

JICA (Japan International Cooperation Agency)
Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division

Ref. No. JICA-RRPE (Ayeyarwaddy) -01

1st March 2009

Director General
Irrigation Department
The Union on Myanmar

COPY


Re: Submission of Check List for Sluice Gates Functioning Condition

Dear Sir,

A JICA Mission has prepared a diagnostic list for sluice gates functioning condition during site investigation with the counterpart staff officer of Irrigation Department as attached herewith. The mission believes that the said check list can contribute to prepare restoration and rehabilitation plan on sluice gate systems at polders where the areas have been seriously affected by the disaster of the strong cyclone "Nargis" in May 2008. It is recommended that the diagnostic list shall be filled separately at each and every site of sluice gate system for future restoration.

We would appreciate very much for your utilization of the above mentioned diagnostic list, we remain.

Cordially Yours


Dr. Motoyoshi HIKASA
A Member of the JICA Mission

Copy to

- Deputy Director General (Upper Myanmar), Irrigation Department
- Deputy Director General (Lower Myanmar), Irrigation Department
- Chief Mechanical Engineer, Irrigation Department
- Director, Planning and Works, Irrigation Department
- Director, Design Division, Irrigation Department
- Director, Maintenance Division (Ayeyarwaddy Division), Irrigation Department
- Director, Construction Division (No. 1), Irrigation Department
- Personal Secretary Officer, Deputy Minister Office, MOAI
- Office File, JICA Myanmar Office

Attached

- Diagnostic List on Sluice Gate

Diagnostic List on Sluice Gate

	Number/Volume
1 Slide gate	
1 Number of existing gate	
2 Number of newly required gate	
3 Number of gate to be repaired	
1 Guide frame set to be repaired due to rust	
2 Shaft to be repaired	
3 Lifting equipment to be repaired	
4 Gate to be repaired	
5 Base RC to be repaired	
4 Number of gate to be replaced	
1 Guide frame set to be replaced due to rust	
2 Shaft to be replaced	
3 Lifting equipment to be replaced	
4 Gate to be replaced	
6 No. of base RC to be replaced (seriously damaged so to be reconstructed)	
5 Stop log	
1 Groove for stop log to be repaired	
2 Groove for stop log to be replaced	
2 Flap gate	
1 Number of existing gate	
2 Number of newly required gate	
3 Number of gate to be repaired/replaced	
1 Number of hinge to be replaced	
2 Number of gate and frame to be repaired	
3 Number of gate and frame to be replaced	
4 Number of copper seal repairing	
5 Number of base RC to be repaired	
6 Number of base RC to be replaced	
7 Number of base RC to be replaced (seriously damaged so to be reconstructed)	
3 Dike embankment	
1 Top elevation of existing dike around sluice gate	
2 Top width of existing dike around sluice gate	
3 Length concrete barrel of sluice gate	
4 Leading canal	
1 Erosion length at left bank from sluice gate	
2 Erosion width at left bank from sluice gate	
3 Erosion length at right bank from sluice gate	
4 Erosion width at right bank from sluice gate	
5 Outfall canal	
1 Erosion length at left bank from sluice gate	
2 Erosion width at left bank from sluice gate	
3 Erosion length at right bank from sluice gate	
4 Erosion width at right bank from sluice gate	
6 Proposed cofferdam for repairing works	
1 Canal width of upstream side	
2 Estimated reduced level at upstream side during dry season = water level + 2 feet	
3 Canal width of downstream side	
4 Estimated reduced level at downstream side during dry season= water level+3 feet	
7 Other Information	
1 Overtopped flood depth at Nargis cyclone	
2 Average monsoon paddy yield per acre before Nargis cyclone	
3 Average monsoon paddy yield per acre after Nargis cyclone	
4 Drinking water resource of villagers at present (Ex. Drinking water pond, Donors, Purchase)	

JICA (Japan International Cooperation Agency)
**Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division**

Ref. No. JICA-RRPE (Ayeyarwaddy) -02
1st March 2009

**Director General
Irrigation Department
The Union on Myanmar**

COPY


Re: Submission of Cost Estimation Form for rehabilitation of Sluice Gates
(Labutta Area)

Dear Sir,

A JICA mission has prepared a cost estimation form for rehabilitation of sluice gate systems in Labutta area cooperation with the counterpart staff officer of Irrigation Department as attached herewith. We estimated that rehabilitation workshop shall be placed at the center of the area for the purpose of economic and effective works.

We would appreciate very much for your utilization of the above mentioned form, in advance.

Cordially Yours


Dr. Motoyoshi HIKASA
A Member of the JICA Mission

Copy to

- Deputy Director General (Upper Myanmar), Irrigation Department
- Deputy Director General (Lower Myanmar), Irrigation Department
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- Director, Design Division, Irrigation Department
- Director, Maintenance Division (Ayeyarwaddy Division), Irrigation Department
- Director, Construction Division (No. 1), Irrigation Department
- Personal Secretary Officer, Deputy Minister Office, MOAI
- Office File, JICA Myanmar Office

Attached

- Cost Estimation Form at Labutta

Cost Estimation Form at Labutta Area for

Sluice Gates Repairing

No.	Description of works	Volume	Unit	Unit cost	Cost
1	Preparation Works				
1	Upstream temporary dike				
1	Provision of embankment toe fence				
2	Maneuvering excavation and embankment machineries				
3	Soil excavation, transportation, embankment				
2	Downstream temporary dike				
1	Provision of embankment toe fence				
2	Maneuvering excavation and embankment machineries				
3	Soil excavation, transportation, embankment				
3	Dewatering by pump at upstream and downstream				
1	Pump, hose, pipe maneuvering cost				
2	Rental cost for pump, hose, and pipe				
3	Dewatering cost				
4	Temporary dike removal				
5	Supervision cost				
2	Flap gate repairing				
1	Gate removing				
1	Chain block transportation (round trip)				
2	Rental charge of chain block				
3	Labor cost				
2	Repairing Equipment Transportation				
1	Transportation cost (Yangon-Laputta round trip)				
3	Gate transportation				
1	Shipping charge (Site-Laputta round trip)				
2	Land transportation charge (Site-Laputta round trip)				
4	Gate repairing cost				
1	Material cost				
2	Repairing cost				
5	Gate fixing				
1	Chain block transportation				
2	Rental charge of chain block				
3	Labor cost				
6	Supervision cost				
3	Slide gate repairing				
1	Gear box, guide frame, fixing bolt assembling				
1	Material cost				
2	Assembling cost				
2	Repairing Equipment Transportation				
1	Transportation cost (Yangon-Laputta round trip)				
3	Gear box, guide frame, fixing bolt transportation				
1	Land transportation charge (Site-Laputta round trip)				
2	Shipping charge (Site-Laputta round trip)				
4	Base RC concrete construction				
1	Air compressor, pick hammer transportation (round trip)				
2	Rental charge of air compressor, pick hammer				
3	Labor charge for damaged concrete picking works				
4	Fuel charge for air compressor operation				
5	RC material transportation cost				
6	RC material (cement, sand, gravel, reinforcement bar)				
7	Portable concrete mixer transportation (round trip)				
8	Portable concrete mixer rental cost				
8	Operation cost of concrete mixer				
9	Formworks for RC including material				
10	Labor cost for concrete mixing, transportation, placing				
11	Survey on leveling, bolt positioning				
5	Fixing bolt, gear box, guide frame fixing				
1	Chain block transportation (round trip)				
2	Rental charge of chain block				
3	Labor cost				
6	Supervision cost				
Total Cost					

JICA (Japan International Cooperation Agency)
Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division

Ref. No. JICA-RRPE (Ayeyarwaddy) -03
1st March 2009

**Director General
Irrigation Department
The Union on Myanmar**

COPY

Re: Submission of Cost Estimation Form for rehabilitation of Sluice Gates
(Bogalay Area)

Dear Sir,

A JICA mission has prepared a cost estimation form for rehabilitation of sluice gate systems in Bogalay area cooperation with the counterpart staff officer of Irrigation Department as attached herewith. We estimated that rehabilitation workshop shall be placed at the center of the area for the purpose of economic and effective works.

We would appreciate very much for your utilization of the above mentioned form, in advance.

Cordially Yours



Dr. Motoyoshi HIKASA
A Member of the JICA Mission

Copy to

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- Deputy Director General (Lower Myanmar), Irrigation Department
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- Director, Maintenance Division (Ayeyarwaddy Division), Irrigation Department
- Director, Construction Division (No. 1), Irrigation Department
- Personal Secretary Officer, Deputy Minister Office, MOAI
- Office File, JICA Myanmar Office

Attached

- Cost Estimation Form at Bogalay

No.	Description of works	Volume	Unit	Unit cost	Cost
1	Preparation Works				
1	Upstream temporary dike				
1	Provision of embankment toe fence				
2	Manuevering excavation and embankment machineries				
3	Soil excavation, transportation, embankment				
2	Downstream temporary dike				
1	Provision of embankment toe fence				
2	Manuevering excavation and embankment machineries				
3	Soil excavation, transportation, embankment				
3	Dewatering by pump at upstream and downstream				
1	Pump, hose, pipe manuevering cost				
2	Rental cost for pump, hose, and pipe				
3	Dewatering cost				
4	Temporary dike removal				
5	Supervision cost				
2	Flap gate repairing				
1	Gate removing				
1	Chain block transportation (round trip)				
2	Rental charge of chain block				
3	Labor cost				
2	Repairing Equipment Transportation				
1	Transportation cost (Yangon-Bogalay round trip)				
3	Gate transportation				
1	Shipping charge (Site-Bogalay round trip)				
2	Land transportation charge (Site-Bogalay round trip)				
4	Gate repairing cost				
1	Material cost				
2	Repairing cost				
5	Gate fixing				
1	Chain block transportation				
2	Rental charge of chain block				
3	Labor cost				
6	Supervision cost				
3	Slide gate repairing				
1	Gear box, guide frame, fixing bolt assembling				
1	Material cost				
2	Assembling cost				
2	Repairing Equipment Transportation				
1	Transportation cost (Yangon-Bogalay round trip)				
3	Gear box, guide frame, fixing bolt transportation				
1	Land transportation charge (Site-Bogalay round trip)				
2	Shipping charge (Site-Bogalay round trip)				
4	Base RC concrete construction				
1	Air compressor, pick hammer transportation (round trip)				
2	Rental charge of air compressor, pick hammer				
3	Labor charge for damaged concrete picking works				
4	Fuel charge for air compressor operation				
5	RC material transportation cost				
6	RC material (cement, sand, gravel, reinforcement bar)				
7	Portable concrete mixer transportation (round trip)				
8	Portable concrete mixer rental cost				
8	Operation cost of concrete mixer				
9	Formworks for RC including material				
10	Labor cost for concrete mixing, transportation, placing				
11	Survey on leveling, bolt positioning				
5	Fixing bolt, gear box, guide frame fixing				
1	Chain block transportation (round trip)				
2	Rental charge of chain block				
3	Labor cost				
6	Supervision cost				
	Total Cost				

JICA (Japan International Cooperation Agency)
**Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division**

Ref. No. JICA-RRPE (Ayeyarwaddy) -04

1st March 2009

**Director General
Irrigation Department
The Union on Myanmar**

COPY

Re: Recommendation on Test Repairing of Sluice Gate (LabuttaLok Sluice)

Dear Sir,

A JICA mission has explained how to repair one barrel of sluice gate system at Labuttalok Sluice Gate System. The recommended procedure was only for trial basis not for permanent basis as follows.

<Flap gate>

- To open flap gate widely
- To clean and polish/grind the alloy water tightness seal as much as possible
- To clean inside of barrel as much as possible

<Slide gate>

- To lift up slide gate fully
- To clean and polish/grind the alloy water tightness seal as much as possible
- To clean and polish the guide frame (Upper and bottom, right and left) as much as possible
- To remove stones and rubbish around the slide gate, especially at upstream side

It is kindly requested that all test repairing result would be sent to the Irrigation Department Head Office and JICA Myanmar Office for future rehabilitation planning. And then, if there would be found some difficulty, it is recommended to report it to the Irrigation Department and JICA Myanmar Office as well.

We would appreciate very much for your test practice on the above mentioned matter.

Cordially Yours


Dr. Motoyoshi HIKASA

A Member of the JICA Mission

Copy to

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- Deputy Director General (Lower Myanmar), Irrigation Department
- Chief Mechanical Engineer, Irrigation Department
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- Director, Maintenance Division (Ayeyarwaddy Division), Irrigation Department
- Director, Construction Division (No. 1), Irrigation Department
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JICA (Japan International Cooperation Agency)
Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division

Ref. No. JICA-RRPE (Ayeyarwaddy) -05
1st March 2009

Director General
Irrigation Department
The Union on Myanmar

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Re: Recommendation on Test Repairing of Slide Gate (Miu Sluice)

Dear Sir,

A JICA mission has explained how to repair one number of slide gate No. 7 counting from left side at Miu sluice gate system as follows.


- To lift up slide gate fully
- To clean and polish the guide frame (Upper and bottom, right and left) as much as possible
- To remove stones and rubbish around the slide gate, especially at upstream side

It was considered that flap gate was well functioning at this moment so flap gate repairing program was not included in this recommendation.

It is kindly requested that the test repairing result would be sent to the Irrigation Department Head Office and JICA Myanmar Office.

We would appreciate very much for your test practice on the above mentioned matter, in advance.

Cordially Yours


Dr. Motoyoshi HIKASA
A Member of the JICA Mission

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- Office File, JICA Myanmar Office

JICA (Japan International Cooperation Agency)
**Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division**

Ref. No. JICA-RRPE (Ayeyarwaddy) -06
9th March 2009

**Director General
Irrigation Department
The Union of Myanmar**

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Re: Comment on Drain Channel Dredging Plan (Kathabaung Sluice)

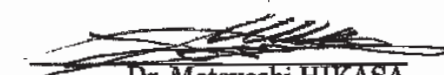
Dear Sir,

A JICA mission has inspected drain channels connecting to Kathaboung Sluice on 5th March 2009 we would like to submit our comment as follows.

- It is good idea that utilization of water for irrigation purpose in drainage channel during dry season.
- However, drainage channel bed elevation is nearly the same as RL. 0 (zero) at present.
- Flap gates of Kathabaung Sluice are not well functioning and sea water may intrude into the channel especially during dry season.
- Intruded saline water into drainage channel after dredging may cause serious saline water problem along the channel and the water may not be able to utilize.
- Channel dredging shall be done after finishing flap gate repairing completely for long period utilization of water in the channel.

We would appreciate very much for your understanding on the above mentioned matter, we remain.

Cordially Yours


Dr. Motoyoshi HIKASA
A Member of the JICA Mission

Copy to

- Deputy Director General (Upper Myanmar), Irrigation Department
- Deputy Director General (Lower Myanmar), Irrigation Department
- Chief Mechanical Engineer, Irrigation Department
- Director, Planning and Works, Irrigation Department
- Director, Design Division, Irrigation Department
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JICA (Japan International Cooperation Agency)
**Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division**

Ref No. JICA-RRPE (Ayeyarwaddy) -07
9th March 2009

**Director General
Irrigation Department
The Union on Myanmar**

COPY


Re: Recommendation on Dike Repairing (Myitkyo Sluice)

Dear Sir,

A JICA mission has inspected small damage of dike near Thabyegon village where the dike at old Chaung portion flashed twice during Nargis cyclone and following rainy season in 2008. Damaged area of the said dike is very small but it may cause saline water intrusion into polder and farm practice will face difficulties. An attached sketch is recommended dike repairing at the said portion.

We would appreciate very much for your prompt arrangement on dike repairing, we remain.

Cordially Yours


Dr. Motoyoshi HIKASA
A Member of the JICA Mission

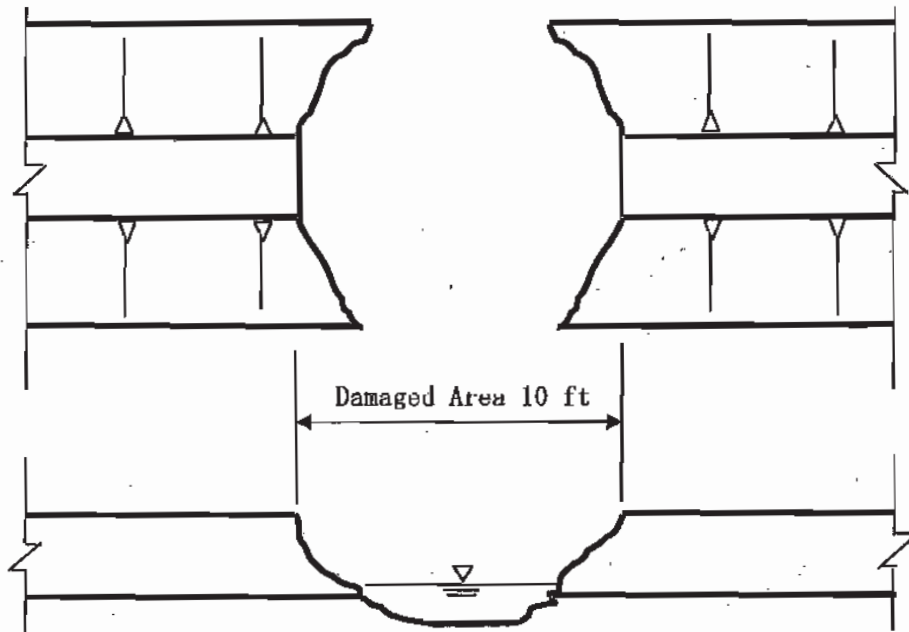
Copy to

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- Deputy Director General (Lower Myanmar), Irrigation Department
- Chief Mechanical Engineer, Irrigation Department
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- Director, Design Division, Irrigation Department
- Director, Maintenance Division (Ayeyarwaddy Division), Irrigation Department
- Personal Secretary Officer, Deputy Minister Office, MOAI
- Office File, JICA Myanmar Office

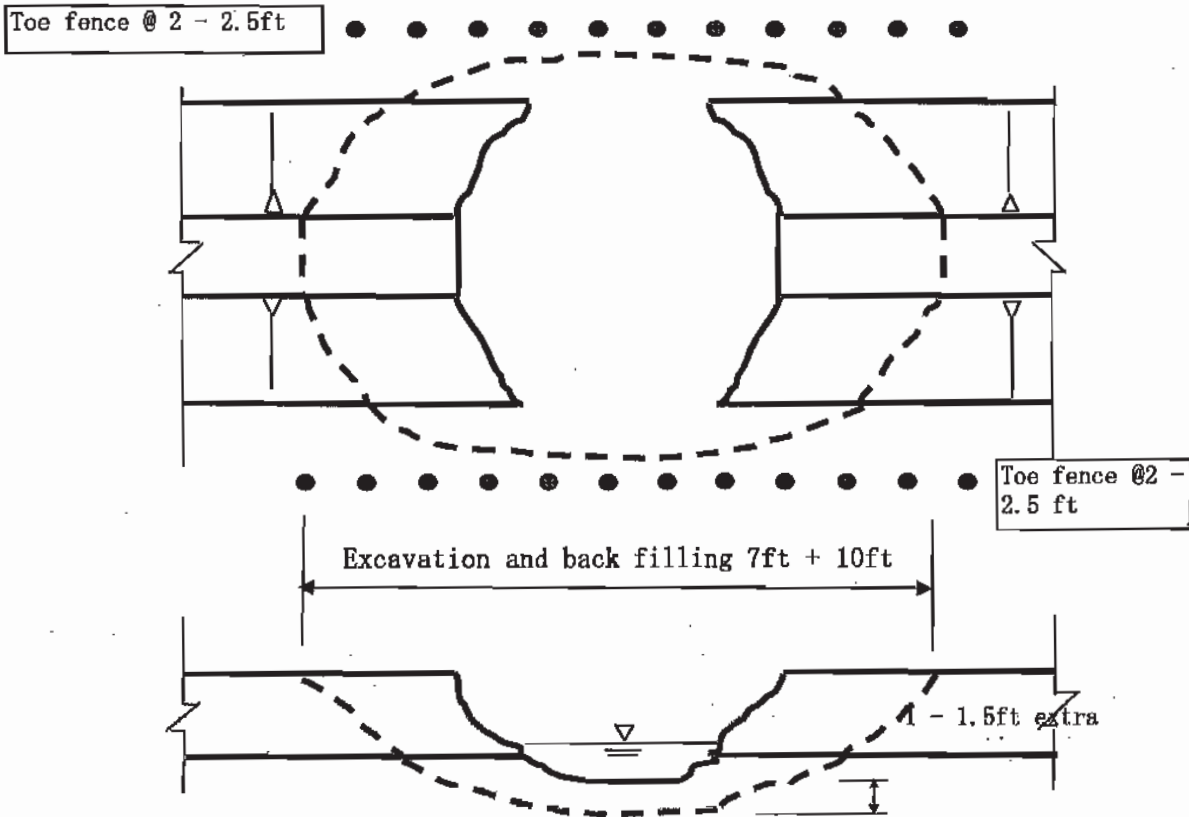
Attached

- Recommended Dike Repairing Method

An attachment: Recommended Dike Repairing Method



Sketch of Damaged Portion of Dike at Old Chaung Route



Sketch of Recommended Dike Repairing Method

JICA (Japan International Cooperation Agency)
**Rehabilitation and Renovation of Polders and Embankment in
Ayeyarwaddy Division**

Ref. No. JICA-RRPE (Ayeyarwaddy) -08
19th March 2009

**Director General
Irrigation Department
The Union on Myanmar**

COPY


Re: Recommendation of Soil Test

Dear Sir,

A JICA mission would like to recommend to carry out laboratory test on the soil materials for dike embankment, which we discussed on 18th March during explanation meeting between MOAI officials and our mission. Soil tests for the said materials are essential part of data collection and soil materials shall be collected during this dry season because JICA study is expected to commence during coming rainy season. An attached sheet is detailed test items of our recommendation and the test results will be also helpful to other donors for their dike design and work planning.

We would appreciate very much for your prompt action on the tests for future restoration and rehabilitation of polders in Ayeyarwaddy and Yangon Delta area.

Cordially Yours


Dr. Motoyoshi HIKASA
A Member of the JICA Mission

Copy to

- Deputy Director General (Upper Myanmar), Irrigation Department
- Deputy Director General (Lower Myanmar), Irrigation Department
- Director, Design Division, Irrigation Department
- Director, Planning and Works, Irrigation Department
- Director, Maintenance Division (Ayeyarwaddy Division), Irrigation Department
- Personal Secretary Officer, Deputy Minister Office, MOAI
- Office File, JICA Myanmar Office

Attached

- Recommended Test Items of Soil Test

Recommended Items on Soil Test

1. Test Materials

Test materials to be tested on this recommendation are as follows.

- Material from the most offshore side (Material A), if possible.
- Material from the middle portion of Ayeyarwaddy delta (Material B), if possible.
- Material from the upstream portion of Ayeyarwaddy delta (Material C), if possible.

Instead of the materials above mentioned, three types of soil materials can be utilized for laboratory test as follows.

- Relatively fine material (silty clay)
- Relatively intermediate size material (clayey silt)
- Relatively course material (sandy silt)

Necessary quantity of one material for test is about 120 kg, 6 bags in volume for each material is required.

Table 1 Required test materials

Type of material	Weight	Volume	Remarks
Fine material (or silty clay)	120 kg	6 bags	Offshore material
Medium material (or clayey silt)	120 kg	6 bags	Delta intermediate place
Course material (or sandy silt)	120 kg	6 bags	Upstream of delta

2. Test Items

Physical property test and mechanical property test are required for designing dike structure and small specimen is enough for those tests that the test equipment is available in the Irrigation Technology Center, Bago.

2.1 Physical Property

Recommended physical property tests are as follows.

- Grain size distribution
- Specific gravity of soil
- Consistency test (liquid limit, plastic limit)

2.2 Mechanical Property

Recommended mechanical property tests are as follows.

- Compaction test (plasticity condition shall be observed)
- Permeability test (2 points for each material compacted by different soil moisture)
- Consolidation test
- Tri-axial compressive strength test (2 points for each material compacted by different soil moisture, lateral pressure is 0.5kg/cm², 1.0kg/cm², 2.0kg/cm²)

During compaction test, compacting soil condition especially from optimum moisture content (OMC) to wet side shall be observed carefully. If workability of compacting material is not so good, it shall be reported. For machine excavation, spreading, and compaction, workability on soil is essential part of water content quality control at the site and construction manual for dike embankment will be formulated with consideration of the said information.

For permeability test and tri-axial compressive strength test, two (2) points of different moisture contents are recommended. One is at optimum moisture content, and other is an intersection point between compaction density curve and saturation density 80% curve. The latter one is usually at dry side of OMC and it will meet to the condition during dry season in Myanmar.

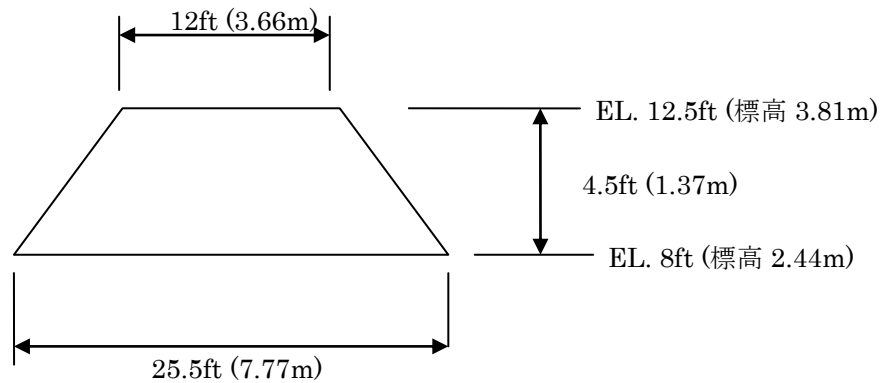
Test items	Silty clay	Clayey silt	Sandy silt	Total
1. Physical property	3	3	3	9
a Grain size distribution	1	1	1	3
b Specific gravity of soil	1	1	1	3
c Consistency	1	1	1	3
2. Mechanical property	6	6	6	18
a Compaction	1	1	1	3
b Permeability	2	2	2	6
c Consolidation	1	1	1	3
d Tri-axial compressive strength	2	2	2	6
Total	9	9	9	27

4. Cost Estimation Table

Summary of Cost Estimation

Items	Details	Unit Cost (Kt)	Quantity	Unit	Cost (Kt)	Cost (JPY)	Remarks
Gate	Labuttaloke sluice	10,258,000	9	Opening	92,322,000	9,232,000	
	Kyonkow sluice	10,360,000	8	Opening	82,880,000	8,288,000	
	Other sluices in Labutta (north)	10,309,000	36	Opening	371,124,000	37,112,000	Unit cost is an average of above
	subtotal		53	Opening	546,326,000	54,633,000	
Channel	Labuttaloke sluice	460,000	80	m	36,800,000	3,680,000	20m for up/downstreamXboth sides
	Kyonkow sluice	570,355	80	m	45,628,400	4,563,000	20m for up/downstreamXboth sides
	Other sluice in Labutta (north)	515,000	320	m	164,800,000	16,480,000	10mXboth sides (2)Xup/downstream (2)X8locations (unit cost is an average of above)
	subtotal		480	m	247,228,400	24,723,000	
Dike	Labutta (north) Polder	27,690,000	60.81	km	1,683,828,900	168,383,000	61.81km - 1km (PWD)
	Daukgyi Island Polder	36,540,000	6.5	km	237,510,000	23,751,000	Around Satsan village 4 miles
	subtotal		67.31	km	1,921,338,900	192,134,000	total 67.31km
Preparation & Others		14,258,000	1	L/S	14,258,000	1,426,000	
Pond	Borrow pit improvement	5,000,000	3	no.	15,000,000	1,500,000	Drinking water pond construction
	Miscellaneous	5% of total cost	1	L/S		13,721,000	
	Total					288,137,000	

Labutta (north)の堤防数量



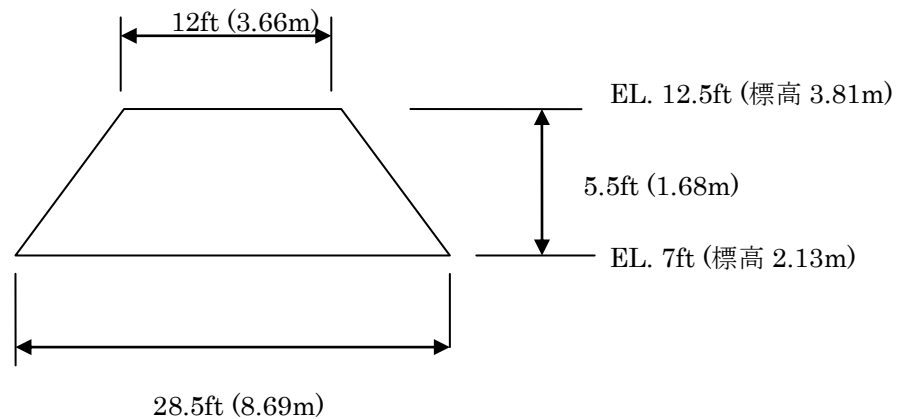
標準断面 1ft 当り $(12\text{ft} + 25.5\text{ft}) / 2 \times 4.5\text{ft} = 84.38 \text{ ft}^2$

1Km = 1,000m = 3,281 ft

1 Km 当り施工量: $84.38\text{ft}^2 \times 3,281\text{ft} = 276,851 \text{ ft}^3 = 2,769 \text{ sud}$ (1sud = 100ft^3)

∴ 1km 当り施工単価 $2,769\text{sud} \times 10,000 \text{ kt/sud} = 27,690,000\text{kt} \approx 2,769,000 \text{ 円}$

Daukgyi の堤防数量



標準断面 1ft 当り $(12\text{ft} + 28.5\text{ft}) / 2 \times 5.5\text{ft} = 111.38 \text{ ft}^2$

1Km = 1,000m = 3,281 ft

1 Km 当り施工量: $111.38\text{ft}^2 \times 3,281\text{ft} = 365,438 \text{ ft}^3 = 3,654 \text{ sud}$

∴ 1km 当り施工単価 $3,654 \times 10,000 \text{ kt} = 36,540,000\text{kt} \approx 3,654,000 \text{ 円}$

Cost Estimate of Earthwork filling for Dam by Machine

I. Machine combination to be used:

Tracked Dozer Class I	-	1No
Wheel loader	-	1No
Dump Truck (12 cyd)	-	8 Nos
Motor Grader (spreading)	-	1No
Water Bowser (Dam spraying)	-	1No
Tracked Dozer Class II (compacting)	-	1No
Water Bowser (Dam)	-	1No
Motor Grader (Haul road)	-	1No
Water Bowser (Haul road spraying)	-	1No
Water Pump (Hual road)	-	1No
Output of above combination per hour	-	66.15 sud

II. Operation Cost per hour for Earth-moving Equipment

Sr. No.	Machine & equipment	P.O.L	Consumption (gal)	Rate	Amount	Total Kyats/hour	Remark
1	Tracked Dozer Class I	H.S.D	10 gals	3000	30000.00	32,525	
		Lubricant	0.2 gals	12000	2400.00		
		Grease	0.25 lb	500	125.00		
2	Tracked Dozer Class II	H.S.D	6.50 gals	3000	19500.00	21,400	
		Lubricant	0.15 gals	12000	1800.00		
		Grease	0.20 lb	500	100.00		
3	Wheel Loader (3 Cyd)	H.S.D	5.50 gals	3000	16500.00	18,015	
		Lubricant	0.12 gals	12000	1440.00		
		Grease	0.15 lb	500	75.00		
4	Dump Truck (12 Cyd)	H.S.D	6.0 gals	3000	18000.00	19,875	
		Lubricant	0.15 gals	12000	1800.00		
		Grease	0.150 lb	500	75.00		
5	Motor Grader	H.S.D	4.0 gals	3000	12000.00	13,275	
		Lubricant	0.1 gals	12000	1200.00		
		Grease	0.15 lb	500	75.00		
6	Water Bow, Tipper Fuel Bowser, Truck	H.S.D	3.0 gals	3000	9000.00	10,250	
		Lubricant	0.1 gals	12000	1200.00		
		Grease	0.10 lb	500	50.00		
7	Water Pump 300 G.P.M (6 HP)	H.S.D	0.24 gals	3000	720.00	778	
		Lubricant	0.0048 gals	12000	57.60		

III. Operation Cost of combination

Tracked Dozer Class I	1 hr x @ Ks	32,525	=	32,525
Wheel loader (3 cyd)	0.87 hr x @ Ks	18,015	=	15,673
Dump Truck (12 cyd)	7.2 hr x @ Ks	19,875	=	143,100
Motor Grader (spreading)	0.33 hr x @ Ks	13,275	=	4,381
Water Bowser (Dam spraying)	0.66 hr x @ Ks	10,250	=	6,765
Tracked Dozer Class II (compacting)	0.64 hr x @ Ks	21,400	=	13,696
Water Pump (Dam)	0.17 hr x @ Ks	777.6	=	132
Motor Grader (Haul road)	0.29 hr x @ Ks	13,275	=	3,850
Water Bowser (Haul road spraying)	0.53 hr x @ Ks	10,250	=	5,433
Water Pump (Hual road)	0.12 hr x @ Ks	777.6	=	93
45 Generator, Water pump, removing roots & slump checker, operators for Generator, Water pump, Studge pump, Waer sprayers, Watchman and etc =	<u>45 x 1500/8 =</u> 45 1500	0.125	=	8438

		Operation cost for 66.15 sud	=	234,086
		Cost for 1 sud /	=	3,539

IV. Machine Cost for (1) hr

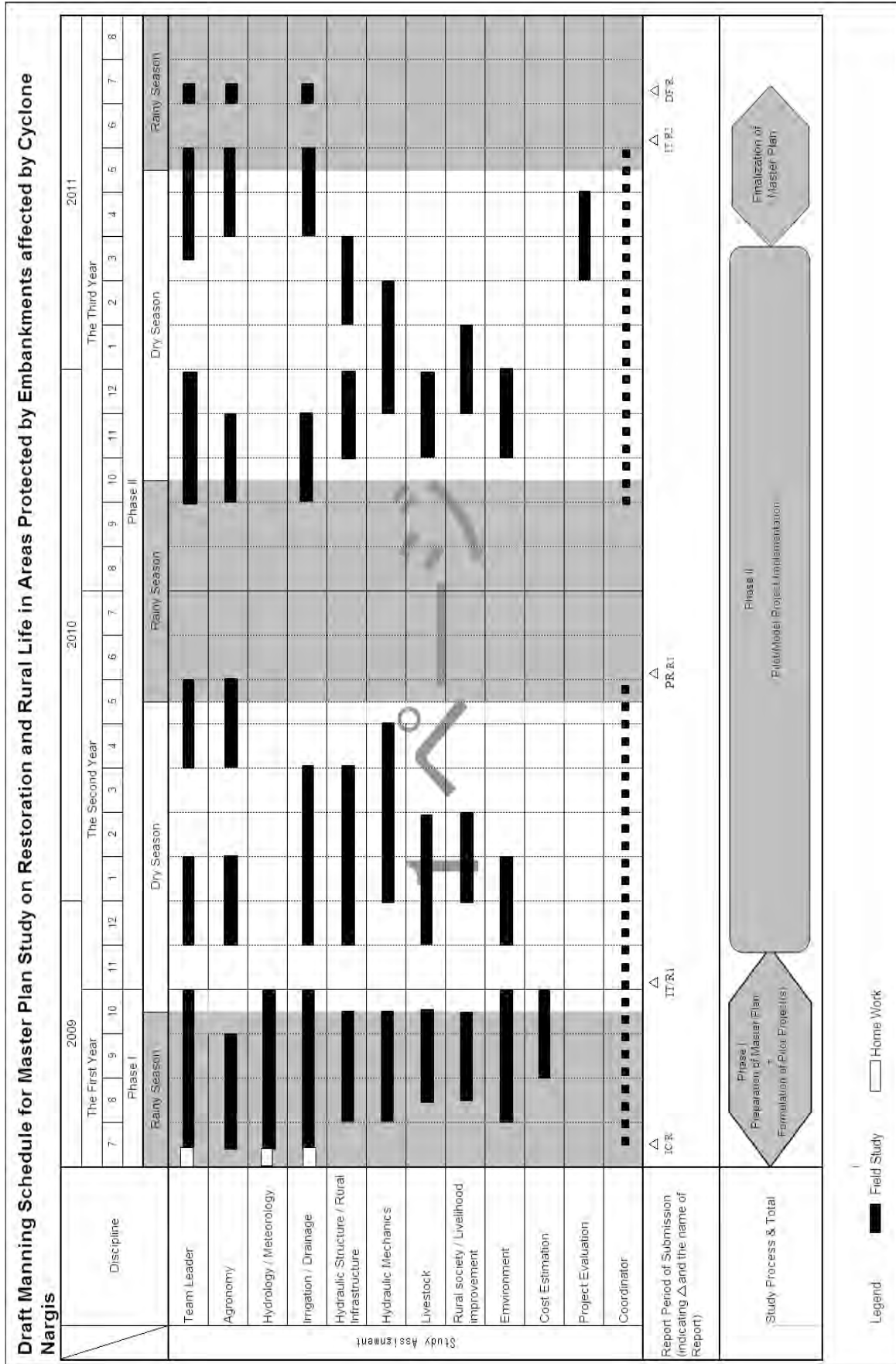
Tracked Dozer Class I	-	43,750.0
Wheel Loader	-	31,250.0
Dump Truck	24000 x 7.2	172,800.0
Motor Grader	2 Nos	60,000.0
(spreading + haul road)		
Water Bowser	2 Nos	60,000.0
(Dam + haul road)		
Tracked Dozer Class II	-	35,000.0
Water pump	-	15,000.0
		<hr/>
For 66.15 sud	-	417,800.0
For 1 sud / 66.15	-	6,316

- Note: The cost listed above includes;
- 1) Cost for machine operators
 - 2) Cost for maintenance
 - 3) Cost for labors and parts
 - 4) Cost for Machine & Equipment rent
 - 5) Cost for other necessary items

Total Cost

III. Operation cost for 1 sud	- Ks	3,539
IV. Machine cost for 1 sud	- Ks	6,316
	- Ks	<hr/> 9,855
Estimated unit cost for 1 sud (round up)	Ks	10,000

5. Draft Manning Schedule for M/P Study



参考：業務調整 2 M/M 込 8 8 M/M

**TERMS OF REFERENCE
FOR
MASTER PLAN STUDY ON RESTORATION
OF
AGRICULTURAL PRODUCTION AND RURAL LIFE
IN
AREAS PROTECTED BY EMBANKMENTS AFFECTED BY CYCLONE NARGIS**

1. Background

The cyclone Nargis hit the southern area of the Union of Myanmar on May 2 – 3, 2008 with maximum momentary wind speed of 72m/s and the lowest barometric pressure of 962 hpa, and caused more than 140,000 deaths and 11 billion dollars total damages in the river-mouth delta area of the Ayeyarwady River, where is an important granary of the country, was seriously damaged in agricultural production. The cyclone Nargis caused the flood damage to the farm land of 770,000 ha of 4 divisions, 10 townships of the country. Households of 130,000 in Ayeyarwady division and 117,000 in Yangon division were affected by the cyclone. The population of the affected townships is estimated about 4.5 million people as of May 2008 and the population in the worst affected area is estimated at about 3.2 million people according to UNDP MIMU.

The people in the area lost almost every means to sustain their lives due to the overwhelming impact of cyclone Nargis. They lost essential commodities for daily life such as foods, drinking water, houses and other necessities. As the urgent assistance to the affected area, food, medicines, drinking water, temporary shelters, and others have been provided by the government of the Union of Myanmar, UN and other donor agencies. Without the urgent assistance, they can not even continue their lives.

At the same time, the equipment for agricultural production, seeds, cattle, and other necessary measures for rice production were seriously damaged or lost. According to FAO, the delta of the Ayeyarwady River that yields 65% of rice of the whole country was most seriously damaged, at least 120,000 heads of cattle and buffalo were lost and some of remaining cattle and buffalo are not working well as the draft animal. The government of Union of Myanmar and some donors distributed farm tillers as substitutes for draft animals but number of distributed farm tillers was quite limited comparing with lost numbers of draft animals in the area.

The decline of agricultural production in the area affected by the cyclone Nargis may menace the security of food supply not only in the affected area but also in the whole country. It may further affect the neighboring countries such as Bangladesh, Sri Lanka and Indonesia that import much rice from the Union

of Myanmar. In recognition of the importance of the said area, the government of the Union of Myanmar has conducted the emergency assistance to those areas in lending agricultural materials such as farm equipment and seeds.

The areas affected by the cyclone Nargis, those are the major agricultural production areas protected by continuous embankments from saline water intrusion. This system is well known as “polder” that consists of dikes and sluices mostly constructed in the period of 1980’s by World Bank financed projects “Paddy I” and “Paddy II”. With the passage of time after the said projects, the top elevation of the most of dikes has lowered due to wind and water erosion so flooded saline water by cyclone Nargis overtopped the lowered dikes easily and some portions of them were collapsed. Due to the said saline water inundation, large areas of the farm land were seriously damaged and the damaged embankments urgently needed rehabilitation.

Without the urgent rehabilitation of dike embankments, wide agricultural area could be under saline water due to every day rise and fall of the tide, and the country would lose the important granary of the nation as the vital foundation for people’s life. This was why the government of Union of Myanmar started emergency repairing works of embankment during rainy season in 2008. This emergency works aimed to construct dikes up to the level just before cyclone Nargis hitting, not the designed dike top level in 1980’s, which the top level of emergency dike repairing was a few feet lower than that of designed one.

In addition, it is reported that dike had an important role for saving people’s life as emergency shelter where the cyclone sufferers ran into the top of the dike and remained there even though the flood surge height reached a few feet above the dike embankments. Without the dike, many more people would have drowned and died. Accordingly the rehabilitation and/or grade-up of the embankments would directly lead to saving people’s life for another cyclone attack. Further, the dikes have been playing an important role as the rural communication road networks connecting the scattered villages in a polder with function of vital means for daily life.

Some of emergency works have been executed by the government of Union of Myanmar and other donors concerns as mentioned above, however, appropriate restoration plan is not yet established for securing human security and disaster prevention purpose in the area. In this context, necessity of formulation of Master Plan Study comes up as an urgent requirement before starting restoration activities.

1.2 Project Justification

As the assistance for restoration of rice production in the area, seeds, cultivators, fertilizer and others for the next rice production have been provided to the area. But in view of rice field protection from saline

water intrusion, not only the articles for rice production, but also the embankments should be rehabilitated in full-scale as soon as possible for sustainable rice production of the area leading to the food security of Myanmar and the neighboring countries such as Bangladesh, Sri Lanka and Indonesia, as urgent life-saving measures in the attack of a next cyclone to avoid the loss of many lives not like in the case of Nargis, and for the restoration of ordinary rural daily life.

Thus the dike and sluice rehabilitation project will surely assist the said rural area for the recovery from the disaster caused by the cyclone Nargis. The government of the Union of Myanmar has prepared the rehabilitation plan for agricultural sector affected by the cyclone Nargis and put the priorities on 1) agricultural rehabilitation work to be carried out in affected areas, and on 2) reconstruction/renovation of damaged embankments. At the same time, FAO also put the priority on rehabilitation of embankments among others.

The urgent rehabilitation works of those embankments have been conducted by the Government of the Union of Myanmar but since the urgent rehabilitation works are of those of emergency works in the rainy season, the emergency embankment can not be strong enough against next time high tide attack. This means that the agricultural production and protection of people's life in the said area are still menaced under the present situation.

From such situation, a master plan study on restoration of agricultural production and rural life is strongly required for sustainable food security of the said countries, urgent life-saving, and the restoration of ordinary rural life in the said areas. Implementation of pilot project(s) where the said recovery is urgently required is also to be conducted.

This project is left outside of urgent aid programs by other donor agencies related to the recovery from the damages due to the cyclone Nargis. Accordingly the government of the Union of Myanmar strongly desires that this project is implemented by the aid of the Japanese Government. The government of the Union of Myanmar puts the high priority on this project.

1.3 Prospective Beneficiaries

The prospective beneficiaries of this project are people in the area affected by the cyclone Nargis. The number of the beneficiaries is temporarily estimated at 3.2 million people at least.

1.4 Desirable Implementation Schedule

The intention of the Government of Union of Myanmar for the study schedule is as follows:

2009 – 2010 Master plan study for restoration of agricultural production and rural life together with implementation of pilot project(s)

1.5 Study Area

Study area will be the proposed 41 agricultural production areas being protected from saline water intrusion by embankments among the areas affected by the cyclone Nargis in Ayeyarwady Division. The proposed 41 areas are shown in the attached table.

2. Objectives of the Study

The objectives of the study are:

- a To review the needs for restoration of agricultural production and rural life
- b To formulate a master plan for restoration of agricultural production and rural life in the areas protected by embankments
- c To carry out pilot project(s) in the study

3. Scope of the Study

The Study shall consist of drafting a master plan, identifying pilot project(s), implementing pilot project(s) and finalizing the master plan.

(1) Data Collection and Review

- a National, regional and sectoral development plans
- b Statistics on the socio-economy
- c Villagers' livelihood (agriculture and livestock) and living environment
- d Meteorological and hydrological data
- e Topographical, geological and soil data
- f Land use data
- g Past cyclone damage data
- h Existing facilities to protect agricultural lands and for rice production
- i Previous studies on construction of embankments and other facilities
- j Programs/projects for urgent recovery and rehabilitation implemented by the government, UN and donor agencies
- k Disaster risk reduction and management,
- l Other related data (related institutions, cost estimate data, etc.)

(2) Field Reconnaissance

- a Agriculture, livestock and other livelihoods
- b Villagers' living environment
- c Related Facilities

(3) Examination and analysis

- a Needs and opportunities to restore and improve agricultural production and rural life
- b Priority analysis among above needs and opportunities
- c Disaster risk analysis for designing of embankment dimensions
- d Evaluation of existing plans and on-going projects on rehabilitation of the target area

(4) Drafting a master plan on restoration of agricultural production and rural life

(5) Evaluation of the drafted master plan

- a Economic evaluation
- b Social and environmental evaluation

(6) Implementation schedule of drafted master plan

- a Review of legal and institutional frameworks
- b Overall implementation schedule
- c Selection of priority project(s) and pilot project area(s)
- d Identification of components in pilot project(s)

(7) Implementation of Pilot Project(s)

- a Additional data collection and review
- b Canal and topographical survey
- c Geological and soil-mechanics investigation
- d Detailed Design
- e Construction Plan and Cost Estimate
- f Evaluation of Pilot Project(s)
- g Economic, Social and financial evaluation
- h Environmental impact analysis
- i Implementation of Pilot Project(s)

(8) Finalization of the Master Plan

4. Study Schedule

The entire study period shall be 24 months including preparation of master plan and implementation of pilot project(s).

5. Expected Input of Expertise

(1) Required Man/Month

The man-month (M/M) of the expertise required for technical assistance is anticipated to be approximately 100(one hundred) M/M.

(2) Expertise Input

The study team composed of the following experts will be needed:

- a Team Leader,
- b Agronomist
- c Hydrology/Meteorology Expert,
- d Irrigation/Drainage Expert,
- e Hydraulic Structure / Rural Infrastructure Expert,
- f Hydraulic Mechanical Engineer,
- g Livestock Expert,
- h Rural Society/Livelihood Improvement Expert
- i Natural/Social Environment Expert,
- j Cost Estimation
- k Project Evaluation Expert,

6. Expected Outputs

The expected outputs of the Study will be a complete set of Study Report with its supporting documents which present all the study results on formulation of the master plan and implementation of priority project(s).

7. SPECIFIC ISSUES

7.1 Disaster Reduction and Human Security

In preparation of master plan, disaster reduction and human security aspects should be deeply taken into account especially for rehabilitation of embankments. During the cyclone Nargis, it is reported that even the low elevation embankments functioned as a shelter and evacuation place for saving people's life from high surge. Accordingly this study is closely related to the urgency of the project, not only for protecting the agricultural land, but also for protecting the people's life.

7.2 Civil Work

In preparation of construction plan, the cash for work (to mobilize labors as many as possible for villagers' income) viewpoint should be carefully taken into account from the viewpoint of rural people's income recovery.

7.3 Environmental Component

Environmental impacts of the project to be implemented by the study would not give any serious environmental impacts, because the project would basically restore the agricultural production basis which has existed for many years.

But impacts to the society might arise when the project is implemented in such a way of noise, vibration, dusts, disturbance to the public land transportation and water transportation during construction stage. These features should be examined to minimize adverse impacts, although the features will depend on the project characteristics and the methodology of project implementation.

7.4 Women in Development

Restoration of agricultural basis in the study area will certainly contribute to the restoration of the regional agricultural production and the rural people's life. The activated economy will need additional employment, which will improve the existing unemployment/under employment problem for women in the region. The expected restoration of agricultural basis will also contribute, in general, to reducing women labor in daily activities.

7.5 Poverty Alleviation

Restoration of agricultural basis and rural people's life through the project implementation will surely improve the situation of poverty in the region. The expected increase in employment and the resulting

income will contribute directly to alleviate poverty problem in the area.

8. UNDERTAKINGS OF THE GOVERNMENT OF UNION OF MYANMAR

In order to facilitate a smooth and efficient study, the Government of Union of Myanmar will take the necessary measures:

- a to permit members of the study team to enter, leave and sojourn in Myanmar for duration of their assignment, and to exempt them from alien registration requirements (and consular fees),
- b to exempt members of the study team from taxes, duties and other charges on equipment, machinery and materials brought into Myanmar for implementation of the study,
- c to exempt members of the study team from income tax and other charges imposed on or in connection with any emolument or allowance paid to members of the study team for their services in connection with implementation of the study,
- d to provide medical services as needed at the expense of the members,
- e to secure permission for entry to the facilities and areas considered necessary for the study,
- f to secure permission for the study team to take all data and documents (including photographs) related to the study out of Myanmar to foreign countries by the study team.
- g to provide the study team with the following in connection with other relevant organizations;
 - available data and information related to the study,
 - counterpart personnel,
 - suitable office space with necessary equipment in Site, and
 - credentials or identification cards.

The government of the Union of Myanmar shall bear claims if any arises against members of the study team arising from, occurring in the course of, or otherwise connected with the discharge of their duties in implementation of the study except when such arise from gross negligence or willful misconduct on the part of members of the study team.

Directorate General of Irrigation Department will act as the counterpart agency to the study team and also act as a coordination body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the study.