APPENDIX M : SMALL DIKE SYSTEM IMPROVEMENT PLAN

APPENDIX- M SMALL DIKE SYSTEM IMPROVEMENT PROJECT

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APPENDIX M SMALL DIKE SYSTEM IMPROVEMENT PROJECT

M.1 PROJECT DESCRIPTION

M.1.1 DEFINITION OF PRE-F/S AND F/S

Construction work of the project does not include the large scale and sophisticated ones. However, the rotational inundation mitigation is rather new approach to the area and requires relevant farmer's organization. For the evaluation of rotational inundation mitigation, the study needs to cover rather broad area. At the same time, there exists difference between medium and shallow inundation areas on their characteristics. Taking into account the various facts such as acid sulfated soils, priority on implementation schedule, existing farmer's organization and current dike system, Block-4 of the medium inundation area and Block-8 of shallow inundation area were selected as the Study Area with about 40,000 ha in total.

All the necessary study will be conducted for the area at the F/S level excluding the study on consensus building. As intensive study on consensus building for such a broad area of 40,000 ha is difficult to manage m a limited time, the study on social environment will focus on the followings

- Identification of the beneficiaries
- Confirmation of the needs of beneficiaries
- Cost sharing capacity of beneficiaries
- Capacities of executing agencies
- Gender issues
- Impact on the socially disadvantaged group

Among 40,000 ha, around 2,000 ha (as a total area) is selected for the F/S area and an additional study on consensus building is conducted. This will provide the basis for earlier implementation of the project. The study focuses on the followings;

- To verify the proposed inundation mitigation system
- To sensitize the beneficiaries and,
- To facilitate active participation of the beneficiaries in the project

M.1.2 STUDY AREA AND PRESENT CONDITIONS

M.1.2.1 Study Area

(1) Pre-F/S Area

In accordance with the Master Plan Study, two areas were selected for the small dike system improvement project to be conducted the pre-feasibility study. The one is the block-4 from the Dong Thap Province representing the medium inundation area, and the other is the block-8 from the Tien Giang Province representing the shallow inundation area.

The block-4 has the total area of around 21,150 ha located in the center 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-8 has the 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 Lon 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.

The total area, cultivated area and number of farm households in the Study Area are summarized as below, and Fig. M1.2.1 and M1.2.2 show the Study Area:

Block / District		Total Area (ha)	Cultivated Area (ha)	Number of Farm Households
BLOCK-4 (Dong Thap)	Thanh Binh Distrcit	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 of Block-4	21,153	18,228	15,926
BLOCK-8 (Tien Gian)	Cai Be District	11,440	10,910	6,929
	Cai Lay District	8,354	6,933	5,419
	Sub-total of Block-8	19,794	17,843	12,348
Total		40,947	36,071	28,274

Source : Study Team, Inventory Survey, 2000

The concerned districts and communes of the pre-F/S area is shown below:

Block-4		Block-8	
District	Commune	District	Commune
Than Binh	Tan My	Cai Be	Hau My Bac A
	Binh Tan		Hau My Bac B
	Tan Phu		My Trung
	Binh Tanh		Hau My Trinh
Cao Lanh	Gao Giong		Thanh Trang
	Phong My		Hoi Cu
	Tan Nghia	Cai Lay	My Thanh Bac
Tam Nong	Phu Cuong		My Thanh Nam
			Thanh Loc
			Phu Nhuan
			Phu Cuong
			My Phuoc Tay
			Tan Binh

(2) F/S Area

The F/S area has the total area of around 2,000 ha located in the north-central part of the Block-4. The area stretches over two communes in two districts, i.e., the Binh Tanh Commune of the Tanh 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 Tanh 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 / Dyke Unit	Total Area (ha)	Cultivated Area (ha)	Number of Farm-households		
			Total	Have paddy field inside	Have Paddy field outside
Binh Tanh Commune	1,056	954	624	257	367
Dyke Unit BT1	*476*	*432*	*221*	*120*	*101*
Dyke Unit BT2	*580*	*522*	*403*	*137*	*266*
Gao Giong Commune	986	870	649	375	274
Dyke Unit G4-G1B	*986*	*870*	*649*	*375*	*274*
Total	2,042	1,824	1,273	632	641

Source : Study Team, Inventory Survey, 2000

M.1.2.2 Present Conditions of Agricultural and Rural Infrastructures

For the infrastructure sector, the supplemental field survey and data collection concentrating the pre-F/S area was carried out. The results of this survey are summarized as below:

(1) Road Network

The road network in Vietnam is classified into 5 categories from the administrative aspect, i.e., national

road, provincial road, district road, commune road and other roads. The road network in each category is developed, operated and maintained by each level of government or authority. Bridges area developed, operated and maintained by each administrative level in a same way as roads, but in some cases, the provincial government provides bridges for district road due to the technical and budget consideration.

In general, the road networks in both of the pre-F/S area are not developed and are not suitable for car transportation. The road network in the areas and the present conditions are shown in Fig M1.2.3 and M1.2.4.

BLOCK-4:Present Condition

The access to/from the external area of the Block-4 is provided by the National Road QL30, which passes the southwestern 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 an 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 into the eastern area of the block. However, those roads are not suitable for car transportation due to lack of bridges, 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 meter width of road surface paved by late rite soil and bridges with 8 tons of loading capacity.

BLOCK-4:Development Plan

The Department of Transportation of the Dong Thap Province (DOT) has the responsibility to make and execute the plan for transportation development in the province. The Dong Thap DOT prepared the Transportation Development Master Plan 2010 and this plan has been revised in the 1999. In accordance with the plan, DOT has the following plan of road improvement to be implemented from 2000 to 2010 in the Block-4:

For provincial road:

- DT844: Upgrading road width and elevation and installing asphalt pavement for the distance of 47.5 km (including the distance from Tram Chim to Hung Thanh). This route has the high priority in the Province and to be improved in the year 2001.
- DT846: New construction of 8 km of the distance from Phong My to Duong Thet, which connect DT846 to QL30. This route also applied high priority in the plan and is expected early implementation.
- DT855: New construction of the route along the An Phong My Hoa Main Canal, which runs the

center of the block from west to east. The implementation schedule has not been yet decided yet.

For district road:

- Khang Chien Canal Road: New construction of 20 km of dike road in the Thanh Binh District. The implementation schedule has not been decided yet.
- Binh Tanh 4 Canal Road: Dike upgrade has completed for the distance of 9.5 km in the Thanh Binh District. Bridges shall be installed but the implementation schedule has not been decided yet.
- Gia Giong – T.X.Cao Lanh Road: 15 km of dike road. Dike upgrade has completed in some distance. Bridges shall be installed but the implementation schedule has not been decided yet.

BLOCK-8:Present Condition

The Block-8 is located along the National Road QL1, which has asphalt pavement and sufficient elevation to prevent flood throughout the year, and this road secures the access to the external area. Several provincial roads, i.e., DT863 and DT869 for the western side, DT865 for the northern side and DT868 for the eastern side, surround the block. Those provincial roads are paved by late rite soil and gravel, and have enough elevation to prevent flood barely in August to November, so that they provide car transportation through year. Though the area along the above provincial road has better access 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 car bridges has not been provided.

BLOCK-8:Development Plan

The responsible organization for transportation development is similar to the Block-4 and the Tien Gian Provincial DOT has that responsibility. In accordance with the provincial transportation development master plan to 2010, the following road development and improvement are proposed:

For provincial road:

- DT863: This route has been upgraded the elevation and width with laterite soil and gravel pavement in 1996. The elevation is enough for preventing 1996 flood.
- DT865: The distance of 12 km will be asphalt paved and 6 bridges are to be constructed. The elevation is enough for preventing 1996 flood.
- DT868: The distance of 24 km will be asphalt paved, and 1bridge is planned to be newly constructed and 7 bridges to be improved. The elevation is enough for preventing 1996 flood.
- DT869: The distance of 18.4 km will be gravel paved, and 6 bridges is planned to be newly constructed. The elevation is enough for preventing 1996 flood.

For district road:

- No.8 Canal Road in the Cai Be District: This route has been upgraded to dike road with 5 meter with and laterite soil. The bridge construction is required.
- No.10 Canal Road in the Cai Lay District: This route is planned to be improved as dike road and prepared bridges on year 2001 by the District.

(2) Canal Network

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

In the Mekong delta area, the canal network system is classified into 3 categories, i.e., main canal, secondary canal and tertiary canal.

- Main canal: canal connected to the main river (sometime *the main canal* is divided into two categories, i.e., *the main canal and the 1st canal* in Vietnam, but they are treated as one category in this report.)
- Secondary canal: canal connected to the main canal
- Tertiary canal: canal connected to the secondary canal.

The responsibility for operation and maintenance of the main canal system is taken by the Provincial Government, the secondary canal by the District Government and the tertiary canal by the Commune Authority basically, but some confusions are observed in some cases.

The canal network system in the areas and the present conditions are summarized below and shown in Fig.M1.2.5 and M1.2.6.

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 Widh (m)	24 ~ 40	10 ~ 20	
BLOCK-8			
Number of Canals (pcs)	3	9	12
Total Length (km)	24.5	80.1	104.6
Canal Widh (m)	45	20 ~ 35	

Source : Study Team, Inventory Survey, 2000

BLOCK-4

The canal network in the Block-4 consists of 3 main canals, i.e., Dong Tien Canal, An Phong My An Canal and Thap Muoi Canal, running from east to west direction and reaching to the Tien River mainstream. There are some secondary canals running from north to south direction connecting each main canal.

BLOCK-8

Block-8 has 3 main canals in the area, i.e., Nguyen Van Tiep Canal running from west to east, No.28 Canal and No.12 – Ba Ray Canal running from south to north. Due to the bending of the Tien river mainstream near by the block, the canal network in the Block-8 is observed a little complicated.

In both of the blocks, the corruptions of canal bank are observed everywhere along canal. Some of them are considered to be serious for the safety of boat transportation and dike structures. The major reason of corruption is supposed to be wave effect by large boat. To protect canal bank and dike, farmers plant trees along the canal bank. However, tree routs are exposed by wave corruption and some of trees fall down to the canal side.

Canal in the area suffers from 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 a two or three year on average.

INVENTORY OF MAIN AND SECONDARY CANAL

BLOCK-4

Main Canal	Length (m)	Width (m)
An Phong-My Hoa Canal	14.9	24～30
Dong Tien Canal	8.0	30
Nguyen Van Tiep Canal	7.2	35～40
TOTAL	30.0	24～40

Secondary Canal	Length (m)	Width (m)
Binh Thanh 4 Canal	10.6	20
Duong Gao Canal	17.6	10～15
Gao Giong Canal	16.1	12～20
Kenh 2/9 Canal	8.2	18
Khang Chien Canal	8.3	18
TOTAL	60.7	10～20

BLOCK-8

Main Canal	Length (m)	Width (m)
Nguyen Van Tiep Canal	17.0	45
No.28 Canal	7.5	45
TOTAL	24.5	45

Secondary Canal	Length (m)	Width (m)
Nguyen Van Tiep B Canal	8.5	35
No.6 Canal	12.5	30
Duong Cui Canal	1.1	30
No.7 Canal	13.5	30
No.8 Canal	9.5	25
No.9 Canal	8.0	20
No.10 Canal	11.5	25
No.12 Canal	9.0	35
Bang Day Canal	6.5	20
TOTAL	80.1	20～35

(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 after year. So far, almost all of the both blocks are covered by the small dike system with various scale of such as for August flood to October flood and for average flood to large flood. The present condition of the dike system in the area are summarized as below and shown in Fig.M1.2.7 and M1.2.8.

SUMMARY OF PRESENT DYKE SYSTEM

Items	Total Area (ha)	Cultivated Area (ha)	Total Length of Main Dyke System	Number of Small Dyke System
BLOCK-4	17,849	14,687	301.3	48
Tanh Binh District	*10,016*	*8,365*	*157.9*	*26*
Cao Lanh District	*5,077*	*4,328*	*111.2*	*20*
Tam Nong Distirct	*2,756*	*1,994*	*32.1*	*2*
BLOCK-8	18,171	16,076	340.3	131
Cai Be District	*10,502*	*9,830*	*194.4*	*86*
Cai Lay District	*7,669*	*6,246*	*145.9*	*45*
TOTAL	36,020	30,763	641.6	179

Source : Study Team , Invntory Survey, 2000

For the dike system, Block-4 and Block-8 have different characteristics due to the different flood condition and farming practice. The outline of the dike systems are summarized below:

BLOCK-4

At present, the dike system covers almost all the block-4 area even some of them are insufficient to prevent flood effectively. The dike system in the Block-4 has the concept to protect paddy field for harvesting Summer-Autumn crop and to realize double crop production. The flooding conditions of this area do not allow double crop production without any dike system because most of area is inundated from July to February or from August to January without any protection. Therefore, most of the dikes in this area are set up for preventing July or August flood with the top elevation from EL 2.5 m to EL 3.3 m or the dike height from 1.2 m to 2.0 m, which are decided by farmers experimentally. As a result, the dike suffers overflow of dike top in September and inundated until November or January.

The dike system in this area is recognized as one type even the elevation varies and the main dike system and small dike system are not distinguished in most cases. The area of each dike unit varies from 120 ha to 800 ha and exceeds 1,000 ha in some cases with the average of 540 ha.

BLOCK-8

At present, the dike system covers all of the Block-8 area and triple crop of paddy is realized in the whole area. However, the Autumn-Winter crop suffers flood damage frequently when flood comes early in August or the beginning of September even they have dike system. That is to say the harvesting of summer-autumn crop in this area is a race with flood coming, and farmers suffers damage when thy defeat the race.

The concept of the dike system in the Block-8 is to protect paddy field for harvesting Autumn-Winter crop and to stabilize its production. For this purpose, most of the dikes in this area are set up to cope with the water level in August or the beginning of September. The top elevation of dike is set from EL 1.3 m to EL 2.0 m or the dike height from 0.5 m to 1.3 m in general, which are decided by farmers experimentally. As a result, the dike suffers overflow of dike top in September and the dike unit is inundated until November.

The basic unit of the dike system is observed as the small dike system to prevent inundation within the main dike system. The area of each small dike unit varies from 40 ha to 430 ha and the average is 170 ha, which is smaller scale compared to the Block-4.

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

- Overflowing on dike top occurs every year in September because the top elevation dose not copes with yearly maximum water level. This is the major reason of the corruption of dike top and shoulder. This kind of corruption is observed at the section having lower dike top compared to others.
- Wave by large boat on canal makes erosion on dike slope. This type of corruption is observed along the large canal where large boats are operated. In some cases, severe erosion fell down trees on dike slope into the canal and obstruct boat transportation.
- In general, the embankments of dike built by farmers themselves are just to put soil on and no compaction is conducted. Furthermore, the cross sections of them are insufficient in slope ratio 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 so 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 burdened with this "cut and repair dike" water management. Furthermore, they repair dike after each cropping but the repair is insufficient and not carefully done for dike structures. In some cases, they repair dike at lower elevation at the cutting point and it causes dike weakness.

Due to the above conditions, the maintenance of dike system requires a lot of effort and money of farmers. Farmers contribute to dike maintenance by labor (in some case farmers hire a dredging machinery by themselves) or by paying dike maintenance fee included irrigation fee under the control of irrigation team of hamlet or commune. According to the results of interview to farmers, the burden to dike maintenance is estimated as maintenance fee of from 300,000 to 600,000VND/ha/year or duty of dike maintenance of from 40 to 60m/household/year.

(4) Irrigation and Drainage

CANAL FACILITIES

In the Mekong Delta Region, the main and secondary canal are recognized the canal system to bring water to the certain area and the tertiary and internal canal are to deliver water into the field in dike unit. The development condition of the tertiary and internal canal system in the Block-4 and Block-8 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 total canal density is similar, in Block-4 is 19.6 m/ha and in the Block-8 is 23.7 m/ha.

In general, the study area is abundant in water resources throughout the year due to the Mekong River and the well-developed canal network system. Though there is enough water in canal system even in dry season, it is necessary to pump up from main or secondary canals to tertiary canal or internal canal of dike due to the low water level.

SUMMARY OF TERTIARY AND INTERNALCANALS

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 Widh (m)	7 ~ 25	10 ~ 20	
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 Widh (m)	8 ~ 20	1 ~ 3	
Canal Density (m/ha)	13.68	10.01	23.69

Source : Study Team, Inventory Survey, 2000

PUMP FACILITIES

As pump is 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-4. In this area, the practices of pump operation by farmers were observed well operated. Farmers inspect the water level in their paddy field periodically and control carefully by operating or requesting pump operation.

According to the inventory survey by the Study Team, there are 167 fixed pump stations in the Block-4, of which 112 stations are with engine pumps and 55 stations with electric motor pump. 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.

Rest private pumps, which supply water not only for their own paddy field but also to neighboring farmers and collect water fee. In addition, there are many farmers possessing pump and lease them to neighboring farmers and collect 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. That is to say private pump service is one of the commercial activity in the rural area.

The cooperatives charge water fees to farmers and collect them by paddy and fuel or in some cases by cash. The water fee is from 400,000 to 600,000 VND/ha/crop by respective farmers and cooperatives. The water fee of private pump services is similar to that of cooperative pumps.

In the Block-4, some of farmers groups introduce pump drainage to decrease water level in dike unit earlier in November. This is for preparing winter-summer crop. Even pump drain is not required for double crop in this area basically, they intend to advance their cropping calendar so that agricultural labor force will not be crowded and labor cost will be saved. The leader of agricultural cooperative say that they believe it is profitable even taking into account the cost for pump operation because they could save from 20% to 30% of production cost by advanced cropping calendar.

RESULT OF INTERVIEW ABOUT IRRIGATION FEE IN BLOCK-4

No	Block	Commune	Irrigation Fee (ha/crop)			Type
			Paddy (kg)	Fuel (litter)	VND	
1	4	Binh Tanh	200	80	600,000	Coop
2	4	Binh Tanh	380		532,000	Private
3	4	Binh Tanh	200	55	500,000	Coop
4	4	Phu Cuong	150	60	450,000	Private
5	4	Gao Giong	320		448,000	Coop
6	4	Binh Tan	340		476,000	Coop
7	4	Phong My	300		420,000	Private

Unit price applied for conversion

Paddy (VND/kg)	1,400
Fuel (VND/litter)	4,000

Source : Study Team

On the other hand, most of the pumps in the Block-8 are private pump, and 74 % of farm households possess private pump, 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 pumps for irrigation because required pump capacity is not large. Farmers who do not have their own pump hire private pumps from neighbor 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 including fuel cost.

As mentioned above, private pump service has played an important role for irrigation and drainage in both blocks. Considering current situation of pump owners and their activity, the integration of pump stations in dike unit and their replace 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 developed well and the area having electricity is limited. This restricts introducing electric motor pumps in this area even there is demand.

M.1.3 FACILITY PLAN

M.1.3.1 Arrangement of Small Dike Units

Existing dike units have an infinite variety of its shape and size in both blocks. In general, it is required to avoid scattered micro dike units as to reduce construction cost while large size of dike unit makes farming practice and water management difficult. Through the discussion with farmers and administrators in the consensus building survey of F/S, it was found that from 500 to 1,000 ha of the size of dike unit would be well balanced one in view of the above aspects.

The arrangements of small dike units are studied based on following considerations.

- Present condition of existing dike system
- Present condition of canal network (convenience of boat transportation)
- Farmers' activity in dike unit (water management in dike unit)
- Minimize land loss
- Economic efficiency

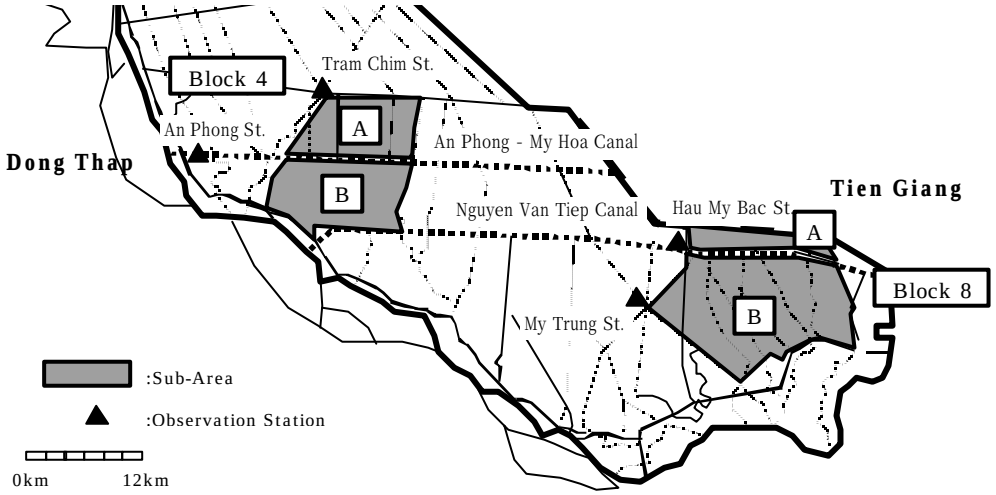
As a conclusion, 33 small dike units of the area from 145 ha to 2,358 ha, on average 641 ha, are proposed to the Block-4, and 34 small dikes of the area from 127 ha to 1,190 ha, on average 582 ha, are proposed to the Block-8. The proposed small dike units of both blocks are listed in the Table M1.3.1 and shown in Fig.M1.3.1 and Fig. M1.3.2.

M.1.3.2 Dike Cross Sections

(1) Dike Elevation

The elevation of the dike top is set for avoiding submerging even in October, when the water level reaches maximum in the year. By setting this way, the damages of dike body caused by water overflowing on the top and the access of the rural road network will be secured. To set up the design water level, both of the blocks are divided into two sub-area based on the hydrological character, that is the water level at flood heavily influenced by the water level in the main canals. The sub-areas and the observation stations selected for each sub-area are as below:

Block	Sub-Area	Station
Block-4A	Northern part of the **An Phong - My Hoa Canal**	**Tram Chim Station** along the Dong Tien Canal
Block4B	Southern part of the **An Phong - My Hoa Canal**	**An Phong Station** along the An Phong - My Hoa Canal
Block-8A	Northern part of the **Nguyen Van Tiep Canal**	**Hau My Bac Station** along the Nguyen Van Tiep Canal
Block-8B	Southern part of the **Nguyen Van Tiep Canal**	**My Trung Station** along the No.28 Canal



The design water levels of each sub-area are set as below:

Probable Yearly Maximum Water Level (cm)

Return Period	Probability	Block-4		Block-8	
		Tram Chim	An Phong	Hau My Bac	My Trung
20 year	5%	415	382	224	259
10 year	10%	399	368	209	240
5 year	20%	381	352	194	221
2 year	50%	348	324	170	193

Probable Maximum Water Level of August (cm)

Return Period	Probability	Block-4		Block-8	
		Tram Chim	An Phong	Hau My Bac	My Trung
10 year	10%	319	295	122	118
5 year	20%	297	275	113	111

(2) Dike Dimensions

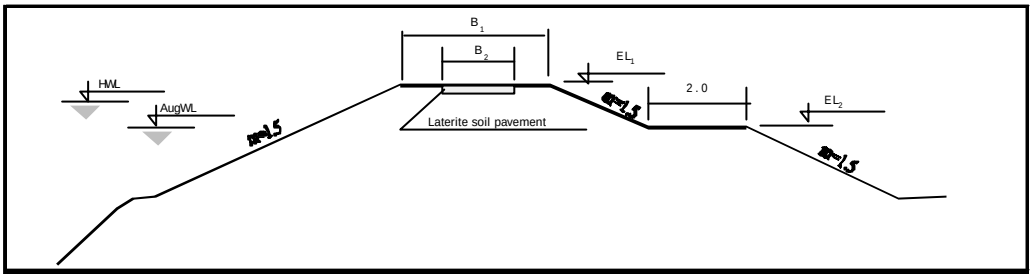
Elevation: The elevation is set to cope with the water level of the 10% probability flood in October. For the car road distance, 5% probability is applied due to the importance of social infrastructure.

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



	TYPE	HWL (EL.m)	AugWL (EL.m)	EL1 (EL.m)	EL2 (EL.m)	B1 (m)	B2 (m)
BLOCK-4							
(A) Northern Part of An Phong My An Canal	Car Road	4.15	3.20	4.70	3.20	5.00	3.00
	Standard	3.99	3.20	4.50	3.20	3.00	1.50
(B) Southern Part of An Phong My An Canal	Car Road	3.82	3.00	4.30	3.00	5.00	3.00
	Standard	3.68	3.00	4.20	3.00	3.00	1.50
BLOCK-8							
(A) Northern Part of Nguyen Vann Tiep Canal	Car Road	2.59	1.50	3.10	1.30	5.00	3.00
	Standard	2.40	1.50	2.90	1.30	3.00	1.50
(B) Soutern Part of Nguyen Vann Tiep Canal	Car Road	2.24	1.30	2.80	1.20	5.00	3.00
	Srtandard	2.09	1.30	2.60	1.20	3.00	1.50

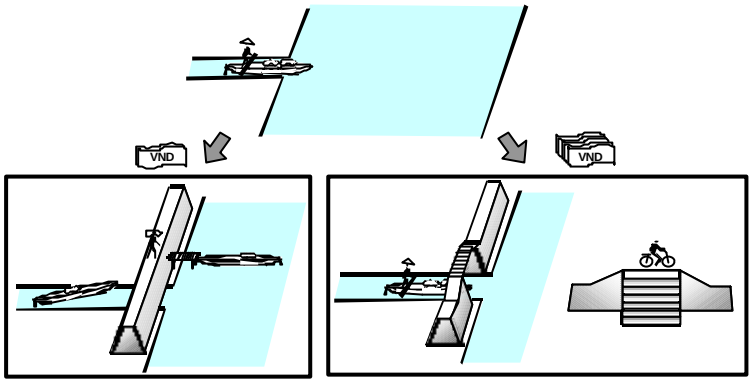
The total amount of dike improvement is summarized below and the total amount of the proposed dike improvement is shown in Table M1.3.2:

Block	Sub-Area	Dike with Car Road	Standard Dike
Block-4	(A) Northern Part of An Phong My An Canal	18.53 km	108.62 km
	(B) Southern Part of An Phong My An Canal	41.90 km	138.49 km
Block-8	(A) Northern Part of Nguyen Van Tiep Canal	17.84 km	49.46 km
	(B) Southern Part of Nguyen Van Tiep Canal	41.72 km	207.54 km

M.1.3.3 Related Structures

(1) Water Gate

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.



The stop log is proposed for water gates in consideration that the frequency of gate operation is very small. The following 4 kinds of water gate type are proposed for the project.

- Water gate for existing pump station with car pass
- Water gate for existing pump station with motorbike pass
- Water gate without pump station with car pass
- Water gate without pump station with motorbike pass

The basic dimensions of water gates are set as below:

- Width of gate: 2.5 m + 1.0 m + 1.0 m for pump station and 2.5 m for without pump station
- Height of pass: High water level on October plus 1.0 m
- Width of pass: 5.0 m for car pass and 3.0 m for motorbike pass
- Gate type: Wooden stop log

The number of proposed water gates for both blocks are shown in Table M1.3.3 and M1.3.4, and summarized below:

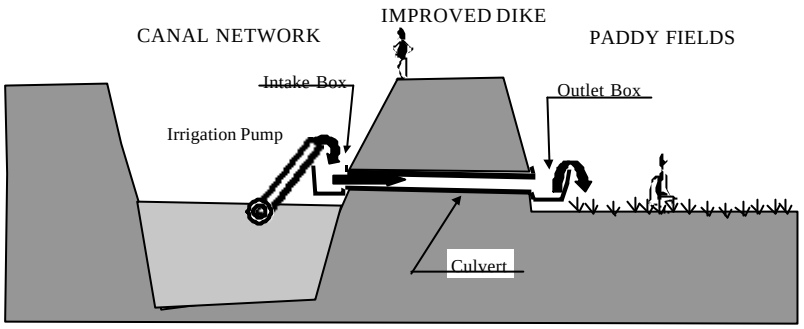
SUMMARY OF PROPOSED WATER GATES

	Watergate with car pass		Water gate with motorbike pass	
	For existing pump station	Without pump station	For pump station	Without pump station
Block-4	8	11	3	47
Block-8	1	18	0	98

(2) Culverts

It is proposed to install culverts under improved dike at the interconnection of small canals or at the location where farmers set fixed pump or temporally fix pump for irrigation and drainage. Those 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.

The basic idea of installation of culverts is to put intake/outlet boxes with stop log at the both side of culverts so that farmers can use those culverts for pump irrigation and drainage.



Two kinds of culverts are proposed, i.e., one is the large culvert to be installed at the interconnection of internal canals and the other is the small culvert for minor pumping points. The locations of large culvert are set at the existing major pumping point and the interconnection of major internal canals, while small culverts are set to locate hydraulic facilities at one per approximate 500 m length of dike. The dimensions of culverts are set based on the existing culverts or cut off of dike as shown below:

	Large culvert		Small culvert	
Block	Diameter (mm)	Number (pcs)	Diameter (mm)	Number (pcs)
Block-4	1,000	276	600	360
Block-8	800	198	400	377

The numbers of proposed water gates for both blocks are shown in Table M1.3.3 and M1.3.4.

(3) 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 spillway of dike at the same time.

The control gates of the dike units in the inundation turn of RICS will be open during the flood season so

that water will flow into the dike units automatically when the water level comes over the elevation of gate foundation. The elevation of gate foundation is set for the water level of August flood with 10 % frequency. On the other hand, the control gates of the dike units in the non-inundation turn of RICS will be shut to keep dike units non-inundation during September and October, so as to prevent paddy damage by inundation. The top of the gate is set for peak water level in October with 10 % frequency.

The wooden stop log type gate is proposed for the control gate due to the low frequency of their operations. Control gates are proposed to put approximate every 2 km of dike length in consideration of the convenience of water management.

The basic dimensions and numbers of installation are summarize as below:

Items	Remarks	Block-4		Blcok-8	
		(A) Northern Part of APMA Canal	(B) Southern Part of APMA Canal	(A) Northern Part of NVT Canal	(B) Southern Part of NVT Canal
Gate width (m)		2.5m×2pcs			
Elevation of foundation	10 % peak water level on August	EL 3.20 m	EL 3.00 m	EL 1.30 m	EL 1.20 m
Elevation of gate top	10 % peak water level through year	EL 4.00 m	EL 3.70 m	EL 2.40 m	EL 2.10 m
Number of installation	One per 2 km length of dike	77	113	34	152

The numbers of control gates of each dike unit are shown in Table M1.3.3 and M1.3.4.

(4) Pier and Approach

Some of the existing wooden pier will be removed during the construction work and farmers shall reconstruct them after dike improvement. However, the approach way along the dike slope will be included into the project to reduce farmers' efforts. The proposed facility plans of related structures are shown in Fig. M1.3.3 and M1.3.2.

M.1.3.4 Rural Road Network

The dikes are planned used for a basement of rural road network after completion of improvement. The road network development with dike improvement consists of two kinds of development level, i.e., a car road development and a motorbike road development.

The basic concept of the road network development is as follows:

- The developed road network will provide access to the main road network into each dike unit throughout the year.
- All top of dike will be used for road basement. Basically, the road network development will provide access of motorbikes.
- The routes or distances in which the district authority plans to develop the car road are considered to have enough cross section for such road development. That is to avoid duplication or waste of investment after completion of dike improvement.
- The elevations f road foundation are set as 10 % frequency flood for motorbike road and 5 % frequency flood for car road in consideration of the importance of infrastructure.
- Bridges for motorbike to connect each dike unit are proposed so as to complete the network. The width of those bridges is proposed to be 3.0m and the loading capacity at 4 tons.
- Bridges for car are proposed to the routes planned to be car road. The width of those bridges is proposed to be 5.0m and the loading capacity is set as 8 tons that is for light vehicles.

The distances of car road development are listed in Table M1.3.5 and summarized below:

PROPOSED CAR ROAD DEVELOPMENT

BLOCK-4

No.	Road Name	Distance (m)
1	Khan Chien Canal Road	8,290
2	Binh Thanh 4 Canal Road	14,477
3	Gao Gion g T.X. Cao Lanh Road	18,753
4	Bin Tan Gao Giong Road	5,050
5	DT855	13,864
Total		60,434

BLOCK-8

No.	Road Name	Distance (m)
1	Nguyen Van Tiep B Canal Road	8,280
2	No.6 Canal Road	7,940
3	No.9 Canal Road	7,600
4	No.10 Canal Road	7,700
5	Cha La Canal Road	7,500
6	Bang Day Canal Road	20,540
Total		59,560

The proposed bridges are listed in Table M1.3.6 and M1.3.7, and they are summarized below:

PROPOSED BRIDGE DEVELOPMENT

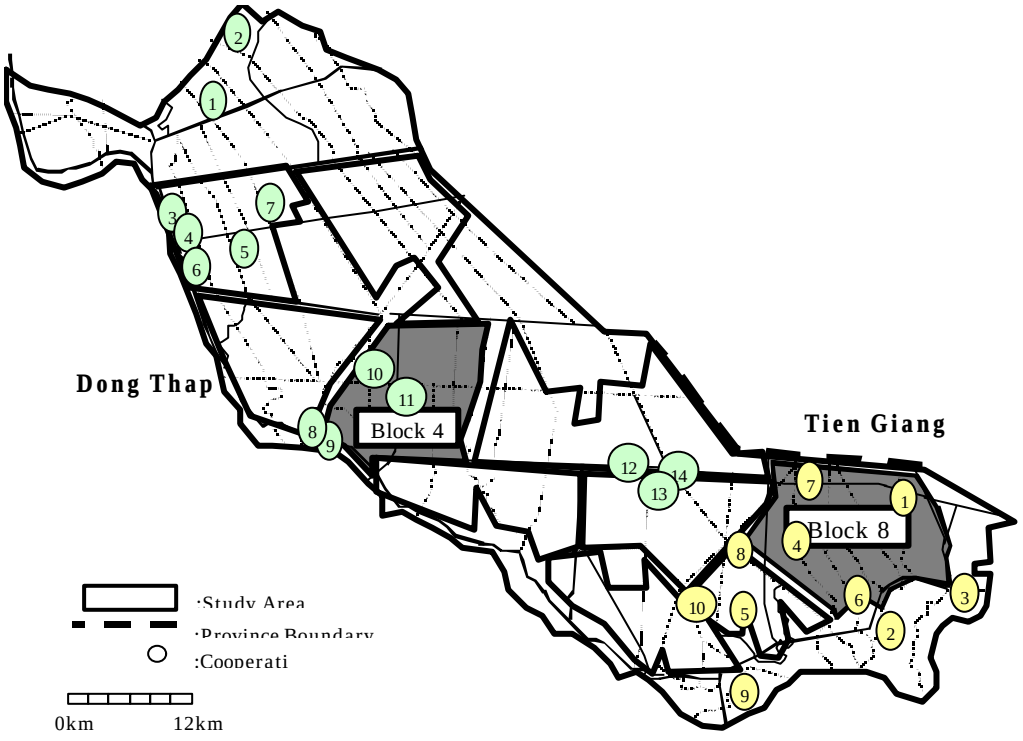
	Car Bridge			Motorbike bridge		
	Number (pcs)	Length (m)	Total Length (m)	Number (pcs)	Length (m)	Total Length (m)
Block-4	21	13～43	467	24	13～28	431
Block-8	21	10～40	440	26	12～30	583

The road network development plan and the location of proposed bridges are shown in Fig. M1.3.5 and M1.3.6.

M.1.4 ORGANIZATION

(1) Organizations in Pre-F/S Area

There are 14 agricultural cooperatives in Dong Thap province and 9 cooperatives in Tien Giang province in Study Area (See Table M1.4.1.). The oldest cooperative is Hau My Trinh in Cai Be District of Tien Giang province (established in September 1997) and the newly established cooperative is Binh Minh in Thanh Binh District of Dong Thap province (established in January 2000). Their number of the members, covered farm land area; capital and activities vary as shown in the table below. The common characteristics among all the cooperatives can be summarized as that they have short history of the cooperative and irrigation and drainage services are major activities to the members. In comparison with cooperatives in Dong Thap and Tien Giang provinces, those in Tien Giang province have diversified activities, which come from its geographical conditions (transportation, farming pattern, development history, etc.).



Cooperatives in The Study Area

Looking at the Pre-F/S Area, there are 2 cooperatives in Block 4 and 3 in Block 8 of the Pre F/S Area.

In addition to the cooperatives, there are many small farmer's groups. They are informal groups with single-objective such as water use, dike maintenance, credit, production, etc. They are not recognized as

legal entities and continue their activities as far as their objectives are achieved.

Alliances of Cooperative of Dong Thap province and Tien Giang province operate under the Cooperative Law. 90% of the total financial source comes from government budget and the rest 10% from contribution by member cooperatives. Their roles are to support member cooperatives in legal, technical, managerial and financial aspects, to establish good relationship with central government and to represent cooperatives in coordinating and operating relations between its domestic and foreign members according to laws. All information of member cooperatives including their activities and financial conditions are reported to the Alliances and monitored whether they comply with Cooperative Law. Additionally, Alliances provide training courses on management, accounting, farming technique to the members.

Among 27 agricultural cooperatives in Dong Thap province, 18 cooperatives join the Alliances (66% of the total agricultural cooperatives). Among 34 agricultural cooperatives in Tien Giang province, 15 cooperatives are members and the participation rate is 44%. There are 11 member agricultural cooperatives in the Study Area as shown in the table below. 2 cooperatives in Block 4 and 1 cooperative in Block 8 are members.

Members of Cooperative Alliance in the Study Area

No.	Name of Cooperative	Place (District)
		DONG THAP PROVINCE
1	An Phu	Tam Nong
2	Phu Tho	Tam Nong
3	Binh Hoa	Thanh Binh
4	Binh Trung	Thanh Binh
5	Binh Minh	Thanh Binh
6	Gao Giong	Cao Lanh
7	KDDV TS Tan Tien	Tan Hong
8	Tan Tien	Thap Muoi
		TIEN GIANG PROVINCE
1	My Hoa	Cai Be
2	Loi Thuan	Cai Be
3	Cam Son	Cai Lay
4	Quyet Tien	Cai Lay

Local governments have tried to expand the number and quality of cooperatives and 3 more cooperatives are planned to be established in the year 2000 in Dong Thap province. However, there are no specific approaches to implement this plan. The number of provincial DARD staff in charge of cooperative is not enough to support the cooperative activities, even to cover the information of the all existing cooperatives and the assignment of the staff is not clear. Necessary training opportunities for them are limited and networking of DARD in other provinces is not established well to exchange information.

(2) Organizations in F/S Area

Two cooperatives are located in the F/S Area, namely Binh Minh Cooperative and Gao Giong Cooperative. These cooperatives were visited by the JICA Study Team and interviewed with leaders and some members of the cooperatives and staff of Commune PCs. Their present conditions are summarized in the table below:

Condition of Cooperatives in F/S Area

	Binh Minh Cooperative	Gao Giong Cooperative
Location	Binh Tan Commune, Thanh Binh District	Gao Giong Commune, Cao Lanh District
No. of Members (Share of total commune households)	403 households (60%)	127 households (30%)
Initial Capital (VND)	52 million	970.2 million
Present Capital (VND)	52 million	1.1 billion
The Way of Establishment	Based on government instruction, inter-production groups got together.	Several production collectives got together voluntarily.

Compared with Gao Giong Cooperative, since Binh Minh Cooperative is at the primitive stage (only 3 months have passed since its establishment), capital is small and activities are not strongly developed. The participant rate in Gao Giong cooperative is lower than that of Binh Minh, which is caused by establishment circumstances. It is likely that the Binh Minh was established by government intention and Gao Giong by voluntary will of some farmers. In addition to these cooperatives, there are 2 collectives in Binh Tan commune and 1 collective in Gao Giong commune which are doing irrigation and drainage activities.

(3) Organizations for Dike

In general, the dike system are managed by following organizations:

- dike along the main canal: Provincial authority
- dike along the 1st and secondary canal: District authority
- dike along the tertiary canal: Commune authority

And in some cases, the farmer's groups construct and manage their dike system by themselves.

Even the responsibility of development and management of dikes are taken by above authorities, farmers through commune authority or farmer's group usually burden the maintenance works. In that case, chief of hamlet or farmer's group have the duty of inspection and investigation under the supervision of district technical staffs. The maintenance work itself is carried out by labor contribution of farmers or under the contract, for which the dike maintenance fee is charged to farmers. The dike maintenance works by farmers are observed well conducted.

For irrigation and drainage facilities including pump equipment, while 4 agricultural cooperatives are observed in the Block-4, no such organization exists in the Block-8. The contents of the activity for pumping service of them are summarize as blow:

AGRICULTURAL COOPERATIVE FOR PUMPING SERVICE IN THE BLOCK-4

Name of Cooperative / Location	Possession of Pump Station	Beneficiary Area of Irrigation	Beneficiary Area of Drainage
Binh Hoa Cooperative Binh Tanh Commune Tanh Binh District	22 pump stations with 24 pumps Total capacity : 320HP (21,600m^3/hr)	540 ha	540 ha
Binh Trung Cooperative Binh Tanh Commune Tanh Binh District	7 fixed pump stations and 5 mobile pump on boat for 10 pumping sites Total capacity : 255HP (13,000m^3/hr)	357 ha	811 ha (using private pumps under coordination)
Binh Minh Cooperative Binh Tan Commune Tanh Binh District	2 pump stations Total capacity : 22KW (2,000m^3/hr)	100 ha	521 ha (using private pumps under coordination)
Giao Giong Cooperative Giao Giong Commune Cao Lanh District	5 pump stations with 9 pumps Total capacity : 182KW + 49HP (13,000m^3/hr)	666 ha	666 ha