CHAPTER 6

AGRICULTURAL SECTOR

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6.1 General

Background

East Timor is a small and poor country, is an economy dominated by agriculture, having limited public revenues to spend on this sector. The sector, in turn, is largely dominated by subsistence production of primary staples (maize, rice, cassava and sweet potatoes), employing family labor and little purchased input.

It is estimated that around 600,000 ha are suitable for agriculture of which approximately half are currently being used. In addition around 200,000 ha are suitable for rearing livestock, which, hitherto, was the territory's second largest export after coffee. However, after the recent events and given security, ownership concerns and lack of capital investment, the sector remains well below potential.

Land Use

East Timor with a area of 14,600 km^2 holds the eastern half of the Timor island which locates at 10 ° south longitude and 125 ° east latitude. It includes an enclave of Ambeno district to the side of Indonesia. Regarding the land utilization of districts, the bushed forest accounts for 76.4 % of the country as shown in Table 6.1.1. However, the forests are thin and soil erosion can be seen in many places.

Table 6.1.1 Land Use

(Unit : km2)

District	Urban area	Wetland (inc. paddy)	Bare Land	Estates	Bushed Forest	Others	Total
Covalima	17,400	22,740	76,690	15,790	941,950	150,960	1,225,530
Ainaro	14,700	380	56,610	14,640	567,730	144,810	798,870
Manufahi	19,385	19,710	50,530	83,710	1,035,105	116,470	1,324,910
Viqueque	16,000	58,100	31,800	34,300	1,370,280	270,020	1,780,500
Lautem	6,400	13,867	35,786	54,111	1,351,474	240,692	1,702,330
Baucau	11,490	105,650	23,640	14,940	1,149,520	188,560	1,493,800
Manututo	13,131	80,970	23,430	9,610	1,463,110	115,194	1,705,445
Dili	24,650	1,780	21,230	-	285,930	38,010	371,600
Aileu	10,126	3,665	17,534	535	673,395	24,235	729,490
Liquica	9,730	5,920	11,240	49,530	359,100	112,600	548,120
Ermera	21,355	18,090	67,305	170,030	422,490	46,730	746,000
Bobonaro	23,235	68,670	82,875	9,440	921,830	262,070	1,368,120
Ambeno	25,460	19,500	104,890	100	590,830	73,880	814,660
Total	213,062	419,042	589,000	456,436	11,158,484	1,773,351	14,609,375
(%)	1.5	2.9	4.0	3.1	76.4	12.1	100.0

Source : East Timor in Figures, BPS, Central Board of Statistics of East Timor Province

Most of the land area of East Timor is subject to erosion and steep. The land is occupied and farmed under *swidden* (shifting/slash and burn) agriculture. Land use, however, is highly constrained by steep topography, poor soils, erosion and unpredictable heavy downpours common to the country.

In general, soils do not support heavy vegetation, which limits the scope for crop diversification. Because of these constraints, farmers are largely risk averse, employing a strategy aimed at minimizing potential losses rather than maximizing yields. Periodically the country is affected by El Nino related weather anomalies, which further reduce food production.

Agricultural Climate

The climate is dominated by the intense north - east monsoon rainfall from November to March, followed by a pronounced dry season. In northern parts of country, this constitutes the main wet season, whilst in the south, the rainy season is more prolonged spanning December to June, increasing the potential for secondary crop production of maize and possibly rice. The northern coast has the lowest average rainfall, ranging from 600 to 1,000 mm per annum. In contrast, total precipitation is highest in the central mountainous areas with a range from 1,800 to 3,000 mm per annum. Rainfall in southern coastal areas ranges from around 1,250 to 3,000 mm per annum.

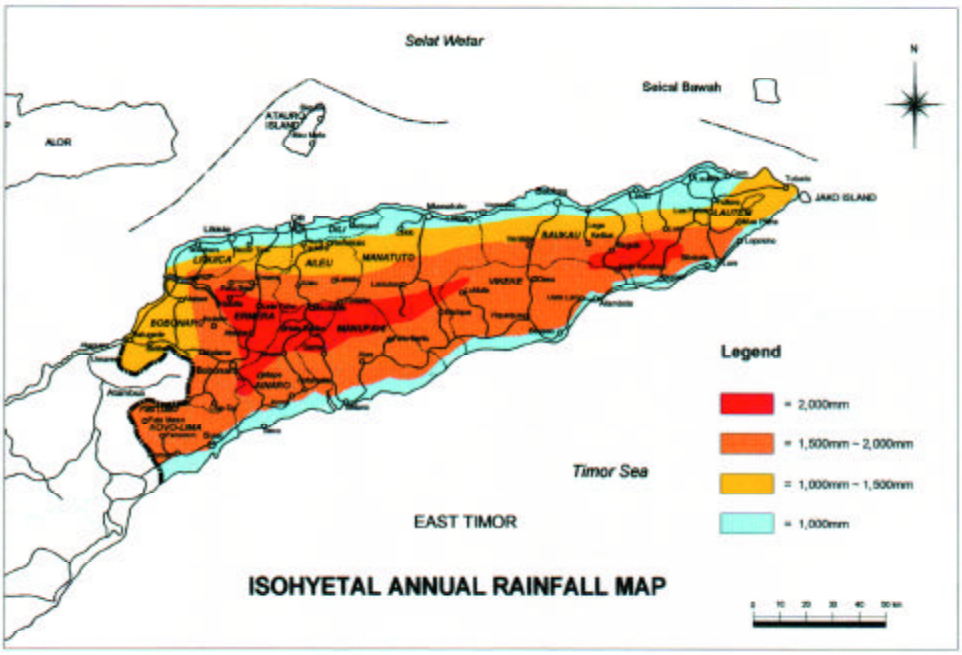
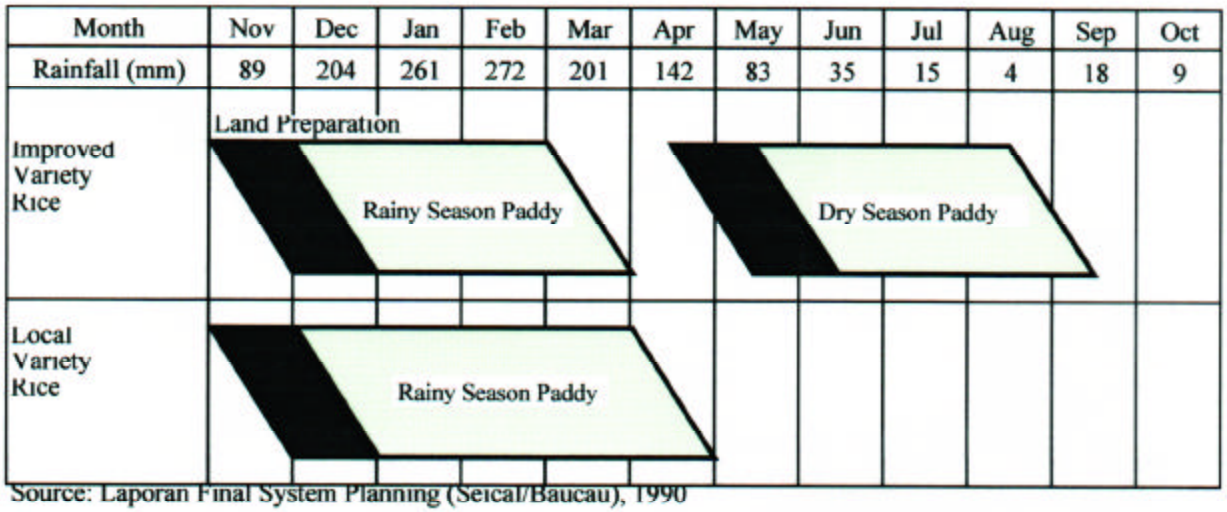


Figure 6.1.1 Isohyetal Annual Rainfall Map in East Timor

The mountains over or less than 2,000 meters lie in a low at the central part of the island, whose rainfall increases from north to south under the influences of the mountains. Consequently, the southern part is suitable for agriculture in terms of available rainfall.

Agricultural Product Activities

In normal years, coinciding with the rainy season, the agricultural cycle in East Timor begins in November with land preparation and planting of maize, followed by nursery preparation and transplanting of rice in December/January. Maize is harvested in April and wet season rice around May/June. In southern areas, where there is a second rainy season and in areas with some supplementary irrigation it is possible to grow a second crop of maize or rice. The relative importance of this crop, however, is small. Cow peas and sweet potatoes are also cultivated at the onset of rains in November. Cassava is a perennial crop and can be relied on for food at times of need. As shown in Figure 6.1.2, whose source is the data under the Indonesian government.



Source: Laporan Final System Planning (Seical/Baucau), 1990

Figure 6.1.2 Cropping Pattern of Paddy

Irrigation in East Timor is confined, almost exclusively, to the production of paddy rice in the rainy season. Most irrigation systems were established by the Indonesian authorities in the last two decades, and managed on behalf of the farmers by staff from the Department of Agriculture.

6.2 Present Situation of Agriculture

6.2.1 Agriculture

Agriculture is the most important economic sector and approximately 90 % of population resides in rural areas, and 71 % of population derives their primary income sources from agriculture. Principal staple crops are rice and corn, with coffee and beef produced for export.

However, agricultural productivity has decreased due to many farmers quitting farming, following the violence occurred in 1999. In addition, the structure of the agricultural sector of this country is fragile caused by the destruction of irrigation facilities, their poor maintenance & management, stoppage of agricultural activities

with mutual argument, killing of domestic animals, loss of tractors and loss of rice mills.

Under such circumstances, rehabilitation works of irrigation facilities help increase the production of staple food i.e. rice, therefore it is urgent and important for the country to receive food aid from other countries. Furthermore this help will enhances the return of farmers to farming, thus helping to stabilize agricultural communities.

Photo 6.2.1 The *Rencah* (cattle trampling system) of Land Preparation

6.2.2 Agricultural Production

(1) Food Production

Rice is an important food and cash crop. The main rice crop is grown in the wet season from November to March. In 1997 the total harvested area was reported at around 21,700 ha yielding an average of 3.3ton/ha (paddy) and total production was about 72,000 ton (paddy). However, the consumption of unpolished rice per person is 53kg, thus East Timor is presently relies on the import of rice from abroad. Official trends (1992-1997) for main crop production are indicated in Table 6.2.1.

Table 6.2.1 Production of Main Crop in East Timor

(Unit: ton)

Crop	Unit	1992	1993	1994	1995	1996	1997	2000
Maize	Ton	94,000	104,400	115,700	103,000	122,400	126,300	94,565
Rice (paddy)	Ton	56,300	64,000	67,000	47,700	69,500	72,000	50,920
Cassava	Ton	51,500	70,000	74,300	75,600	78,100	82,300	-
Sweet Potato	Ton	10,400	19,100	18,000	18,200	17,100	17,600	-

Source: Timor Timor Dalam Angka, 1997 (BPS: Central Board of Statistics of East Timor Province)

According to 「FAO/WFP Crop and Food Supply Assessment Mission to East Timor」 Special Report (April 2000), rice production of East Timor in 1999/2000 decreases 30% in comparison to 1997 years as shown in Table 6.2.2.

Table 6.2.2 1999/2000 Rice and Maize Production

District	1996/1997		1999/2000	
	Paddy	Maize	Paddy	Maize
Covalima	5,000	16,000	3,600	12,160
Ainaro	1,600	4,500	1,072	3,195
Manufahi	2,200	5,000	1,848	5,000
Viqueque	17,200	14,000	13,760	14,000
Lautem	3,200	7,700	2,880	7,392
Baucau	12,000	14,000	9,720	13,300
Manatuto	4,800	4,000	3,984	3,680
Dili	200	2,000	172	1,900
Aileu	1,700	10,500	1,411	9,240
Liquica	500	5,000	210	1,400
Ermera	3,300	6,200	2,838	4,774
Bobonaro	15,000	28,600	8,100	15,444
Oecussi	5,300	8,800	1,325	3,080
TOTAL	72,000 (43,200)	126300	50,920 (30,552)	94,565

Source: FAO/WFP
Note: Milling rate for paddy to rice taken at 60 percent
Millet rice equivalent given in brackets

(2) Coffee Production

In the mountainous area, coffee of Arabic variety is cultivated as a cash crop. Its production reached about 9,900 tons in 1,997. Coffee is expected to be an important export crop in the future. As shown in Table 6.2.3, the coffee production in the western four (4) districts of Emera, Manufahi, Ainaro and Liquica is 4,562 ton, 1,786 ton, 1,498 ton and 1,381 ton respectively. Thus production amounts to 93 % of the total production.

Table 6.2.3 Coffee Production in East Timor (1997)

District	Cropping area (ha)	Production (ton)	Yield (kg/ha)
Covalima	267	42	157
Ainaro	4,318	1,498	347
Manufahi	6,012	1,786	297
Viqueque	284	0	0
Lautem	16	3	188
Baucau	131	22	168
Manatuto	692	159	230
Dili	24	5	208
Aileu	783	102	130
Liquca	5,366	1,381	257
Ermera	27,821	4,562	164
Bobonaro	2,065	339	164
Ambeno	5	1	200
Total	47,784	9,900	207

Source: East Timor in Figures, BPS, Central Board of Statistics of East Timor Province

6.2.3 Irrigation

(1) Present condition of the irrigation

Rice cultivation is being carried out in both rain-fed upland areas and irrigated areas. Rain-fed rice cultivation is mainly carried out in various districts covering about 3,000 ha throughout the country, while irrigated rice cultivation is carried out in over 18,695 ha. Therefore, in the agricultural infrastructure, irrigation performs a big role in rice production.

Most of the irrigation projects for rice cultivation were constructed from 1980-1997 and there are about 40 major projects. Locations of these irrigation areas occur in the flatland along the rivers flowing to the north and south coasts. Surface water of the river is utilized for irrigation. The cultivation areas of these projects are estimated to be about 25,800ha, but only 15,600ha is functioning i.e. a 60 % utilization ratio.

(2) Necessity of irrigation infrastructure repair

The major impediments to rice cultivation are shortage of the irrigation water and irrigation facilities and the lack of cattle and tractors. No irrigation systems have been damaged as results of recent violence. However, repairs to irrigation canals, which are normally done during the dry season, have not been carried out this year. Damages to the irrigation system are mainly caused by neglecting their maintenance, insufficient budgets and/or by natural disaster, including flood and landslide.

Photo 6.2.2 Deteriorated Siphon

Furthermore, actual cultivation area is low due to poor maintenance and lack of management caused by the farmers abandoning their farms and stopping cultivation following the violence. Under such circumstances, the proposed projects, therefore are to implement agricultural facility rehabilitation works, especially there works centering on irrigation facility rehabilitation to cause the farmers to return to farming and thus to provide rice production.

6.2.4 Inventory Survey

Irrigation systems of this country are classified into the following three categories:

Technical irrigation system:
The permanent weir and channels are designed by DPU (Public Works Department in Indonesia) engineers and constructed under DPU supervision. The primary, secondary and tertiary channels are fitted with control structures which control the height and rate and rate of irrigation supply. Drainage channels are constructed to control flooding and drainage of excess rainfall runoff. The weir is constructed for a river is large enough to guarantee continuous supply of water throughout the year or during the cropping season for a relatively large irrigation area.

Semi-Technical irrigation system:
The height of water in the river is controlled by a rock or gabion (bronjong) semi-permanent weir which is capable of standing for a number of years. Once the water in the weir is high enough to enter the intake channels, there is no control over the height and rate of irrigation supply. The weir is built on a medium size river to supply a relatively small irrigation area.

Communal irrigation system (traditional irrigation system):
The weirs for these schemes are simple structures of rock or timber or bamboo which act as emergency diversion structures. They are frequently damaged or washed away during flooding and may need to be repaired or rebuilt by the local community many times. The initiation and maintenance of these schemes is sometimes supervised or supported by DPU and in other cases according to the sole initiative of the local farmers group. The supply channels do not control the rate of irrigation supply. Usually these schemes are built on small rivers and streams and the area of rice field (sawah) is less than 500 ha.

Major irrigation areas consist of Technical and Semi-Technical irrigation system which were constructed during Indonesian time. There are about 4 units throughout the country. The survey activities for urgent irrigation infrastructure rehabilitation project are to be carried out except in the Bobonaro, Covalima, Ambeo areas. The size of survey area is about 100 ha per unit (i.e. 20 systems). The location map of 20 irrigation systems is shown in Figure 6.2.1. Results of inventory survey for each irrigation system are attached in APP. 6.2.4.

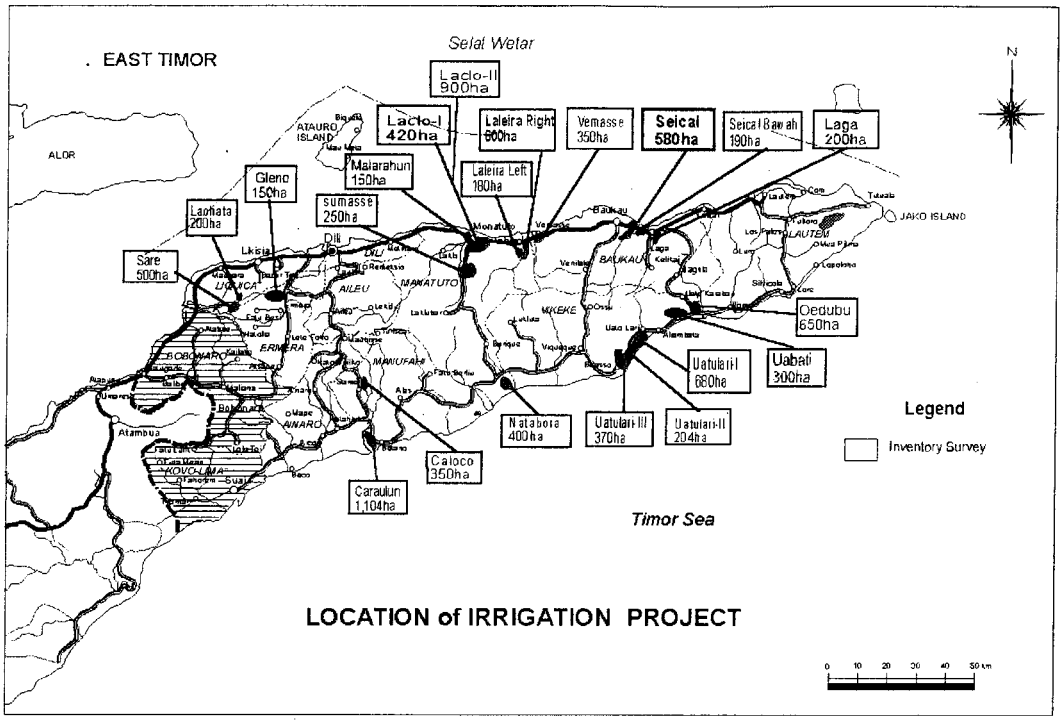


Figure 6.2.1 Location of Irrigation Project

6.2.5 Assessment of Inventory Surveys

Irrigation facilities

The Inventory surveys were carried out for 20 irrigation systems in six districts. The conditions of damage of the 20 irrigation facilities can be summarized as follows:

- Intake facilities for 8 of the irrigation systems among the 20 systems collect water using the dam form, while those of the remaining 12 systems are of free intake type. Two of the intake facilities of dam type have collapsed, and another is in dangerous condition. Four of the remaining five do not particularly require repairs. On the other hand, all 12 facilities of the free intake type require rehabilitation.

- Canals are either classified as main, secondary or tertiary canals. The main canals are made up of block structural canals, and the remaining canals are earth canals. Generally, block structural canals of the main canals will be reusable after mowing of weeds and cleaning, including removal of earth and sand. These block structure canals are partly damaged. Earth canals of the secondary and tertiary canals are used and maintained by farmers.

- Damage of these facilities results from poor planning and construction of the facilities or insufficient management of them. Therefore, it is necessary to rehabilitate them through this plan and, at the same time, to give consideration to the formation of organizations to manage the facilities. Work should be planned to include farmers as much as possible so as to improve the conditions for the formation of such organizations.

Photo 6.2.3 Excavation of Free Intake

Farm Roads

Farm roads are rarely placed through rice fields in East Timor. Usually, roads for maintenance of canal are constructed along main canals. These roads are also used for agricultural management. Maintenance of the roads is poor, hindering access. The management of canals in Laclo (Manatuto) and Seical (Baucau), the roads for management of canals are also used as public roads to connect communities. These farm roads should be improved during the rehabilitation of canal.

Agricultural Machine

Major impediments to rice cultivation include the shortage of irrigation water, inadequate irrigation facilities and the lack of cattle, tractors, and rice mills. Damages to the irrigation system are mainly caused by maintenance neglect after a natural disaster, such as flood and landslide. In order to maintain irrigation systems and farm roads, construction machines (i.e. back hoe, truck) are requested by CNRT and farmer groups. Tractors and rice mills also are necessary equipment to increase rice production effectively.

Photo 6.2.4 Threshing Machine

6.3 3 Year Urgent Rehabilitation Plan

6.3.1 Basic Concept for Urgent Rehabilitation

(1) Basic Concept

The Basic Concept of the Rehabilitation Plan is to rehabilitate the existing facilities. Therefore, the locations of intake facilities and canals will not be changed, basically. In terms of structure, damaged facilities will be improved, and the existing facilities will be used if possible after future maintenance improvements.

(2) Objectives and Scope of Improvement of Facilities

Objectives

The objectives of the Rehabilitation Plan include reconstructing and providing stable intake-water by improving weir facilities and recovering water flow by improving the irrigation canal. Realization of these objectives aims at increasing yields of rice, stable employment and improvement of living standards. It is also sought to make agricultural work more efficient, reduce the volume of labor and improve the living conditions, through rehabilitation of farm roads.

Scope of the Rehabilitation Plan

The scope of the Rehabilitation Plan of Irrigation Facilities includes improvement of intake facilities and main canals as its main objective. Secondary canals and facilities for small-scale structure are not included in the Rehabilitation Plan because they are managed by farmer groups. Farm roads will be repaired by embankment and placing a gravel surface on lost/impassable portions of roads along the main canal.

6.3.2 Formulation of Urgent Rehabilitation Plan

(1) Rehabilitation Approaches

A 3 years Plan for Urgent Rehabilitation was formulated after assessing damage of the facilities and repair and rehabilitation costs. The rehabilitation plan was analyzed for the effects of investment. The flow chart for this is shown below.

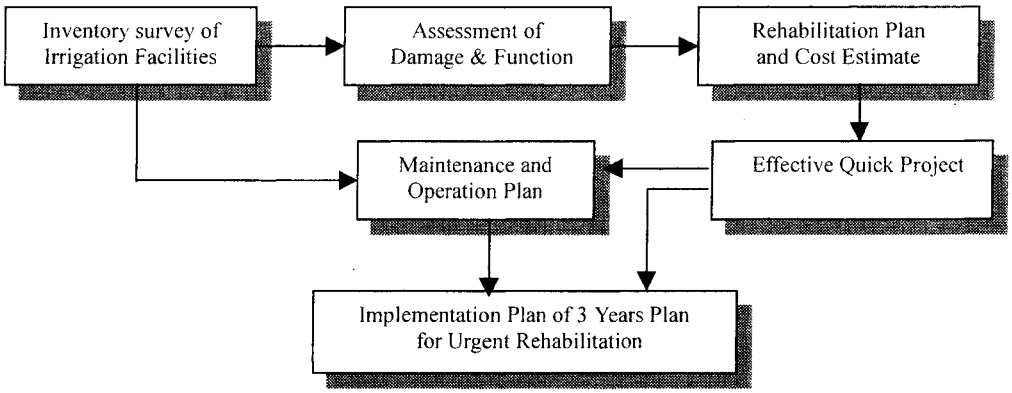


Figure 6.3.1 Flow Chart of Urgent Rehabilitation Plan

(2) Priorities of the rehabilitation

From the results of Inventory surveys, priorities for urgency of rehabilitation can be classified by assessing the damage of the facilities and influences on agriculture (sleeping areas).

Class A:
The system of class A is an irrigation system whose entire irrigation area is a sleeping area because water cannot be collected and the main intake facilities have been destroyed. Damage of the main facilities is significant, and it is expected that the intake dams will be broken if the main facilities are not rehabilitated urgently. In the case of the breakage of the intake dam the whole area will become a sleeping area.

Class B:
The system of class B is an irrigation system that is repaired and cared for by a farmer group because of its free intake form, although it is significantly damaged. The farming area is about 70% - 90% of the arable area.

Class C:
The system of class C is an irrigation system that does not require urgent rehabilitation work although it has some damage.

As a result of assessing each irrigation system under the above-mentioned conditions, their priorities in the urgent rehabilitation project can be classified and positioned as shown in Table 6.3.1.

Table 6.3.1 Summary of Inventory Survey

No	District	System	Function area of Irri-gation	Damage Assessment				Note (Doner)
				Principal Contents of Facilities	Priority of rehabilitation			
					High	Medium	Low	
			(ha)		(class A)	(Class B)	(ClassC)	
1	Baucau	Seical	580	Weie, canal	○			Rehabili. P.
2		Seical Bawah	190	Intake canal		○		
3		Vemasse	350	Intake canal		○		
4		Laga	200	Intake canal		○		
5	Viqueque	Uatulari - I	680	Weir, canal	○			Rehabilit. P.
6		Uatulari - II	200	Weir, canal			○	
7		Uatulari - III	370	Weir, canal			○	
8		Uabati	300	Weir, canal		○		
9		Oedubu	650	Intake canal		○		
10	Manatuto	Laclo	660	Intake canal	○			Rehabili. P.(First Year:Japan)
11		Sumasse	250	Intake canal		○		
12		Malarahun	150	Intake canal		○		
13		Laleia - L	180	Intake canal		○		
14		Laleia - R	600	Intake canal	○			Rehabilit. P.
15		Natarbora	400	Dam canal		○		
16	Ermera	Sare	500	Intake canal		○		
17		Gleno	150	Intake canal		○		
18	Liquica	Laohata	200	Intake canal		○		
19	Manufahi	Caraulun	1,100	Weir, canal	○			(IDA)
20		Caloco	350	Weir, canal		○		
	Total		8,060					

The inventory survey of 20 locations as listed in table shown above was carried out to judge the rehabilitation of irrigation facilities such as intake facilities, canals and so on, as well as maintenance roads. As a result of assessing the urgent rehabilitation of irrigation facilities, the five (5), the thirteen (13) and two (2) areas are classified into the class A, the class B and the class C, respectively.

(3) Production target by rehabilitation of facilities

Rice production is 72,000 ton in 1997 and 50,920 ton from May 1999 to April 2,000 respectively. Consequently, the struggle for independence decreased rice production of about 30 % in comparison to 1997. 85 % of the paddy fields are irrigated and the irrigation facilities are thus important for rice production. The irrigation facilities are poorly maintained because some farmers abandoned farming during the disturbance. In addition, the sleeping paddy fields are seen in the whole of the country because of the shortage of irrigation water. The rehabilitation of the irrigation facilities in the 3 Years Urgent Rehabilitation Plan aims at raising rice productivity to the same level as 1997 as one of the important targets as shown in Table 6.3.2.

Table 6.3.2 Target of Paddy Production

Year	1997	2000	2003
Production (ton)	72,000	50,920	72,000
Population	887,000	753,000	823,000
Production per capita (kg)	81.2	67.6	87.5

(4) Urgent Irrigation Rehabilitation Plan

In order to recover the rice productivity, the four(4) irrigation systems out of the five irrigation systems with a high priority(Class A) have been selected as the target project area of the 3 Years Urgent Rehabilitation Plan. The Caraulun irrigation system is excluded since the International Development Association (IDA-of World Bank group) is conducting a study in this area. Considering the investment costs for the urgent rehabilitation projects from 2,000 to 2,003 and the UNTAET's budget of the Irrigation sector (US$ 14 million), the selection of the four areas is reasonable for these infrastructure projects.

On the other hand, the irrigation facilities have to be maintained every year. Especially, the sediments of the main canal should be disposed every year while the conducting canal of the free intake is to be excavated and soil removed. The farming area decreases because of sedimentation in the year with many floods. Consequently, an *Operation & Maintenance Strengthening Project* has been formulated to achieve the target of rice production.

The project can keep the irrigation facilities in functional conditions and constructs farm roads which are helpful for the farming and the daily life of farmers.

The 3 Years Urgent Rehabilitation Plan which aims at the agricultural restoration, especially the recovery of rice production and it aims to keep 20 irrigation facilities in functional conditions. The anticipated scope of work consists of the rehabilitation of infrastructure for irrigation in the four irrigation system and providing an intensive project for operation and maintenance of 20 irrigation systems. The outline of the irrigation projects in the 3 Years Urgent Rehabilitation Plan is shown in Table 6.3.3.

Table 6.3.3 Outline of the Rehabilitation Project

Implementation	Name of Irrigation System	District	Total Irrigation Area (ha)	Construction and Procurement
Urgent Irrigation Rehabilitation Project	Laclo	Manatuto	420	1) Construction of temporary intake at the Sumasse river 2) Repair works of existing canal, structures and maintenance road 3) Construction for union's house 4) Procurement of back hoe
	Seical	Baucau	580	1) Repair works of rear apron and side wall of existing weir 2) Gabion works for existing weir 3) Repair works of existing canal, structures and maintenance road 4) Construction for union's house
	Uatolari-I	Viqueque	680	1) Construction of intake weir (submerged bridge) 2) Gabion works for conduction canal 3) Repair works of existing canal, structures and maintenance road 4) Construction for union's house
	Laclo-II	Manatuto	900	1) Protection gabion dike and concrete wall 2) Construction intake, gate, Siphon and Culvert 3) Reconstruction main canal and structures 4) Construction for union's house
	Laleia-R	Manatuto	600	1) Gabion Dike and Conducting intake dike 2) Construction intake and gate 3) Repair works of existing canal and structures 4) Construction for union's house

6.3.3 Formulation of Operation and Maintenance Strengthening Project

(1) Needs for Operation and Maintenance Strengthening Project

With the departure of the Indonesian staff in 1999 and the widespread civil strife, most of irrigation schemes were left without management and budgets for operation and maintenance. Many irrigation systems depended on annual maintenance operations normally carried out before and after the rainy season – because these operations were not carried and, because many irrigation systems were sited flashy, highly erosive river systems, the following damages are now commonplace:

- Weirs, intakes and farm roads were damaged and not repaired during 1998/1999 to 1999/2000;
- Main canals were silted and, where inflows were reduced, became overgrown;
- Secondary canals also silted and became overgrown;
- Some of rural and agricultural road damaged and left without repair works;

Many of repairs for weirs and intakes are beyond the capabilities of the farmers. At the field level, operations to remove sediment and vegetation in tertiary canals and to rebuild accessway have not been completed due to the lack of equipment and budget.

(2) Concept for the Project

Procurement of Equipment

This project is not construction project but supply and procurement of equipment for operation and maintenance in irrigation sector. Equipment will be supplied to regional operation and maintenance (O/M) stations. These O/M stations will be organized by new governmental organization of East Timor.

Participatory Approach

In order to ensure smooth and effective implementation, this project adopts the concept of "*Participatory approach and management*" which includes the participation of farmers in every step of the planning of a program and implementation of community activities.

The establishment of regional O/M stations is essential to integrate all farmers and to be able to plan and work effectively. Many local government staffs, technicians and farmers will participate in workshops, trainings and activities in implementation stage.

(3) Summary of the Project

Composition of the Project

As shown in Table 6.3.4 and Figure 6.3.2, the Project is basically made into the following seven (7) stages.

Table 6.3.4 Composition of the Project

Stage	Main works	Responsibility
1	Detailed design and tender preparation	Consultant
2	Supply and procurement of equipment	Supplier
3	Establishment of organization for operation	Government of East Timor
4	Commissioning and training	Supplier's engineer
5	Inland transportation	Government of East Timor
6	Final inspection	Consultant
7	Operation	Government of East Timor

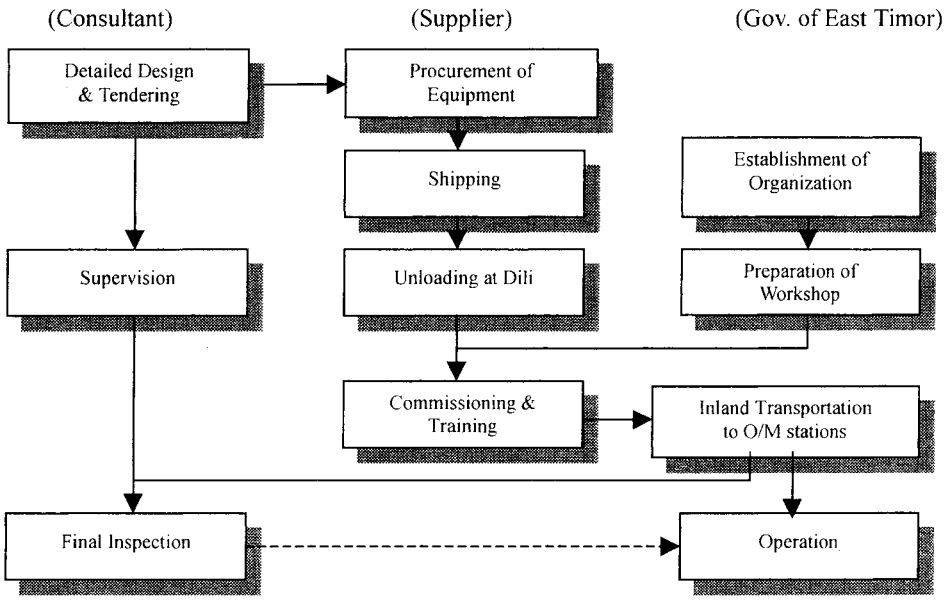


Figure 6.3.2 Flowchart of the Project

Organization of the Project

To cope with the above-mentioned situation, this Project is proposed. Beneficiaries of this Project cover all irrigation systems which have more than 100 ha in East Timor except Bobonaro, Covalima and Ambeno districts. Considering the location of each irrigation systems, one (1) workshop and nine (9) O/M stations will be installed by this project as shown in Figure 6.3.3.

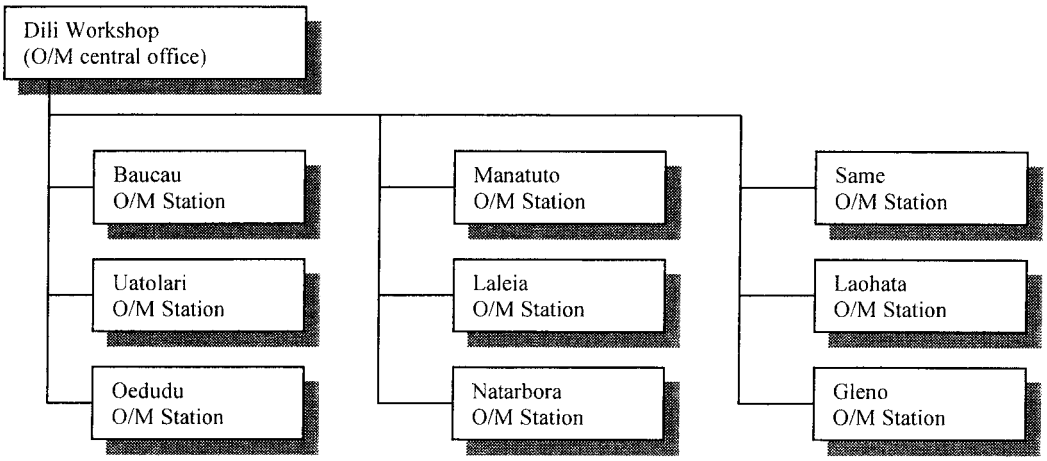


Figure 6.3.3 Organization of O/M Strengthening Project

New Employment Opportunities

New employment opportunities will be produced by the establishment of these O/M stations and 80 persons will be provided with new job as shown in Table 6.3.5.

Table 6.3.5 Staff of O/M Stations and Workshop

No.	Profession	Number (persons)	Remarks
1	Manager	10	Workshop and O/M Sta.
2	Clark	10	Workshop and O/M Sta.
3	Driver for mobile workshop	1	Workshop
4	Operator for excavator	9	O/M Stations
5	Driver for 4 ton cargo truck with crane	9	O/M Stations
6	Driver for pickup	10	Workshop and O/M Sta.
7	Operator for rice mill	9	O/M Stations
8	Mechanics	1	Workshop
9	Assistant	21	Workshop and O/M Sta.
	Total	80	

Equipment Procured by the Project

Based on the results of field survey and questionnaire for this project, the following equipment is needed to be procured for the 20 irrigation systems by this project.

Table 6.3.6 Major Component of Equipment

No.	Item	Number of Equipment (set)	Distribution Place	Purpose
1	Equipment for workshop	1	Dili workshop	Delivery of excavators
2	Mobile workshop	1	Dili workshop	Repair for equipment
3	Excavator (Back hoe)	5	9 O/M stations	Repair for temporary conduction canals and roads Dredging of sediment
4	Brush cutter	16	9 O/M stations	Maintenance & operation for canals and roads
5	4 ton cargo truck with crane	9	9 O/M stations	Transportation for equipment, agricultural products and inputs
6	Pickup	10	Dili workshop & 9 O/M stations	Transportation for agricultural products and inputs
7	Removable pump	9	9 O/M stations	Emergency irrigation pump
8	Rice mill	19	9 O/M stations	Milling of paddy
9	Power thresher	29	9 O/M stations	Threshing of paddy
10	Diesel oil	500	9 O/M stations	Fuel for O/M equipment

6.3.4 Preliminary Design

The preliminary design of the Irrigation sector has been divided into four (4) irrigation systems and the procurement of equipment for their operation and maintenance. Project profiles and drawings of these projects are attached in APP. 6.3.4. The study has been carried out in accordance with the *Canal works and Headworks Design Manual by Japan Irrigation, Drainage and Reclamation Association* and *Cost Estimation Guideline for Japanese Grant Aid by JICA Standard.* The location of the four irrigation systems is shown in the following

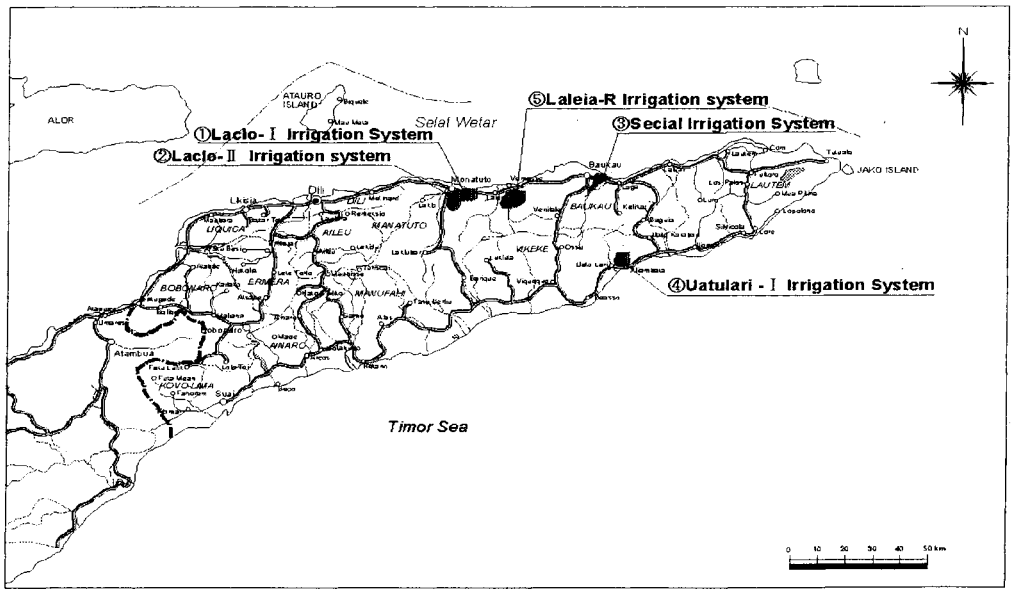


Figure 6.3.4.

Figure 6.3.4 Location of Urgent Irrigation Rehabilitation Plan

(1) Laclo Urgent Irrigation Rehabilitation Project

1) Background

Adjoining to Manatuto city, the Laclo Irrigation system lies at the east of 50 km from Dili and is located at the downstream of the Laclo River which flows into the north of the Manatuto district. The irrigated area of 660 ha lies at the right bank of the Laclo river and is an important producing area of rice. However, the rice cultivation here is impossible without irrigation because the average annual rainfall is less than 1,000 mm.

The irrigation facilities including an intake structure were constructed by Portugal in 1960's. They were rehabilitated by the Indonesian government 10 years ago. The irrigation facilities have been constructed near the sandbar surrounding by the Laclo River and the Sumasse River of a Laclo's tributary.

Irrigation water is conveyed to the target area located 4 km to the east. The main canal crosses the Sumasse river by a siphon because of its location at the sandbar. The siphon and the part of the main canal were destroyed by the flood of the Sumasse river in 1998. As the Laclo irrigation system is not functional at present, the irrigable land is in the fallow condition. Some of the farmers who abandoned farming have moved to Dili city for temporary jobs. The rest can not cultivate in the irrigable area, which increases the social unrest in the community.

2) Rehabilitation Plan

Present Situation of Destruction of Facilities

According to the results of the inventory survey, the destroyed portions of the Laclo irrigation system to be rehabilitated are described as follows;

- Portion of the conducting dike washed away at the free intake facility. Damage intake and damaged portion of protection wall

- Portion of Sumasse siphon damaged and washed away (Length: 100 m)

- Damaged portion of culvert canal and removal of sediment (Length: 145 m)

- Destroyed masonry of main canal (Length: 1,400 m)

- Repair of main canal (Total length: 200 m)

- Gabion dike for protection destroyed and washed away (Length: 200 m)

The following points should be considered for rehabilitation works of facilities;

- A detailed survey and investigation are necessary to formulate the rehabilitation or removal plan because the design documents of existing structures were lost.

- Countermeasures for the stability of river flow and floods of the Sumasse river are required to ensure the safety of the main canal.

- A survey is necessary for removal of much sediment from the Laclo river.

- The farm land is laid waste because of long-term fallow conditions. For the reason, it will take a longer time for land preparation. In addition, the farmers puddle paddy fields by their traditional Rencha method wherein a buffalo with low efficiency puddles in paddy fields. The transplanting of all of the area is rather difficult because of the long period for land preparation and transplanting.

- The countermeasure for post-harvest as well as the one for the recovery of water conveyance is essential for the restoration of functional rice cultivation in the target area.

Phasing Rehabilitation Plan

Because of budgetary limitation for the first year of the 3 Years Urgent Rehabilitation Plan of Irrigation, the budget and the total construction period of the facilities to be rehabilitated and the urgent need to resume the irrigated farming, the rehabilitation plan is divided into the two phases and is implemented.

a) Laclo irrigation system-Phase I

The route of Sumasse river is to be trained and the intake structure is to be constructed from the Sumasse river. The conducting canal is connected from the intake structure to the existing main canal to convey water conveyance. The paddy field of 420 ha will be irrigated from the year of 2,001. However, irrigation will function only in the rainy season because the Sumasse river dries in the dry season.

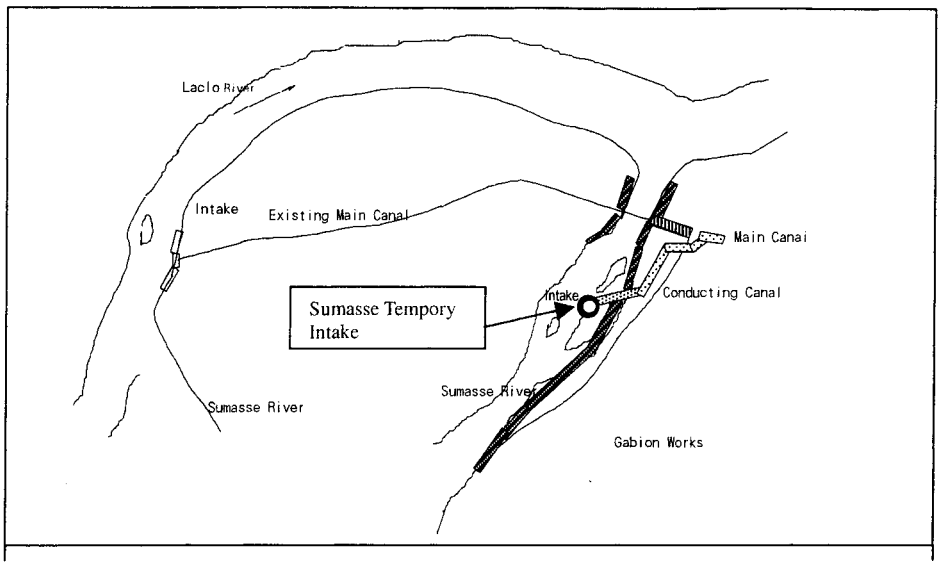


Figure 6.3.5 Plan of Laclo Irrigation System-Phase I

b) Laclo irrigation system-Phase II

Double rice cropping is possible in the area of 660 ha by rehabilitating of the existing Laclo intake, settling pond, main canal, Sumasse siphon and culvert canal as well as rehabilitating and constructing a new protection dike.

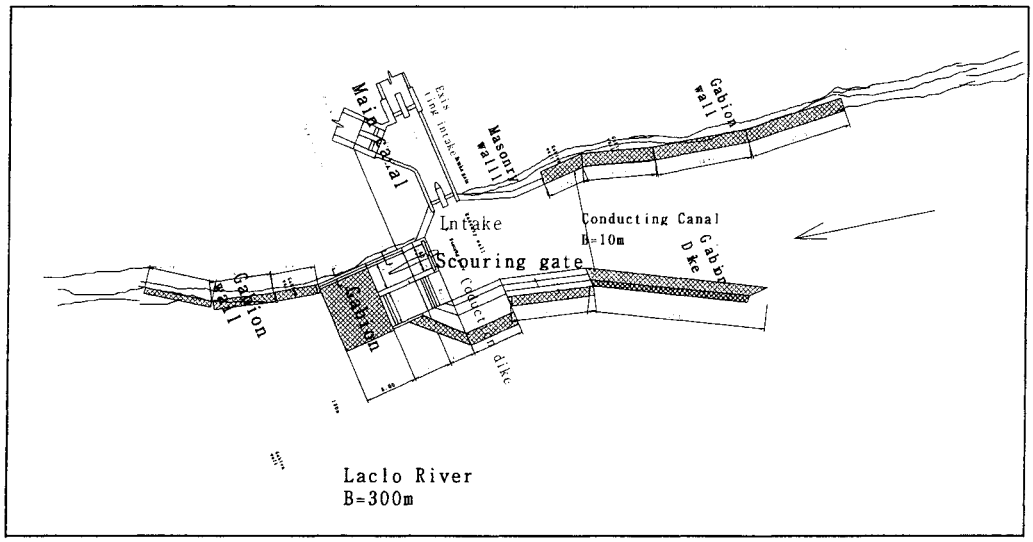


Figure 6.3.6 Plan of Laclo Irrigation System-Phase II

Content of Rehabilitation

The following facilities of the Laclo irrigation system have been planned to be rehabilitated.

a) Laclo Irrigation System - Phase I

Construction of Sumasse free intake

The temporary free intake is constructed at the upstream of 400 m from the existing Sumasse siphon. The free intake consists of a conducting dike collecting water from the Sumasse river, a protection dike and an intake gate.

Construction of conducting canal

The conducting canal is constructed from the Sumasse free intake to the existing main canal. Its length is 500 m. The cross section of new canal is the same as the existing canal. The canal is to be lined with gabion because it occurs over a sedimentary layer of gravel.

Protection dike

The protection dike is planned to prevent flooding by the Sumasse river.

Canal repair work

The existing culverts, distribution boxes and spillway gates locate at the crossing points of the roads to be rehabilitated.

Repairs of maintenance farm road

The maintenance farm road in along with the main canal was partly destroyed, it thus is dangerous for the traffic of vehicles. The missing portions are to be repaired. The road is to be given a surface by graveling because it is also used as a road for the daily life of the people.

The content, scale and quantity of the Laclo- I irrigation system is shown in Table 6.3.7.

Table 6.3.7 Summary of Laclo irrigation system – Phase I

Facility Item	Structure Content	Scale	Remarks
Temporary intake	Gabion dike	H: 2.0m, L: 80m	New construction
Conducting Canal	Masonry canal	H:1.8m, B: 2.8m, L: 300m	ditto
Bridge	Concrete culvert box	B: 3.5m, L: 9.0m	ditto
Repair Canal	Main Canal & related structures	Partly Main canal (total 100.0m)	Rehabilitation
Repair gate	Scouring gate	B: 1.0m 2 unite	Rehabilitation
Protection dike	Gabion Dike	H: 3.0m, L: 120m H: 2.0m, L: 800m	Rehabilitation & new construction
Maintenance & Farm road	Embankment & gravel pavement	B: 3.0m, L: 2,800m	Rehabilitation
Construction for union's house	Steel Frame house	A: 50m^2	New construction
Procurement Equipment	Back hoe(excavation)	Back hoe: 0.3m^3	New Equipment

b) Laclo Irrigation System - Phase II

Construction of Laclo free intake

The Laclo free intake is to be reconstructed because it was washed away. The free intake consists of a conducting dike and a scouring gate. The gate consisting of 2 units each 1.6 m in width. The purpose of the scouring gate is operated to decrease sediments flowing into the canal.

Protection dike

The flooding of the Laclo river scours the right bank every year and thus wides the river width. For the purpose of the safety of the intake structure and the canal, the protection dike is to be constructed of either masonry or gabion.

Reconstruction of Sumasse siphon

The siphon is to be reconstructed because it was washed away by flood. The structural design is to be decided after the examining the removed of sediments and providing countermeasure for floods.

Repair of culvert canal

The siphon structure is a culvert to remove sand and stones during floods because the canal at the downstream of a siphon passes through the sandbar of the river. The use of existing facilities will be decided after examining the foundation and delaying on countermeasures. The siphon is to be fully rehabilitated.

The content, scale and quantity of the Laclo irrigation system - Phase II is shown in the following table.

Table 6.3.8 Summary of Laclo Irrigation System – Phase II

Facility Item	Structure Content	Scale	Remarks
Intake facility	Conduction Gabion dike Conduction Concrete dike Scouring	H:1.0m, L:27.0 H:2.0m, L:5.0m H:1.0m, L:21.0m B:1.6m, 2 unit	New construction
Protection dike	Masonry Gabion	H:4m , L::30.0m H:2.m, L::8.0m H:3.0m ,L=150.0m H:2.0m ,L=600.0m	Rehabilitaton & new construction
Sumasse siphon	Concrete culvert box, (with protection dam)	L: 100.0m	Reconstruction
Culvert Canal	Concrete culvert box	L:145.0m	Reconsturctuin
Main Canal	Masonry	H:1.8m , B:2..8m L:1,400m	Reconsturction
Repair gate	Intake gate Scouring gate Distribution gate	B:1.4m, 2 units B:1.4m, 2 units B:1.4m, 2 units	Rehabilitation
Maintenance & Farm road	Embankment & gravel pavement	B:3.0m, L:1,500m	Rehabilitation

(2) Seical Urgent Irrigation Rehabilitation Project

1) Background

The Secial irrigation system lies to the east of Baucau city. The system irrigates an area of 580 ha, located at the low land of the right bank of the Seical river. It is the largest irrigation system in Baucau district and was constructed in 1989. The Secial river is a water resource and its discharge decreases during the drought time from August to November. In addition, the river dries up some years. Consequently, double cropping of rice is in the difficult condition.

Intake facility

A weir of 2 m high and 95 m long was constructed with a cross-sectional direction to the river for intake. Irrigation water is conveyed to the main canal. A scouring sluice gate, an intake gate and a spillway gate are installed at the left bank of the river. These structures are to be functional to stable intake and maintenance of a canal. However, the weir is in the dangerous condition because its rear apron was destroyed by a flood in 1998. The destroyed portion is 30 m in length. In addition, the riprap structure of gabion on the downstream side of the rear apron was washed away, causing scouring of the river bed. Scour reaches more than 3 m. Furthermore, the both side walls of the river banks were destroyed and the damage continues. This destruction badly affects to the safety of the weir. Consequently, it is urgently required to rehabilitate those facilities.

Canal system

The canal system consists of a main canal and secondary canals. For the main canal, a length of 9.8 km is lined with masonry. The secondary canals are earthen. It is necessary to partly rehabilitate the main canal. This main canal was damaged by floods from the streams because it is located along the mountain.

2) Rehabilitation Plan

Present Situation of Destruction of Facilities

According to the results of an inventory survey, the situation of destruction is judged as follows;

- Rear apron destroyed (Length: 20 m, Width: 30 m)

- Riprap washed away (Length: 100 m, Width: 110 m)

- Protection wall destroyed (Length: 45m, Height: 2-3m)

- Maintenance road to be rehabilitated.

An irrigation system is only used during irrigation periods. Consequently, it is desirable to rehabilitate the canals in the dry season when the canals are not used. Additionally, it is necessary to obtain the farmers' consent to interrupt irrigation water.

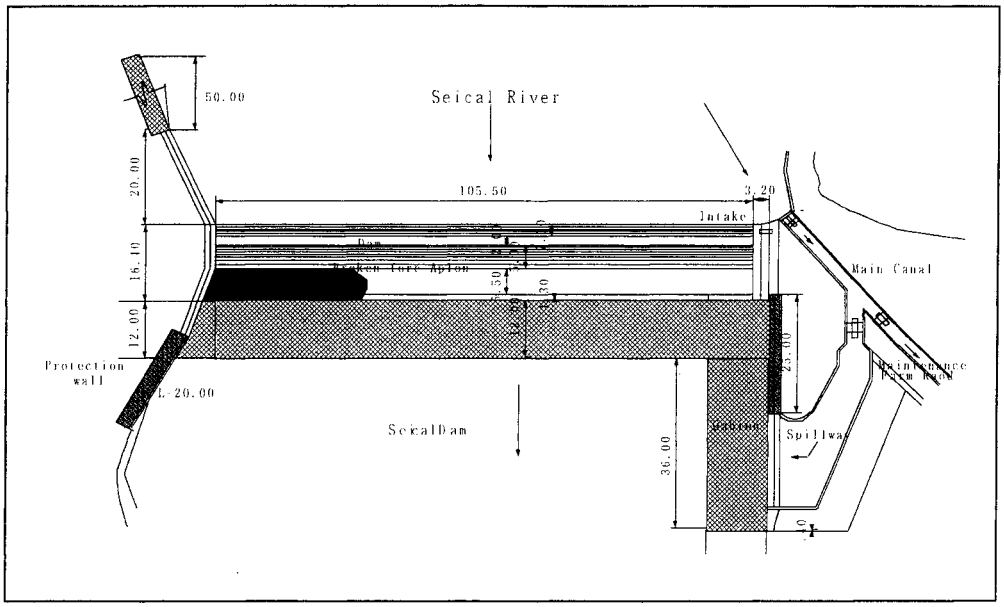


Figure 6.3.7 Plan of Seical Irrigation System

Contents of Rehabilitation

1) Rehabilitation of rear apron

The 30 m in length of rear apron was destroyed and washed away; it is necessary to be rehabilitated. It will be rehabilitated by use of concrete aprons. However, the weir is in a dangerous condition. In addition, the riprap of gabion structures downstream of the rear apron were washed away, which causes scouring in the river bed. Scour reaches up to 3 m at the deepest place. Furthermore, both sidewalls of the riverbanks were destroyed and the destroyed portions are getting larger. This damage badly affects the safety of the weir.

2) Reconstruction of riprap by gabion

Where the riprap at the downstream of apron was washed away, it will be reconstructed. The length of the gabion is 10 m.

3) Rehabilitation of protection wall

Since the both protection dikes on at the right or left bank of the river was destroyed, they will be rehabilitated to protect the weir. As the present masonry is poor, it will be reconstructed by well-construction concrete masonry. In addition, the protection gabion dike on the upstream side will be reconstructed because it was washed away.

4) Rehabilitation of main canal

The main canal is partially rehabilitated because some portions of masonry was lost. The damaged portions of the canal from flooding will be repaired together with incidental structures.

5) Rehabilitation of maintenance farm road

The maintenance road is constructed along side the main canal from the National Road. It was partially destroyed and some places are dangerous for vehicular traffic. The dangerous portions will be rehabilitated. The maintenance road will be rehabilitated with gravel surface because it is used for the daily life of the people among the villages.

The content, scale and quantity of the Secial irrigation system are shown in Table 6.3.9 the following table.

Table 6.3.9 Summary of Seical Irrigation System

Facility Item	Structure Content	Scale	Remarks
Intake Weir facility	Rear apron (concrete) Rip Lap (Gabion)	A: 210 m^2 A: 1,550 m^2	Rehabilitation ditto
Protection dike	Gabion Mamsonry	H:2.0m, L:50m, H:3.0m ,L:40m	Rehabilitaton ditto
Repair Main Canal	Masonry	H:1.8m , B:1..8m Partly repair (L: 500m)	Rehabilitation
Maintenance & Farm road	Embankment & gravel pavement	B:3.0m, L:10 km	Rehabilitation
Construction for union's house	Steel Frame house	A: 50m^2	New construction
Procurement Equipment	Bach hoe	0.3 m^3	New Equipment

(3) Uatolari-I Urgent Irrigation Rehabilitation Project

1) Background

Uatolari-Irrigation system lies along the southern coast in the southeast of Viqueque district. Its command area is 680 ha locating at the low land of the left bank of the Bebui river. The region along the south coast has much rainfall and the annual rainfall is over 1,800 mm. The Bebui river does not dry up during the dry season. However, the rainfall is insufficient for double cropping of rice in all of the command area. It is reported that 50 % of the command area enjoys double cropping of rice.

The irrigation system is the largest in Viqueque district. However, the irrigated cultivation is, at present, impossible because of destruction of the intake weir. The irrigation system was constructed in 1983. The intake weir was washed away by a flood in 1989. After that, a reconstruction plan was made in 1992 and the construction of the intake weir started. However, it was stopped and left as it was.

Consequently, the weir cannot be used at present. In the rainy season, the farmers make a simple intake for a minor irrigation every year. As the main canal is not used, sediments are thick in the canal. In addition, some parts of masonry of canal slopes were destroyed. Consequently, it is necessary to clean the canal and to rehabilitate the masonry.

2) Rehabilitation Plan

Present Situation of Deterioration of Facilities

According to the results of a inventory survey, the facilities to be rehabilitated are judged as follows;

- Washed away weir (Height: 2.00 m, Length: 90.00 m)
- Deterioration of main canal (Total length:1.0 km)
- Obstacle for main canal flow by sedimentation
- Damage of distribution box
- Deterioration of farm road (Total length: 2.5 km)

For the rehabilitating the intake weir, the new site of a weir is shifted upstream by 150 m from its existing position. In addition, the weir was designed as a temporary structure instead of a permanent and strong structure.

- Since the elevation of the riverbed went down after a flood washing away the intake weir, the height of a new weir needs to be raised more than 4 m for irrigation. Consequently, the new site is to be shifted upstream by about 150 m.
- It is difficult to construct a permanent and strong structure because of the budgetary limitation of the 3 Year Urgent Rehabilitation Plan. Consequently, a temporary intake weir and a conducting canal will be constructed. For the maintenance of structures, the appropriate machinery will be provided.
- As the Bebui river has no bridge, pedestrian walks to the river. In the rainy season, traffic is impossible. Consequently, the top of a new temporary weir will be widened for passing.

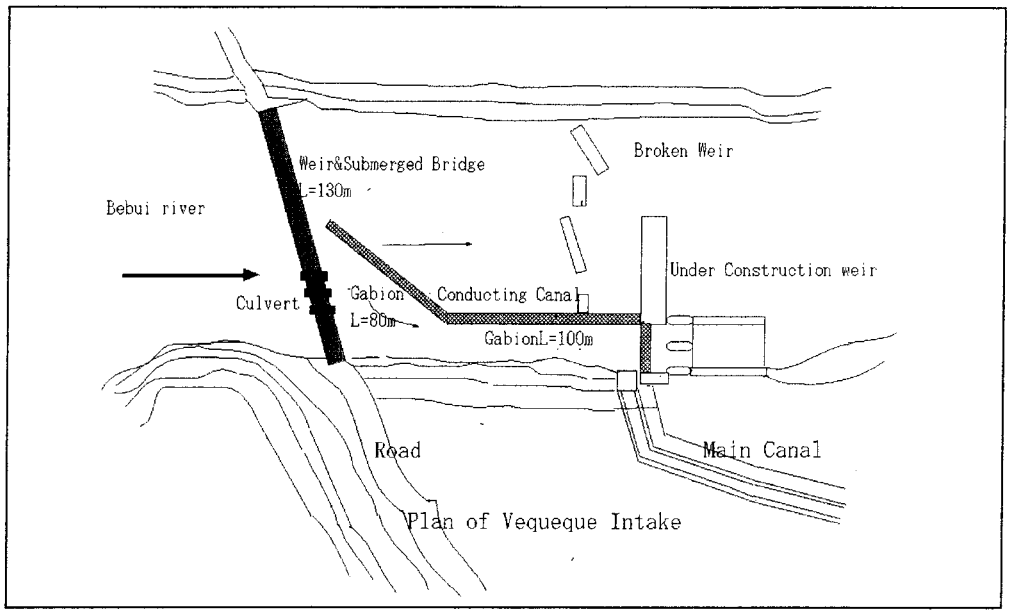


Figure 6.3.8 Plan of Uatolari-I Irrigation System

Contents of Rehabilitation

a) Construction of Intake Weir

As the intake weir was washed away, a new weir will be constructed at a new site 150 m further upstream from the former site. The height and length of the crest are 1.00 m and 90 m, respectively. The river cross section will be completely blocked up by a weir. A conduit pipe will be installed to the weir for intaking of river water. A conducting canal will be constructed in the river to the existing intake.

b) Rehabilitation of Main Canal

The unused main canal needs removal of sediments throughout its length. In addition, it will be necessary to partly rehabilitate the damaged masonry of the canal.

c) Maintenance of Farm Road

The existing road is in the poor condition for traffic. The rehabilitation of the maintenance road aims at letting vehicles of 2 tons weight pass on the road.

The content, scale and quantity of Uatolari-I irrigation system are shown in the following table.

Table 6.3.10 Summary of Uatolari- I Irrigation System

Facility Item	Structure Content	Scale	Remarks
Intake Dam	Temporary intake dam (with submerged Bridge) Riprap (gabion)	H:1.0m, B:4.0m, L:130m H:1.0m A:1,040m^2	New construction
Intake facility	Intake pipe Conducting canal (gabion dike)	Diameter:800mm, L: 48m (Total) L: 100m	Rehabilitation
Repair Main canal	Masonry canal (partly: total: 2.0km) Canal cleaning	H: 1.5m B:1.6～1.0m L: 2.50km	Rehabilitation
Maintenance & Farm road	Embankment & gravel pavement	B: 3.0m, L: 2.50km	Rehabilitation
Construction for union's house	Steel Frame house	A: 50m^2	New construction
Procurement Equipment	Back hoe (excavation)	Back hoe: 0.3m^3	New Equipment

(4) Laleia-R Urgent Irrigation Rehabilitation Project

1) Background

The Laleia -R irrigation system lies east 50 km from Manatuto City. The target area of irrigation is 600 ha and reaches the right bank of the Laleia River and partly to Vemasse. The annual rainfall of the area is less than 1,000mm similar to Laclo. Consequently, rice cultivation without irrigation is impossible there.

The irrigation system was constructed in 1993. The intake facility was destroyed by flood and is not functional now. The farmers make free intakes at the downstream for themselves and take water for minor irrigation. Especially, Vemasse area cannot be cultivated. In addition, some parts of the maintenance road for an intake facility and a main canal are suspended, which hinders the management of facilities. On the other hand, the discharge of the river is enough and rice production can be expected on an enlarged scale if an intake facility is to function again.

2) Rehabilitation Plan

Present Situation of Destruction of Facilities

According to the result of the inventory survey, the destroyed portions of Laleia-R irrigation system to be rehabilitated are estimated as follows;

- Conducting gabion dike washed away (Dike height: 1.00 m, Length: 20.00 m)
- Destruction of intake facility
- Partly damaged main canal (Total length: 1.0 km)
- Obstacle to flow of main canal by sedimentation (Length: 1.5 km)
- Destruction of protection dike (Length: 40 m, Height:2-3 m)
- Damaged farm road (Length: 2.5 km)

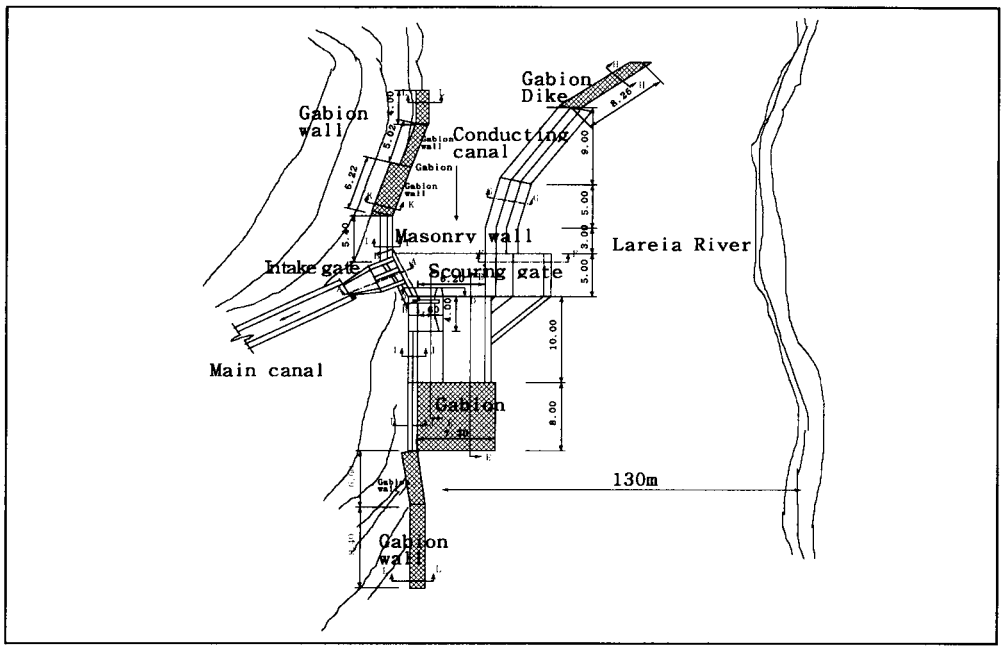


Figure 6.3.9 Plan of Laleia-R Irrigation System

Content of Rehabilitation

The following facilities of the Laclo irrigation system are to be rehabilitated:

a) Intake Facility

For getting water from the main stream of the river, a conducting dike and a scouring gate are planned. In addition, the regulating gate is to be equipped to prevent surplus water in floods.

b) Protection Dike

Since the protection dike to guard intake facilities is destroyed, it is to be rehabilitated by the use of masonry and gabions.

c) Main Canal

The main canal to convey irrigation water from intake to the irrigated area is mostly constructed using earth. For this reason, the canal slope is destroyed, causing the canal to hinder the smooth flow of irrigation water. For the solution, the main canal is to be lined with masonry and the sediment in the canal is to be removed.

d) Maintenance and Farm Road

The existing farm road is in poor condition for traffic due to lack of maintenance. Vehicles of two tons weight at least can pass on the existing arm road by rehabilitation.

The content and quantity of the rehabilitation plan of the Laleia-R irrigation system are shown in the following table;

Table 6.3.11 Summary of Laleia-R Irrigation System

Facility Item	Structure Content	Scale	Remarks
Intake facility	Conducting dike: gabion Ditto: concrete Scouring gate Intake gate	H:1.0m, L: 8.0 m H:2.0m, L: 25.0m B: 1.6m, 1 unit B: 1.0m, 1 unit	New construction
Protection dike	Masonry wall Gabion wall	H:4-2m, L: 25.0 m H:3-2m, L: 25.0 m	Rehabilitation
Main Canal	Masonry	H:1.0m , B:1.5 m L: 3.5 km	Rehabilitation & new construction
Repair gate	Distribution gate	B: 0.6m, 2set	Rehabilitation
Maintenance & Farm road	Embankment & gravel pavement	B: 3.0m, L: 2.0 km	Rehabilitation
Construction for union's house	Steel Frame house	A: 50m^2	New construction
Procurement Equipment	Back hoe (excavation)	Back hoe: 0.3m^3	New Equipment

(5) 20 Irrigation System Operation and Maintenance Strengthening Project

1) Required Equipment

Quantities of equipment procured for each O/M station are shown in Table 6.3.12.

Table 6.3.12 List of Equipment for Each O/M Station

O/M Station	Irrigation System		Irrigation area (ha)	Equipment for workshop (set)	Mobile workshop (set)	Excavator (set)	Brush cutter (set)	4ton truck with crane (set)	Pickup truck (set)	Remo-vable pump (set)	Rice mill (set)	Power thresher	Diesel oil (drum)
Dili Workshop				1	1	0	0	0	1	0	0	0	50
Baucau O/M Station	1	Seical	580										
	2	Seical Bawal	190										
	3	Vemasse	350										
	4	Laga	200	0	0	(1)	2	1	1	1	3	6	50
Uatolari O/M Station	5	Uatolari-I	680										
	6	Uatolari-II	200										
	7	Uatolari-III	370	0	0	(1)	2	1	1	1	3	6	50
Oedubu O/M Station	8	Uabati	300										
	9	Oedubu	650	0	0	1	2	1	1	1	2	4	50
Manatuto O/M Station	10	Laclo	660										
	11	Sumasse	250										
	12	Malarhun	150	0	0	(1)	2	1	1	1	2	4	50
Laleia O/M Station	13	Laleia-L	180										
	14	Laleia-R	600	0	0	(1)	2	1	1	1	2	4	50
Natarbora O/M Station	15	Natarbora	400	0	0	1	1	1	1	1	1	2	50
Gleno O/M Station	17	Gleno	150	0	0	1	1	1	1	1	1	2	50
Laohata O/M Station	18	Laohata	200										
	16	Sare	500	0	0	1	2	1	1	1	2	4	50
Same O/M Station	19	Caraulun	1,100										
	20	Caloco	350	0	0	1	2	1	1	1	3	4	50
Total			8,060	1	1	5	16	9	10	9	19	36	500

Note: Excavators of Baucau, Viqueque and Manatuto O/M offices will be procured by another project

2) Outline of Equipment

Equipment for this project will be procured for the following purposes;

Purpose A: Repair of equipment

Purpose B: Excavation of temporary conduction canals from waterway to intake

Purpose C: Repair of communal intake after flood damage

Purpose D: Dredging of sedimentation in irrigation and drainage canals

Purpose E: Transportation of equipment, fuel, agricultural products and inputs

Purpose F: Emergency irrigation and drainage

Purpose G: Post harvesting

Purposes and specifications of each equipment are summarized in Table 6.3.13.

Table 6.3.13 Purposes for Using of Equipment

No.	Equipment	Purposes							Specifications
		A	B	C	D	E	F	G	
1.	Equipment for workshop	○							
2.	Mobile workshop	○							
3.	Excavator		○	○	○				wheel type, 0.3-0.5 m^3bucket
4.	Brush cutter			○	○				
5.	4 ton cargo truck with crane			○	○	○			4 wheel drive, 2ton crane
6.	Pickup			○	○	○			4 wheel drive
7.	Removable pump		○	○	○		○		6 inch, 5000 l/min
8.	Rice mill							○	
9.	Power thresher							○	
10.	Diesel oil	○	○	○	○	○	○		200 l/drum

6.3.5 Construction Cost

(1) Total Project Cost

The construction cost of the 3 Year Urgent Rehabilitation Plan for irrigation sector is summarized in Table 6.3.14.

Table 6.3.14 Construction Cost

(Unit: US$)

Project		Construction/ Equipment Cost	Engineering Cost	Contingency	Total Cost
Urgent Irrigation Rehabilitation Project (Construction)	Laclo-I	2,650,000	505,000	-	3,155,000
	Laclo-II	4,931,000	986,000	493,000	6,410,000
	Seical	1,500,000	643,000	-	2,143,000
	Uatolari	1,850,000	643,000	-	2,493,000
	Laleia-R	2,200,000	440,000	220,000	2,860,000
	sub-total	13,131,000	3,217,000	713,000	17,061,000
20 irrigation Systems O/M Strengthening Project (Equipment)		4,000,000	600,000	320,000	4,920,000
Total		17,131,000	3,817,000	1,033,000	21,981,000

(2) Breakdown of Urgent Irrigation Rehabilitation Project

Breakdown of the project cost of urgent irrigation rehabilitation project is shown in Table 6.3.15 and APP. 6.3.5.

Table 6.3.15 Breakdown of Construction Project

Irrigation system	Item			Amount (US$)	Quantities of main works
Laclo Phase-I	Construction cost	Direct cost	Temporary work	50,000	Construction road and water control
			Protection dike	555,000	5,380m2 of gabion works
			Channel works	213,000	2,530m3 of excavation, 320m3 of concrete
			Road crossing	176,000	1,660m3 of excavation, 200m3 of concrete
			Cleaning of canal	29,000	9,200 man/day of manpowers
			Maintenance road	216,000	12,000m3 of embankment, 1,800m3 of gravel
			Repair for structure	329,000	Lining, structures and gates
			Unit house	60,000	25m2 x 2 unit house
			Equipment	143,000	Wheel backhoe and spare parts
			sub-total	1,771,000	
		Indirect cost		879,000	
		total		2,650,000	Direct cost + Indirect cost
	Engineering services cost			505,000	Detailed design + Construction supervision
	Project cost			3,155,000	
Laclo Phase-II	Construction cost	Temporary work		220,000	Construction road and water control
		Intake works		372,000	5,380m2 of gabion works
		Concrete wall works		208,000	2,530m3 of excavation, 320m3 of concrete
		Gabion work		252,000	1,860m3 of gabion
		Channel works		707,000	1,125 m3 of wet masonry and 980 m3 of concrete
		Siphon works		1,906,000	2,744m3 of concrete, 325tons of sheet pile
		Protection dike		169,000	Lining, structures and gates
		Concrete channel-1		239,000	529 m3 of concrete
		Concrete channel-2		390,000	Wheel backhoe and spare parts
		General expense		468,000	
		total		4,931,000	Direct cost + Indirect cost
	Engineering services cost			986,000	20% of construction cost
	Contingency			493,000	
	Project cost			6,410,000	
Seical	Construction cost	Direct cost	Temporary work	78,000	Construction road and water control
			Repair for rear apron	42,000	130m3 of concrete, 75m3 of wet masonry
			Concrete wall	50,000	115m3 of concrete, 140m3 of wet masonry
			River bed work	139,000	200m3 of concrete
			Cut-off for gabion	126,000	
			Cleaning of canal	19,000	
			Maintenance road	108,000	2,700m3 of gravel
			Repair for structure	103,000	
			Unit house	60,000	25m2 x 2 unit house
			Equipment	143,000	Wheel backhoe and spare parts
			sub-total	868,000	
		Indirect cost		632,000	
		total		1,500,000	Direct cost + Indirect cost
	Engineering services cost			643,000	Detailed design + Construction supervision
	Project cost			2,143,000	
Uatolari-I	Construction cost	Direct cost	Temporary work	68,000	Construction road and water control
			Weir works	243,000	375m3 of concrete
			Intake channel works	108,000	150m3 of concrete
			River bed work	141,000	1,200m2 of gabion
			Cleaning of canals	29,000	9,000 man-day of manpower
			Maintenance road	156,000	780m3 of gravel, 10,400m3 of embankment
			Repair for structure	152,000	
			Unit house	60,000	25m2 x 2 unit house
			Equipment	143,000	Wheel backhoe and spare parts
			sub-total	1,100,000	
		Indirect cost		750,000	
		total		1,850,000	Direct cost + Indirect cost
	Engineering services cost			643,000	Detailed design + Construction supervision
	Project cost			2,493,000	
Laleia-R	Construction cost	Temporary work		73,000	Construction road and water control
		Intake works		337,000	220m3 of concrete
		Dike & Protection		122,000	339m2 of gabion, 111m3 of concrete
		Canal & road works		1,256,000	L=3,500 m
		Unit house		60,000	25m2 x 2 unit house
		Equipment		143,000	Wheel backhoe and spare parts
		General expense		209,000	
		total		2,200,000	Direct cost + Indirect cost
	Engineering services cost			440,000	20% of construction cost
	Contingency			220,000	
	Project cost			2,860,000	

(3) Breakdown of Equipment Project

Breakdown of equipment for the project is shown in Table 6.3.16.

Table 6.3.16 Breakdown of Equipment Project

		Unit price (US$)	Q'ty	Amount (US$)	Remarks
1. Equipment Cost	1.1 Equipment cost				
	Equipment for workshop	210,000	1	210,000	
	Mobile workshop	220,000	1	180,000	
	Excavator	143,000	5	715,000	
	Brush cutter	1,000	16	16,000	
	4 ton truck with crane	74,000	9	666,000	
	2 ton truck	25,000	10	250,000	
	Removable pump	45,000	9	405,000	
	Rice mill	48,000	19	912,000	
	Power thresher	3,000	29	87,000	
	Diesel oil	220	500	110,000	
	Sub-total			3,551,000	
	1.2 Engineering cost			54,000	
	1.3 Shipping cost			287,200	
	1.4 Overhead			107,800	3% of (1.1+1.2)
	1.5 Total			4,000,000	
2. Consulting services cost				600,000	15% of (1.5)
3. Contingency				320,000	8% of (1.5)
4. Project Cost (1+2+3)				4,920,000	

6.3.6 Construction Plan

(1) Basic Concepts of Project Construction

Taking into account the project features, topographic and geological conditions, present infrastructure situation and socio-economic conditions in East Timor, the construction concepts are established as follows:

① Maximize the procurement of local labors, materials and equipment in East Timor so as to increase employment opportunities, to facilitate technology transfer;
② Establish good communication among UNTAET, UNDP, Consultant, Contractor and the other related agencies;
③ Prepare a practical construction plan taking into account the cropping pattern and river discharge for application of appropriate construction methods.

(2) Special Attention to Construction

Responsibility for Right of Way (ROW)

UNTAET and/or CNRT shall be responsible for land acquisition if required, and any compensation to local residents with regard to ROW, acquisition of quarry site, borrow pit and spoil bank rights related to the rehabilitation works for irrigation.

Unloading Port of Imported Materials and Equipment

Dili Port, which is the main international port available in East Timor, has limited port facilities of 240 m berth length with 6.2m water depth and is relatively congested. Furthermore, no loading and unloading equipment is available at present. Under such conditions, procurement of imported materials and equipment for construction use need to be scheduled well in advance.

Priority of Local Procurement

The materials, equipment and manpower locally available in East Timor shall be procured on a priority basis to facilitate local economy.

Availability of Local Contractors

About 14 contractors have been registered in UNTAET and are available in East Timor. Among these, only 3 are local contractors and the remaining are either JVs with foreign contractors or foreign contractors. These companies own commonly used equipment such as small dump trucks; dozer/shovel, small compactor, cargo trucks and they are willing to lease these equipments to a Contractor of the project.

Relevant Laws of Procurement from the Third Countries

All the regulations issued by UNTAET are applicable law in East Timor for construction business and procurement from outside country. It is expected that Gross Revenue Tax, Import Tax and other Taxes imposed in East Timor are exempted in the projects funded by bilateral donors.

(3) Procurement Schedule

Construction Materials

Lubricant/oil, gasoline, sand and gravel are available locally for the project. Gabion wire, cement, reinforcing bar, corrugated pipe, plywood, timber are not available locally and are procured from the neighboring countries. The sources of construction materials to be procured are listed in Table 6.3.17.

Table 6.3.17 Procurement of Major Construction Materials

Item	Procured in East Timor	Procured in Neighboring Countries
1. Cement		O
2. Aggregate and sand	O	
3. Gabion Wire		O
4. Reinforcing bar		O
5. Straight asphalt	O	
6. Emulsion		O
7. Concrete admixture		O
8. Gasoline	O	
9. Gravel & Boulder	O	
10. Timber		O
11. Plywood		O
12. Laboratory Equipment		O

Construction Equipment

There are minors and commonly used small construction equipment owned by local contractors in East Timor. The equipment will be lent to contractors. However, these equipment are scheduled to be used only for short term period in the project and construction equipment required for use for long term periods will be procured in neighboring countries.

Table 6.3.18 Procurement for Major Construction Equipment

Item	Capacity	Procured in East Timor	Procured in neighboring countries
Bulldozer	10 t		O
Excavator	0.4 m3		O
Dump Truck	3 t	O	
Trailer	20 t	O	
Cargo Truck	3 t		O
Generator	30 kVA		O
Air Compressor	3 m3/min	O	
Tamper	60 - 100 kg		O
Water Pump	4" dia., 30 m		O
Vibrator	45 mm		O

(4) Construction Schedule

Taking into account the above-mention local conditions, the construction schedule for irrigation sector is proposed as shown in Figure 6.3.10.

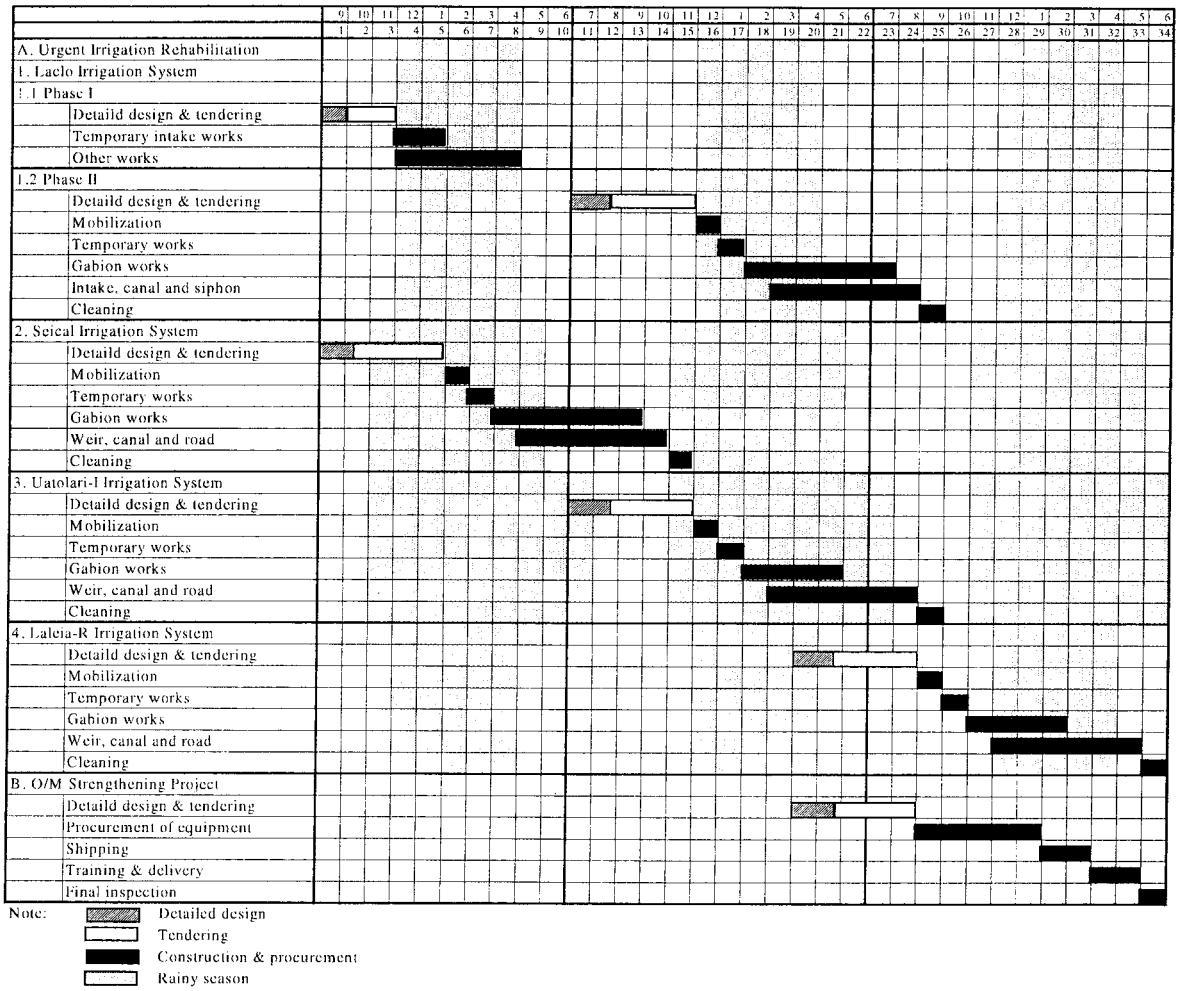


Figure 6.3.10 Construction Schedule

6.4 Quick Project

6.4.1 Objectives

Quick Project was carried out effectively and promptly for Laclo irrigation system in Manatuto district as a part of the three years rehabilitation plan. Contents of Quick project works are cleaning and removal of sediment soil and sand, and grass cutting for the canal.

The purpose of implementing this project is as follows:

- To make water supply possible to Laclo irrigation system about one month earlier compared with a case of only implementing Urgent rehabilitation plan.
- To return the farmers to Laclo irrigation area which are now sleeping.
- To remove the social unrest of those farmers who didn't have a way of income.

6.4.2 Outline of the Project

In Laclo Irrigation area, farming was stopped since 1998 due to the inability of supplying water to the field because of breakage of intakes and siphons, and the occurrence of sediment in the canal. The extent of Quick Project for this canal is about 11 km downstream from the Sumasse River

(1) Obstructive for Water Flow

At present, the Laclo irrigation system cannot supply irrigation water to the command areas because of the destruction of the intake facilities and the siphon crossing the Sumasse River. In addition, sediments occur in the main canal of the command areas. Irrigation water cannot flow unless the sediments are removed from the main canal. The Sumasse Siphon was destroyed by the flood in 1998. It cannot supply irrigation water because of wild grasses and trees growing from the sediments in the canal due to the lack of maintenance.

(2) Necessity of Quick Projects

According to the 3 Year Urgent Rehabilitation Plan, the Laclo irrigation system will be rehabilitated by the two phases. The rice cultivation from the coming rainy season is supposedly difficult in November 2000 because the rehabilitation of the Phase-I is just to start in December 2000 according to the schedule of the Urgent Rehabilitation Plan. Therefore, some parts of the main canal and the secondary canals in the command areas shoud be cleaned by the farmers as much as possible. Transplanting becomes possible from January 2001 for the first rice crop in case the canal is constructed by the start of rehabilitation project in December 2001. The location of the canal for the Quick Project is shown in Figure 6.4.1.

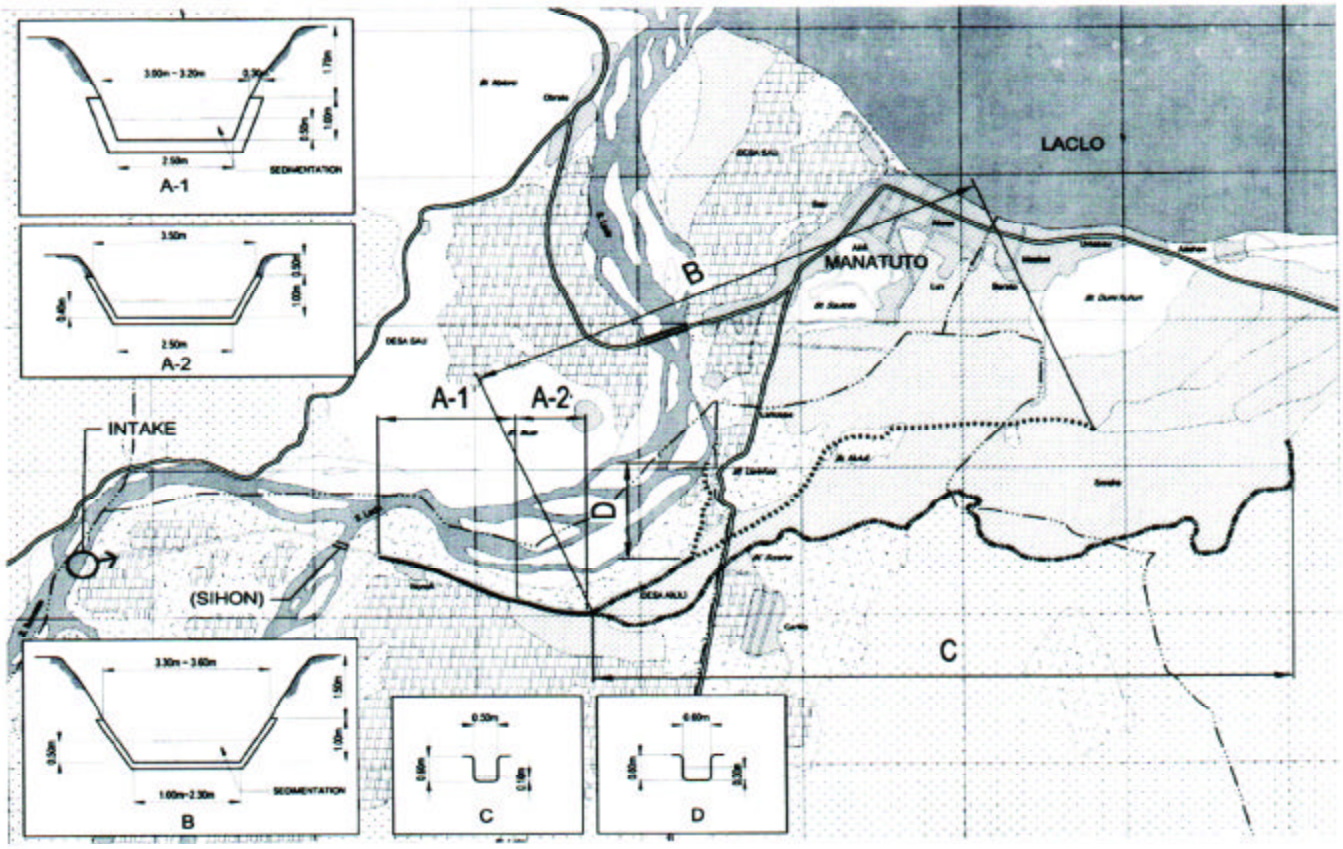


Figure 6.4.1 Location of Laclo Quick Project

(3) Contents of Quick Projects

The Quick project aims at the cutting of grasses and trees, and removing sediment along the canal. The total length of the main canal is 11.3 km downstream from the Sumasse River. The removal soil volume and grass cutting area amount to 4,510 m^3 and about 23,500m^2 respectively, and are shown in Table 6.4.1

Table 6.4.1 Soil Volume and Cleaning Area

Name of cross section	Length (m)	Height of canal (m)	Bottom of canal wide (m)	Depth of sediment (m)	Volume of sediment (m^3)	Cleaning width (m^3	Cleaning area (m^2)
A-1-1	400	1.00	2.50	0.50	550	3.4	1,360
A-1-2	200	1.80	1.50	0.40	120	3.6	720
A-1-3	500	1.00	3.00	0.40	630	3.2	1,600
A-2	600	1.00	2.50	0.40	650	1.8	1,080
B-1	800	1.00	2.30	0.50	1,020	3.0	2,400
B-2	2,000	0.80	1.00	0.50	1,000	4.0	8,000
B-3	800	0.60	1.00	0.20	160	3.2	2,560
C	5,400	0.60	0.50	0.10	270	1.0	5,400
D	600	0.50	0.60	0.30	110	0.6	360
Total	11,300				4,510		23,480

6.4.3 Implementation Schedule

For smooth and effective implementation, the quick project was implemented by the three (3) worker-groups. The work schedule is as shown in Table 6.4.2.

Table 6.4.2 The Work Schedule of Quick Project

Item	June 2000	July 2001
1. Preparatory work		
2. Grass cutting		
3. Cleaning of sedimentation		
4. Final check & work		

Photo 6.4.1 Laclo Quick Project

Excavation work by farmers in June 2000

After excavation of main canal

6.5 Implementation Plan

6.5.1 Basic Concepts for Formulating Implementation Plan

Basic concepts for formulating the Irrigation Implementation Plan in this study are as follows:

- Implementation types of this project are divided into the following two (2) types:

Implementation Type	Project	Description
Construction	Urgent irrigation rehabilitation project in Laclo, Seical,Uatolari-I and Laleia-R systems	Repair work of weir, canals and farm roads
Supply and Procurement	20 irrigation system operation and maintenance strengthening project	Supply and procurement of equipment for O/M

- The scope covered in the Implementation Plan for construction type comprises a total command area of 2,520 ha for four (4) irrigation systems such as Laclo (660ha), Seical (580ha), Uatolari-I (680ha) and Laleia-R (600ha);

- Due to the limitation of budget, rehabilitation of Laclo irrigation project is devided into two phases;

  Phase-I: New construction of Sumasse temporary intake and rehabilitation of its downstream canals and related facilities

  Phase-II: New construction of Laclo intake and Sumasse River Siphon, and rehabilitation of canals and related facilities in the upstream section of Sumasse Siphon.

- The implementation period covers three Timorese fiscal years from July 2000 to June 2003.

- The implementation priority is 1) to recover the irrigation function of the sleeping area and 2) to repair the dangerous section of irrigation facilities.

6.5.2 Implementation Plan

Taking into account the basic concepts mentioned above, the implementation plan of each project is scheduled as shown in Figure 6.5.1.

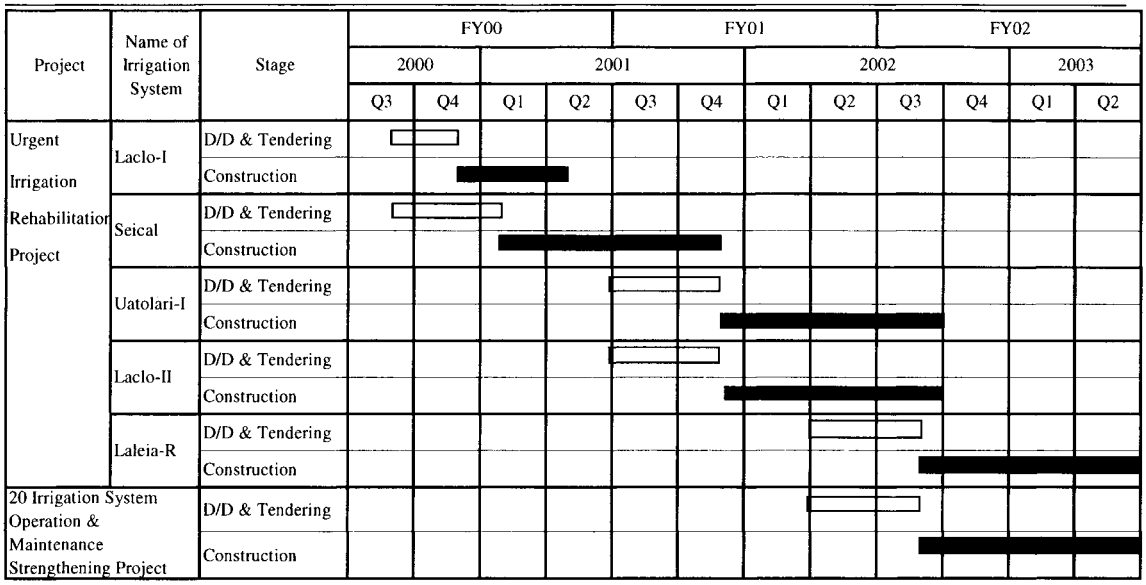


Figure 6.5.1 Implementation Schedule

6.5.3 Capital Investment Coast

The total capital cost required for the three (3) years urgent rehabilitation project for the irrigation sector in East Timor is estimated at 22 million US$ at June 2000 price. An annual investment for each project is shown in Table 6.5.3.

Table 6.5.3 Annual Investment for Irrigation Sector

(Unit: Thousand US$)

Project			FY00	FY01	FY02	Total
Urgent Irrigation Rehabilitation Project	Laclo	Phase-I	3,155			3,155
		Phase-II		4,787	1,623	6,410
	Seical		1,393	750		2,143
	Uatolari-I			1,938	555	2,493
	Laleia-R			264	2,596	2,860
	sub-total		4,548	7,739	4,774	17,061
20 Irrigation System Operation & Maintenance Strengthening Project				360	4,560	4,920
Total			4,548	8,099	9,334	21,981

6.6 Maintenance and Operation Plan

6.6.1 Present Conditions

All 48 formal irrigation schemes in East Timor were operated and managed by the Indonesian Government staff up to 1998/1999. Farmer responsibility lay in land preparation and basic water control in their fields. Government policy was to manage and maintain the major infrastructures and canal systems of these schemes with little or no farmer consultation or involvement. Now none remains.

No water charges were imposed on farmers who was not required to form Water User Associations. But some farmers did form groups for communal land preparation and harvesting operation.

6.6.2 Present Organization

(1) Organization of UNTAET

The Irrigation and Water Management Division under the Agricultural Affair Department in UNTAET is responsible for formulating and developing institutional policies, planning, design and operation & maintenance for irrigation facilities in East Timor. The organization of the Agricultural Affairs Department is shown in Figure 6.6.1.

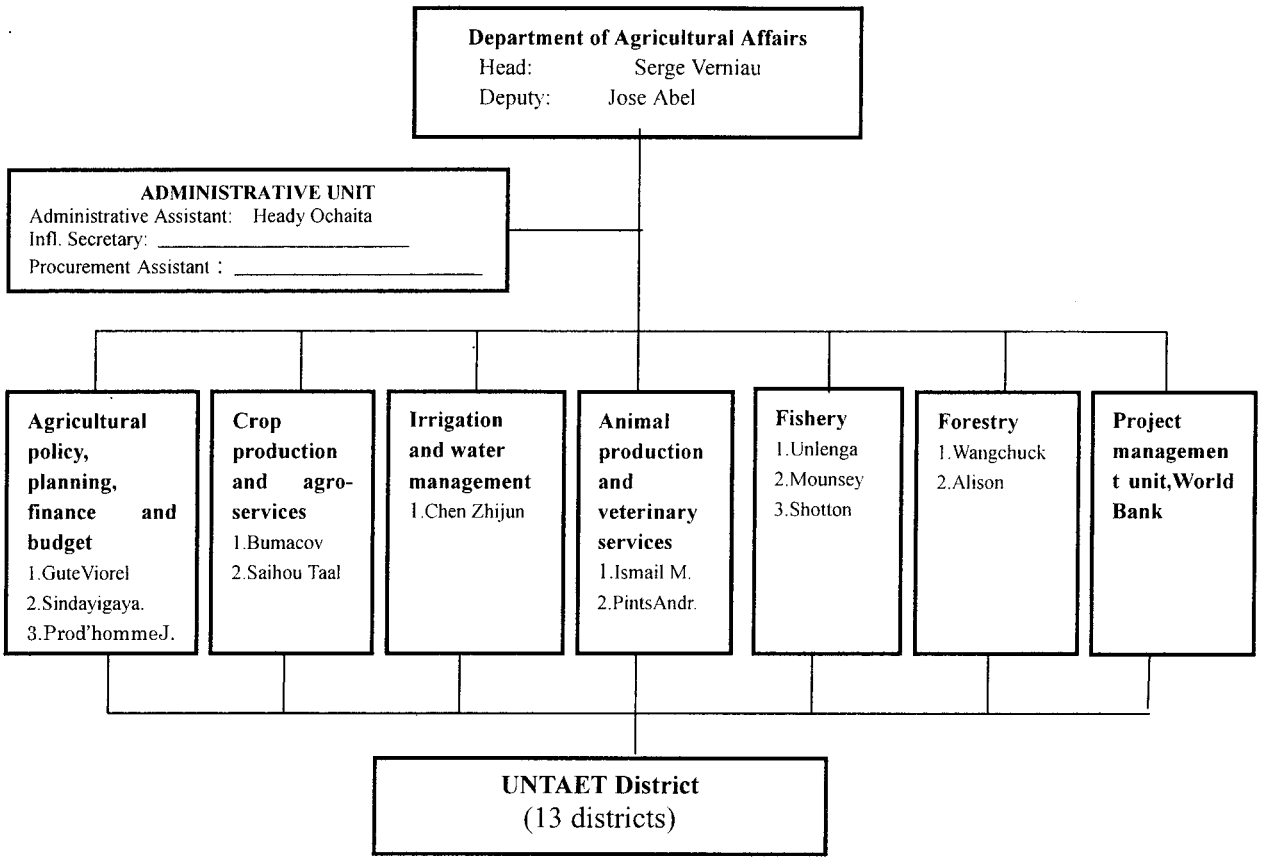


Figure 6.6.1 Organization of Agricultural Affairs Department in UNTAET

(2) Organization of CNRT (National Council of Timorese Resistance)

At present, the Irrigation system is not included in CNRT and it is not functioning as a real counterpart agency of UNTAET due to a shortage of number of experienced staff.

According to information from CNRT, the irrigation section will be organized as a public works department of the Ministry of Social Equipment and Environment as shown in Figure 6.6.2.

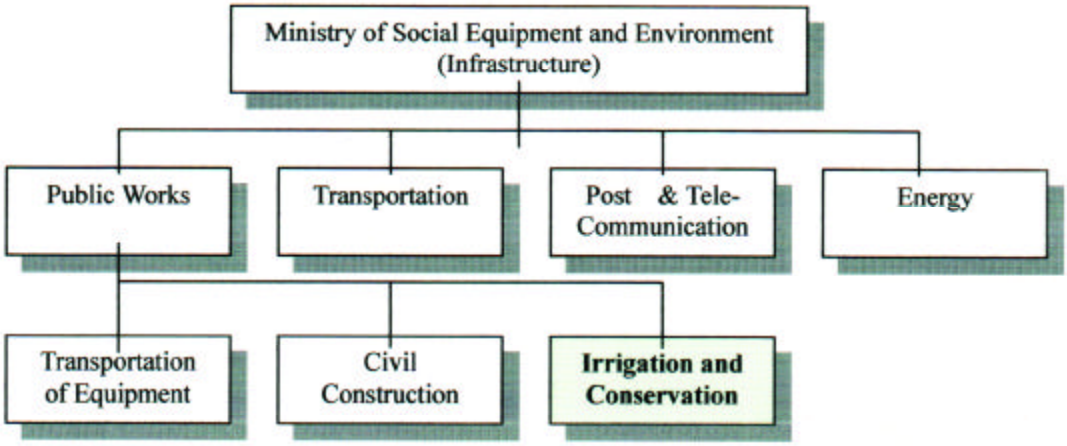


Figure 6.6.2 Organization of CNRT

(3) Staffing and Budget

As of the end of June 2000, the irrigation and water management division of UNTAET is only one international staff from China. He has no local staff (supporting staff). Therefore, there are a few staff to function for the Irrigation Sector in East Timor.

The annual capital investment for the irrigation Sector from the Trust Fund for East Timor (TFET) and from bilateral sources is about 14.4 million US$ which is insufficient for the Irrigation Sector in the 3 year Urgent Rehabilitation Plan. Annual recurrent budget for agriculture department including the Irrigation Sector is about 0.5 million US$.

6.6.3 Proposed Operation and Maintenance Plan

(1) Establishment of Organization for Operation and Maintenance

As part of the *"20 Irrigation Systems O/M Strengthening Project"*, one workshop in Dili and nine O/M stations for irrigation will be established by the Government of East Timor (See **Figure 6.3.3**).

(2) Operation and Maintenance Technicians

As shown in Table 6.3.5, the mechanics and assistants are required. These technicians shoud be trained during the implementation period of *"20 Irrigation Systems O/M Strengthening Project"*.

(3) Training

Training course of 2 months at Dili workshop for 22 technicians shoud be undertaken during the *"20 Irrigation Systems O/M Strengthening Project"*. Training cost is included in this project.

(4) Water User Associations (WUA)

There are rudimentary farmer groups at many irrigation systems. With the assistance of special training, agricultural extension workers, irrigation technicians and farmers can expand these into WUA responsible for the operation, maintenance and management of their infrastructures of the irrigation systems. These costs should be paid by farmers and be subsidized by the government of East Timor.