                           | Paddy                                 | Parawija  | Vegetable  |                                   |
| 1. Bandung Kab.                           | <u>446</u>                            | <u>25</u> | <u>58</u>  | <u>332</u>                        |
| 1.1 Mekarjaya DESA<br>(Arjasari Kec.)     | 0<br>(12)                             | 0<br>(0)  | 0<br>(0)   | 0<br>(4)                          |
| 1.2 Tugumukti DESA<br>(Cisarua Kec.)      | 0<br>(4)                              | 0<br>(0)  | 0<br>(4)   | 0<br>(0)                          |
| 1.3 Langensari DESA<br>(Lembang Kec.)     | 0<br>(0)                              | 0<br>(0)  | 0<br>(10)  | 0<br>(0)                          |
| 2. Cianjur Kab.                           | <u>320</u>                            | <u>12</u> | <u>4</u>   | <u>n.a.</u>                       |
| 2.1 Gekbrong DESA<br>(Warungkondang Kec.) | 0<br>(22)                             | 0<br>(0)  | 0<br>(0)   | 0<br>n.a.                         |
| 3. Garut Kab.                             | <u>532</u>                            | <u>15</u> | <u>58</u>  | <u>278</u>                        |
| 3.1 Cisurupan DESA<br>(Cisurupan Kec.)    | 0<br>(20)                             | 0<br>(0)  | 1<br>(13)  | 1<br>(4)                          |
| 3.2 Tanjungkarya DESA<br>(Samarang Kec.)  | 1<br>(39)                             | 0<br>(0)  | 0<br>(17)  | 2<br>(38)                         |
| 4. Sumedang Kab.                          | <u>382</u>                            | <u>27</u> | <u>0</u>   | <u>270</u>                        |
| 4.1 Mekarmukti DESA<br>(Buhadua Kec.)     | 1<br>(32)                             | 0<br>(7)  | 0<br>(0)   | 2<br>(60)                         |
| 5. Kuningan Kab.                          | <u>321</u>                            | <u>8</u>  | <u>4</u>   | <u>175</u>                        |
| 5.1 Cisantana DESA<br>(Cigugur Kec.)      | 0<br>(16)                             | 0<br>(0)  | 0<br>(0)   | 0<br>(7)                          |
| <b>Total</b>                              |                                       |           |            |                                   |
| Five Kabupatens                           | <u>2,001</u>                          | <u>87</u> | <u>124</u> | <u>≥ 1,055</u>                    |
| Eight Kecamatans                          | <u>145</u>                            | <u>7</u>  | <u>44</u>  | <u>≥ 113</u>                      |
| Eight DESAs                               | <u>2</u>                              | <u>0</u>  | <u>1</u>   | <u>5</u>                          |

Remarks : "n.a." means "not available clear data".

Source : District Agricultural Service Offices in each district.

**Table VII-5 Number of Medical Facilities and Personnel in and around the Model Areas**

|                                                    | No. of Medical Facilities (Nos.) |                  |                   |                      |          | No. of medical personnel (Persons) |           |             |           |
|----------------------------------------------------|----------------------------------|------------------|-------------------|----------------------|----------|------------------------------------|-----------|-------------|-----------|
|                                                    | Hospital                         | Public<br>Clinic | Private<br>Clinic | Public<br>sub-clinic | Pharmacy | Doctor                             | Dentist   | Midwife     | Nurse     |
| 1. Mekarjaya<br>(Arjasari sub-district)            | 0<br>(0)                         | 0<br>(2)         | 0<br>(4)          | 1<br>(4)             | 0<br>(0) | 0<br>(4)                           | 0<br>(2)  | 1<br>(16)   | 0<br>(14) |
| 2. Langensari<br>(Lembang sub-district)            | 0<br>(1)                         | 0<br>(3)         | 2<br>(6)          | 1<br>(16)            | 0<br>(1) | 0<br>(11)                          | 0<br>(4)  | 1<br>(27)   | 0<br>(19) |
| 3. Tugumukti<br>(Cisarua sub-district)             | 0<br>(0)                         | 0<br>(2)         | 0<br>(0)          | 0<br>(3)             | 0<br>(0) | 0<br>(2)                           | 0<br>(2)  | 1<br>(7)    | 0<br>(3)  |
| 4. Gekbrong<br>(Warungkondang sub-district)        | 0<br>(0)                         | 1<br>(2)         | 0<br>(0)          | 1<br>(2)             | 0<br>(0) | 1<br>(2)                           | 1<br>(2)  | 6<br>(8)    | 6<br>(8)  |
| 5. Cisurupan<br>(Cisurupan sub-district)           | 0<br>(1)                         | 0<br>(3)         | 1<br>(3)          | 0<br>(4)             | 0<br>(0) | 1<br>(3)                           | 0<br>(1)  | 1<br>(22)   | 2<br>(17) |
| 6. Tanjungkarya<br>(Samarang sub-district)         | 0<br>(0)                         | 0<br>(1)         | 0<br>(0)          | 0<br>(1)             | 0<br>(0) | 0<br>(3)                           | 0<br>(1)  | 1<br>(11)   | 0<br>(21) |
| 7. Mekarmukti<br>(Buhadua sub-district)            | 0<br>(0)                         | 0<br>(2)         | 0<br>(0)          | 1<br>(9)             | 0<br>(0) | 0<br>(2)                           | 0<br>(1)  | 1<br>(18)   | 0<br>(3)  |
| 8. Cisantana<br>(Cigugur sub-district)             | 0<br>(0)                         | 0<br>(1)         | 0<br>(1)          | 1<br>(1)             | 0<br>(0) | 0<br>(1)                           | 0<br>(1)  | 1<br>(8)    | 0<br>(5)  |
| Total of eight DESAs<br>(Total of eight Kecamatan) | 0<br>(2)                         | 1<br>(16)        | 3<br>(14)         | 5<br>(40)            | 0<br>(1) | 2<br>(28)                          | 1<br>(14) | 13<br>(117) | 8<br>(90) |

Source : Interview survey to Sub-district Health Clinics in each Sub-district, JICA Study Team (1999)

**Table VII-6 (1/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(1) Mekarjaya**

| Probable / Potential Impacts                                                                                                                                                                                     | Present (potential)     | Stage                  |                      |                               |                       | Comments / recommended mitigation measures                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------|----------------------|-------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                  |                         | Construction           |                      | Operation                     |                       |                                                                                                                                                                                                                                                                                                             |
|                                                                                                                                                                                                                  |                         | Without                | With                 | Without                       | With                  |                                                                                                                                                                                                                                                                                                             |
| 1. Health hazard from mishandling of agrochemical use                                                                                                                                                            | 3N                      | -                      | -                    | 2N-d-s-r                      | 3N                    | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works.                                      |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer<br><br>(2) Pollution of domestic waste<br><br>(3) Inflow of construction materials into rivers | 3N<br><br>2~3N<br><br>- | -<br><br>-<br><br>2-3N | -<br><br>-<br><br>3N | 2N-d-s-r<br><br>2~3N<br><br>- | 3N<br><br>3N<br><br>- | - Introduction of Environment-friendly agriculture<br><br>- Health education for proper disposal of domestic waste is essential to reduce dumping waste.<br><br>- Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly. |
| 3. Deterioration of water quality in groundwater                                                                                                                                                                 | 3N                      | -                      | -                    | 2N-id-s-r                     | 3N                    | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                                                          |
| 4. Soil erosion and land degradation                                                                                                                                                                             | 2N                      | -                      | -                    | 2N-d-s-ir                     | 3N                    | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                                                               |
| 5. Disturbance of Forest lands                                                                                                                                                                                   | -                       | 2~3N-d-ir-l            | 3N                   | -                             | -                     | - Disturbance will be minimized taking into consideration ecological management.<br>- Activities will mainly focus on the rehabilitation of existing facilities rather than new                                                                                                                             |
| 6. Shortage of farm land due to construction works for rural infrastructure development                                                                                                                          | -                       | 2~3N-d-ir-l            | 3N                   | -                             | -                     | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                                                                 |
| 7. Conflicts among water users related with the water resource<br>(1) Water users in DESA<br><br>(2) Water users outside DESA                                                                                    | -<br><br>3N             | -<br><br>-             | -<br><br>-           | 2N-d-s-r<br><br>2~3N-d-s-r    | 3N<br><br>3N          | - Water users group will be activate and strengthened for farmers to conduct proper water management.<br>- Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                                     |
| 8. Conflicts among the villagers in DESA                                                                                                                                                                         | 3N                      | -                      | -                    | 3N                            | -                     | - Unlikely                                                                                                                                                                                                                                                                                                  |
| 9. Increase of construction-related employment opportunity                                                                                                                                                       | -                       | 1P-d-s                 | 1P-d-s               | -                             | -                     | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                                                                    |
| 10. Stabilization of crop production (which results in the increase of farm income)                                                                                                                              | -                       | -                      | -                    | 1P-d-l                        | 1P-d-l                | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                                                           |
| 11. Increase of agricultural-related employment opportunity                                                                                                                                                      | -                       | -                      | -                    | 1P-id-l                       | 1P-id-l               | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                                                              |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- D : Direct
- ID : Indirect
- S : Short term
- L : Long term
- R : Reversible
- IR : Irreversible

The feature of impacts is indicated as follow:

**1P-d-s-r** meaning that the positive impact would be significant, direct, short term, and reversible.

**2N-d-s-r** meaning that the negative impact would be significant, direct, long term, and reversible.

**Table VII-6 (2/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(2) Tugumukti**

| Probable / Potential Impacts                                                                                                                                                                             | Present (potential) | Stage          |              |                       |               | Comments / recommended mitigation measures                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|--------------|-----------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                          |                     | Construction   |              | Operation             |               |                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                          |                     | Without        | With         | Without               | With          |                                                                                                                                                                                                                                                                                                     |
| 1. Health hazard from mishandling of agrochemical use                                                                                                                                                    | (2N)                | -              | -            | 2N-d-s-r              | 3N            | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works.                              |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer<br>(2) Pollution of domestic waste<br>(3) Inflow of construction materials into rivers | 2N<br>2~3N<br>-     | -<br>-<br>2-3N | -<br>-<br>3N | 2N-d-s-r<br>2~3N<br>- | 3N<br>3N<br>- | - Introduction of Environment-friendly agriculture<br>- Health education for proper disposal of domestic waste is essential to reduce dumping waste.<br>- Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly. |
| 3. Deterioration of water quality in groundwater                                                                                                                                                         | (2~3N)              | -              | -            | 2N-id-l-r             | 3N            | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                                                  |
| 4. Soil erosion and land degradation                                                                                                                                                                     | 2~3N                | -              | -            | 2N-d-s-ir             | 3N            | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                                                       |
| 5. Shortage of farm land due to construction works for rural infrastructure development                                                                                                                  | -                   | 2-3N-d-ir-l    | 3N           | -                     | -             | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                                                         |
| 6. Conflicts among water users related with the water resource<br>(1) Water users in DESA<br>(2) Water users outside DESA                                                                                | -<br>3N             | -<br>-         | -<br>-       | 3N<br>3N              | -<br>-        | - Water users group will be activate and strengthened for farmers to conduct proper water management.<br>- Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                             |
| 7. Conflicts among the villagers in DESA                                                                                                                                                                 | 2~3N                | -              | -            | 2~3N-id-s-r           | 3N            | - Rural infrastructure outside the model site in DESA will be improved by the project or by using other fund, such as stock fund or regional government.                                                                                                                                            |
| 8. Increase of construction-related employment opportunity                                                                                                                                               | -                   | 1P-d-s         | 1P-d-s       | -                     | -             | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                                                            |
| 9. Stabilization of crop production (which results in the increase of farm income)                                                                                                                       | -                   | -              | -            | 1P-d-l                | 1P-d-l        | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                                                   |
| 10. Increase of agricultural-related employment opportunity                                                                                                                                              | -                   | -              | -            | 1P-d-l                | 1P-d-l        | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                                                      |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact  
1 : Significant  
2 : Moderate  
3 : Minor

Feature of impact  
P : Positive  
N : Negative

Characteristics of impact  
D : Direct  
ID : Indirect  
S : Short term  
L : Long term  
R : Reversible  
IR : Irreversible

The feature of impacts is indicated as follow:

**1P-d-s-r** meaning that the positive impact would be significant, direct, short term, and reversible.

**2N-d-s-r** meaning that the negative impact would be significant, direct, long term, and reversible.

**Table VII-6 (3/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(3) Langensari**

| Probable / Potential Impacts                                                                                                                                                                             | Present (potential) | Stage          |              |                       |               | Comments / recommended mitigation measures                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|--------------|-----------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                          |                     | Construction   |              | Operation             |               |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                          |                     | Without        | With         | Without               | With          |                                                                                                                                                                                                                                                                                                                      |
| 1. Health hazard from mishandling of agrochemical use                                                                                                                                                    | (2N)                | -              | -            | 2N-d-s-r              | 3N            | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works.                                               |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer<br>(2) Pollution of domestic waste<br>(3) Inflow of construction materials into rivers | 2N<br>2~3N<br>-     | -<br>-<br>2-3N | -<br>-<br>3N | 2N-d-s-r<br>2~3N<br>- | 3N<br>3N<br>- | - Introduction of Environment-friendly agriculture<br>- Health education for proper disposal of domestic waste is essential to reduce dumping waste.<br>- Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly.                  |
| 3. Deterioration of water quality in groundwater                                                                                                                                                         | 2N                  | -              | -            | 2N-id-s-r             | 3N            | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                                                                   |
| 4. Soil erosion and land degradation                                                                                                                                                                     | 2~3N                | -              | -            | 2N-d-s-ir             | 3N            | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                                                                        |
| 5. Shortage of farm land due to construction works for rural infrastructure development                                                                                                                  | -                   | 2-3N-d-ir-l    | 3N           | -                     | -             | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                                                                          |
| 6. Conflicts among water users related with the water resource<br>(1) Water users in DESA<br>(2) Water users outside DESA                                                                                | -<br>3N             | -<br>-         | -<br>-       | 3N<br>3N              | -<br>-        | Scale of development will not be large and activity will be basically the rehabilitation.<br>- Water users group will be activate and strengthened for farmers to conduct proper water management.<br>- Vested rights for existing water users will be taken into consideration in estimation of water distribution. |
| 7. Conflicts among the villagers in DESA                                                                                                                                                                 | 2~3N                | -              | -            | 2~3N-id-s-r           | 3N            | - Rural infrastructure outside the model site in DESA will be improved by the project or by using other fund, such as stock fund or regional government.                                                                                                                                                             |
| 8. Increase of construction-related employment opportunity                                                                                                                                               | -                   | 1P-d-s         | 1P-d-s       | -                     | -             | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                                                                             |
| 9. Stabilization of crop production (which results in the increase of farm income)                                                                                                                       | -                   | -              | -            | 1P-d-l                | 1P-d-l        | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                                                                    |
| 10. Increase of agricultural-related employment opportunity                                                                                                                                              | -                   | -              | -            | 1P-id-l               | 1P-id-l       | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                                                                       |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact  
1 : Significant  
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Characteristics of impact  
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The feature of impacts is indicated as follow:

**1P-d-s-r** meaning that the positive impact would be significant, direct, short term, and reversible.

**2N-d-s-r** meaning that the negative impact would be significant, direct, long term, and reversible.

**Table VII-6 (4/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(4) Gekbrong**

| Probable / Potential Impacts                                                                                      | Present (potential) | Stage        |        |             |         | Comments / recommended mitigation measures                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------|---------------------|--------------|--------|-------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                   |                     | Construction |        | Operation   |         |                                                                                                                                                                                                                                                                        |
|                                                                                                                   |                     | Without      | With   | Without     | With    |                                                                                                                                                                                                                                                                        |
| 1. Health hazard from mishandling of agrochemical use                                                             | (2N)                | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works. |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer | 2N                  | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture                                                                                                                                                                                                                     |
| (2) Pollution of domestic waste                                                                                   | 2~3N                | -            | -      | 2~3N        | 3N      | - Health education for proper disposal of domestic waste is essential to reduce dumping waste.                                                                                                                                                                         |
| (3) Inflow of construction materials into rivers                                                                  | -                   | 2-3N         | 3N     | -           | -       | - Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly.                                                                                                                            |
| 3. Deterioration of water quality in groundwater                                                                  | (2-3N)              | -            | -      | 2N-id-s-r   | 3N      | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                     |
| 4. Soil erosion and land degradation                                                                              | 2~3N                | -            | -      | 2N-d-s-ir   | 3N      | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                          |
| 5. Disturbance of Forest lands                                                                                    | -                   | 2N-d-s-ir    | 3N     | -           | -       | - Disturbance will be minimized taking into consideration ecological management.<br>- Activities will mainly focus on the rehabilitation of existing facilities rather than new development.                                                                           |
| 6. Shortage of farm land due to construction works for rural infrastructure development                           | -                   | 2-3N-d-ir-l  | 3N     | -           | -       | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                            |
| 7. Conflicts among water users related with the water resource<br>(1) Water users in DESA                         | -                   | -            | -      | 3N          | -       | - Water users group will be activate and strengthened for farmers to conduct proper water management.                                                                                                                                                                  |
| (2) Water users outside DESA                                                                                      | 3N                  | -            | -      | 3N          | -       | - Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                                                                                                         |
| 8. Conflicts among the villagers in DESA                                                                          | 2~3N                | -            | -      | 2~3N-id-s-r | 3N      | - Rural infrastructure outside the model site in DESA will be improved by the project or by using other fund, such as stock fund or regional government.                                                                                                               |
| 9. Increase of construction-related employment opportunity                                                        | -                   | 1P-d-s       | 1P-d-s | -           | -       | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                               |
| 10. Stabilization of crop production (which results in the increase of farm income)                               | -                   | -            | -      | 1P-d-l      | 1P-d-l  | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                      |
| 11. Increase of agricultural-related employment opportunity                                                       | -                   | -            | -      | 1P-id-l     | 1P-id-l | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                         |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- D : Direct
- ID : Indirect
- S : Short term
- L : Long term
- R : Reversible
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The feature of impacts is indicated as follow:

- 1P-d-s-r** meaning that the positive impact would be significant, direct, short term, and reversible.
- 2N-d-s-r** meaning that the negative impact would be significant, direct, long term, and reversible.



**Table VII-6 (5/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(5) Cisurupan**

| Probable / Potential Impacts                                                                                      | Present (potential) | Stage        |        |             |         | Comments / recommended mitigation measures                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------|---------------------|--------------|--------|-------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                   |                     | Construction |        | Operation   |         |                                                                                                                                                                                                                                                                        |
|                                                                                                                   |                     | Without      | With   | Without     | With    |                                                                                                                                                                                                                                                                        |
| 1. Health hazard from mishandling of agrochemical use                                                             | (2N)                | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works. |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer | 2N                  | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture                                                                                                                                                                                                                     |
| (2) Pollution of domestic waste                                                                                   | 2~3N                | -            | -      | 2~3N        | 3N      | - Health education for proper disposal of domestic waste is essential to reduce dumping waste.                                                                                                                                                                         |
| (3) Inflow of construction materials into rivers                                                                  | -                   | 2-3N         | 3N     | -           | -       | - Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly.                                                                                                                            |
| 3. Deterioration of water quality in groundwater                                                                  | (2-3N)              | -            | -      | 2N-id-s-r   | 3N      | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                     |
| 4. Soil erosion and land degradation                                                                              | 2~3N                | -            | -      | 2N-d-s-ir   | 3N      | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                          |
| 5. Disturbance of Forest lands                                                                                    | -                   | 3N           | -      | -           | -       | - Disturbance will be minimized taking into consideration ecological management.<br>- Activities will mainly focus on the rehabilitation of existing facilities rather than new development.                                                                           |
| 6. Shortage of farm land due to construction works for rural infrastructure development                           | -                   | 2-3N-d-ir-l  | 3N     | -           | -       | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                            |
| 7. Conflicts among water users related with the water resource<br>(1) Water users in DESA                         | -                   | -            | -      | 3N          | -       | - Water users group will be activate and strengthened for farmers to conduct proper water management.                                                                                                                                                                  |
| (2) Water users outside DESA                                                                                      | 3N                  | -            | -      | 3N          | -       | - Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                                                                                                         |
| 8. Conflicts among the villagers in DESA                                                                          | 2N                  | -            | -      | 1~2N-id-s-r | 3N      | - Rural infrastructure outside the model site in DESA will be improved by the project or by using other fund, such as stock fund or regional government.                                                                                                               |
| 9. Increase of construction-related employment opportunity                                                        | -                   | 1P-d-s       | 1P-d-s | -           | -       | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                               |
| 10. Stabilization of crop production (which results in the increase of farm income)                               | -                   | -            | -      | 1P-d-l      | 1P-d-l  | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                      |
| 11. Increase of agricultural-related employment opportunity                                                       | -                   | -            | -      | 1P-id-l     | 1P-id-l | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                         |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- D : Direct
- ID : Indirect
- S : Short term
- L : Long term
- R : Reversible
- IR : Irreversible

The feature of impacts is indicated as follow:

- 1P-d-s-r** meaning that the positive impact would be significant, direct, short term, and reversible.
- 2N-d-s-r** meaning that the negative impact would be significant, direct, long term, and reversible.

**Table VII-6 (6/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(6) Tanjungkarya**

| Probable / Potential Impacts                                                            | Present (potential) | Stage        |        |             |         | Comments / recommended mitigation measures                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------|---------------------|--------------|--------|-------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                         |                     | Construction |        | Operation   |         |                                                                                                                                                                                                                                                                        |
|                                                                                         |                     | Without      | With   | Without     | With    |                                                                                                                                                                                                                                                                        |
| 1. Health hazard from mishandling of agrochemical use                                   | (2N)                | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works. |
| 2. Deterioration of water quality in downstream                                         |                     |              |        |             |         |                                                                                                                                                                                                                                                                        |
| (1) Pollution of agrochemical and Eutrophication of fertilizer                          | 2N                  | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture                                                                                                                                                                                                                     |
| (2) Pollution of domestic waste                                                         | 2N                  | -            | -      | 2~3N        | 3N      | - Health education for proper disposal of domestic waste is essential to reduce dumping waste.                                                                                                                                                                         |
| (3) Inflow of construction materials into rivers                                        | -                   | 2-3N         | 3N     | -           | -       | - Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly.                                                                                                                            |
| 3. Deterioration of water quality in groundwater                                        | (2-3N)              | -            | -      | 2N-id-s-r   | 3N      | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                     |
| 4. Soil erosion and land degradation                                                    | 2N                  | -            | -      | 2N-d-s-ir   | 3N      | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                          |
| 5. Shortage of farm land due to construction works for rural infrastructure development | -                   | 2-3N-d-ir-l  | 3N     | -           | -       | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                            |
| 6. Conflicts among water users related with the water resource                          |                     |              |        |             |         |                                                                                                                                                                                                                                                                        |
| (1) Water users in DESA                                                                 | -                   | -            | -      | 3N          | -       | - Water users group will be activate and strengthened for farmers to conduct proper water management.                                                                                                                                                                  |
| (2) Water users outside DESA                                                            | 3N                  | -            | -      | 3N          | -       | - Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                                                                                                         |
| 7. Conflicts among the villagers in DESA                                                | 3N                  | -            | -      | 2~3N-id-s-r | 3N      | - Rural infrastructure outside the model site in DESA will be improved by the project or by using other fund, such as stock fund or regional government.                                                                                                               |
| 8. Increase of construction-related employment opportunity                              | -                   | 1P-d-s       | 1P-d-s | -           | -       | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                               |
| 9. Stabilization of crop production (which results in the increase of farm income)      | -                   | -            | -      | 1P-d-l      | 1P-d-l  | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                      |
| 10. Increase of agricultural-related employment opportunity                             | -                   | -            | -      | 1P-id-l     | 1P-id-l | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                         |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

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**Table VII-6 (7/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(7) Mekarmukti**

| Probable / Potential Impacts                                                                                      | Present (potential) | Stage        |        |           |         | Comments / recommended mitigation measures                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------|---------------------|--------------|--------|-----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                   |                     | Construction |        | Operation |         |                                                                                                                                                                                                                                                                        |
|                                                                                                                   |                     | Without      | With   | Without   | With    |                                                                                                                                                                                                                                                                        |
| 1. Health hazard from mishandling of agrochemical use                                                             | 3N                  | -            | -      | 2N-d-s-r  | 3N      | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works. |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer | 3N                  | -            | -      | 2N-d-s-r  | 3N      | - Introduction of Environment-friendly agriculture                                                                                                                                                                                                                     |
| (2) Pollution of domestic waste                                                                                   | 2~3N                | -            | -      | 2~3N      | 3N      | - Health education for proper disposal of domestic waste is essential to reduce dumping waste.                                                                                                                                                                         |
| (3) Inflow of construction materials into rivers                                                                  | -                   | 2-3N         | 3N     | -         | -       | - Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly.                                                                                                                            |
| 3. Deterioration of water quality in groundwater                                                                  | 3N                  | -            | -      | 2N-id-s-r | 3N      | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                     |
| 4. Soil erosion and land degradation                                                                              | 2N                  | -            | -      | 2N-d-s-ir | 3N      | - Soil conservation measures with proper farm management will be introduced under extension works.<br><br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                      |
| 5. Shortage of farm land due to construction works for rural infrastructure development                           | -                   | 2-3N-d-ir-l  | 3N     | -         | -       | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                            |
| 6. Conflicts among water users related with the water resource<br>(1) Water users in DESA                         | -                   | -            | -      | 3N        | -       | - Water users group will be activate and strengthened for farmers to conduct proper water management.                                                                                                                                                                  |
| (2) Water users outside DESA                                                                                      | 3N                  | -            | -      | 3N        | -       | - Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                                                                                                         |
| 7. Conflicts among the villagers in DESA                                                                          | 3N                  | -            | -      | 3N        | -       | - Unlikely                                                                                                                                                                                                                                                             |
| 8. Increase of construction-related employment opportunity                                                        | -                   | 1P-d-s       | 1P-d-s | -         | -       | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                               |
| 9. Stabilization of crop production (which results in the increase of farm income)                                | -                   | -            | -      | 1P-d-l    | 1P-d-l  | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                      |
| 10. Increase of agricultural-related employment opportunity                                                       | -                   | -            | -      | 1P-id-l   | 1P-id-l | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                         |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- D : Direct
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**Table VII-6 (8/8) Assessment of Probable Environmental Impacts and Recommended Mitigation Measures**

**(8) Cisantana**

| Probable / Potential Impacts                                                                                      | Present (potential) | Stage        |        |             |         | Comments / recommended mitigation measures                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------|---------------------|--------------|--------|-------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                   |                     | Construction |        | Operation   |         |                                                                                                                                                                                                                                                                        |
|                                                                                                                   |                     | Without      | With   | Without     | With    |                                                                                                                                                                                                                                                                        |
| 1. Health hazard from mishandling of agrochemical use                                                             | (2N)                | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture (IPM program including organic farming will be continuously conducted as the extension activities in the model sites.)<br>- Hazard will be minimized by proper handling of chemical under proposed extension works. |
| 2. Deterioration of water quality in downstream<br>(1) Pollution of agrochemical and Eutrophication of fertilizer | 2N                  | -            | -      | 2N-d-s-r    | 3N      | - Introduction of Environment-friendly agriculture                                                                                                                                                                                                                     |
| (2) Pollution of domestic waste                                                                                   | 2N                  | -            | -      | 2N          | 3N      | - Health education for proper disposal of domestic waste is essential to reduce dumping waste.                                                                                                                                                                         |
| (3) Inflow of construction materials into rivers                                                                  | -                   | 2-3N         | 3N     | -           | -       | - Proper construction methods will be employed on the construction.<br>- Proper disposal of construction waste will be enforced thoroughly.                                                                                                                            |
| 3. Deterioration of water quality in groundwater                                                                  | 2N                  | -            | -      | 2N-id-s-r   | 3N      | - Introduction of Environment-friendly agriculture<br>- Deepening dug wells to take safety water from agro-inputs.                                                                                                                                                     |
| 4. Soil erosion and land degradation                                                                              | 2~3N                | -            | -      | 2N-d-s-ir   | 3N      | - Soil conservation measures with proper farm management will be introduced under extension works.<br>- Perennial crops (fruit trees, valuable trees, etc.) will be introduced in steep land.                                                                          |
| 5. Disturbance of Forest lands                                                                                    | -                   | 2~3N-d-s-ir  | 3N     | -           | -       | - Disturbance will be minimized taking into consideration ecological management.<br>- Activities will mainly focus on the rehabilitation of existing facilities rather than new development.                                                                           |
| 6. Shortage of farm land due to construction works for rural infrastructure development                           | -                   | 2-3N-d-ir-l  | 3N     | -           | -       | - Scale of development will not be large and activity will be basically the rehabilitation.                                                                                                                                                                            |
| 7. Conflicts among water users related with the water resource<br>(1) Water users in DESA                         | 2N                  | -            | -      | 2N-id-s-r   | 3N      | - Water users group will be activate and strengthened for farmers to conduct proper water management.                                                                                                                                                                  |
| (2) Water users outside DESA                                                                                      | 3N                  | -            | -      | 3N          | -       | - Vested rights for existing water users will be taken into consideration in estimation of water distribution.                                                                                                                                                         |
| 8. Conflicts among the villagers in DESA                                                                          | 2~3N                | -            | -      | 2~3N-id-s-r | 3N      | - Unlikely                                                                                                                                                                                                                                                             |
| 9. Increase of construction-related employment opportunity                                                        | -                   | 1P-d-s       | 1P-d-s | -           | -       | - The construction works will provide temporary job opportunity to the villagers in DESA                                                                                                                                                                               |
| 10. Stabilization of crop production (which results in the increase of farm income)                               | -                   | -            | -      | 1P-d-l      | 1P-d-l  | - The living standards for rural life will be improved through increase of agricultural production and improvement of rural road.                                                                                                                                      |
| 11. Increase of agricultural-related employment opportunity                                                       | -                   | -            | -      | 1P-id-l     | 1P-id-l | - Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.                                                                                                                                                         |

Remarks : <1 "with" indicates future condition with mitigation measures

Significance of impact  
1 : Significant  
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**Table VII-7 Recommended Grasses and Tree Crops for Soil Conservation (1/3)**

**(1) Grass species introduced in Indonesia**

| Name of Crops                                                                                                 | Characters                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><u><i>Brachiara brisantha</i></u> (BB)<br/>(E: Palisade grass or Signal grass)</p>                         | <ul style="list-style-type: none"> <li>- Native: Africa</li> <li>- Roots creep, and underground stems can regenerate at the points of joint.</li> <li>- Height: 80 – 150 cm</li> <li>- High regeneration ability</li> <li>- Useful in maintaining terrace (edge and slope) and for fodder crops</li> <li>- Harvest interval : 35 – 45 days under good management</li> </ul>                                                                                             |
| <p><u><i>Brachiaria decumbens</i></u> (BD)<br/>(E : Signal grass)</p>                                         | <ul style="list-style-type: none"> <li>- Native: Africa</li> <li>- Roots creep, and underground stems can regenerate at the points of joint.</li> <li>- Height: 80 – 150 cm</li> <li>- Annual crop</li> <li>- High regeneration ability</li> <li>- Useful in maintaining terrace (edge and slope) and for fodder crops</li> <li>- Harvest interval : 30 – 40 days under good management</li> <li>- BD is extensively grown in West Java.</li> </ul>                     |
| <p><u><i>Panicum muticum</i></u> Fost.<br/>(I : Kolonjono)</p>                                                | <ul style="list-style-type: none"> <li>- Native: Tropical Africa and South America</li> <li>- Height: under 250 cm</li> <li>- Roots creep, and underground stems can regenerate at the points of joint.</li> <li>- Broad leaves</li> <li>- Useful for fodder crops</li> <li>- High resistance to drought</li> </ul>                                                                                                                                                     |
| <p><u><i>Paspalum notatum</i></u><br/>(I : Rumput Bahia,<br/>E : Bahia grass)</p>                             | <ul style="list-style-type: none"> <li>- Native: South America</li> <li>- Grow under 1,500 m altitude</li> <li>- Height: 30 - 50 cm</li> <li>- Diameter of stem : 0.5 – 1 cm</li> <li>- Roots creep, and underground stems can regenerate at the points of joint.</li> <li>- Roots of crop extend broadly.<br/>(Therefore, the crop has high capability for soil conservation.)</li> <li>- Useful in maintaining terrace, bank, and drainage canal.</li> </ul>          |
| <p><u><i>Panisetum purpureum</i></u><br/>(I : Rumput Gajah,<br/>E : Elephant grass or Napier grass)</p>       | <ul style="list-style-type: none"> <li>- Native: Tropical Africa</li> <li>- Grow under 1,500 m altitude</li> <li>- Height: 3 – 4 m</li> <li>- Diameter of stem : 0.5 – 1 cm</li> <li>- Roots can penetrate up to 4 m.</li> <li>- Grow in the area which have the precipitation from 1,000 to 2,500 mm</li> <li>- Useful in maintaining terrace (edge and slope) and for fodder crops</li> <li>- Harvest interval : 6 – 8 weeks after the height of 1 – 1.5 m</li> </ul> |
| <p><u><i>Panicum maximum</i></u><br/>(I : Rumput Benggala (Java :<br/>Suket Londo),<br/>E : Guinea grass)</p> | <ul style="list-style-type: none"> <li>- Native: Tropical and Semi-tropical Africa</li> <li>- Grow in the area which have the precipitation of over 760 mm</li> <li>- Not suitable on the poor drainage area</li> <li>- Height: Raksara type: 3.6 – 4.2 m<br/>Middle type: 1.6 – 2.5 m<br/>Short type: 1 m</li> <li>- Grow in the dry area</li> </ul>                                                                                                                   |

Remarks: E: English name, I: Indonesian name

**Table VII-7 Recommended Grasses and Tree Crops for Soil Conservation (2/3)**

**(2) Trees**

| Name of Crops                                     | Characters                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Clotalaria spp.</u>                            | <ul style="list-style-type: none"> <li>- Native: Java Island</li> <li>- High tolerance of drought</li> <li>- Roots can penetrate deeply and fix nitrogen</li> <li>- High generation ability</li> </ul>                                                                                                                                                                                                 |
| <u>Acacia villosa</u>                             | <ul style="list-style-type: none"> <li>- Native: West India</li> <li>- Height: maximum 4 m</li> <li>- Useful for green manure, strengthening terrace, preventing soil erosion and pioneering vegetation</li> <li>- Not suitable for fodder crop</li> </ul>                                                                                                                                             |
| <u>Flemingia congesta</u>                         | <ul style="list-style-type: none"> <li>- Height: maximum 2 m</li> <li>- Deep root penetration</li> <li>- Well growth in the shade</li> <li>- Useful for green manure and strengthening terrace</li> <li>- High generation ability</li> </ul>                                                                                                                                                           |
| <u>Leucaena leucocephala</u><br>(I: Lamtoro gung) | <ul style="list-style-type: none"> <li>- Native: Central and South America</li> <li>- High tall tree</li> <li>- High tolerance of drought and alkali soil</li> <li>- Useful for green manure, strengthening terrace, preventing soil erosion, shade trees, fodder trees and soil improvement crops</li> <li>- Stem can be used for fuel woods.</li> <li>- Fruit (seed) is edible.</li> </ul>           |
| <u>Leucaena glauca</u>                            | <ul style="list-style-type: none"> <li>- Native: Hawaii</li> <li>- High tall tree</li> <li>- High tolerance of drought</li> <li>- Well growth on any types of soils</li> <li>- Useful for green manure, strengthening terrace, preventing soil erosion, shade trees, fodder trees and soil improvement crops</li> <li>- Stem can be used for fuel woods.</li> <li>- Fruit (seed) is edible.</li> </ul> |
| <u>Sesbania grandiflora</u>                       | <ul style="list-style-type: none"> <li>- Early growing tree</li> <li>- Height: 5 to 10 m</li> <li>- Useful for green manure, strengthening terrace, preventing soil erosion, fodder crops, and shade trees</li> <li>- Stems can be used for material of paper and fuel woods.</li> <li>- Flower and leaves are edible.</li> </ul>                                                                      |
| <u>Gliricidea maeulata</u>                        | <ul style="list-style-type: none"> <li>- Native: India</li> <li>- Prevent the growth of alang-alang</li> <li>- Useful for preventing soil erosion, fodder crops, and shade trees</li> <li>- Stems and branches can be used for fuel woods.</li> <li>- Trees can improve soil chemical and physical condition.</li> </ul>                                                                               |

Remarks: E: English name, I: Indonesian name

**Table VII-7 Recommended Grasses and Tree Crops for Soil Conservation (3/3)**

**(3) Cover crops and Leguminous crops**

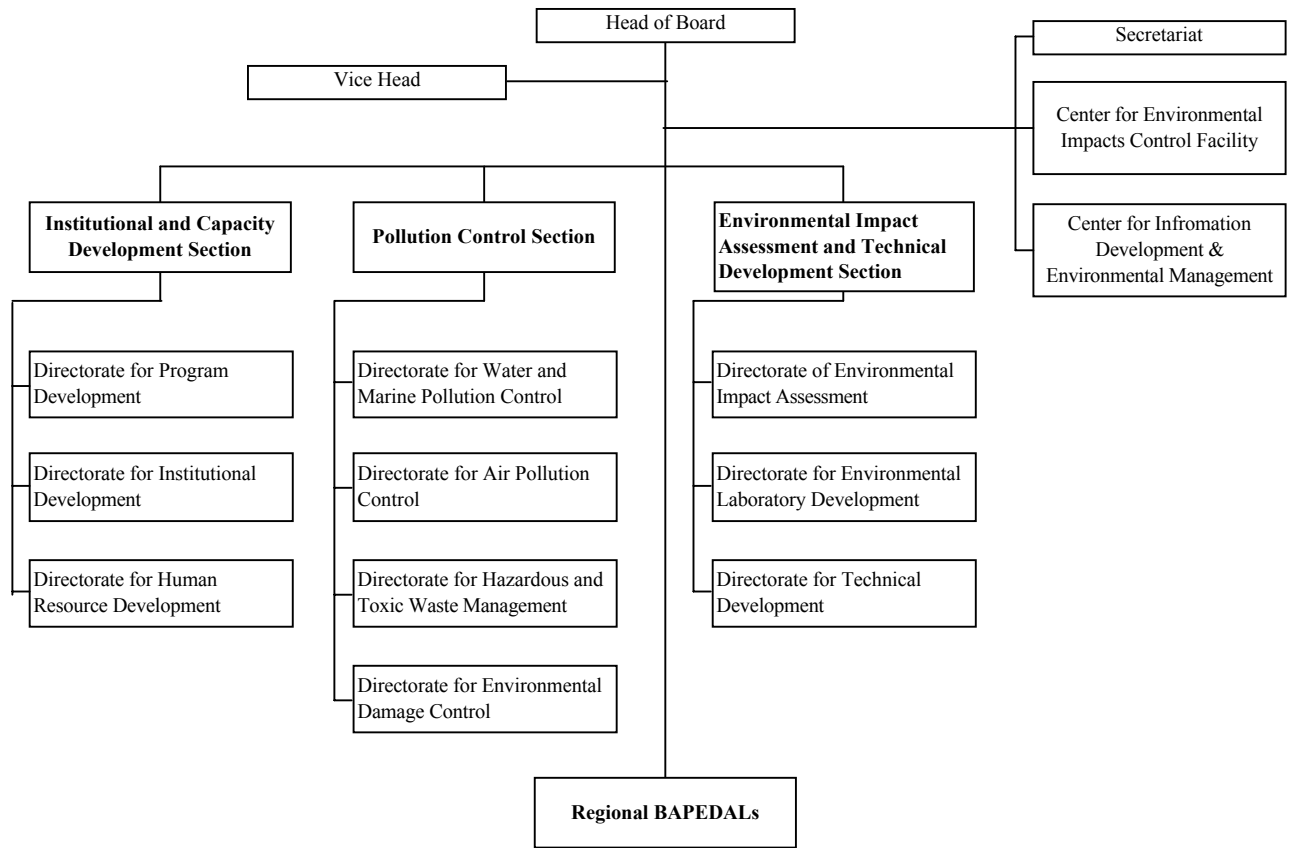
| Name of Crops                                | Characters                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u><i>Calopogonium muncunoides</i></u>       | <ul style="list-style-type: none"> <li>- Native: South America</li> <li>- Creeper crops</li> <li>- Perennial crops</li> <li>- Effective for prevention of alang-alang growing</li> </ul>                                                                                                                                                                                                                                           |
| <u><i>Centrosema spp.</i></u>                | <ul style="list-style-type: none"> <li>- Native: South America</li> <li>- Creeper crops</li> <li>- Suitable for acid soils and low organic soils</li> <li>- Useful for green manure and preventing soil erosion</li> </ul>                                                                                                                                                                                                         |
| <u><i>Pueraria spp.</i></u>                  | <ul style="list-style-type: none"> <li>- Native: Western Asia and Pacific Islands</li> <li>- Creeper crops</li> <li>- Suitable for acid soils and low Ca soils</li> <li>- High tolerance of drought</li> <li>- Useful for green manure, preventing soil erosion, and fodder crops</li> <li>- Effective for preventing weed growing</li> </ul>                                                                                      |
| <u><i>Mucuna pruriens</i></u>                | <ul style="list-style-type: none"> <li>- Native: Asia (Tropical)</li> <li>- Creeper crops</li> <li>- Moderately suitable for acid soils</li> <li>- Useful for green manure, preventing soil erosion, and fodder crops</li> <li>- Effective for improvement of soil fertility (by incorporating leaves and stems into soils)</li> </ul>                                                                                             |
| <u><i>Vigna sinensis</i></u><br>(E: Cow pea) | <ul style="list-style-type: none"> <li>- Leguminous crops</li> <li>- Fruit (beans) and young leaves are edible.</li> <li>- By harvesting: 60 – 80 days</li> <li>- Possible to plant through the year</li> <li>- Useful for green manure and fodder crops</li> <li>- Tolerance of dry soils</li> <li>- Effective for improvement of soil fertility and physical condition (by incorporating leaves and stems into soils)</li> </ul> |
| <u><i>Dolichos lablab</i></u>                | <ul style="list-style-type: none"> <li>- Leguminous crops</li> <li>- Fruit (beans) and young leaves are edible.</li> <li>- Possible to plant in dry season</li> <li>- Useful for green manure and fodder crops</li> <li>- Popular in Bali island and West Nusa Tenggara</li> </ul>                                                                                                                                                 |

Remarks: E: English name, I: Indonesian name

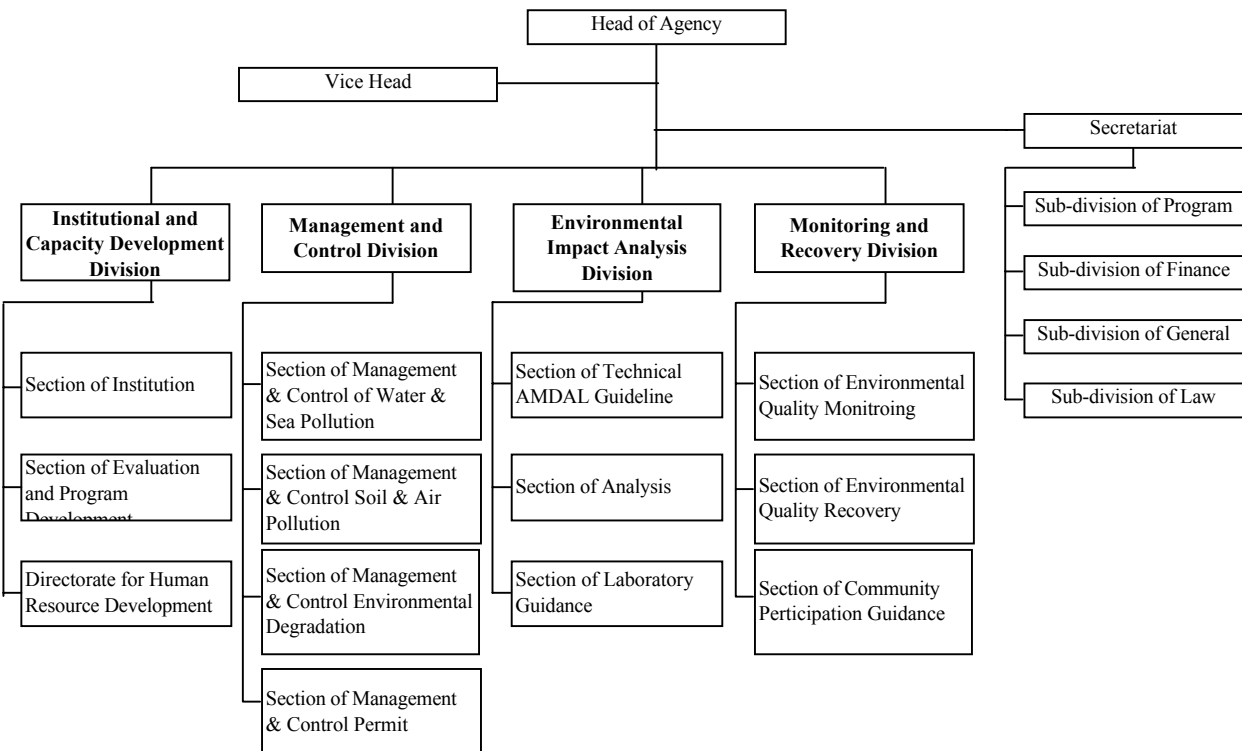
## Figures



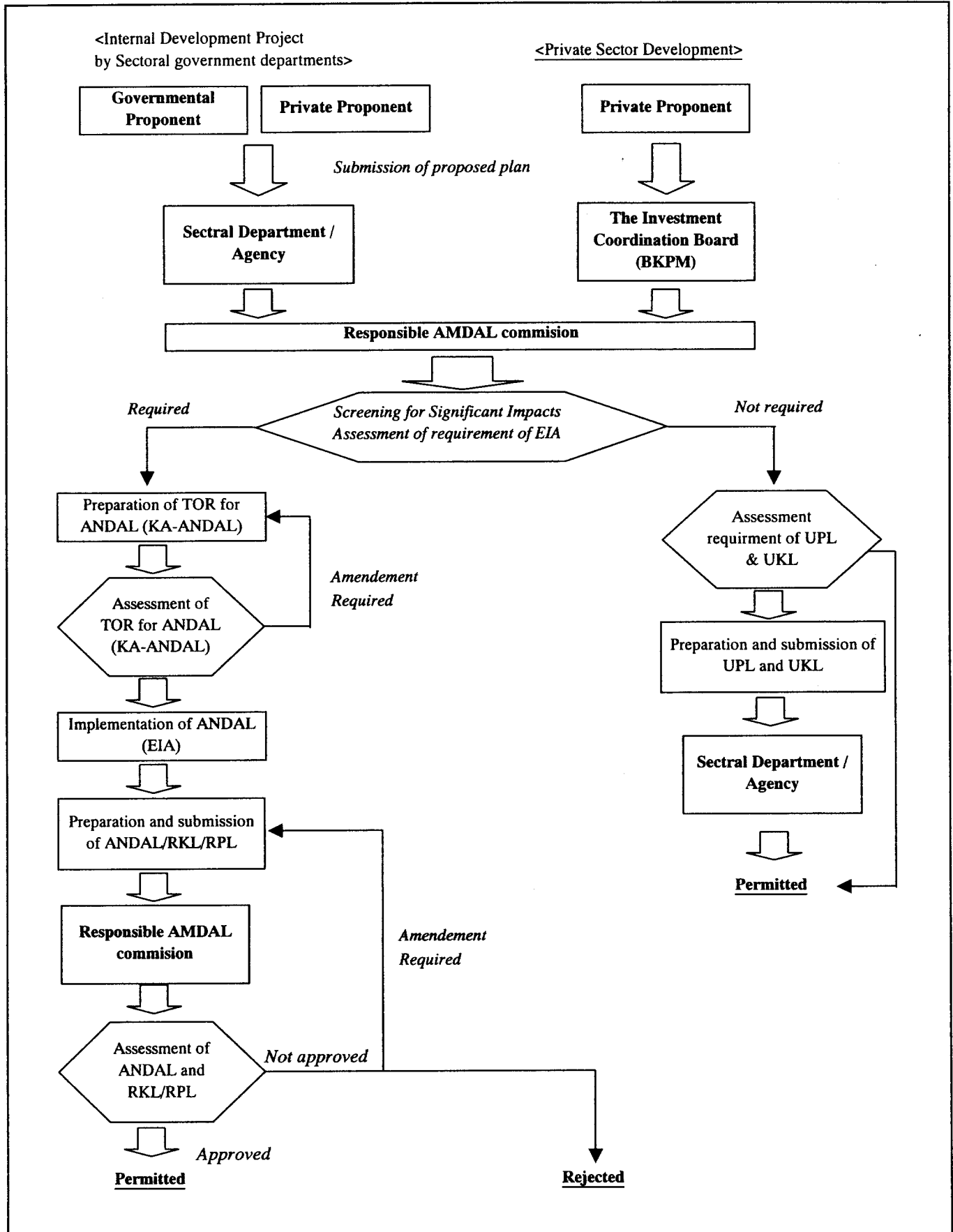
(1) Central Level



(2) Provincial Level (West Java)



**Figure VII-1 Organizational Structures of BAPEDAL**



**Figure VII-2 Outline of AMDAL Process**

Remarks :

|                                          |                                          |
|------------------------------------------|------------------------------------------|
| AMDAL : Procedure of EIA System          | ANDAL : EIA study                        |
| RKL: Environmental Management Plan       | RPL: Environmental Monitoring Plan       |
| UKL: Environmental Management Procedures | RPL: Environmental Monitoring Procedures |

# ***Attachment - I***

*Basic Assumption for USLE Estimation*

## Attachment 1 Basic Assumptions for USLE Estimation

Equation: Mean annual soil loss =  $R \times K \times LS \times C \times P$

### Assumption

Rainfall (R): Rainfall in the model sites ranges from 1,500 to 2,500 mm. The values also fluctuate for the last decade. Therefore, average annual rainfall is set up as 2,000 mm for all the sites.

Value of (R) is calculated referring the Indonesian standard as shown below.

(Buku Pintar Penyuluhan Kehutanan, 1997)

$$R = 2.21 \times \text{Average Monthly Rainfall (cm)}^{1.36}$$

Therefore, the value of R is assumed 2323.

Soil (K): Soils of the model sites are classified into three (3) categories such as Andosols, Regosols, Latosols, based on the Soil Map (1/250,000) prepared by the Center for soil and agro-climate in 19???. Some of the sites form a complex of these soils. Further, the textures and structures of the soils are relatively similar. The value (K) for all the sites is assumed 0.4 based on the research data of Cisurupan and Tanjungkarya.

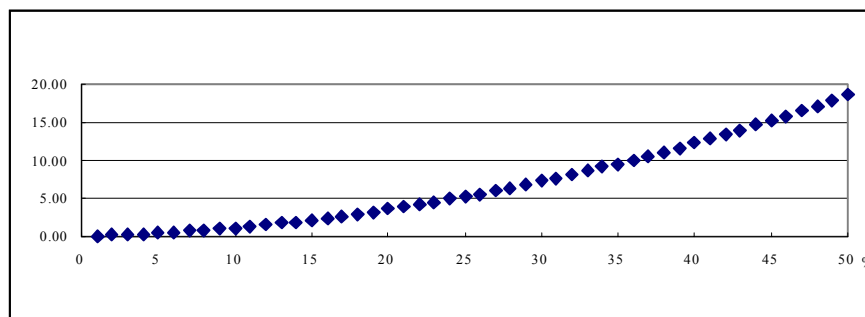
Slope (S) and Slope length (L)

Slope length varies fields. It is quite difficult to identify the precise length of each field. Therefore, a simple estimation set up by the Department of Forestry is utilized in the calculation as shown below.

**Factors of LS**

| <u>Slope (%)</u> | <u>LS</u> |
|------------------|-----------|
| 0-8              | 0.4       |
| 8-15             | 1.4       |
| 15-25            | 3.1       |
| 25-40            | 6.8       |
| >40              | 9.5       |

To make the estimation be more fit for the sites, the above values are adjusted by referring the following relationship between slope and LS.



**Relation between Slope and factor LS (in case of L = 22m)**

Land use (C):

Cropping patterns in the model sites are assumed as follows:

| <u>Model sites</u> | <u>Crops</u>                                                |
|--------------------|-------------------------------------------------------------|
| Gekbrong           | Vegetables (Tomato)                                         |
| Mekarjaya          | Vegetables (Sweet potato, Tomato, Chilly)                   |
| Tugumukti          | Vegetables (Cabbages, Tomato, Chilly)                       |
| Langensari         | Vegetables (Cabbages, Tomato, Chilly)                       |
| Mekarmukti         | Paddy, Upland crops (Soybean, Chilly, Banana), Agroforestry |
| Cisurupan          | Vegetables (Cabbages, Tomato, Chilly) and Maize             |
| Tanjungkarya       | Vegetables (Cabbages, Tomato, Chilly)                       |
| Cisantana          | Vegetables (Green onion)                                    |

The values of C are estimated based on the data of Indonesia and other country as shown below.

| <b>Factors of C</b>                                   |                 |
|-------------------------------------------------------|-----------------|
| <u>Crop types</u>                                     | <u>C values</u> |
| Vegetables (Cabbages, Chinese Cabbages, Tomato, etc.) | 0.3             |
| Paddy                                                 | 0.01            |
| Upland crops (Maize, Soybeans, Chilly)                | 0.4             |
| Agroforestry                                          | 0.05            |

Conservation measures (P):

The following table shows the major conservation measures in the model sites and the value of P-factor of them.

| <b>Factors of P</b>                                            |                 |
|----------------------------------------------------------------|-----------------|
| <u>Conservation measures</u>                                   | <u>P values</u> |
| Bench terrace                                                  |                 |
| Perfect (Reverse slope)                                        | 0.04            |
| Moderate (Level)                                               | 0.15            |
| Poor (Outward-sloping)                                         | 0.35            |
| Contour Bund                                                   |                 |
| (If contour strip cropping is applied, use 50 % of the values) |                 |
| 0-3 %                                                          | 0.30            |
| 3-8 %                                                          | 0.50            |
| 8-20%                                                          | 0.75            |
| > 20%                                                          | 0.90            |

Adjustment of slope length

When the reverse terrace or level terrace with ridge is adopted, the LS factor will be adjusted by using the following factors. In case of outward sloping terrace and strip row, 120 % for the value of the adjustment is applied (except the one of 0-3% slope).

|                            |      |
|----------------------------|------|
| Terrace on 0-3% slope:     | 1.00 |
| Terrace on 3-8% slope:     | 0.75 |
| Terrace on 8-10% slope:    | 0.67 |
| Terrace on 10-15% slope:   | 0.55 |
| Terrace on 15-20% slope:   | 0.48 |
| Terrace on 20-25% slope:   | 0.43 |
| Terrace on over 30% slope: | 0.40 |

## ***Attachment - II***

*Results of Screening and Scoping*

## Attachment II-1(1/8) Result of Environmental Screening

## (1) Mekarjaya

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | No         | -                |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 1 and 4          |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | No         | -                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 1 and 4          |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |

## Attachment II-1 (2/8) Result of Environmental Screening

## (2) Tugumukti

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4                |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | No         | -                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 4                |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |



## Attachment II-1 (3/8) Result of Environmental Screening

## (3) Langensari

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4                |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | No         | -                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 4                |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7                |

**Attachment II-1 (4/8) Result of Environmental Screening****(4) Gekbrong**

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4 and 10         |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | Yes        | 6                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 4                |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |

**Attachment II-1 (5/8) Result of Environmental Screening****(5) Cisurupan**

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4 and 10         |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | No         | -                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 4                |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |

## Attachment II-1 (6/8) Result of Environmental Screening

## (6) Tanjungkarya

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4                |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | No         | -                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 1 and 4          |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |

## Attachment II-1 (7/8) Result of Environmental Screening

## (7) Mekarmukti

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4                |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | No         | -                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 1 and 4          |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |

## Attachment II-1 (8/8) Result of Environmental Screening

## (8) Cisantana

| Environmental Issues                           | Potential SEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evaluation | Evaluation Bases |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| <b>1. Social Environment</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 1.1 Socio economic Issues                      | <ol style="list-style-type: none"> <li>1. Planned agricultural settlement</li> <li>2. Involuntary resettlement</li> <li>3. Substantial changes in way of life</li> <li>4. Conflict among communities or peoples</li> <li>5. Impact on indigenous peoples, ethnic minorities, nomads</li> <li>6. Population increase</li> <li>7. Drastic change in population composition</li> <li>8. Relocation of bases of economic activities</li> <li>9. Occupational change, loss of labor opportunity</li> <li>10. Increase in income disparities</li> <li>11. Adjustment and regulation of riparian rights</li> <li>12. Changes in social and institutional structures</li> <li>13. Changes in existing institutions and customs</li> </ol> | Yes        | 4                |
| 1.2 Health and Sanitary Issues                 | <ol style="list-style-type: none"> <li>1. Increased use of agrochemicals</li> <li>2. Outbreak of endemic diseases</li> <li>3. Prevalence of epidemic diseases</li> <li>4. Residual toxicity of agrochemicals</li> <li>5. Increase in domestic and other human waste</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes        | 4                |
| 1.3 Cultural Issues                            | <ol style="list-style-type: none"> <li>1. Impairment of historic remains and cultural assets</li> <li>2. Damage to aesthetic sites</li> <li>3. Impediment of mineral resources exploitation</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No         | -                |
| <b>2. Natural Environment</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |
| 2.1 Biological and Ecological Issues           | <ol style="list-style-type: none"> <li>1. Deterioration or degradation of vegetation</li> <li>2. Negative impacts on important or indigenous fauna and flora</li> <li>3. Degradation of ecosystem with biological diversity</li> <li>4. Proliferation of exotic and/or hazardous species</li> <li>5. Encroachment on wetland and peat swamp</li> <li>6. Encroachment on tropical forests</li> <li>7. Destruction or degradation of mangrove forests</li> <li>8. Degradation of coral reef</li> </ol>                                                                                                                                                                                                                              | Yes        | 6                |
| 2.2 Soil and Land Resources                    | <ol style="list-style-type: none"> <li>1. Soil erosion</li> <li>2. Soil salinization</li> <li>3. Deterioration of soil fertility</li> <li>4. Soil contamination by agrochemicals</li> <li>5. Devastation or desertification of land</li> <li>6. Devastation of hinterland</li> <li>7. Ground subsidence</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                | Yes        | 1 and 4          |
| 2.3 Hydrology and Air and Water Quality Issues | <ol style="list-style-type: none"> <li>1. Changes in surface water hydrology</li> <li>2. Changes in groundwater hydrology</li> <li>3. Inundation and flood</li> <li>4. Soil sedimentation</li> <li>5. Riverbed degradation</li> <li>6. Impediment of inland navigation</li> <li>7. Water contamination and deterioration of water quality</li> <li>8. Water eutrophication</li> <li>9. Sea water intrusion</li> <li>10. Low irrigation water temperature</li> <li>11. Atmospheric pollution</li> </ol>                                                                                                                                                                                                                            | Yes        | 7 and 8          |

## Attachment II-2 (1/8) Result of Environmental Scoping

## (1) Mekarjaya

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                 |
|------------------------------------------------------------|----------------------|---|---|---|----------------------------------|
|                                                            | A                    | B | C | D |                                  |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                  |
| (1) Social Aspects                                         |                      |   |   |   |                                  |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                  |
| 2. Involuntary resettlement                                |                      |   | x |   |                                  |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                  |
| 4. Conflict among communities or peoples                   |                      |   | x |   |                                  |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| (2) Demographic Issues                                     |                      |   |   |   |                                  |
| 1. Population increase                                     |                      |   |   | x |                                  |
| 2. Drastic change in population composition                |                      |   | x |   |                                  |
| 3. Others                                                  |                      |   | x |   |                                  |
| (3) Economic activities                                    |                      |   |   |   |                                  |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                  |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                  |
| 3. Increase in income disparities                          |                      | x | x |   | Small disparities are predicted. |
| 4. Others                                                  |                      |   | x |   |                                  |
| (4) Institutional and custom related issues                |                      |   |   |   |                                  |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                  |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                  |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                  |
| 1. Increased use of agrochemicals                          |                      | x |   |   | With increase of irrigated area  |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                  |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                  |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal  |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                  |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                  |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                  |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |

## Note :

- <1 A : The subject SEI is unquestionably induced by the project  
 B : The subject SEI is likely to be induced by the Project  
 C : There is no possibility of the subject SEI being induced by the Project  
 D : The SEI is unknown

## Attachment II-2 (1/8) Result of Environmental Scoping

## (1) Mekarjaya

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                          |
|----------------------------------------------------------------|----------------------|---|---|---|-------------------------------------------|
|                                                                | A                    | B | C | D |                                           |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                           |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                           |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                           |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                           |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                           |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                           |
| 6. Encroachment on tropical forests                            |                      |   | x |   | Presently encroached to production forest |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                           |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                           |
| 9. Others                                                      |                      |   | x |   |                                           |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                           |
| (1) Soil Resources                                             |                      |   |   |   |                                           |
| 1. Soil erosion                                                |                      | x | x |   | Present environmental issues              |
| 2. Soil salinization                                           |                      |   | x |   |                                           |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                           |
| 4. Soil contamination by agrochemicals                         |                      | x | x |   | Misuse and overuse of chemicals           |
| 5. Others                                                      |                      |   | x |   | Parts of area are subjected to land slid. |
| (2) Land Resources                                             |                      |   |   |   |                                           |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                           |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                           |
| 3. Ground subsidence                                           |                      |   | x |   |                                           |
| 4. Others                                                      |                      |   | x |   |                                           |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                           |
| (1) Hydrology                                                  |                      |   |   |   |                                           |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                           |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                           |
| 3. Inundation and flood                                        |                      |   | x |   |                                           |
| 4. Soil sedimentation                                          |                      |   | x |   | High sedimentation at present             |
| 5. Riverbed degradation                                        |                      |   | x |   |                                           |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                           |
| 7. Others                                                      |                      |   | x |   |                                           |
| (2) Water quality and temperature                              |                      |   |   |   |                                           |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | Pollution from farm input                 |
| 2. Water eutrophication                                        |                      | x |   |   | Pollution from farm input                 |
| 3. Sea water intrusion                                         |                      |   | x |   |                                           |
| 4. Others                                                      |                      |   | x |   |                                           |
| (3) Atmosphere                                                 |                      |   |   |   |                                           |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                           |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                           |
| 3. Others                                                      |                      |   | x |   |                                           |

Note :

- <1 A : The subject SEI is unquestionably induced by the project
- B : The subject SEI is likely to be induced by the Project
- C : There is no possibility of the subject SEI being induced by the Project
- D : The SEI is unknown



## Attachment II-2 (2/8) Result of Environmental Scoping

## (2) Tugumukti

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                 |
|------------------------------------------------------------|----------------------|---|---|---|----------------------------------|
|                                                            | A                    | B | C | D |                                  |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                  |
| (1) Social Aspects                                         |                      |   |   |   |                                  |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                  |
| 2. Involuntary resettlement                                |                      |   | x |   |                                  |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                  |
| 4. Conflict among communities or peoples                   |                      | x |   |   | Benefit from project is limited. |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| (2) Demographic Issues                                     |                      |   |   |   |                                  |
| 1. Population increase                                     |                      |   |   | x |                                  |
| 2. Drastic change in population composition                |                      |   | x |   |                                  |
| 3. Others                                                  |                      |   | x |   |                                  |
| (3) Economic activities                                    |                      |   |   |   |                                  |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                  |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                  |
| 3. Increase in income disparities                          |                      | x | x |   | Small disparities are predicted. |
| 4. Others                                                  |                      |   | x |   |                                  |
| (4) Institutional and custom related issues                |                      |   |   |   |                                  |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                  |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                  |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                  |
| 1. Increased use of agrochemicals                          |                      | x | x |   | with increase of irrigated area  |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                  |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                  |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal  |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                  |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                  |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                  |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |

Note :

- <1 A : The subject SEI is unquestionably induced by the project  
 B : The subject SEI is likely to be induced by the Project  
 C : There is no possibility of the subject SEI being induced by the Project  
 D : The SEI is unknown

## Attachment II-2 (2/8) Result of Environmental Scoping

## (2) Tugumukti

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                  |
|----------------------------------------------------------------|----------------------|---|---|---|-----------------------------------|
|                                                                | A                    | B | C | D |                                   |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                   |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                   |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                   |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                   |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                   |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                   |
| 6. Encroachment on tropical forests                            |                      |   | x |   |                                   |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                   |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                   |
| 9. Others                                                      |                      |   | x |   |                                   |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                   |
| (1) Soil Resources                                             |                      |   |   |   |                                   |
| 1. Soil erosion                                                |                      |   | x |   | Presently the possibility is low. |
| 2. Soil salinization                                           |                      |   | x |   |                                   |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                   |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | Overuse of agrochemical           |
| 5. Others                                                      |                      |   | x |   |                                   |
| (2) Land Resources                                             |                      |   |   |   |                                   |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                   |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                   |
| 3. Ground subsidence                                           |                      |   | x |   |                                   |
| 4. Others                                                      |                      |   | x |   |                                   |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                   |
| (1) Hydrology                                                  |                      |   |   |   |                                   |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                   |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                   |
| 3. Inundation and flood                                        |                      |   | x |   |                                   |
| 4. Soil sedimentation                                          |                      |   | x |   |                                   |
| 5. Riverbed degradation                                        |                      |   | x |   |                                   |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                   |
| 7. Others                                                      |                      |   | x |   |                                   |
| (2) Water quality and temperature                              |                      |   |   |   |                                   |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | Pollution from farm input         |
| 2. Water eutrophication                                        |                      | x |   |   | Pollution from farm input         |
| 3. Sea water intrusion                                         |                      |   | x |   |                                   |
| 4. Others                                                      |                      |   | x |   |                                   |
| (3) Atmosphere                                                 |                      |   |   |   |                                   |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                   |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                   |
| 3. Others                                                      |                      |   | x |   |                                   |

Note :

- <1 A : The subject SEI is unquestionably induced by the project
- B : The subject SEI is likely to be induced by the Project
- C : There is no possibility of the subject SEI being induced by the Project
- D : The SEI is unknown

## Attachment II-2 (3/8) Result of Environmental Scoping

## (3) Langensari

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                         |
|------------------------------------------------------------|----------------------|---|---|---|------------------------------------------|
|                                                            | A                    | B | C | D |                                          |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                          |
| (1) Social Aspects                                         |                      |   |   |   |                                          |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                          |
| 2. Involuntary resettlement                                |                      |   | x |   |                                          |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                          |
| 4. Conflict among communities or peoples                   |                      | x |   |   | Benefit from project is limited.         |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                          |
| 6. Others                                                  |                      |   | x |   |                                          |
| (2) Demographic Issues                                     |                      |   |   |   |                                          |
| 1. Population increase                                     |                      |   |   | x |                                          |
| 2. Drastic change in population composition                |                      |   | x |   |                                          |
| 3. Others                                                  |                      |   | x |   |                                          |
| (3) Economic activities                                    |                      |   |   |   |                                          |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                          |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                          |
| 3. Increase in income disparities                          |                      | x | x |   | Small disparities are predicted.         |
| 4. Others                                                  |                      |   | x |   |                                          |
| (4) Institutional and custom related issues                |                      |   |   |   |                                          |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                          |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                          |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                          |
| 4. Others                                                  |                      |   | x |   |                                          |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                          |
| 1. Increased use of agrochemicals                          |                      | x |   |   | with increase of irrigated area          |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                          |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                          |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | mis-selection and mishandle of chemicals |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                          |
| 6. Others                                                  |                      |   | x |   |                                          |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                          |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                          |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                          |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                          |
| 4. Others                                                  |                      |   | x |   |                                          |

Note :

- <1 A : The subject SEI is unquestionably induced by the project
- B : The subject SEI is likely to be induced by the Project
- C : There is no possibility of the subject SEI being induced by the Project
- D : The SEI is unknown

## Attachment II-2 (3/8) Result of Environmental Scoping

## (3) Langensari

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                               |
|----------------------------------------------------------------|----------------------|---|---|---|------------------------------------------------|
|                                                                | A                    | B | C | D |                                                |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                                |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                                |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                                |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                                |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                                |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                                |
| 6. Encroachment on tropical forests                            |                      |   | x |   |                                                |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                                |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                                |
| 9. Others                                                      |                      |   | x |   |                                                |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                                |
| (1) Soil Resources                                             |                      |   |   |   |                                                |
| 1. Soil erosion                                                |                      | x | x |   | Possibility in almost area in the site is low. |
| 2. Soil salinization                                           |                      |   | x |   |                                                |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                                |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | misuse and overuse of chemicals                |
| 5. Others                                                      |                      |   | x |   |                                                |
| (2) Land Resources                                             |                      |   |   |   |                                                |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                                |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                                |
| 3. Ground subsidence                                           |                      |   | x |   |                                                |
| 4. Others                                                      |                      |   | x |   |                                                |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                                |
| (1) Hydrology                                                  |                      |   |   |   |                                                |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                                |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                                |
| 3. Inundation and flood                                        |                      |   | x |   |                                                |
| 4. Soil sedimentation                                          |                      |   | x |   |                                                |
| 5. Riverbed degradation                                        |                      |   | x |   |                                                |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                                |
| 7. Others                                                      |                      |   | x |   |                                                |
| (2) Water quality and temperature                              |                      |   |   |   |                                                |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | pollution from farm input                      |
| 2. Water eutrophication                                        |                      | x |   |   | pollution from farm input                      |
| 3. Sea water intrusion                                         |                      |   | x |   |                                                |
| 4. Others                                                      |                      |   | x |   |                                                |
| (3) Atmosphere                                                 |                      |   |   |   |                                                |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                                |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                                |
| 3. Others                                                      |                      |   | x |   |                                                |

Note :

- <1 A : The subject SEI is unquestionably induced by the project
- B : The subject SEI is likely to be induced by the Project
- C : There is no possibility of the subject SEI being induced by the Project
- D : The SEI is unknown

## Attachment II-2 (4/8) Result of Environmental Scoping

## (4) Gekbrong

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                 |
|------------------------------------------------------------|----------------------|---|---|---|----------------------------------|
|                                                            | A                    | B | C | D |                                  |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                  |
| (1) Social Aspects                                         |                      |   |   |   |                                  |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                  |
| 2. Involuntary resettlement                                |                      |   | x |   |                                  |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                  |
| 4. Conflict among communities or peoples                   |                      | x |   |   | Benefit from project is limited. |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| (2) Demographic Issues                                     |                      |   |   |   |                                  |
| 1. Population increase                                     |                      |   |   | x |                                  |
| 2. Drastic change in population composition                |                      |   | x |   |                                  |
| 3. Others                                                  |                      |   | x |   |                                  |
| (3) Economic activities                                    |                      |   |   |   |                                  |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                  |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                  |
| 3. Increase in income disparities                          |                      | x |   |   | Existing large holding farmer    |
| 4. Others                                                  |                      |   | x |   |                                  |
| (4) Institutional and custom related issues                |                      |   |   |   |                                  |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                  |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                  |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                  |
| 1. Increased use of agrochemicals                          |                      | x |   |   | With increase of irrigated area  |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                  |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                  |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal  |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                  |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                  |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                  |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |

Note :

- <1 A : The subject SEI is unquestionably induced by the project  
 B : The subject SEI is likely to be induced by the Project  
 C : There is no possibility of the subject SEI being induced by the Project  
 D : The SEI is unknown

## Attachment II-2 (4/8) Result of Environmental Scoping

## (4) Gekbrong

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                               |
|----------------------------------------------------------------|----------------------|---|---|---|------------------------------------------------|
|                                                                | A                    | B | C | D |                                                |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                                |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                                |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                                |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                                |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                                |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                                |
| 6. Encroachment on tropical forests                            |                      | x | x |   | Intake site is located in conservation forest. |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                                |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                                |
| 9. Others                                                      |                      |   | x |   |                                                |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                                |
| (1) Soil Resources                                             |                      |   |   |   |                                                |
| 1. Soil erosion                                                |                      | x |   |   | Possibility in site is low to moderate.        |
| 2. Soil salinization                                           |                      |   | x |   |                                                |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                                |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | Misuse and overuse of chemicals                |
| 5. Others                                                      |                      |   | x |   |                                                |
| (2) Land Resources                                             |                      |   |   |   |                                                |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                                |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                                |
| 3. Ground subsidence                                           |                      |   | x |   |                                                |
| 4. Others                                                      |                      |   | x |   |                                                |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                                |
| (1) Hydrology                                                  |                      |   |   |   |                                                |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                                |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                                |
| 3. Inundation and flood                                        |                      |   | x |   |                                                |
| 4. Soil sedimentation                                          |                      |   | x |   |                                                |
| 5. Riverbed degradation                                        |                      |   | x |   |                                                |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                                |
| 7. Others                                                      |                      |   | x |   |                                                |
| (2) Water quality and temperature                              |                      |   |   |   |                                                |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | Pollution from farm input                      |
| 2. Water eutrophication                                        |                      | x |   |   | Pollution from farm input                      |
| 3. Sea water intrusion                                         |                      |   | x |   |                                                |
| 4. Others                                                      |                      |   | x |   |                                                |
| (3) Atmosphere                                                 |                      |   |   |   |                                                |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                                |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                                |
| 3. Others                                                      |                      |   | x |   |                                                |

Note :

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- C : There is no possibility of the subject SEI being induced by the Project
- D : The SEI is unknown

## Attachment II-2 (5/8) Result of Environmental Scoping

## (5) Cisurupan

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                 |
|------------------------------------------------------------|----------------------|---|---|---|----------------------------------|
|                                                            | A                    | B | C | D |                                  |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                  |
| (1) Social Aspects                                         |                      |   |   |   |                                  |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                  |
| 2. Involuntary resettlement                                |                      |   | x |   |                                  |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                  |
| 4. Conflict among communities or peoples                   |                      | x |   |   | Benefit from project is limited. |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| (2) Demographic Issues                                     |                      |   |   |   |                                  |
| 1. Population increase                                     |                      |   |   | x |                                  |
| 2. Drastic change in population composition                |                      |   | x |   |                                  |
| 3. Others                                                  |                      |   | x |   |                                  |
| (3) Economic activities                                    |                      |   |   |   |                                  |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                  |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                  |
| 3. Increase in income disparities                          |                      | x |   |   | Benefit from project is limited. |
| 4. Others                                                  |                      |   | x |   |                                  |
| (4) Institutional and custom related issues                |                      |   |   |   |                                  |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                  |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                  |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                  |
| 1. Increased use of agrochemicals                          |                      | x |   |   | With increase of irrigated area  |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                  |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                  |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal  |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                  |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                  |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                  |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |

Note :

- <1 A : The subject SEI is unquestionably induced by the project  
 B : The subject SEI is likely to be induced by the Project  
 C : There is no possibility of the subject SEI being induced by the Project  
 D : The SEI is unknown

## Attachment II-2 (5/8) Result of Environmental Scoping

## (5) Cisurupan

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                              |
|----------------------------------------------------------------|----------------------|---|---|---|-----------------------------------------------|
|                                                                | A                    | B | C | D |                                               |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                               |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                               |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                               |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                               |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                               |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                               |
| 6. Encroachment on tropical forests                            |                      |   | x |   |                                               |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                               |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                               |
| 9. Others                                                      |                      |   | x |   |                                               |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                               |
| (1) Soil Resources                                             |                      |   |   |   |                                               |
| 1. Soil erosion                                                |                      | x | x |   | Possibility is high in the slope along canal. |
| 2. Soil salinization                                           |                      |   | x |   |                                               |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                               |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | Misuse and overuse of chemicals               |
| 5. Others                                                      |                      |   | x |   |                                               |
| (2) Land Resources                                             |                      |   |   |   |                                               |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                               |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                               |
| 3. Ground subsidence                                           |                      |   | x |   |                                               |
| 4. Others                                                      |                      |   | x |   |                                               |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                               |
| (1) Hydrology                                                  |                      |   |   |   |                                               |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                               |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                               |
| 3. Inundation and flood                                        |                      |   | x |   |                                               |
| 4. Soil sedimentation                                          |                      |   | x |   | Sedimentation in canal is a present problem.  |
| 5. Riverbed degradation                                        |                      |   | x |   |                                               |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                               |
| 7. Others                                                      |                      |   | x |   |                                               |
| (2) Water quality and temperature                              |                      |   |   |   |                                               |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | Pollution from farm input                     |
| 2. Water eutrophication                                        |                      | x |   |   | Pollution from farm input                     |
| 3. Sea water intrusion                                         |                      |   | x |   |                                               |
| 4. Others                                                      |                      |   | x |   |                                               |
| (3) Atmosphere                                                 |                      |   |   |   |                                               |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                               |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                               |
| 3. Others                                                      |                      |   | x |   |                                               |

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## Attachment II-2 (6/8) Result of Environmental Scoping

## (6) Tanjungkarya

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                 |
|------------------------------------------------------------|----------------------|---|---|---|----------------------------------|
|                                                            | A                    | B | C | D |                                  |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                  |
| (1) Social Aspects                                         |                      |   |   |   |                                  |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                  |
| 2. Involuntary resettlement                                |                      |   | x |   |                                  |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                  |
| 4. Conflict among communities or peoples                   |                      | x | x |   | Benefit from project is limited. |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| (2) Demographic Issues                                     |                      |   |   |   |                                  |
| 1. Population increase                                     |                      |   |   | x |                                  |
| 2. Drastic change in population composition                |                      |   | x |   |                                  |
| 3. Others                                                  |                      |   | x |   |                                  |
| (3) Economic activities                                    |                      |   |   |   |                                  |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                  |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                  |
| 3. Increase in income disparities                          |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| (4) Institutional and custom related issues                |                      |   |   |   |                                  |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                  |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                  |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                  |
| 1. Increased use of agrochemicals                          |                      | x |   |   | With increase of irrigated area  |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                  |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                  |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal  |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                  |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                  |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                  |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |

## Note :

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 C : There is no possibility of the subject SEI being induced by the Project  
 D : The SEI is unknown

## Attachment-II (6/8) Result of Environmental Scoping

## (6) Tanjungkarya

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                          |
|----------------------------------------------------------------|----------------------|---|---|---|-------------------------------------------|
|                                                                | A                    | B | C | D |                                           |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                           |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                           |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                           |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                           |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                           |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                           |
| 6. Encroachment on tropical forests                            |                      |   | x |   | Presently encroached to production forest |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                           |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                           |
| 9. Others                                                      |                      |   | x |   |                                           |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                           |
| (1) Soil Resources                                             |                      |   |   |   |                                           |
| 1. Soil erosion                                                |                      | x | x |   | Parts of area is moderate.                |
| 2. Soil salinization                                           |                      |   | x |   |                                           |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                           |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | Misuse and overuse of chemicals           |
| 5. Others                                                      |                      |   | x |   |                                           |
| (2) Land Resources                                             |                      |   |   |   |                                           |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                           |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                           |
| 3. Ground subsidence                                           |                      |   | x |   |                                           |
| 4. Others                                                      |                      |   | x |   |                                           |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                           |
| (1) Hydrology                                                  |                      |   |   |   |                                           |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                           |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                           |
| 3. Inundation and flood                                        |                      |   | x |   |                                           |
| 4. Soil sedimentation                                          |                      |   | x |   |                                           |
| 5. Riverbed degradation                                        |                      |   | x |   |                                           |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                           |
| 7. Others                                                      |                      |   | x |   |                                           |
| (2) Water quality and temperature                              |                      |   |   |   |                                           |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | pollution from farm input                 |
| 2. Water eutrophication                                        |                      | x |   |   | pollution from farm input                 |
| 3. Sea water intrusion                                         |                      |   | x |   |                                           |
| 4. Others                                                      |                      |   | x |   |                                           |
| (3) Atmosphere                                                 |                      |   |   |   |                                           |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                           |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                           |
| 3. Others                                                      |                      |   | x |   |                                           |

Note :

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- D : The SEI is unknown

## Attachment II-2 (7/8) Result of Environmental Scoping

## (7) Mekarmukti

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                 |
|------------------------------------------------------------|----------------------|---|---|---|----------------------------------|
|                                                            | A                    | B | C | D |                                  |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                  |
| (1) Social Aspects                                         |                      |   |   |   |                                  |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                  |
| 2. Involuntary resettlement                                |                      |   | x |   |                                  |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                  |
| 4. Conflict among communities or peoples                   |                      | x | x |   | Benefit from project is limited. |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| (2) Demographic Issues                                     |                      |   |   |   |                                  |
| 1. Population increase                                     |                      |   |   | x |                                  |
| 2. Drastic change in population composition                |                      |   | x |   |                                  |
| 3. Others                                                  |                      |   | x |   |                                  |
| (3) Economic activities                                    |                      |   |   |   |                                  |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                  |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                  |
| 3. Increase in income disparities                          |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| (4) Institutional and custom related issues                |                      |   |   |   |                                  |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                  |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                  |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                  |
| 1. Increased use of agrochemicals                          |                      | x |   |   | With increase of irrigated area  |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                  |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                  |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal  |
| 5. Increase in domestic and other human waste              |                      |   | x |   |                                  |
| 6. Others                                                  |                      |   | x |   |                                  |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                  |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                  |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                  |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                  |
| 4. Others                                                  |                      |   | x |   |                                  |

## Note :

- <1 A : The subject SEI is unquestionably induced by the project  
 B : The subject SEI is likely to be induced by the Project  
 C : There is no possibility of the subject SEI being induced by the Project  
 D : The SEI is unknown

## Attachment II-2 (7/8) Result of Environmental Scoping

## (7) Mekarmukti

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                            |
|----------------------------------------------------------------|----------------------|---|---|---|---------------------------------------------|
|                                                                | A                    | B | C | D |                                             |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                             |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                             |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                             |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                             |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                             |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                             |
| 6. Encroachment on tropical forests                            |                      |   | x |   |                                             |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                             |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                             |
| 9. Others                                                      |                      |   | x |   |                                             |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                             |
| (1) Soil Resources                                             |                      |   |   |   |                                             |
| 1. Soil erosion                                                |                      | x | x |   | Parts of area is moderate.                  |
| 2. Soil salinization                                           |                      |   | x |   |                                             |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                             |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | Misuse and overuse of chemicals             |
| 5. Others                                                      |                      |   | x |   |                                             |
| (2) Land Resources                                             |                      |   |   |   |                                             |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                             |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                             |
| 3. Ground subsidence                                           |                      |   | x |   |                                             |
| 4. Others                                                      |                      |   | x |   |                                             |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                             |
| (1) Hydrology                                                  |                      |   |   |   |                                             |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                             |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                             |
| 3. Inundation and flood                                        |                      |   | x |   |                                             |
| 4. Soil sedimentation                                          |                      |   | x |   | Sedimentaion in canal is a present problem. |
| 5. Riverbed degradation                                        |                      |   | x |   |                                             |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                             |
| 7. Others                                                      |                      |   | x |   |                                             |
| (2) Water quality and temperature                              |                      |   |   |   |                                             |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | pollution from farm input                   |
| 2. Water eutrophication                                        |                      | x |   |   | pollution from farm input                   |
| 3. Sea water intrusion                                         |                      |   | x |   |                                             |
| 4. Others                                                      |                      |   | x |   |                                             |
| (3) Atmosphere                                                 |                      |   |   |   |                                             |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                             |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                             |
| 3. Others                                                      |                      |   | x |   |                                             |

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## Attachment II-2 (8/8) Result of Environmental Scoping

## (8) Cisantana

## I. Social Environment

| Category of environmental impact                           | Evaluation of SEI <1 |   |   |   | Evaluation Bases                               |
|------------------------------------------------------------|----------------------|---|---|---|------------------------------------------------|
|                                                            | A                    | B | C | D |                                                |
| 1.1 Socio economic Issues                                  |                      |   |   |   |                                                |
| (1) Social Aspects                                         |                      |   |   |   |                                                |
| 1. Planned agricultural settlement                         |                      |   | x |   |                                                |
| 2. Involuntary resettlement                                |                      |   | x |   |                                                |
| 3. Substantial changes in way of life                      |                      |   | x |   |                                                |
| 4. Conflict among communities or peoples                   |                      | x | x |   | Water distribution is not equitable presently. |
| 5. Impact on indigenous peoples, ethnic minorities, nomads |                      |   | x |   |                                                |
| 6. Others                                                  |                      |   | x |   |                                                |
| (2) Demographic Issues                                     |                      |   |   |   |                                                |
| 1. Population increase                                     |                      |   |   | x |                                                |
| 2. Drastic change in population composition                |                      |   | x |   |                                                |
| 3. Others                                                  |                      |   | x |   |                                                |
| (3) Economic activities                                    |                      |   |   |   |                                                |
| 1. Relocation of bases of economic activities              |                      |   | x |   |                                                |
| 2. Occupational change, loss of labor opportunity          |                      |   | x |   |                                                |
| 3. Increase in income disparities                          |                      |   | x |   |                                                |
| 4. Others                                                  |                      |   | x |   |                                                |
| (4) Institutional and custom related issues                |                      |   |   |   |                                                |
| 1. Adjustment and regulation of riparian rights            |                      |   | x |   |                                                |
| 2. Changes in social and institutional structures          |                      |   | x |   |                                                |
| 3. Changes in existing institutions and customs            |                      |   | x |   |                                                |
| 4. Others                                                  |                      |   | x |   |                                                |
| 1.2 Health and Sanitary Issues                             |                      |   |   |   |                                                |
| 1. Increased use of agrochemicals                          |                      | x |   |   | With increase of irrigated area                |
| 2. Outbreak of endemic diseases                            |                      |   | x |   |                                                |
| 3. Prevalence of epidemic diseases                         |                      |   | x |   |                                                |
| 4. Residual toxicity of agrochemicals                      |                      | x |   |   | Mishandle and improper disposal                |
| 5. Increase in domestic and other human waste              |                      |   | x |   | Waste is presently dumped in river.            |
| 6. Others                                                  |                      |   | x |   |                                                |
| 1.3 Cultural Issues                                        |                      |   |   |   |                                                |
| 1. Impairment of historic remains and cultural assets      |                      |   | x |   |                                                |
| 2. Damage to aesthetic sites                               |                      |   | x |   |                                                |
| 3. Impediment of mineral resources exploitation            |                      |   | x |   |                                                |
| 4. Others                                                  |                      |   | x |   |                                                |

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## Attachment II-2 (8/8) Result of Environmental Scoping

## (8) Cisantana

## II. Natural Environment

| Category of environmental impact                               | Evaluation of SEI <1 |   |   |   | Evaluation Bases                               |
|----------------------------------------------------------------|----------------------|---|---|---|------------------------------------------------|
|                                                                | A                    | B | C | D |                                                |
| 2.1 Biological and Ecological Issues                           |                      |   |   |   |                                                |
| 1. Deterioration or degradation of vegetation                  |                      |   | x |   |                                                |
| 2. Negative impacts on important or indigenous fauna and flora |                      |   | x |   |                                                |
| 3. Degradation of ecosystem with biological diversity          |                      |   | x |   |                                                |
| 4. Proliferation of exotic and/or hazardous species            |                      |   | x |   |                                                |
| 5. Encroachment on wetland and peat swamp                      |                      |   | x |   |                                                |
| 6. Encroachment on tropical forests                            |                      | x | x |   | Intake site is located in conservation forest. |
| 7. Destruction or degradation of mangrove forests              |                      |   | x |   |                                                |
| 8. Degradation of coral reef                                   |                      |   | x |   |                                                |
| 9. Others                                                      |                      |   | x |   |                                                |
| 2.2 Soil and Land Resources                                    |                      |   |   |   |                                                |
| (1) Soil Resources                                             |                      |   |   |   |                                                |
| 1. Soil erosion                                                |                      | x | x |   | Parts of area is moderate.                     |
| 2. Soil salinization                                           |                      |   | x |   |                                                |
| 3. Deterioration of soil fertility                             |                      |   | x |   |                                                |
| 4. Soil contamination by agrochemicals                         |                      | x |   |   | Misuse and overuse of chemicals                |
| 5. Others                                                      |                      |   | x |   |                                                |
| (2) Land Resources                                             |                      |   |   |   |                                                |
| 1. Devastation or desertification of land                      |                      |   | x |   |                                                |
| 2. Devastation of hinterland                                   |                      |   | x |   |                                                |
| 3. Ground subsidence                                           |                      |   | x |   |                                                |
| 4. Others                                                      |                      |   | x |   |                                                |
| 2.3 Hydrology and Air and Water Quality Issues                 |                      |   |   |   |                                                |
| (1) Hydrology                                                  |                      |   |   |   |                                                |
| 1. Changes in surface water hydrology                          |                      |   | x |   |                                                |
| 2. Changes in groundwater hydrology                            |                      |   | x |   |                                                |
| 3. Inundation and flood                                        |                      |   | x |   |                                                |
| 4. Soil sedimentation                                          |                      |   | x |   |                                                |
| 5. Riverbed degradation                                        |                      |   | x |   |                                                |
| 6. Impediment of inland navigation                             |                      |   | x |   |                                                |
| 7. Others                                                      |                      |   | x |   |                                                |
| (2) Water quality and temperature                              |                      |   |   |   |                                                |
| 1. Water contamination and deterioration of water quality      |                      | x |   |   | Pollution from farm input                      |
| 2. Water eutrophication                                        |                      | x |   |   | Pollution from farm input                      |
| 3. Sea water intrusion                                         |                      |   | x |   |                                                |
| 4. Others                                                      |                      |   | x |   |                                                |
| (3) Atmosphere                                                 |                      |   |   |   |                                                |
| 1. Low irrigation water temperature                            |                      |   | x |   |                                                |
| 2. Atmospheric pollution                                       |                      |   | x |   |                                                |
| 3. Others                                                      |                      |   | x |   |                                                |

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