

2.3.2.4 Road and Bridge Plan and Design

(1) Design policy

The design policy of road & bridge are following.

- Two existing Barangay roads in the irrigation area will be improved in the project. New construction of the access road to the proposed resettlement area is also planned. The proposed roads are paved with gravel in principle, however, in the case that longitudinal slope is more than 9%, concrete pavement will be intended, to ensure all-weather traffic.
- The roads around the reservoir will be used for reservoir management, forest management of water source, access for afforestation, and convenience of farmer's daily lives. The location of the route will be selected taking such factors into consideration. Since the roads are to be newly constructed or improved around the reservoir, they are being designed from viewpoint of safety for disaster prevention and protection of the environment.
- For the road design, the detail specifications (width, load, structure, etc.) will be decided based on the expected traffic volume, and the road standards of the Philippines.

(2) Design cross section of road

The design cross section of the proposed road is considered as follows.

| Road classification | Width (effective/total) | Design speed | Road surface | Longitudinal slope |
|------------------------------|-------------------------|--------------|-------------------|--------------------|
| Improvement of existing road | 4.0/5.0 m | 30 km/h | Gravel pavement | 8.0% |
| " | " | " | Concrete pavement | more than 9.0% |
| Roads around reservoir | 3.0/4.0 | 20 km/h | Gravel pavement | 10.0% |

The standard cross section of the proposed road is shown in the attached cross-section drawing.

(3) Selection of road improvement route

There are four Barangay roads in the project area. Based on the current conditions of the road network and the survey details, Cato to Bamban access road (3.5 km), which is relatively poor and strongly requested by residents for repair, and the road from PSU Infanta Campus to the San Felipe River (1.2 km) will be selected as major sections for improvement. These roads can be utilized as construction access roads for the project implementation and are considered effective.

There is no existing road to connect Bamban Barangay and the proposed resettlement area. New construction of this road covering 2.5 km (1.9 km newly constructed, 0.6 km improved), which is indispensable for the future, will be planned. Three Barangay roads are selected as the improvement road.

[Improvement plan]

- Road improvement plan

- Improvement section : 3 routes, 5.3 km
- New construction section : 1 route, 1.9 km

- Related structures

- Road bridge (18 m span) : 2 places
- Submerged bridge (for crossing San Felipe River): 2 places

The reasons for selection of the roads are as follows.

(A) Cato to Bamban access road (Improvement)

Along this road, there are Cato and Bamban Barangays consisting of approximately 50 farmhouses and 150 ha of paddy fields. Since the Cato Bamban primary school is located along the national road, approximately 30 school children are using this road. The traffic condition is shown in the following table.

| Use | Traffic condition | Daily traffic volume |
|----------------------------------|---|----------------------|
| 1. Regular bus service | 5 to 6 jeepney shuttle services per day | 10 cars/day |
| 2. Rice transport (rainy season) | Approximately 450 tons of rice are transported (by 2-ton truck) | 24 cars/day |
| 3. Farming traffic | Traffic for 100 ha of agricultural fields (motorcycles, hand tractors etc.) | 50 cars/day |
| 4. Use as rural road | Ladies going-out for shopping using tricycles (auto-taxis) | 20 cars/day |
| 5. School road | Approximately 30 school children going to school and coming home | 60 persons/day |
| 6. Construction access road | Used for construction under the project | |

(B) PSU Infanta Campus to San Felipe road (Improvement)

- Rural road to lead to Pita Barangay.
- Bamban intake weir maintenance road.
- Access road to the dam site to be constructed.
- Connecting road to the roads around the reservoir.

| Use | Traffic condition | Daily traffic volume |
|--------------------------------------|--|----------------------|
| 1. Use as rural road | Rural road of Pita Barangay | 20 cars/day |
| 2. Agricultural Products transport | Agricultural products are transported from approximately 50 ha | 5 cars/day |
| 3. Farming traffic | Traffic for 50 ha of agricultural fields (motorcycles, hand tractors etc.) | 25 cars/day |
| 4. O&M road | O&M road for the dam and the intake weir etc. | 5 cars/day |
| 5. Access road for the afforestation | Young trees are transported. | 5 persons/day |
| 6. Construction access road | Used for construction under the project | |

(C) Bamban to Resettlement area road (partially new, partially improvement)

- The road runs in the middle of the project area, and connect the right and left sides of the San Felipe River.
- Connecting road between Bamban Barangay and the proposed resettlement area.
- Access road for future resettlers to go to Infanta.

| Use | Traffic condition | Daily traffic volume |
|-----------------------------|--|----------------------|
| 1. Regular bus service | 5 to 6 jeepney shuttle services per day | 10 cars/day |
| 2. Use as rural road | Ladies going-out for shopping using tricycles (auto-taxis) | 30 cars/day |
| 3. School road | Approximately 40 school children going to school and coming home | 80 persons/day |
| 4. Construction access road | Used for construction under the project | |

(4) Design of Bridge

The Cato to Bamban access road, which is planned for the project, has two bridges. Both are 18.0 m long wooden bridges crossing creeks. The wooden girders are partially rotten, and it is very dangerous to go over the bridges.

As for the foundation, there are middle to hard clay layers as main components until the depth of 20 m, and, excepting a certain part, relatively good bearing layers of N-value = 20 to 40 are formed. Since this road is an inter-village connecting road for comparatively light traffic, the bridges will be specified as class 2 (T-15), and the economical box culvert system (the construction cost is 50% of the bridge type) which ground reaction is small will be employed as a bridge.

For crossing the San Felipe River, the submerged bridge system which enables traffic 350 days/year based on the past river data (15 days per common year is more than 5.0 m³/s), will be employed.

(5) Construction of roads around the reservoir

The crest of the dam is planned to be constructed at an elevation of 57.0 m. The river basin area is approximately 23 km². The geographical features of the reservoir area include relatively gentle-sloped hilly land with several ridges of 100 to 300 m elevation. Excepting the forests in valleys, most of the area is covered with grass. Therefore, afforestation is going on in some part. In this project, on the right riverbed side, utilizing the existing mountain woodland paths leading along the ridges, a connecting road along the ridge on the left riverbed side will be planned. Field reconnaissance will be performed based on a 1/5,000 topographical map, and efforts will be made to select a safe and economical route that can protect the natural environment and protect against disaster with the least possible cutting and embankment of soil for construction.

The construction plan are as follows.

- Road construction plan

- New construction section : 13.4 km
- Reconstruction section : 3.4 km
- Total : 16.8 km

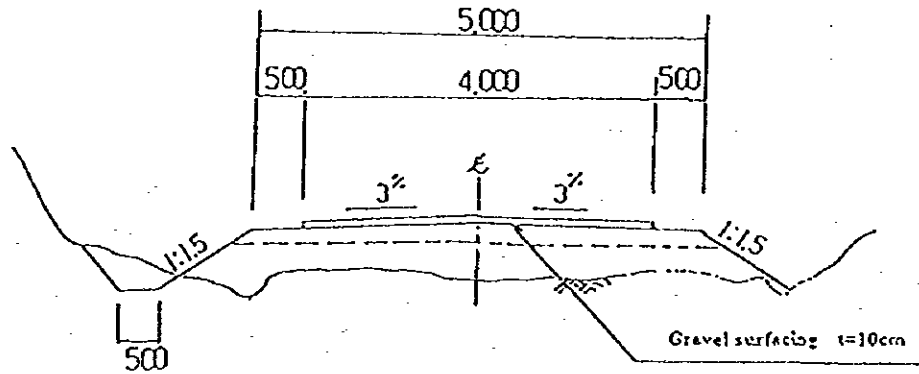
- Related structures

- Submerged bridge : 3 places (at San Felipe river and its blanch)
- Crossing conduit : approximately 10 places (at crossing places of mountain stream)

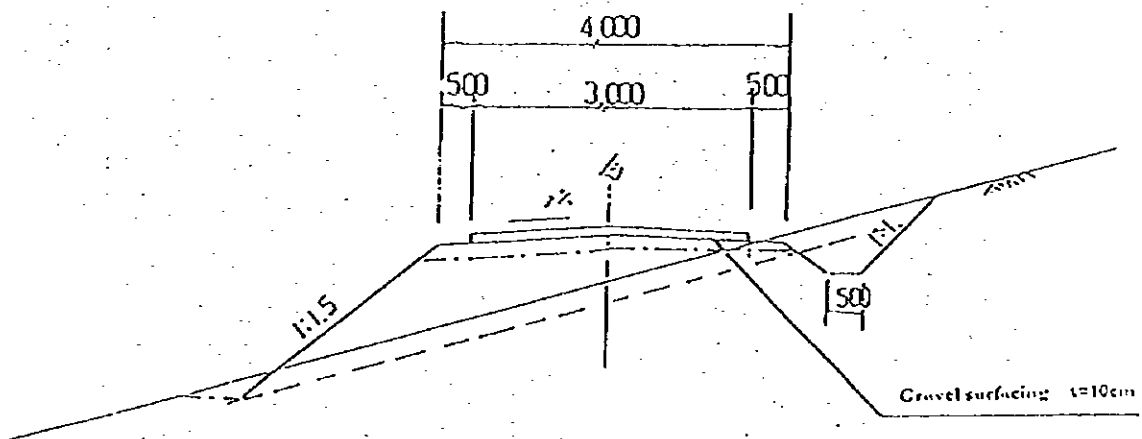
(6) Design Drawings

The drawings for the basic design of road & bridge are shown in the Fig. 2.3.2.4-1 to 2.3.2.4-4.

Section of Connection Road for village
(Barangay Road)



Maintenance Road of Reservoir
(Around Reservoir Road)



BASIC DESIGN FOR INFANTA IMPOUNDING IRRIGATION
AND ENVIRONMENTAL IMPROVEMENT PROJECT

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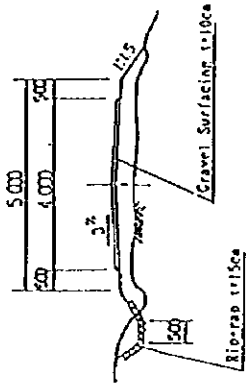
FIG. 2.3.2.4-1 STANDARD SECTION
OF ROAD

REPAIR PLAN OF BARANGAY ROAD

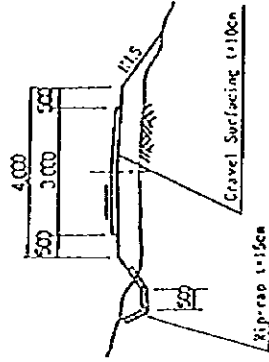


TYPICAL ROAD SECTION

(TYPE 1) ROUTE-1/2



(TYPE 2) ROUTE-3



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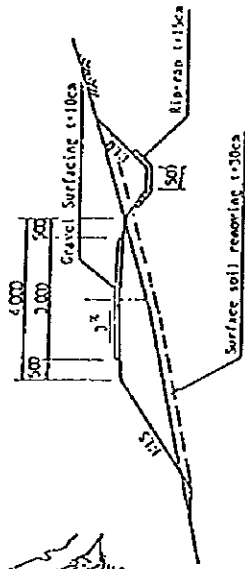
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FIG. 2.3.2.4-2 REPAIR PLAN OF
BARANGAY ROAD (1)

ARO RESERVOIR ROAD PLAN



TYPICAL ROAD SECTION

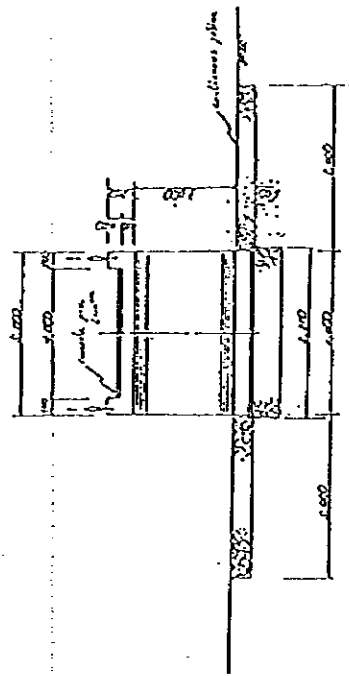


BASIC DESIGN FOR INFANTA IMPOUNDING IRRIGATION
AND ENVIRONMENTAL IMPROVEMENT PROJECT

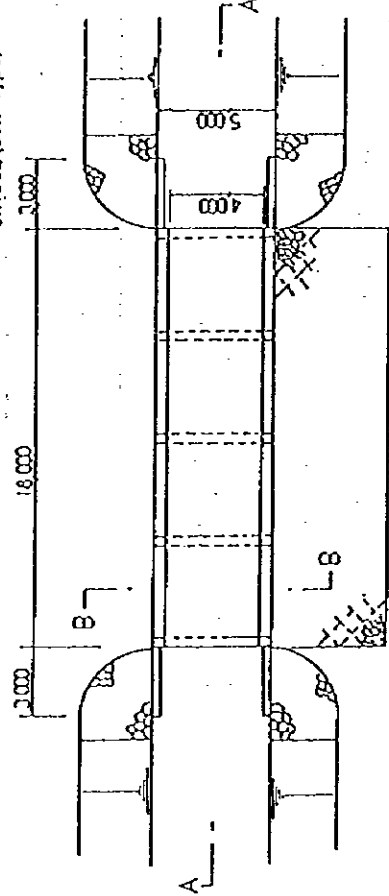
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FIG. 2.3.2.4-3 AROUND RESERVOIR
ROAD PLAN (2)

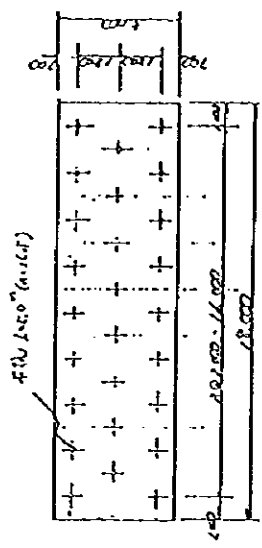
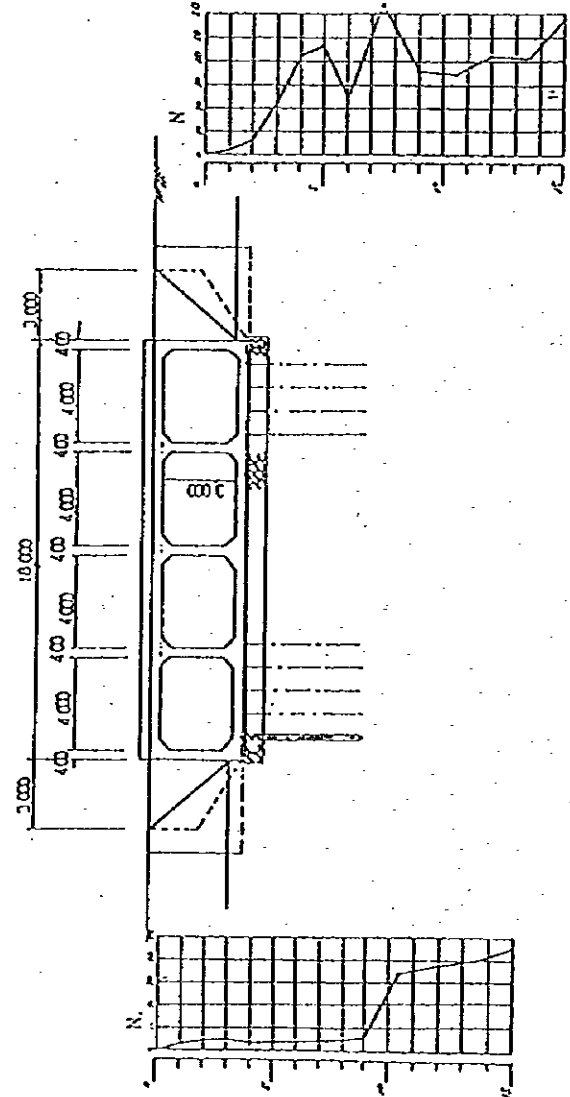
B-B SECTION



BRIDGE (Box-Type)



A-A SECTION



BASIC DESIGN FOR INFANTA IMPOUNDING IRRIGATION AND ENVIRONMENTAL IMPROVEMENT PROJECT

FIG. 2.3.2.4-4 BRIDGE (Box-Type)

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2.3.2.5 Post-harvest Facility Plan and Design

After completion of the project, considerably increased rice production is expected in every Barangay, both in the rainy and the dry seasons. To comply with such increased production, an additional request is applied by the Infanta Municipal Government to prepare a solar dryer (concrete pavement, 25 m wide x 35 m long) in every Barangay.

As the result of survey on the situation of solar dryer, there are some existing solar dryers in the municipality, however the capacity is not enough even at present. Therefore, road surface which is paved, and school yard are used as a solar drier. Utilization of the road make trouble for the traffic as well as so danger. The shortage will be more serious after the project which can remarkably increase the rice production. Because there are approximately 60 to 200 ha of rice fields at each Barangay respectively. Therefore it is considered necessary for providing the additional solar dryers.

This facility is 875 m² (25 m x 35 m) per location, or about two times as large as a standard basketball court area. A solar dryer capacity of approximately 200 gavan/day can be expected. Assuming that harvesting period is approximately 20 days, husk collected from paddy fields equivalent to 2.5 ha to 3.0 ha/day x 20 days = 50 to 60 ha, can be dried. Since it starts raining unexpectedly during the rainy season, a simple storage (approximately 5 m x 8 m) will be necessary near the drying facility.

[Facility plan]

Solar dryer: Concrete pavement (approximately 15 cm thick) at 8 locations
875 m² (25 m x 35 m)
furnished with a simple storage (approximately 5 m x 8 m)
Location of proposed facilities are shown in Fig. 2.3.2.5-1.

As a secondary benefit, when the solar dryer is not used for its primary purpose, it can be used for recreation and sports activities at each Barangay. The facility is earnestly requested by the farmers.

After completion of the project, rice cultivation area will be 1,280 ha during rainy season and 760 ha during dry season respectively. Its harvesting period of each Barangays will be different a little, on the whole, 40 days on March (30 days) and October to December. Solar dryer facilities are necessary in the period. Assuming that drying capacity per day is 3.0 ha, the annual using day of the each facilities are as following.

| Name of Barangay | Cultivation area (ha) | | Annual using day of new solar dryer facilities | | |
|------------------|-----------------------|------------|--|------------|-------|
| | Rainy season | Dry season | Rainy season | Dry season | Total |
| 1. Bamban | 417 | 248 | 40 | 30 | 70 |
| 2. Nangalisan | 154 | 91 | 40 | 30 | 70 |
| 3. Maya | 117 | 70 | 39 | 24 | 63 |
| 4. Doliman | 216 | 128 | 40 | 40 | 80 |
| 5. Potoi | 140 | 83 | 40 | 28 | 68 |
| 6. Patima | 99 | 59 | 33 | 20 | 53 |
| 7. Cato | 62 | 37 | 21 | 13 | 34 |
| 8. Nayom | 180 | 107 | 40 | 36 | 76 |

Location of proposed facilities which are constructed at each Barangay, are shown in Fig. 2.3.2.5-1.



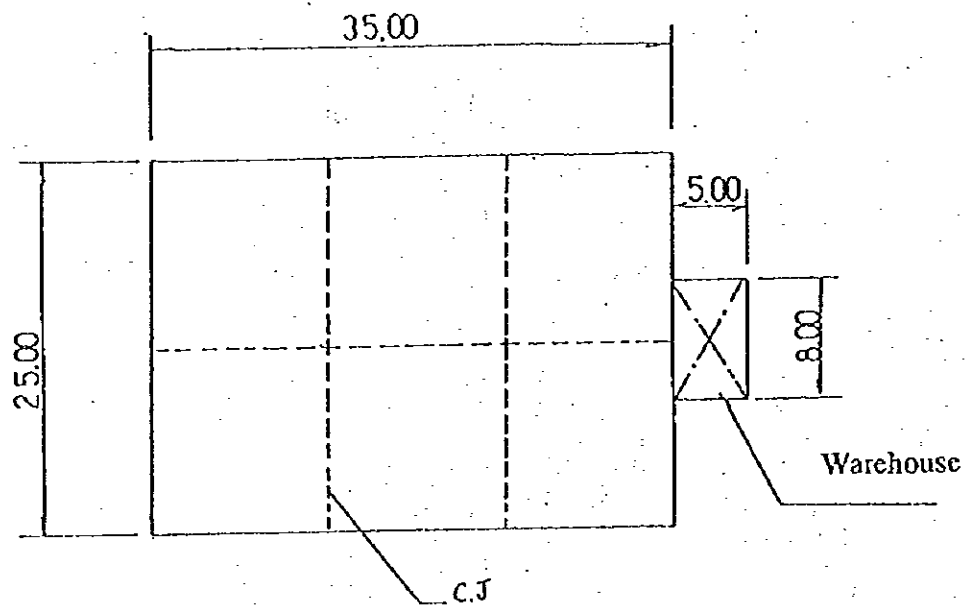
■：ポストハーベスト施設位置

LOCATION OF POST HARVEST FACILITY

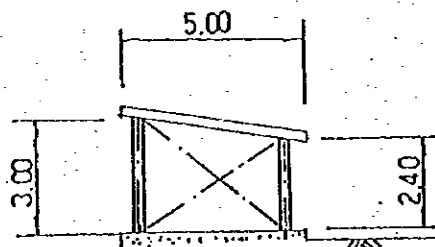
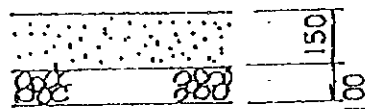
FIG. 2.3.2.5-1

BASIC DESIGN FOR INFANTA IMPOUNDING IRRIGATION AND ENVIRONMENTAL IMPROVEMENT PROJECT

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concrete pavement



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AND ENVIRONMENTAL IMPROVEMENT PROJECT

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FIG. 2.3.2.5-2 POST HARVEST FACILITY

2.3.2.6 Resettlement Plan and Design

(1) Proposed resettlement area

The proposed resettlement area is located on the left bank of the San Felipe River, east of Infanta. Soil investigations were performed at seven places of the resettlement area. The result of investigation shows that it is possible to turn the land into farm land if an adequate water supply and fertilization control are provided. The land use of the proposed resettlement area are generally grass land (95%) except for 3 ha of paddy field and 10 ha of mango plantation. According to the result of the outcrop survey, gravel cover the surface at some place. However, it is found that the land can turn into farm land by removal of gravel during the land reclamation. The total area is 220 ha including the farm land provided for sustainable farming. The Pangasinan Provincial Government is planning to distribute to each resettling household totaling 2.0 ha to 3.0 ha of irrigated paddy fields and rainfed water cultivation fields respectively depending on the land condition.

(2) Expected number of resettler and households

The expected resettler in this project are classified into the following three categories. Approximately 70 households will move to the resettlement area.

- a: Those from the submerged area due to dam construction
- b: Pinatubo victims (living in Infanta)
- c: New Pinatubo victims

(A) Those from the submerged area due to dam construction

There are 20 families living in and around the proposed reservoir area. They have to move to the resettlement area before the dam construction or impounding.

(B) Pinatubo victims (living in Infanta)

There are approximately 20 households of Pinatubo victims currently living in Infanta. It is planned that they will move to the resettlement area an early stage.

(C) New Pinatubo victims

A small number of victims from Zambales are living with their relatives in Pangasinan Province. Under the circumstances, and to comply with request of Central Government, the Pangasinan Provincial Government has decided to receive approximately 100 victims and the municipality of Infanta is one of proposed locations. In accordance with the capacity of the resettlement area, approximately 30 families will be accepted. The Mount Pinatubo Committee (MPC) will invite agricultural engagement desiring immigrants in public, and select those who have experience in rice

cropping especially.

(3) Land use and cultivation plan

(A) Land use plan

Approximately 220 ha of hilly land can be prepared by the Infanta Municipal Government as resettlement area, including residential zone and farmland. A 120 ha area of this will be provided with irrigation water from the dam to be constructed under this project. Another 100 ha, however, will be a rainfed water agricultural area without gravitation irrigation due to the topographical condition. The irrigable area can be used for rice cropping. The rainfed water agricultural area will be used for pastures, growing fruit trees (mangoes), and rainfed water rice cropping. Vegetable cultivation may be possible, but a considerable amount of fertilizers must be applied in consideration with the current poor land fertility. Therefore, it does not look economically feasible.

Since the entire area is hilly, terraced paddy fields must be prepared, and each paddy field will be long shaped along the contour line. When preparing terraced paddy fields, fertilized surface soil should provisionally be replaced, and returned after leveling. Since there are many gravel, the use of heavy machines like bulldozers is desirable to efficiently remove them. Land reclamation will be drawn up and executed by the Provincial Government under cooperation of NIA.

(B) Cultivation plan

Rice cropping is the main cultivation at the irrigated area. The rainfed water cultivation area is expected to be used for the cultivation of fruit trees and pastures, and pasturage. The rice production at paddy fields, which may depend also on the fertilizer quantity to be provided, is reasonably estimated at approximately 70% of that of the existing paddy fields at alluvium equivalent to 2.0 to 2.5 tons/ha.

Rainfed water rice cropping are already found in some parts of the rainfed water cultivation area, therefore rice cropping in the rainy season is also judged possible. Mango trees are already cultivated, and this item looks promising. Since it takes 8 to 10 years before harvesting fruits, however, it is difficult to spread the cultivation of mangoes all over. Cattle breeding is available for a quick living income instead. In such a case, combined farming of pasture cultivation and pasturage may be beneficial. Maize and soybean farming, which needs a considerable amount of fertilizer, is judged unrealistic. In conclusion, the agriculture for living fundamentals covers paddy rice cropping combined with secondary pasturage, fruit tree cultivation, and rainfed water agriculture.

(4) Farming and distribution area

The Pangasinan Provincial Government plans to use the irrigated area mainly for rice cropping, and the rainfed water cultivation area for rainfed water rice cropping, fruit trees, and pasture cultivation, or beef cattle pasturage. Distribution area is being planned in consideration with the size that resettler can live on sustainable farming. The land holding area of 8 Barangays in Infanta is 1.3 to 1.8 ha per household, and farming income is Ps. 100,000 to 250,000. Since the resettlement area is reclaimed newly, productivity of the land is low compared to the existing paddy fields. It is proposed, therefore, that the distribution size per household of resettler will be approximately 1.5 ha of irrigable land and 1.5 ha of rainfed water cultivation area. This farming size is calculated on the base of Ps. 215,000 gross income in 10 years after resettlement.

(5) Residential zone of resettler and its area

The residential zone for resettlers should be planned so that the sustainable farmer's life and farming can continue. The residential zone for resettlers will be located in the southern side of the resettlement area in consideration with the obtainment of domestic water (domestic water supplied from the dam should be distributed by gravity after filtration as well as expenses for maintenance should be low), convenience for social life, and utilization of farming land.

Minimum 1,200 square meters (30 m x 40 m) per household is planned for the area of the residential zone in order to save the necessary living space that resettlers can live on the agriculture, in short, including kitchen garden, cattle shed, agricultural machinery storage and granary. The Pangasinan Provincial Government plans following priorities of the resettler.

| | | |
|-----------|---|---------------|
| Phase I | People from the area submerged due to dam construction: | 20 households |
| Phase II | Pinatubo victims (living in Infanta): | 20 households |
| Phase III | Pinatubo victims: | 30 households |

Based on the above examination of farming, residential space, and the number of resettlements, the land use of the resettlement area is planned as shown in the following table.

Land Distribution Plan

| Category of land | Settlers (family) | Area (ha) family | Total Area (ha) |
|------------------|-------------------|------------------|-----------------|
| Settlement area | | 0.12 | 8.4 |
| Irrigation field | 70 | 1.42 | 100 |
| Rainfed field | | 1.42 | 100 |
| Road & Other | | - | 11.6 |
| Total | | | 220 |

(6) Social infrastructure improvement plan

(A) Electric power supply

Electric power supply to farmers is available at Barangay Sitio Mose located approximately 1 km from the proposed resettlement area. The electric power supply to the resettlement area, therefore, will be extended from here. The District 1 Electric Cooperative supplies electric power to the resettlement area, and expenses will be paid by the Pangasinan Provincial Government. The estimation of this electric power distribution plan is under preparation. Electric power transmission lines will be located along the road to be constructed, and indoor wires to each individual household will be paid in general by the corresponding household.

(B) Schools

Children in the resettlement area will go to primary school in Barangay Doliman. The junior high school in Barangay Bamban is the nearest from the resettlement area. The resettlement will not be executed at once, but extended for a few years depending on the progress of resettlement. It is determined that the resettlers from the submerged area have the priority in the Phase I of the resettlement plan, and approximately 20 households will move in. Therefore, the municipal government judges that there is no serious impact to receive pupils into existing schools. For Phases II and III, the Provincial Social Welfare & Development Office of the provincial government is studying an expansion plan.

(C) Health and sanitation

The Health Office in Barangay Bamban is the nearest for health and sanitation of resettlers. The municipal government recognizes the insufficiency of the current health and sanitation facilities, and has applied to the provincial government for an expansion plan.

(7) Resettlement plan implementation schedule

In the implementation schedule for the resettlement plan, construction of road and domestic water supply in the resettlement area will be carried out with high priority. The Pangasinan Provincial Government is preparing the following construction schedule.

Implementation Plan of Resettlement

| Items | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---------------------------------|-------|-------|-------|---------|---------------|---------------|-------|---------------|-------|
| Land acquisition | ■■■■■ | | | | | | | | |
| Construction of road | | ■■■■■ | | (JAPAN) | | | | | |
| Construction of domestic water | | | ■■■■■ | | | | | | |
| Distribution of land | | | ■■■■■ | ■■■■■ | (JAPAN) | | | | |
| Construction of house | | | | ■■■■■ | | (MPC) | | | |
| Conduct of resettlement | | | | ■■■■■ | ■■■■■ | ■■■■■ | | | |
| Phase I (Affected farmer) | | | | ■■■■■ | (20 Settlers) | | | | |
| Phase II (Pinatubo victims I) | | | | | ■■■■■ | (20 Settlers) | | | |
| Phase III (Pinatubo victims II) | | | | | | | ■■■■■ | (20 Settlers) | |
| Electric power | | | | ■■■■■ | ■■■■■ | | | | |
| Social welfare | | | | | | | ■■■■■ | ■■■■■ | ■■■■■ |
| Finance of Pangasinan Province | 3,000 | 3,000 | 1,000 | 3,000 | 3,000 | 3,000 | 1,000 | 1,000 | 1,000 |

Notes: Unit on Finance of Pangasinan Province is Ps. 1,000.

Construction of Japanese Grant Aid

| | | | | | | | | | |
|--------------------------------|--|-------|-------|-------|--|--|--|--|--|
| Construction of road | | ■■■■■ | | | | | | | |
| Construction of canal works | | ■■■■■ | ■■■■■ | | | | | | |
| Construction of domestic water | | | ■■■■■ | | | | | | |
| Construction of dam | | | ■■■■■ | ■■■■■ | | | | | |

(8) Attention of movement to resettlement area

As for the implementation of resettlement plan, following matter should be paid attention to.

- To distribute the farm land and houses for settlers at once after have finished to construct roads
- To station a tap for two households at useful places for inhabitants.
- The provincial government should guide the land reclamation to resettlers because the land to be distributed is not farm land with slope.
- The provincial government should support or assist the farming guidance and early funds.

The land reclamation and social infrastructure improvement will be carried out by the Pangasinan Provincial Government.

(9) Scope of works in the project

For constructions under the above resettlement plan, Japan will execute the construction of roads to approach the resettlement area, roads in the residential area, and domestic water supply facilities for the resettlers. Since the present land can use as rural residential area, therefore, the land reclamation should not be executed. Because there is not existing irrigation facility the resettlement area, secondary irrigation canals should be constructed in the future irrigation area for smoothly farming after resettlement.

(A) Domestic water supply plan

(a) Water supply volume

The volume of water supply to the resettlement area should cover the total of water for the population of resettlers and miscellaneous use for cattle, etc. Assuming that a hundred immigrant household (including expected future setup of branch families), with seven family members per household on the average, 200 lit./day per person is estimated. Approximately 400 lit./day per household is estimated for miscellaneous use (livestock, cleaning water for machine, garden agricultural)

$$Q_{\text{max.}} = 100 \times 7 \times 200 + 100 \times 400 = 180,000 \text{ (lit./day)}$$

The design purified water volume (Q_t), with a 10% margin, is calculated as follows.

$$\begin{aligned} Q_t &= 180.0 \times 1.1 = 198.0 \text{ (m}^3\text{/day)} \\ &= 0.138 \text{ (m}^3\text{/min.)} \\ &= 2.3 \text{ (lit./sec)} \end{aligned}$$

(b) Capacity of facility

(b-1) Intake facility

The dam to be constructed is the source of domestic water supply. Water will be taken in at the division facility that will be constructed at down stream of the inclined conduit. Therefore, the discharge control valve for the intake facility is set up at the division facility.

(b-2) Water supply pipe

The domestic water supply pipe will utilize vinyl chloride pipes. A 150 mm pipe diameter is used in consideration with the elevation of the water distribution area and the pressure of water supply. Hydraulic conditions of conduit for the domestic water supply are as follows.

$$I = 10.66 \times C^{(-1.85)} \times D^{(-4.87)} \times Q^{(0.85)}$$

$$hf = I \times L = 1.8 \text{ m}$$

where I: Hydraulic gradient

| | |
|-------------------------------|----------------|
| C: Coefficient of discharge : | 130 |
| D: Pipe inner diameter : | 0.15 (m) |
| Q: Discharge : | 2.3 (lit./sec) |
| L: Length of conduit : | 3,600 (m) |
| hf: Friction loss : | (m) |

(b-3) Purified water facility

The purified water facility consists of an regulation pond, slow filter bed, disinfection facility, and distribution pond. The capacity of each facility is described below.

<Regulation pond>

The capacity of the regulation pond (V_{rr}) can be calculated as follows.

$$V_{rr} = Q_t \times M_t \times a \quad (m^3)$$

where V_{rr}: Regulation pond (m³)

Q_t : Design purified water volume (m³/min.)

M_t : Residentiary time (1.5 min.)

a : Safety factor (5.0)

$$V_{rr} = 0.18 \times 1.5 \times 5.0 = 10.35 \quad (m^3)$$

Therefore, the facility is constructed by reinforced concrete as follow.

$$1.0 \text{ m (W)} \times 1.0 \text{ (L)} \times 1.2 \text{ (H)} = 1.2 \text{ (m}^3\text{)}$$

<Slow filter bed>

The area necessary for filtration is given by the following formula.

$$A = Q_t / V_s \quad (m^2)$$

where A : Necessary area (m²)

Q_t: Design purified water volume (m³/day)

V_s: Filtration speed (m/day)

Assuming that filtration speed is 6 m/day,

$$A = 198.0/6.0 = 33.0 \quad (\text{m}^2)$$

The structure is as follow.

$$3.0 \text{ m (W)} \times 6 \text{ m (L)} \times 2.0 \text{ m (H)} \times 2 \text{ ponds} = 36 \text{ m}^3 > 33 \text{ m}^3$$

Two ponds are planned, because one is prepared as a spare for cleaning of the filtration pond.

<Disinfection facility>

A chlorine agent (sodium hypochlorous acid for tap water) is used for disinfection, and the injection volume (V_c lit./day) is as follows:

$$V_c = Q_t \times R \times 100/C \times 1/d \quad (\text{lit./day})$$

where Q_t : Design purified water volume (m^3/day)

R : Injection volume (ppm)

C : Effective chlorine density (%)

d : Specific weight of chlorine

Assuming that the injection volume is 1.0 ppm, the effective chlorine density is 6%, and the specific weight of chlorine is 1.2, the necessary chlorine quantity is as follows:

$$V_c = 198.0 \times 1.0 \times 100/6 \times 1/1.2 = 2.7 \text{ (lit./day)} = 1.9 \text{ (cc/min.)}$$

<Distribution pond>

Assuming that the volume of distribution pond is amount for more than eight hour of the maximum daily water supply volume (Q_{max}) per day and use it twice, the effective distribution pond capacity (V_{dr}) can be calculated as follows:

$$V_{\text{dr}} = Q_{\text{max}} (\text{m}^3/\text{day}) \times 8/24 (\text{hr}) / 2 = 198.0 \times 8 / 24 / 2 = 33.0 (\text{m}^3)$$

Therefore, the distribution pond capacity will be planned as follows.

$$6.0 \text{ m (w)} \times 6.0 \text{ m (L)} \times 1.0 \text{ m (H)} = 36.0 (\text{m}^3)$$

(b-4) Water supply facility to each household

The water supply to each household are distributed by the conduit from distribution ponds. Pipes of 50 to 150 mm diameter are used so that sufficient water-head is secured at every tap. One

outdoor type tap with 15-mm diameter will be planned for every two households.

(c) Summary of the facility

The summary of the principal facilities based on the above mentioned basic policy and design is as follows.

| Facility | Size and Construction |
|-----------------------|---|
| Intake facility | : Intake/irrigation shared valve: 150 mm dia. |
| Water supply pipe | : Vinyl chloride pipe, 150 mm dia./L = 3.6 km |
| Regulation pond | : V = 1.2 m ³ , concrete construction |
| Slow filter bed | : V = 36 m ³ x 2, concrete construction |
| Disinfection facility | : Chlorine injection |
| Distribution pond | : V = 36 m ³ , concrete construction |
| Distribution pipe | : Vinyl chloride pipe, 50 to 150 mm dia., L = 4.12 km |
| Tap | : Outdoor type, 15 mm dia., at 40 locations |

(d) Operation and Maintenance of facilities

It is not necessary to operate and maintain from the dam to the tap because of gravity supply. The chlorine disinfection need to add the disinfectant several time per year. It is planed that the operation will be carried out by Infanta Municipality and the cost are paid by inhabitants.

(B) Road improvement plan

The approach road to the resettlement area will extend 400 m from Barangay Sitio Meso. Since the existing road in this zone is extremely poor, it should be repaired. Roads extending 2.09 km in total in the residential zone will be paved.

| Item | Road construction | Width (m) | Extension (m) |
|------------------------------------|-------------------|------------|---------------|
| 1 Approach Road | Gravel pavement | 5.0 | 400 |
| 2 Residential zone road | Concrete pavement | 5.0 | 2,090 |
| 3 Bridges | Concrete box | 4.0 | 3.0 |
| 4 Bridges | Concrete box | 4.0 | 1.5 |
| 5 Cross structure of concrete pipe | Concrete pipe | 500 mm Dia | 8.0 |

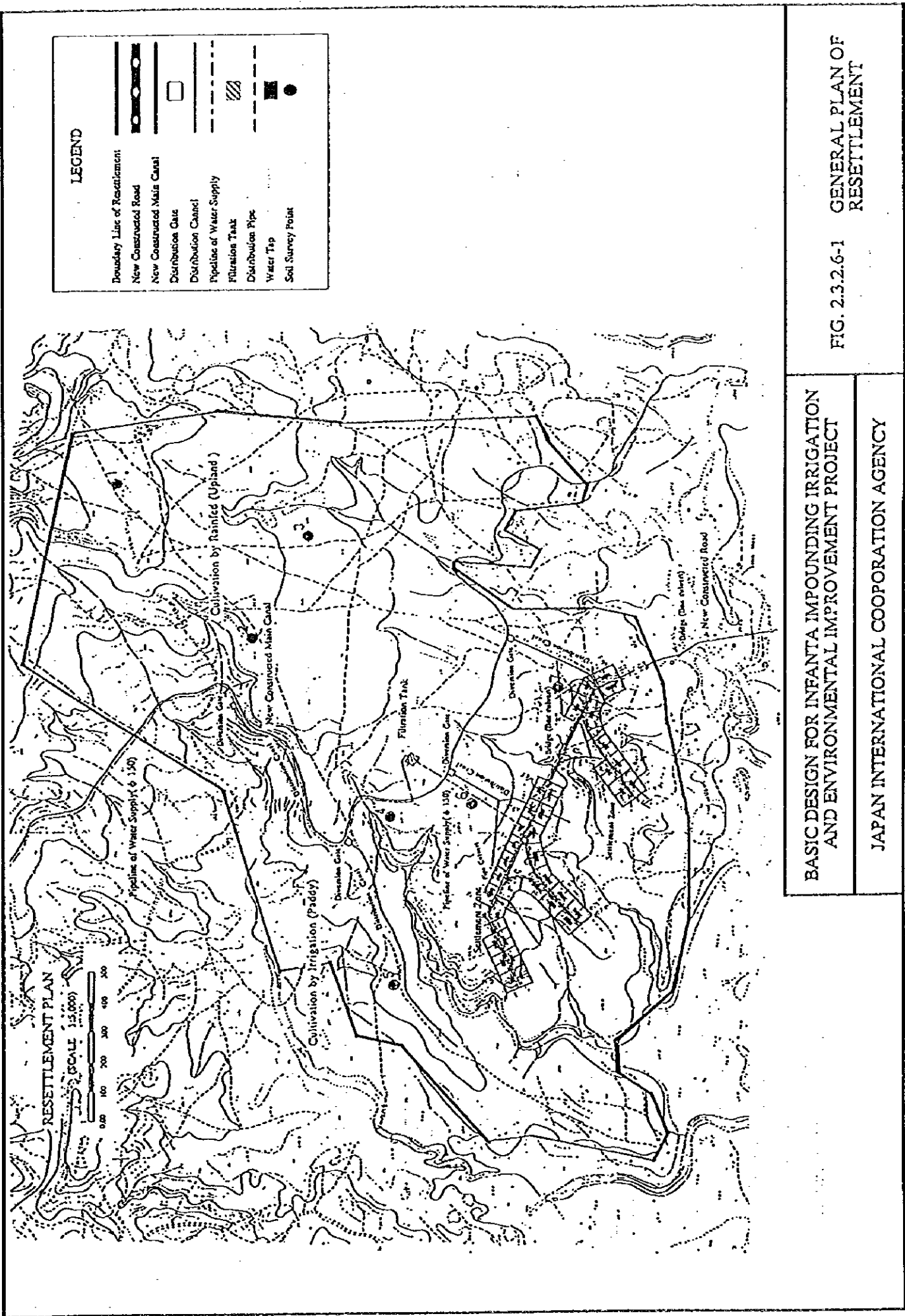
Since utilization rate of the road in the residential area will be so high, MPC has requested the concrete paved road for it in consideration of maintenance.

(C) Irrigation canals

There is not existing irrigation facility in the resettlement area. Secondary irrigation canals should be constructed in the future irrigation area for smoothly farming after resettlement. Four diversion gates and 3.25 km extension of irrigation canals will be planned.

Facility of Distribution Canals

| No. of gate | Length of canal (m) | Structure | Cross structure |
|----------------|---------------------|-------------|-------------------------------------|
| 1 Gate of No.1 | 600 | Earth canal | - |
| 2 Gate of No.2 | 750 | Earth canal | - |
| 3 Gate of No.3 | 950 | Earth canal | Concrete pipe ϕ 300 (2 places) |
| 4 Gate of No.4 | 950 | Earth canal | Concrete pipe ϕ 300 (3 places) |
| Total | 3,250 | | |



LEGEND

- Boundary Line of Resettlement
- New Constructed Road
- New Constructed Main Canal
- Distribution Canal
- Distribution Canal
- Pipeline of Water Supply
- Filtration Tank
- Distribution Pipe
- Water Tsp
- Soil Survey Point

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FIG. 2.3.2.6-1 GENERAL PLAN OF RESETTLEMENT

Profile of Proposed Road for Settlement Area

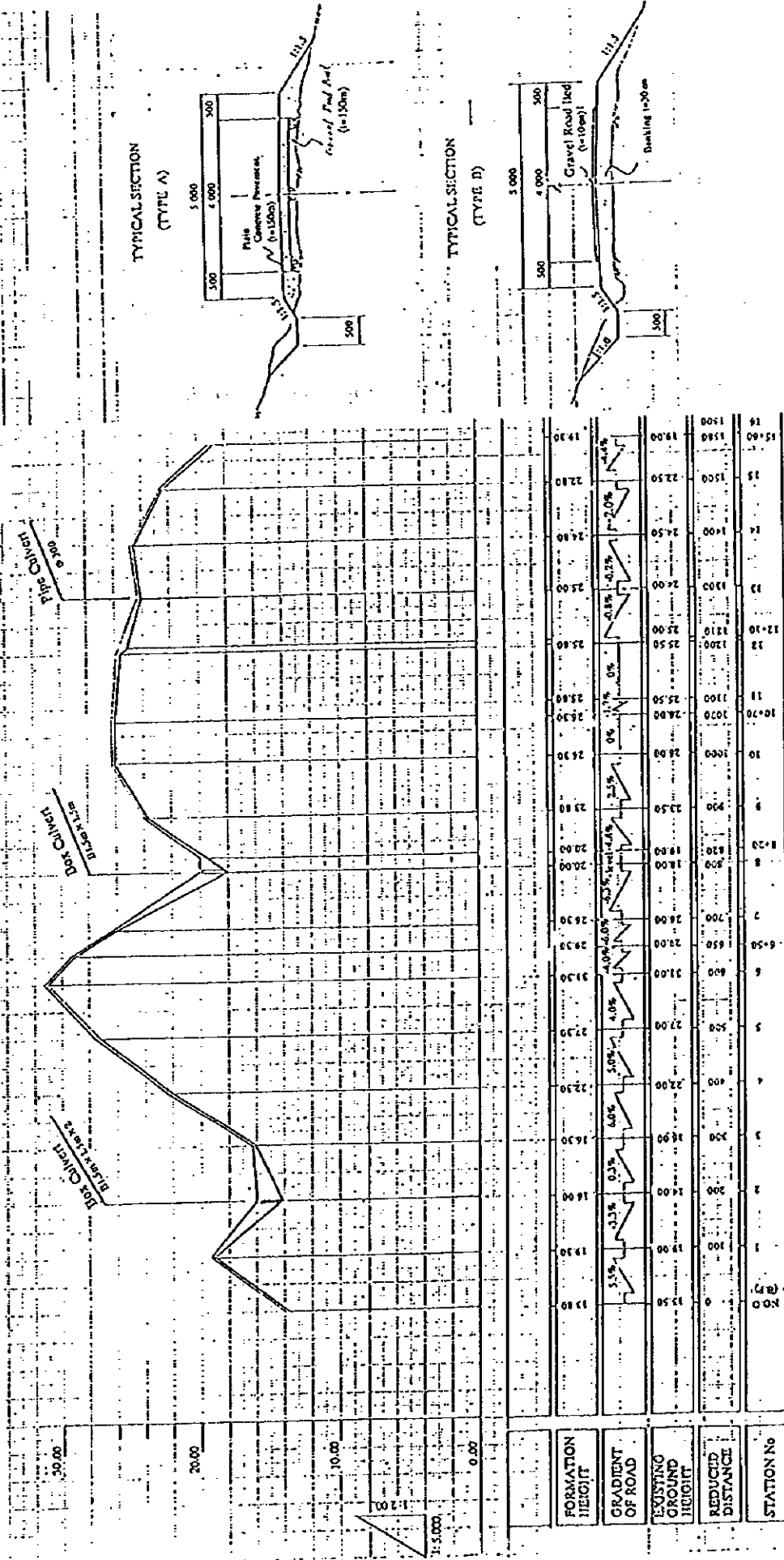


FIG. 2.3.2.6-3 ROAD PLAN OF RESETTLEMENT

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2.3.2.7 Nursery and Afforestation Plan

(1) Afforestation Plan by the Pangasinan Province

The Pangasinan province prepared an afforestation plan in and around the drainage area of the dam site. The main objectives of afforestation plan are briefly explained below:

- (a) Environmental conservation and improvement such as water resources cultivation, protection of fauna & flora, forest beautification, and reduction of natural disaster such as soil erosion and flood.
- (b) Economic effects by increasing the income of inhabitants from the fruit trees as well as timber trees.
- (b) Social effects by becoming conscious of the importance of environment conservation through the beautification by afforestation and improvement of natural scenery..

The Province considers that the following trees are suitable for planting in the proposed area.

(A) Forest tree

- (a) Gmelina arborea (Yemane)
- (b) Mahogany
- (c) Acacia auricaleaformes
- (d) Acacia mangium
- (e) Teak
- (f) Eucalytus deglupta
- (g) Neem tree
- (h) Narra

(B) Orchard tree

- (a) Mango
- (b) Cahew
- (c) Jackfruit
- (d) Guyabano
- (e) Duhat

(f) Coconut

(C) Others

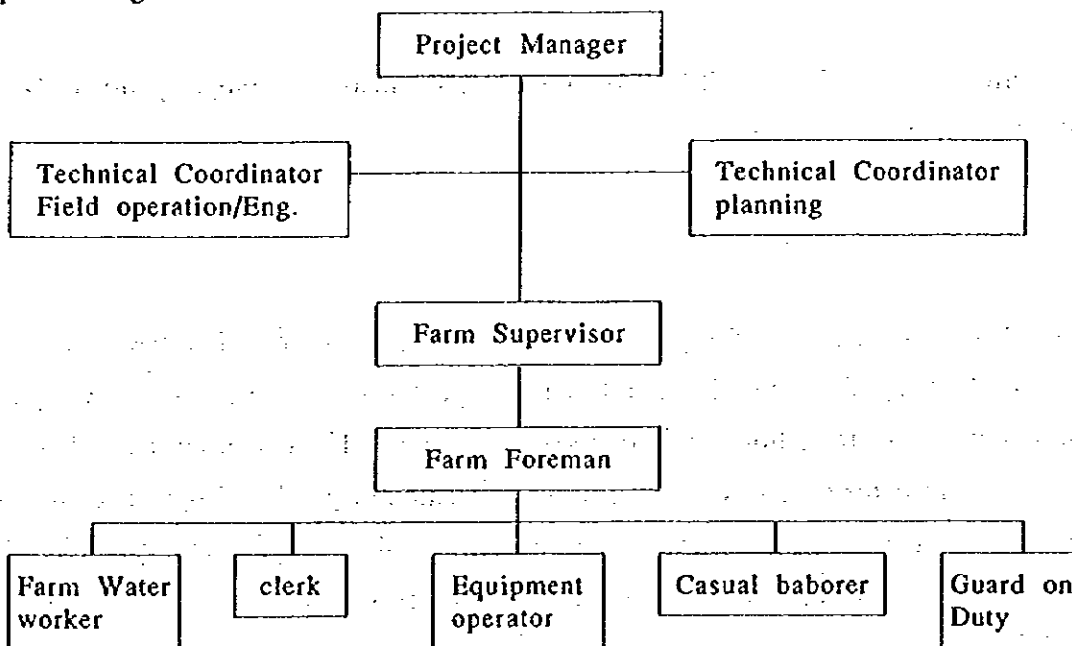
(a) Native bamboo

(b) Grass (Cogon etc.)

These trees are already confirmed to be suitable for the natural conditions in the objective area as they are already planted in the area and get a good result of growth rate.

The Province prepared the afforestation schedule starting in late 1997 for the first time as they considered that the nursery by Japanese aide could be constructed in 1997. However, the Province takes another look at the schedule now after understanding the present implementation schedule of nursery is in 2000.

After the study and discussion on the matter, the Province entrusted to PENRO to be the responsible agency for O & M of nursery as well as afforestation and both agencies signed on the memorandum for O & M. It is informed that PENRO can prepare more budget for the afforestation and has more experience for the general trees to be planted in the mountain area. However, the O & M activities will be carried out by the cooperative organization shown below.



General Organizational Chart for the Afforestation Project

The technical coordinator will be assigned from the province and most of the other staff including the project manager will be assigned from PENRO. Although the province and DENR agrees to cooperate each other for the afforestation of the Infanta Project., the other agencies such as the Agricultural Department of PSU and Municipality of Infanta are likely to join in the organization for implementing the project with an administrative and technical support in nursery and afforestation, if required. Also, an participation by a Japanese volunteer (JICA) is considerable for expecting the reliable implementation.

The afforestation plan, which is prepared on the basis of discussion with OPAG & DENR staff, is shown in Fig. 2.3.2.7-1. The area for the plan covers 2,290 ha, which is almost equivalent to the drainage area of the planned dam. The area is divided into the following three categories:

- (a) The first one is timber-use forest which covers almost 1,200 ha in total by narra, mahogany teak, and the other useful timber trees.
- (b) The second one is nature cultivation forest covering the total area of approximately 600 ha by generally fast growing trees such as acacia, eucalyptus, and gmelina.
- (c) The third one is orchard forest covering the area of approxi. 490ha by fruit trees such as oranges, lemons, gayabano, cashew, and coconut.

The afforestation activities will be carried out by labours to be employed periodically and also by volunteers for planting.

(2) Sapling Production Plan

The plan for the nursery and sapling production was prepared based on the afforestation plan of the Pangasinan Province. It has a clear goal of providing good quality saplings necessary for an afforestation project on its own. Paper or ziffee pots used in fixed nursery beds are suited for a low-cost yet efficient production of good saplings. The saplings produced this way are expected to settle well upon planting and grow steady and healthy. The number of saplings to be produced a year based on the plan is shown in Table 2.3.2.7-1.

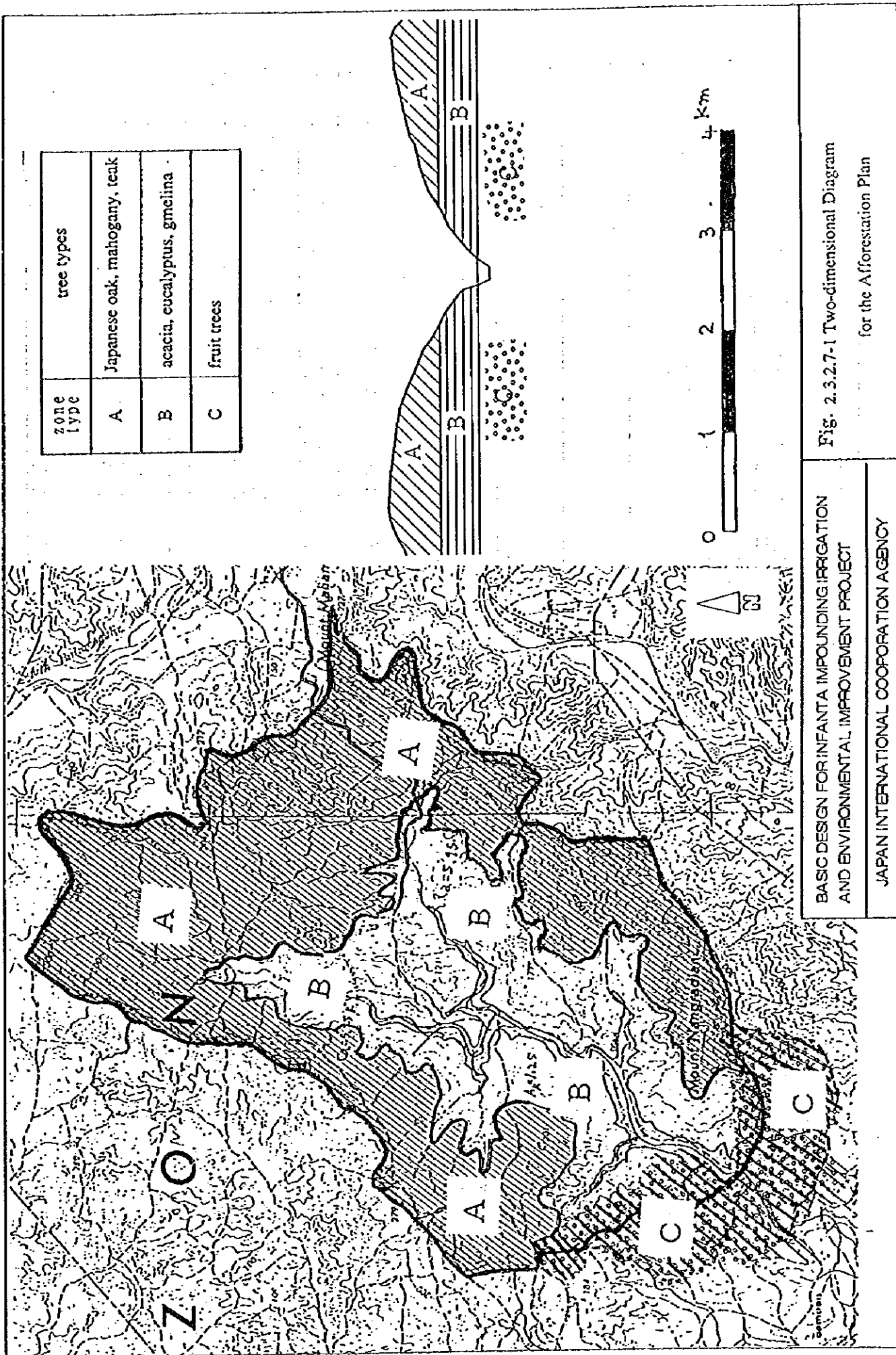


Fig. 2.3.2.7-1 Two-dimensional Diagram for the Afforestation Plan

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Table 2.3.2.7-1 Production Plan for Saplings & Planting

Unit (the number of trees a thousand, the area: ha)

| items | project year | | | | | | | | total |
|------------------------------|--------------|------|-------|-------|-------|-------|-------|-------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| calendar | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | |
| Japanese oak, mahogany, teak | | | | | | | | | |
| the area for planting | -- | -- | 80 | 160 | 240 | 240 | 240 | 240 | 1,200 |
| the number to be planted | -- | -- | 88.9 | 177.8 | 266.7 | 266.7 | 266.7 | 266.7 | 1,333.50 |
| the sapling number | -- | -- | 104.6 | 209.1 | 313.7 | 313.7 | 313.7 | 313.7 | 1,568.50 |
| acacia, eucalyptus, gmelina | -- | -- | | | | | | | |
| the area for planting | -- | -- | 40 | 80 | 120 | 120 | 120 | 120 | 600 |
| the number to be planted | -- | -- | 44.5 | 88.9 | 133.4 | 133.4 | 133.4 | 133.4 | 667 |
| the sapling number | -- | -- | 52.3 | 104.6 | 156.9 | 156.9 | 156.9 | 156.9 | 784.5 |
| fruit trees | -- | -- | | | | | | | |
| the area for planting | -- | -- | -- | 90 | 100 | 100 | 100 | 100 | 490 |
| the number to be planted | -- | -- | -- | 100 | 111.1 | 111.1 | 111.1 | 111.1 | 544.4 |
| the sapling number | -- | -- | -- | 125 | 138.8 | 138.8 | 138.8 | 138.8 | 680.2 |
| total | -- | -- | | | | | | | |
| the area for planting | -- | -- | 120 | 330 | 460 | 460 | 460 | 460 | 2,290 |
| the number to be planted | -- | -- | 133.4 | 366.7 | 511.2 | 511.2 | 511.2 | 511.2 | 2,544.90 |
| the sapling number | -- | -- | 156.9 | 438.7 | 609.4 | 609.4 | 609.4 | 609.4 | 3,033.20 |

- Note: (1) The number to be planted is set as 85% of the total number of saplings.
 (2) Planting bamboo and brushwoods shall be implemented only when necessary for protection of the forest soil. The number of saplings after 2000 should be kept sufficiently high enough, even though the number of sapling to be planted is relatively low.
 (3) Also bamboos and shrub woods shall be included if necessary for a good forest environment.
 (4) The basic condition for estimation is that 1,111 trees per hectare = 3 m x 3 m in a total of 2,290 ha are planned with consideration for works and maintenance necessary afterward.

(3) Study on the Nursery Site Selection

The planned site for the nursery is located some 1.6 km south-south-east of the planned dam (in a beeline). It is close not only to a planned settlement site but also to the irrigation canal and water supply pipe to be newly built and service water facilities in the north-east slope. The land is low at some 28 to 36 meters above the sea level facing a slow slope on the south-west direction of the rather high hill. Shrubs are seen sparsely on the top of the northern slope and grasses are dense on the eastern side. The west and

south-west sides are low lands with the cultivated paddies. Those rich grasses are Samon Grass, Tanlar Grass and kaya-kind called Cogon. The adjacent low area is a wet land with water filtered through from the near-by hill sides and seen sufficiently good and suitable for taking nursery soils as it is proven by a healthy growth of farms and rich grasses on it despite a bad water drain system.

The favorable aspects of the site for the nursery establishment are shown below.

- (a) The water for the nursery can be diverted from the irrigation canal to be newly built. Thus, a low-cost, gravitational watering system can be made possible.
- (b) The east side of the planned site is at a relatively higher altitude to minimize the damages from strong winds.
- (c) The lands with sufficient area for nursery plan are available for purchase at a low price due to low level of land use.
- (d) The site is next to the resettlement area and it would be easy for management staff PSU and the center of Barangay Bamban are located in about 1.7 km distance to commute from the village and further there would be sufficient labours available for nursery and planting.
- (e) Good soil filling in the nursery pots could be obtained from nearby areas.

(4) The Scale of the Nursery

The plan for the nursery set-up must be made according to the plan to be efficient in a sapling production. Some facilities for this end will include not only a nursery house but also an administrative office.

The pot nursery bed of 4,320 m² is necessary for production of 609,400 saplings at maximum, however, with passages for workers to be included, the area for it will be 8,160 m². When the areas for passages, buildings and other facilities are included, the total area necessary comes to some 2.35 hectares. The area of each facility/structure is shown in a table below.

| items | areas (m ²) | descriptions |
|---|-------------------------|---|
| pot beds | 8,160 | yearly turnover is one, 4,320 m ² for pot nursery bed including passages |
| passage | 4,032 | width of 5m with ditch of 0.5 m wide on both sides, total length of 672 meters |
| peripheral buildings | 1,848 | buildings and squares |
| water pools and squares around facilities | 5,280 | to pool underground water, spring water, rain water soil mixing & preparation |
| Soil preparation area | 4,140 | wind breaker, soil fertilizer site |
| total | 23,460 | |

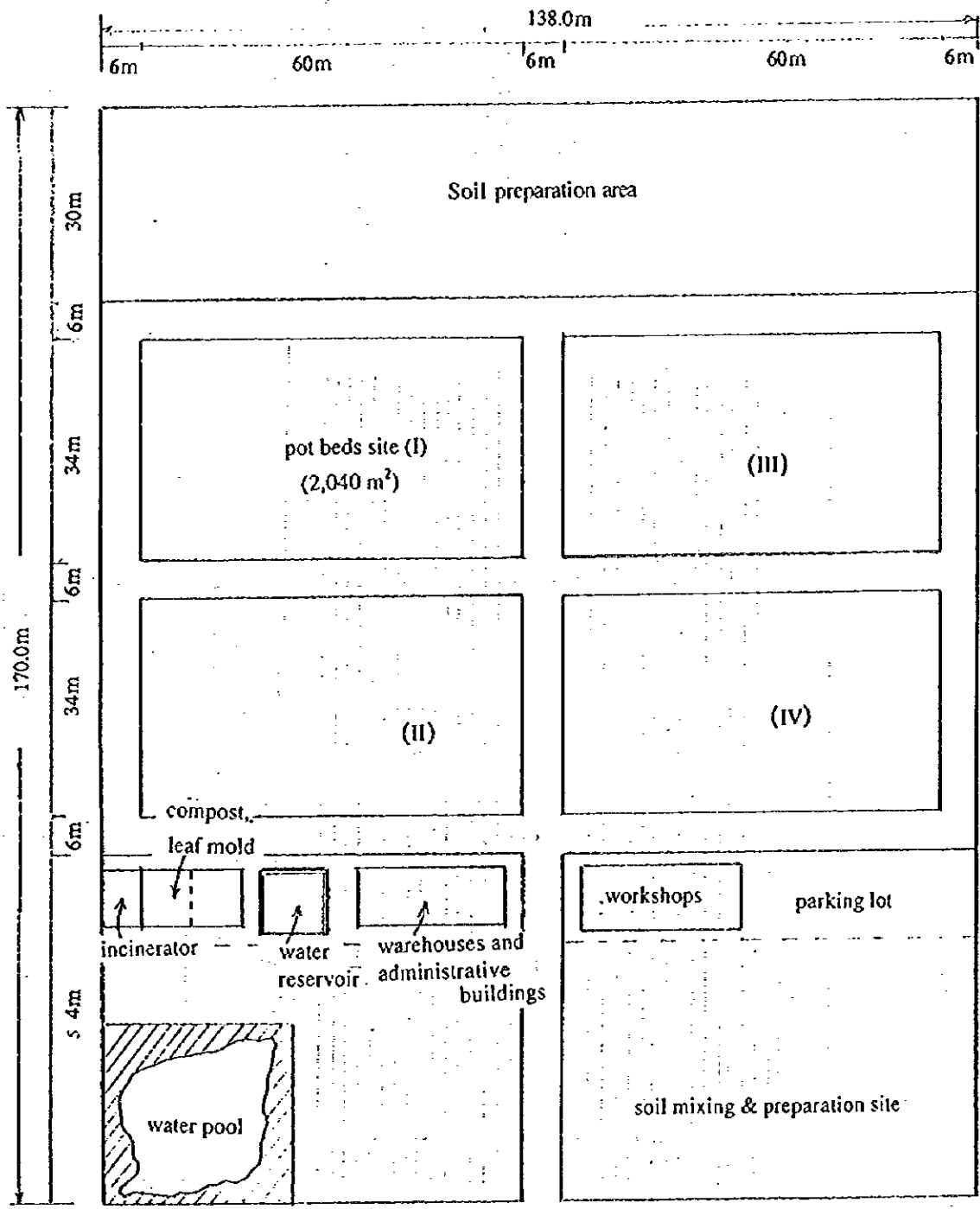
(5) Planning and Design of the Nursery

The location of various facilities for the nursery shall be allocated in consideration of its geography and topography to nurture healthy saplings in the most efficient way. The allocation plan is shown as Fig. 2.3.2.7-2 and Fig. 2.3.2.7-3. The explanation for major facilities is to be made as follows:

(A) Nursery Facilities

(a) Pot nursery site; (the area of 8,160 m² including 4,320 m² for pot beds)

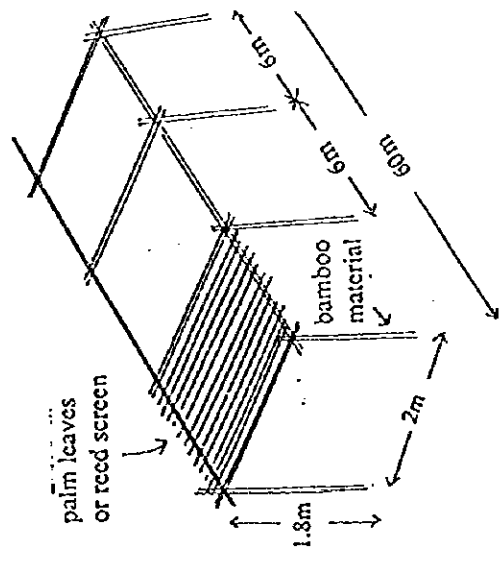
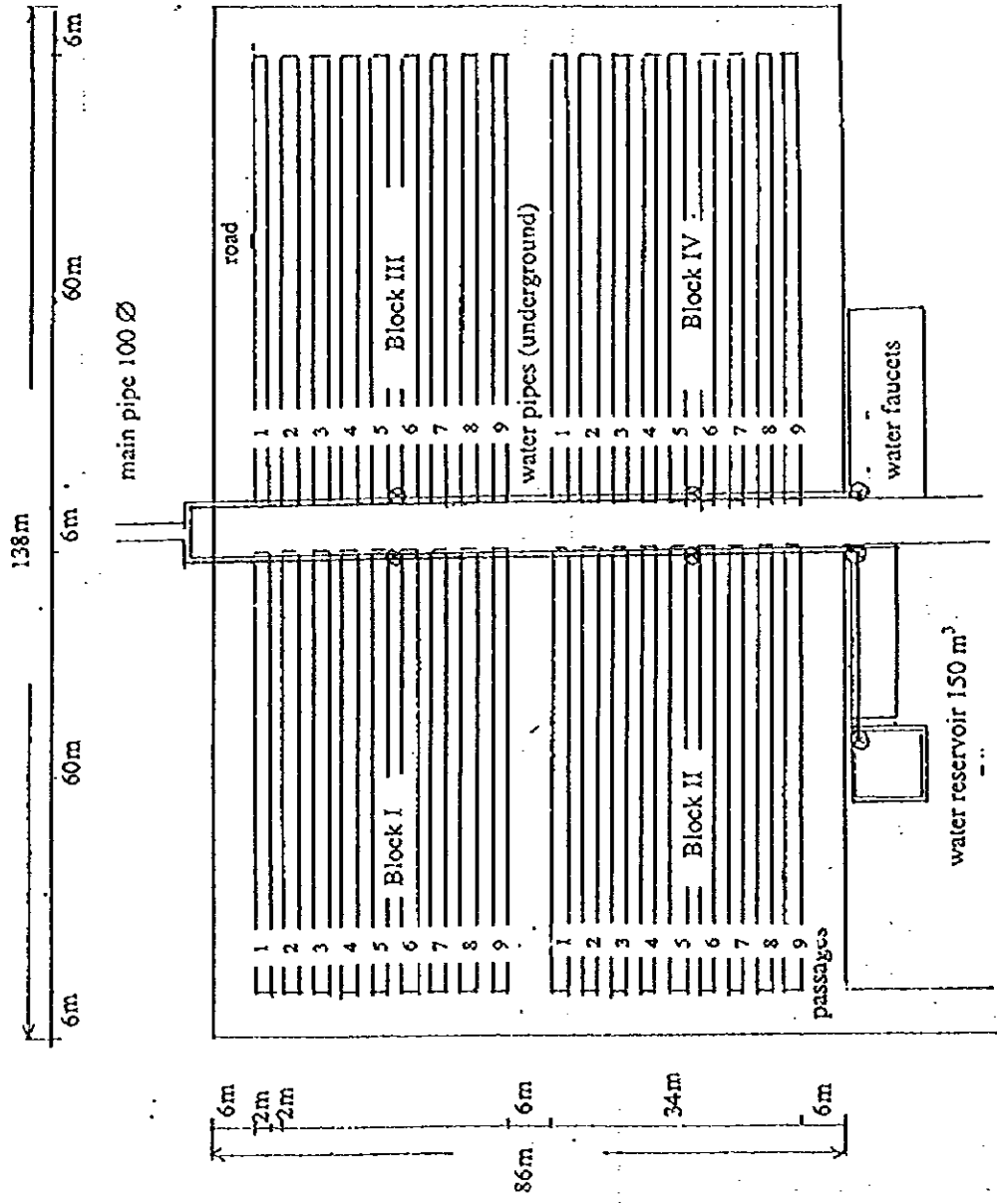
The bed will be compacted for preventing weeds and elevated by 10 cm by the mounds for a water drain during the rainy season. Each section of the nursery beds has 2 m x 60 m space with a 10 cm high mound. One block consists of the 1,080 m² area with 9 sections. Total of 4 blocks, 36 sections and the area of 4,320 m², will be prepared. One section has a capacity of 18,750 sapling pots when 8 cm-diameter pots were used. Thus, total of 675,000 pots (18,750 saplings x 36 sections) should be enough as 609,400 saplings or 511,200 trees are planned for planting at the production peak. The area planned is wide enough even when 10 cm diameter pots are used along with 8 cm diameter pots.



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Fig. 2.3.2.7-2 allocation of the Nursery Facilities

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 Design for Rain-Water Oriented
 Agriculture in the Infanta
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Fig. 2.3.2.7-3 Pot Nursery Beds Allocation
 (water supply facility and sun shade facility)

(b) Sun Shade Facility (the bed area of 4,320 m²)

The pot nursery bed must have a device to adjust an intensity and amount of sun light and sun light collection after germination so that transplanted saplings in the pots will be protected and nurtured well. Sun screens can be made of locally available bamboos, palm leaves, kaya or reeds. Sun shade screens should have a 40 to 50 % cut-off capacity. Drawing for a sun shade device is shown in Fig. 2.3.2.7-3. See the table below for the necessary materials for it.

| Sun shade facility | | |
|-----------------------------|---|---------|
| materials | descriptions | volumes |
| bamboo | bamboo materials length of 6 meters or more, diameter of 5 cm (20 poles) length of 2 meters or more, diameter of 5 cm (11 poles) length of 1.8 meters or more, diameter of 5 cm (22 poles) | 36 sets |
| palm leaves or reed screens | 600 kg as one set, total of 21,600 kg | 36 sets |
| others | strings or ropes | |

(c) Irrigation Facility (the area for irrigation: 4,320 m²)

This facility will be built only for the use in the pot nursery beds. The water for this purpose can be diverted from the irrigation canal, which will run the nearby high-land north to the site. A gravitational watering method will be adapted to avoid any influence by seasonal changes such as a rainy or dry season and to be seen as economical, efficient and practical in the area.

The water volume needed for irrigation per day on an average is set as 8 mm. Bases for this figure are a high evaporation rate in the area and eucalyptus trees to be planted. The break-down for the water volume is shown below:

$$\text{Pot nursery beds : } 2\text{m} \times 60\text{m} \times 36 \text{ sections} = 4,320\text{m}^2$$

$$\text{Irrigation water (per day) : } 0.008\text{m} \times 4,320\text{m}^2 = 34.56 \text{ tons}$$

The total irrigation water volume for a dry season = 34.56 tons x 180 days = 6,300 tons.

In addition, water needed for administrative offices, a germination room, a season. As for a rainy season, only one fourth of a dry season, that is approximately 12 tons per day, will be needed. The total water use during the rainy season is estimated to be 2,160 m³ (= 12 m³ x 180 days)

(d) Storage Water Pond and Water Pool

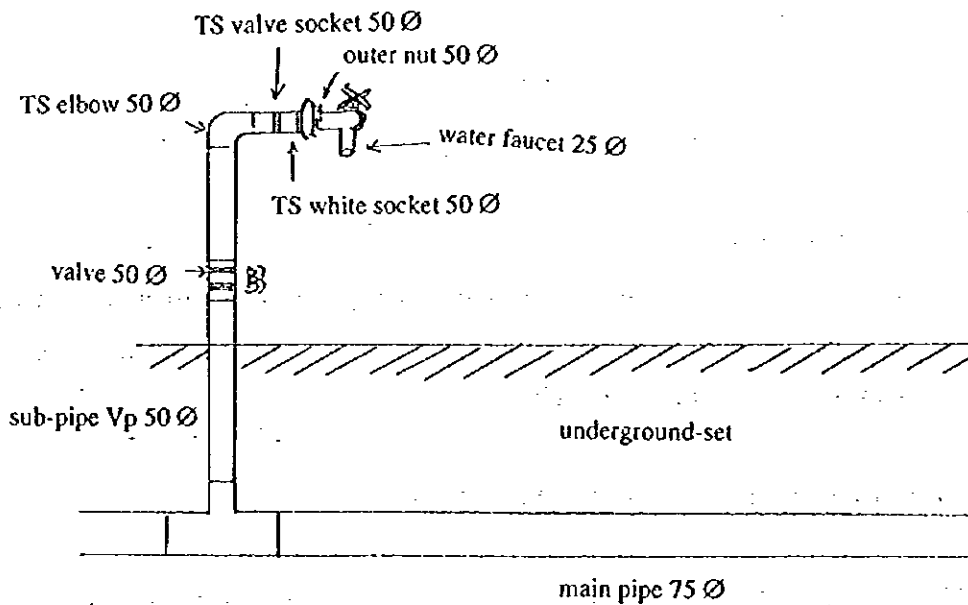
A storage pond will be located in an appropriate low land to gather water from the underground, spring waters and rains. The pond will be useful not only for water use in an emergency case but also nature conservation in the area. The pond has approximately 400 m² of area. The water pool is a concrete structure of 10m x 10m x 1.5m.

(e) Irrigation System

The drawing for the nursery plumbing with a gravitational irrigation method is shown below.

Vinyl chloride material will be used for plumbing pipes. Motored watering involves synthetic rubber hoses connected to the water faucets. The necessary materials for the system are as follows:

| | |
|--------------------------|---|
| water flow adjustment | water valve one set |
| main pipe | Vp 100 Φ, 28 m |
| sub pipe | Vp 75 Φ, 210m (70m x 2= 140m set underground) |
| pipe with a drain faucet | Vp 50 Φ, 60cm 7 pipes |
| water faucet | Vp 25 Φ, 7 faucets |



(B) Buildings

(a) Warehouse, Administrative office: the area of 90m²

Wooden flat buildings will be build for a warehouse and an administrative office. The warehouse should be big enough to store all nursery equipment. And some quarter of the administrative office will be partitioned to be used for a clerical work and a room for sleeping and resting. The warehouse structure should allow a door open as wide as possible and has a careful robbery prevention system.

(b) Germination House: the area of 48m²

The lower half of a germination house of a wooden flat structure will be covered by wood panels and be built next to the warehouse to make an easy access to the each other. The roof top will use a strong semi-transparent plastic material to gather sun light in the room and on the nursery beds. Another consideration is shelves for germination boxes.

(c) Work Shop: the area of 250m²

The work shop is of a wooden flat building with part of the flooring concrete

mortar. The building will be simple and the lower half of it will be covered by wood panels or concrete blocks. Works such as mixing soil or fertilizer and filling pots will be done here and the soil for nursery pots will also be stored here.

The plan for these building facilities is shown in Fig. 2.3.2.7-4

(C) Passage (Road)

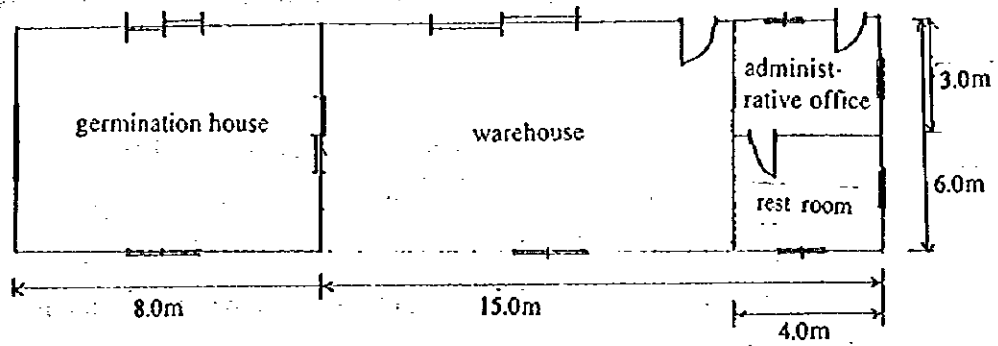
The passages within the nursery area is designed to be a road of 5 m wide and 672 m long with a side ditch of 50 cm wide and 30 cm deep on the both sides and the gravel pavement of 6 cm thick.

(6) Schedule for the Nursery Land Development

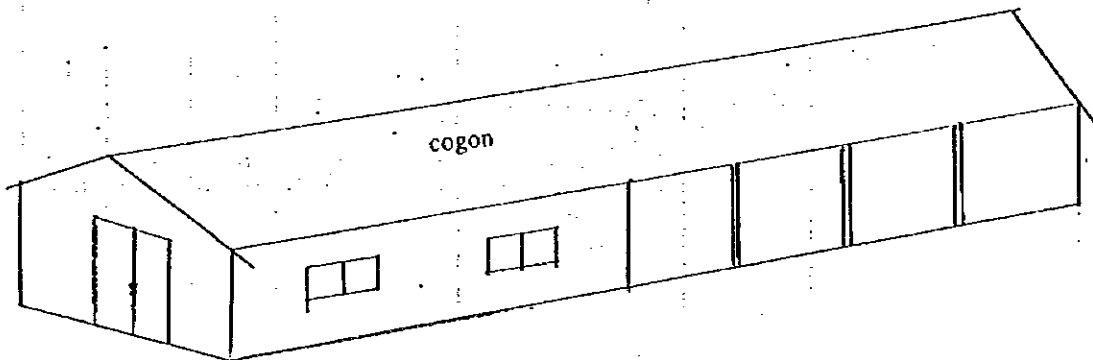
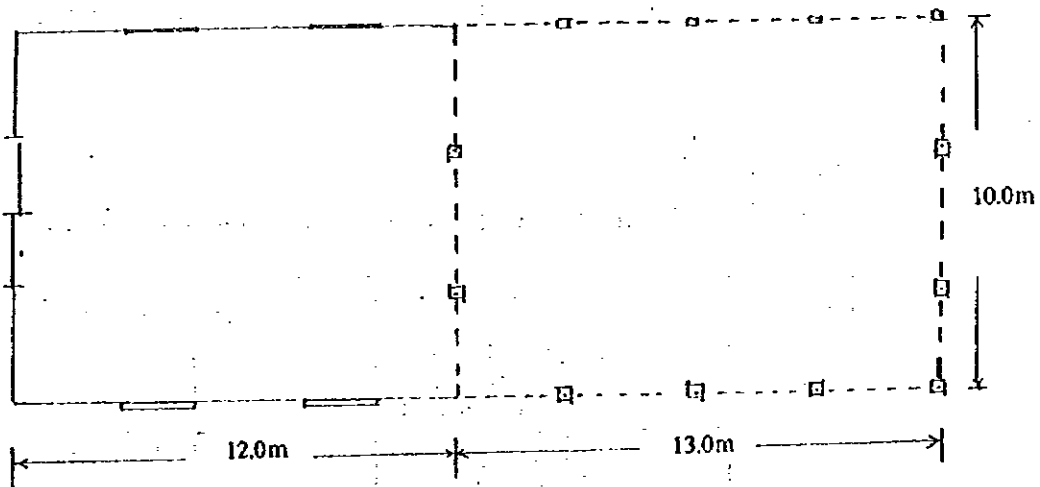
Nursery and afforestation plans for this project should be well integrated into each other. For this reason, works must start with securing a water supply from the new canal. The time schedule for a nursery land development and the nursery was set in such a way that the full-fledged afforestation project is to begin in 1999. Therefore, the start of a actual planting work as a preparatory phrase is planned to be in 2000. The table for the nursery land development schedule is shown as follows:

| items | a calendar year of 1999 | | | | | | | | | | | |
|---|-------------------------|---|---|---|---|---|----|----|----|---|---|---|
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| clearing for nursery site | | | | | | | | | | | | |
| rooting and clearing, smoothing of the land | | | | | | | | | | | | |
| land survey (for each use) | | | | | | | | | | | | |
| laboratory site clearing | | | | | | | | | | | | |
| construction of a nursery facility | | | | | | | | | | | | |
| construct an irrig. | | | | | | | | | | | | |
| construction of a work shop | | | | | | | | | | | | |
| construction of a warehouse and germination house | | | | | | | | | | | | |

warehouse, administrative office, germination house



work shop



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Fig. 2.3.2.7-4 building facilities

(7) Planting and Foresting Plan

Some reference explanations for the planting and foresting plan are made as follows:

(A) Work Schedule

The Philippines side will be in charge of planting and forestation. Yet a careful planning should be drawn up because of its importance just as in the nursery planning. Table 2.3.2.7-2 shows a yearly work schedule for planting and forestation plan for reference, although the definite work schedule is not prepared yet by the province.

A normal workload for planting is 100 to 300 trees a day for a person. However, it would be conservation to assume approxi.100 trees/day/person in consideration of the necessity of careful planting as well as planting by many common labours in wide area.

(B) Nurturing Forests

Forest fertilization for the first time will be carried out as shown in the table below.

| frequency | method | | fertilizer volume used | | | |
|------------|----------------------|---|--|------------------------|-------------|-------------|
| first time | timing | 1. at the time of planting 2. after settlement or after shrubcutting 3. a year after planting | tree types | volume per tree (gram) | | |
| | fertilizer placement | 1. in a row (3 to 4 spots) 2. underground 3. ground surface 4. combination of above | | | N | P |
| | | | Trees around the reservoir. Broadleaf trees (including fruit) | 6~8 10~20 | 4~6 8~16 | 4~6 6~12 |

From the second time on, the amount can be increased by 20 to 40 percent from that of the first time but only by carefully observing the outcome of the first fertilization and a fertility condition of the forests from the time of planting to the fully matured

Table 2,3.2.7-2 yearly work schedule plan for forestation (draft)

| works | month | climate | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | degree of necessity | |
|---------------------------------------|--|----------------------------------|-------------------|----|----|--------------|----|----|-------------------|----|----|-----|----|----|---------------------|---|
| | | | transitory period | | | rainy season | | | transitory period | | | dry | | | | |
| nursery plan | sapling production | seed purchase and culturing | | | | | | | | | | | | | △ | |
| | | nursery land cultivation | | | | | | | | | | | | | | ● |
| | | nursery beds work | | | | | | | | | | | | | | ● |
| | | sowing | ←→ | | | | | | | | | | | | | ● |
| | | cutting | | ←→ | | | | | | ←→ | | | | | | ○ |
| | | grafting | ←→ | ←→ | | | | | | ←→ | | | | | | ○ |
| | | sapling transplanting | ←→ | ←→ | | | | | | | | | | | | ○ |
| maintenance and management of nursery | | first fertilization | ←→ | | | | | | | | | | ←→ | | ● | |
| | | additional fertilization | | ←→ | ←→ | | | | | ←→ | | | | | ● | |
| | | weeding | ←→ | ←→ | ←→ | | | | | ←→ | | | | | ● | |
| | | thinning | | ←→ | ←→ | | | | | | | | | | | ● |
| | | disease measures | | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | | | | | | ○ |
| | | soil disinfection | | | | | | | | | | | ←→ | ←→ | ←→ | ○ |
| forestation plan | planting | land preparation | ←→ | | | | | | | | | | | | ● | |
| | | sapling transport | | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ● | |
| | | planting | | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ● | |
| | nurturing | shrubcutting and climber cutting | | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ● | |
| | | improvement | | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ○ | |
| | trimming, selecting forest fertilization | | | | | | | | | | | ←→ | ←→ | ←→ | △ | |
| bamboo forest plan | | transplant | ←→ | ←→ | ←→ | | | | | | | | | | ● | |
| | | logging | | | | | | | | | ←→ | ←→ | ←→ | ←→ | ←→ | ● |
| | | grassing and soil filling | | | | | | | | | ←→ | ←→ | ←→ | ←→ | ←→ | ○ |
| soil & fertilizer plan | | soil's physical improvement | | | | | | | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ○ | |
| | | changing soil acidity | | | | | | | | | ←→ | ←→ | ←→ | ←→ | △ | |
| | | improvement of soil fertility | | | | | | | | | ←→ | ←→ | ←→ | ←→ | △ | |
| | | sustained fertilization | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ←→ | ● |

● critical work

○ work if necessary

△ work judged necessary by circumstances

phrase. A use of nitrogen only would be fine once forests have matured. However, fertilizer of phosphorus and potassium together with nitrogen applied over the ground surface twice or three times are good as well. After thinning of young forest, 80 to 100kg per ha of fertilizer with nitrogen ingredient are suggested. Applying fertilizer at the time of planting should be avoided when planting were delayed or carried out in a dry season or saplings were not healthy.

Although many kinds of fertilizer for forest lands are now available in a market, the soil characteristics of a particular forest and a growth of the trees there require a careful choice of fertilizer.

(C) Forest Nurturing & Management

(a) Shrubcutting

Shrubcutting together with climber cutting are recommended once in the year of planting, then four times by the end of the fifth year. A workload for a clear shrub cutting is about 0.05 to 0.1 ha per day for a person in a land populated by sprouts, shrub and grasses.

(b) Pruning

The best timing of pruning is when trees seem to be fully crowned and a few lower branches are dead. Most of the time, it is carried out at the time of thinning or either before or after that. In a warn area like Infanta, a pruning work of two or three times between a fifth and fifteenth ring year are desired.

(c) Thinning

Thinning is to adjust forests' density so that a quality and quantity of the remaining trees' growth will improve. Thus, the number of the remaining trees and their spacing become more important. To implement this process, an attention should be paid to the trees to be left rather than those cut down. Those to be cut are of dying, too weak to grow, poor quality and hampering a growth of the neighboring good, healthy trees. A start of a thinning phrase is from a fifth to fifteenth year after planting. As for an interval of the work, it differs depending on a type of trees, a tree's age, a land altitude and a thinning rate. However, with 20% of logging, once every four or five years would be common.

(8) Share of Works

Although the study is carried out for all the major structures and facilities necessary for the nursery, it is essential to make the share of responsibilities between the Japanese side and the Philippines side for the construction works as well as the preparation of equipment & tools. The Japanese side will construct the major structures & facilities including the roads and water supply facility. However, the Provincial side has to construct comparatively simple or temporary facilities and also prepare the working equipment & tools without delay. The share for the nursery preparation and the share of facilities for the nursery site are respectively shown in Table 2.3.2.7-3 & 4.

2.3.2.8 Operation, Maintenance & Management Plan

Concerning the operation, maintenance & management after the completion of the project, the common comments for all the structures and works are made below:

(A) Organization for Operation, Maintenance & Management

The basic organization for operation, maintenance & management is already established among the related government agencies in which the province is the responsible one. The related agencies are different by the objective structures. The cooperation from NIA would be the most essential one among all the cooperative agencies.

(B) Share of Responsibility

The adjustment for share of responsibility among the cooperative agencies in the organization would be made by the province. The cooperation from the other agencies is inevitable as the province itself does not have sufficient experience for O & M of a project with a dam. NIA would be the most reliable agency to make cooperation to the province. The municipality of Infanta would have to carry out the activities directly although the municipality is a part of the provincial government. The staff for O & M will be prepared among the cooperative agencies as the representative of each agency is listed up as the counterpart of the project execution.

(C) Finance/ Budget

The provincial government is the agency for taking full responsibility of budget preparation for O & M. The province already prepared a certain amount of budget, however it could be increased according to its necessity.

Although the detailed O & M plan should be actually prepared by the province, some comments and suggestion on O & M for each component of the project are presented as follows:

(1) Road

All the roads to be constructed or improved by the Japanese side will belong to the municipality. Consequently the municipality has to take responsibility for the maintenance. There is no construction equipment for the maintenance in the municipality at present. The following cases are considered for the maintenance.

- For man-power, the cooperation from inhabitants can be expected.
- For materials, the sand & gravel materials can be obtained from the nearby area.
- For construction equipment, the following methods can be considered.
 - Rent a equipment from the mining company (Short hours would be possible depending on the company's convenience)
 - Rent a equipment from the district office of DPWH (It would not be easy as DPWH is in charge of national road)
 - Rent a equipment from the province, a new team established in 1996 (It would be more or less reliable than the above two cases, however one team has to be used in common among ten municipalities of the district. The municipality of Infanta only could not use them with priority.)

The situation mentioned above shows that it is difficult to expect the good maintenance without the additional countermeasures.

Accordingly the new equipment to be procured by the Japanese side (if agreed officially), dump truck and motor grader, could be used efficiently for the maintenance activities. It is essential, however, to establish the organization and system for the proper use of these equipment. It seems difficult for the municipality of Infanta to maintain the equipment by itself due to shortage of budget & expert for keeping them in good condition. Therefore, it is considered better for the province to take responsibility of maintenance & repair of the equipment and for the municipality to bear the direct cost for operation and maintenance. In any case, the province and the municipality have to prepare a definite organization, budget, share system, operation rule, and so on :

(2) Irrigation Canals and Structures

There are, at present, the farmers who belong to one of the existing three irrigators' associations and also the farmers who do not belong to either of them. All these farmers will be newly organized in the new IA after the project implementation. The fundamental system would be not different, however all the irrigation network including existing one and new one should be managed as a unified system for the efficient and fair use of water. The maintenance works would be carried out as follows:

- Large - Medium scale canal works

The provincial government is in charge ,but with the cooperation from NIA.

(However, NIA has to take share the works for the structures constructed by NIA and the farmers have to share the man-power works when necessary.)

- Small scale canal works

The farmers would have to share the works depending on the locations and individual paddy areas based on the cooperative discussion. However, the province as well as NIA has to assist in the work when required.

The remaining amount of present amortization of existing IA could be paid by the province to NIA on behalf for the farmers. And the new irrigation water fee will be paid from the farmers to the province. That is , the payment system is basically the same for the farmers, although the adjustment of fee amount would be necessary between the present member of IA and the non-members. The amount will be decided in reference to the present fee, so that the 1.5 - 2.0 cavan (75 - 100 kg)/ha/year would be the probable amount. As far as the collection rate is high at present, no anxiety for collecting the water charge would be necessary.

With regard to the construction of secondary & tertiary canals, most of the works will be carried out by the man-power of farmers with some financial and technical assistance from the province. The works will make the most of the experience through the activities for existing irrigation system .

(3) Dam & Reservoir

The dam design is made in consideration of the easier operation and maintenance. It is suggested to assign a permanent staff who belongs exclusively to the dam for the reliable duties. It is suggested to assign the reliable O & M staff from OPAG as well as IA. However, it would be necessary to get technical guidance & assistance from NIA. That is, the O & M system would be made by the cooperative organization among the province (PEO & OPAG), NIA, and IA, although the province should be the responsible agency. However, it would be desirable for the province to entrust the site management to the new IA , with the assistance from the municipality, for the daily operation and maintenance. The budget for O & M has to be prepared by the province, however the water charge collected from the farmers can be allotted for such expenses. In addition, it is advised to prepare the O & M manual, before the completion of the construction, for the measurement of dam & reservoir, meteorological observation, inspection, maintenance,

repair of structures/facilities, and so on.

(4) Tree Nursery and Afforestation

The O & M will be in charge of PENRO(DENR) with the cooperation from OPAG of the province. The other cooperative agencies such as BSWM, OMAG, PSU, and the municipality of Infanta will assist the work, if necessary. The share of budget & management would be decided through the cooperative discussion between the Province and PENRO. Both agencies have sufficient experience for the nursery and afforestation activities so that the the effective progress is expected but depending on the definite plan with sufficient budget . It is necessary to improve the draft plan and prepare the practical and appropriate implementation plan by the both agencies. In addition , it is considerable to have cooperative participation from the inhabitants and school students for the planting activities.

The Japanese side will construct basically the roads, pot nursery bed (land preparation) and water supply facilities. Then the provincial side has to construct the other necessary facilities such as building/houses, sunshade, storage pond, etc. and also to provide the necessary equipment , tools & materials such as insecticide sprayer, cultivation set, small truck, farm tractor, potting compost, shovels and so on at the earlier stage. It is suggested for the province to prepare the sufficient budget to make sure the implementation and assistance to O & M. It is probable for JICA to dispatch a volunteer for assisting in the O & M activities for a few years.

(5) Resettlement Area

The O & M activities for the resettlement area have to be carried out basically by the resettlers themselves, however the positive backup from the related agencies is necessary at least for several years until they can live independently from the constant agricultural production. The provincial government will support them with the cooperation from the other agencies such as MPC,NIA, BSWM, and so on. The general conditions for the resettlers seem to be comparatively good in regard to the size of agriculture land per family as well as the infrastructure so that it is probable that this resettlement area become a good model for the other similar schemes. There is no remarkable problematic matters concerning the soil and topographic conditions although the preparatory works for cultivation will need some efforts and technical guidance.

The Japanese side will construct the main canal, subsidiary canals, main roads, and water

supply facilities. Then the provincial side has to construct or provide the other necessary facilities such as houses, canals, power supply and so on at the earlier stage. The tentative budget is already prepared by the province, however it is suggested for the province to prepare the additional/contingency budget to make sure the implementation and assistance to O & M.

2.3.2.9 Road Maintenance Equipment Plan

There are eight Barangays in the project area, and the total length of the roads connecting these Barangays is approximately 30 km. Except a certain paved section, these Barangay roads are unpaved soil roads, and there appear many suspension of traffic sections during the rainy season.

Improvement of these roads is planned as gravel pavement in consideration with the traffic volume and the road size. Therefore, the road surface maintenance will be necessary occasionally, especially in the rainy season. As described in the preceding section (Operation, maintenance and management), the municipality has no maintenance equipment at present and it seems difficult to rent the equipment from the outside owners, except some cases. For this purpose, it was requested from the province to provide one motor grader and one dump truck as the minimum requirement. The request is considered reasonable.

Under the circumstances, procurement of one motor grader (3.7 m class) and one dump truck (11 ton class) are planned. The size of equipment is decided in consideration of the efficiency of operation and maintenance. For example, a motor grader with 3.7 m blade will be appropriate for the road with the gravel pavement width of 5 to 6 m.

Utilization plan of these equipment are as follows.

| Equipment | Purpose of Utilization | Annual Utilization Rate of Equipment |
|--------------|--|--|
| Motor grader | Improvement of road surface and shoulder | Improvement of Barangay road equivalent to 30 km will be carried out 2 times (the end of the dry season and during the rainy season). Total 120 day (0.5 km/day) |
| Dump truck | Hauling of materials | ditto |

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Chapter 3 Implementation Plan

3.1 Implementation Plan

3.1.1 Implementation Concept

The implementing agency of this project is the Pangasinan province. A Japanese construction company selected by the public tender will execute the implementation, while a Japanese consulting firm will carry out the detail design and supervision.

Common materials concerned with the implementation available in the Philippines. However, special materials that can not be provided in the nation, such as the inclined conduit, maintenance bridge of the spill way, steel slide gate, pressure reducing valve, valve for the pipe line and the big size steel pipe joint, are imported from Japan.

Common construction machinery can be provided in the nation generally. However, special machinery concerned with the dam construction such as a grouting machine, batcher plant and tamping roller, are to be imported from Japan.

Average annual rainfall in the project area is approximately 3,230.6 mm during past five years. The season is clearly divided into the rainy season and the dry season. The rainy season starts in May and continues until October. Approximately 95% of the annual rainfall is concentrated during these 6 months.

Annual workable days are estimated as approximately 216 days (the annual workable day ratio is 59.2 %), in consideration of national holidays and the effects of the rainy day. However, during the rainy season, especially June to September, the workable day ratio is very low (29.2 %). Moreover, the condition of the site also becomes unsuitable for construction machinery. Therefore, it is decided that the implementation period is the dry season and rainy season except June to September.

The local contractor will be able to execute the implementation on the standard civil works such as the irrigation canal construction and related structures, road construction, pipe line and various kinds of reclamation, without any problem. However, it will be necessary to dispatch engineers from Japan to set up the inclined conduit and pressure reducing valve, and also to perform grouting works because the local construction dose not have enough experience.

The general supervisor of the dam construction work has to supervise the dam construction at

some important stage of the implementation in order to gain good progress and have a good result. Because the dam height is 40 m, moreover, the period is limited.

The local firms will execute the land survey and the soil survey that are necessary for the detail design because they have ability to execute them sufficiently.

3.1.2 Implementation Conditions

(1) General Condition

- To pay attention to cooperate with the inhabitants and to protect against trouble because the implementation extends over a comprehensive area.
- To construct the settling basin in order to protect the outflow of muddy water or oil due to the implementation.
- To station a person for traffic control at places on roads with heavy traffic by heavy machinery concerned with the implementation for the purpose of preventing traffic accidents.
- To construct turnouts to passage of heavy machinery and common traffic without problem in the village.
- To implement leveling and land reclamation for the spoil bank or the borrow pit in order to protect against collapse or landslides in the future.

(2) Dam construction

- To pay sufficient attention to the machinery, method of implementation and quality control of the implementation. The foundation excavation and foundation treatment must be executed during one dry season. Additionally, implementation will dominate the safety of the fill-type dam.
- To safety execute the dewatering of the riverbed by the temporarily drainage facility and the submerged pump. The dewatering dominates the quality of the foundation treatment.
- To set up a lighting system sufficient for the purpose of safe embankment of the dam during the night. The temporary power source for construction will be preserved after completion to survey the present situation of electricity in the area and will be discussed with NPCO.
- To bank the core material up after mixing and controlling the quality at the stock yard in order to execute the sure quality control of the material.
- To pay attention to safety storing of the powder that is used for the foundation excavation of the spill way and excavation of the quarry site, in compliance with the domestic law of the Philippines.

- (3) Road improvement around the reservoir dam
 - To sufficiently compact cutting and banking occurs on the mountainside of heights. Such places are susceptible to erosion due to rain.
 - To compact backfilled places sufficiently the protection concrete for the toe of slopes will be executed. The backfilling place will be the embankment of the road.
- (4) Irrigation canal improvement
 - To hold sufficient prior consultation with inhabitants for the purpose of preventing any misunderstanding. It will be necessary to stop the irrigation water for a time to improve the irrigation canal.
 - To inform the Philippine government regarding the proposed canal route and needed width of land as soon as possible in order to prevent the delay of implementation. The Philippine government must acquire the land for the new irrigation canal route based on these data.
- (5) Village road improvement
 - To pay sufficient attention to the safety of common traffic during implementation. The purpose of village road improvement is to extend and improve the existing road.
 - To take countermeasures against the dust that could adversely effect inhabitants along the road. There is a possibility that clouds of dust can arise due to the implementation during the dry season.
 - To dig the ditch on the cutting side of the road as a drainage in case of heavy rain.
- (6) Resettlement, Nursery, Post harvest facility
 - To hold sufficient meetings on the land acquisition with the government of the Philippines in order to prevent delay of the implementation. The government of the Philippines must acquire the land for facilities before the implementation.
 - To pave the access road of the resettlement area with gravel, and the living road with concrete, and to compact the roadbed of the concrete pavement in order to prevent cracks due to the subsidence of the roadbed.
 - To simultaneously execute the head race pipe of the domestic water supply for the resettlement area and the related irrigation canal. The head race pipe from the dam will be laid side along the new irrigation canal.

3.1.3 Scope of Works

The scope of works on the project is shown in Table 3-1.

Table 3-1 Scope of works

| Scope of works | Scope of works | |
|--|----------------|-------------|
| | Japan | Philippines |
| 1. Dam and reservoir construction | | |
| 1) Acquisition of land for construction | | ○ |
| 2) Acquisition of land for temporary works such as detour and material storage | | ○ |
| 3) Construction of the dam | ○ | |
| 4) Setting up and evacuation of temporary road | ○ | |
| 5) Leading works of temporary power source | ○ | |
| 6) Application and proceeding of necessary permission for construction work in the river | | ○ |
| 2. Irrigation canals | | |
| 1) Acquisition of land for canal and inspection road | | ○ |
| 2) Acquisition of land for temporary works such as material storage | | ○ |
| 3) Construction of main irrigation canal | ○ | |
| 4) Construction of secondary, tertiary irrigation canal | | ○ |
| 5) Adjustment on preparation of irrigation water during execution | | ○ |
| 3. Road improvement | | |
| 1) Acquisition of land for new road and widening | | ○ |
| 2) Acquisition of land for temporary works such as material storage | | ○ |
| 3) Improvement of roads, construction of roads and bridges | ○ | |
| 4) Environmental countermeasure such as Preventing dust | ○ | |
| 5) Garage for road maintenance equipment | | ○ |
| 4. Resettlement area | | |
| 1) Acquisition of land for resettlement area | | ○ |
| 2) Land reclamation of the area | | ○ |
| 3) Construction of road in the area | ○ | |
| 4) Construction of secondary irrigation canal in the area | ○ | |
| 5) Construction of domestic water supply | ○ | |
| 6) Execution of power receiving and distribution facility | | ○ |
| 7) Construction of houses for resettlers | | ○ |
| 8) Implementation of resettlement and support including selection of resettlers | | ○ |

| Scope of works | Scope of works | |
|---|-----------------------|-----------------------|
| | Japan | Philippines |
| 5. Nursery | | |
| 1) Acquisition of land for nursery | | <input type="radio"/> |
| 2) Reclamation of nursery area and construction of major facilities | <input type="radio"/> | |
| 3) Construction of water supply facility | <input type="radio"/> | |
| 4) Seedling and afforestation | | <input type="radio"/> |
| 5) Construction of appurtenant/miscellaneous facilities | | <input type="radio"/> |
| 6) Procurement of equipment and tools | | <input type="radio"/> |
| 6. Payment of charges for the Japanese foreign exchange bank based on the bank agreement | | <input type="radio"/> |
| 7. Formalities of customs for import | | |
| 1) Transportation cost to the Philippines | <input type="radio"/> | |
| 2) Exemption of tax and formalities of customs | | <input type="radio"/> |
| 3) Domestic transportation cost in the Philippines (Manila to the si | <input type="radio"/> | |
| 8. Recognition of entry into the Philippines and visit concerning the project | | <input type="radio"/> |
| 9. Proper operation and maintenance of facilities and equipment that are delivered by Japanese grant aid | | <input type="radio"/> |
| 10. Payment of all expense for the construction cost of facilities and transportation cost of the equipment that are excluded from Japanese grant aid | | <input type="radio"/> |

3.1.4 Consultant Supervision

(1) Detail design and public tender service

After have terminated the Exchange of Notes, the consulting company shall make a contract with the government of Pangasinan province at once. The consulting company shall hold in depth discussion of the detail design with the government after the start of the detail design. The implementation schedule will be discussed during field reconnaissance. The government of Pangasinan province will execute arrangements for the implementation, such as land acquisition for the construction or temporary works and the temporary office, before the start of execution. Activities related to the detail design are as follows.

Supplementary survey (Entrusted local contractor will execute)

1. Survey

a) Center line longitudinal survey

- Irrigation canal: L=21.7 km (50 m intervals and additional points)

Reason: Supplementary survey of the basic design study

- Village road: L=7.5 km (50 m intervals and additional points)

Reason: Supplementary survey of the basic design study

- Road around the reservoir: L=17.0 km (50 m intervals and additional points)

Reason: Supplementary survey of the basic design study

- Resettlement area: L=2.4 km (50 m intervals and additional points)

Reason: Supplementary survey of the basic design study

- Dam axis longitudinal survey L=0.4 km (50 m intervals and additional points)

Reason: Supplementary survey of the basic design study

- Spillway longitudinal survey L=0.3 km (50 m intervals and additional points)

Reason: Supplementary survey of the basic design study

b) Cross section survey

- Irrigation canal: Width=20 m (434 sections)

Reason: To ensure the accuracy of the detail design

- Village road: Width=20 m (150 sections)

Reason: To ensure the accuracy of the detail design

- Road around the reservoir: Width=20 m (340 sections)

Reason: To ensure the accuracy of the detail design

- Resettlement area: Width=20 m (48 sections)

Reason: To ensure the accuracy of the detail design

- Dam axis cross-section survey: Average width=150 m (25 sections)

Reason: To ensure the accuracy of the detail design

- Spillway cross-section survey: Average width=30 m (20 sections)

Reason: To ensure the accuracy of the detail design

c) Plane table survey

- Irrigation canal: $A=2,500 \text{ m}^2$ (Scale=1/100, Bamban weir intake site)

Reason: To ensure the accuracy of the detail design

- Village road: $A=5,000 \text{ m}^2$ (Scale=1/100, Bridge sites)

Reason: To ensure the accuracy of the detail design

- Nursery area: $A=60,000 \text{ m}^2$ (Scale=1/100)

Reason: To ensure the accuracy of the detail design

- Post harvest facilities: $A=20,000 \text{ m}^2$ (Scale=1/100)

Reason: To ensure the accuracy of the detail design

- Dam site: $A=420,000 \text{ m}^2$ (Scale=1/1000)

Reason: To ensure the accuracy of the detail design

2. Geological and Soil Investigation

a) Boring investigation

- Bridge sites: 4 holes (2 holes each for 2 bridges, Depth=20 m each)

Item: Core extraction, Standard penetration test

Reason: To confirm the bearing layer that could not investigate during the basic design study

- Dam sites: 6 holes (Dam axis and spillway, Depth=30 m each)

Item: Core extraction, Standard penetration, Insitu permeability test (Lugion test)

Reason: As the result of the basic design study, the dam site was moved upper stream

b) Material survey

- Core materials: 3 locations (Depth=5 m, 12 samples)

Item: Moisture content, Specific gravity, Grain size test, Liquid limited/ Plastic limited

Insitu moisture content, Proctor compression test, Permeability test

Unconfined compression test, Triaxial compression test

Reason: To confirm the dynamical character at selected sites

- Random materials: 4 locations

Item: Specific gravity, Grain size, Unconfined compression test (Samples from boring core box), Triaxial compression test

Reason: To confirm the dynamical character at selected sites

- Filter materials/ Concrete aggregate materials: 4 locations (Depth=3 m, 8 samples)
- Item for filter materials: Specific gravity, Grain size test
- Item for aggregate materials: Specific gravity, Grain size test, Unit weight
Soundness test, Absorbed water content

Detail design

- 1) Confirmation on the basic design based on the topographical survey and Geological and Soil investigation.
- 2) Estimation of the project cost based on the detail design.

Drawing up tender documents and Procedure of the public tender as well as a contract

- 1) Drawing up design plans for the tender
- 2) Drawing up tender documents for the execution and granted equipment
- 3) The public tender to select a contractor shall require approval by the client before a tender is made.

The prequalification shall first be executed to select tenderers. This public announcement shall be published in a major Japanese daily newspaper related to construction by name of the client. The consulting company shall distribute prequalification documents to applicants. The consulting company shall distribute tender documents to firms who have succeeded in passing the prequalification of the tenderer. The consulting company shall receive tender documents of the firms and shall unseal them in the presence of a person authorized by the government of Pangasinan province. The consulting company and the client shall evaluate the documents at once after they have been unsealed. Then the consulting company and the client shall decide a negotiator for the contract as well as draw up draft contract documents.

(2) Supervision

After having terminated the contract of construction, the general responsible person of the consulting company shall discuss and confirm the implementation schedule with the client and the contractor. The general responsible person of the consulting company shall be stationed to the site at the beginning and ending period of the execution of each fiscal year to supervise the execution. Moreover, the general responsible person shall periodically report the situation of the execution to the client, JICA and the Embassy of Japan in the Philippine. Experts of each field shall be dispatched in addition to resident supervisors on demand because the components of this project are various fields and the execution is concentrated during the dry season. Supervisors shall make effort to attain the determination of the execution within the term that has been decided, with a peaceful procedure of the execution and best results. Summaries of the supervision are as follows.

Suggestion and guidance concerning the contract of the execution

Prequalification of the tenderer, evaluation of tender documents, support upon the selection of the contractor of the execution, presence of the contract on the execution.

Examination and inspection of implementation plan

Examination of documents on implementation plans, application for permission of the execution, sample of materials, specifications of machinery that the contractor will submit. Inspection of processed articles in a factory.

Examination and guidance of the execution

Investigation and guidance on the scheme of the execution as well as the schedule. Comprehension and guidance on the procedure of the execution. The interim inspection and the completion inspection of the execution.

Payment recognition

Confirmation and inspection on the production that are necessary for publications of certificates on stage payment and the certificate of completion of work under execution as well as after completion.

Report on the procedure of the execution

The supervisor shall make a monthly report of the execution and periodically report the procedure of the execution to the client, JICA and the embassy of Japan in the Philippines. The supervisor shall hold consultations with them to strive for the smooth execution.

Delivery of completed facilities

After completion, the supervisor shall be present at the delivery of facilities after having confirmed that conditions of the contract have been accomplished certainly.

3.1.5 Procurement plan

Construction materials and equipment are basically provided in the Philippines. However, special materials that can not be provided or are very difficult to obtain in the nation, or for which the quality is not adequate, shall be imported from Japan. Most of construction materials and equipment can be provided in the nation. Construction equipment that will be imported from Japan includes grouting machines, the Batcher plant and the tamping roller. Construction materials that will be imported from Japan are the inclined conduit, the maintenance bridge of the spillway, the steel slide gate, the pressure reducing valve, the valve for the pipe line and big size steel pipe joint. Granted equipment is to be imported from Japan as the result of the price comparison.

The granted equipment is not utilized for the execution due to following reasons as the result of investigation.

- The granted equipment is machinery for the hauling and the construction of roads. The machinery for the construction of roads can not be utilized during first fiscal year in which the road construction is a lot because it takes approximately a half-year to deliver the equipment, even if proceeding is taken at an early stage.
- The hauling machine is used in high frequency in the execution. Therefore, there is very high risk of reducing the repaying period in comparison with operation and maintenance.

Procurement plan of principal construction materials and equipment are shown in Table 3-2.

Construction materials and equipment that are provided in Japan are transported by ship to Manila port. Then they are transported by land from Manila port to the site. Land transportation from Manila port to the site does not have a problem particularly because the roads are paved with asphalt and it is not necessary to reinforce bridges. It will take approximately 20 days to arrive at the site from Japan.

Table3-2 Procurement plan of principal construction materials and equipment

| Items | Material or equipment | Procurement plan | | |
|--------------------------------------|-------------------------------------|------------------|-------|---------------|
| | | Philippine | Japan | Third country |
| Materials | Cement, aggregate | ○ | | |
| | Reinforced bar, form | ○ | | |
| | Fuel, lubricating oil | ○ | | |
| | Pipe (excepted big size steel pipe) | ○ | | |
| | Concrete pipe, roof tile | ○ | | |
| | Steel gate | | ○ | |
| | Valve | | ○ | |
| | Inclined conduit | | ○ | |
| | Big size steel pipe joint | | ○ | |
| | Maintenance bridge of spill way | | ○ | |
| | Equipment | Back hoe | ○ | |
| Bulldozer | | ○ | | |
| Dump truck | | ○ | | |
| Tractor shovel | | ○ | | |
| Crawler crane | | ○ | | |
| Mobile concrete pump | | ○ | | |
| Road sprinkler | | ○ | | |
| Tamping roller | | | ○ | |
| Vibrating roller | | ○ | | |
| Concrete breaker | | ○ | | |
| Portable air compressor | | ○ | | |
| Grouting center plant | | | ○ | |
| Grouting pump | | | ○ | |
| Grouting mixer | | | ○ | |
| Grouting discharge pressure measurer | | | ○ | |
| Grouting data recorder | | | ○ | |
| Grouting data processing machine | | | ○ | |
| Batcher plant | | ○ | | |
| Submerged pump, generator | ○ | | | |

Procurement plan of granted equipment

| Items | Machinery or equipment | Procurement plan | | |
|-------------------|------------------------|------------------|-------|---------------|
| | | Philippine | Japan | Third country |
| Granted equipment | Dump truck | | ○ | |
| | Motor grader | | ○ | |

3.1.6 Implementation schedule

Detail design takes 7.0 months and the execution as well as procurement of construction materials and equipment takes 18.0 months in the case of this project. The construction period will extend to 3 years, so 3 dry seasons (October to next May) will be necessary for the execution.

The implementation schedule is shown in Table 3-3.

3.1.7 Obligations of recipient country

The necessary obligations of the recipient country of the project are as follows.

- 1) Acquisition of land and permissions of land utilization for the project.
- 2) Acquisition of land and permissions of land utilization to construct the access road from the existing road to the dam site.
- 3) Traffic permission of the national road and village road for construction machinery and cars.
- 4) Exemption of import tax and proceeding cost. To take necessary action against the formalities of customs for construction materials and equipment as well as their accessories that are necessary to the project.
- 5) Following payment of charges for the Japanese foreign exchange bank based on the bank agreement.
 - Notice charge of authority to pay (A/P)
 - Payment charges
- 6) Recognition of entry into the Philippines and visit during the execution for the Japanese who have been stationed to the project under certified contract.
- 7) Exemption of taxes such as domestic tax and others that are taxed in the Philippines for the Japanese who have been stationed to the project under certified contract.
- 8) Proper operation and maintenance of facilities and equipment that are delivered by Japanese grant aid.
- 9) Payment of all expense for the construction cost of facilities and transportation cost of the equipment that are excluded from Japanese grant aid.

3.2 Operation and Maintenance Plan

The total amount of the annual expenses needed for the operation maintenance and administration of the dam, irrigation facilities, and roads is estimated as Ps. 3,003 thousand, as shown below.

However, average annual expense mentioned below is an aim for ensuring of budget. Therefore, it will be actually changed every year according to the necessary of maintenance and renovation of facilities. It is necessary that the balance of budget should be transferred to next year. The cost for nursery and afforestation is average of the total period, therefore, after completion of afforestation, the cost will reduce sharply.

| | Name of facilities | Annual O & M cost (Pesos) |
|----|--|---------------------------|
| 1. | Dam and Reservoir (1 place) | 408,000 |
| 2. | Irrigation facilities (21.7 km) | 155,000 |
| 3. | Village road and Road around the reservoir (24 km) | 508,000 |
| 4. | Resettlement area (220 ha) | 88,000 |
| 5. | Nursery (2.35 ha), Afforestation | 1,844,000 |
| | Total | 3,003,000 |

Details of annual maintenance expenses of each facility are as follows.

(1) Dam

One full-time manager and an assistant manager will be stationed for control and maintenance of the dam and reservoir, and measurement of leakage amount. Weeding on the side slope of the dam will be performed twice a year.

| | |
|---|---|
| Personnel expenses: | Full-time manager Ps.12,000/month x 12 months = Ps. 144,000 |
| | Assistant manager Ps. 6,000 /month x 12 months = Ps. 72,000 |
| | Laborers 5 persons x 2 days x Ps.180/day = Ps. 1,800 |
| Repairing cost: | Ps. 6,000 /month x 12 months = Ps. 72,000 |
| Renovation cost: | Ps. 1,000,000 x 0.05 = Ps.50,000 |
| Miscellaneous expenses (25% of the above total) = | 67,960 |

| | | |
|-------|----------------|--------------|
| Total | = | Ps. 407,760 |
| | (Approximately | Ps. 408,000) |

(2) Irrigation facilities

Canals and related facilities will be maintained twice a year. The labor necessary for this is estimated for the total canal length of 21.7 km x twice/year / 0.5 km/person/day = 87 persons/day. Since the durable period of the steel gate to be installed at the diversion structure is approximately 20 years, 5% of the gate construction cost is taken for gate renovation cost.

| | | |
|---|-----------------------------|--------------------|
| Personnel expenses: | 87 persons/day x Ps.180/day | = Ps. 15,660 |
| Renovation costs: | Ps.2,500,000 x 0.05 | = Ps. 125,000 |
| Miscellaneous expenses (10% of the above total) | | = Ps. 14,066 |
| Total | | Ps. 154,726 |
| | (Approximately | Ps. 155,000) |

(3) Village roads and roads around the reservoir

The average road maintenance cost in the Philippines is approximately Ps. 35,000 /km (2 lane road). The proposed village roads are 2 lanes, and the roads around the reservoir are one lane. Both are paved with gravel. Therefore, estimation is made with the coefficient 0.55 for the gravel pavement.

| | | |
|---|--------------------------|--------------------|
| Personnel, material and equipment expenses: | 24 km x Ps.35,000 x 0.55 | = Ps. 462,000 |
| Miscellaneous expenses (10% of the above) | | = Ps. 46,200 |
| Total | | Ps. 508,200 |
| | (Approximately | Ps. 508,000) |

(4) Resettlement area

The facilities to be constructed under the project include domestic water supply facilities, roads, and irrigation canals. Since the domestic water supply facilities are provided with a distribution pond that needs filtration and disinfection by chlorine, expense for one person x 30% (workable) per year is estimated. Almost no maintenance cost is necessary for the roads in the resettlement area, since they are planned to be paved with concrete.

| | | |
|---------------------|--|-------------------|
| Personnel expenses: | Ps. 12,000 /month x 12 months x 0.3 | = Ps. 43,200 |
| Laborer | Ps. 180 /day x 10 persons x 2 days | = Ps. 3,600 |
| Material expenses: | Filter 50 m3 x Ps.300 /m3 | = Ps. 15,000 |
| | Chlorine agent (for disinfection) Ps. 3000 /year | 3,000 |
| Canal management | Ps. 7,100 /km x 3.3 km | = Ps. 23,430 |
| Total | | Ps. 88,230 |
| | (Approximately | Ps. 88,000) |

(5) Nursery, Afforestation

One full-time manager, an assistant manager and labor will be necessary for operation and maintenance of the nursery. Repairing costs of facilities and procurement cost of pot, fertilizer, agricultural chemicals, equipment (spray, culture equipment, laboratory equipment) are necessary too. It is necessary to include the afforestation cost.

| | | |
|---|--|------------------------|
| Personnel expenses: | Full-time manager Ps.12,000/month x 12 months = Ps. 144,000 | |
| | Assistant manager Ps. 8,000 /month x 12 months = Ps. 96,000 | |
| | Permanent laborers 2 persons x Ps. 4,000 /month x 12 months = Ps. 96,000 | |
| | Temporary laborers 5 persons x Ps. 4,000 /month x 4 months = Ps. 80,000 | |
| Repairing and transportation cost: | Ps. 5,000 /month x 12 months | = Ps. 60,000 |
| Material and equipment cost: | Ps. 10,000 /month x 12 months | = Ps. 120,000 |
| Afforestation cost: | 1,200 trees/ha x 450 ha/year x 2 pesos/tree | = Ps. 1,080,000 |
| Miscellaneous expenses (10% of the above total) | | = Ps. 167,600 |
| Total | | = Ps. 1,843,600 |
| | (Approximately | Ps. 1,844,000) |

The expenses of dam, reservoir and irrigation facilities are covered by the irrigation fees collected from the irrigation associations of farmer basically. The village roads and roads around the reservoir are managed by budget of the Infanta Municipal Government. The maintenance and operation expenses of the resettlement area are basically paid by resettlers themselves, however, the Provincial Government and related organizations will support them for a few years until the resettlers can become economically independent. The operation and maintenance of nursery is programmed in the afforestation plan of the Provincial Government. The implementation is taken care of mainly by OPAG of the Provincial Government and DENR. In case of necessary, the Infanta Municipal Government and PSU will cooperate to the operation and maintenance.

Table 3-3

Implementation plan on first execution

| 【Detail design】 | | | | | | | | | | | | |
|-----------------------|---|---|------------------------|---------------------|---|---|---|---|----|--------------------|----|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| | | | (Feild reconnaissance) | | | | | | | | | |
| | | | (Home office works) | | | | | | | | | |
| | | | | | | | | | | (Total 2.5 months) | | |
| 【First pysical year】 | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| | | | | (Preparation works) | | | | | | | | |
| | | | | | (Village road improvement) | | | | | | | |
| | | | | | (Road improvement around the reservoir dam) | | | | | | | |
| | | | | | (Post harvest facilities) | | | | | | | |
| | | | | | (Delivery, inspection) | | | | | | | |
| | | | | | | | | | | (Total 5.0 months) | | |
| 【Second pysical year】 | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| | | | | | | | | | | | | |
| 【Third pysical year】 | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| | | | | | | | | | | | | |

Table 3-3

Implementation plan on second execution

【Detail design】

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------------------------|---|---------------------|---|---|---|---|---|---|----|--------------------|----|
| (Field reconnaissance) | | | | | | | | | | | |
| | | (Home office works) | | | | | | | | | |
| | | | | | | | | | | (Total 4.5 months) | |

【First pysical year】

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|----|----|----|
| | | | | | | | | | | | |

【Second pysical year】

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---------------------|---|--------------------------------|---|---|---|---|---|---|----|--------------------|----|
| (Preparation works) | | | | | | | | | | | |
| | | (Irrigation canal improvement) | | | | | | | | | |
| (Dam construction) | | | | | | | | | | | |
| | | (Resettlement area) | | | | | | | | | |
| | | | | | | | | | | (Total 5.0 months) | |

【Third pysical year】

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|--------------------------------|---|---|---|---|---|-----------|------------------------|---|----|----|----|
| (Irrigation canal improvement) | | | | | | | | | | | |
| (Dam construction) | | | | | | | | | | | |
| | | | | | | (Nursery) | | | | | |
| (Resettlement area) | | | | | | | | | | | |
| | | | | | | | (Delivery, inspection) | | | | |
| (Total 8.0 months) | | | | | | | | | | | |

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial matters. This section outlines the various methods and tools used to collect and store data, ensuring that all information is readily accessible and up-to-date.

2. The second part of the document focuses on the analysis and interpretation of the collected data. It describes the process of identifying trends, patterns, and anomalies within the data sets. This involves the use of statistical techniques and data visualization tools to present the information in a clear and understandable manner. The goal is to provide meaningful insights that can inform decision-making and strategic planning.

3. The third part of the document addresses the challenges and limitations of data analysis. It acknowledges that while data provides valuable information, it is not always perfect. Issues such as data quality, completeness, and bias can affect the accuracy of the results. The document offers strategies to mitigate these risks, such as implementing data validation procedures and regularly reviewing the data for errors.

4. The final part of the document discusses the future of data analysis and the role of emerging technologies. It highlights the potential of artificial intelligence, machine learning, and big data to revolutionize the way we analyze and interpret information. These technologies can process vast amounts of data much more efficiently than traditional methods, allowing for more complex and detailed analyses. However, it also notes the need for ongoing education and training to ensure that professionals are equipped to handle these new tools and techniques.

Chapter 4 Project Evaluation and Recommendation

4.1 Project Effect

It is considered that the project will contribute a lot of beneficial effects on socio-economy and environmental conservation in the municipality and also the surrounding areas such as follows:

- The project can alleviate the poverty especially in rural areas by increasing the agricultural production. (This coincides with the main objective of the national development plan)
- The rural road construction & improvement will improve the daily conveniences of the inhabitants and also the transportation system of agricultural products.
- The afforestation using the project's nursery will enhance the environmental conservation and improvement and also increase the income. (This coincides with the main objective of the national target to restore the lost forest.)
- The resettlement area also contribute to a part of national activities for assisting in the settling of Pinatubo victims.
- The life of inhabitants will be revitalized,
- The natural fauna & flora will be conserved.
- The agricultural technology will be improved.
- The future development projects of fishery, logging, and tourism will be expected.

The major items for beneficial effects are explained as follows:

(A) Agricultural Production Increase and Enhancement of Economic & Living Standard

Many parts of objective area depends on the unstable rainfall at present for the agricultural production. After the construction of dam & reservoir, the agricultural conditions will be remarkably improved by the much increase of irrigation area in the dry season and more reliable water supply in the rainy season. The cropping intensity will be increased from 123 % at present to 159 %. And the annual production of rice will be increased by approx. 60% (2,845 t) on an average. The table below shows the comparative situations between the present and after the

project.

| | Irrigated cultivation area | | | | | | Rainfed cultivation area | | | Total |
|--------------------|----------------------------|--------|-------|------------|--------|-------|--------------------------|--------|-----|-------|
| | Rainy season | | | Dry season | | | Rainy season | | | |
| | (1) | (2) | (3) | (1) | (2) | (3) | (1) | (2) | (3) | |
| | ha | ton/ha | ton | ha | ton/ha | ton | ha | ton/ha | ton | |
| Present | 620 | 3.0 | 1,860 | 250 | 3.5 | 875 | 460 | 2.0 | 920 | 3,655 |
| Proposed | 1,280 | 3.0 | 3,840 | 760 | 3.5 | 2,660 | 0 | 0.0 | 0 | 6,500 |
| After extention | 1,280 | 4.0 | 5,120 | 760 | 5.0 | 3,800 | 0 | 0.0 | 0 | 8,920 |

Notes; (1) Area (2) Unit production (3) Production

The project has the beneficial effect to approximately 13,000 people, equivalent to nearly 68% of the whole population (19,000 people) of Infanta. The paddy production will be increased by approximately 2,845 ton/year, equivalent to approx. 25 million pesos (at farm-gate price, 8,750peso/ton x 2,845 ton). This amount is equivalent to approx. 10 years' recovery of the construction cost for dam (approx. $10.4 = 1,300 \text{ million yen} \div 5.0 \text{ yen/peso} \div 25 \text{ million peso}$). The irrigation area in the dry season will become 760 ha from 250 ha, that is, almost 3 times. This change also contribute to the increase of working opportunity of farmers in the dry season. In addition, if the agricultural productivity is improved by technical guidance in the future, it is expected that the production will be further increased to approx. 8,920 ton/year, (Increase of 5,265 ton/year) which is approx. 2.5 times from the present level.

(B) Road Construction and Improvement

There are approximately 30 km of barangay roads in the project area at present. Among them, approxi. 7 km of roads including 4 bridges will be constructed or improved by the project. These roads are quite useful for the transportation of agricultural products, traffic for shopping, school commuting, and daily activities, and so on. Although it is difficult to pass some of these roads during the rainy season at present, the traffic and transportation will become easy, safe and

comfortable. It is estimated that approxi. 2,000 families in 8 barangays will receive the contribution by the new roads and bridges.

In addition to the barangay roads, the road surrounding the proposed reservoir area will be also constructed and partially improved. This roads has beneficial effects on the traffic and transportation for the people living in the mountain area including Barangay Pita. The road will be also effectively used for the afforestation activities and inspection of the reservoir area.

It is further considerable to use the road for the development of a recreational site as the landscape of the reservoir surrounding area is more or less excellent. The road will be used for the access road to the recreational site.

(C) Enhancement of Afforestation Activities

The preparation of tree nursery site will contribute for enhancement of afforestation activities in and around the reservoir catchment area of approximately 25 km². The afforestation will contribute to various aspects such as water resources cultivation, prevention of soil erosion, conservation of fauna & flora, income by logging or fruit culture, and so on. That is, the afforestation will be beneficial not only for the natural conservation but also socio-economic improvement. In addition, it will also input to the national objective to restore the forest areas.

(D) Settlement of Pinatubo Victims

In the proposed resettlement area, the irrigation water as well as tap water will be supplied from the reservoir. The resettlers of approximately 70 or more families, including those from the proposed reservoir area, will be able to settle in the area based on the agricultural land including the irrigation area of more than 100 ha in total.

There are still several thousands of Mt. Pinatubo victims living in the temporary refugee camp. Although some of them have intention to live as a farmer, the most resettlement areas prepared by MPC are not for farmers and some resettlement areas for farmers do not have sufficient infrastructures. Accordingly, although the number of resettlers for the Pinatubo victims is quite limited, the resettlement scheme by the

project will become a good model as a resettlement area for farmers.

(E) Others

In addition to the above matters, some additional beneficial effects are anticipated as follows:

- The landscape in and around the dam & reservoir is more or less excellent so that the development for the recreation or tourism will have good potential.
- The reservoir will be rich in fish so that the fishing for recreation or fish cultivation for business will be possible.
- The eight locations of solar drier will be useful as the post-harvest facility which will contribute to the efficient harvest activities and reducing the labor force.
- In line with the project implementation and O & M activities, the technological level for agricultural production and O & M capacity for the structures will be brought up or increased.

In addition to the above, the beneficial aspects of the project are to be confirmed from the viewpoints of appropriateness as a Japanese grant aid project as summarizes as follows:

- (a) The objective beneficiaries are the whole people of Infanta (approx. 19,000 in population) in general and some Pinatubo victims coming to the resettlement area. And many of them will be categorized as the poor. The beneficiaries could be extended to the whole province with more than 2 million people, if considered the indirect ones.
- (b) The socio-economic situation as well as the infrastructures in the objective area will be remarkably improved so that the project would contribute to the welfare and living conditions of inhabitants.
- (c) The O & M activities are to be carried out by the budget prepared by the province in general. The budget for afforestation will be prepared by PENRO/DENR. The province already prepared a certain amount of budget and the additional budget will be prepared if necessary. For the technical aspects, the cooperative agencies such as NIA, BSWM, and DENR will assist the

province in the O & M guidance.

- (d) The project components agree with the objectives of the development plan of the nation, region, and province.
- (e) The agricultural production will be increased by the project and the farmers' living standard will be improved. However the economic benefit scale will be not so high in comparison with a large development project. The benefit for social aspects and environmental factors are rather remarkable.

The dam height is changed to 40 m from 28 m at the time of feasibility study. This change is necessary due to the deeper foundation excavation. The embankment volume is increased from approx. 400 thousands m³ to approx. 423 thousands m³, only nearly 5 % increase.

The project cost is increased remarkably from that of feasibility study (Jan. 1993) due to the change of unit prices, exchange rate, and so on. However, according to the economic evaluation study prepared for ICC by the provincial government in March 1997, the economic internal rate of return (EIRR) becomes 15.87 %. The rate is still high enough as a agricultural project, although the rate was 19.1% at the feasibility study. The net present value (NPV) is estimated at 109.567 million peso by the discount rate of 10% and the benefit and cost ratio(B/C) at 1.46.

The above mentioned economic evaluation does not include indirect benefit items (such as conservation & improvement of natural environment, improvement of inhabitants' living conveniences, resettlement of Pinatubo victims, etc.) which are also significant to the people in and around the Municipality of Infanta. If these indirect benefit can be properly calculated, the economic viability become much higher.

For the reference, the comparison with the Western Barrios Irrigation Project (WBIP), executed by Japanese grant aide a few years ago, is made. The EIRR of WBIP was 16.7%, however the irrigation area per unit volume of dam embankment is approx. 16 m²/m³ and that of Infanta project is approx. 30 m²/m³.

It is considered that the project implementation is appropriate from the economic viewpoint as well.

(f) There is no remarkable adverse impact from the results of the preliminary environmental impact assessment, if the construction works could be executed properly. On the contrary, some beneficial environmental impacts can be expected especially through the afforestation.

(g) The province has some Japanese grant aid projects carried out in the province, but by national agencies. It is expected that the province has a capacity to be the executing agency for the Japanese grant aid project, if the province can follow up the process carefully. In any case, it is necessary for the province to make positive effort to follow the necessary preparation including the budget charged to the Philippines side.

4.2 Recommendation

The project would have a lot of aspects on the improvement of present conditions in the municipality, as explained in the preceding section 4.1, which would contribute to BHN of the inhabitants. Accordingly it is considered to be significant to implement the project. However, the operation & maintenance after the project's completion, would need special care for expecting an effective function of the project. The project could be more effective and uninterrupted if the appropriate measures are taken for the following points:

(A) Budget Preparation

The budget preparation by the province is one of the key factors for the successful operation of the project. The province has to prepare a sufficient amount of budget for the land acquisition, compensation for relocation, staff salary, construction of secondary & tertiary canals, supplying power, building houses, maintenance & repair of structures/facilities, and so on based on the long term as well as short term plans.

(B) Organization and Coordination for O & M

The organization for O & M is already established in 1995. However it seems that the organization does not have reliable function yet. It is necessary for the provincial government to establish a functional coordination and follow up the effective operation. The cooperation by NIA among all the related agencies would be inevitable for the practical assistance to IA of the project.

(C) Positive Support by the Province

Although the provincial government is the responsible body for O & M of the project, the actual activities would be carried out mostly by the municipality of Infanta and the farmers. Accordingly the provincial government and the municipality have to establish a definite cooperative relation. That is, the province has to take positive support to LGU for strengthening the independent activities by the farmers for appropriate operation and maintenance of dam, canals and so on.

(D) Operation for Dam & Reservoir

For the proper O & M of dam & reservoir, special carefulness has to be taken especially for the arrangement of reliable site chief, inspection & observation of reservoir water quality, control of fishing activities, inspection & measurement of leakage water and so on.

(E) Construction of Secondary & Tertiary Canals

In connection with the secondary & tertiary canals to be constructed by the provincial side, it seems that the farmers have good experiences in the past through the activities for the existing irrigation systems. That is, the construction will be executed directly by the farmers with the assistance from the provincial government and the other cooperative agencies including NIA. It is essential for the province to establish the supporting system in regard to the engineering guidance, financial assistance, providing equipment, etc. for the earlier operation of the new system.

(F) Maintenance of Roads

The roads to be constructed are generally gravel roads which would need occasional maintenance & repair. It is necessary to establish an effective maintenance system by using the equipment (dump truck and motor grader) which will be procured by the Japanese side. It is also advised that the equipment should be well maintained and not used for the other purposes or locations.

(G) Land Preparation in the Resettlement Area

The proposed irrigation area in the resettlement area is mostly not used at present. The area is generally flat but with gentle & undulated slopes. It is essential to make careful plan for the land preparation by cutting and embankment. Especially the effective use of the surface layer with organic soils would be noteworthy.

(H) Infrastructure for the Resettlement Area

After the resettlement, one new small village with 70 or more families will appear on the hill. It is necessary for the province to take care about long-term dwelling

and provide the infrastructures such as power supply, tele-communication facilities, school, medical care center, and so on as early as possible. Further the various guidance and supports should be also given to the resettlers until they can independently live in the area.

(I) Selection of Resettlers and Resettlement Schedule

There are four kinds of resettlers ; Pinatubo victims living in a refugee camp, Pinatubo victims already living in the municipality, people living in and around the proposed reservoir area, and people living in the proposed resettlement area at present. It needs special care for the selection of appropriate and qualified resettlers. It is suggested to prepare the basic criteria for the selection and establish a committee for the proper selection. In addition, the earlier arrangement of resettlement based on the definite schedule is also necessary for the smooth progress of construction.

(J) Afforestation

The afforestation activities will be carried out based on the afforestation plan and the new nursery should be effectively used. It is essential for the province to prepare a detailed annual plan including the financial factor. The activity will be done in cooperation with DENR so that the definite cooperative system should be established. Further, special attention should be taken for the inspection & maintenance after planting in order to prevent burning, control illegal cutting, replantat or protect weak trees and so on.

(K) Follow-up of O & M Conditions by the Japanese Side

The O & M activities are carried out fundamentally only by the Philippine side, however it is considerable to make a follow-up inspection by the Japanese consultants or the other agencies which can be made, for example, once several months at least for several years after the completion. It would be quite effective to confirm the situation periodically and provide the necessary guidance and assistance if any problems happen. In addition, it is also considerable that NGO or Japanese volunteers of JICA will be dispatched for some years to give a constant assistance in the project site.

(L) Landscape from the Dam & Reservoir Site

The landscape from the dam & reservoir site is beautiful and more or less magnificent. There is a potential for tourism or recreational development in the future. It is suggested to make a plan of environmental beautification in the dam & reservoir site area in consideration of the future development.

(M) Meteo-Hydrological Observation

There is no meteo-hydrological observatory in the project area at present except a temporary water gauging stations established during the basic design study in 1996. It is suggested to establish a meteo-hydrological observatory (at least the rainfall gauge) at the dam site and also to carry out the periodical observation or measurement of sediments and water quality in the reservoir. The data will be useful for the appropriate operation and maintenance of the project facilities.

(N) Land Aquisition and Compensation

For the smooth execution of the project, it is essential to prepare the land aquisition and compensation in time for the land area as listed as follows:

- Reservoir area
- Dam construction site , including material sites, construction roads, temporary facilities yards, etc.
- Canal route (canal extension route, canal enlarged area, etc.)
- Resettlement area and nursery area
- Road (to be newly constructed or improved)
- Post-harvest areas

The provincial government already started the investigation and negotiation for this purpose and the agreement from the inhabitants and/or land owners are almost obtained for the reservoir areas and resettlement area, according to the province. However, it is necessary to continue the activities for this purpose to confirm the aquisition in detail.

(O) ECC and ICC

It is necessary for the Province to obtain ECC and ICC for the project in prior to the decision of the project implementation by the Japanese side. As of April, both ECC and ICC are not yet obtained although they are on the way of approval. It is actually much behind the schedule.

Furthermore, the additional survey will be successively carried out to improve the precision of the basic design.