

## CHAPTER 6. AQUACULTURE DEVELOPMENT



## CHAPTER 6 AQUACULTURE DEVELOPMENT

### 6-1 Improvement of Brackishwater Fish Culture Demonstration Farm

#### 6-1-1 Reconstruction and Expansion of Fish Pond

The existing demonstration farm for fish and shrimp in Tamayo, Sta. Cruz has a total area of 4.7 ha with eight ponds varying in sizes from 0.25 ha to 1.4 ha (three nursing ponds and five grow-out ponds). For the year round shrimp culture experimental operation, at least 12 ponds with an area of about 0.5 ha is required.

The existing bank of the culture ponds is narrow and weak against heavy rainfall and also insufficient transport for various materials by small trucks. The depth of the ponds are shallow hence it is difficult to maintain a suitable temperature for appetizing feed by the animal and poly culture. The temperature records of the farm is shown often more than 30°C. The pond soil shows 3.6 - 3.7 PH which is extremely high acidity and not suitable for culturing fish and crustaceans.

The farming ponds should, therefore, be reconstructed and the area extended to about 10 ha with reinforced banks and proper depth ponds suitable for culturing and testing various marine animals. (refer to Table 6-1-1 and Figure 6-1-1)

#### 6-1-2 Objectives to be Undertaken in Laboratory

It is fundamental problems and essential to studying various condition of water temperature, quality of the water, water salinity, condition of culture ponds and bottom soil, system of culture, environmental condition and quality of feeds together with compound of ingredients by species for each stages of growing for fish and crustaceans. And proceeding publication of the result of the study for popularizing to the member of aquaculture farmers in Marinduque. Objectives to be undertaken in the laboratory are summarized below.

- To study the prevention of diseases for the animals.
- To develop new technology in aquaculture.
- To develop a low cost but high animal feeds
- To experiment culture of new species of fish.
- To collect data on culture of new species of fish.
- To publish studies being carried out in the laboratory.

For the purpose of the above mentioned objectives of studies and demonstration of aquaculture technology at the Tamayo laboratory, a shrimp hatchery plant, a pilot processing plant and an ice making plant with a cold storage are required.

#### 6-2 Shrimp Hatchery Plant

Tamayo, Sta. Cruz is the center of brackishwater aquaculture and about 65% of brackishwater fishponds in the province is located in this municipality.

For supply of post larva (PL) to the member of Marinduque aquaculture industry (or Cooperative Union) with reasonable price and continuous supply should be required self-financing operation of the hatchery plant. Namely, to secure obtaining mother shrimp, replenishment of various materials, charge and fee of energies (fuel, electricity, etc.) and personal expenses.

The hatchery plant will have a capacity of supplying PL to cover a minimum 500 ha of shrimp ponds with density of about 60 - 70 thousand PLs/ha with two crops per year (culture period is 120 - 140 days/crop with size of under 16/20 per lb.). (refer to Table 6-2-1 and Figure 6-2-1)

#### 6-3 Pilot Processing Plant and Ice Plant

The processing of agro-fisheries products will conform with the standard set for the processing of exportable products. It will not only maintain the freshness of the products but also increase its

commercial value. Demonstration on the proper handling of agro-fishery products will be conducted in the training center, specifically, for farmers and other interested groups as well as fish processing industry. (refer to Figures 6-3-1 and 6-3-2)

Basic facilities of the processing plant:

- One-line of shrimp or fish processing (in capacity equivalent 2,000 lbs/hr shrimp processing)
- Horizontal plate freezer (3 tons/day)
- Cold store  $-30^{\circ}\text{C}$  (115 cu.m)
- Automatic plate ice making machine (10 MT/day) with 15 MT ice store

Table 6-1-1 List of Shrimp Farm and Equipments

| <u>Item</u>                   | <u>Quantity</u> |
|-------------------------------|-----------------|
| 1. Main Gate                  | 3 units         |
| 2. Secondary Gate             | 18 "            |
| 3. Civil Engineering Works    | 10 ha           |
| 4. Road                       | 450 m           |
| 5. Axial Flow Pump            | 3 units         |
| 6. Service Vehicle            | 1 unit          |
| 7. Paddle Wheel               | 24 units        |
| 8. Generator (Standby) 50 KVA | 1 unit          |

Table 6-2-1 List of Proposed Prawn Hatchery w/10 Million Capacity

Quantity

Description

|    | Description                              | Quantity |
|----|--|----------|
| 1) | Water Tank                               |          |
| a) | Folycarbonate Tank 2 ton                 | 4 pcs.   |
| b) | " " 1 "                                  | 6 "      |
| c) | " " 0.5 "                                | 10 "     |
| d) | " " 0.1 "                                | 10 "     |
| e) | Hatching brine shrimp eggs 1 "           | 6 "      |
| f) | Inside Tank for Breeding 4m x 3m x 1.5m  | 12 Nos.  |
| g) | Outside Tank for Breeding 4m x 6m x 1.5m | 14 Nos.  |
| 2) | Water Supply Facilities (Sea Water)      |          |
| a) | Sea-water Pump 7.5 kw                    | 2 pcs.   |
| b) | " " 5.0 kw                               | 2 "      |
| c) | " " 1.5 kw                               | 1 "      |
| d) | Portable under water pump 0.75 kw        | 4 "      |
| e) | High Level Tank 7 m high                 | 1 "      |
| f) | Piping (construction arrange at spot)    |          |
| g) | Machine for Electric works               |          |
| h) | Sterilizer                               | 2 "      |
| 3) | Water Supply Facilities (Fresh Water)    |          |
| a) | Well and High Level Tank                 |          |
| b) | Water Pump 0.75 kw (200 L/Min.)          | 2 pcs.   |
| c) | Sanitation facilities                    |          |
| d) | Piping                                   |          |
| 4) | Air Reaction System                      |          |
| a) | Root Blower 3.7 kw                       | 2 pcs.   |
| b) | Air Pipe (with Cock)                     | 1 set    |
| c) | Air Stone                                | 400 pcs. |
| 5) | Generator and Transmission               |          |
| a) | Generator, Diesel Engine 35 KVA          | 1 unit   |
| b) | " " 15 KVA                               | 1 "      |
| c) | Portable Gasoline Generator 5 KVA        | 1 "      |
| d) | Transformer 2 kw                         | 2 "      |
| e) | Automatic Voltage Regulator 1 kw         | 1 "      |
| f) | Trans-Distributor                        | 1 set    |
| g) | Distributing Board and Wiring            |          |
| 6) | Domestic Electrification                 |          |
| a) | Juice Mixer                              | 2 units  |
| b) | Refrigerator                             | 1 "      |
| c) | Freezer                                  | 1 "      |
| d) | Coffee Mill                              | 1 "      |
| 7) | Laboratory Materials and Equipments      |          |
| a) | Microscope                               | 2 units  |
| b) | " " Three Lenses                         | 1 "      |
| c) | Thermometer, 0 - 100 °C                  | 10 pcs.  |
| d) | Hydrometer                               | 5 sets   |
| e) | DO Meter                                 | 1 "      |
| f) | PH Meter                                 | 2 "      |
| g) | Ammonia Meter                            | 1 "      |
| h) | Salinity Refractometer, S-100            | 2 "      |
| i) | Dissecting Instrument Set                | 1 "      |
| j) | Electric Balances, 100 gr.               | 2 "      |
| k) | Chemical Balance                         | 1 "      |
| l) | Heater Set                               | 10 "     |
| 8) | Articles of Consumption                  |          |
| a) | Glass Instrument for test                | 1 set    |
| b) | Hose Cock                                | 1 "      |
| c) | Net (Polyethylene, Nylon)                | 1 "      |
| d) | Stainless Wire Net, 30 m                 | 1 "      |
| e) | Assorted Feed for Shrimp                 | 1 "      |
| f) | Medicines                                | 1 "      |
| g) | Materials for Tank Repairing             |          |
| h) | Articles of Consumption                  |          |
| 9) | Hatchery Building                        | 360 sq.m |

Figure 6-1-1 Brackishwater Fish Culture Demonstration Farm

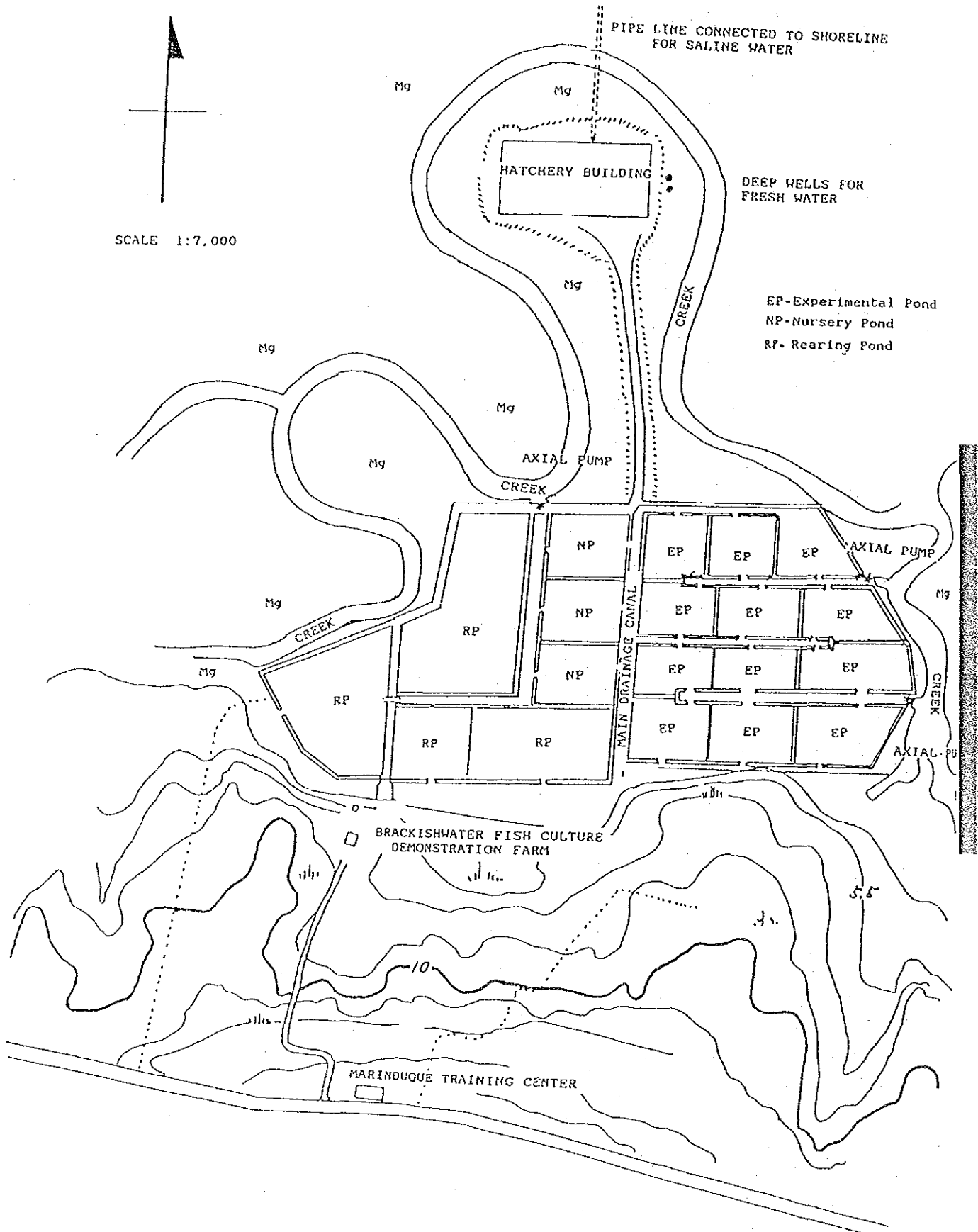
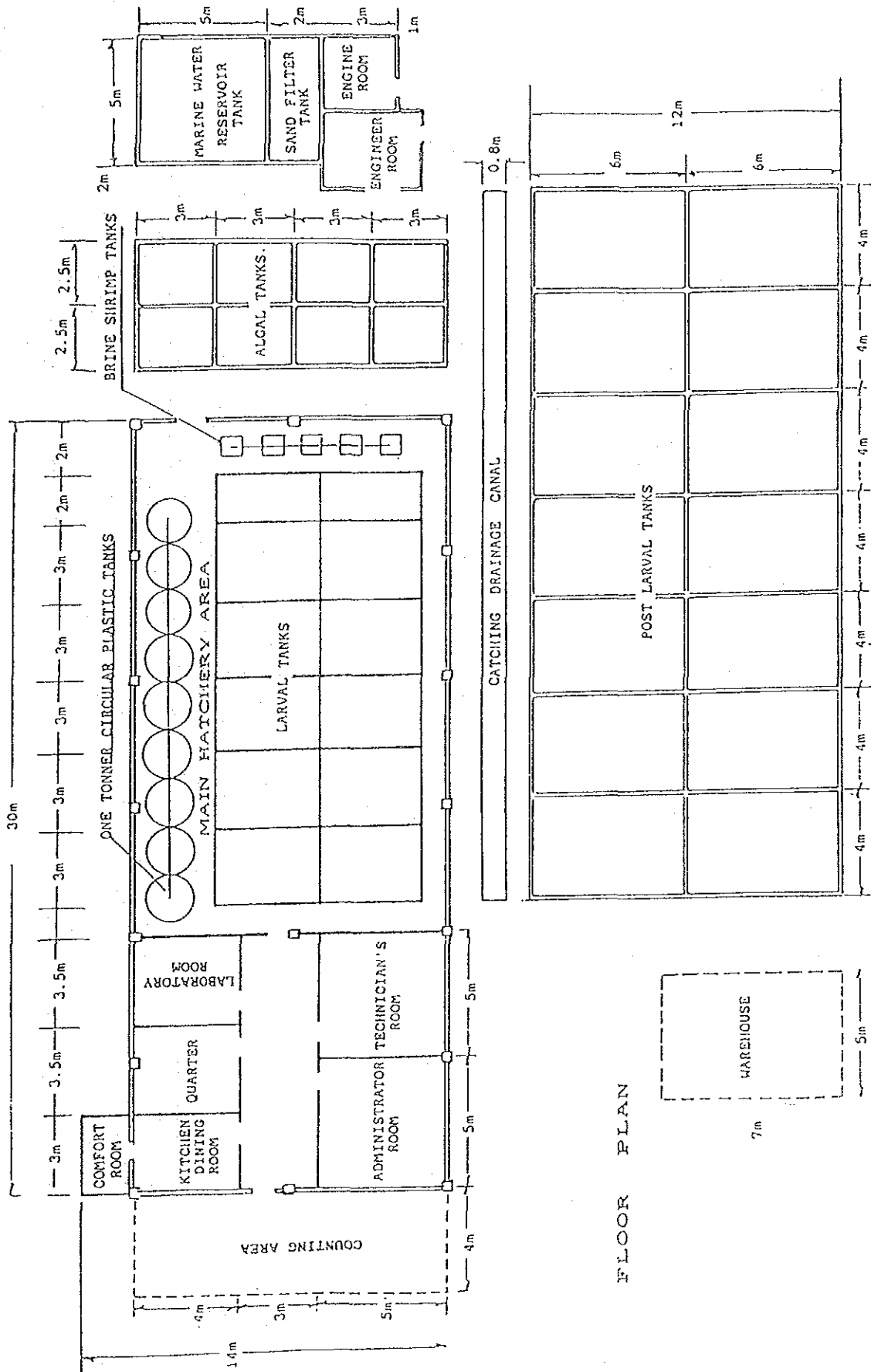




Figure 6-2-1 Shrimp Hatchery Plant



FLOOR PLAN

Figure 6-3-1 Fish & Shrimp Processing and Feed Plant

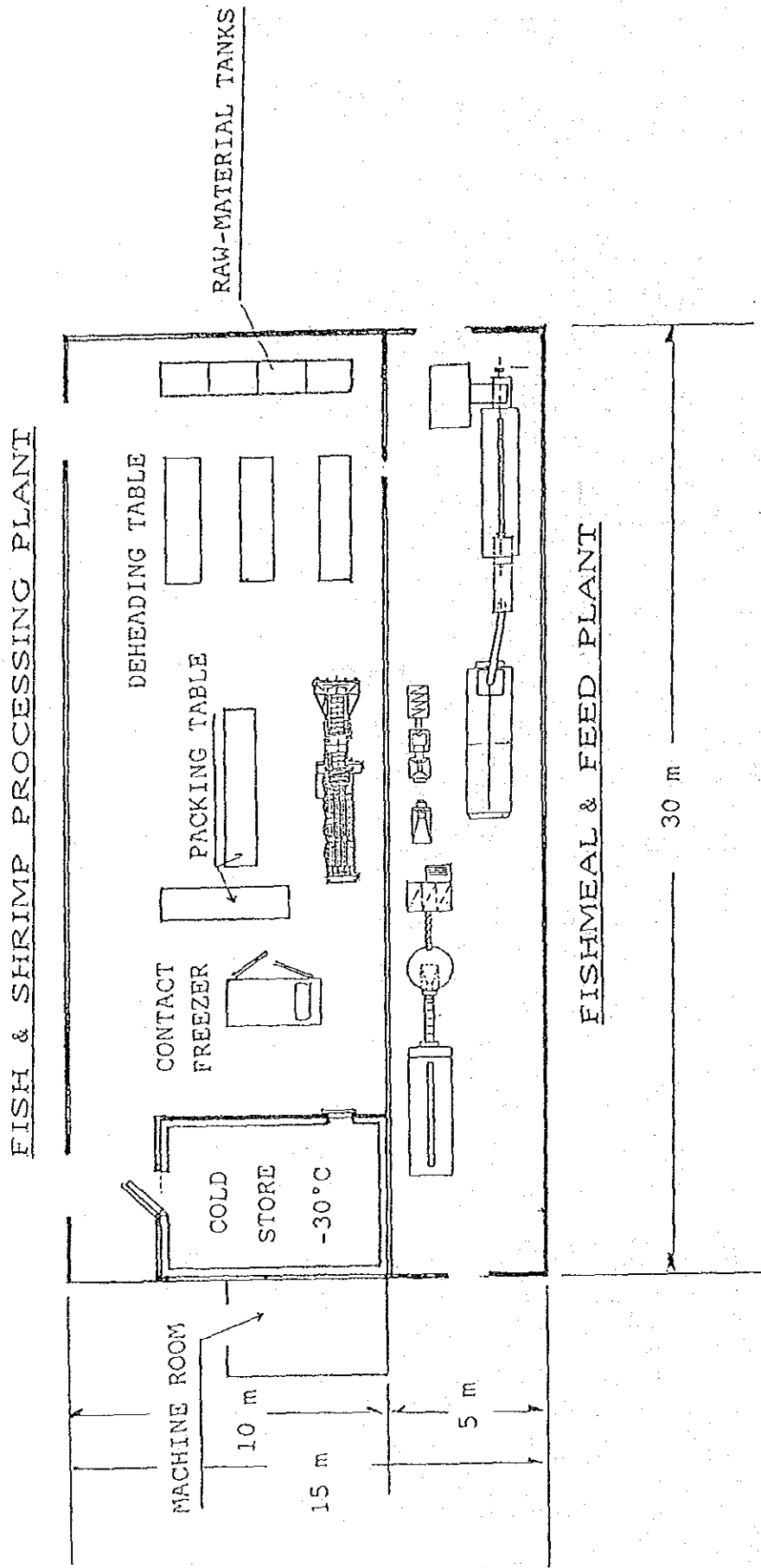
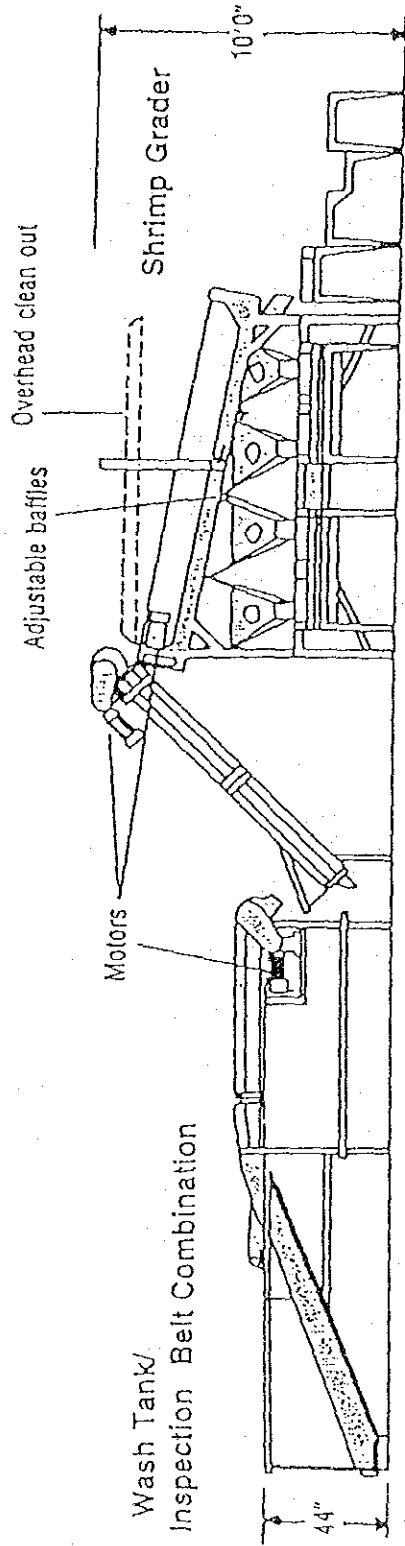
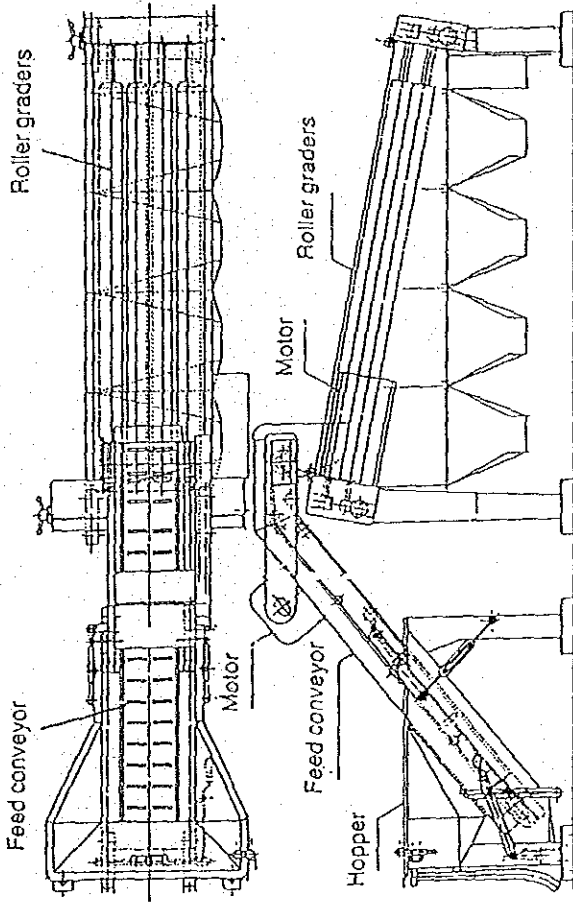


Figure 6-3-2.

*Double-type shrimp grader*



Grading capacity 2000 lbs/hr — 5 sizes



## CHAPTER 7. PROJECT COST



## CHAPTER 7 PROJECT COST

### 7-1 Estimate Condition

The quantities of works were carefully calculated and reviewed based on the preliminary design in each development project of MADPP.

The construction mode is contract basis and basic unit costs were determined based on the unit prices that have been used in the similar projects in Region IV including the Marinduque province. Price year in this cost estimate is June 1989. For materials and equipment to be procured from outside of the Philippines, the CIF price at Manila is applied. The exchange rate between Philippine peso and U.S. dollar is adapted at 21.80 pesos (US\$1.00 = 21.80 Philippine pesos). Costs for land acquisition and compensation are not included in the project cost.

20% of construction cost as engineering and administration cost, and 15% as physical contingency were added to the project cost.

### 7-2 Project Cost

The total project cost of MADPP at the current price is estimated at 376 million pesos. (refer to Tables 7-2-1 and 7-2-2)

### 7-3 Operation and Maintenance Cost

The annual operation and maintenance cost for MADPP is amounted at nine million pesos as shown in Tables 7-3-1 and 7-3-2.

Table 7-2-1 Summary of Project Cost for MADPP  
(As of June 1989)

(Unit: 1,000 ₱)

| Description                                | Q'ty | Unit | Amount         |
|--|------|------|----------------|
| 1. Agricultural Development                | 1    | lot  | <u>62,200</u>  |
| 2. Agricultural Infrastructure Development |      |      |                |
| 1) Irrigation Development                  | 630  | ha   | 185,300        |
| 2) Rural Road Development                  | 25   | km   | 26,000         |
| 3) Village Water Supply Development        | 1    | lot  | 51,200         |
| <u>Sub-total of 2</u>                      |      |      | <u>262,500</u> |
| 3. Rural Infrastructure Development        |      |      |                |
| 1) Rural Electrification Development       | 12.5 | km   | 4,800          |
| 2) Traffic System Development              | 17   | unit | 1,000          |
| 3) Education Development                   | 11   | "    | 1,500          |
| <u>Sub-total of 3</u>                      |      |      | <u>7,300</u>   |
| 4. Aquaculture Development                 | 1    | lot  | <u>44,000</u>  |
| <u>Total (1~4)</u>                         |      |      | <u>376,000</u> |

Table 7-3-1 Summary of Annual Operation and Maintenance Cost  
for MADPP

(Unit: 1,000 ₱)

| Description                                | Q'ty | Unit | Amount       |
|--|------|------|--------------|
| 1. Agricultural Development                | 1    | lot  | <u>5,200</u> |
| 2. Agricultural Infrastructure Development |      |      |              |
| 1) Irrigation Development                  | 630  | ha   | 600          |
| 2) Rural Road Development                  | 25   | km   | 330          |
| 3) Village Water Supply Development        | 1    | lot  | 370          |
| <u>Sub-total of 2</u>                      |      |      | <u>1,300</u> |
| 3. Rural Infrastructure Development        |      |      |              |
| 1) Rural Electrification Development       | 12.5 | km   | 44           |
| 2) Traffic System Development              | 17   | unit | 10           |
| 3) Education Development                   | 11   | "    | 46           |
| <u>Sub-total of 3</u>                      |      |      | <u>100</u>   |
| 4. Aquaculture Development                 | 1    | lot  | <u>2,400</u> |
| <u>Total (1~4)</u>                         |      |      | <u>9,000</u> |



Table 7-2-2 Breakdown of Project Cost (1/5)

(Unit: 1,000 ₱)

| Description   | Q'ty | Unit   | Rate  | Amount  |     |
|---|------|--------|-------|---------|-----|
| <b>1. Agricultural Development</b>                        |      |        |       |         |     |
| 1) Marinduque Agricultural Development<br>Production Farm | 1    | lot    |       | 25,000  | :9  |
| 2) DA Municipal Nursery                                   | 1    | "      |       | 1,600   | :10 |
| 3) Irrigated Paddy Demonstration Farm                     | 1    | "      |       | 1,360   | :11 |
| 4) Rainfed Paddy/Diversified Crops Demonstration Farm     | 1    | "      |       | 1,310   | :12 |
| 5) Post-Harvest of Rice                                   | 1    | "      |       | 950     | :13 |
| 6) Post-Harvest of Corn                                   | 1    | "      |       | 270     | :14 |
| 7) Rehabilitation of Marinduque Breeding Station          | 1    | "      |       | 15,600  | :15 |
| <u>Sub-total</u>  |      |        |       | 46,090  |     |
| Engineering and Administration Cost                       |      |        |       | 9,200   |     |
| Physical Contingency                                      |      |        |       | 6,910   |     |
| <u>Total</u>  |      |        |       | 62,200  |     |
| <b>2. Irrigation Development</b>                          |      |        |       |         |     |
| 1) Reservoir Dam  | 1    | lot    |       | 83,000  | :16 |
| 2) Irrigation Canal                                       | 1    | "      |       | 48,550  | :17 |
| 3) On-farm Facility                                       | 630  | ha     | 3.0   | 1,890   |     |
| 4) Drainage Canal   | 630  | "      | 9.0   | 5,670   |     |
| <u>Sub-total</u>  |      |        |       | 139,110 |     |
| Engineering and Administration Cost                       |      |        |       | 27,800  |     |
| Physical Contingency                                      |      |        |       | 18,390  |     |
| <u>Total</u>  |      |        |       | 185,300 |     |
| <b>3. Rural Road Development</b>                          |      |        |       |         |     |
| 1) Improvement of Harm-to-market Road<br>Type B           | 5.5  | km     | 600   | 3,300   |     |
| Type C  | 4.5  | "      | 400   | 1,800   |     |
| <u>Sub-total</u>  |      |        |       | 5,100   |     |
| 2) Construction of Farm Road (Type D)                     | 15   | km     | 540   | 8,100   |     |
| 3) Construction of Multi-purpose Pavement                 | 20   | places | 300   | 6,000   |     |
| <u>Total</u>  |      |        |       | 19,200  |     |
| Engineering and Administration Cost                       |      |        |       | 3,840   |     |
| Physical Contingency                                      |      |        |       | 2,960   |     |
| <u>Grand Total</u>  |      |        |       | 26,000  |     |
| <b>4. Village Water Supply Development</b>                |      |        |       |         |     |
| 1) Tagum-Angas Village Water Supply                       |      |        |       |         |     |
| 1- Ground Reservoir V = 300 m <sup>3</sup>                | 1    | unit   |       | 1,500   |     |
| 2- Major Pipeline $\phi 8''$ ( $\phi 200$ )               | 6    | km     | 2,700 | 16,200  |     |
| 3- Distribution Pipeline $\phi 6''$ ( $\phi 150$ )        | 5    | "      | 1,900 | 9,500   |     |
| 4- - do - $\phi 4''$ ( $\phi 100$ )                       | 6    | "      | 1,200 | 7,200   |     |
| 5- - do - $\phi 2''$ ( $\phi 50$ )                        | 8    | "      | 400   | 3,200   |     |
| 6- Communal Faucets                                       | 70   | set    | 4     | 280     |     |
| <u>Sub-total</u>  |      |        |       | 37,880  |     |

Table 7-2-2 Breakdown of Project Cost (2/5)

(Unit: 1,000 ₱)

| Description   | Q'ty | Unit   | Rate | Amount        |
|---|------|--------|------|---------------|
| Engineering and Administration Cost   |      |        |      | 7,600         |
| Physical Contingency  |      |        |      | 5,720         |
| <u>Total</u>  |      |        |      | <u>51,200</u> |
| 5. Rural Electrification Development  |      |        |      |               |
| 1) Transmission Line 69 KV  | 8    | km     | 360  | 2,880         |
| 2) Distribution Line 1 ϕ  | 3    | "      | 100  | 300           |
| 3) Secondary Line   | 1.5  | "      | 80   | 360           |
| <u>Sub-total</u>  |      |        |      | <u>3,540</u>  |
| Engineering and Administration Cost   | L.S. |        |      | 710           |
| Physical Contingency  | "    |        |      | 550           |
| <u>Total</u>  |      |        |      | <u>4,800</u>  |
| 6. Traffic System Development   |      |        |      |               |
| 1) Waiting Shed   | 17   | place  | 45   | 765           |
| Engineering and Administration Cost   | L.S. |        |      | 153           |
| Physical Contingency  | "    |        |      | 82            |
| <u>Total</u>  |      |        |      | <u>1,000</u>  |
| 7. Education Development  |      |        |      |               |
| 1) Rehabilitation of Elementary School  | 9    | school | 100  | 900           |
| 2) Construction of School Toilet  | 2    | unit   | 120  | 240           |
| <u>Sub-total</u>  |      |        |      | <u>1,140</u>  |
| Engineering and Administration Cost   | L.S. |        |      | 230           |
| Physical Contingency  | "    |        |      | 130           |
| <u>Total</u>  |      |        |      | <u>1,500</u>  |
| 8. Aquaculture Development  |      |        |      |               |
| 1) Improvement of Brackishwater Demonstration Farm                            | 1    | lot    |      | 6,700 :18     |
| 2) Construction of Laboratory of Brackishwater Aquaculture Demonstration Farm |      |        |      |               |
| 1- Shrimp Hatchery Plant  | 1    | "      |      | 6,800 :19     |
| 2- Pilot Processing Plant and Ice Plant                                       | 1    | "      |      | 19,200 :20    |
| <u>Sub-total</u>  |      |        |      | <u>26,000</u> |
| <u>Total</u>  |      |        |      | <u>32,700</u> |
| Engineering and Administration Cost   | L.S. |        |      | 6,500         |
| Physical Contingency  | "    |        |      | 4,800         |
| <u>Grand Total</u>  |      |        |      | <u>44,000</u> |

Table 7-2-2 Breakdown of Project Cost (3/5)

| Description  | Q'ty  | Unit           | Unit: 1,000P |                    |
|--|-------|----------------|--------------|--------------------|
|  |       |                | Rate         | Amount<br>(P1,000) |
| <b>9. Marinduque Agricultural Development and Promotion Farm</b> |       |                |              |                    |
| Office, Research room, Lecture room etc.                         | 1,250 | m <sup>2</sup> | 8            | 10,000             |
| Warehouse, Working house and Isolation chamber                   | 540   | m <sup>2</sup> | 4            | 2,160              |
| Animal shed  | 100   | m <sup>2</sup> | 3            | 300                |
| Office furnitures  | 1     | lot            |              | 330                |
| Vehicles   | 1     | lot            |              | 1,450              |
| Experiential & Training Equipment                                | 1     | lot            |              | 3,135              |
| Weather observation equipment                                    | 1     | lot            |              | 950                |
| Land consolidation   | 2     | ha             | 60           | 120                |
| Paddy field reclamation  | 1     | ha             |              | 170                |
| Irrigation facility  | 4.5   | ha             | 400          | 1,800              |
| Deepwell   | 1     | lot            |              | 200                |
| Farm machine   | 1     | lot            |              | 2,100              |
| Miscellaneous  | L.S.  |                |              | 2,285              |
| <u>Total</u>   |       |                |              | <u>25,000</u>      |
| <b>10. DA Municipal Nursery</b>                                  |       |                |              |                    |
| Deep well  | 1     | lot            |              | 200                |
| Irrigation facility  | 0.5   | ha             | 400          | 200                |
| Working house  | 100   | m <sup>2</sup> | 4            | 400                |
| Pick-up truck 1.0 t  | 2     | unit           | 230          | 460                |
| Soil fumigator   | 1     | "              |              | 200                |
| Miscellaneous  | L.S.  |                |              | 140                |
| <u>Total</u>   |       |                |              | <u>1,600</u>       |
| <b>11. Irrigated Paddy Demonstration Farm</b>                    |       |                |              |                    |
| Power tiller   | 1     | unit           |              | 140                |
| Carabao  | 1     | head           |              | 8                  |
| Power sprayer  | 2     | unit           | 36           | 72                 |
| Power duster   | 2     | "              | 50           | 100                |
| Power thresher   | 1     | "              |              | 62                 |
| Rice mill 0.5 t/hr   | 1     | "              |              | 460                |
| Warehouse  | 100   | m <sup>2</sup> | 4            | 400                |
| Miscellaneous  | L.S.  |                |              | 118                |
| <u>Total</u>   |       |                |              | <u>1,360</u>       |
| <b>12. Rainfed Paddy/Diversified Crops Demonstration Farm</b>    |       |                |              |                    |
| Power tiller 10 HP   | 1     | unit           |              | 140                |
| Carabao  | 1     | head           |              | 8                  |
| Hand sprayer knap-sack type                                      | 5     | unit           | 15           | 75                 |
| Portable hand duster   | 5     | "              | 10           | 50                 |
| Manual thresher  | 1     | "              |              | 14                 |
| Power corn thresher  | 1     | "              |              | 50                 |
| Rice mill 0.5 t/hr   | 1     | "              |              | 460                |
| Warehouse  | 100   | m <sup>2</sup> | 4            | 400                |
| Miscellaneous  | L.S.  |                |              | 113                |
| <u>Total</u>   |       |                |              | <u>1,310</u>       |

Table 7-2-2 Breakdown of Project Cost (4/5)

|   |               |                |      | Unit:         | 1,000P |
|---|---------------|----------------|------|---------------|--------|
| Description                                       | Q'ty          | Unit           | Rate | Amount        |        |
| 13. Post-Harvest of Rice                          |               |                |      |               |        |
| Warehouse   | 100           | m <sup>2</sup> | 4    | 400           |        |
| Rice mill 0.5 t/hr                                | 1             | unit           |      | 460           |        |
| Miscellaneous                                     | L.S.          |                |      | 90            |        |
| <u>Total</u>                                      |               |                |      | <u>950</u>    |        |
| 14. Post-Harvest of Corn                          |               |                |      |               |        |
| Warehouse   | 50            | m <sup>2</sup> | 4    | 200           |        |
| Power corn thresher                               | 1             | unit           |      | 50            |        |
| Miscellaneous                                     | L.S.          |                |      | 20            |        |
| <u>Total</u>                                      |               |                |      | <u>270</u>    |        |
| 15. Rehabilitation of Marinduque Breeding Station |               |                |      |               |        |
| Animal shed                                       | 660           | m <sup>2</sup> | 3    | 1,980         |        |
| Office building                                   | 100           | m <sup>2</sup> | 8    | 800           |        |
| Pig pen   | 240           | m <sup>2</sup> | 4    | 960           |        |
| Motor pool  | 300           | m <sup>2</sup> | 1    | 300           |        |
| Warehouse   | 200           |                | 4    | 800           |        |
| Water supply system w/deepwell, water tank        | 1             | unit           |      | 500           |        |
| Fence   | 10            | km             | 150  | 1,500         |        |
| Equipment   | 1             | lot            |      | 5,700         |        |
| Pick-up truck 1.0 t                               | 2             | unit           | 230  | 460           |        |
| Station wagon 4 WD                                | 1             | unit           |      | 460           |        |
| Motorcycle  | 5             | unit           | 46   | 230           |        |
| Animals   |               |                |      | 500           |        |
| Miscellaneous                                     |               |                |      | 1,410         |        |
| <u>Total</u>                                      |               |                |      | <u>15,600</u> |        |
| 16. Reservoir Dam (Tagun-Angas)                   |               |                |      |               |        |
| Dam embankment V = 181,000 m <sup>3</sup>         | 1             | lot            |      | 22,000        |        |
| Dam foundation                                    | 1             | lot            |      | 8,900         |        |
| Spilway & bridge                                  | 1             | lot            |      | 32,600        |        |
| Outlet works w/steel gate                         | 1             |                |      | 12,300        |        |
| Temporary works                                   | L.S.          |                |      | 7,200         |        |
| <u>Total</u>                                      |               |                |      | <u>83,000</u> |        |
| 17. Tagum-Angas Irrigation Facility               |               |                |      |               |        |
| Main conduit                                      | 2,660         | m              | 6.5  | 17,290        |        |
| Siphon  | 400           | m              | 8.0  | 3,200         |        |
| Irrigation canal - Main 2                         | 930           | m              | 2.0  | 1,860         |        |
| Irrigation canal - Main 3                         | 1,400         | m              | 2.0  | 2,800         |        |
| Irrigation canal - Main 4                         | 5,500         | m              | 2.0  | 11,000        |        |
| Irrigation canal - Main 5                         | 1,000         | m              | 2.0  | 2,000         |        |
| Lateral canal                                     | 13,000        | m              | 0.8  | 10,400        |        |
| <u>Total</u>                                      | <u>24,890</u> | <u>m</u>       |      | <u>48,550</u> |        |

Table 7-2-2 Breakdown of Project Cost (5/5)

| Description  | Q'ty | Unit           | Unit: 1,000P |               |
|--|------|----------------|--------------|---------------|
|  |      |                | Rate         | Amount        |
| <b>18. Improvement of Brackishwater Demonstration Farm</b> |      |                |              |               |
| Main gate  | 3    | unit           | 63           | 189           |
| Secondary gate   | 18   | unit           | 42           | 756           |
| Fish pond  | 10   | ha             | 280          | 2,800         |
| Road   | 450  | m              | 0.8          | 360           |
| Axial flow pump  | 3    | unit           | 37           | 111           |
| Pick-up  | 2    | unit           | 230          | 460           |
| Paddle wheel   | 24   | unit           | 15           | 360           |
| Generator 50 KVA   | 1    | unit           | 600          | 600           |
| Miscellaneous  | L.S. |                |              | 1,064         |
| <u>Total</u>   |      |                |              | <u>6,700</u>  |
| <b>19. Shrimp Hatchery Plant</b>                           |      |                |              |               |
| Water Tank   | 1    | lot            |              | 500           |
| Water Supply Facilities (Sea water)                        | 1    | lot            |              | 600           |
| - do - (Fresh water)                                       | 1    | lot            |              | 400           |
| Air Ration System  | 1    | lot            |              | 100           |
| Generator & Transmission                                   | 1    | lot            |              | 1,100         |
| Laboratory Materials & Equipment                           | 1    | lot            |              | 700           |
| Hatchery Building  | 360  | m <sup>2</sup> |              | 3,400         |
| <u>Total</u>   |      |                |              | <u>6,800</u>  |
| <b>20. Pilot Processing Plant and Ice Plant</b>            |      |                |              |               |
| One-line processing line for shrimp/fish                   | 1    | unit           |              | 700           |
| Horizontal plate freezer 3 ton/day                         | 1    | unit           |              | 4,700         |
| Cold store -30°C, 115 m <sup>3</sup>                       | 1    | unit           |              | 2,600         |
| Ice making machine 10 t/day                                | 1    | unit           |              | 5,500         |
| Ice store 15 t   | 1    | unit           |              | 1,600         |
| Building   | 300  | m <sup>2</sup> | 8            | 2,400         |
| Miscellaneous  |      |                |              | 1,700         |
| <u>Total</u>   |      |                |              | <u>19,200</u> |

Table 7-3-2 Breakdown of Annual Operation and Maintenance Cost

(Unit: 1,000 ₱)

| Description   | Q'ty        | Unit     | Rate | Amount       |
|---|-------------|----------|------|--------------|
| 1. Agricultural Development                                   |             |          |      |              |
| 1) Marinduque Agricultural Development Promotion Farm         | 1           | place    |      | 2,750        |
| 2) DA Municipal Nursery                                       | 1           | "        |      | 140          |
| 3) Irrigated Paddy Demonstration Farm                         | 1           | "        |      | 150          |
| 4) Rainfed Paddy/Diversified Crops Demonstration Farm         | 1           | "        |      | 110          |
| 5) Post-Harvest of Rice                                       | 1           | unit     |      | 60           |
| 6) Post-Harvest of Corn                                       | 1           | "        |      | 10           |
| 7) Rehabilitation of Marinduque Breeding Station              | 1           | place    |      | 1,980        |
| <u>Sub-total</u>  |             |          |      | <u>5,200</u> |
| 2. Irrigation Development                                     |             |          |      |              |
| 1) Tagum-Angas Reservoir Dam                                  | 1           | lot      |      | 348          |
| 2) Irrigation/Drainage Facility                               | 630         | ha       | 0.4  | 252          |
| <u>Total</u>  |             |          |      | <u>600</u>   |
| 3. Rural Road Development                                     |             |          |      |              |
| 1) Farm-to-Market Road  |             |          |      |              |
| Type B  | 5.5         | km       | 24   | 132          |
| Type C  | 4.5         | "        | 15   | 68           |
| <u>Sub-total</u>  | <u>10.0</u> | <u>"</u> |      | <u>200</u>   |
| 2) Farm Road (Type D)   | 15          | km       | 6    | 90           |
| 3) Multi-purpose Pavement                                     | 20          | place    | 2    | 40           |
| <u>Total</u>  |             |          |      | <u>330</u>   |
| 4. Village Water Supply Development                           |             |          |      |              |
| 1) Tagum-Angas Village Water Supply                           | 1           | lot      |      | 370          |
| <u>Total</u>  |             |          |      | <u>370</u>   |
| 5. Rural Electrification Development                          |             |          |      |              |
| 1) Transmission Line  | 360         | MWH      | 0.06 | 22           |
| 2) Distribution & Secondary Line                              | 360         | "        | 0.06 | 22           |
| <u>Total</u>  |             |          |      | <u>44</u>    |
| 6. Traffic System Development                                 |             |          |      |              |
| 1) Waiting Shed   | 17          | place    | 0.6  | 10           |
| <u>Total</u>  |             |          |      | <u>10</u>    |
| 7. Education Development                                      |             |          |      |              |
| 1) Elementary School  | 9           | school   | 4    | 36           |
| 2) School Toilet  | 2           | unit     | 5    | 10           |
| <u>Total</u>  |             |          |      | <u>46</u>    |
| 8. Aquaculture Development                                    |             |          |      |              |
| 1) Improvement of Brackishwater Demonstration Farm            | 1           | place    |      | 900          |
| 2) Laboratory of Brackishwater Aquaculture Demonstration Farm | 1           | lot      |      | 1,500        |
| <u>Total</u>  |             |          |      | <u>2,400</u> |

## CHAPTER 8. PROJECT IMPLEMENTATION PLAN





## CHAPTER 8 PROJECT IMPLEMENTATION PLAN

### 8-1 Implementing Agency

Basic national policy of the Philippine government for implementation of integrated area development (IAD) projects is to promote and accelerate administrative decentralization. According to NEDA implementing guidelines (No. 68, 1988) for IAD projects, coordination and management of implementation of single-province IAD projects are to be responsibility of the provincial government.

Under the above state policy, it is recommended that the implementing agency be the Provincial Government of Marinduque which has sufficient number of staff and experiences. The Project Board with the Provincial Governor as chairman shall be established to act as overall manager and coordinator. A Project Management Unit (PMU) shall be created under the Project Board to execute general implementation activities. (refer to Figure 8-i-1)

Since the MADPP covers several sectors, sectoral line agencies concerned shall participate in the implementation of the project. Such sectoral line agencies are as listed below:

- a) Agricultural development ----- DA, NFA, DAR
  
- b) Agricultural Infrastructure Development
  - Irrigation Development ----- NIA
  - Rural Road Development ----- DPWH, PEO
  - Village Water Supply Development ---- LWUA
  
- c) Rural Infrastructure Development
  - Rural Electrification Development ---- NEA
  - Traffic System Development ----- DPWH
  - Education Development ----- DECS, DPWH
  
- d) Aquaculture Development ----- BOF

## 8-2 Implementation Schedule

The Provincial Government of Marinduque should implement the project under the assistance of consultants in employing the sufficiently capable and well-experienced contractors on the contract basis.

The project could be completed within 20 months after commencement of the detailed design. Seasonal weather conditions should carefully be considered in the detailed construction schedule particularly for irrigation, rural road and village water supply projects.

The implementation schedule is as shown in Figure 8-2-1.

## 8-3 Operation and Maintenance Body

Executing agencies for the operation and maintenance of facilities and equipment constructed/purchased under each development project would be divided into two categories, i.e., public sector and private sector, depending on the characteristics of the projects.

The operation and maintenance of the irrigation, village water supply and rural electrification development projects would be turned over to the private sector. O/M body of these projects shall be the cooperatives/associations which are to be organized by the beneficiaries and formed by project/sector and/or by area.

On the other hand, facilities and equipment provided by the project such as agriculture, rural roads, traffic system, social services and aquaculture shall be managed and maintained by the relevant government agencies.

Figure 8-1-1 Proposed Organizational Chart for Implementation

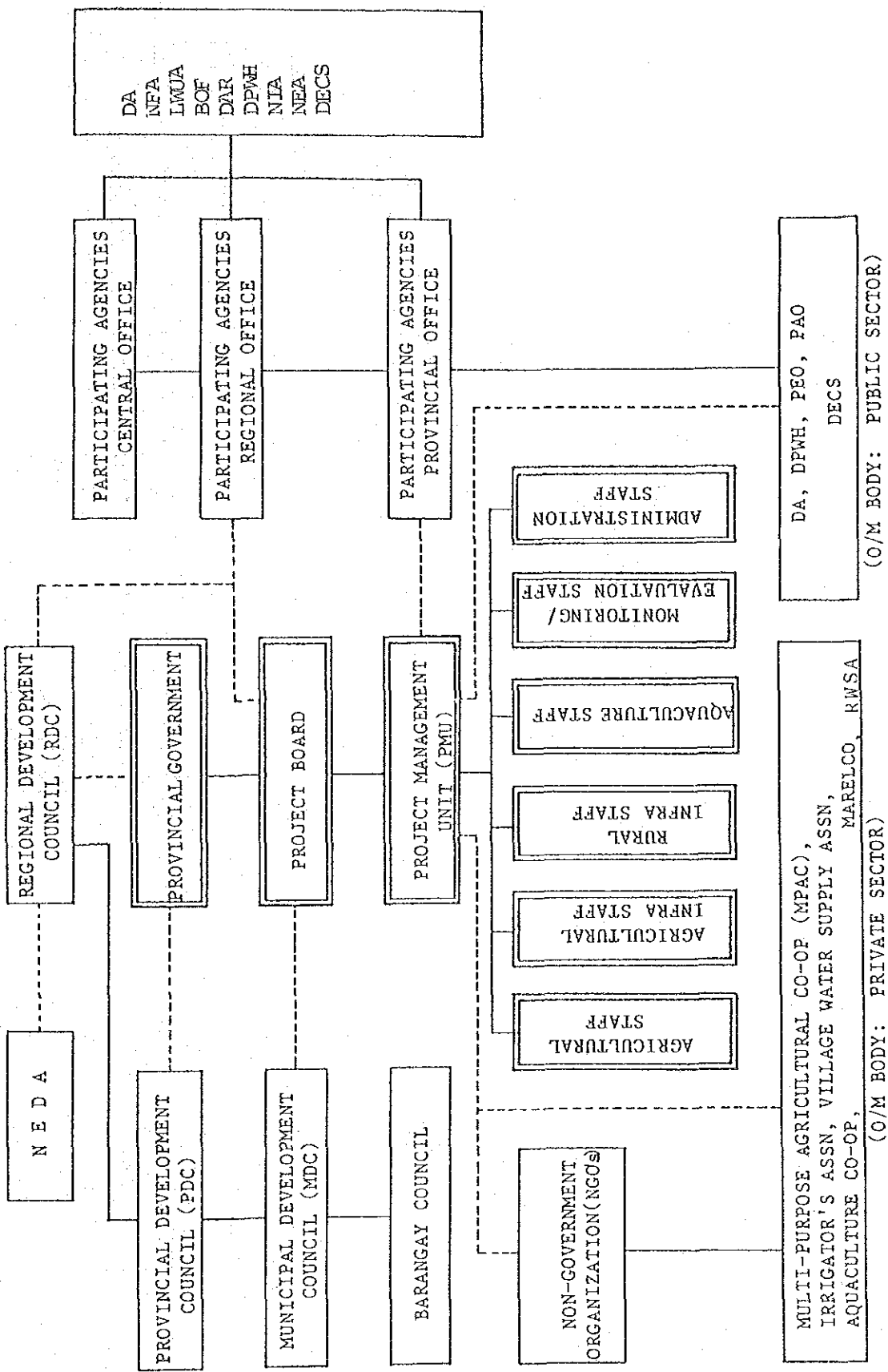
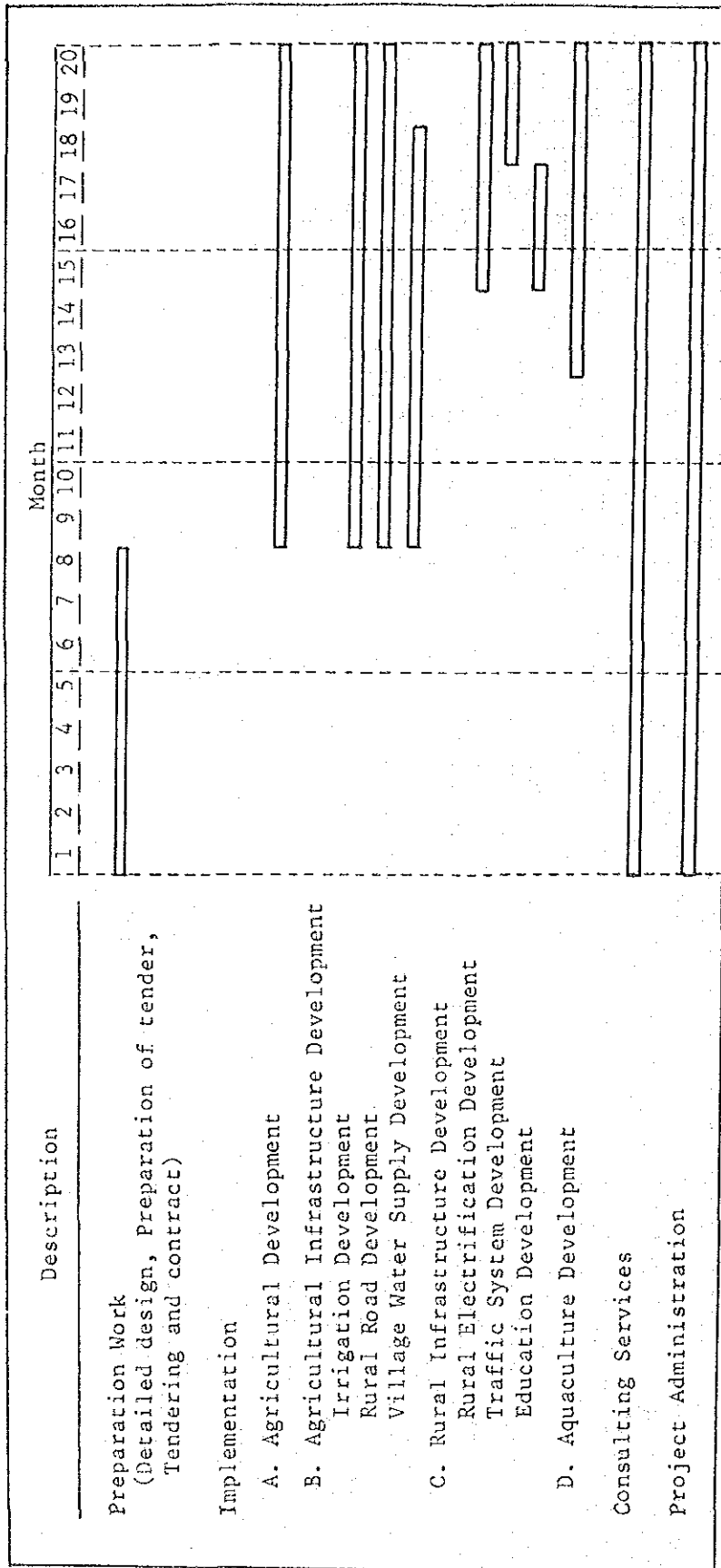


Figure 8-2-1 Implementation Schedule of MADPP



## CHAPTER 9. PROJECT EVALUATION



## CHAPTER 9 PROJECT EVALUATION

### 9-1 Basic Concept

Project evaluation is made to assess the viability of a project from the financial, economic and socioeconomic aspects. Financial analysis is made from the viewpoint of farmers' economy. Economic analysis is made from the viewpoint of national economy as a whole. Socioeconomic analysis includes secondary or intangible effects such as generation of job opportunity, and improvement of quality of life, production technology and extension workers' ability. Different unit and method are utilized for each analysis.

### 9-2 Financial Analysis

#### 9-2-1 Financial Project Costs

The proposed Project includes components of (i) agricultural development, (ii) agricultural infrastructure development including irrigation, rural roads, and village water supply, (iii) rural infrastructure development including rural electrification and education development, and (iv) aquaculture development. Based on the current market prices as of June 1989, the financial cost of the Project is estimated at 376 million pesos including costs for engineering and administration, and physical contingency. Costs for price contingency are not included in the cost estimate.

#### 9-2-2 Farm Budget Analysis

For evaluating the Project feasibility from the viewpoint of farmers' economy, farm budget analysis has been undertaken. As mentioned in Chapter 1, farm budget analysis has been made for three typical farms, i.e. 1.0 ha rice farm (type 1), 1.0 ha rice and 1.0 ha coconut farm (type 2), and 1.0 ha rice and 0.2 ha vegetables farm (type 3).

As a result of the analysis, the capacity to pay which is expected under future "with project" situation would be 21,712 pesos, 32,467 pesos and 43,482 pesos for type 1, type 2 and type 3 farms, respectively. The irrigation service fee to be collected from the water users, which is 75 kg of paddy in kind or 262 pesos in cash per ha, is within a reasonable range in the capacity to pay. It is apparent from the analysis that the proposed Project would give sufficient incentive to farmers even if the water charges are collected from them.

### 9-3 Economic Analysis

#### 9-3-1 Methodology for Economic Analysis

Economic analysis is made to assess the viability of a project from the viewpoint of national economy. Direct tangible benefits will be quantified and compared with direct project costs. Benefits and costs identified will be converted into present value and expressed in terms of Economic Internal Rate of Return (EIRR). Valuation of costs and benefits for the traded goods will be made on the basis of international prices. Financial prices of non-traded goods (e.g. labor) will be converted into international parity prices using standard conversion factor (SCF) of 0.86 which is widely used for the project evaluation in the Philippines by international institutions. The costs for land acquisition and price contingency will not be taken into account in economic analysis.

#### 9-3-2 Basic Assumptions

The economic evaluation has been undertaken on the basis of the following assumptions.

- (1) Exchange rate: The exchange rate between Philippine pesos and U.S. dollars is set at US\$1.00 = ₱21.80, which is an official exchange rate as of June 1989.



- (2) Price level: The current prices as of June 1989 are used in the cost estimate.
- (3) Project life: Economic life of the Project is set at 30 years. The costs and benefits are discounted over a period of 30 years.
- (4) Benefits: Only direct tangible benefits are quantified for the calculation of EIRR. Indirect benefits are not valued in monetary terms, but assessed in a qualitative manner.
- (5) Interest during construction: Interest during construction (IDC) is not included in the cost estimate.
- (6) Price escalation: Escalation of costs and benefits in the future is assumed to be in the order of magnitude of overall inflation rates. Therefore, costs and benefits are not escalated in the economic analysis.
- (7) Construction Period: It is assumed that construction works will be completed within a year.

### 9-3-3 Economic Costs

Tariff and trade restrictions disturb the price relationship between traded and non-traded goods and services. In order to make value of non-traded goods and services to more closely reflect their economic value, it needs to be converted into border prices using a standard conversion factor (SCF). SCF of 0.86 is applied in the analysis. Project costs are assumed to include 50% of non-traded goods and services which are converted into border prices based on the financial prices multiplied by 0.86.

Transfer payments such as taxes and subsidies are excluded in the economic costs. Also excluded are the costs for land acquisition and price escalation.

Economic costs thus estimated amount to 350 million pesos.

#### 9-3-4 Economic Benefits

Direct tangible benefits of each project category have been identified as follows.

##### 1) Agricultural Development

Agricultural development component includes 7 sub-projects. These sub-projects aim at increased agricultural production, particularly foodcrops, through strengthening of agricultural support services including research, extension and marketing services. Paddy production will be significantly increased from the present level of about 1,200 tons to about 5,000 tons at full development stage, although a part of the incremental production is attributable to irrigation development program. In addition to paddy, production of other crops such as coconut, corn, pulses, root crops, vegetables and fruit are also increased. Net value of production of these crops are derived from the comparison of net value of production between "without project" and "with project" situations as presented in Table 9-3-1.

It is assumed that 60% of total benefits will arise in 1992 and will reach full development in 1996 onwards.

##### 2) Agricultural Infrastructure Development

###### a) Irrigation Development

The direct benefits will arise from increased agricultural production through rehabilitation and construction of irrigation facilities. Incremental production of paddy is assumed to be main benefits attributable to irrigation development program. (refer to Table 9-3-1)

###### b) Rural Roads

Rural roads component will play vital role in the master plan in promoting a greater equitable distribution of benefits particularly in

rural areas. Main benefits accruing from improvement/upgrading of existing roads are vehicle operating cost savings, whereas main benefits accruing from construction of new roads are value of time savings and running cost savings.

Vehicle operating cost savings are estimated as 0.70 pesos per km for cars, jeepneys and pickups, 0.30 pesos per km for motor cycles and motor tricycles, and 1.60 pesos per km for buses and trucks which are estimated on the basis of experiences of similar projects in the Philippines.

Benefits accruing from rehabilitation of rural roads and construction of new roads are presented in Table 9-3-2.

c) Village Water Supply

Economic benefits of village and rural water supply will be (i) economic value of water, (ii) increase in income due to reduction in mortality, and (iii) increase in income due to reduction in morbidity.

i) Economic value of water

The economic value of water can be measured by the willingness of the household to pay for potable water supply and is reflected in the water fees. Specifically, the economic value of water can be estimated by: (number of served household) x (water fee per household per month) x 12. The experience gathered under the past projects reveal that the water charges are 54 pesos for Level II system. Result of computation is given in Table 9-3-3.

ii) Increase in income due to reduction in mortality

With the improved quality of water provided through the project, mortality levels from water-borne diseases can be reduced. It is estimated that mortality and morbidity levels will decrease by 60%. The direct benefits that can be generated by the reduction in mortality

rates can be quantified by savings in man-days that would have been lost due to deaths caused by the incidence of water-related diseases.

iii) Increase in income due to reduction in morbidity

With the project, morbidity levels can be expected to be likewise reduced by 40%. Economic benefits from the reduction in morbidity levels are presented in Table 9-3-3.

3) Rural Infrastructure Development

a) Rural Electrification

The economic value of electrification can be measured by the willingness of the household to pay for electricity and is reflected in the electricity fees. Specifically, the economic value of electrification can be estimated by: (power demand) x (electricity fee x 2.5 pesos per kwb). Annual benefits are presented in Table 9-3-4.

b) Education Development

Main benefits will be in social aspects such as better education, better quality of life, etc. which are difficult to quantify. Benefits accruing from this category are not quantified.

4) Aquaculture Development

The direct benefits consist of (1) production of shrimp fry totaling about 120 million per year, with net value of production of 0.29 million pesos, and (2) processed shrimp totaling about 500 tons (with head) per year, with net value of production of 8.49 million pesos. (refer to Table 9-3-5)

In addition to the above, farmers and other people who are willing to invest in aquaculture production will be able to receive more improved technology on aquaculture and stable supply of shrimp fry which will help increase fish and shrimp production in the province.

## 5) Economic Rate of Return (EIRR)

Using the costs and benefits estimated in the preceding sections, the costs and benefits streams are prepared as shown in Table 9-3-6, and then the EIRR has been calculated. The calculated EIRR is 17.0% which indicates that the proposed Project is economically feasible taking into account the opportunity cost of capital of 15% in the Philippines.

### 9-3-5 Sensitivity Analysis

In order to evaluate further the soundness of the Project to the possible changes of economic conditions in the future, the sensitivity analysis has been undertaken for the following critical conditions.

- i) Total costs increase by 10%
- ii) Benefits decrease by 10%
- iii) Combination of the above i) and ii)

| <u>Assumptions</u>                       | <u>EIRR (%)</u> |
|--|-----------------|
| i) Total costs increase by 10%           | 15.4            |
| ii) Benefits decrease by 10%             | 15.2            |
| iii) Combination of the above i) and ii) | 13.7            |

As seen from the above results, the EIRR indicates economic soundness even in the adverse conditions of 10% increase in total costs, and 10% decrease in benefits. The EIRR of the worst case, i.e. 10% increase in total costs and 2 years delay in benefits, is 13.7%. (refer to Table 9-3-7)

### 9-4 Socio-economic Impact

In addition to direct benefits as mentioned in the preceding sections, indirect or intangible socio-economic impacts are expected through the implementation of the Project.

#### 9-4-1 Improvement of Local Transportation

The construction and improvement of rural roads will remove the constraint of poor accessibility and will bring Barangays in the Project Area into the mainstream of regional economy. As a result, mobility of goods and services will be improved and economic activities will be expanded.

#### 9-4-2 Increased Employment Opportunities

Labor input proposed in the Project is expected to increase to a level of 0.5 million man-days which corresponds to farm labor requirement of 2,500 assuming 200 working days a year.

The Project will increase the utilization of surplus rural labor force and it is estimated that about 0.7 million man-days of labor would be required during the implementation of the Project. The Project would generate about 35 thousand man-days of employment per year for operation and maintenance of the Project facilities.

#### 9-4-3 Improvement of Rural Life

The development of rural infrastructure facilities and social services will contribute significantly to reduce the incidence of disease, improving health standards and raising the general quality of life in the Project area.

Table 9-3-1 (1/3) Economic Benefits of Agricultural/Irrigation Development  
(Irrigation Area)

(Unit: Net Value of Production in Million Pesos)

|  | Irrigation Service Area within the Project Area |                     |                   |                |        |        |                           |                              |
|--|---|---------------------|-------------------|----------------|--------|--------|---------------------------|------------------------------|
|  | Coconut<br>(Copra)                              | Paddy,<br>Irrigated | Paddy,<br>Rainfed | Upland<br>Rice | Corn   | Pulses | Root<br>Crops<br>(Tomato) | Vegetables<br>Total<br>(NVP) |
| <u>Without Project (1)</u>                   |   |                     |                   |                |        |        |                           |                              |
| Yield (ton/ha)                               | 1.0   | 0                   | 0.8               | 0.7            | 0.6    | 0.6    | 2.0                       | 0                            |
| Farmgate price (P/ton)                       | 3,870   | 0                   | 3,100             | 3,100          | 3,960  | 11,700 | 2,060                     | 0                            |
| Gross production value (P/ha)                | 3,870   | 0                   | 2,480             | 2,170          | 2,170  | 7,020  | 4,120                     | 0                            |
| Production cost (P/ha)                       | 1,776   | 0                   | 2,741             | 1,970          | 2,227  | 2,209  | 771                       | 0                            |
| Cropped area (ha)                            | 120   | 0                   | 440               | 30             | 30     | 20     | 10                        | 0                            |
| Net value of production (P 10 <sup>6</sup> ) | 0.25  | 0                   | -0.11             | 0.01           | -0.002 | 0.10   | 0.03                      | 0                            |
| <u>With Project (2)</u>                      |   |                     |                   |                |        |        |                           |                              |
| Yield (ton/ha)                               | 1.1   | 4.0                 | 0                 | 0              | 2.0    | 1.3    | 10.0                      | 18.0                         |
| Farmgate price (P/ton)                       | 3,870   | 3,100               | 0                 | 0              | 3,960  | 11,700 | 2,060                     | 10,750                       |
| Gross production value (P/ha)                | 4,257   | 12,400              | 0                 | 0              | 7,920  | 15,210 | 20,600                    | 193,500                      |
| Production cost (P/ha)                       | 1,776   | 5,857               | 0                 | 0              | 4,338  | 3,876  | 2,787                     | 10,467                       |
| Cropped area (ha)                            | 120   | 840                 | 0                 | 0              | 45     | 38     | 15                        | 240                          |
| Net value of production (P 10 <sup>6</sup> ) | 0.30  | 5.50                | 0                 | 0              | 0.16   | 0.43   | 0.27                      | 43.93                        |
| Net Value of Production (2)-(1) :            | 0.05  | 5.50                | 0.11              | -0.01          | 0.16   | 0.33   | 0.24                      | 43.93                        |
|  |   |                     |                   |                |        |        |                           | 50.33                        |

Table 9-3-1 (2/3) Economic Benefits of Agricultural/Irrigation Development  
(Non-irrigation Area)

(Unit: Net Value of Production in Million Pesos)

|  | Non-Irrigation Service Area in the Project Area |                     |                   |                |       |        |               |            |            |                |
|--|---|---------------------|-------------------|----------------|-------|--------|---------------|------------|------------|----------------|
|  | Coconut<br>(Copra)                              | Paddy,<br>Irrigated | Faddy,<br>Rainfed | Upland<br>Rice | Corn  | Pulses | Root<br>Crops | Vegetables | Pineapples | Total<br>(NVP) |
| <u>Without Project (1)</u>                   |   |                     |                   |                |       |        |               |            |            |                |
| Yield (ton/ha)                               | 1.0   | 4.0                 | 0.8               | 0.7            | 0.6   | 0.6    | 2.0           | 0          | 0          | 0              |
| Farmgate price (P/ton)                       | 3,870   | 3,100               | 3,100             | 3,100          | 3,960 | 11,700 | 2,060         | 0          | 0          | 0              |
| Gross production value (P/ha)                | 3,870   | 12,400              | 2,480             | 2,170          | 2,376 | 7,020  | 4,120         | 0          | 0          | 0              |
| Production cost (P/ha)                       | 1,776   | 5,857               | 2,741             | 1,970          | 2,227 | 2,209  | 771           | 0          | 0          | 0              |
| Cropped area (ha)                            | 177   | 105 <sup>1/2</sup>  | 45                | 55             | 55    | 30     | 10            | 0          | 0          | 0              |
| Net value of production (P 10 <sup>6</sup> ) | 0.37  | 0.69                | -0.01             | 0.01           | -     | 0.14   | 0.03          | 0          | 0          | 0              |
| <u>With Project (2)</u>                      |   |                     |                   |                |       |        |               |            |            |                |
| Yield (ton/ha)                               | 1.1   | 4.0                 | 2.5               | 0.9            | 1.5   | 1.1    | 10.0          | 10.0       | 7.1        | 7.1            |
| Farmgate price (P/ton)                       | 3,870   | 3,100               | 3,100             | 3,100          | 3,960 | 11,700 | 2,060         | 10,750     | 11,360     | 11,360         |
| Gross production value (P/ha)                | 4,257   | 12,400              | 7,750             | 2,790          | 5,940 | 12,870 | 20,600        | 107,500    | 80,656     | 80,656         |
| Production cost (P/ha)                       | 1,776   | 5,857               | 4,286             | 2,775          | 4,338 | 3,876  | 2,787         | 10,467     | 10,467     | 10,467         |
| Cropped area (ha)                            | 177   | 103 <sup>1/2</sup>  | 70                | 75             | 75    | 47     | 20            | 130        | 50         | 50             |
| Net value of production (P 10 <sup>6</sup> ) | 0.44  | 0.69                | 0.24              | 0.001          | 0.12  | 0.42   | 0.36          | 12.61      | 2.11       | 2.11           |
| Net Value of Production (2)-(1):             | 0.07  | 0                   | 0.25              | -              | 0.12  | 0.28   | 0.33          | 12.61      | 2.11       | 15.77          |

Note : 1/ On-going irrigation project (60 ha)



Table 9-3-1 (3/3) Economic Benefits of Agricultural/Irrigation Development  
(Livestock Development)

(Unit: Net Value of Production in Million Pesos)

|  | Cattle | Carabao                  |
|--|--------|--------------------------|
| <u>Without Project (1)</u>                   |        |                          |
| Annual production (male, head)               | 15     | 30                       |
| Unit Price (P/head)                          | 7,000  | 5,000                    |
| Gross production value (P 10 <sup>6</sup> )  | 0.11   | 0.15                     |
| Production cost (P 10 <sup>6</sup> )         | 0.02   | 0.03                     |
| Net value of production (P 10 <sup>6</sup> ) | 0.09   | 0.12                     |
| <u>With Project (2)</u>                      |        |                          |
| Annual production (head)                     | 100    | 200                      |
| Unit price (P/head)                          | 7,000  | 5,000                    |
| Gross production value (P 10 <sup>6</sup> )  | 0.70   | 1.00                     |
| Production cost (P 10 <sup>6</sup> )         | 0.14   | 0.20                     |
| Net value of production (P 10 <sup>6</sup> ) | 0.56   | 0.80                     |
| Net Value of Production (2)-(1):             | 0.47   | 0.68                     |
|  |        | Total: 1.5 million pesos |

Note: (1) It is assumed that production of cattle and carabao would not exceed 500 and 1,000 heads respectively due to limitation of feeds.

(2) Production of cattle and carabao is assumed to increase by 3% per annum without the project.

(3) Number of female livestock for artificial insemination (AI) is assumed to be 10% of the total livestock.

Table 9-3-2 (1/2) Benefits of Rural Roads Development (MADPP)

1. Improvement of Roads (10 km)

(Unit: Benefits in Million Pesos)

| Kind of Vehicle       | Traffic Volume (per day) |      |      | Operating Cost Saving (year) |      |      |      |      |
|-----------------------|--------------------------|------|------|------------------------------|------|------|------|------|
|                       | 1992                     | 1995 | 2000 | 2010                         | 1992 | 1995 | 2000 | 2010 |
| Car, Truck, Jeepney   | 164                      | 186  | 220  | 254                          | 0.55 | 0.63 | 0.74 | 0.86 |
| Tricycle, Motor cycle | 36                       | 41   | 49   | 56                           | 0.12 | 0.14 | 0.17 | 0.19 |
| Total Benefits:       |                          |      |      |                              | 0.67 | 0.77 | 0.91 | 1.05 |

Note: (1) Traffic volume is assumed to be 40% of total traffic volume estimated in Table G-2-7.

(2) Vehicle operating costs savings are estimated at 0.70 pesos per km for cars, jeepneys, etc. (80%) and 1.60 pesos per km for trucks and buses, with average saving cost of 0.88 pesos per km per day.

Vehicle operating costs savings are estimated at 0.30 pesos per km for tricycles and motor cycles.

(3) Benefits = Traffic volume x Operating cost saving x 10.0 km

Table 9-3-2 (2/2) Benefits of Rural Roads Development (MADPP)

2. Construction of New Roads (15 km)

(Unit: Benefits in Million Pesos)

| Kind of Vehicle         | Passengers (per day) |       |       | Saving Time Benefits (year) |      |      |
|-------------------------|----------------------|-------|-------|-----------------------------|------|------|
|                         | 1992                 | 1995  | 2000  | 2010                        | 2000 | 2010 |
| <u>Without Project</u>  |                      |       |       |                             |      |      |
| Cart, on foot           | 391                  | 414   | 454   | 548                         |      |      |
| <u>With Project</u>     |                      |       |       |                             |      |      |
| Car, Truck, Jeepney     | 1,640                | 1,860 | 2,200 | 2,540                       |      |      |
| Tricycle, Motor cycle   | 72                   | 82    | 98    | 112                         |      |      |
| Total passengers:       | 1,712                | 1,942 | 2,298 | 2,652                       |      |      |
| Incremental passengers: | 1,321                | 1,528 | 1,844 | 2,104                       | 1.86 | 2.59 |
|                         |                      |       |       |                             | 2.15 | 2.96 |

Note: (1) Number of passengers without the project is assumed to be 1% of total population.

(2) Number of passengers with the project is assumed to be 10 passengers for jeepney, car, truck, etc. on average and 2 passengers for each tricycle and motor cycle.

(3) Time saving benefits = traffic volume x time saving x wage rate per hour x 300 working days x 0.5

(4) Average travel time without the project is estimated at 4 hours on foot and 1 hour by cart, with average time of 3.4 hours.

(5) Average travel time with the project is estimated at 0.4 hours.

(6) Annual wage rate is assumed to be 7,500 pesos with 300 working days.

Table 9-3-3 Benefits of Village Water Supply System (MADP Project)

1. Economic Value of Water

|                              | 1992                                    | 1995 | 2000 | 2005 | 2010 |
|------------------------------|---|------|------|------|------|
| No. of families              | 586                                     | 620  | 681  | 748  | 822  |
| Economic value of water      | --- 54 pesos per month per Level II --- |      |      |      |      |
| Annual benefits in mln pesos | 0.38                                    | 0.40 | 0.44 | 0.48 | 0.53 |

Note: (1) Economic value of water in 1989 is estimated at 54 pesos per Level II on the basis of water fee of 40 pesos in 1984 multiplied by price indexes of 1.357.

(2) Population growth rate is assumed to be 1.9% per annum.

2. Increase in Income due to Reduction in Mortality

|                                     | 1992  | 1995  | 2000  | 2005  | 2010  |
|-------------------------------------|-------|-------|-------|-------|-------|
| Population                          | 3,908 | 4,135 | 4,543 | 4,991 | 5,484 |
| Mortality rate (%) <sup>1/</sup>    | 0.85  | 0.85  | 0.85  | 0.85  | 0.85  |
| No. of reported deaths              | 33    | 35    | 39    | 42    | 47    |
| Annual wage rate <sup>2/</sup>      | 7,500 | 7,500 | 7,500 | 7,500 | 7,500 |
| WP income (mln pesos) <sup>3/</sup> | 0.25  | 0.26  | 0.30  | 0.32  | 0.35  |
| Annual benefits                     | 0.15  | 0.16  | 0.18  | 0.19  | 0.21  |

Note: (1) Mortality rate due to the incidence of water-borne diseases of diarrhea (0.46%) and pneumonia (0.37%) is reported in Appendix I.

(2) Wage rate of 25 pesos at 300 working days is assumed.

(3) WP indicates with the project situation. Increase in income is expected from reduction in mortality by 60% under with the project situation. Annual benefits = WP income x 60%.

Table 9-3-3 (Continued)

## 3. Increase in Income due to Reduction in Morbidity

|                                     | 1992  | 1995  | 2000  | 2005  | 2010  |
|-------------------------------------|-------|-------|-------|-------|-------|
| Population                          | 3,908 | 4,135 | 4,543 | 4,991 | 5,484 |
| Morbidity rate (%) <sup>1/</sup>    | 2.36  | 2.36  | 2.36  | 2.36  | 2.36  |
| No. of reported morbidity           | 92    | 98    | 107   | 118   | 129   |
| Annual wage rate <sup>2/</sup>      | 7,500 | 7,500 | 7,500 | 7,500 | 7,500 |
| WP income (mln pesos) <sup>3/</sup> | 0.69  | 0.74  | 0.80  | 0.89  | 0.97  |
| Annual benefits                     | 0.41  | 0.44  | 0.48  | 0.53  | 0.58  |

Note: (1) Morbidity rate due to the incidence of water-borne disease of diarrhea (1.96%) and pneumonia (0.40%) is reported in Appendix I.

(2) Wage rate of 25 pesos at 300 working days is assumed.

(3) WP indicates with the project situation. Increase in income is expected from reduction in morbidity by 60% under with the project situation. Annual benefits = WP income x 60%.

Table 9-3-4 Benefits of Rural Electrification Program (MADPP)

|                                 | 1992 | 1995 | 2000 | 2010 |
|---------------------------------|------|------|------|------|
| Total demand (MH, year)         | 136  | 242  | 379  | 662  |
| Electricity fee (kwh)           | 2.5  | 2.5  | 2.5  | 2.5  |
| Annual benefits (million pesos) | 0.34 | 0.61 | 0.95 | 1.66 |

Note: (1) Total demand is estimated from Table 5-1-1 in Appendix II.

(2) Power demand is expected to grow at a rate of 21% per annum between 1989 and 1995.

Table 9-3-5 Benefits of Aquaculture Development (MADP Project)

|   |   |
|---|---|
| 1. <u>Shrimp Hatchery Plant</u>                 |   |
| a. Average number of eggs                       | 20 million/month with 200,000 mother shrimps    |
| b. Shrimp fry production                        | 10 million/month (recovery rate of 50%)         |
| c. Unit price per 1,000 fries                   | 70 pesos  |
| d. Gross value of production                    | 700,000 pesos                                   |
| e. Production cost                              | 410,000 pesos                                   |
| f. Net value of production                      | 290,000 pesos (0.29 million pesos)              |
| 2. <u>Processing Plant (with size of 16/20)</u> |   |
| a. Gross value of production                    | 109 million pesos<br>(500 tons x 218,000 pesos) |
| b. Production cost                              |   |
| i. Material                                     | 98 million pesos                                |
| ii. Processing cost                             | 2.7 million pesos                               |
| Sub-total:                                      | 100.7 million pesos                             |
| c. Net value of production                      | 8.3 million pesos per year                      |
| 3. <u>Total Annual Benefits:</u>                | <u>8.59 million pesos</u>                       |

Table 9-3-6 Economic Evaluation of the MADP Project

(Unit: Million Pesos)

| Year | Project | O/M   | Total | Benefits |     |     |     |     | Total |
|------|---------|-------|-------|----------|-----|-----|-----|-----|-------|
|      | Costs   | Costs | Costs | 1        | 2   | 3   | 4   | 5   |       |
| 1991 | 350.0   | 0     | 350.0 | 0        | 0   | 0   | 0   | 0   | 0     |
| 1992 | 0       | 8.4   | 8.4   | 40.4     | 2.5 | 0.9 | 0.3 | 0.3 | 44.4  |
| 1993 | 0       | 8.4   | 8.4   | 47.1     | 2.5 | 0.9 | 0.3 | 0.3 | 51.1  |
| 1994 | 0       | 8.4   | 8.4   | 53.8     | 2.5 | 0.9 | 0.3 | 0.3 | 57.8  |
| 1995 | 0       | 8.4   | 8.4   | 60.6     | 2.9 | 1.0 | 0.6 | 8.6 | 73.7  |
| 1996 | 0       | 8.4   | 8.4   | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 1997 | 0       | 8.4   | 8.4   | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 1998 | 0       | 8.4   | 8.4   | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 1999 | 0       | 8.4   | 8.4   | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 2000 | 0       | 8.4   | 8.4   | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2001 | 0       | 8.4   | 8.4   | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2002 | 0       | 8.4   | 8.4   | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2003 | 0       | 8.4   | 8.4   | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2004 | 0       | 8.4   | 8.4   | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2005 | 0       | 8.4   | 8.4   | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2006 | 0       | 8.4   | 8.4   | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2007 | 0       | 8.4   | 8.4   | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2008 | 0       | 8.4   | 8.4   | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2009 | 0       | 8.4   | 8.4   | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2010 | 0       | 8.4   | 8.4   | 67.3     | 4.0 | 1.3 | 1.7 | 8.6 | 82.9  |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| 2020 | 0       | 8.4   | 8.4   | 67.3     | 4.0 | 1.3 | 1.7 | 8.6 | 82.9  |

Economic Internal Rate of Return (EIRR) 17.0%

- Note: (1) Economic cost = Financial cost x (0.5 + 0.5 x 0.86)  
(2) Benefits include: 1. Agriculture and Irrigation, 2. Rural Road, 3. Village and Rural Water Supply, 4. Rural Electrification, and 5. Aquaculture

Table 9-3-7 (1/3) Economic Evaluation of the MADP Project  
(Cost, + 10%)

(Unit: Million Pesos)

| Year | Project Costs | O/M Costs | Total Costs | Benefits |     |     |     |     | Total |
|------|---------------|-----------|-------------|----------|-----|-----|-----|-----|-------|
|      |               |           |             | 1        | 2   | 3   | 4   | 5   |       |
| 1991 | 385.0         | 0         | 385.0       | 0        | 0   | 0   | 0   | 0   | 0     |
| 1992 | 0             | 9.2       | 9.2         | 40.4     | 2.5 | 0.9 | 0.3 | 0.3 | 44.4  |
| 1993 | 0             | 9.2       | 9.2         | 47.1     | 2.5 | 0.9 | 0.3 | 0.3 | 51.1  |
| 1994 | 0             | 9.2       | 9.2         | 53.8     | 2.5 | 0.9 | 0.3 | 0.3 | 57.8  |
| 1995 | 0             | 9.2       | 9.2         | 60.6     | 2.9 | 1.0 | 0.6 | 8.6 | 73.7  |
| 1996 | 0             | 9.2       | 9.2         | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 1997 | 0             | 9.2       | 9.2         | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 1998 | 0             | 9.2       | 9.2         | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 1999 | 0             | 9.2       | 9.2         | 67.3     | 2.9 | 1.0 | 0.6 | 8.6 | 80.4  |
| 2000 | 0             | 9.2       | 9.2         | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2001 | 0             | 9.2       | 9.2         | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2002 | 0             | 9.2       | 9.2         | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2003 | 0             | 9.2       | 9.2         | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2004 | 0             | 9.2       | 9.2         | 67.3     | 3.5 | 1.1 | 1.0 | 8.6 | 80.4  |
| 2005 | 0             | 9.2       | 9.2         | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2006 | 0             | 9.2       | 9.2         | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2007 | 0             | 9.2       | 9.2         | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2008 | 0             | 9.2       | 9.2         | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2009 | 0             | 9.2       | 9.2         | 67.3     | 3.8 | 1.2 | 1.3 | 8.6 | 82.2  |
| 2010 | 0             | 9.2       | 9.2         | 67.3     | 4.0 | 1.3 | 1.7 | 8.6 | 82.9  |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| 2020 | 0             | 9.2       | 9.2         | 67.3     | 4.0 | 1.3 | 1.7 | 8.6 | 82.9  |

Economic Internal Rate of Return (EIRR) 15.4%

Note: (1) Economic cost = Financial cost x (0.5 + 0.5 x 0.86)  
 (2) Benefits include: 1. Agriculture and Irrigation, 2. Rural Road, 3. Village and Rural Water Supply, 4. Rural Electrification, and 5. Aquaculture



Table 9-3-7 (2/3) Economic Evaluation of the MADP Project  
(Benefit, -10%)

(Unit: Million Pesos)

| Year | Project Costs | O/M Costs | Total Costs | Benefits |     |     |     |     | Total |
|------|---------------|-----------|-------------|----------|-----|-----|-----|-----|-------|
|      |               |           |             | 1        | 2   | 3   | 4   | 5   |       |
| 1991 | 350.0         | 0         | 350.0       | 0        | 0   | 0   | 0   | 0   | 0     |
| 1992 | 0             | 8.4       | 8.4         | 36.4     | 2.3 | 0.8 | 0.3 | 0.3 | 40.1  |
| 1993 | 0             | 8.4       | 8.4         | 42.4     | 2.3 | 0.8 | 0.3 | 0.3 | 46.1  |
| 1994 | 0             | 8.4       | 8.4         | 48.4     | 2.3 | 0.8 | 0.3 | 0.3 | 52.1  |
| 1995 | 0             | 8.4       | 8.4         | 54.5     | 2.6 | 0.9 | 0.5 | 7.7 | 66.2  |
| 1996 | 0             | 8.4       | 8.4         | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 1997 | 0             | 8.4       | 8.4         | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 1998 | 0             | 8.4       | 8.4         | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 1999 | 0             | 8.4       | 8.4         | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 2000 | 0             | 8.4       | 8.4         | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2001 | 0             | 8.4       | 8.4         | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2002 | 0             | 8.4       | 8.4         | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2003 | 0             | 8.4       | 8.4         | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2004 | 0             | 8.4       | 8.4         | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2005 | 0             | 8.4       | 8.4         | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2006 | 0             | 8.4       | 8.4         | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2007 | 0             | 8.4       | 8.4         | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2008 | 0             | 8.4       | 8.4         | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2009 | 0             | 8.4       | 8.4         | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2010 | 0             | 8.4       | 8.4         | 60.6     | 3.6 | 1.2 | 1.5 | 7.7 | 74.6  |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| .    | .             | .         | .           | .        | .   | .   | .   | .   | .     |
| 2020 | 0             | 8.4       | 8.4         | 60.6     | 3.6 | 1.2 | 1.5 | 7.7 | 74.6  |

Economic Internal Rate of Return (EIRR) 15.2%

Note: (1) Economic cost = Financial cost x (0.5 + 0.5 x 0.86)  
(2) Benefits include: 1. Agriculture and Irrigation, 2. Rural road, 3. Village and Rural Water Supply, 4. Rural Electrification, and 5. Aquaculture

Table 9-3-7 (3/3) Economic Evaluation of the MADP Project  
 (Cost +10%, Benefit -10%)  
 (Unit: Million Pesos)

| Year | Project | O/M   | Total | Benefits |     |     |     |     | Total |
|------|---------|-------|-------|----------|-----|-----|-----|-----|-------|
|      | Costs   | Costs | Costs | 1        | 2   | 3   | 4   | 5   |       |
| 1991 | 385.0   | 0     | 385.0 | 0        | 0   | 0   | 0   | 0   | 0     |
| 1992 | 0       | 9.2   | 9.2   | 36.4     | 2.3 | 0.8 | 0.3 | 0.3 | 40.1  |
| 1993 | 0       | 9.2   | 9.2   | 42.4     | 2.3 | 0.8 | 0.3 | 0.3 | 46.1  |
| 1994 | 0       | 9.2   | 9.2   | 48.4     | 2.3 | 0.8 | 0.3 | 0.3 | 52.1  |
| 1995 | 0       | 9.2   | 9.2   | 54.5     | 2.6 | 0.9 | 0.5 | 7.7 | 66.2  |
| 1996 | 0       | 9.2   | 9.2   | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 1997 | 0       | 9.2   | 9.2   | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 1998 | 0       | 9.2   | 9.2   | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 1999 | 0       | 9.2   | 9.2   | 60.6     | 2.6 | 0.9 | 0.5 | 7.7 | 72.3  |
| 2000 | 0       | 9.2   | 9.2   | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2001 | 0       | 9.2   | 9.2   | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2002 | 0       | 9.2   | 9.2   | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2003 | 0       | 9.2   | 9.2   | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2004 | 0       | 9.2   | 9.2   | 60.6     | 3.2 | 1.0 | 0.9 | 7.7 | 72.3  |
| 2005 | 0       | 9.2   | 9.2   | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2006 | 0       | 9.2   | 9.2   | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2007 | 0       | 9.2   | 9.2   | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2008 | 0       | 9.2   | 9.2   | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2009 | 0       | 9.2   | 9.2   | 60.6     | 3.4 | 1.1 | 1.2 | 7.7 | 74.0  |
| 2010 | 0       | 9.2   | 9.2   | 60.6     | 3.6 | 1.2 | 1.5 | 7.7 | 74.6  |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| .    | .       | .     | .     | .        | .   | .   | .   | .   | .     |
| 2020 | 0       | 9.2   | 9.2   | 60.6     | 3.6 | 1.2 | 1.5 | 7.7 | 74.6  |

Economic Internal Rate of Return (EIRR) 13.7%

Note: (1) Economic cost = Financial cost x (0.5 + 0.5 x 0.86)  
 (2) Benefits include: 1. Agriculture and Irrigation, 2. Rural Road, 3. Village and Rural Water Supply, 4. Rural Electrification, and 5. Aquaculture



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