

CHAPTER 6 : SMALL DIKE SYSTEM IMPROVEMENT PLAN

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6.1 General

6.1.1 Outline of Small Dike System Improvement Plan

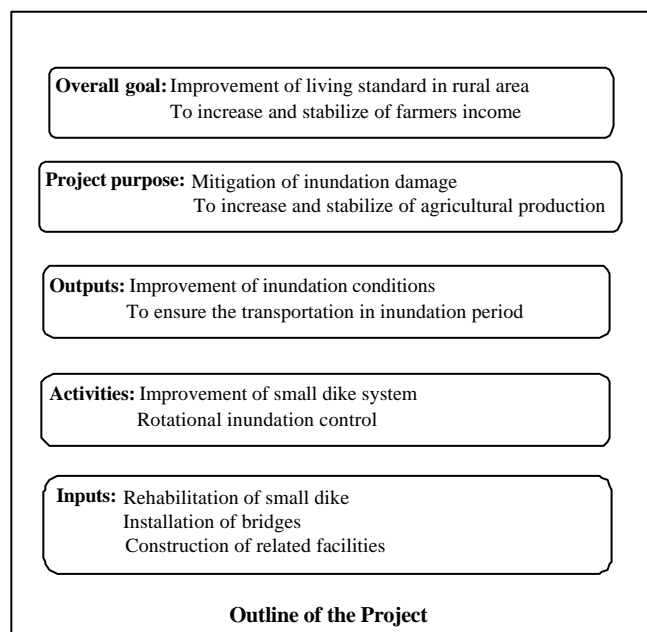
The inundation is occurring every year in the study area caused by geographic and hydrological conditions. In this plan, the mitigation of inundation damage, stabilization of agricultural production and increasing of farmers' income are expected through the improvement of existing small dike system. At the same time, the improvement of living condition is expected with improvement of social infrastructures such as dike road. The selected Blocks (and) are represented for conditions of middle and shallow inundation area and agricultural conditions in these area are summarized below:

Block : Double rice cropping is followed in this area. The second crop (S-A) is damaged often caused by inundation and production is not stabilized. Stabilization of production of second crop and introducing of third crop are expected through the improvement of small dike system.

Block : Triple rice cropping is followed in this area. The production of third crop (A-W) is influenced from starting time of inundation and damaged often. Protection of production of third crop is expected through the improvement of small dike system.

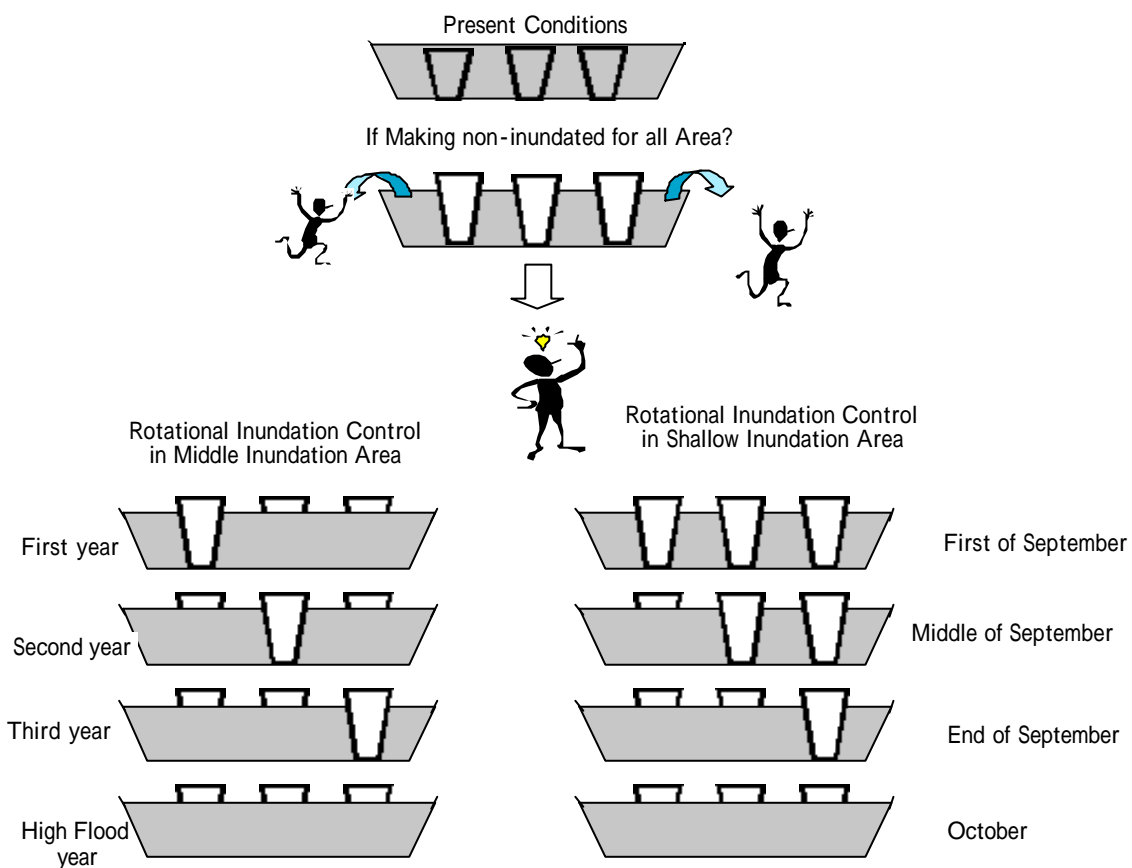
For this purpose, improvement of small dike (645 km total length) for protection of inundation through the year and installation of related structures are proposed. Furthermore, the top of dike will be prepared as road for improvement of rural transportation.

Agricultural development in Mekong Delta with improvement of small dike will affect to increase the water level in neighboring area. And the increase of the water level will have a bad impact on the area. That is reason why "the rotational inundation control" as explained next paragraph is suggested. This control system should be a basic condition for the development in Mekong Delta with consideration of environmental impact. On the other hand, for introducing the new idea of water management and farming practice, it is necessary for the rural people to understand the necessity of the rotational inundation control and to participate in the planning of the project.

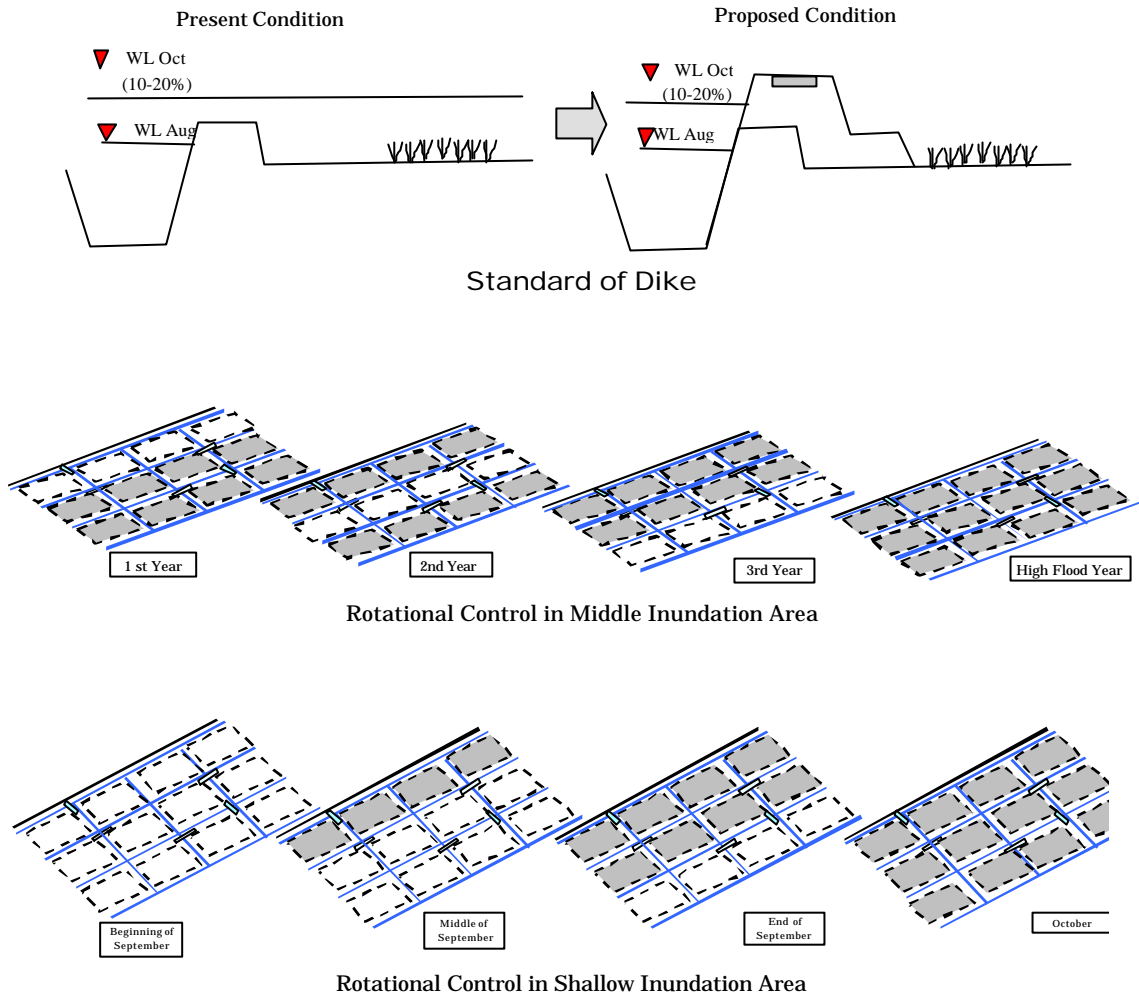


6.1.2 Basic Idea of Rotational Inundation Control

At present, most of the dikes are constructed based on August inundation water level and farmlands are inundated in September and October. Assuming that inundation in the farmland is completely controlled by dike system, the water level outside of dike and surrounding areas will be raised. If the inundation is controlled by the rotational inundation system, some of farmland will be non-inundated at their cropping period without serious influences on surrounding areas. In some years of big flood, all farmlands will be inundated as at present but rural road network is still safely prevented.



The existing dike will be improved so as to prevent the October inundation. The elevation of dike will be raised up 1 to 2 m from existing level. The width of dike top will be expanded so that bike roads or vehicle roads are developed. In addition, some necessary facilities will be installed such as water gate, culvert, boat anchorage, and bridges.



6.1.3 Selection of F/S Area

The total number of farm households in the area Block and is approximately 28 thousand and it is impossible to confirm the consensus building of the farmers in all area within limited study period. Then around 1,800 ha of area (about 1,300 farm household) is selected and concentrated social survey on consensus building was carried out. In this study, the total area of Block and was definite as Pre-F/S area and 1,800 ha of area was definite as F/S area and those areas was considered below:

F/S area: The study was done at F/S level from the viewpoints of technical, economical, natural environment and social environment.

Pre-F/S area: The study was done at F/S level from the viewpoints of technical, economical, and natural environment. As for the viewpoint of social environment, the study was done at Pre-F/S level.

The study area for F/S was selected from pre-F/S area based on the following viewpoints.

- Technical view points

For the verification of the effect of rotational inundation control, more than 1,800 ha of the project area will be required. It is necessary to have more than 3 dike units for operation of rotational inundation control. The dike for August water level exists. The shape of project area is not complicated.

- Natural view points

The area has typical problems concerning inundation and now planting 2 rice crops per year. Presence of ASS is also considered, though countermeasures are required for improvement of soil conditions.

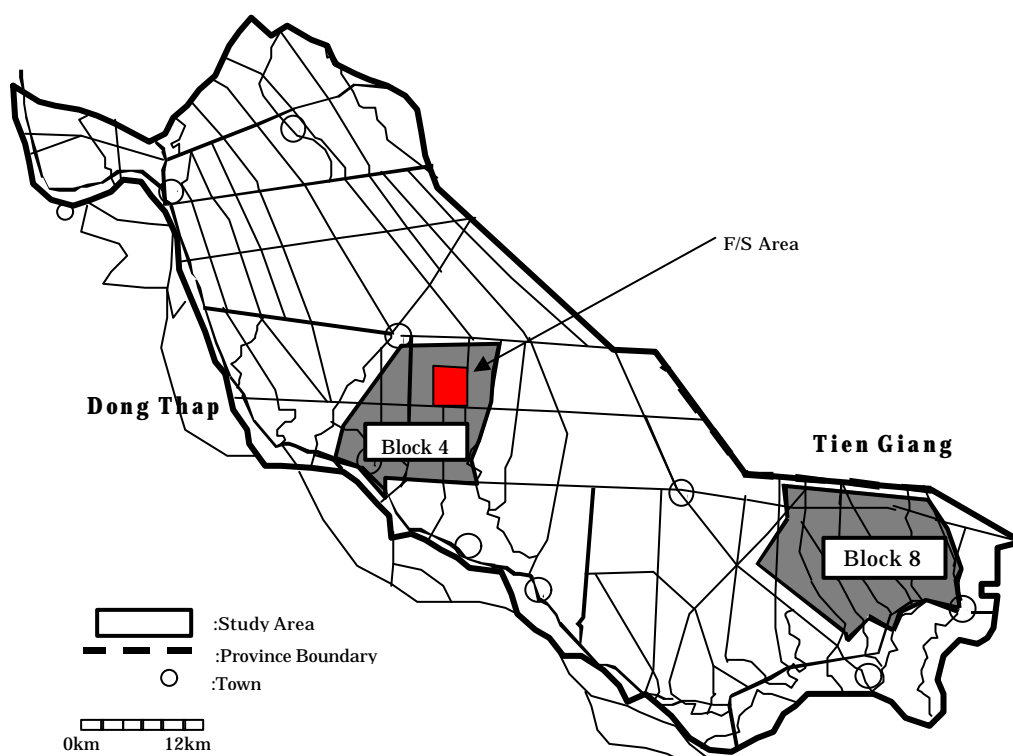
- Social view points

Various farmers and farmers' organizations such as collective and cooperative exist.

- Administrative view points

The area would be better to cover the two or three communes for finding out administrative difficulties. The technical transfer to communes PC needs to be considered.

Considering these points, DARD of Dong Thap Province proposed the area of 1,824 ha in total as shown below. After mutual discussion among SIWRP, Sub-NIAPP, Dong Thap Province and the Study Team, this area was accepted as the F/S area.



6.2 The Study Area

6.2.1 Pre-F/S Area and F/S Area

The block has a total area of around 21,200 ha located in the central part of the Dong Thap Province. The area stretches over three districts, i.e., the Thanh Binh District, Cao Lanh District and Tam Nong District. The area spreads from the Provincial Road DT844 to the National Road QL30 – Provincial Road DT846 from north to south, and from the Giua - Hai Hien - Ca Mac Canal to the Provincial Road DT843 from east to west. The block has a total area of around 19,800 ha located in the western edge of the Tien Giang Province. The area stretches over two districts, i.e., the Cai Lay District and Cai Be District. The area spreads from the provincial boundary with Long An to the National Road QL1 – Cho Market Road from north to south, and from the Provincial Road DT868 to the Provincial Road DT863 – the provincial boundary with Dong Thap from east to west. General features of the Study Area are summarized as below;

Block / District		Total Area (ha)	Cultivated Area (ha)	Number of Farm Households
BLOCK (Dong Thap)	Thanh Binh District	11,870	10,382	10,399
	Cao Lanh District	6,472	5,736	4,428
	Tam Nong District	2,811	2,110	1,099
	Sub-total	21,153	18,228	15,926
BLOCK (Tien Giang)	Cai Be District	11,440	10,910	6,929
	Cai Lay District	8,354	6,933	5,419
	Sub-total	19,794	17,843	12,348
Total		40,947	36,071	28,274

Source : Study Team, Inventory Survey, 2000

The F/S area has around 1,800 ha of cultivated area located in the north-central part of the Block . The area stretches over two communes in two districts, i.e., the Binh Thanh Commune of the Thanh Binh District and Gao Giong Commune of the Cao Lanh District. The area spreads from the district boundary with the Tam Nong District to the An Phong My Hoa Main Canal from north to south, and from the Binh Thanh 4 Canal to the Gao Giong Canal from east to west. The total area, cultivated area and number of farm households of the F/S Area are summarized as below:

Commune / Dike Unit	Total Area (ha)	Cultivated Area (ha)	Number of Farm-households		
			Total	Have paddy field inside	Have Paddy field outside
Binh Thanh Commune	1,056	954	624	257	367
<i>Dike Unit BT1</i>	476	432	221	120	101
<i>Dike Unit BT2</i>	580	522	403	137	266
Gao Giong Commune	986	870	649	375	274
<i>Dike Unit G4-G1B</i>	986	870	649	375	274
Total	2,042	1,824	1,273	632	641

Source : Study Team, Inventory Survey, 2000

6.2.2 Present Situation of Agricultural and Rural Infrastructures

(1) Road Network

In general, the road networks in both of the pre-F/S areas are not developed and are not suitable for car transportation.

The access to/from the external area of the Block is provided by the National Road QL30, which passes the south western edge of the block boundary. For the inside of the block, the Provincial Road DT843 runs along the western boundary of the block and connects the QL30 to Tram Chim Town. Both of the road QL30 and DT843 are the only routes having permanent pavement by asphalt and they have enough elevation to prevent flood even in August to November. Due to those roads, the western marginal area of the block has a good and stable access of transportation throughout the year. From the DT843, two provincial roads, DT844 runs along northern edge and DT846 runs along southern edge of the block, are recognized as the main access to the eastern area of the block. However, these roads are not suitable for car transportation due to lack of bridges for car, pavement and embankment. For the internal area, the Binh Thanh – Binh Tan Road along the Gao Duong Canal in the Thanh Binh District is the only route developed for car transportation throughout the year. That road has 3 meters width of road surface paved by laterite soil and bridges for 8 tons of loading capacity.

The Block is located along the National Road QL1, which has asphalt pavement and sufficient elevation to prevent flood throughout the year, and the access to the external area is secured by this road. The block is surrounded by several provincial roads, i.e., DT863 and DT869 for the western side, DT865 for the northern side and DT868 for the eastern side. These provincial roads are paved by laterite soil and gravel, and have enough elevation to prevent flood barely in August to November, so they provide a car transportation throughout the year. Though the area along the above provincial roads is well accessed to transportation, the area inside are difficult to access by road due to lack of the rural road network and bridge. Some of dike roads, i.e., No.6 Canal Road and No.8 Canal Road in the Cai Be District and No.10 Canal Road in the Cai Lay District, are upgraded the width and elevation for district road but bridges for automobile has not been provided.

(2) Canal Network

In both blocks, the canal network is recognized as the most important infrastructure for both of transportation and agriculture. Especially the boat transportation through canal network is recognized as a major transportation mode in the areas due to lack of road network. Furthermore, water from the canals are used for domestic use. The canal network provides not only irrigation and drainage but also transportation of goods for farming practice such as machinery, harvested paddy, fertilizer and so on.

The responsibility for operation and maintenance of the main canal system is taken by the Central

Government, the secondary canal by the Provincial Government and the tertiary canal by the District Commune But it was observed that some confusion exists in some cases. The canal network system in the areas and the present conditions are summarized below

SUMMARY OF CANAL SYSTEMS

Items	Main Canal	Secondary Canal	Total
BLOCK-4			
Number of Canals (pcs)	3	5	8
Total Length (km)	30.0	60.7	90.7
Canal Width (m)	24 ~ 40	10 ~ 20	
BLOCK-8			
Number of Canals (pcs)	2	9	11
Total Length (km)	24.5	80.1	104.6
Canal Width (m)	45	20 ~ 35	

Source : Study Team, Inventory Survey, 2000

In both of the blocks, the collapse of canal bank is observed everywhere along canal and some of them are considered to be serious for the safety of boat transportation and dike structures. The major reason of collapse is supposed to be wave effect by large boat. To protect canal bank and dike, farmer's plant trees along the canal bank, however tree roots are exposed to wave and some of trees fall down to the canal side. Canal in the area suffers an increase of bottom elevation caused by sedimentation from the Tien River. As a result, dredging works in canals are necessary to keep canal depth enough for boat transportation and water conveyance once in two or three years on an average.

(3) Dike system

The present dike systems have been developed since the early part of 1980s and continued to be constructed and improved by both of administrative authorities and farmers themselves year by year. So far, most of the both blocks are covered by the small dike system with scale of August flood. The present conditions of the dike system in the area are summarized as below;

SUMMARY OF PRESENT DIKE SYSTEM

Items	Total Area (ha)	Cultivated Area (ha)	Total Length of Main Dike System (km)	Number of Small Dike System (pcs)
BLOCK-4	21,153	18,228	301.3	48
<i>Tanh Binh District</i>	11,870	10,382	157.9	26
<i>Cao Lanh District</i>	6,472	5,736	111.2	20
<i>Tam Nong District</i>	2,811	2,110	32.1	2
BLOCK-8	19,794	17,843	340.3	131
<i>Cai Be District</i>	11,440	10,910	194.4	86
<i>Cai Lay District</i>	8,354	6,933	145.9	45
TOTAL	40,947	36,071	641.6	179

Source : Study Team , Inventory Survey, 2000

In both of the blocks, the collapse in slope and top of dike is observed in many places. Those collapse and weakness are considered as severe problem for the safety of dike facility. The major reasons of those

collapse and weakness are observed as mentioned below:

- Overflowing on dike top occurs every year in September because the top elevation does not cope up with yearly maximum water level. This is the major reason of the collapse of dike top and shoulder. This kind of collapse was observed at the section having lower dike top compared to the other places.
- Wave by large boat on canal causes erosion on dike slope. This type of collapse is observed along the large canal where large boats are operated. In some cases, severe erosion causes falling down of trees on dike slope into the canal and obstruct boat transportation.
- In general the embankments of dike built by farmers themselves are made just by putting soil on and no compaction is conducted. Furthermore the cross sections of them are insufficient in slope and dike width. As a result, dike body is easily damaged by any attack by water.
- There are very few sluice or culvert for water management of the small dike system. In the area with small dike system, it is necessary for farmers to cut dike for irrigation in the dry season as to cover insufficient pump head and for drainage. And also it is necessary to embank again to protect paddy field from flood in the flood season. Farmers in this area are heavily burdened with this "cut and repair dike" water management. Furthermore, they repair dike after each cropping but the habit to repair is insufficient and not careful for dike structures. In some cases, they repair dike as lower elevation at the cutting point and it causes dike weakness.

(4) Irrigation and Drainage

CANAL FACILITIES

In the Mekong Delta Region, the main and secondary canals are recognized as the canal system to bring water to a certain area and the tertiary and internal canal to deliver water into the field in dike unit. The development condition of the tertiary and internal canal system in the Block and Block is summarized as shown below. The balance of canal categorized into tertiary canal and internal canal is different between each block due to the difference of the characteristics of dike system as mentioned above. However, the canal density is similar as the Block is 20m/ha and the Block is 24m/ha.

SUMMARY OF TERTIARY AND INTERNAL CANALS

Items	Tertiary Canal	Internal Canal	Total
BLOCK-4 (A=21,153ha)			
Number of Canals (pcs)	30	259	289
Total Length (km)	128.0	286.4	414.4
Canal Width (m)	7 ~ 20	6 ~ 10	
Canal Density (m/ha)	6.05	13.54	19.59
BLOCK-8 (A=19,794ha)			
Number of Canals (pcs)	83	185	268
Total Length (km)	270.8	198.2	469.0
Canal Width (m)	8 ~ 20	1 ~ 3	
Canal Density (m/ha)	13.68	10.01	23.69

Source : Study Team, Inventory Survey, 2000

PUMP FACILITIES

Since pump is an indispensable equipment to cultivate two or three crops of paddy, there are so many pumps in the area with various sizes and types from small portable engine pump to fixed pump station with large electric motor pump. The total pump capacity in both blocks is observed enough for irrigation demand but shortage of capacity for drainage occurs in some area of the Block . In this area, the practice of pump operation by farmers were observed to be well operated. Farmers inspect the water level in their paddy field periodically and control carefully by operating or requesting pump. According to the inventory survey by the Study Team, there are 167 fixed pump stations in the Block , of which 112 stations are with engine pumps and 55 stations have electric motor pumps. Some of those fixed pump stations are possessed and operated by public or semi-public organizations such as agricultural cooperatives. The number of pump stations operated by cooperatives is 36, which is 22 % of total pump stations.

Remaining are private pumps, which supply water not only for owner's paddy field but also to neighboring farmers through collection of a water fee. In addition, there are many farmers possessing pump and lease them to neighboring farmers and collect a pump fee. In this case, pump owners provide also internal canal service to beneficiaries' paddy field. Development, operation and maintenance of those canals are duty of pump owners and the cost is covered by collected water fee. This is to say that private pump service is one of the enterprise activity in the rural area.

On the other hand, most of pumps in the Block are private pumps, and 74 % of farm households possess private pumps according to Tien Giang Provincial DARD. Based on this information, the total number of pumps in this block is estimated to be more than 9,000. Removable or portable pumps are predominant in this block and no fixed pump stations are observed. Most of the farmers in this block use their own pump for irrigation because required pump capacity is not large. Farmers who do not have their own pumps hire a private pump from neighboring farmer. When farmers drain water from paddy field for preparation of winter-spring crop in November, they coordinate to hire and operate large capacity pumps from private owner in addition to their own pumps. These pumps are operated based on the farmer's requests and farmers pay to pump owner under coordination of farmer's organization such as agricultural collectives. The fee of hiring private pump in this area is from 100,000 to 200,000 VND/ha excluding fuel cost.

As mentioned above, private pump service has played an important role for irrigation and drainage in both blocks. In consideration of pump owners and their activity, the integration of pump stations in dike unit replacing by public pump service may cause negative impact and may invite social conflict among them. There is a large demand for electric motor pump because of the low operation cost. However, the electricity supply has not yet been developed well and the area having electricity is limited, which restricts introducing electric motor pumps in this area.

6.3 Agriculture production plan

6.3.1 Pre-F/S Area

(1) Block-

1) Land Use

The Study Area is the typical paddy mono-crop zone. The eastern periphery of the study area, in which acid sulphate soils exist with a belt of 5km width, has been reserved mainly for forest.

The proposed land use plan in the Study Area was formulated based on the Small Dike Improvement Plan. Increased triple cropping is planned with shifting from double cropping. This is summarized in the following table.

Land Use	Present Land Use	Proposed Land Use	Change
Agricultural land	18,228	18,228	0
Single rice cropping land	0	0	0
Double rice cropping land	17,736	11,933	- 5,803
Triple rice cropping land	164	5,967	+ 5,803
Rice + Upland crop land	18	18	0
Upland cropping land	0	0	0
Perennial crop land	310	310	0
Forest land	959	959	0
Presidential land	333	333	0
Fishpond	26	26	0
Other land	1,606	1,606	0

Source from Provincial Statistic Books

2) Agricultural Production

By the small dike improvement, the triple rice cultivation area will be increase and the production will be stabilized.

Agricultural Production Plan after the small dike improvement plan will be as follows.

Main Target of Agricultural Production Plan to Year 2010

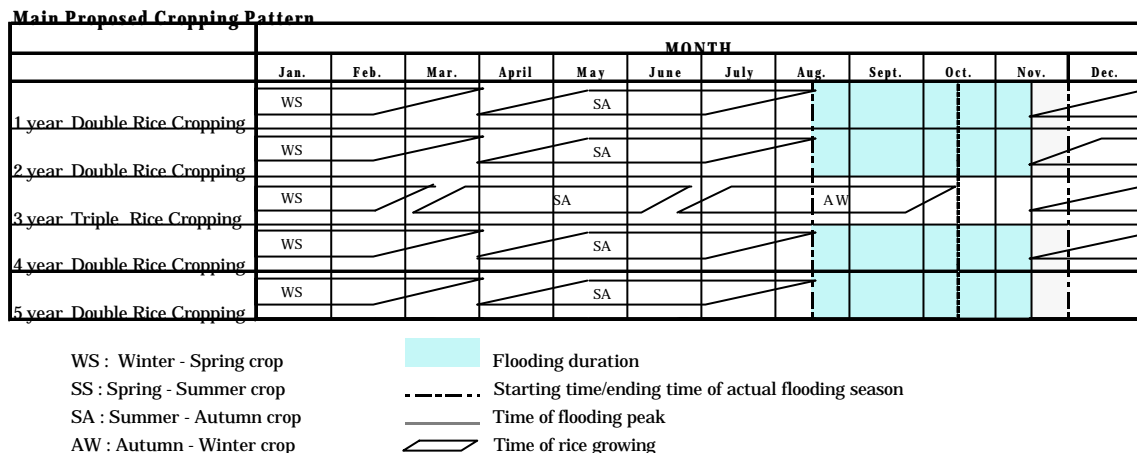
		Present 1/ 1998	Target 2010	Remark (Land increase and decrease)
Rice				
Productivity	ton	175,592	213,000	+37,404ton
Yield	ton/ha	4.9	5.1	
Cropping intensity		2.0	2.3	+
Cultivated area	ha	35,836	41,785	+5,949ha
Paddy land	ha	17,918	17,918	
Livestock product				
Pig		7,225	9,000	+1,775ha
Aquatic product				
Natural catching yield	ton	1,499	1,100	-349ha
Breeding pond yield	ton	284	300	

1/ Source from Provincial Statistic Books

3) Cropping Pattern

In the Study Area, farming system is simple with dominant rice-based farming of double cropping. Other farming systems are too minor.

Proposed cropping pattern was formulated with considering from farmers' manpower, capital and knowledge.



(2) Block-

1) Land Use

The proposed land use plan in the Study Area was formulated based on the Small Dike Improvement Plan, the land use will not change before. It is summarized in the following table, in comparison with the present land use.

Land Use	Present Land Use	Proposed Land Use	Change
Agricultural land	17,843	17,843	0
Single rice cropping land	0	0	0
Double rice cropping land	0	0	0
Triple rice cropping land	14,631	14,631	0
Rice + Upland crop land	0	0	0
Upland cropping land	178	178	0
Perennial crop land	3,033	3,033	0
Residential land	839	839	0
Other land	1,113	1,113	0

Source from Provincial Statistic Books

2) Agricultural Production

As a result of the inundation control by the small dike improvement, it is expected that the paddy and fruit production will be stabilized and the livestock will be increased. Therefore, main target crops of agricultural production will be paddy, fruit and livestock.

Agricultural Production Plan after the small dike improvement plan will be as follows.

Main Target of Agricultural Production Plan to Year 2010

		Present 1/ 1999	Target 2010	Remark
Rice				
Productivity	ton	223,854	232,600 1/	+8,746ton
Yield	ton/ha	5.10	5.30	
Cropping intensity		3.00	3.00	
Cultivated area	ha	43,893	43,893	
Paddy land	ha	14,631	14,631	
Perennial crop				
Cultivated area	ha	3,033	3,033	
Fruit				
Mango	ton	12,479	15,000	+2,521ton
Coconut	ton	1,400	1,600	+200ton
Livestock product				
Pig		22,730	27,000	
Chicken		102,045	120,000	

1/ Source from Provincial Statistic Books

3) Cropping pattern

In the Study Area, triple rice cropping is the dominant rice-based farming system.

The proposed cropping pattern was built for rice-based farming, presupposing the cataclysm that will not be expected. Therefore, it avoids cultivation from the end of September to the middle of November.

Main Proposed Cropping Pattern

	MONTH											
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Triple Rice Cropping	WS				SA			AW				

6.3.2 F/S Area

(1) Land Use

The Study Area of about 2,100ha is classified into three by land use. More than 89% of land area is used for agriculture, 5% for residence and 6% for other purposes such as roads and public facilities. Most of the agricultural land are used for annual crops of which paddy is dominant with the share of 99%. Agricultural land comprises 1,824ha of rice based annual cropland and 15ha of perennial cropland.

The proposed land use plan aims at increasing the area of triple paddy cropping by improved dyke system. Proposed land use plan in comparison with the present land use is summarized in the following table.

**THE STUDY ON INTEGRATED AGRICULTURAL DEVELOPMENT PLAN
IN THE DONG THAP MUOI AREA VIET NAM FINAL REPORT**

Proposed Land Use

(Unit : ha)

Land Use	Present Land Use	Proposed Land Use	Change
Agricultural land	1,824	1,824	0
Single rice cropping land	0	0	0
Double rice cropping land	1,809	1,206	- 603
Triple rice cropping land	0	603	+ 603
Rice + Upland crop land	0	0	0
Upland cropping land	0	0	0
Perennial crop land	15	15	0
Presidential land	98	98	0
Other land	120	120	0

Source from Provincial Statistic Books

(2) Agricultural Production

Agricultural Production Plan after the small dike improvement will be as follows.

Main Target of Agricultural Production Plan to Year 2010

		Present 1/ 1998	Target 2010	Remark (Land increase and decrease)
Rice				
Productivity	ton	18,814	22,793	+3,979ton
Yield	ton/ha	5.2	5.4	
Cropping intensity		2.0	2.3	
Cultivated area	ha	3,618	4,221	+603ha
Paddy land	ha	1,809	1,809	
Livestock product				
Pig		650	800	+150
Aquatic product				
Natural catching yield	ton	186	140	+46ton
Breeding pond yield	ton	27	27	

1/ Source from Provincial Statistic Books

(3) Cropping Pattern

The proposed rice-based cropping pattern is shown in the following figure. The cropping calendar shows that due to intensive cultivation, the interval between the cropping season is very much limited. However, the most of other areas are already implementing this cropping pattern. It was judged to be adapted this cropping pattern in this area.

Main Proposed Cropping Pattern

	MONTH											
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 year Double Cropping	WS				SA							
2 year Double Cropping	WS				SA							
3 year Triple Cropping	WS				SA			AW				
4 year Double Cropping	WS				SA							
5 year Double Cropping	WS				SA							

6.4 Small Dike System Improvement Plan

6.4.1 Layout Plan of Small Dike Units

The shape and size of those small dikes were designed based on 1) Present condition of existing dike system, 2) Present condition of canal network (convenience of boat transportation), 3) Farmers' activity in dike unit (water management in dike unit), 4) Minimize land loss, 5) Economic efficiency etc. The results of social survey on the consensus building in the F/S area were also considered. The proposed small dike units of both blocks are summarized below:

Block	Units No.	Unit size (ha)	Length of dike (for 1 unit, km)	Total length of Dike
Block	33	145 ~ 2,358 (average 641)	3.2 ~ 19.8 (average 9.1)	345 km
Block	34	127 ~ 1,190 (average 582)	5.0 ~ 22.6 (average 10.2)	340 km

6.4.2 Irrigation and Drainage Plan

Irrigation Plan:

Land use plan in the study area is mainly double and triple rice cropping and enough irrigation water resources can be expected at the present canal networks. Based on the water level in/out side of dike, the pump is used for irrigation from March to July. In the remaining period, the rainfall is available or high water influenced by tidal wave can be used for irrigation.

In this plan, the present irrigation method will be applied for plan. Basically, the existing pump will be used for irrigation and dike and related structures are designed considering present pumping operation. Existing canal system inside of dike will be used for plan.

The cropping pattern in Block will not be changed from present as triple rice cropping. As for Block , based on the rotational control, third crop will be applied and this farming practice is not different from first and second crop. Therefore, there is no technical problem for introducing third crop.

Drainage plan:

There are 2 types of drainage for small dike, one is drainage for direct runoff from rainfall, the other is drainage for inundation water at after inundation period.

In the low water season, it is expected to drain water by gravity, but in the high water season (July to September) it is necessary to drain water by pump. In Block , triple rice cropping is followed at present and present capacity of pump for drainage is enough for the drainage. In Block , also present capacity of pump will be enough considering only 30% of non-inundation control for the area. Therefore, present pumping use will be available for this plan and it is necessary to consider culvert for the pump with dike system. Drainage canal in the dike unit is also enough for the drainage and this will be used in the plan.

The water is also drained after inundation time in November for applying triple rice cropping. In Block , this operation is carried out at present and present pump has enough capacity. In Block , this operation is done in sometime somewhere for stabilization of production and for peak cut of labor demand. considering only 30% of area will drain water in November, the present pump capacity is enough for this drainage.

6.4.3 Water Management Plan

Water management can be classified into two types, one is for inundation control, and the other is for irrigation and drainage in farmland. It is necessary to apply rotational inundation control for middle inundation area in Block and for shallow inundation area in Block .

In Block , “rotation control for middle inundation area” will be applied. For the purpose of reduction of environmental impact as much as possible, non-inundation control will be done at 30 % of area in September and October and triple rice cropping will be applied for non-inundation control area. And this non-inundation control area will be rotated 1 time for 3 years. Each dike unit using control gate on the dike will operate the rotational inundation control. As the height of the gate foot will be set as same as water level in August, quantities and qualities of second rice crop (S-A) can be stabilized and protected from inundation. 70 % of area will be inundated when water level comes up over this level (August) and 30 % of area will be protected and non-inundation will continue until October.

In Block , “rotational control for shallow inundation area” will be applied. For the purpose of reduction of environmental impact as much as possible, the inundation will be controlled in order in September with applying triple rice cropping for all area. 30 % of area will be inundated by first of September, other 30 % will be done by middle of September and remaining area will be done by end of September. This control will also be done by control gate and this order will be rotated every year.

The water management for irrigation and drainage in farmland is not changed from that of present.

6.4.4 Facility Improvement Plan

(1) Dike

The elevation and cross section of the existing dike will be upgraded so that the dike will not be submerged and the dike units will be protected from the October flood. The basic requirement for the cross section of dike improvement is as below:

Elevation: The elevation is set to cope with the water level of the 10% probability flood in October.

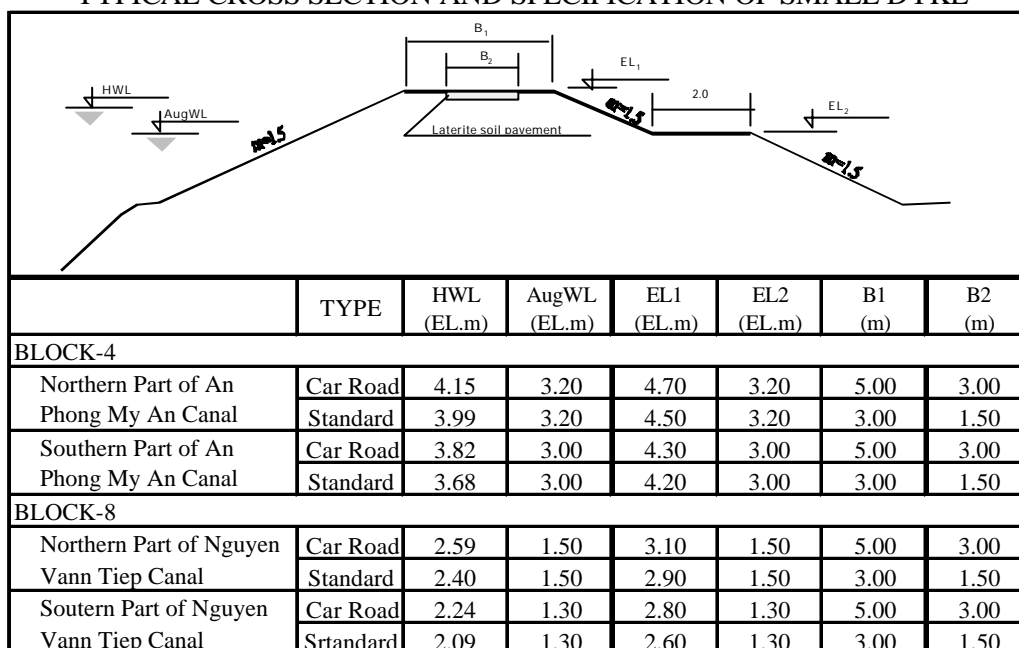
For the car road, 5% probability is applied due to the importance of social infrastructure.

Width: The width of dike top (crest) is set to be 3.0m and road for motorbike will be prepared with laterite soil pavement. For the car road distance, 5.0m of width is applied.

Slope: The slope of dike is set to be 1 to 1.5.

Step: Step of 2.0m width is prepared on the slope inside for tree planting.

TYPICAL CROSS SECTION AND SPECIFICATION OF SMALL DYKE



Rehabilitation work is summarized below;

Block	Area	Dike for Car	Dike for Bike
	Northern of An Phong My An Canal	18.53 km	108.62 km
	Southern of An Phong My An Canal	41.90 km	138.49 km
	Northern of Nguyen Van Tiep Canal	17.84 km	49.46 km
	Southern of Nguyen Van Tiep Canal	41.72 km	207.54 km

(2) Water Gate

Small boat is the major transportation mode into/out of the dike through internal canal. Those internal canals will be shut and boat transportation is to be stopped at the interconnection with external canal by

the dike improvement even water inflow/outflow will be secured and controlled by some structures. Water gates will be prepared to the major internal canal shut by the dike systems so that the boat transportation will be secured. The water gate will provide minimum access of small boat except during the flood period and the irrigation period. Considering the frequency of Open/Close, Water gate will be made with stop log. Following four types of structure is applied.

Block	Water gate with bridge for car		Water gate with bridge for bike	
	with facilities for pump	without facilities for pump	with facilities for pump	without facilities for pump
	8	11	3	47
	1	18	0	98

(3) Culverts

Once the dike is improved, disorderly "cut and repair dike" water management will be prohibited even if it was a custom of farmer in this area. As an alternative to such water management, the installation of culverts is proposed. The culverts will be installed at the interconnection of small canals or at the location where farmers set fixed pump, temporary pumping or temporary drainage. These culverts provide the condition to farmers that they can use their present pump or they can drain water by gravity, so that they will not be required to change their water management and equipment.

Block	Culvert (large)	Culvert (small)
	276	360
	198	377

(4) Control Gate

To realize the rotational inundation control system, control gates will be installed on dike. This gate controls the overflow of flood and the inundation condition in the dike unit. Control gate possess the function as a spill way of dike at the same time. Considering frequency of open/close the gate, control gate will be made with stop log. The dimensions are summarized below:

Item	Criteria	Block		Block	
		Northern of An Phong My An Canal	Southern of An Phong My An Canal	Northern of Nguyen Van Tiep Canal	Southern of Nguyen Van Tiep Canal
Width of Gate		2.5 m x 2			
Height of crest	Peak water level in august for 10 % probability	EL 3.20 m	EL 3.00 m	EL 1.50 m	EL 1.30 m
Height of Gate Top	Peak water level for 10 % probability	EL 4.00 m	EL 3.70 m	EL 2.40 m	EL 2.10 m

(5) Pier and Approach

Some of the existing wooden pier will be removed during the construction work and they shall be reconstructed by farmers after dike improvement. However, the approach way along the dike slope will be included into the project to reduce farmers' efforts. In this plan, some of slope for accesses to the pier will

be prepared.

(6) Rural Road Network

The dike system after improvement is planned to be utilized as basement of rural road network which provide access to the main road network throughout the year even in flood season. Basically the dike improvement will provide road for motorbike transportation with laterite soil pavement. However, the distances in which the district authority plans to develop the road network for car transportation are proposed to have enough cross section for such road, so that duplicate and waste of investment will not occur in the future. Bridges for motorbike to connect each dike unit are also proposed in the project so as to complete the network. For the car bridges, some of the locations will be considered to be installed but the remains are expected for the provincial and district development plan.

(7) Other Components

The following items proposed in the M/P are eliminated from the proposed components in accordance with the discussion in the process of consensus building survey:

- residential area: to avoid further land loss and resettlement
- gravel pavement: to reduce project cost

6.5 Study on Environmental Impact

6.5.1 Natural Environmental Impact

In order to study the project's impacts on natural environment, a related study was conducted including Environmental Impact Assessment, associated Environmental Management and Monitoring Plan. An EIA report, which may be prepared based on this study, needs to be submitted to National Environmental Agency following the Viet Nam's procedure.

(1) Assessment of the Potential Impacts

Following environmental issues are studied.

Acidification of Soil:

Project activities such as excavation of canal for dike elevation is assessed to have significant but mitigable impacts on soil environment. Disturbance of acid sulfate soils and subsequent release of acid produced from the oxidation processes represents a major environmental risk of this activity. Significant quantities of sulfuric acid may be dispersed into the surrounding environment when oxidised pyritic layers are flushed following a dry period. The horizon permeation occurs when the surface of paddy field is not saturated with water after harvest or as farmers drain off water from the paddy field.

Changes in Surface Water Hydrology:

Changes in surface water level are not assessed to have significant environmental impacts. In the Rotational Inundation Control System proposed in the Master Plan study, 1/3 rotation was judged as appropriate.

Degradation of Surface Water Quality:

The water quality campaign conducted in March 2000 concluded that level of contamination by coliform within the study area appeared to exceed national water quality standard. Further degradation of surface water quality inside dike system, particularly within the unified dike units, was forecasted and judged significant. The contaminants include 'domestic waste water', 'waste water from aquaculture', 'solid waste' and 'agrochemicals'. Increasing contamination of downstream surface water quality from pesticides and fertilizer application caused by increased cropping intensity and suspended solid during construction phase was assessed as unknown impacts because of insufficient baseline data within the study area.

Deterioration of soil fertility:

Project impact on soil fertility, regularly replenished by flood deposits, is judged as unknown impact because quantity and quality of sediments in the Mekong Delta has not been fully understood.

Loss of fish resources:

The Project will create some potential negative impacts such as decline of wild fish yield by bisection of white fish and prawn migration routes.

Changes in rodent population:

Project impacts on changes in rodent population was assessed to be significant but mitigable. Among 12 species of rat identified in the Mekong delta, four dominant species are of *Rattus argentiventer*, *Rattus losea*, *Rattus koratensis* and *Bandicata spp.* Population of these species has close relevance to precipitation and flooding pattern. Population is kept low in flooding season because the reproductive rate of these species declines while the mortality rate rises in the season. However, population may be increased because micro-niche will be provided by the elevation of dike and rural road.

(2) Proposed Environmental Mitigation

The recommended environmental mitigation activities are discussed below:

Summary of Mitigation Measures

Environmental Issue	Assessment	Recommended Mitigation Management Plan
Soil Acidification induced by excavation of canal and dike elevation	Mitigable	Application of special soil excavation technique for canal works in order to minimize the release of acidic substances from dike elevation work. Techniques consists of 1) covering of the pyritic material with good top soil and 2) provision of drainage ditches at the field side of the dike and connecting the ditches at the field canals so as to prevent acid water to enter the paddy field at the beginning of the rainy season.
Degradation of Surface Water Quality - inside Unified dike units-	Mitigable	Sluice and pump operation for flushing the water inside unified dike units to improve water quality. Flushing can be applied during the third cropping when water quality may be deteriorated by letting fresh water in and draining it out.
Degradation of Surface Water Quality - possible downstream surface water contamination by agrochemicals	Unknown	Continuation of education on IPM technique for rice cultivation through provincial and district's Plant Protection Sub-Departments. Experience in applying IPM technique in the Dong Thap Province shows decreases of the number of pesticides application to over 35%, and slight increases in paddy production. Hence a successful IPM program can negate the otherwise expected negative impacts.
Degradation of Surface Water Quality -possible downstream surface water contamination by SS	Unknown	Selecting the suitable implementing schedule which could reduce the time of impacts. This should be examined as part of water quality monitoring.
Degradation of soil fertility	Unknown	This is unknown impact because of insufficient baseline data. Parameters of Water Quality Monitoring should include content of SS brought into the field.
Loss of fish resources	Unknown	Prohibition of fishing brood stocks/ fingerlings and exterminated fishing methods. Rice-cum-fish, forest-cum-fish, small floating cages, pond fish cultures Maintaining flood duration, provision of fishpasses
Changes in rodent population	Mitigable	1) Physical and mechanical measure {Mechanical trap, hand keeping rat by digging burrow, glues, trap barrier system, rice trap in combination with barrier system are recommended.} 2) Biological measure {Cat and dog are domesticated for hunting the rats and biological pesticide containing Samonella Enteritidia }.

(3) Proposed monitoring Plan

The proposed environmental monitoring plan consists of 1) Surface Water Quality Monitoring Plan and 2) Biological Monitoring Plan covering F/S area and Pre-F/S area separately. The former plan is an expansion of the existing Surface Water Quality Monitoring Network. These monitoring plans are proposed to be commenced before project implementation to establish baseline database of the environmental parameters.

1) Surface Water Quality Monitoring Plan

For F/S area, 5 additional surface quality monitoring stations are proposed. Monitoring would consist of basic surface water quality parameters, pesticides and bacteria (coliform). Incremental annual operating cost are estimated to be VND 86,800,000 (US\$6,200.-). For Pre-F/S area, 12 additional surface quality monitoring stations are proposed. Monitoring would consist of basic surface water quality parameters, pesticides and bacteria (coliform). Incremental annual operating cost is estimated to be VND217,780,000(US\$15,556.-)

2) Biological Monitoring Plan

For F/S area, 5 new monitoring stations are proposed. Monitoring would consist of basic aquatic environmental parameters, and collection of terrestrial environmental information. Annual operating cost are estimated to be VND 139,000,000(US\$ 9,928.-). For Pre-F/S area, 12 new monitoring stations are proposed. Monitoring would consist of basic aquatic environmental parameters, and collection of terrestrial environmental information. Annual operating cost is estimated to be VND 255,280,000(US\$18,234.-)

Summary of Monitoring Program

Environmental Issue	Recommended Mitigation Management Plan	Parameters	Annual Operating Cost
Degradation of Surface Water Quality For F/S area	Surface Water Quality Monitoring including 5 monitoring stations	pH, EC, TSS, NO ₃ -N, NH ₄ -N, T-N, PO ₄ -P, T-P, O ₂ , BOD ₅ , COD(KMnO ₄)	VND 86,800,000 (US\$6,200.-)
Degradation of Surface Water Quality For Pre-F/S area	Surface Water Quality Monitoring including 12 monitoring stations	Organochlorin, Organophosphorous and Coliform	VND217,780,000 (US\$15,556.-)
Effects on aquatic biological Resources For F/S area	Aquatic Biological Monitoring Including 5 monitoring stations	Aquatic Environment (F/S and PreF/S) - phytoplankton species composition and density - zooplankton species composition and density - Zoobenthos species composition and density/biomass	VND 139,000,000 (US\$ 9,928.-)
Effects on aquatic biological Resources For Pre-F/S area	Aquatic Biological Monitoring including 12 monitoring stations	- Fish species composition - Densities of broodstock and seed Terrestrial Environment(PreF/S) - Native tree species composition - Bird species composition - Species composition and density of rat	VND 255,280,000 (US\$18,234.-)

6.5.2 Social Environmental Assessment

(1) Pre-F/S Area

Four communes were selected for the social environment survey in Block and Block respectively considering geographical conditions, farming pattern, development history, etc. with cooperation with DARD of Dong Thap and Tien Giang provinces. The selected communes are shown in the table below.

List of Surveyed Communes

Block	Block
1. Phu Cuong (Tam Nong District)	1. Hau My Bac B (Cai Be District)
2. Binh Thanh (Thanh Binh District)	2. Hau My Phu (Cai Be District)
3. Phong My (Cao Lanh District)	3. Thanh Loc (Cai Lay District)
4. Phuong Thinh (Cao Lanh District)	4. Phu Nhuan (Cai Lay District)

1) Public Hearing

At the beginning of the survey, Public Hearing for the inhabitants in Block and Block was held in Dong Thap and Tien Giang provinces respectively. Participants were representatives of the local farmers, hamlet leaders, staff of PCs of communes in the Pre-F/S Area. About 100 participants in Tien Giang province and 80 participants in Dong Thap province attended. Basically all the participants agreed on improvement of small-scale dike system. However, since the rotational system was not familiar to them, some participants expected the project and some were afraid of the negative impacts. Major comments are summarized as follows.

Comments at the Public Hearing

Block	Block
1. Serious damages can be increased by rats.	1. Farmers need avoiding flood only for short period such as 5-10 days before the harvesting.
2. Non-inundation may reduce alluvial, so the quality of fruit trees may be influenced.	2. Farmers worry about change of quality of water, decrease of supply of fertile alluvial, decrease of fishing.
3. Compensation for the loss of land and houses is necessary.	3. Fruit trees cannot be planted.
4. Fresh water supply system is necessary in the residential area.	4. If land and houses are expropriated for dike enlargement, compensation is necessary.
	5. Damage by rats should be considered.
	6. Residential area needs wastewater treatment and fresh water supply system.

2) RRA (Rapid Rural Appraisal) and Quantitative Survey

Through RRA, the following qualitative information was collected mainly;

- history of the area including changes in the natural resources base and production systems,
- expectation of families and perceived constraints related to inundation, and
- socio-cultural factors that may be important in formulating the project.

Furthermore, about 400 households in one block were selected at random for quantitative survey using questionnaire to get a characteristics in the whole area. The results of the analysis are as

follows.

Basic Socioeconomic Information

Basic Information of the Surveyed Communes

	Block				Block			
	Phu Cuong	Binh Thanh	Phong My	Phuong Thinh	Hau My Bac B	Hau My Phu	Phu Nhuan	Thanh Loc
No. of Households	1,314	3,540	3,552	1,517	1,812	1,487	1,653	1,941
Land Area (ha)	5,596	3,840	2,821	4,425	1,827	1,045	1,260	2,158
Agricultural Land (ha) (Share in the Total Land)	4,638 (82.9%)	3,091 (80.5%)	2,177 (77.2%)	4,023 (90.9%)	1,782 (97.5%)	948 (90.7%)	1,126 (89.4%)	2,037 (94.4%)

Source: DARD Dong Thap 2000, Commune Statistics

In Block , monoculture of paddy is popular and farming pattern is double cropping of paddy. Fishing relies on the river and canal systems and the catch is the largest in the flood period. In Block , the triple cropping of paddy has been practiced stably and diversification of cropping pattern has been promoted. The trend is changing the use of land from paddy or wild/mixed garden to specialized garden of high economic value fruits such as mango, longan, orange and mandarin.

The income from paddy production occupies 81% of the total income of the surveyed households in Block . Moreover, paddy production provides employment for landless or poor farmers. In Block , since VAC system is developed and structure of income sources is different from that in Block and the shares of fruit trees and livestock are high.

Annual Income Structure of the Households

(Unit: %)

Income Source	Block	Block
Paddy	81.0	66.6
Fruit Trees	1.8	12.5
Livestock	3.0	15.7
Fishing	5.7	3.8
Others (milling, carpentry, trade, services, etc.)	8.5	0.4

Source: Social Environmental Survey, March and April, 2000

The farmers are provided with various credit sources by the government. At the commune level, the farmers can borrow money from the VBARD (Viet Nam Bank for Agricultural and Rural Development) using their land certificate as collateral. The national funds of Hunger Eradication and Poverty Reduction (HEPR) and Job Creation (JC) also provide some of the farmers with credit. In addition to that the Women's Union forms their saving-credit groups to help poor women generate income. For those sources, the interest rate is low, from 0.7-1%/month. However, as the government fund is limited the farmers have to borrow money from private moneylenders with higher interest rate of 6-10%/month. Moreover, many families reveal that when they do not have money to pay back for the government fund to renew their loan they often borrow money from moneylenders, thus they are more indebted. In Block , 75% of the study households are in debt, in which 57%

borrow money from the government, 18% from the private moneylenders and 25% from both sources.

Housing Conditions

Water is one of the most serious problem in the study areas. The canal water is used broadly for washing and bathing. In addition to that, some farmers in Block reported that the use of chemicals in agriculture usually makes the canal polluted thus badly affects the health of the people.

Drinking Water

(Unit:%)

Sources	Block	Block
Rainwater	2	33.7
Canal/River	90	8.9
Deep Well	8	57.4

Source: Social Environmental Survey, 2000

The study reflects that 93% of the surveyed households in Block and 48.3% in Block have not built their own toilets yet. They often use their fishpond as their toilets. Bathroom facilities are also lacking as the people are used to bathe in the canal/river.

One characteristic of housing pattern in the study area is that the majority of houses are located along the canal/river banks, which are used as the dike systems as well as rural road network. Concrete houses are concentrated at the commune center, which is also located along the canal/river where the PC building and other commune public facilities such as post office, medical station, market, etc. are located. Far away in the secondary or tertiary canals where transportation is very difficult, temporary houses scatter with thatched roof and walls. Owners of these houses are rich farmers whose main houses are located at the other convenient commune area but whose lands are in the remote field. They only come and stay there sometimes to take care of their paddy fields. Owners of these houses are also the poor farmers. In Block , 47% of the houses are called “concrete houses”, made of ferroconcrete, 7% of the houses are “semi-concrete houses” with processed-wooden pillars and tile roof and 46% are “temporary houses” with thatched roof, raw-tree pillars and palm leaf walls. In Block , 22% of the houses are concrete houses, 26% are semi-concrete houses and 53% are temporary houses.

Social Structure/Rural Organizations

Statistics of the commune show that in Block , 98% of the study households deal with paddy production and in Block the number of households who deal with agricultural occupies 82% of the total households. In both blocks, the average growth rate of population is 1.6% yearly and the rate has been decreased. Extended family with three generations living together under the same roof is the most common family structure in the study area.

Besides mass formal organizations such as the Fatherland Front, the Women’s Union, the Farmer’s

Union, the Youth Union, the Veteran Union, the Red Cross, etc., there are some informal organizations.

- Labor-exchange Groups: The farmers organized themselves into small groups of 5-10 members and when one member needs labor to work on the farm, the group arranges time to work for him/her without payment.
- Harvesting Groups: In the harvesting time, the poor usually work in groups. Farmers who need labor to harvest their paddy usually contact one hired-labor who can gather some of his relatives or friends to work for the farmers until the work complete. Wage defined by the employer is the same for all members.
- Dike Cooperative Group: In Block depending on the condition of the farms, the farmers from dike cooperative groups construct dike to protect their farm from the flood.
- Collectives/Cooperatives: In both blocks, there are some collective/cooperatives who deal with water supply or agro-productions. Some collectives invest in materials, breeding trees or pigs, seed, etc. and negotiate the selling price of the outputs for the farmers.

Characteristics of the Beneficiary Groups

The population in Block can be divided into the rich, the middle and the poor groups who might receive the benefit from the project.

	Phong My	Binh Thanh	Phu Cuong	Phuong Thinh
The Poor	313 (8.8%)	452 (12.7%)	150 (11.4%)	372 (24.5%)
Landless	936 (26.3%)	n. a.	72 (5.4%)	229 (15.1%)
Total Households	3,552	3,540	1,314	1,517

Source: Commune Statistics, 1999

The characteristics of the poor are that they have no land or very small land, have many children, lack capital and jobs. Most of them are hired labors and their livelihoods depend completely on the natural conditions. In the dry season they usually move out of their villages to look for off-farm jobs, when the paddy is not ready to be harvested thus no employments are available for them. They come back to their villages when the harvesting seasons come. In inundation period they pick wild lotus and water lily and other wild flowers to sell at the market. They also catch fish to eat and to sell. They can be employed to excavate soil for house construction.

The government has applied special policies to support the poor. Each households received a social welfare book, which the poor can be exempted from various fees such as school fee, hospital fee, rural road improvement fee, etc. The rich have land and capital to invest in diversified activities. They have double paddy crops as their main income. In very limited area farmers have tried triple crops and also grow upland crops such as green beans, cucumbers, sweet potatoes, watermelons, etc. They also raise livestock such as pigs and poultry as supplementary income. In addition to that they raise fish and shrimp, which give them much higher income than rice.

The beneficiary groups in Block can be divided into two groups; the paddy production group and the VACR (garden, fish pond, husbandry and paddy field) group. The paddy production groups produce triple crop of paddy per year. For these groups, they need a dike system that can protect their field in 10-15 days before harvesting so that their S-A paddy is ripe enough for harvesting in September. The VACR groups scattered in the communes. According to some sources, income of the VACR groups is at least 5 times higher than income of the paddy production groups.

Beneficiaries' Needs

The needs of the people in the Block are as follows.

No.	Phong My	Binh Thanh/ Phuong Thinh	Phu Cuong
1	Uncompleted dike system	Stability of paddy price and marketing	Lack of jobs
2	Difficult transportation due to uncompleted rural road network	Dike and rural road construction	Difficulty of transportation due to lack of dike system and road network
3	Lack of production means such as credit and boats	Capital for husbandry and agricultural production	Poor health and degradation of rural environment
4	Loss of crops due to flood	Stability of price of production materials	Difficulties in production activities
5	Damage of houses by flood	Stability of family and society	Poor education and recreation facilities

Source: Group Discussions in Communes, 2000

In general, the people in the study area depend almost on the paddy production thus an improved dike system to protect their paddy from inundation is always their concern. Additionally, due to the temporary current reality, hot issues can be the fall of paddy price or job creation.

The needs of the beneficiaries in Block are almost the same with those on Block .

No.	Needs
1	Construction of dike (The dike systems that protect the whole commune residential and fruit tree gardens.)
2	Contracted trade of agricultural output
3	Construction of water supply system (construction of deep drilled well, and tapped waterworks)
4	Improvement of rural road network
5	Credit (For paddy storage until the price is higher and for production, health care, etc.)

Source: Workshops at the communes, 2000

Beneficiaries' Demand

In both blocks, the farmers have contributed a lot of money and efforts to the improvement of the current dike and irrigation system. For example, in Thanh Loc commune, 7,206 working days and 8.3 million VND were spent for dike construction. Also, people in Hau My Phu commune shared 56% (252 million VND) of the total budget for road pavement. The government subsidizes the dike system projects by reducing the price of one m3 of soil dug from the river or canal and heaped on the dike from 4,000 VND (market price) to 2,300 VND. The government also supported a half of the total budget. In spite of these efforts, the dike is not strong enough to protect their field from the flood and the need for repair of the dike every flood time.

Absorptive Capacity of the Beneficiaries

In Block , the farmers seem to be reluctant to practice the triple paddy cropping and they expect dike construction to stable the present double cropping pattern. They say that it will cause degradation of soil fertility and increased farm input, thereby, decreased profit and resultant lower price of land. It is very difficult for farmers in Block to accept RICS proposed because they have already practiced triple cropping. However, they appreciate the construction of small dike, irrigation system and rural road network because their dike system now is not strong enough to protect their field from the October flood. The poor of the two blocks can be provided with more job opportunities as the third crop will be promoted by the project, while they feel that their income will be reduced because the fish source will be lessened.

The water management of the communes is different from one to another and there is no rule or law concerning this matter. In Phong My, the PC pays the maintenance and operation fee for the water pump station. The management of the dike is assigned to the head of the hamlet or the irrigation group. In Binh Thanh the collectives sign contract with some members to take care of the irrigation system and other members to monitor the operation. At the commune level, very few PC staff has been trained on dike or irrigation construction and management. For the construction of the dike they have to rely on the technicians at the district and province DARD. To effectively maintain and operate the system, training of staff on techniques of management of the system must be considered.

Potential Adverse Impacts

Farmers whose small pieces of land are located along the dike would be affected by the project the most because their land will be lost due to the enlargement of the dike system. In both blocks, triple-crop paddy production farmers as well as large-scale farmers will benefit the most by the project as their double crop are guaranteed by the irrigation and drainage system. Moreover, the project will facilitate a third crop, which might be a paddy or an upland crop. However, the farmers express their concern about degradation of soil fertility, loss of fishing opportunity, field cleansing, increasing of rat population and water pollution. Another potential adverse impact that can happen is the shortage of labor in the seedling and harvesting periods.

3) Wrap-up Workshop of Social Survey in Pre-F/S Area

The workshop was held in each block (April in Thanh Binh District of Dong Thap province and April 24 in Cai Lay District of Tien Giang province) in conclusion of the Survey. The objectives were to inform the beneficiaries about the output of the survey and other project related matters, to get participant's comments and opinions and to request for their cooperation for the future EIA survey. The participants were representatives from dike units and communes in Pre-F/S Area. The comments raised by the participants are summarized as table below.

Block	Block
<ol style="list-style-type: none"> 1. Improved dyke and third crop may lead contamination of water for daily use. 2. Economic aspects of the project which farmers should pay attention are not mentioned clearly. For example, profits from the third crop can cover repayment of loan by the farmers? 3. The term of redemption mentioned by the team is longer than the duration of land use right. Therefore, new regulation needs to be issued by government. 	<ol style="list-style-type: none"> 1. Closed dike system suitable for VAC and VACR systems is preferable. Getting water in the field after 3rd harvest should not inundate fruit trees, fishponds and animal cages. 2. Government should contribute 30% with preferential interest rate. 3. The area of dike unit is large and management is difficult.

4) Findings from the Social Survey in Pre-F/S Area

- The improvement of small dike system is very necessary to secure the paddy production of the farmers in Block and Block . For many years they have paid a lot of efforts and money to construct the dike systems but the dike systems have not been strong and high enough to protect the farm from the October flood and their paddy production is always at risk. To facilitate the paddy production, the current dike system needs to be improved. Improved dike systems not only favor the paddy production but also create jobs for landless labors in the area when the farm is intensified. However, it is likely that the RICS is not partly accepted in Block and does not attract the people in Block . The RICS will have some potential adverse impacts on some farmers who have specialized in fruit production garden.
- Depending on the reality and other conditions relating to paddy production such as paddy price and marketing, etc., the local people of the Block will decide when to practice triple paddy crops.
- RICS is a new model that can bring high socioeconomic effects to the deep and middle inundation area of Dong Thap province. For the people living in the shallow inundation area of Tien Giang province with diversification of cropping pattern, another cropping pattern has been proposed. In order to convince the people to believe on the invisible social effects of the RICS, pilot project might be needed so that the farmers in the area can witness its results.
- For the households whose land is lost due to dike construction, appropriate compensation is necessary. To compensate for the loss of their land there are some suggestions; 1)to pay them with the market price of land, 2)to give them another piece of land, and 3)training on off-farm activities.
- Training on community development approaches for the local staff must be very necessary before the RICS will be implemented. The local staff will be trained how to organize their community, how to work in team and make group decisions and how to monitor and to evaluate them.

(2) F/S Area

The western part of F/S Area of 1,800ha, approximately 935 ha, is under Binh Tan commune of Thanh Binh district while the eastern part, approximately 828 ha , belong to Gao Giong commune of

Cao Lanh district. Information of the area was mainly obtained from the preliminary rural appraisal. Following this, the activities such as formation of project design, assessment of consensus building and finalization of the project design were conducted.

1) Preliminary Rural Appraisal

Purposes of this appraisal were as follows.

- To give the survey team clear understanding of the local community, so as to help the team to work smoothly on the next activities
- To make the local people recognize and accept the study team
- To facilitate the local people to understand themselves more clearly and objectively by the workshop and interview which give them a picture of their implicit and embedded local knowledge and information
- To encourage the local people's participation in this survey
- To identify persons to be representatives of local community for the stakeholder meetings and technical working group in the next survey steps

Binh Than Commune

Kind of Household	Cooperative (Hamlet 4)	Collective 11 (Hamlet 2)	Collective 6 (Hamlet 2)	Total
Household whose house and land is inside the Study Area	131 (721)	37 (172)	87 (485)	255 (1,378)
Household whose house is outside and land is inside the Study Area	275	62	124	462
Total Households	406	99	212	717

Gao Giong Commune

Kind of Household	Cooperative (Hamlet 2)	Hamlet 1	Total
Household whose house and land is inside the Study Area	258 (1,213)	58 (232)	316 (1,445)
Household whose house is outside and land is inside the Study Area	222 (1,945)	55 (333)	277 (1,378)
Total Households	480 (2,258)	113 (565)	598 (2,823)

Note: The number in the parenthesis is population

In Binh Tan commune, there is Binh Minh Cooperative and 2 Collectives. In Gao Giong commune there is Gao Giong Cooperative and no collective. The total area of Gao Giong commune is 827.8 ha (in which cooperative covers 666.1 ha, hamlet 1 covers 161.7 ha) and the total area of Binh Tan commune is 953 has (in which cooperative covers 521.7 ha, collective 11 covers 147 has and collective 6 covers 285 ha).

To protect the houses from flood, it is very common that houses along small dike are silt-house and other have high-floor. In Binh Tan commune, there are about 9 wells and Gao Giong commune has no well. Since these wells are not sufficient, a lot of people have to use the water from canal or

rainwater. The sanitary condition is very low. 30% of the total households in Gao Giong commune and 20% in Binh Tan commune have their own toilets. The others share toilets with these households. Most of toilets are on the fishponds and this water is also coming to canals, at least during the flood time. Another cause of contaminated water resources is from the waste management. Residents in this area use waterway as the main transportation means. In Gao Giong commune, the number of household who have boats with engine are 50% of the total households. In Binh Tan commune, 100% has their own boats and 60% of boats are engine installed.

After changing from one crop per year to two crops per year in 1987-1988, the household' economy has been better. The main income is from agricultural activities. The rich farmers normally invest into buying more rice field and increase profits. But the expenses of a crop also increase. Other sources of income are from natural fishery during the flood time, raising poultry or fish, business activities and hired labor. The poor depends on especially hired labor in harvesting time and natural fishery in flood time. Under the increase of population, the lack of farmland, low education level and limitation of labor absorption in agricultural sector, no factory in this area, there are not many job opportunities for residents, especially for the youth. The unemployment of the young people becomes one of the serious problems.

In the F/S Area, all facilities and infrastructure related to water supply, health, sanitary, education, etc. are not sufficient. Especially lack of road network makes these two communes difficult to access to all social services.

2) Draft Project Design

The works by Technical Working Group (TWG) and 2 Stake Holder Meetings (SHM) were organized in order to formulate the Draft Project Design and evaluate it. The purposes of SHM are;

- To notify concerned local people of the project proposed by JICA study team,
- To listen to the initial opinions of local people about the proposed project, and
- To choose the members of the TWG.

TWG aimed at achieving the following objectives through examining the proposed project further in detail and formulating the draft project design on behalf of stakeholders.

- To make the project feasible
- To make the project to meet the local needs
- To develop the sense of ownership and responsibility for the project among local people and authorities

The Draft Project Design prepared by TWG was presented at the 2nd SHM. The discussed issues are as follows.

The 1st issue: Mitigating the Negative Impacts of the Project

The conclusion is that the problems below are not serious or can be solved.

- Reduction of natural aqua-products
- Reducing of alluvium
- Release of acid sulfate
- Increasing in number of rats and other harmful insects
- Environmental pollution
- Losing of land and moving houses
- The 3rd crop does not bring much benefit to beneficiaries

The 2nd issue: RICS and Small Dike System

The number of dike unit, impacts, acceptance of RICS, organization, regulation and rules to implement RICS, etc. are included.

The 3rd issue: Cropping Pattern and Infrastructure

Accepted cropping pattern, kinds of infrastructure and the number necessary to be installed were suggested.

The 4th issue: Operation and Maintenance of the Dike System

Organization and responsibility for operation and maintenance are included.

3) Assessment of Consensus Building

The purposes of this assessment were as follows.

- To make sure what extent the public understand and agree the project
- To pick up public opinions, which have not yet been expressed in SHMs and TWG in order to improve the project design

Consensus building has been a parallel process going on with the project process with bottom up of the public participation. Consensus building is consisting of mainly 4 activities such as public hearing, discussion in the hamlets, opinion boxes setting and survey of consensus building assessment. The summary of consensus via 16 public hearings in 4 hamlets and group discussions of TWG were explained at the 3rd SHM. As a result, the local people accepted basically the draft project design prepared by TWG.

(a) Public consensus information via 10 group discussions with 222 local people's representatives:

- Dike unit in the project area: most participants agreed with 3 dike units proposed
- Rotational inundation control system: participants of 9 groups agrees with RICS and only 1 group still felt reluctant to accept

- Cropping pattern: 9 groups agreed with case 2 of cropping suggested, they agreed to harvest the third crop as soon as possible
- Infrastructure and facilities: all groups agreed not to build residential area
- Operation and maintenance: all agreed with what were concluded in the second SHM
- Financial issue: opinions of local people seem to be very diversified in contribution of the project cost
- Mitigation of negative impacts: most accepted negative impacts as a bargain for having a third crop once three years

(b) Consensus building via the third SHM

- Dike unit: they accepted 3 units as proposed
- RICS: they totally agreed with RICS suggested
- Cropping pattern: basically accepted but whether the flood water to be inundated into the rice field or not depends on the water level outside
- Infrastructure: they decided not to omit the bridge for car through An Phong-My Hoa canal in Binh Tan commune
- Operation and management: they suggested that the Steering Board must be approved by Province PC
- Budget and expenses: they concluded that any decision making related to expenses should be waited until the official project design is finished then total expense of the project will be informed
- Mitigation of negative impacts: some thought that amount of fish may not be reduced, environmental pollution and other issues related to rats, insects can be solved easily

(c) Consensus building via questionnaires to assess local people's acceptance

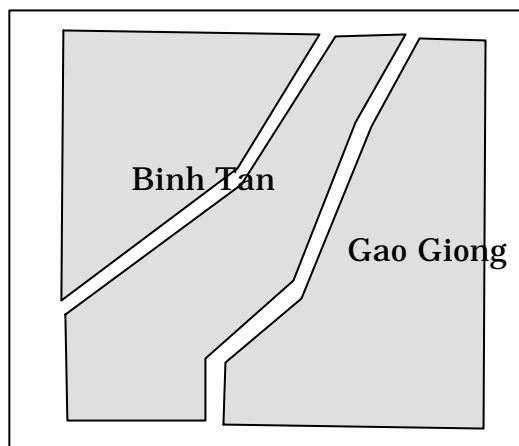
In order to assess acceptance of local people toward the project design and the project in general, the social survey team distributed questionnaires to all 1,321 households. The result of the survey is as follows.

- The percentage of households that are informed about the project is 96% of the total households answered. The most important sources of information are from the neighbors or relatives, public hearing, hamlet leaders.
- The households that totally or partly agree with the project share 74% of the total households answered. However, their appreciation and worry about project is quite different.
- The number of households that partly disagree with the project is 81, that of totally disagree is 139. There is a gap between their thinking about advantages and disadvantages of the project.
- The number of households that have no idea about the project is 73. The reasons are; they know about the project but the information is not enough for them to make decision, they feel it is not easy to understand well the project, and they do not have any information of the project, etc.

4) Final Project Design

With all of the ideas contributed by farmers and participants in the 3rd SHM, the Final Project Design has been finalized. The content is as follows.

- Dike unit: The whole 1,800 ha of the project area will be divided into 3 dike units of which 2 units are in Binh Tan commune and 1 unit is in Gao Giong commune (see the picture illustrated)
- RICS: Each dike unit must be allied the rotation as suggested in the project “ 1 non-inundated, 2 inundated”.
- Cropping pattern: they do harvest and then planting intensively and simultaneously in order to finish the 3rd crop around the middle or at the end of September.
- Infrastructure: Necessary facilities to be constructed (dike, water gate, bridge, culvert, etc.) in each commune are decided
- Operation and maintenance: The chart of O/M of the dike system is illustrated in the Appendix.
- Expenses of the project: The expense of the project and the portion contributed by residents will be discussed after the information of total expense has been announced
- Mitigation of negative impacts: The negative impacts of the project and the solutions for these impacts are listed



5) Technology Transfer Seminar

Based on the survey results, the draft of EIA operation manual was prepared with particular focus on the consensus building of social survey. The execution plan for social survey of EIA is suggested in the Draft and the idea was explained in the technology transfer seminar held on April 28, 2000. In the seminar, opinions on survey for consensus building were exchanged.

6) Conclusion and Recommendation

The main output of the survey was public participation and consensus built among local people and the project working teams including governmental officials and surveyors. Project design was done by local people themselves, via hard working of their representatives- the TWG with supports of the survey team. With participatory approach, what was done feasibility of the project proved the bottom up acceptance toward the project proposal.

Training is the basic tool for the project implementation and also for capacity building. Both “Small Scale Dike System Improvement Project” and the survey methods are entirely new for the people concerned including survey team members, TWG and stakeholders. Therefore, it is necessary to conduct appropriate training courses for survey team first, and then they will be trainers of TWG and

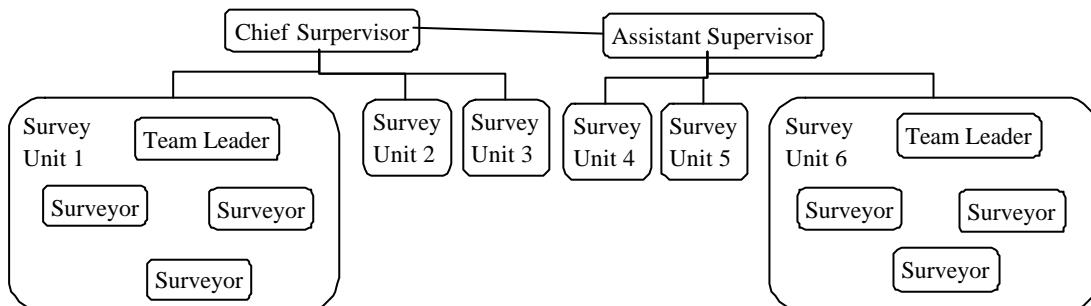
other local key persons. Information of the total expenses of the project as well as the payment of each household must be disclosed after the project design is finished and calculation is ready. Financial supports and compensation for those who have to remove houses or lose land must be carried out properly and satisfactorily. Furthermore, it should be considered as common and regular activities with participation of the persons in charge and beneficiaries for monitoring and evaluation of the project.

(3) Consideration of Social Environmental Survey for EIA

In order to confirm the people's consensus building in the implementation of the project, EIA social survey in the Pre-F/S Area should be carried out based on the social survey conducted this time. The procedure of the survey is summarized as follows.

1) Formulation of the Survey Team

A sociologist with enough experience is a chief supervisor of the team and the official of province DARD in charge of agricultural development is an assistant supervisor. The survey team for one survey unit will consist of one team leader and 3 surveyors and six teams in total will be formed under the supervision of a chief supervisor and an assistant supervisor.



The surveyors who already joined the survey this time can be used as survey leaders.

2) Training of the Survey Staff

It is essential to give appropriate training for the survey staff to understand the project and survey method before the survey implementation.

3) Survey Procedure

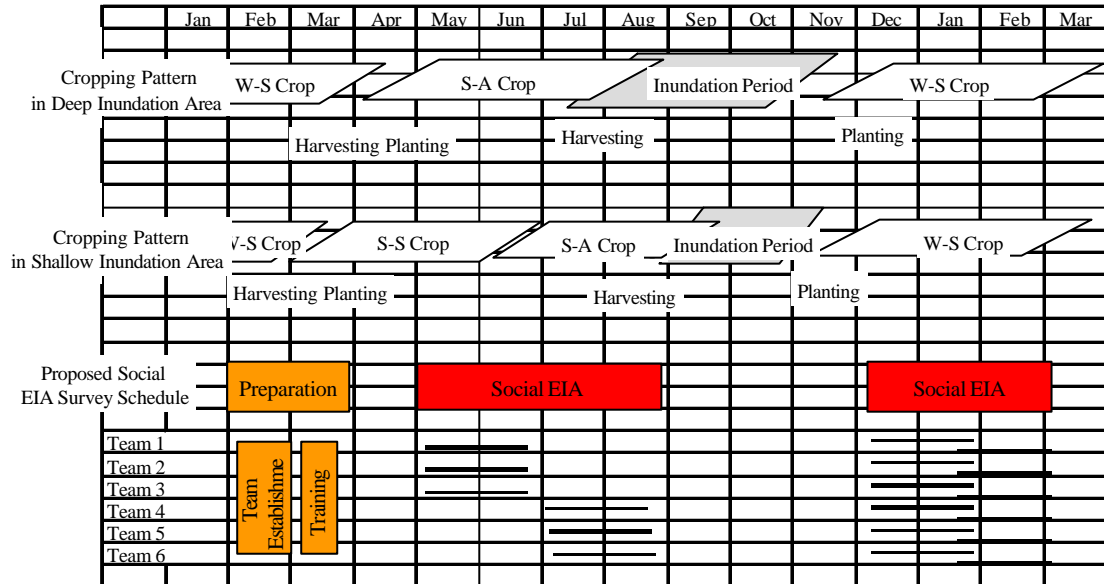
One survey unit will cover 2,000-3,000 ha in one block and it takes about 7 weeks to finish one unit of all steps.

Schedule of the one survey cycle

Activity	No. of week	1	2	3	4	5	6	7
1 Identification of the stakeholders								
2 Stakeholder meeting 1								
3 Technical Working Group Discussion								
4 Stakeholder meeting 2								
5 Public hearing								
6 Hamlet discussion								
7 Consensus building assessment								
8 Stakeholder meeting 3								
9 Summarization of the survey								

4) Survey Schedule

The schedule of EIA survey on consensus building is proposed as follows considering farming practice in order to get cooperation of the farmers.



Tentative EIA Survey Execution Plan

6.6 Project Implementation Plan

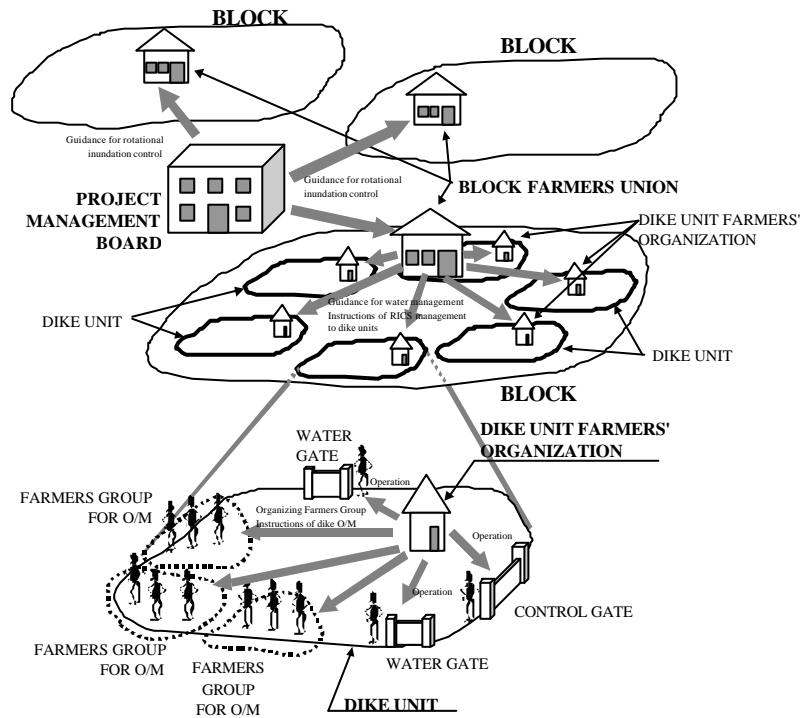
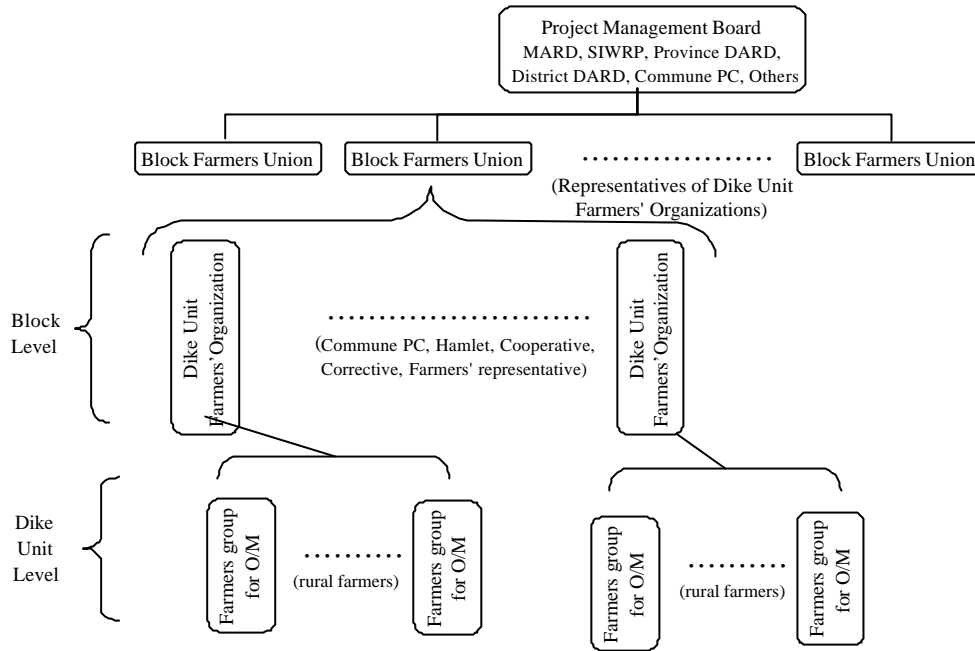
6.6.1 Project Implementation and O/M Organization

It is necessary to establish three organizations for this project, one for project implementation, the second for management of rotational inundation control, and the third for O/M of small dike and related structures. The project management board consisting of SIWRP and other related institutes will manage the implementation of the project. Inundation control based on rotation system will be done for each dike unit and the control plan will be decided by a combined organization consisting of local government staff and representative(s) of farmers. This organization will also consider the plan for high flood year and monitoring of rotational inundation control. The operation and maintenance of rotational inundation control, small dike and related structures will be done by the farmers' organization for each dike unit. These are summarized below:

Organization	Members	Role on Implementation	Role on O/M
Project management board	MARD, SIWRP, Province DARD, District DARD, Commune PC, Others	To implement preparation and construction of project. To guide establishment or strengthen the farmers organization for dike block and dike unit. To execute environmental monitoring	To guide Operation and maintenance through the province DARD in technical aspects and through farmers organization in management aspects. To continue environmental monitoring
Block Farmers Union	Farmers' organizations for each dike unit	To organize farmers' organization for each dike block	To make a plan for rotation. To correspond high flood (to coordinate rotational control plan for next year) To monitor rotational inundation control
Dike Unit Farmers' Organization	Commune PC, Hamlet, Cooperative, Corrective, Farmers representative	To organize Dike Unit Farmers' Organization and farmers grope for O/M	To control inundation rotationally To make maintenance plan for dike and related structures To execute maintenance through farmers' group To collect the fee for dike
Farmers group for O/M	Rural farmers (for each 1 km of dike)		To execute maintenance work for dike and related structures

As for environmental monitoring, it is better to start before implementation of project. SIWRP will take the main responsibility for this monitoring and province DARD and other institutes will provide support.

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IN THE DONG THAP MUOI AREA VIET NAM FINAL REPORT**



CONCEPT FOR RICS OPERATION

6.6.2 Implementation Plan

For the implementation of the project, it is necessary to consider the social impact and to complete EIA including consensus building of farmers before commencement of the project. The EIA study including social survey on farmer's consensus building will be done in parallel for Block and Block and it will take 1 year and 3 months. Other 9 months will be considered for detailed design and tendering. Total construction period will be 3 years considering construction volume. Since the construction of embankment for dike is the main construction work, it is necessary to concentrate the construction in the dry season and low water period. The period from March to July will be available for constructions. In the area for ASS, it is necessary to carry out the construction with monitoring of water quality in the canals. This monitoring will be continued after construction.

Proposed Implementation Plan of Small Dike Improvement Project

Years	1	2	3	4	5
EIA and Consensus Building					
D/D and Tendering					
Construction					

6.7 Operation Plan

Operation of rotational inundation control will be done by the organizations mentioned above based on the following procedure. These procedure should be discussed among farmers and related institutions through the study on consensus building of EIA.

Operation at block level

- Combined organization for each block will be established for rotational inundation control. This organization will be under the guidance of management board.
- Water management for rotational inundation control will be done for each block which consists of dike units. The block will be divided into 3 control groups and each group will be inundated in order.
- Block Farmers Union will make the agreement for rotational inundation control under the guidance of project management board and each dike unit will be operated based on the agreement.
- Block Farmers Union confirms the rotational inundation control program including the gate

operation time and inundation/non-inundation dike unit (or inundation order in September) in every year. In principle, inundation/non-inundation dike will be changed by control group every year, however, after high flood year, this order will be coordinated by Block Farmers Union.

- The problems among the dike units in block will be solved by Block Farmers Union.
- Block Farmers Union, which will monitor the conditions of rotational inundation control, will inform to project management board and make guidance for farmer's organizations for dike unit.

Operation at dike unit level

- Dike Unit Farmers' Organization consisting of representatives of farmers, commune PC, hamlet, cooperatives, collectives, etc. will be established for operation of rotational inundation control and O/M of dike and related structures. Representatives of this organization will be members of the Block Farmers Union.
- Dike Unit Farmers' Organization will operate inundation control for dike unit based on rotational inundation plan formulated by Block Farmers Union. Dike Unit Farmers' Organization nominates the gate manager and inundation will be controlled with operation of open/close the gate (put/remove the stop log). Dike Unit Farmers' Organization will confirm the condition of gate operation periodically and inform to Block Farmers Union.
- Dike Unit Farmers' Organization will be main institute for maintenance of dike, gate and other related structures. Maintenance work will be done by farmers group managed by farmers' organization.
- The necessary cost for O/M of small dike system will be collected and managed as water management fee by Dike Unit Farmers' Organization.
- The gate inside the dike will be opened/closed by the gate manager according to decision of the Dike Unit Farmers' Organization based on the request of farmers.

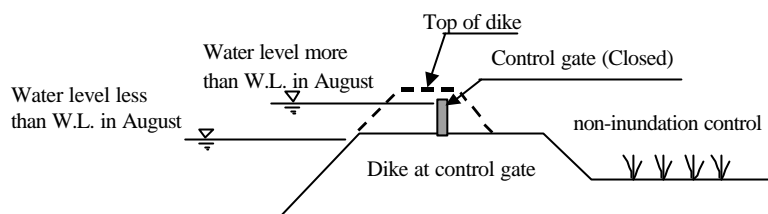
Methodology of rotational inundation control

Block (middle inundation area)

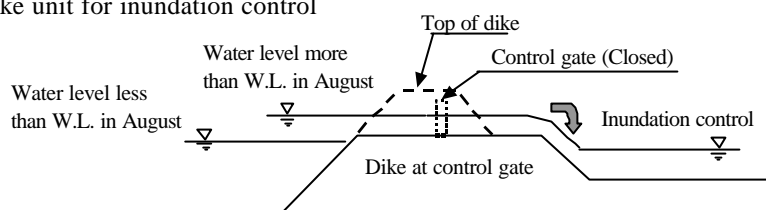
- Control gate is opened basically.
- According to rotational inundation plan formulated by Block Farmers Union, the control gate at the dike units for non-inundation will be closed before inundation season. The gate will be opened eminently after inundation period.
- At the dike units for inundation, the gate is opened through out the year.
- As elevation of dike at control gate will be set for the water level at August, the inundation will be prevented by August.

- In September and August, the water will come into inside at the dike unit for inundation control. At the dike unit for non-inundation control, inside will be prevented from inundation by closing control gate.

Dike unit for non-inundation control



Dike unit for inundation control



Block (shallow inundation area)

- Control gate is opened basically.
- All control gates will be closed before inundation period.

According to rotational inundation plan formulated by Block Farmers Union, the control gate at the dike units for first inundation group will be opened in first of September. At next, the control gate at the dike units for second inundation group will be opened in middle of September. Then the control gate at the dike units for third group will be opened by the end of September.

6.8 Maintenance Plan

In maintenance, there are works for patrol/inspection, routine maintenance, periodical maintenance and rehabilitation. It is necessary to make malignance plan considering total coordination of the works. Based on the results of patrol/inspection works, it is necessary to consider the effective plan with getting conditions of facilities. Those plans will be proposed by farmer’s organization for dike unit under the guidance of province/districts DARD in technical. Farmers group will do the patrol/inspection and routine maintenance works. The periodical maintenance and rehabilitation will be done by farmer’s organization for dike unit.

Work item	Contents	Work interval	Organization
Patrol/inspection	To confirm the site for repairing based on patrol/inspection periodically	Every month	Farmers group

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	To make maintenance plan		
Routine maintenance	To repair dike slope, road and shoulders etc.	Two times per 1 year (Before/after inundation period)	Farmers group (under the guidance of Dike Unit Farmers' Organization)
Periodical maintenance	To repair and replace the water gate, culverts and other related structures To maintain canal, etc.	One time for 5 to 10 years	Farmers organizations for dike
Rehabilitation	To repair big damage caused by overflowing of the dike	Whenever necessary	Farmers' organization for dike under the guidance and supporting from project management board

Basically farmers will owe the maintenance cost and it will be collected as a part of irrigation fee. Commune PC will be in charge of coordination. The O/M costs are estimated as shown below:

Block	O/M cost for 1 year	O/M cost for 1 year, per 1 ha of agricultural land
	9,856 million VND	541,000 VND
	9,190 million VND	515,000 VND

6.9 Project Cost

(1) Construction Cost

Total construction costs required for the project are calculated as local currency 381,869 million VND. For the details, it refers to Appendix.

(2) Engineering Cost

The engineering cost which covers consulting service is estimated to be 38,190 million VND as 10% of total construction cost.

(3) Compensation Cost

Compensation Cost of land is estimated to be 124,159 million VND.

	Equipment and goods	Construction	Compensation cost	Total
	Million VND	Million VND	Million VND	Million VND
1.Block 4	208,637	20,866	79,881	309,384
2.Block 8	173,232	17,324	44,278	234,834
Total	381,869	38,190	124,159	544,218

6.10 Alternative Study for Project Implementation

6.10.1 Study on Preceded Area

Considering the smooth implementation for the small dike system improvement project, the alternative implementation plan, such as that to implement the project for small area (1,800ha) at first in stead of a large area (40,000 ha) at same time, is proposed based on the following reasons.

- The preceded area can be considered as the pilot area for evaluation of natural and social environmental impact from the project.
- It is necessary to confirm the environmental impact concerning the ASS. Through the monitoring of the water quality at the canals during construction period and after construction, the conditions of ASS will be confirmed and countermeasure and its' effect for reduction of impact will be considered. Based on this, countermeasures can be improved and it will be proved that the project can be implemented with reducing the natural environmental impact as small as possible.
- As for the social environment, the project will be implemented based on the consensus building of the farmers and rotational inundation control will be monitored after the construction. Furthermore, the farmers' organizations and conditions of O/M for structures will be monitored. Based on this, it will be proved that the rotational inundation control and O/M for structures can be managed by farmers' organization.
- The preceded area can be considered as the model area and it can be expected that the results of project for preceded area will support the people at pre-F/S area (40,000 ha) for consensus building, farmers' organization, etc.
- Considering the verification of rotational inundation control, the preceded area must cover 3 or 4 dike units and total of preceded area will be 1,500 to 2,000 ha.
- Considering the early implementation of the pilot project, it is necessary to complete the social environmental survey and consensus building and F/S area will be available for the preceded area.
- For obtaining the maximum effect as model pilot project, it is necessary to improve the

6.10.3 Implementation Organization for Preceded Area

For project implementation for preceded area, the following organization will be established. Project management board and Block Farmers Union will consist of concerning province, districts and communes at first. When the project will be implemented for all area, other related institutes will take part in the organizations.

Organization		Formation
Project Management Board		SIWRP, DARD of Dong Thap Province, DARD of Than Binh District, DARD of Cao Lanh District, Binh Tanh Commune PC, Gao Giong Commune PC
Block Farmers Union		Farmers Organization of BT1, BT2, G4-G1B dike units
Farmers' Organization of Dike Unit	BT1	Binh Tanh Commune PC, Hamlets, Binh Tanh Cooperative, Agricultural Collective, Farmers' Representatives
	BT2	Binh Tanh Commune PC, Hamlets, Binh Tanh Cooperative, Agricultural Collective, Farmers' Representatives
	G4-G1B	Gao Giong Commune PC, Hamlets, Gao Giong Cooperative, Agricultural Collective, Farmers' Representatives
Farmers group for O/M	BT1	One grope for each 1 km of dike. (10 gropes)
	BT2	One grope for each 1 km of dike. (13 gropes)
	G4-G1B	One grope for each 1 km of dike. (14 gropes)