QUANG NGAI PROVINCIAL PEOPLE'S COMMITTEE (PPC)
THE SOCIALIST REPUBLIC OF VIET NAM

OUTLINE DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION
OF
SMALL-SCALE RESERVOIRS
IN
QUANG NGAI PROVINCE
IN
THE SOCIALIST REPUBLIC OF VIET NAM

JUNE 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

SANYU CONSULTANTS INC.

PREFACE

Japan International Cooperation Agency (JICA) conducted the outline design study on the Project for Rehabilitation of Small-Scale Reservoirs in Quang Ngai Province in the Socialist Republic of Viet Nam.

JICA sent to Viet Nam a survey team from August 17 to October 14, 2009.

The team held discussions with the officials concerned of the Government of Viet Nam, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Viet Nam in order to discuss a draft outline design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Socialist Republic of Viet Nam for their close cooperation extended to the teams.

June 2010

Motofumi KOHARA
Director General, Rural Development Department
Japan International Cooperation Agency

June 2010

LETTER OF TRANSMITTAL

We are pleased to submit to you the outline design study report on the Project for Rehabilitation of Small-Scale Reservoirs in Quang Ngai Province in the Socialist Republic of Viet Nam.

This survey was conducted by Sanyu Consultants Inc., under a contract to JICA, during the period from August 2009 to June 2010. In conducting the survey, we have examined the feasibility and rationale of the project with due consideration to the present situation of Viet Nam and formulated the most appropriate outline design for the project under Japan's Grant Aid scheme for Community Empowerment.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Kazumitsu TSUMURA

Project manager,

Outline Study team on
The Project for Rehabilitation and
Small-Scale Reservoirs
in Quang Ngai Province
in the Socialist Republic of Viet Nam

Sanyu Consultants Inc.

SUMMARY

(1) Background of the Project

There exist more than 100 of small-scale reservoirs in Quang Ngai Province and most of them have degraded and been leading leakage through dam body of reservoir. In addition, farmers are facing upon habitual deficiency of irrigation water due to a lack of reservoir capacity, unimproved intake facilities and main canals. Furthermore, people living in the Province are suffering from the risk of dam collapse caused by recurrent typhoons because of the recent global warming phenomena.

The Government of the Socialist Republic of Vietnam (hereinafter referred to as "Viet Nam") made a request for Grant Aid for Community Empowerment (hereinafter referred to as "GACE") for the Project for Rehabilitation of Small-Scale Reservoirs in Quang Ngai Province (hereinafter referred to as "the Project") to the Government of Japan (GOJ) in order to increase the agricultural productivity and to mitigate the risk of destructing dam bodies of 10 reservoirs in the Province.

(2) Study Results and Contents of the Project

In response to the request, JICA sent a preliminary study mission to Vietnam in February, 2009, then Outline Design Study (hereinafter referred to as "the O/D Study") Team. The O/D Study team held discussions with the officials of Provincial People's Committee (PPC) in Quang Ngai about the requested contents and carried out a field survey as well.

Based on the O/D Study, seven(7) reservoirs, namely; "1.Tri Binh, 4.An Hoi, 5.Mach Dieu, 6.Hoc Mit, 8.An Tho, 9.Hoc Nghi and 10.Huan Phong", Intake and Spillway are suggested to rehabilitate in high priority and then Operation & Maintenance (O&M) Houses, Main Cannals and Access Roads which are the next urgent facilities need to be upgraded.

On the basis of the Project purpose, they compose of 1) securing the stability of irrigation water and 2) reducing risk of dam collapse in beneficial areas of 7 reservoirs, they are proposed to rehabilitate by following policies;

■ Adoption of design standard

Much discrepancy was not found between Vietnamese standard and Japanese one, based on examining three(3) reservoirs whose F/S have been done by local consultants. It is, therefore, better adopt Vietnamese standard for detailed designing as well as construction planning to reservoirs in taking procedures of implementation approval issued by PPC later on.

■ Reservoirs to request Japanese assistance

Out of ten(10) reservoirs requested by Vietnamese side for Japanese assistance, seven(7) ones were selected based on the selection criteria of 1) securing the stability of irrigation water such as efficiency of reservoir capacity and irrigation area to be expanded, and 2) reducing risk of dam

collapse such as overtopping, leakage through the dam body, numbers of household to be benefited and so on.

■ Dam body, Spillway and Intake

It is essential for those reservoirs to be rehabilitated in both designing and construction planning due to the risk of beneficiaries under the reservoirs in order to cope with floods which become more and more serious caused by global climate change. And a valve-type intake will be replaced by an existing inclined or a tower type to operate and manage its discharge simply and easily.

■ Irrigation planning and main canal

Proposed irrigation water volume is required enough for two(2) crops including winter-spring and summer-autumn paddy crops. Water requirements are obtained from paddy crop consumption and effective rainfall in a drought year with 75% probability. While main irrigation canals are rehabilitated by the Project, the concrete lining shall be provided for a part of degraded concrete canals, exsiting earth canals, and new canals.

■ Access roads to reservoirs

All sections of proposed access roads shall be paved because of recurrent typhoons occurring from recent global warming phenomena. Concrete pavement is applied for the purpose of economic efficiency and durability in comparison with asphalt pavement.

■ Operation and Maintenance (O&M) house

O&M house which is designed with an operation room, a toilet, a restroom, a kitchen and a ware house to be relevant for the scale and its function is to take ordinary and extraordinary management for reservoir, since O&M house has been required to construct for each reservoir either to be new or rehabilitated under the regulation in Vietnam.

■ Operation and management Equipment for reservoirs

Auto level meter, rainfall gauge, current meter, handy speaker, water level staff for reservoir/canal and water leakage device shall be procured under the Project. These equipments will be supplied by contractors who will take over construction works.

■ Soft component plan

Although Irrigation Management Company (IMC), Agricultural Cooperative (AC) and Water Users' Group (WUG) have been managing the reservoirs through the accumulated experience and knowledge, it is still found some issues on effectiveness of water management, organizational management and safety management of reservoirs. In order to solve the above issues, activities of soft component are necessary to support the smooth implementation and to sustain effects of the Project as minimum requirements.

■ Beneficiaries and irrigation area

There exist 3,976 households in total under the 7 reservoirs with 1,650 ha of farm land. After

implementation of the Project, 551 ha existing irrigation area will be extended by 846 ha (increasing 53%) in total. Also, it is expected that stable irrigation water would be secured by rehabilitation of seven(7) reservoirs.

Outline of requested Japanese assistance is show in following table;

Outline of requested Japanese assistance

Reservoir name	Reservoir					Irrigation		Access road	Equipment (each reservoir)
	Effective capacity ('000m^3)	Length (m)	Height (m)	Flood discharge (m^3)	Control house Area (m^2)	Irrigation area (ha)	Main canal (m)	(m)	
1.Tri Binh	284	310	8.0	117.5	42	90	2,511	163	Auto level(1), Rainfall gauge(1), Current meter (1), Handy speaker(2), Reservoir water level gauge(2), Canal water level gauge (2), Water leakage device (1)
4.An Hoi	449	235	10.0	27.5	42	40	879	195	
5.Mach Dieu	2,177	656	12.8	118.8	42	270	3,847	748	
6.Hoc Mit	580	699	9.9	56.9	57	70	1,703	416	
8.An Tho	2,390	276	12.3	95.5	42	161	3,691	487	
9.Hoc Nghi	311	230	12.3	20.5	42	50	2,630	2,407	
10.Huan Phong	1,829	435	13.8	55.2	42	165	3,184	3,363	
Total						846	18,445	7,779	

Grant Agreement (G/A), which will be concluded between JICA and PPC after the signing of Exchange of Notes (E/N), an coordination committee will be established to decide and coordinate concerning matters for the implementation of the project. On the basis of G/A, PPC will make an Agent Agreement (A/A) with a procurement agency to procure the supervisory consultant and construction contractors and to supervise the construction of the Project.

(3) Construction Period and Project Cost Estimation

Project implementation requires 5.0 months to prepare final Tender documents after signing of A/A and 21.5 months for the construction. The Project cost in implementing process under the GACE fund is roughly estimated at XXX million J.Yen or XXX million VND (XXX million J.Yen or XXX million VND to be undertaken by Japan; 97 million J.Yen or 17,897 million VND by Vietnamese side).

(4) Evaluation of the Project

Direct effects of the Project which are shown in following table are composed of Direct effect-1; "To secure the stability of irrigation water in 7 reservoirs" and Direct effect-2; "To reduce risk that may cause by occurring collapse of 7 reservoirs" under the Project.

Direct effects of the Project

Expected effects	Current status and issues	Activities under the Project	Objectively verifiable indicators
Direct effect-1 : To be secured stability of irrigation water at 7 reservoirs	There are more than 100 of small-scale Reservoirs in Quang Ngai Province and most of them have degraded and been leading leakage through dam body. In addition, farmers are facing upon habitual deficiency of irrigation water for two(2) paddy crops a year due to a lack of reservoir capacity, unimproved intake facilities and main canals.	To raise up the height of dam bodies, To improve spillway, intake facilities and main canals of Reservoirs	1,260,000m^3 (8,020,100-6,754,000) of active capacity in total for 7 reservoirs will increase.
Direct effect-2 : To be reduced risk by occurring collapse of 7 reservoirs	People living in the Province are suffering from the risk of dam collapse caused by recurrent typhoons occurring from recent global warming phenomena.	To rehabilitate dam bodies and access roads to Reservoirs	Leakage from 7 reservoirs will decrease.

Also, it is expected that 1)appropriate water management will be performed by IMC, AC and WUG, and 2)WUG will manage irrigation facilities properly with understanding necessity of O&M by using water management and O&M Manuals which prepared during the activities. And also 3)appropriate safety management of reservoirs will be executed by using regulation through the Soft component activities.

For indirect effects, it is expected that irrigation area with annual double cropping will be increased by securing the stability of irrigation water after rehabilitation of dam bodies and improvement of main canals of 7 reservoirs. Since the irrigation area will be increased from 1,025 to 1,692 ha (65%) in total, agricultural productivity and livelihood in the Project area would be upgraded.

Present and planed irrigation areas after the Project

Name of reservoirs	Present irrigation area (ha)			Planed irrigation area (ha)			Increase rates
	W-S crops	S-A crops	Total	W-S crops	S-A crops	Total	
1. Tri Binh	74	30	104	90	90	180	73%
4. An Hoi	40	40	80	40	40	80	0%
5. Mac Dieu	167	167	334	270	270	540	62%
6. Hoc Mit	7	40	47	70	70	140	98%
8. An Tho	90	90	180	161	161	322	79%
9. Hoc Nghi	40	40	80	50	50	100	25%
10. Huan Phong	100	100	200	165	165	330	65%
7 reservoirs in Total	**518**	**507**	**1,025**	**846**	**846**	**1,692**	**65%**

Sources: Baseline surveys, JICA O/D Study Team,
Remarks: W-S: Winter-Summer crops, S-A: Summer-Autumn crops

Then, damages by dam collapse due to being inundated in communes located at downstream of the reservoirs are assumed by flood occurred in 1999 which was the biggest in the last 10 years, since information of dam collapse is not available. In the basis of damages in each commune in relation with the requested reservoirs by 1999 flood, it is expected that approximately 28,310 million VND would

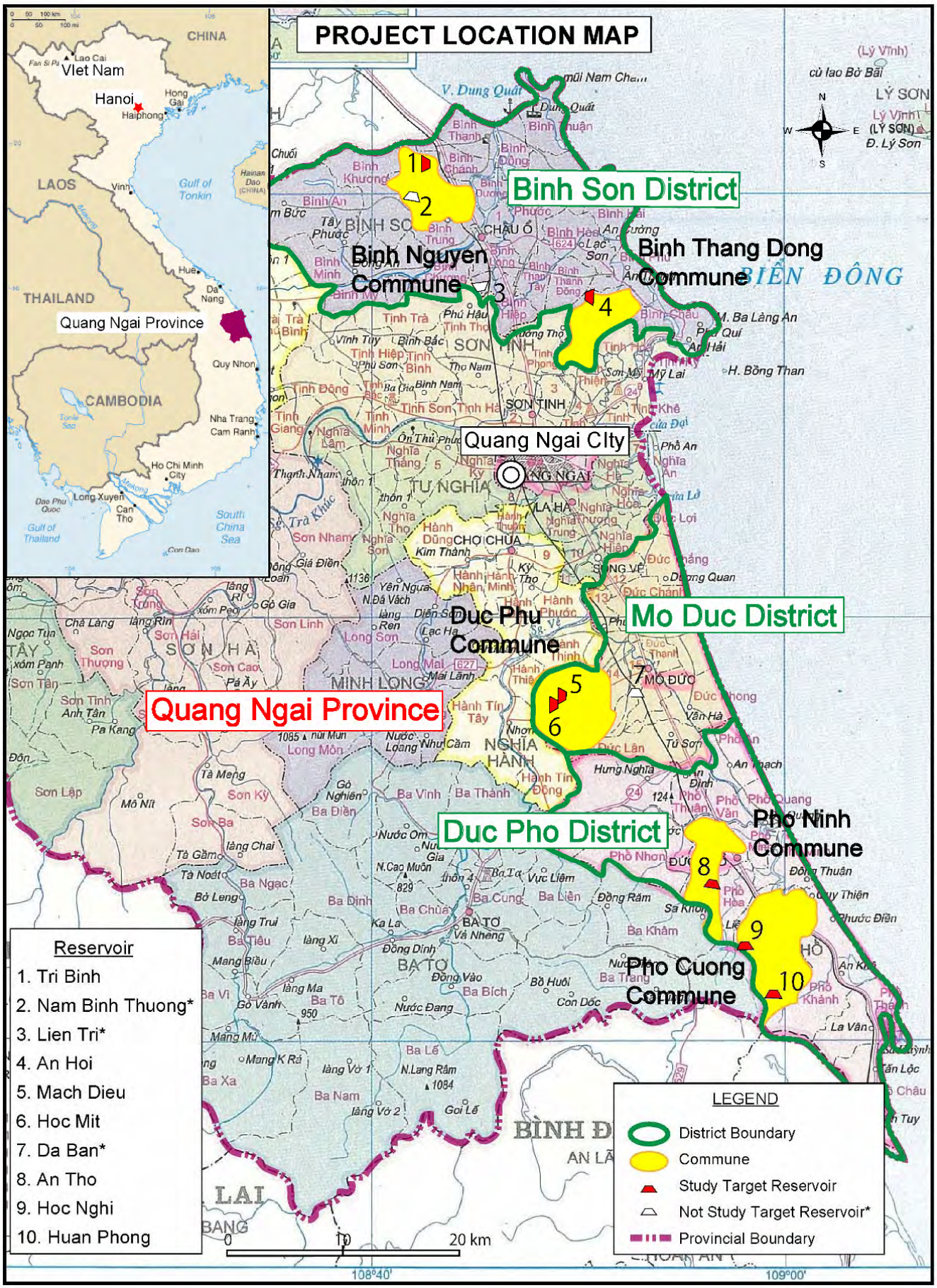
be protected under five(5) communes with population of 47,595 (Statistics of year 2008) by risk of dam collapse.

Ministry of Agriculture and Rural Development (MARD) is reliable government Agency in Viet Nam in partnership with Japanese assistance, international organization and other donors working as supporting agencies for water resources and agricultural development projects. The Department of Agriculture and Rural Development (DARD) under Quang Ngai PPC has many experiences on rehabilitation of reservoirs financed by JBIC, ADB, WB and one Natural Disaster Mitigation Project under the Government of Australia. During implementation of those projects, PPC steadily has executed allocation of the budget for the purposes such as staffing, equipment, O&M, etc. And while there are more than 100 reservoirs in Province, PPC has been implemented by their own budget. Therefore, it is evaluated that this Project will be implemented appropriately assisted by PPC. And also, after implementation, DARD will carry out O&M facilities to be rehabilitated under the Project.

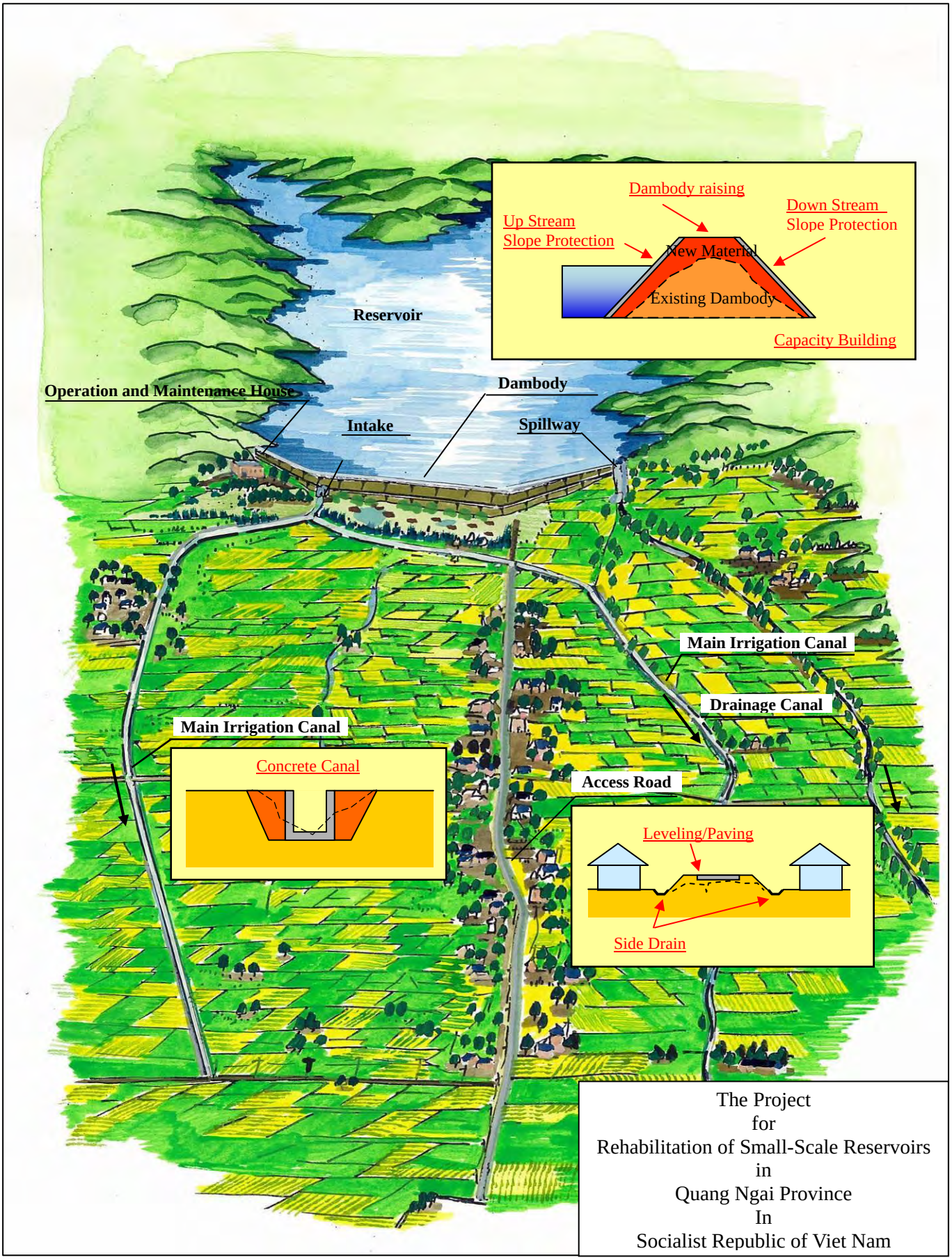
Quang Ngai PPC, however, has no experience to undertake Japan's Grant Aid scheme. In case of this Project, based on the G/A which will be concluded between JICA and PPC, PPC shall make an A/A with a Procurement agency of Japan to procure the supervisory consultant and construction contractors and to supervise the construction of the Project, in accordance with the guideline of GACE and A/A.

While it is found that there are some discrepancies of business custom between Viet Nam and Japan immediately after approval of Japanese Government for the Project implementation such as in financial management, procedure of design changes during construction, handling of surplus fund and so on, so it is required that PPC and concerned organizations shall start to discuss about the contents of A/A with the Procurement Agency of Japan.

CONTENTS


PROJECT LOCATION MAP
CHINA
Viet Nam
Hanoi
Haiphong
LAOS
THAILAND
CAMBODIA
Quang Ngai Province
Gulf of Tonkin
South China Sea
Gulf of Thailand
Binh Son District
Binh Nguyen Commune
Binh Thang Dong Commune
Quang Ngai City
Mo Duc District
Duc Phu Commune
Quang Ngai Province
Duc Pho District
Pho Ninh Commune
Pho Cuong Commune
BIỂN ĐÔNG
LÝ SƠN
Reservoir
1. Tri Binh
2. Nam Binh Thuong*
3. Lien Tri*
4. An Hoi
5. Mach Dieu
6. Hoc Mit
7. Da Ban*
8. An Tho
9. Hoc Nghi
10. Huan Phong
LEGEND
District Boundary
Commune
Study Target Reservoir
Not Study Target Reservoir*
Provincial Boundary
0
10
20 km
108°40'
109°00'

PERSPECTIVE



LIST OF FIGURES AND TABLES

List of Figures

List of Tables

ABBREVIATIONS

Abbreviations

A/A	Agent Agreement
AC	Agricultural Cooperative
ADB	Asian Development Bank
CPC	Commune People's Committee
DARD	Department of Agriculture and Rural Development
E/N	Exchange of Notes
G/A	Grant Agreement
GOJ	Government of Japan
IMC	Irrigation Management Company
MARD	Ministry of Agriculture and Rural Development
PMB	Project Management Board
PPC	Provincial People's Committee
SBFSCR	Steering Board of Flood and Storm Control for Reservoir
WB	World Bank
WUG	Water Users' Group

Name of Reservoir / Japanese assistance

No.	Reservoirs	Japanese assistance
1.	Tri Binh	Under Japanese assistance
2.	Nam Binh Thuong	Not under Japanese assistance
3.	Lien Tri	Not under Japanese assistance
4.	An Hoi	Under Japanese assistance
5.	Mac Dieu	Under Japanese assistance
6.	Hoc Mit	Under Japanese assistance
7.	Da Ban	Not under Japanese assistance
8.	An Tho	Under Japanese assistance
9.	Hoc Nghi	Under Japanese assistance
10.	Huan Phong	Under Japanese assistance

Unit

cm	centimeter	m^3/s	cubic meter per second
m	meter	t	ton (1,000 kg)
km^2	square kilometer	t/ m^2	ton per square meter
m^3	cubic meter	ha	hectare
m^2	square meter	%	percent
m/s	meter per second		

Currency

J. Yen	Japanese Yen
USD	US Dollar
VND	Viet Nam Dong

Exchange Rate（September 2009）

USD = 96.53 J. Yen　　USD= 17,796 VND　　VND= 0.00542 J. Yen

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Project

There are more than 100 of small-scale reservoirs in Quang Ngai Province and most of them have degraded and been leading leakage through dam body. In addition, farmers are facing upon habitual deficiency of irrigation water due to a lack of reservoir capacity, unimproved intake facilities and main canals. Furthermore, people living in the Province are suffering from the risk of dam collapse affected by recurrent typhoons occurring from recent global warming phenomena.

The Government of Socialist Republic of Vietnam (hereinafter referred to as “Viet Nam”) made a request for Grant Aid for Community Empowerment (GACE) for the Project for Rehabilitation of Small-Scale Reservoirs in Quang Ngai Province (hereinafter referred to as “the Project”) to the Government of Japan (GOJ) in order to increase the agricultural productivity and to mitigate the risk of destructing dam bodies of 10 reservoirs in the Province. In response to a request, JICA sent a preliminary study mission to Viet Nam in February, 2009, then Outline Design Study (hereinafter referred to as “the O/D Study”) Team. The O/D Study team held discussions with the Provincial People’s Committee (PPC) and the Department of Agriculture and Rural Development (DARD) in Quang Ngai about requested contents and carried out a field survey.

Based on the O/D Study, seven(7) reservoirs, namely; “1.Tri Binh, 4.An Hoi, 5.Mach Dieu, 6.Hoc Mit, 8.An Tho, 9.Hoc Nghi and 10.Huan Phong”, Intake and Spillway are suggested to rehabilitate in high priority and then Operation & Maintenance (O&M) Houses, Main Cannals and Access Roads which are the next urgent facilities need to be upgraded.

1-2 Components requested by Government of Viet Nam

Table 1-1 shows components requested by Viet Nam and Japanese assistance accepted.

Table 1-1 Components requested by Vietnamese side

	Requested Subject	Original Request	Preliminary Study Stage	Outline Design Study Stage (Accepted components)
1.	Rehabilitation of reservoirs	Rehabilitation of 10 reservoirs (Dam body, Spillway, Embankment, Intake Work, and Main canal)	Same with the original request	Rehabilitation of 7 reservoirs with high priority (Reservoir No. 1.Tri Binh, 4.An hoi, 5.Mac Dieu, 6.Hoc Mit, 8.An Tho, 9.Hoc Ngni and 10.Huan Phong)
	Main canal length	Not mentioned	Not mentioned	Concrete; Total length: 18.4 km
2.	Access road to reservoir	Rehabilitation of access road to 10 reservoirs (Total length: 16.8 km, Pavement: Concrete, Pave width: 3.5m)	Rehabilitation of access road to 10 reservoirs (Total length : 13.7 km)	Rehabilitation of access road; Concrete pavement (Total length : 7.8 km)
3.	Centre for Natural Disaster Mitigation and Management	Centres for Natural Disaster Mitigation and Management Construction of 2 in Binh Son and Mo Duc Districts	10 Operation and Maintenance (O&M) houses for reservoirs	7 Operation and Maintenance (O&M) houses for reservoir with total area of 42 m^2 for each reservoir, and out of 8 houses, to be added a meeting room ($12m^2$) at "6.Hoc Mit" considering DRSC program under JICA
4.	Equipment for Operation and Management of Reservoirs	PC, Printer, Digital camera, Photocopier, Telephone/FAX, Gradient, GPS instrument, Rainfall meter, Flow velocity instrument, Furniture, Motorbike, and Television	Auto level meter, Rainfall gauge, Current meter, Alarm devise	Auto level meter (1/reservoir), Rainfall gauge (1/reservoir), Current meter (1/reservoir), Handy speaker (2/reservoir), Reservoir water level staff (2/reservoir), Canal water level staff (2/reservoir), Water leakage device (1/reservoir)
5.	Capacity building of IMC and WUG staff (Soft Component)	Training and workshops for management staff and WUG members	Same with original request	Same with original request (Target personnel: Staff of IMC, AC and members of WUG)

1-3 Natural Conditions

(1) Topography

Quang Ngai Province is nearly located at the center of Viet Nam, and eastern side of the province faces to the East Sea. Approximate 80% of population in the province lives in low land of which width is only about 20 km located along the coast side.

(2) Meteorology / hydrography

The annual rainfall of Quang Ngai Province is 2,400mm (in average 1998-2008). Most of rain is appeared during rainy season from September to December. Several typhoons attack the province during rainy season and cause serious damages. "Ketsana" cyclone attacked the province during field

survey of O/D Study at the beginning of October. The province was suffered with 34 people died, 4 missings and 112 injured from this cyclone.

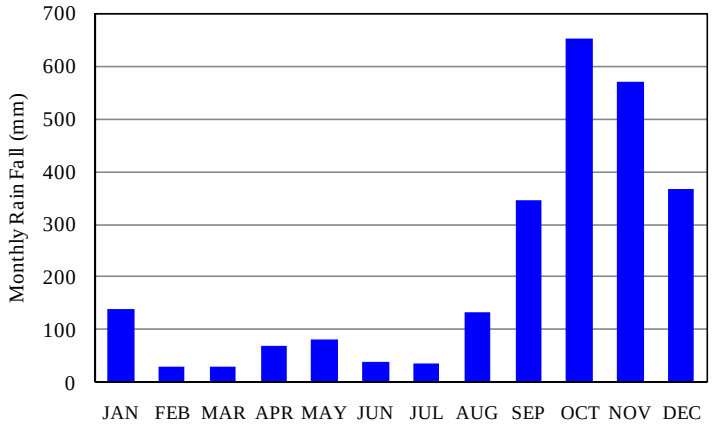


Figure 1-1 Monthly rainfall of Quang Ngai Province

(Mo Duc Hydrography and Meteorology Station, Average of 1998-2008)

(3) Geological conditions

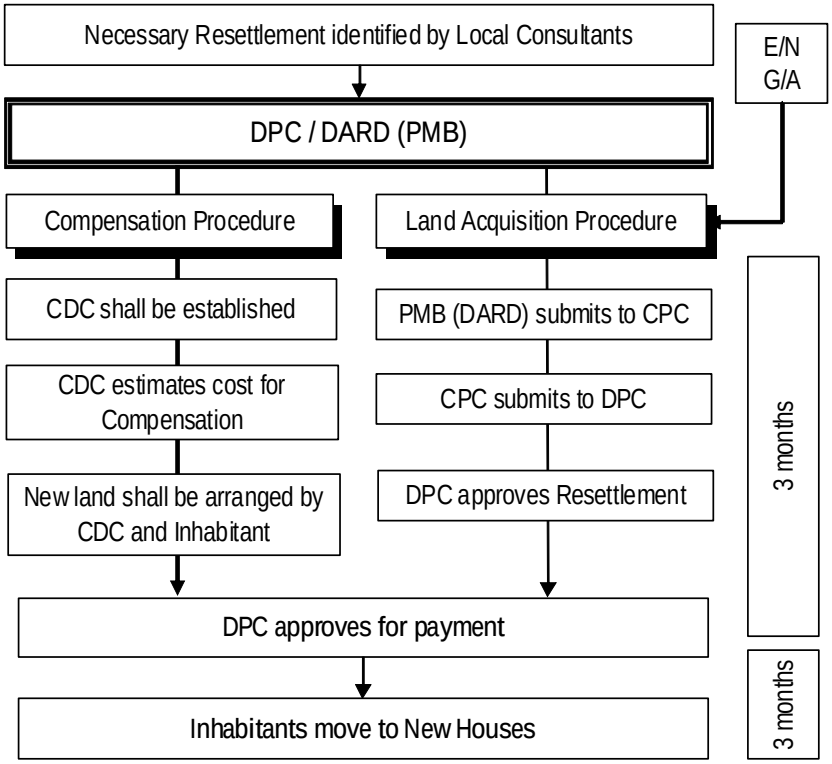
The result of drilling surveys for 7 reservoirs is shown in "Appendix-6 Other Relevant Data".

1-4 Environmental and Social Considerations

While in field survey of the O/D Study, it is found at “1.Tri Binh” reservoir that three(3) households would be needed to resettle due to design high water level after the Project implementation. Resettlement shall be undertaken by Vietnamese side and executed along with the procedure shown in Figure 1-2. Procedure of resettlement will be started after G/A and it will be taken about 6 months.

Expected schedule of the Project is shown as follows. The resettlement should be completed before commencement of construction.

1) July 2010: Exchange of Note (E/N), Grant Agreement (G/A)
2) August 2010: Signing of Agent Agreement (A/A), selection of local consultants for the construction supervision
3) October 2010: Tendering, and evaluation of tendering for approval by PPC
4) December 2010: Contract with local contractor
5) January 2011: Commencement of construction



DARD : Department of Agriculture and Rural Develpoment
PMB : Project Management Board
CPC : Commune People's Committee
DPC : District People's Committee
CDC : Compensetion District Council

Figure 1-2 Procedure of resettlement

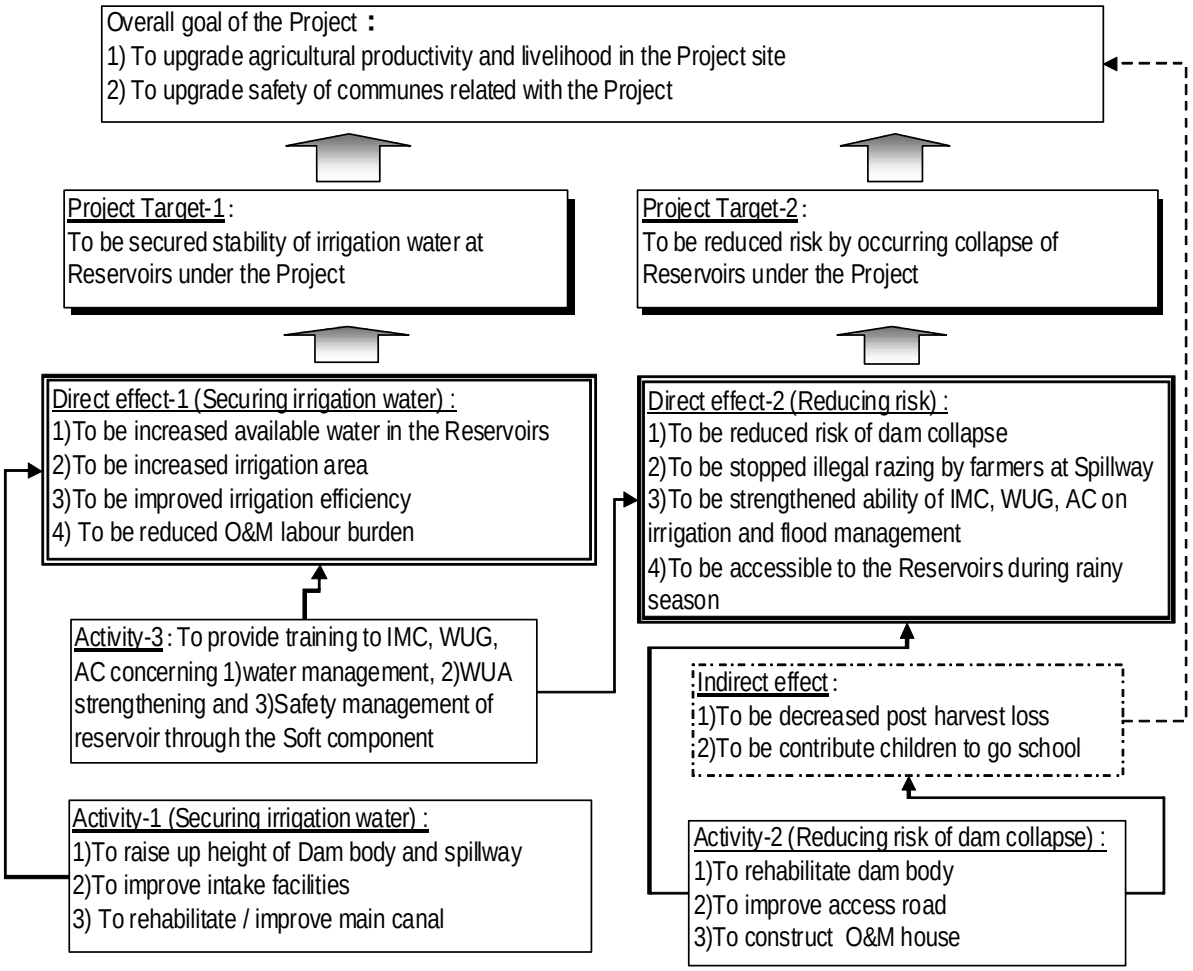
Chapter 2　Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Targets

Overall goal of the Project is 1)upgrading agricultural productivity by securing stable irrigation water and 2)safety of related commune by reducing risk of collapse of reservoir. Project targets, direct effects and activities are summarized in Figure 2-1.



IMC: Irrigation Management Company
AC: Agricultural Cooperative
WUG: Water Users' Group
O&M: Operation & Maintenance

Figure 2-1 The Project targets, direct effects and activities

And main issues of requested reservoirs are shown in followings;

	Issues on securing stability of irrigation water		Issues on reducing risk of dam collapse
1)	Insufficiency of reservoir capacity	1)	Risk of dam collapse by overflow during flood
2)	Leakage of dam body	2)	Inappropriate scale of spillway
3)	Degrading of intake	3)	Illegal raising at spillway by beneficiaries
4)	Low irrigation efficiency of main canal	4)	In-accessibility to reservoir during rainy season
5)	Insufficiency of water management knowledge of beneficiaries	5)	Insufficiency of reservoir management knowledge of beneficiaries

2-1-2 Outline of the Project

(1) Reservoirs of the requested Japanese assistance

Out of ten(10) reservoirs requested by the Vietnamese side for Japanese assistance, seven(7) of them were selected based on selection criteria of 1)securing stability of irrigation water such as efficiency of reservoir capacity and irrigation area to be expanded, and 2)reducing risk of dam collapse such as overtopping, leakage thought the body, numbers of house hold to be benefited and so on.

(2) Dam body, Spillway, Intake

It is essential for those reservoirs to be rehabilitated in both designing and construction planning due to the risk of beneficiaries under the reservoirs in order to cope with floods which become more and more serious caused by global climate change. And a valve-type type of intake facility shall be replaced by existing inclined or a tower type in order to operate and manage the intake discharge simply and easily.

(3) Irrigation planning, Main canal

Proposed irrigation water volume is required for two(2) crops for winter-spring and summer-autumn paddy crops. Water requirements are obtained from paddy crop consumption and effective rainfall in a drought year with 75% probability. While main irrigation canals are rehabilitated by the Project, the concrete lining shall be provided for a part of degraded concrete canals, existing earth canals, and new canals.

(4) Access road to reservoirs

All sections of the proposed access roads shall be paved because of recurrent typhoons occurring from recent global warming phenomena. Concrete pavement is applied by economic efficiency and durability chosen from asphalt pavement and concrete pavement.

(5) Operation and maintenance (O&M) house

O&M house which is designed with an operation room, a toilet, a restroom, a kitchen and a ware house to be relevant for the scale and its function is to take ordinary and extraordinary management for reservoir, since O&M house has been required to construct for each reservoir either to be new or

rehabilitated under the regulation in Vietnam.

(6) Operation and Management Equipment for reservoirs

Auto level meter, rainfall gauge, current meter, handy speaker, water level staff for reservoir/canal and water leakage device shall be procured under the Project. These equipments will be supplied by contractors who will take over construction works.

(7) Soft component plan

Although Irrigation Management Company (IMC), Agricultural Cooperative (AC) and Water Users' Group (WUG) have been managing the reservoirs via their own accumulated experience and knowledge, it is still found some issues on effectiveness of water management, organizational management and safety management of reservoirs. In order to solve these issues, activities of soft component are necessary to support the smooth implementation and to sustain effects of the Project as minimum requirements.

(8) Beneficiaries and irrigation area

There exist 3,976 households in total under the 7 reservoirs with 1,650 ha of farm land. After implementation of the Project, 551 ha existing irrigation area will be extended by 846 ha (increasing 53%) in total shown in Table 2-1. Also, it is expected that stable irrigation water would be secured by rehabilitation of seven(7) reservoirs. However, designed irrigation area of "4.An Hoi" is not increased due that existing irrigation area under this reservoir is maximum excepting by using pump.

Table 2-1 Beneficiaries and irrigation area

Reservoir name	Farm land Incl. non-irrigation area (ha)	House hold (HH)	(ha/HH)	Existing Irrigation area (ha)	Designed irrigation area	
					(ha)	Increased rate
1. Tri Binh	90	550	0.16	74	90	22%
4. An Hoi	130	225	0.58	40	40	0%
5. Mac Dieu	450	1,200	0.38	167	270	62%
6. Hoc Mit	130	230	0.57	40	70	75%
8. An Tho	300	821	0.37	90	161	79%
9. Hoc Nghi	200	360	0.56	40	50	25%
10. Huan Phong	350	590	0.59	100	165	65%
Total	**1,650**	**3,976**	**0.41**	**551**	**846**	**53%**

Source: JICA baseline survey

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Principal Policy

Principal policy-1: The Project is to be implemented under GACE grant aid scheme based on Grant Agreement (G/A) between and by PPC and JICA.

Principal policy-2: Securing safety of reservoirs is to be given high priority during preparation of designing and construction planning.

Principal policy-3: Japanese primary consultant is to be employed for implementation structure of the Project under the Contract of Procurement Agent (the Agent) to be recommended by JICA with using local consultants.

Principal policy-4: Capacity building of IMC, AC personnel for water management, strengthening of WUG, reservoirs' management is to be carried out through Soft component under the Project.

(1) Principal policy-1: Project implementation under GACE Scheme

The Project shall be implemented under GACE scheme in consideration with followings;

(a) Based on examination of design standard of Viet Nam through Feasibility Study (F/S) done by local consultants, the standards is similar to Japanese one in methodology of study, design and construction planning.

(b) Local contractors in Viet Nam have many experiences to have rehabilitated small-scale reservoirs with sufficient construction machinery including international assistance funded by JBIC and ADB, while more than 100 numbers of reservoirs are existed in Quang Ngai province.

(2) Principal policy-2: Securing safety of reservoirs

It is essential that requested reservoirs should be rehabilitated in safe, considering risk of beneficiaries under the reservoirs for both designing and construction planning, in view of increasing flood due to unusual weather caused by global warming.

(3) Principal policy-3: Adoption of Japanese primary consultant in the implementation structure of the project

In accordance with Guideline for GACE and in consideration of following conditions contained in the project, it is planned to make implementation structure of the Project with the employment of Japanese primary consultant.

(a) Each reservoir has different conditions in view of existing facilities, subsoil condition and design detail. Therefore, uniform design to all reservoirs would not be applied.

(b) All reservoirs are dispersed its location in the whole over Quang Ngai province. Independent supervisory teams will be required

(c) It is required to make integrate management structure for handling the matter of safety, quality, construction, schedule, contract and payment for whole reservoirs.

(d) This rehabilitation of reservoirs is aiming to recover on safe of reservoirs and it is important to conduct proper supervision on design and its supervision during construction. It would be desirable to use O/D Study Consultant firm as supervisory consultant in order to implement proper design monitoring and quality control and subsequently to achieve project target certainly

(4) Principal policy-4: Capacity building through Soft component

It is expected to strengthen capacity of personnel for water management, Water Users' Group (WUG) under Irrigation Management Company (IMC) and Agricultural Cooperative (AC) through Soft component during construction of 7 reservoirs by using Auto level meter, Rainfall gauge, Current meter, Handy speaker, Water leakage meter, and water level gauges which will be procured and installed under the Project. And also, a regulation of reservoir safety management will be prepared by IMC and AC in the Project by supporting Japanese consultant, since there is no registered rule at requested reservoir now.

2-2-1-2 Policy for Natural Conditions

Policy-1: The planning section of rehabilitation and material for filling shall be designed taking conditions of geology and soil mechanics for existing dam body and dam foundation into consideration.

Policy-2: The method of rehabilitation of access road shall be studied taking conditions of topography and effect by rainfall into consideration.

Policy-3: The construction schedule shall be planed taking conditions of rainy season and effect by typhoon into consideration.

(1) Policy-1: Planning section of rehabilitation and material for filling

Dam body and foundation of existing reservoir is consisted of the clay and silt based on the hard weathered granite, and the permeability of both is approximately shown in 10-4～10-5cm/s order. Therefore, existing dam body was constructed as homogeneous type which give functions of water stoppage by whole dam section, so that same dam type and equivalent material are adopted for the purpose of securing the safety of seepage (leakage) from dam body.

(2) Policy-2: Method of rehabilitation of access road

Traffic on existing access road usually becomes impassible in accordance with gully erosion on the steep portion of vertical alignment and submergence by rainfall in lowland portion. Therefore, the method of rehabilitation, especially pavement structure shall be designed taking topographic

condition and effect by rainfall into consideration.

(3) Policy-3: Planning of construction schedule

Rainy season in central Vietnam is October to December and often hit by typhoon in that term. Therefore, works on site in rainy season is mainly planned to continue stone and concrete work except embankment in downstream of reservoir body, spillway, main canal and access road as well as monitoring of leakage from completed embankment and treatment work on the problem portion.

2-2-1-3 General Policy for Designing

Policy-4: Adoption of Standard in Viet Nam

Much discrepancy was not found between Vietnamese standard and Japanese one, based on examination of three(3) reservoirs of which F/S done by local consultants, namely; "1.Thi Binh", "4.Mach Dieu" and "8.An Tho". It is, therefore, better adopt Vietnamese standard for detailed designing as well as construction planning for reservoirs in consideration with procedure of implementation approval issued by PPC later on.

2-2-1-4 Designed Policy for Rehabilitation of Reservoir

It is most important to keep the necessary reservoir capacity and to secure the safety of dam body, so that designed policy shall be mainly determined taking countermeasures for the seepage (leakage) and prevention of overtopping from dam body.

Policy-5: decision of appropriate effective reservoir capacity
Policy-6: decision of appropriate designed flood discharge
Policy-7: decision of appropriate dam height and freeboard
Policy-8: decision of rehabilitated dam type and section considering cost reduction and dam safety

(1) Policy-5: decision of appropriate effective reservoir capacity

Calculating available discharge in river as to probability of unexceedance is 75% (return period 1/4year), and effective reservoir capacity is designed by water balance calculation between required water for irrigation and available river discharge, however, in Japanese standard water balance calculation is conducted by return period 1/10year as to standard year (droughty water year). Herein, unit water requirement is approximately designed 1.7 l/s/ha according to Vietnam standard, and converting this value into water requirement rate, it becomes 0.011m/day (11mm/day) calculated by formula: $q=D\times 1000\ l/m^3\times 10{,}000m^2/86{,}400s/day/0.75$（q: unit water requirement=1.7 (l/s/ha), D: water requirement rate (m), 0.75: irrigation efficiency）, and then its result corresponds to the value on ordinary term in Japan (ill-drained paddy field: 10 mm/day, well-drained paddy field: 20 mm/day, depended on "the survey manual on land improvement project" in Japan). Therefore, it is judged to secure appropriate effective reservoir capacity due to adequate water balance calculation.

(2) Policy-6: decision of appropriate designed flood discharge

Designed flood discharge shall be decided taking probability of exceedance (return period) depended on the scale of reservoir into consideration. Generally in Japan, it is designed by rational formula based on the rainfall return period 1/200year: Q=1/3.6 x f x R x A, (Q: designed flood discharge (m^3/s), f: runoff coefficient, R: average effective rainfall (mm/hr), A: catchment area (km^2)), however, the formula in Vietnam standard is: Qp=f x Ap x Hp x A (f, A: same as mentioned before, Ap: flood crest module correlated with designed frequency, Hp: daily rainfall with designed frequency (mm/day)), and a part of Ap x Hp corresponds to 1/3.6 x R in rational formula. Daily rainfall and designed flood discharge on the probability for each reservoir are shown in Table 2-2, and those are judged adequate scale by following reasons;

- When daily rainfall with designed frequency (return period 1/200 year) is calculated based on the rainfall data of Mo Doc district in Quang Ngai province according to the Japanese method, the result shows 479.9mm/day. Daily rainfall with designed frequency by Vietnam standard is larger than the value mentioned before.
- Converted designed flood discharge by Vietnam standard into the specific discharge, figures of the discharge are ranged from 27 to 33 $m^3/s/km^2$, and they are similar to the larger value on the general range 20～30$m^3/s/km^2$ in Japanese specific discharge map.

Table 2-2 Probability of rainfall and flood discharge

Reservoir name	Provability P(%) (1/year)	Daily rainfall Hp (mm/day)	Designed flood discharge Qp (m^3/s)	Specific discharge ($m^3/s/km^2$)	Remarks
1. Tri Binh	1.5 (1/67)	484.0	117.75	24.3	Peak flood is cut by upstream Tra Son reservoir.
4. An Hoi	1.5 (1/67)	484.0	27.50	31.3	
5. Mach Dieu	1.5 (1/67)	538.9	117.79	33.2	
6. Hoc Mit	1.5 (1/67)	483.0	56.94	31.1	
8. An Tho	1.5 (1/67)	538.0	95.48	28.1	
9. Hoc Nghi	1.5 (1/67)	510.0	20.50	29.3	
10. Huan Phong	1.5 (1/67)	510.0	55.15	29.8	

(3) Policy-7: decision of appropriate dam height and freeboard

However freeboard is a little different in the regulation of both standard (Viet Nam standard refers to (a), and Japanese standard refers to (b) in below figure), both freeboards by Vietnam and Japan show the approximate value as shown in the following table and necessary freeboard at the flood time in spillway is secured in freeboard of dam body.

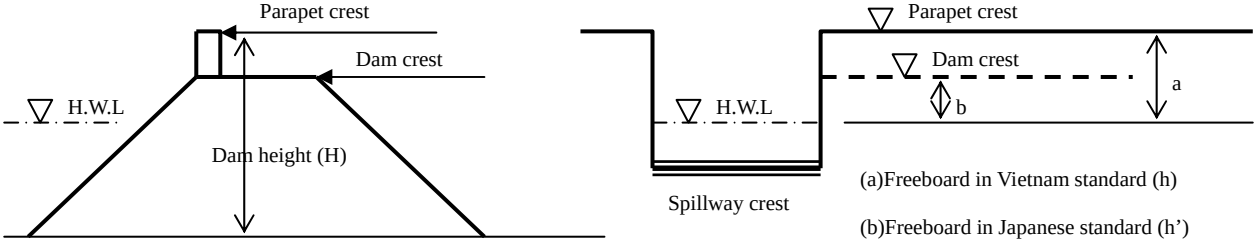


Figure 2-2 Examination of free board

Table 2-3 Examination of free board

Reservoir name	Dam height H(m)	Freeboard in Vietnam: h(m)	Freeboard in Japan: h'(m)	Remarks
1. Tri Binh	8.00	1.47	1.40	Without parapet
4. An Hoi	10.00	1.48	1.50	Without parapet
5. Mach Dieu	12.75	1.58	1.64	
6. Hoc Mit	9.95	1.30	1.50	
8.An Tho	12.30	2.40	1.62	
9. Hoc Nghi	12.25	1.50	1.61	
10. Huan Phong	13.80	1.80	1.69	

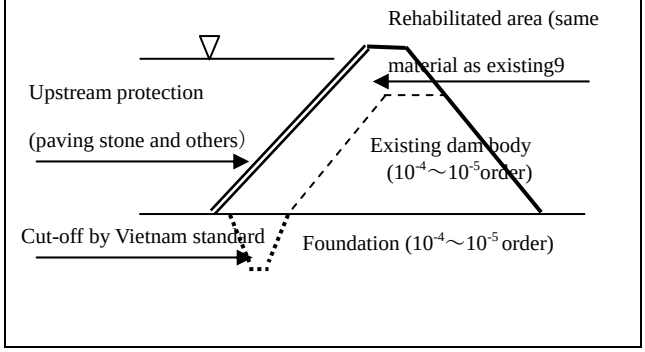
Remark: formula in Japanese standard is h'=0.05xH+1.0（wave run-up height is less than 1.0m）

(4) Policy-8: Decision of rehabilitation dam type and section considering cost reduction and dam safety

Rehabilitated dam type shall be designed by homogeneous type which is most economical according to the following reasons, and the method of levee widening for the upstream or downstream shall be decided taking topographic and geological conditions on site into consideration (Refer to Table 2-4).

1) Existing reservoir is consisted of homogeneous type.
2) Permeability of existing and rehabilitated filling material is shown in 10^{-4}～10^{-5}cm/s order.
3) Enough quantity of filling material for rehabilitation is ensured from borrow area near dam site.

Table 2-4 Dam type to be rehabilitated

General reservoirs (homogeneous type)


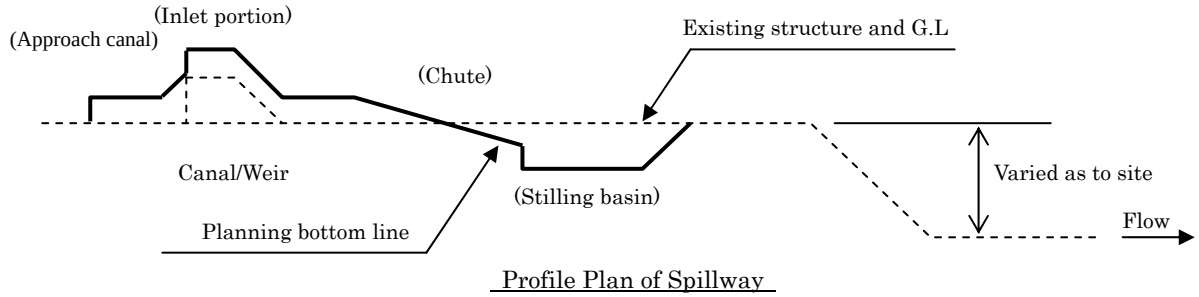
2-2-1-5 Rehabilitation of Spillway

Policy-9: Appropriate component, style and structure in spillway

As to secure the function of leading smooth flood flow and dissipating the energy of flood water, the component, style and structure in spillway is designed as Table 2-5 taking the surrounding topographic and geological conditions and linkage of downstream river into consideration.

Table 2-5 Spillway type

Component	Inlet portion	Chute	Stilling basin
Style	Canal/Weir type (rehabilitated existing, RC structure)	Straight chute (new one, RC structure)	Hydraulic jump (new one, RC structure)



Profile Plan of Spillway

2-2-1-6 Rehabilitation of Intake

Policy-10: appropriate style and structure of intake

Existing intake facility consists of intake tower or inclined type, however each portion of intake is designed as follows;

a) Inlet: installed below L.W.L as to canal type
   - It is not necessary to divert surface water in reservoir because of its high temperature.
   - Its structure is compact and economical compared with other type.

b) Conduit: installed steel pipe covered with reinforced concrete and control valve in outlet
   - Steel pipe is adopted to prevent leakage from pipe due to considering leakage from existing pipe, and covered with reinforced concrete taking the prevention from rust of steel pipe and the protection from outer force into consideration.
   - There is not any valve in existing intake, however appropriation and efficiency of water management in future will be planed to control diversion quantity by the valve in outlet.

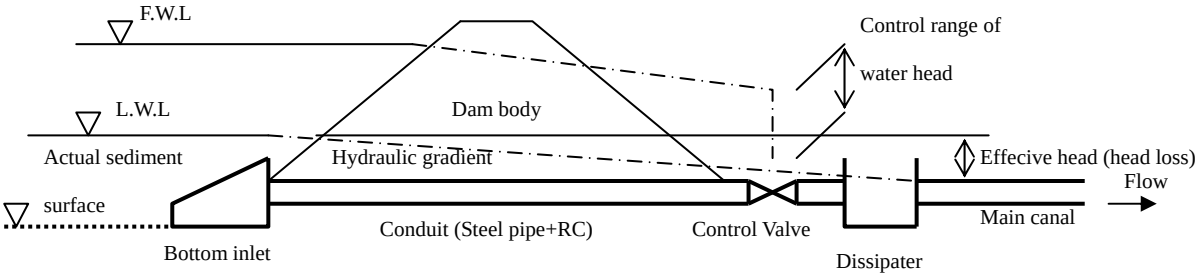


Figure 2-3 Intake type

2-2-1-7 Irrigation, Water and Reservoir Management

Policy-11: To secure the storage capacity of a reservoir for irrigating two paddy cropping systems

Policy-12: To use the reservoir water properly for irrigation

Policy-13: To enhance the technical capacity of AC/WUG staffs in charge of operation and maintenance of irrigation facilities

Policy-14: To improve the managing capacity of AC/WUG organization

Policy-15: To execute the safety management of a reservoir based on regulations at a normal and a flood time

(1) Policy-11: To secure the storage capacity of a reservoir for irrigating two paddy cropping systems

Two paddy cropping systems such as winter-spring and summer-autumn paddies are prevailing over the project area. Though irrigation water for winter-spring paddy crop is supplied enough from the reservoir, summer-autumn paddy crop is always facing the shortage of irrigation water due to the insufficient storage of the reservoir. It is necessary to supply the stable water for the summer-autumn paddy crop through the rehabilitating reservoir securing the sufficient storage capacity by heightening the dam body.

(2) Policy-12: To use the reservoir water properly for irrigation

Overall systems covering from head works to farm fields should be so improved as to use the reservoir water properly for irrigation, getting rid of traditional management based upon experience and scent. A type of intake facility shall be improved to a valve-type from an existing inclined or a tower type in order to operate and manage intake -discharge simply and easily. The intake facility is provided at just downstream of the dam body. In addition, the whole main canals should be rehabilitated to concrete structures from earth for mitigating the conveyance losses of irrigation water.

(3) Policy-13: To enhance the capacity of technical AC/WUG staffs in charge of operation and management of irrigation facilities

Most of the AC/WUG staffs have not sufficient technical knowledge for irrigation and hydraulics and have not been trained by IMC or other related agencies. Before and after rehabilitating reservoirs, it is necessary to train AC/WUG staffs in term of irrigation technology, optimum water management and improvement of operation and maintenance systems.

(4) Policy-14: To improve the managing capacity of AC/WUG organization

Every year, AC/WUG collects the water fees from farmers, but expenditures for operation and maintenance of irrigation facilities are different from and consist with each AC. In this connection, AC requires optimum improvement in term of financial management and allocation of water fees to operation and maintenance.

(5) Policy-15: To establish safety management of a reservoir at a normal and a flood time

Operation and maintenance of small scaled reservoirs has been mostly carried out by AC staffs depending upon their experience. Each reservoir has no specific reservoir management regulations, equipment and operation records. At the time of a flood, information on reservoir conditions has been

mostly reported to CPC by mouth. Therefore, it is necessary to establish regulations on safety management of a reservoir at normal and at flood times.

During the implementation of this Project, such regulations will be by the members of the working group. That group is composed of relevant reservoir management agencies such as DARD, IMC, WUG, CPC and Flood Protection Committee in cooperation with a Japanese Consultant assigned for the soft component assistance. Data collection and analysis on factors leading collapse of a reservoir shall be made before preparation of reservoir regulations. Contents of regulations are better to be expressed by simple and understandable sentences that will be easily accepted by WUG in charge of safety management of a reservoir.

It is important to modify and develop those regulations through actual implementation at each reservoir site and to establish them as a model of other small scaled reservoirs.

2-2-1-8 Main Irrigation Canal

Policy-16: Basic concept of the irrigation plan is to supply stable irrigation water to the existing farmland in order to enable all farmers to irrigate the two paddy cropping systems at each reservoir area. The reservoir capacity, the irrigable area (proposed area) and main canal capacities will be finally determined, based on water balance studies between inflow amount into a reservoir and outflow amount to an irrigation area, the irrigable area. The design policy on the main irrigation canal is as followings;

(1) Proposed irrigation water requirements mean the irrigation water amount required for two paddy cropping systems, for instance, winter-spring and summer-autumn paddies.
(2) Computation of water requirements is accorded with Vietnam design criteria. Crop water requirements are obtained from crop consumption and effective rainfall in a drought year with 75% probability.
(3) All main irrigation canals are rehabilitated with concrete structures to mitigate a leakage through a canal and to improve the water conveyance efficiency. 75% of the irrigation efficiency is applied for computation of main canal capacity, considering 90% of conveyance efficiency and 85% of canal efficiency based on FAO criteria.
(4) Main irrigation canals are rehabilitated by the Project. The concrete structures will be provided for a part of degraded concrete canals, earth canals, and new canals. The following table shows the proposed length of main canals with concrete structures.
(5) New main canals will be provided to the rain fed areas so as to expand the irrigation areas. Turnout structures with gates will be constructed along the main canals and irrigation water is distributed to the field. Distribution of irrigation water should be impartially carried out over the whole area.
(6) The concept of rehabilitation works for main canals is to construct the concrete canals over the whole route according to the following comparison studies (Refer to Table 2-6).

Table 2-6 Comparison between earth canal and concrete canal

Item	Earth Canal		Concrete Canal	
1.Economic view	The cost of rehabilitation works will be cheaper than that of the concrete.	A	The cost of concrete canals will be 50% higher than the earth.	C
2.Workability	The main rehabilitation works is mainly concentrated on reshaping the side slope of canals.	B	Many works such as excavation, concrete placing, refilling is required.	C
3.Conveyance Efficiency	65%	C	90%	A
4.Operation and maintenance	The maintenance cost will be higher than the concrete in connection with risks of collapse, reshaping, mowing, cleaning (74,000VND/m)	C	The canal structure is stable against flood flow. The cost of normal maintenance and repairs will be 1/4 of that of an earth canal. (18,000VND/m)	A
5.Situation of other projects and farmer's needs	Most of secondary and tertiary canals are constructed by earth, excluding main canals.	C	Main canals are constructed by concrete in case of JBIC, ADB and Vietnamese Government projects. Farmers are desiring to change to concrete from earth due to habitual damages by flooding.	B
6.Others	The project aims to develop human resources of beneficiaries and to enhance their ownership through implementing a soft component plan in term of water management. The concrete canal is expected to bear more effects to carry out the proper water distribution.			
Overall evaluation	B		A	

Remarks; A: Better B: Good, C: Fair

2-2-1-9 Rehabilitation Policy of Access Road

Policy-17: Application of pavement method based on the consideration for economical efficiency, durability and socio-economical influence according to each construction location

Designing the access roads shall be done based on the Vietnamese road design standard where specifications of the road shall be decided according to the road grade. The pavement method to be applied, shall be chosen from 1)asphalt pavement or 2)concrete pavement. Concrete pavement is applied based on Table 2-7 in economic efficiency and durability.

Table 2-7 Comparison between asphalt pavement and concrete pavement

Item	Asphalt pavement		Concrete pavement	
Construction cost	Cheaper than concrete （approximately 766,000 VND/m）	A	expensive by about 35 % (approximately 1,040,000 VND/m）	C
Maintenance and rehabilitation	Routine and periodic maintenance is needed in 5 years after completion, and rehabilitation in 10 years.	C	Maintenance works are scarcely needed during its durable period of approximately 20 years.	A
Durability	It is not rare for the base and subgrade to be washed out by the rain/flood water seeping from a deteriorated portion of pavement.	C	The water tightness of the pavement surface scarcely changes during its durable period so that a large scale deterioration of road rarely occurs.	A
Annual maintenance cost	68,000 VND/m	C	21,000 VND/m	A
Regional conditions	Maintenance works of the roads through the village area are done by the community concerned. People in the community request the concrete pavement with less maintenance expenses and works.			
Overall Evaluation	C		A	

Remarks; A: Better B: Good, C: Fair

Typical cross-section of the road applied on the cutting portion is as shown in Figure 2-4.

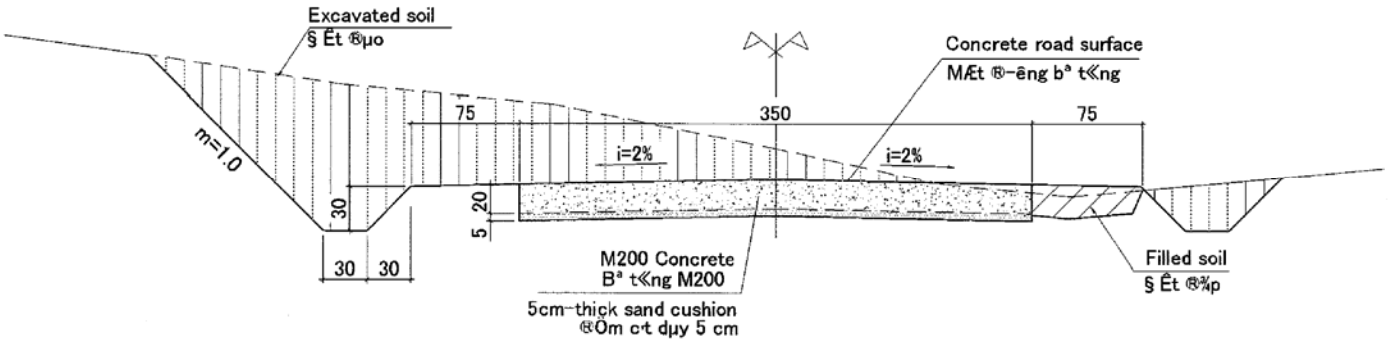


Figure 2-4 Typical cross-section of Access road

2-2-1-10 Rehabilitation of Maintenance Facilities of Reservoir

The purpose of maintenance facility in reservoir is mainly safety management in case of flood and dangerous condition of dam body and water management for linkage between intake and canal, therefore necessary function shall be adapted to the maintenance facility in rehabilitation.

Policy-18: Decision of appropriate scale for the maintenance house
Policy-19: Linkage for the Project for Building Disaster Resilient Societies (DRSC) by JICA
Policy-20: Adoption of leakage monitoring facility to manage safety of dam body
Policy-21: Installation of water gauge in reservoir to grasp supply water from intake
Policy-22: Installation of water gauge in canal for the water management

(1) Policy-18: Decision of appropriate scale for the Operation and Maintenance (O&M) house

The scale and function of maintenance house is designed as Table 2-8 taking ordinary and extraordinary management for reservoir and canal into consideration. Furthermore, maintenance house ought to be constructed for new or rehabilitated reservoir under the regulation in Viet Nam.

Table 2-8 Usage purpose of O&M house

Room area	Usage person	Purpose
(a) Operation room (12 m^2) (e) Toilet (4.5 m^2)	IMC, WUG, AC, CPC, SBFSCR PMB(DARD)	1) Management of dam body (mowing, monitoring of leakage and deformation, others) 2) Recoding water level in reservoir and rainfall 3) Control of outlet valve in intake facility 4) Meeting of cropping plan and water management 5) Collection activity for water usage fee 6) Operation and meeting for reservoir regulation 7) Management of spillway 8) Monitoring and patrol at the flood time
(b) Rest room (9 m^2) (d) Kitchen (7.5 m^2)	IMC or WUG 2persons	24 hours monitoring in rainy season and typhoon season
(c) Ware house (9 m^2)	Equipment: 1)out level, 2)velocity meter, 3)handy speaker for the warning of flood time and dangerous condition of dam body), 4)maintenance manual for reservoir, 5)record of water level and rainfall	

SBFSCR: Steering Board for Flood and Storm Control for Reservoir

(2) Policy-19: Linkage with DRSC by JICA

In accordance with the request from DRSC (Project for Building Disaster Resilient Societies in Central Region in Vietnam), it shall be designed to add the meeting room by 15 m2 around in "6.Hoc Mit" reservoir for the purpose of following matters.

Usage parsons: 1)Steering Board for Flood and Storm Control for Reservoir: SBFSCR, 2)Ward Union, 3)farmers associations, 4)young and old generation associations, 5)Father-land Committee, 6)CPC members, 7)police, and others, approximately 15 parsons

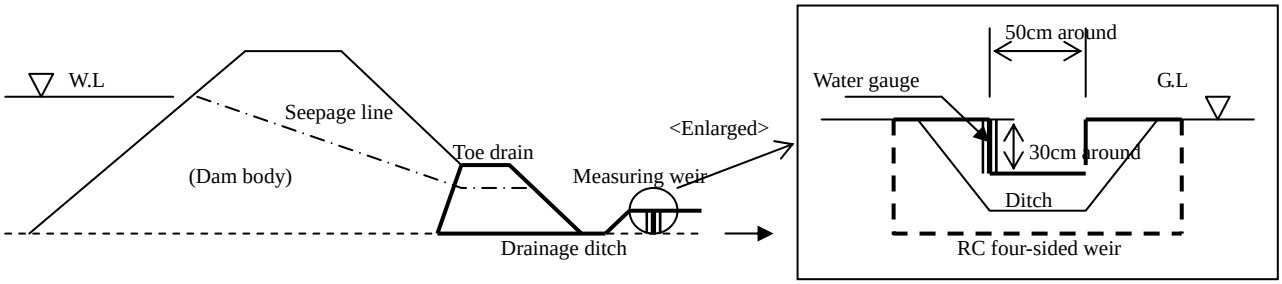
Purpose: 1) meeting of the evacuation structure in rainy season and typhoon season: disaster prevention, rescue work, evacuation route, transmission method, and others, 2) appraisal meeting after emergency affairs, 3) upgrade of evacuation structure

Usage period: Rainy season (September to December), typhoon season, dry season (appraisal)

(3) Policy 20: Adoption of leakage monitoring facility to manage safety of dam body

The purpose of monitoring leakage from dam body and foundation shall be contributed to manage the safety of dam body, because the violent fluctuation of leakage without rainfall and abnormal relation with water level in reservoir shall inform the unusual dangerous conditions of dam body. Therefore, it is necessary to keep long term data by easy measuring system of leakage.

Meanwhile, it shall be designed to fill up the toe drain under the rehabilitation of dam body, so that it shall be adopted to install the four-sided weir made of concrete (thickness is 15cm around) with water gauge on the side in the drainage ditch downstream of toe drain (refer to Figure 2-5).



Leakage monitoring system Concept figure

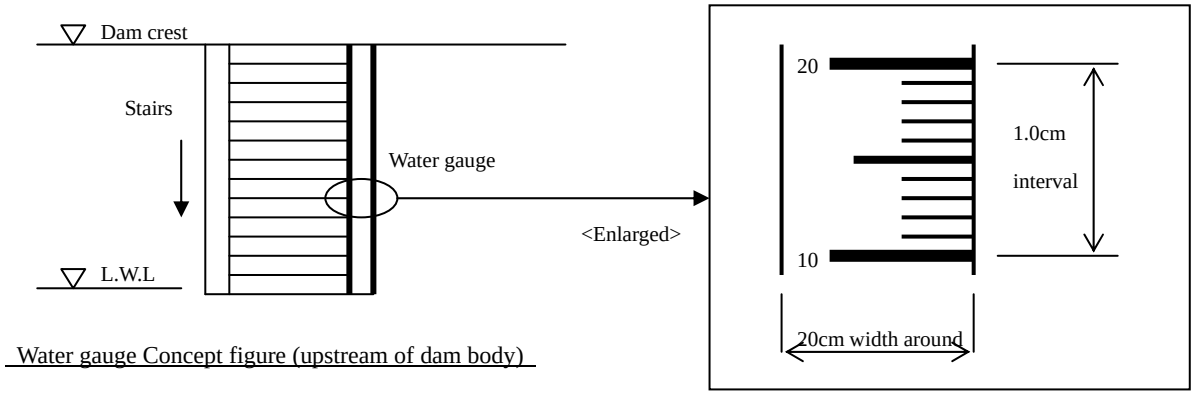
Figure 2-5 Leakage monitoring facility

(4) Policy-21: Installation of water level gauge in reservoir to grasp supply water from intake

When the discharge from Intake is controlled, it is necessary to operate the open ratio of discharge valve (outlet valve). Therefore, it is very important to grasp water level in reservoir to operate discharge valve considering relation between water head and open ratio of the valve. Herein, it shall be designed to install water gauge made of steel according to the following reasons.

- It is troublesome to use mechanical and electric facilities taking breakdown and replacement of it in the future into consideration.
- It is sufficient to improve the water management even by reading of water gauge (it is supposed to be enough to read CM unit in water level).

Water level gauge mentioned above shall be attached on the surface of concrete wall in stairs of upstream slope of dam body. In addition, water gauge shall be installed on the side wall of inlet in spillway, which is on the purpose to grasp overflow discharge from spillway to make useful for the maintenance of the reservoir and issuing the flood warning to the people living in downstream. The structure shall be made of steel same as the above gauge in reservoir.



Water gauge Concept figure (upstream of dam body)

Figure 2-6 Water level gauge

(5) Policy-22: Installation of water gauge in canal for the water management

Water gauge shall be installed on the purpose to grasp discharge in the canal and to divide the water suitably on the division works of canal. Therefore, the location of water gauge shall be decided to consider the whole canal system. E.g. just after outlet of intake in reservoir, middle portion of main canal, before main division works and others.

The structure of water gauge shall be made of the steel with CM unit scale same as water gauge in reservoir, and installed on the side wall in the canal.

2-2-1-11 Policy for Construction and Procurement

Policy-23: Detailed design was conducted by local consultants under the Outline Design of GACE and also as it was found that proper quality and sufficient work force could be available in the market, it is planned to procure necessary work forces such as labors, materials and equipments for the construction locally in Viet Nam but not from Japan and third countries.

2-2-1-12 Policy of Utilization of Local Supervisory Consultants

Policy-24: Utilization of local supervisory consultants under Japanese primary consultant.

In Quang Ngai province, tender documents of about 50% of reservoir projects are usually prepared by DARD /PMB (Project Management Board) and DARD /PMB used to supervise the projects directly. As one of their roles, DARD /PMB are obliged to supervise the projects and usually conduct the supervision job right in their office, far from the project site. In case no sufficient supervisory teams available in the office, then DARD /PMB would employ local consultants to do the supervision of the projects. Main role of local consultants in such supervision is to inspect and supervise the quality of the works and DARD/PMB usually act to monitor the progress, contract and payment of the projects. In the implementation of the project under the scheme of GACE of Japan, it might be difficult for local supervisory consultants to undertake the total project management of progress, quality, contract and payment from the Agent. It is proposed to employ Japanese primary consultant to undertake the supervision of the total project management.

Policy-25: It is required to use English version of Tender and Contract documents formally, but Vietnamese version of these documents will be used as the reference.

Many local contractors and consultants are having less experience in undertaking the reservoir construction projects with contract document in English version. It might be less encouraged for local contractors to participate the tender if only English version of tender document is available. Therefore in order to utilize local contractors and consultants effectively, it is proposed to allow issuing Vietnamese version of tender document only as the reference together with English version which shall be formal documents in the tender and the contract. And also the arrangement of translator/interpreter for the project management will be recommended.

2-2-1-13 Policy of Utilization of Local Contractors

Policy-26: Tender will call for whole possible contractors in Viet Nam

Scope of the project consists of the construction of reservoir dam, intake facilities, spillway, main canal and access road, etc. The contractors will be required to have similar experience of construction. Cost of the proposed reservoir is between 500,000 USD and 1,200,000 USD per one lot (one reservoir). According to the market survey, there are certain numbers of contractors who had experiences in construction of reservoir in Quang Ngai province and it was informed that more than 5 contractors in neighbor provinces. The project of irrigation in the south of Vietnam (Phan Ri Phan

Thiet) funded by JBIC has nearly 21 lots of package and construction cost of one lot is between 600,000 USD and 6,000,000 USD and there were many participants of Tender from whole of Vietnam.

2-2-1-14 Planning Policy on Quality Requirement of Proposed Facilities and Equipment

Policy-27: Quality management of the work during construction stage in accordance with Vietnamese standards

During the survey of rehabilitated reservoirs, leakage of water from construction joint of concrete structure and deterioration, erosion and digging of access road surface were observed. In this project, it will be required to improve such situation with the provision of proper supervision in the construction stage.

2-2-1-15 Policy of Implementation Schedule

Policy-28: Standard construction procedure is prepared in consideration of actual experiences of reservoir construction in the past.

Following consideration was made;

1) In this region, it is not practicable to carry out the soil filling work in dam construction during the rainy season (October - December) and it is practicable in the dry season (February - August).
2) Only one crop is required to stop due to disruption of irrigation water supply which is required for the construction of proposed rehabilitation.
3) Other period except the above disruption, it is required to supply irrigation water for farming as usual.
4) Function of spillway (discharging flood water) is maintained during whole construction period.
5) The references are made to similar reservoir rehabilitation project in the consideration of assessment of local contractor capability.

Policy-29: Dam and Intake rehabilitation work will be carried out during disruption of irrigation water supply by providing temporary coffer dam and temporary canal diversion.

Standard construction procedure is shown in Figure 2-7.

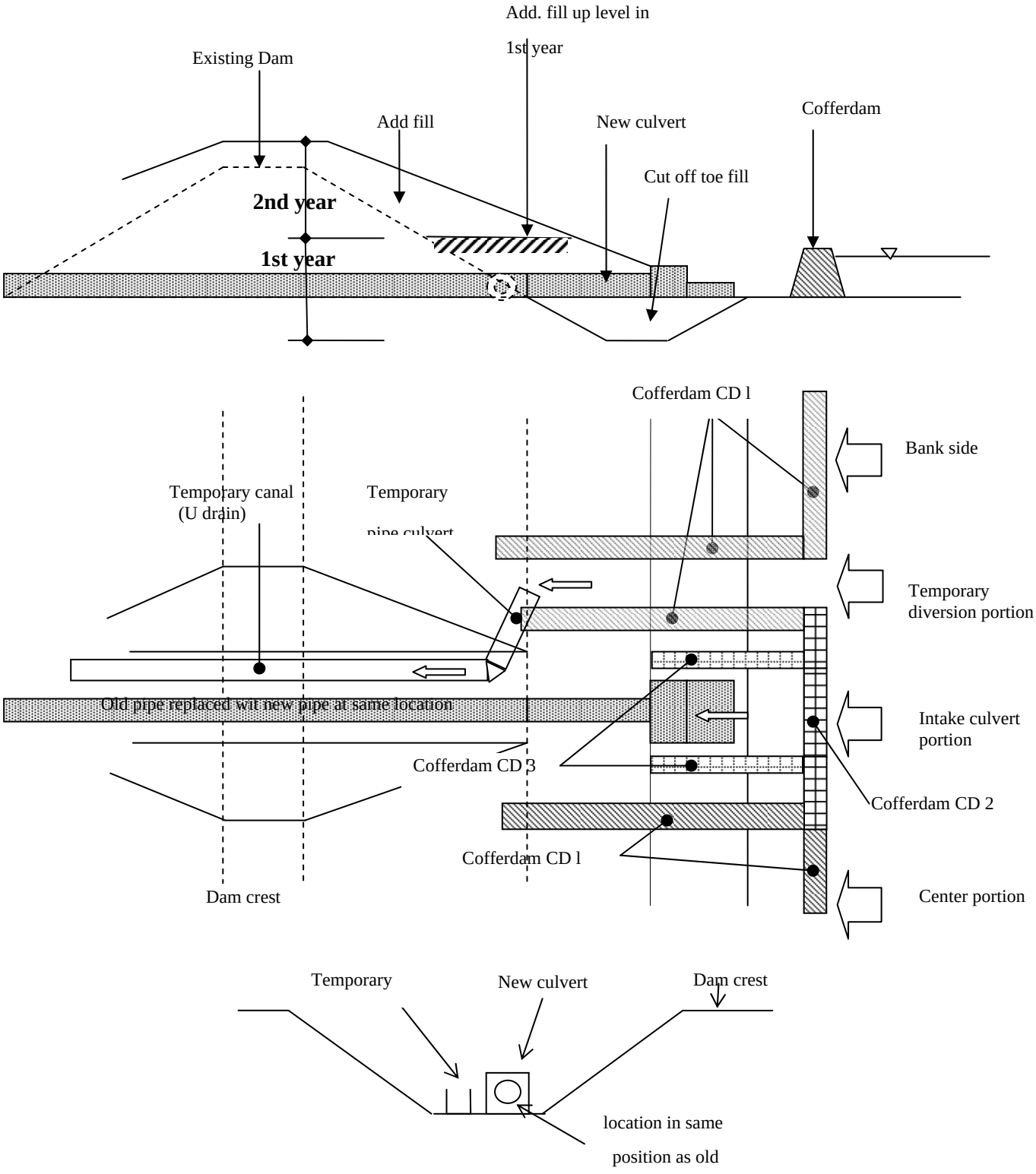


Figure 2-7 Coffer dam and temporary diversion canal

(1) 1 st year (June-August)

1) Intake culvert and US add. filling and cut off toe filling is expected to carry out within Summer-Autumn crop time so that interruption of farming will be limited only in June to August of 1st year.
2) Back filling of dam body up to old crest and add. filling up to the level where it could allow to store the volume of required pond water for 2nd year summer-autumn crop.

(2) 2 nd Year (June-August)

1) Remaining works (US add. filling and slope protection) will be constructed in June-August of 2nd year.
2) It is expected works will be carried out above the pond water level and without interruption to the farming of Summer-Autumn crop.
3) Construction procedure shown in Figure 2-8 will be applied to the reservoirs where larger volume of additional dam earth filling at upstream are expected. Other reservoirs which are having smaller volume will be completed whole works in 1st year.

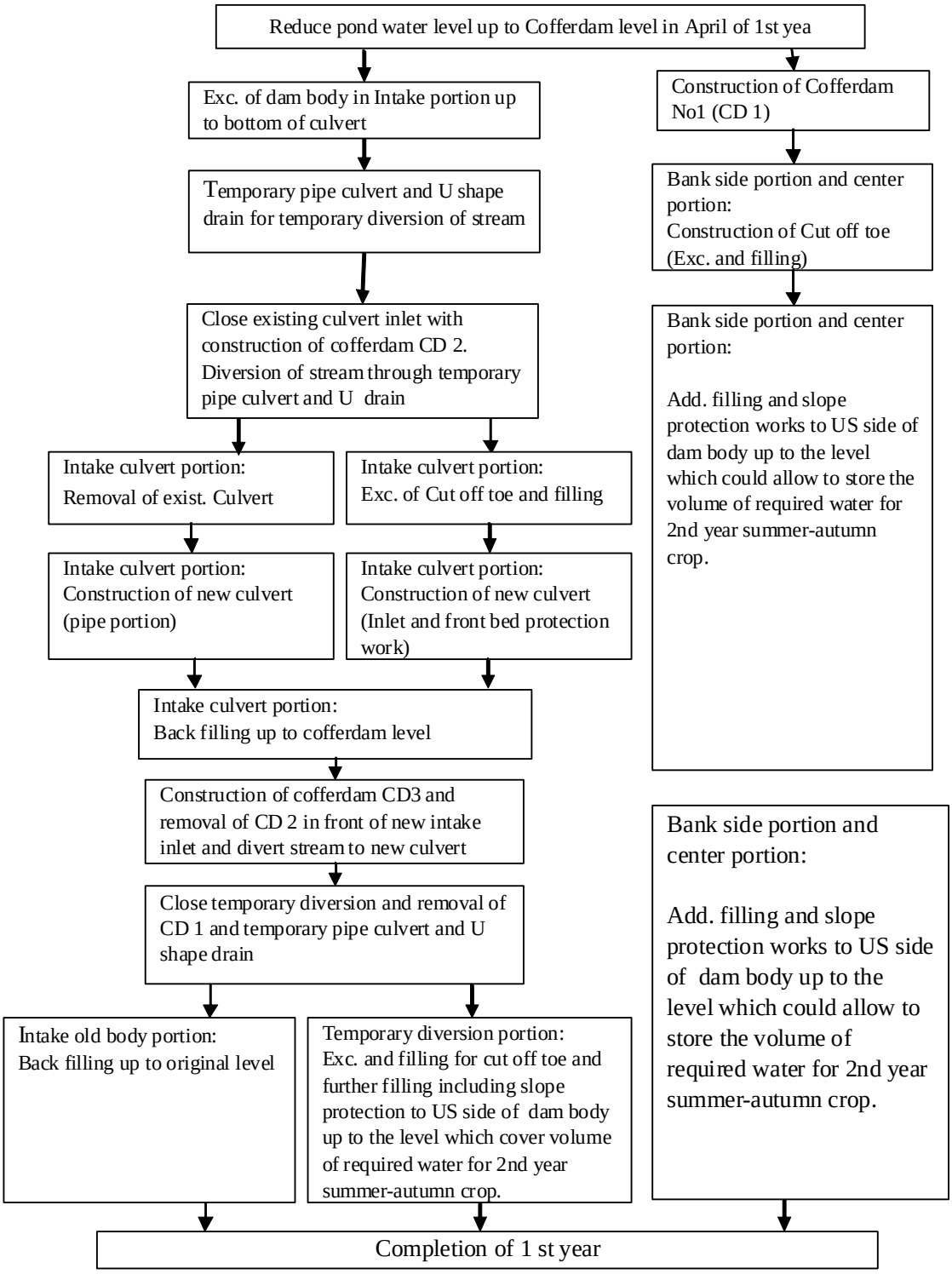


Figure 2-8 Flow of works for Coffer dam and Temporary diversion canal

Policy-30: Based on Standard construction procedure above, following Standard construction time schedule was planned. Refer to Standard construction time schedule as Figure 2-9.

	Month	1	2	3	4	5	6	7	8	9	10	11	12
Year 2010													
	CA/EN/GA/AA												
	Procurement of SV consultant and Contractor												
	Project design document approved by PPC												
	Land acquisition by DARD (3 months)												
First year (2011)		Winter-Spring, 1st Crop					Summer-Autumn 2nd Crop						
						15/Apr :Pond water wash out start (15 days)							
	Contract												
	Preparation/Temporary access road												
	Cofferdam construction												
	Intake												
	US Dam embankment, cut off toe and slope protection (1st stage)												
	DS Dam embankment, and slope protection (1st stage)												
	Spillway (Lower portion than existing crest level)												
	Permanent Access road (Sub-str. and sub-base course etc)												
	Chanal												
	OM house												
Second year (2012)													
	US Dam embankment and slope protection (2nd stage)												
	DS Dam embankment and slope protection a												
	Spillway (Lower portion and Crest portion)												
	Permanent Access road (surface course etc)												

Figure 2-9 Standard time schedule for construction

Based on standard construction time schedule above, the time schedule of each reservoir was discussed with DARD/PMB and concluded as attached.

Below basic mile stone activities shall be observed;

1. The contract of supervisory consultants shall be made in by August of , 2010 and the construction contractors shall be concluded by January of 1st year (2011)
2. To commence preparation works in January of 1st year (2011) and temporary access work subsequently.
3. All land acquisition shall be completed before January of 1st year (2011).
4. For the control of reservoir water, it shall be determined and conducted such as lowering water level up to below cofferdam level by end April of 1st year (2011) and allowing to interrupt the supply of irrigation water to the firm during April to September of 1st year 2011.

2-2-1-16 Policy of Preparation of Tender Documents

Policy-31: Tender documents for the project will be prepared based on the Standard Tender document that is usually used in the projects of DARD/PBM and AUSAID project in Vietnam after making necessary modification to put it in accordance with Guideline of GACE of Japan.

Policy-32: As the reference documents in tendering, proposed BOQ will be required to submit.

The Bidders will be required to submit the proposed BOQ based on the proposed work item, quantity, unit rate and amount which the Bidders studied and priced for tender lump sum amount based on the requirements of tender documents. Bidding document with no submission of proposed BOQ will be considered invalid.

Proposed BOQ will be utilized for the following purpose.

Community Empowerment Grant of Japan will allow to make only lump sum contract with the contractor. No re-measurement of contract amount for the works defined and agreed in accordance with the work requirement that is stated in the contract document shall be carried out, but the proposed BOQ will be referred to in the case of following events.

1) In case of evaluating the works done of intermediate progress, if necessary.
2) In case of evaluating the amount of works done of intermediate progress for the payment to the contractor.
3) In case of evaluating the amount of any variation of contract works

Policy-33: Indication of clear scope of role during defects liability period among stake holders in the construction contract

In accordance with the Guideline of GACE of Japan, it will be clarified of scope of role during defects liability period among stake holders in the construction contract as below Table 2-9, which will be defined in the construction contract document.

Table 2-9 Scope of role during defects liability period among stake holders in the construction contract

	PPC/DARD	Agent	Primary Consultant	Contactor
On Completion of Contract	To inspect completed works and take over the works	After PPC/DARD acceptance of the works and taking over, to issue completion certificate and retain retention bond (money) for Defects liability	After inspection of completion of works, to approve the completion of works and recommend Agent to issue completion certificate	After inspection of completion of works, to request issuing completion certificate to Agent and deposit retention bond (money) for Defects liability to Agent
During Defects liability period	To operate facilities and issue notice if any defects observed to the Contractor and to confirm on remedy of defects	After receiving defects notices from PPC/DARD, to provide advises to PPC/DARD if necessary	No role	After receiving defects notices from PPC/DARD, to remedy the defects under the supervision of DARD
On Completion of Defects liability period	After having inspection of completion of defects liability among PPC/DARD, Agent and Primary consultant, to issue certificate of completion of defect liability to	After having inspection of completion of defects liability among PPC/DARD, Agent and Primary consultant, to issue certificate of completion of defect liability to Contractor and to return retention bond (money) for Defects liability to Contractor	After having inspection of completion of defects liability among PPC/DARD, Agent and Primary consultant, to issue the recommendation of completion of defect liability to Agent.	After remedying the defects during Defects liability period and having inspection of completion of defects liability among PPC/DARD, Agent and Primary consultant, to issue the notice of completion of defect liability to Agent.

2-2-2 Basic Plan

2-2-2-1 Overall Plan

Outline of requested Japanese assistance is show in Table 2-10.

Table 2-10 Outline of requested Japanese Assistance

Reservoir name	Reservoir					Irrigation		Access road	Equipment (each reservoir)
	Effective capacity ('000m^3)	Length (m)	Height (m)	Flood discharge (m^3)	Control house Area (m^2)	Irrigation area (ha)	Main canal (m)	(m)	
1.Tri Binh	284	310	8.0	117.5	42	90	2,511	163	Auto level(1), Rainfall gauge(1), Current meter (1), Handy speaker(2), Reservoir water level gauge(2), Canal water level gauge (2), Water leakage device (1)
4.An Hoi	449	235	10.0	27.5	42	40	879	195	
5.Mach Dieu	2,177	656	12.8	118.8	42	270	3,847	748	
6.Hoc Mit	580	699	9.9	51.7	57	70	1,703	416	
8.An Tho	2,390	276	12.3	95.5	42	161	3,691	487	
9.Hoc Nghi	311	230	12.3	20.5	42	50	2,630	2,407	
10.Huan Phong	1,829	435	13.8	55.2	42	165	3,184	3,363	
Total						846	18,445	7,779	

2-2-2-2 Adoption of Vietnamese standard

As to mention in the designed policy, the safety of facility and structure is sufficiently secured to be designed by local standard on the basis of results of inspection between Vietnam standard and Japanese standard. In addition, quality control is no problem to adapt Vietnam standard, because important standard for quality control is almost equivalent to Japanese standard for example, spreading depth is 30cm, compaction ratio of embankment is larger than equal 95%, standard strength of reinforced concrete is 200 kgf/cm^2 and others.

Therefore, herein after design and quality control for the construction shall be in accordance with Vietnam standard not Japanese standard.

2-2-2-3 Irrigation Water and Reservoir Management Plan

After completing the rehabilitation works of the Project, IMC and AC will be in charge of the operation and maintenance for reservoirs, spillways, intake facilities, main canal and secondary canals. The reservoirs rehabilitated by the Project are going to manage according to the newly established "Reservoir Regulations". In case of "8.An Tho reservoir", IMC has been managing irrigation facilities based on the current irrigation and water management systems, therefore, will be better to follow this systems after rehabilitating the facilities. Principally, new reservoir regulations will not be provided.

(1) Irrigation and water management

At first, AC will establish the seasonal water supply plan for beneficiaries, taking into

consideration the needs of beneficiaries, current storage amount of a reservoir and information of expected rainfalls. Based on the supply plan, valves installed at the intake will be so operated as to deliver the proper water to main canals. The water distribution to secondary and tertiary canals through main canals will be carried out according to the habitual water use by AC/WUG staffs. At the time of drought, AC should secure supplemental water resources such as ponds and wells and recommend farmers to perform water-saving irrigation, changing paddy to upland crops, depending upon discussions with beneficiaries.

(2) Reservoir Management

(a) Normal Time

- Leakage checking
- Disposal of sediment
- Protection of slope on the periphery of reservoir
- Treatment of driftwood and litter
- Environmental investigation on the periphery of reservoir
- Greening measures for bare land

(b) Flood Time

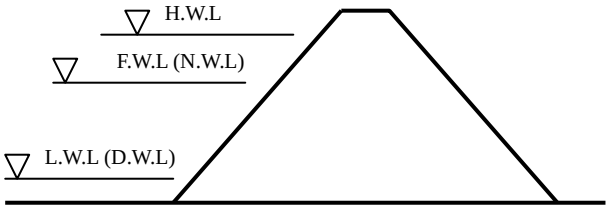
- To collect information on climate and river flooding discharge and to observe rainfall amount by the rain gauge installed at each reservoir
- To forecast the rising of the reservoir water level and runoff discharge in downstream of reservoir and to inform CPC, SBFSCR, AC, IMC.
- To check the spillway and intake before operating so as to take necessary measures to operate
- Based on patrolling around the reservoir, persons in charge of reservoir management shall inform the related agencies as soon as possible if unexpected things happened.
- To manage the reservoir operation and its records.

2-2-2-4 Plan of Facilities

2-2-2-4-1 Dam Body Planning

(1) Features of reservoir

Capacity and surface water area of each reservoir are based on dam height – storage volume (Z-V) curve & dam height – water area (Z-F) curve made by results of topographic survey. The definition of each design water level is as follows;



- L.W.L (D.W.L): minimum useful water level in reservoir during non-flood season, which is same elevation as useful water level at upstream of intake.
- F.W.L (N.W.L): maximum useful water level in

reservoir during non-flood season, which is same elevation as crest of weir or canal bottom at spillway.

- H.W.L: designed flood water level (overflowing from spillway in reservoir), which is same as water level in spillway-inlet for the designed discharge ((H.W.L=F.W.L+Ds: designed water depth in spillway).

Table 2-11 Dimension of each reservoir

Reservoir name	L.W.L (m)	Dead-capacity(m^3)	F.W.L (m)	Effective-capacity(m^3)	Gross-capacity(m^3)	H.W.L (m)	Ds: Water depth in spillway (m)
1.Tri Binh	5.70	118,355	7.70	284,283	402,638	9.53	1.83
4.An Hoi	21.70	13,860	27.96	448,500	462,360	28.92	0.96
5.Mach Dieu	19.35	97,270	26.69	2,177,080	2,274,350	28.17	1.48
6.Hoc Mit	22.50	70,000	28.20	580,000	650,000	29.10	0.90
8.An Tho	20.30	300,000	27.30	2,390,000	2,690,000	28.40	1.10
9.Hoc Nghi	23.80	6,570	30.10	310,900	317,470	31.00	0.90
10.Huan Phong	25.30	69,950	33.50	1,829,250	1,899,200	34.50	1.00

(2) Designed flood discharge

The parameters of hydrology according to dam grade and results of calculation for each reservoir are shown in Table 2-12.

Table 2-12 Flood discharge of each reservoir

Designed flood discharge: $Qp=Ap.\varphi.Hp.F.\delta$ (m^3/s)

Where,
- P: provability of flood based on frequency
- Ap: flood crest module correlated with design frequency
- φ: flood flow coefficient
- Hp: daily rainfall based on design frequency (mm/day)
- F: catchment area (km^2)
- δ: regulation coefficient of ponds in valley (δ=1.0, constant)

Reservoir name	P (%) (1/year)	Ap	φ	Hp (mm/day)	F (km^2)	Qp (m^3/s)	Specific discharge Qp/F ($m^3/s/ km^2$)
1.Tri Binh	1.5 (1/67)	0.0516	0.95	484	3.69 (4.84)	87.50 (117.75)	23.7 (24.3)
4.An Hoi	1.5 (1/67)	0.0690	0.95	484	0.88	27.50	31.3
5.Mach Dieu	1.5 (1/67)	0.0687	0.90	538	3.55	117.79	33.2
6.Hoc Mit	1.5 (1/67)	0.0650	0.90	483	1.83	56.94	31.1
8.An Tho	1.5 (1/67)	0.0580	0.90	538	3.40	95.48	28.1
9.Hoc Nghi	1.5 (1/67)	0.0600	0.95	510	0.70	20.50	29.3
10.Huan Phong	1.5 (1/67)	0.0620	0.95	510	1.85	55.15	29.8

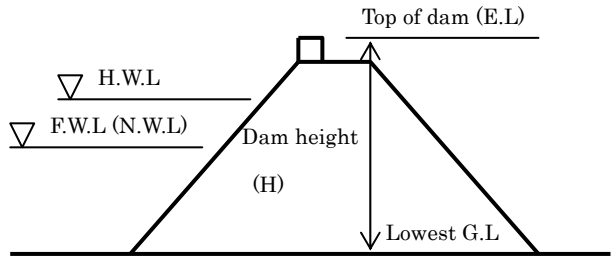
Remarks: Discharge of "1.Tri Binh" includes catchment area in Tra Son reservoir (1.15km^2) and becomes 117.75 m^3/s.

(3) Elevation of dam top (dam height) and freeboard

Top of dam (parapet crest level) is designed to adopt the maximum value in both cases calculated by following formula (Refer to Table 2-13(a);

- Case.1: E.L.1 (top)=F.W.L+Fb1=N.W.L+(Δh+hsl+a)
- Case.2: E.L.2 (top)=H.W.L+Fb2=H.W.L+(Δh'+hsl'+a')

Table 2-13(a) Height of dam and freeboard of each reservoir



Where,

-Δh, Δh': water elevation changed by wind (m)

-hsl, hsl': wave run-up height (m)

-a,a': extra safety height (=0.5m, constant)

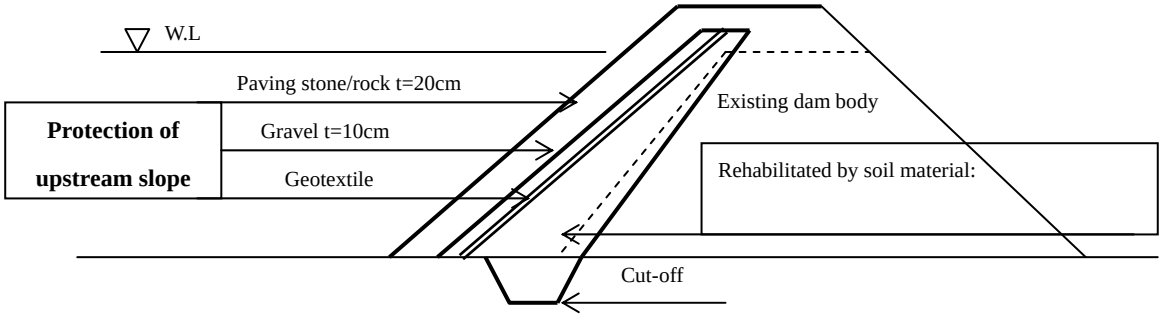
Reservoir name	F.W.L (m) H.W.L (m)	Δh (m) Δh' (m)	hsl (m) hsl' (m)	E.L.1(m) E.L.2(m)	Top of dam E.L (m)	Lowest G.L (m)	Dam Height H (m)	Actual Freeboard E.L-H.W.L (m)
1.Tri Binh	7.70	0.010	0.750	8.960	11.00 (Remark-1)	3.00	8.00	1.47
	9.53	0.002	0.440	10.472				
4.An Hoi	27.96	0.017	1.381	29.858	30.40 (Remark-2)	20.40	10.00	1.48
	28.92	0.004	0.753	30.177				
5.Mach Dieu	26.69	0.038	2.084	29.312	29.75	17.00	12.75	1.58
	28.17	0.008	1.084	29.752				
6.Hoc Mit	28.20	0.005	0.680	29.385	30.40	20.45	9.95	1.30
	29.10	0.005	0.750	30.355				
8.An Tho	27.30	0.028	1.640	29.468	30.80	18.50	12.30	2.40
	28.40	0.038	1.820	30.758				
9.Hoc Nghi	30.10	0.013	1.883	32.496	32.50	20.25	12.25	1.50
	31.00	0.002	0.895	32.397				
10.Huan Phong	33.50	0.013	2.282	36.295	36.30	22.50	13.80	1.80
	34.50	0.009	1.244	36.253				

Remarks: 1. Dam top in Tri Binh is decided according to Existing linkage portion in left abutment E.L=11.0m.
2. Dam top in An Hoi is decided as equivalent to existing dam top E.L=30.40m.

(4) Dam type and section

Slope protection at upstream is aiming prevention from erosion affected by wave and washing-out by seepage water, so that basic structure of slope protection shall be designed by three(3) layers which consist of 1)paving stone or rock with 20cm thickness, 2)gravel with 10cm thickness and 3)geotextile from the surface of slope in accordance with following reasons (Refer to Figure 2-10).

- Type of dam both rehabilitated and existing is homogeneous based on the quality test by using soil material. It means that the function of water stoppage is depended on the whole dam body by both rehabilitated and existing zone.
- In the compassion with stone/rock and concrete, the former is more economical than the latter as well as generality under the construction.
- In consideration with securing to correct river sand in future, geotextile is more economical for filter material in comparison with river sand.



Protection of upstream slope Concept figure

Figure 2-10 Typical section of reservoir

(5) Stability analysis of dam body

Results are shown are shown in Table 2-13(b), ever cases are satisfied with allowable safety factor 1.25.

Table 2-13(b) Stability analysis of each reservoir

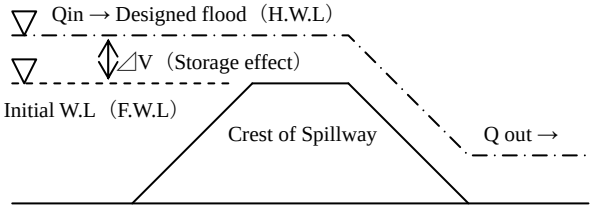
Reservoir name	Case.1:F.W.L (m) Case.2:H.W.L (m)	Upstream Slope	Safety factor Safety factor	Downstream Slope	Safety factor Safety factor
1.Tri Binh	7.70 9.53	1:3.00	2,278 2.243	1:2.50	1.445 1.346
4.An Hoi	27.96 28.92	1:2.75	2.665 2.653	1:2.75	1.853 1.827
5.Mach Dieu	26.69 28.17	1:2.75	2.630 2.615	1:2.25	1.357 1.306
6.Hoc Mit	28.20 29.10	1:2.75	2.252 2.219	1:2.50	1.999 1.963
8.An Tho	27.30 28.40	1:3.00 /3.25	2.307 2.281	1:2.00 /2.50	1.582 1.545
9.Hoc Nghi	30.10 31.00	1:3.00	2.196 2.188	1:2.75	1.263 1.253
10.Huan Phong	33.50 34.50	1:3.25 /3.50	2.818 2.793	1:2.75 /3.00	1.518 1.531

2-2-2-4-2 Spillway Planning

(1) Designed discharge of spillway

Designed discharge for spillway (Qs) is considered storage effect in reservoir. In general, the effectiveness is taken account that ratio for catchment area (F) divided by surface water area (Fn) at N.W.L is less than thirty(30) in Japanese standard. Each reservoir conditions and results of hydrological analysis for designed discharge are shown in Table 2-14. The tendency of both ratio F/Fn and Qs/Qp shows the similar condition which F/Fn and Qs/Qp becomes smaller or bigger at the same time, so that result of hydrological analysis for designed discharge is suitable.

Table 2-14 Discharge of Spillway of each reservoir



Q out＝Qin－⊿V

Where; Q out：Discharge from spillway

Qin ：Designed flood discharge

⊿V ：Storage effect volume

Concept of storage effect in reservoir

Reservoir name	Catchment F (km^2)	Water area Fn (km^2)	Ratio F/Fn	Designed flood Qp (m^3/s)	Spillway discharge Qs (m^3/s)	Effect ratio Qs/Qp
1.Tri Binh	4.84	0.19	25	117.75	90.35	0.77
4.An Hoi	0.88	0.14	6	27.50	17.56	0.64
5.Mach Dieu	3.55	0.47	8	117.79	67.26	0.57
6.Hoc Mit	1.83	0.15	12	56.94	34.40	0.60
8.An Tho	3.40	0.60	6	95.48	62.60	0.66
9.Hoc Nghi	0.70	0.11	6	20.50	15.77	0.77
10.Huan Phong	1.85	0.42	4	55.15	27.92	0.51

(2) Hydraulic calculation of spillway

Hydraulic calculation of spillway structure shall be inspected for inlet portion and stilling basin (energy dissipater) in accordance with following formula. There are not any problems that are found from those results (Refer to Table 2-15).

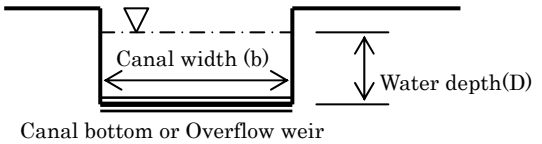
Table 2-15 Hydraulic calculation of spillway of each reservoir

- Inlet portion: $Qs=m.b.(2g)^{1/2}.Ds^{3/2}$ where, Qs: designed discharge (m^3/s)

m: discharge coefficient, b: spillway width(m)

g: gravity acceleration (=9.8, constant)

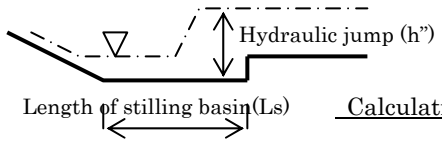
Ds: designed water depth (m)



Calculation section

- Stilling basin: Ls>4.hc" where, Ls: actual length of stilling basin (m)

hc": hydraulic jump depth (m)



Calculation profile

Reservoir name	Qs (m^3/s)	m	b (m)	D (m)	V=Qs/B/D (m/s)	Ls (m)	hc" (m)	Ls/hc"
1.Tri Binh	90.35	0.38	21.6	1.83	2.29	12.0	2.83	4.2
4.An Hoi	17.56	0.35	12.0	0.96	1.52	5.8	1.27	4.6
5.Mach Dieu	67.26	0.35	24.0	1.48	1.89	10.5	2.50	4.2
6.Hoc Mit	31.77	0.35	24.0	0.90	1.47	10.0	1.31	7.6
8.An Tho	62.60	0.35	35.0	1.10	1.63	9.5	1.33	7.1
9.Hoc Nghi	15.77	0.35	12.0	0.90	1.46	8.0	1.27	6.3
10.Huan Phong	27.92	0.35	18.0	1.00	1.55	8.0	1.38	6.2

2-2-2-4-3 Intake Facility Planning

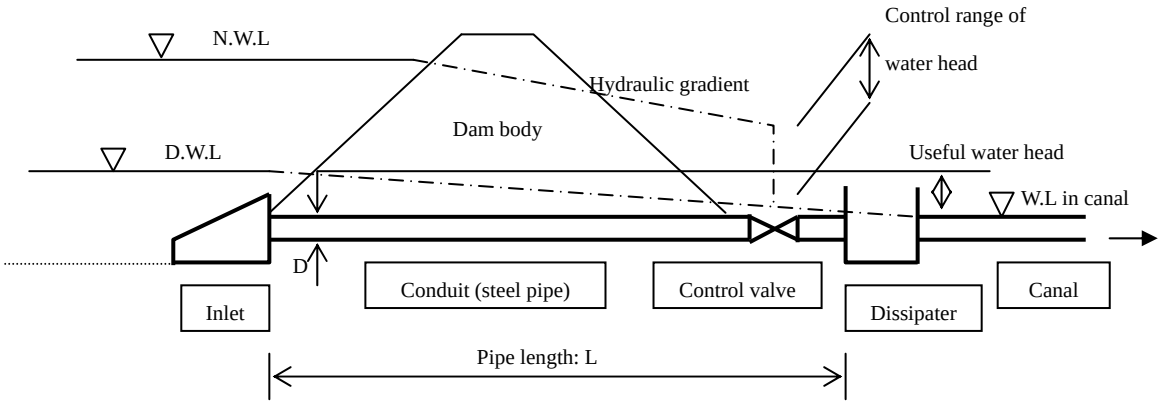
(1) Designed discharge for intake

Designed discharge for intake is decided according to the maximum value of required water discharge in downstream irrigation area. (Refer to next item "2-2-2-4-4. Main canal")

(2) Hydraulic calculation of intake

Intake facility is required to supply water under the stable conditions in any water level of reservoir, so that water head shall be controlled appropriately by valve in outlet. Therefore, it is very important to secure useful water head with L.W.L (available lowest water level) and suitable velocity in conduit (steel pipe) as shown in Table 2-16.

Table 2-16 Hydraulic calculation of intake



Hydraulic calculation of intake structure shall be conducted to inspect available discharge for useful water head with L.W.L in accordance with following formula. Any problem is not found in those results.

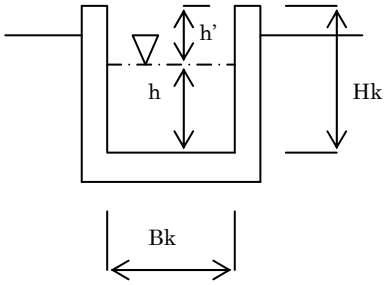
- Available discharge: $Qi=U.W.(2gZ)^{1/2}$, Qi: available discharge (m^3/s)
  U: culvert's discharge factor
  W: pipe section area (m^2)
  Z: useful water head (m), Z=L.W.L-W.L (in canal)
  g: gravity acceleration (=9.8, constant)
  Q: designed discharge (m^3/s)

Reservoir name (Intake name)	Q (m^3/s)	Intake conduit (pipe) features				U	L.W.L (m)	W.L (m)	Z (m)	Qi (m^3/s)	Qis> Q
		D (m)	L (m)	V (m/s)	W (m^2)						
1.Tri Binh (North)	0.116	0.30	44.0	1.64	0.071	0.35	5.70	3.83	1.87	0.15	O.K
1.Tri Binh (South)	0.044	0.20	34.0	1.40	0.031	0.30	5.70	4.30	1.40	0.05	O.K
4.An Hoi	0.061	0.30	64.5	0.86	0.071	0.37	21.70	21.01	0.69	0.10	O.K
5.Mach Dieu	0.328	0.60	62.0	1.16	0.283	0.46	19.35	18.53	0.51	0.41	O.K
6.Hoc Mit	0.122	0.40	54.0	0.97	0.126	0.49	22.50	20.85	1.65	0.35	O.K
8.An Tho (Main)	0.227	0.60	70.0	0.80	0.283	0.49	20.30	19.48	0.82	0.56	O.K
8.An Tho (Sub)	0.055	0.40	89.0	0.44	0.126	0.49	20.30	18.72	1.58	0.34	O.K
9.Hoc Nghi	0.087	0.35	66.0	0.90	0.096	0.29	23.80	21.75	2.05	0.18	O.K
10.Huan Phong	0.287	0.50	86.0	1.46	0.196	0.32	25.30	23.93	1.37	0.33	O.K

2-2-2-4-4 Main Canal Planning

Irrigation canal is required to distribute the necessary water from intake facility to downstream-farm under the stable flow conditions, therefore, it is very important to secure adequate water level under suitable velocity in the canal. Hydraulic calculation of canal structure shall be inspected to compare with available clearance and necessary freeboard in accordance with Manning formula. There are not any problems found from those results (Refer to Table 2-17)

Table 2-17 Dimension of main canal section



$Q=A.V, \quad V=1/n.R^{2/3}.I^{1/2}$

Where, Q: designed discharge (m^3/s)
A: cross-section area of flow =Bk.h(m^2)
V: mean velocity (m/s)
n: coefficient of roughness (=0.017, constant)
R: hydraulic radius (m)
I: hydraulic gradient (canal bottom slope)
Q: designed discharge (m^3/s)
h': Available clearance, h'=Hk-h (m)

Reservoir name (Canal name)	Q (m^3/s)	Irrigable Area (ha)	Unit q (l/s/ha)	Canal features				V (m/s)	h' (m)
				Bk(m)	Hk(m)	I	h (m)		
1.Tri Binh (North)	0.116	65	1.78	0.70	0.70	0.0004	0.43	0.39	0.27
1.Tri Binh (South)	0.044	25	1.76	0.40	0.40	0.0010	0.26	0.43	0.14
4.An Hoi	0.061	40	1.53	0.40	0.50	0.0032	0.21	0.73	0.29
5.Mach Dieu (exis.)	0.165	129	1.28	0.60	0.60	0.0020	0.35	0.78	0.25
5.Mach Dieu (new)	0.114	96	1.19	0.65	0.70	0.0004	0.45	0.39	0.25
6.Hoc Mit	0.122	70	1.74	0.60	0.90	0.0002	0.69	0.29	0.21
8.An Tho (Main)	0.227	130	1.75	0.70	0.80	0.0008	0.55	0.60	0.25
8.An Tho (Sub)	0.055	31	1.77	0.40	0.50	0.0070	0.14	0.99	0.36
9.Hoc Nghi	0.087	50	1.74	0.45	0.55	0.0030	0.25	0.77	0.30
10.Huan Phong	0.287	165	1.74	0.65	0.80	0.0017	0.53	0.83	0.27

And Designed length of concrete main canal of each reservoir is shown Table 2-18.

Table 2-18 Designed length of concrete main canals (Unit: m)

Reservoir Name	Proposed Irrigation Area (ha)	Earth canal to be concrete	Rehabilitation of Existing Concrete Canals	New Canals (Concrete)	Total
1.Tri Binh	90ha	(North) 1,309 (South) 855	347	0	2,511
4.An Hoi	40ha	236	0	643	879
5.Mach Dieu	270ha	1,374	0	2,473	3,847
6.Hoc Mit	70ha	946	739	0	1,703
8.An Tho	161ha	(North) 1,725	0	(West) 1,966	3,691
9.Hoc Nghi	50ha	2,630	0	0	2,630
10.Huan Phong	165ha	3,184	0	0	3,184
Total	846ha	12,259	1,104	5,082	18,445

2-2-2-4-5 Access Road

(1) Road grade and the fundamental specifications

The Vietnamese road design standard, 'Highway-Specifications for Design (TCVN 4045:2005)', is the one based on the design policy/method so called 'empirical design method', where the road grade is defined according to the traffic volume and functional capabilities required and each structural specification follows its grade, the root of which is originated from the studies and achievements done in the state of California, USA, in the 1940s and is as same as the Japanese road design standard.

The traffic volumes of relevant access roads are estimated to be less than 200 vehicles a day so that their road grades are 'Grade VI', the lowest grade in the Vietnamese design standard. Following this Grade VI, the basic specifications of the access roads are shown in Table 2-19.

Table 2-19 Basic specification of Grade IV of road

Item	Application
Design speed	Plain/Hill area : 30 km/h　　Mountain area : 20 km/h
Number of lane	One (1)
Width of roadway	3.5 m
Minimum width of shoulder	Plain/Hill area : 1.5 m（one side : 0.75 m） Mountain area : 1.25 m（one side : 0.625m）
Super elevation of the road surface	More or equal than 2%, less or equal than 8%
Minimum radius of curve	Plain/Hill area : 30 m Mountain area : 15 m
Maximum longitudinal gradient	Plain/Hill area : 9 %　Mountain area : 11 %
Design elevation of the pavement surface	Elevation at road edge≧Flood water level＋50cm （roads alongside rivers or paddy fields）

(2) Outline of the plan

Table 2-20 shows the outline of rehabilitation plan of each access road.

Table 2-20 Designed length of Access road for each reservoir

Existing/Plan	Length of Access road (m)	Appurtenant structure (Nos.)		
Reservoir name	Concrete pavement	Culvert	Bridge	Submergible roadway
1.Tri Binh	163	0	0	1
4.An Hoi	195	0	0	0
5.Mach Dieu	748	2	0	0
6.Hoc Mit	416	4	0	1
8.An Tho	487	0	1	0
9.Hoc Nghi	2,407	3	0	0
10.Huan Phong	3,363	14	0	0
Total	7,779	23	1	2

2-2-2-4-6 Operation and Maintenance (O&M) Facility Planning

The layout plan of maintenance house is designed as shown in Figure 2-11, and the outline is adopted appropriately as a square shape to take economical and easy constructed conditions into consideration. In addition, the basic structure is designed based on Vietnamese standard that foundation, pillar, beam, bearing wall and roof are constructed by reinforced concrete and general wall is made of block and mortar.

a)Operation room: 4.0×3.0m=12.0m^2, b)Rest room: 3.0×3.0m=9.0m^2

c)Kitchen:2.5×3.0m=7.5m^2, d)Toilet:1.5×3.0m=4.5m^2

e)Ware house: 3.0×3.0m=9.0m^2

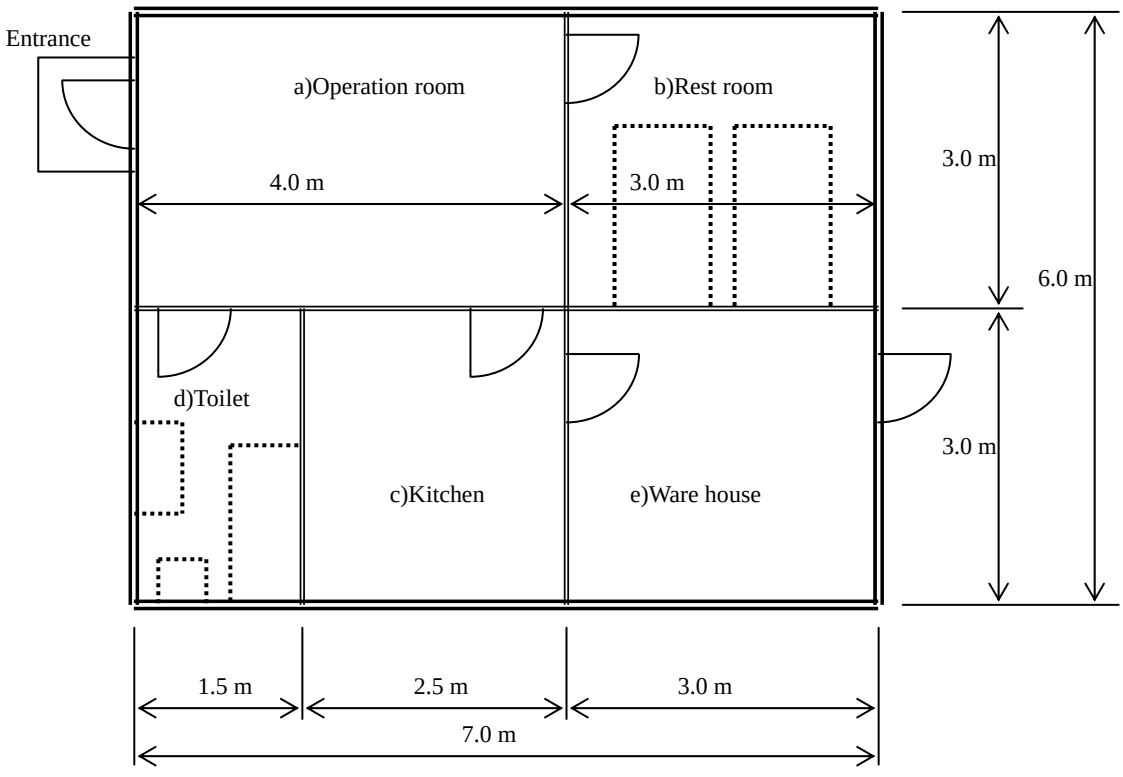


Figure 2-11 Layout plan of Operation and Maintenance (O&M) house

Meanwhile, meeting room by 15m^2 shall be added to the maintenance house in “6.Hoc Mit” reservoir for DRSC (Project for Building Disaster Resilient Societies in Central Region in Vietnam, Refer to Figure 2-12).

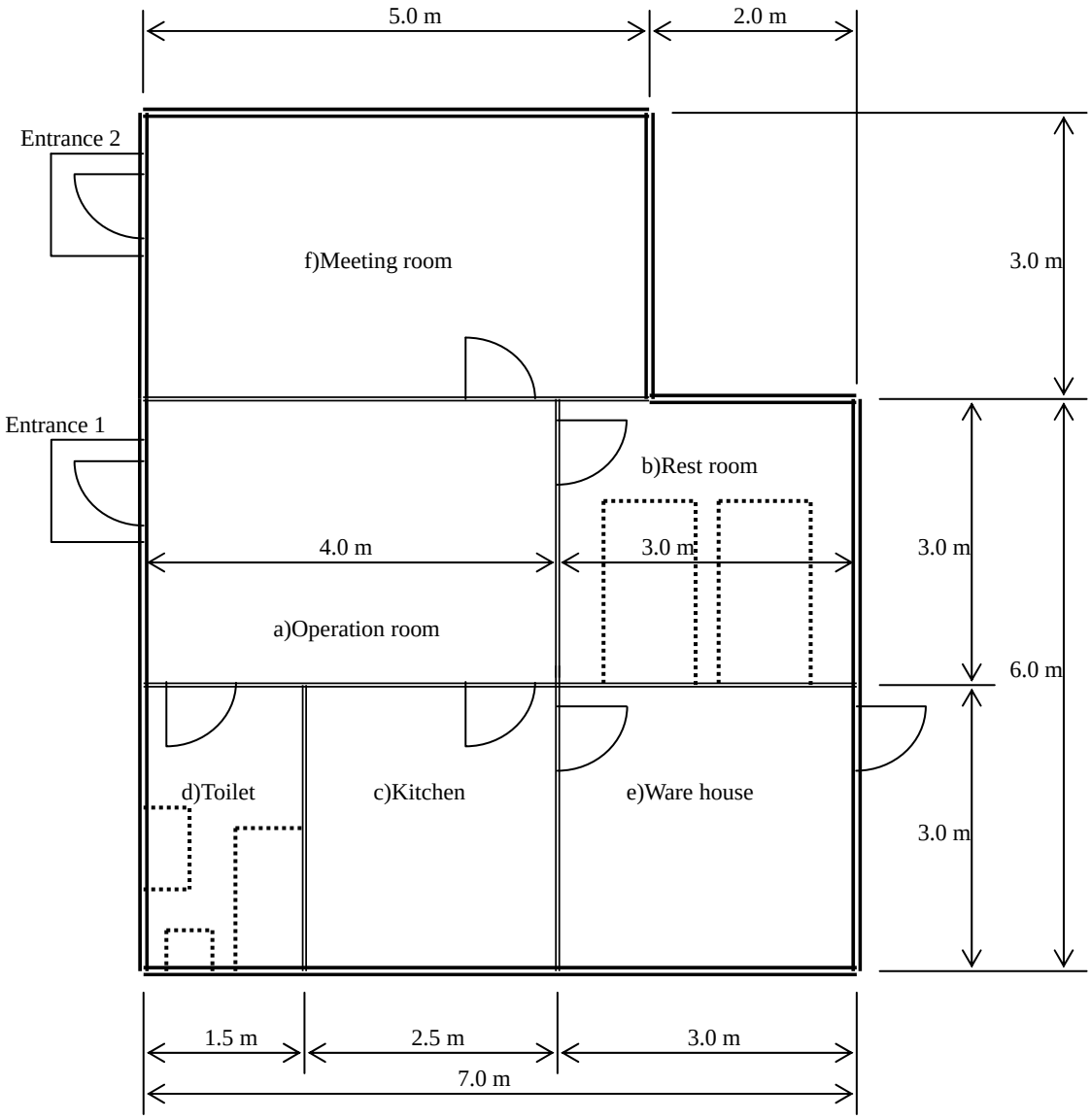
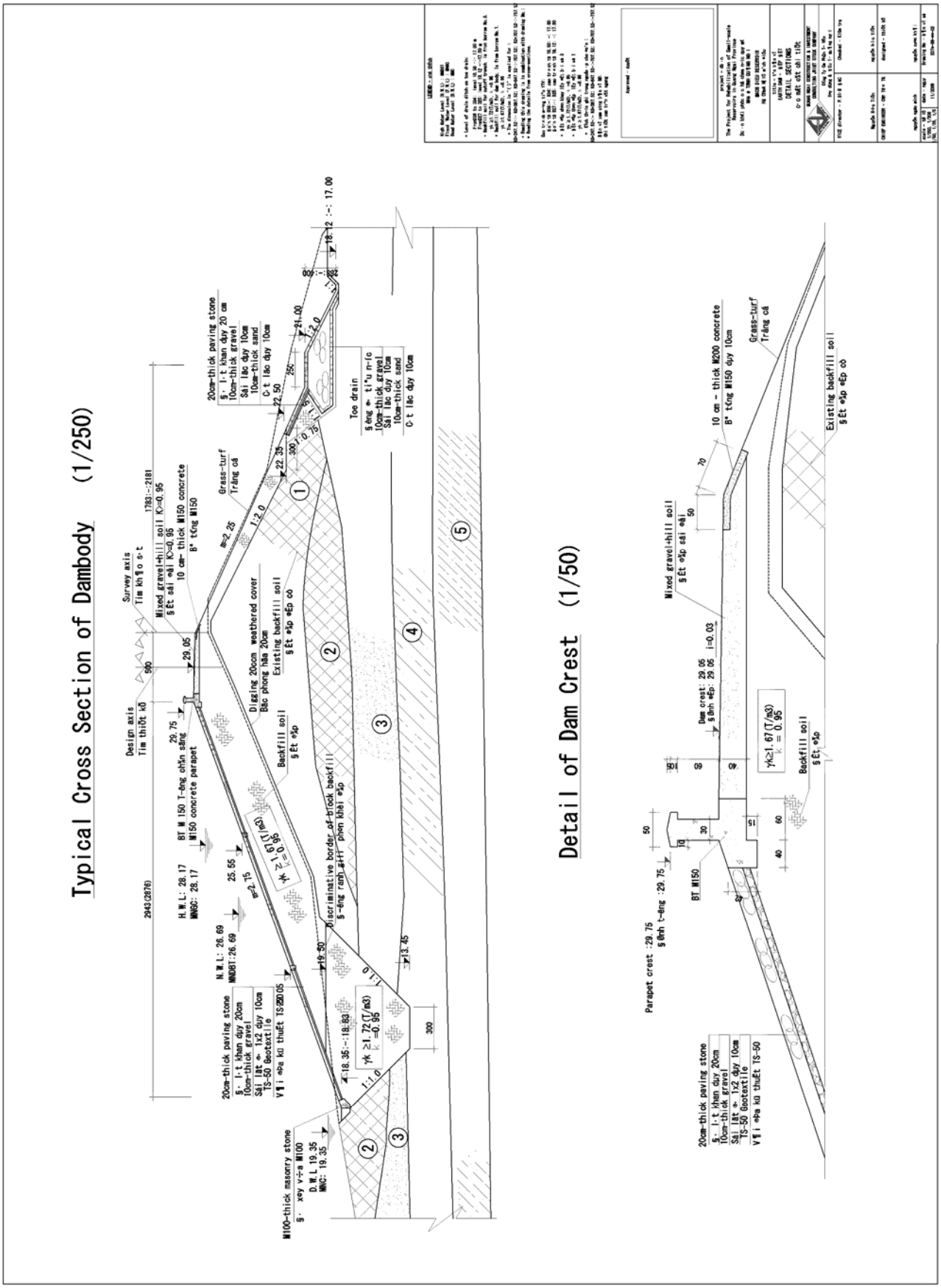


Figure 2-12 Layout plan of Operation and Maintenance (O&M) house ("6. Hoc Mit Reservoir")

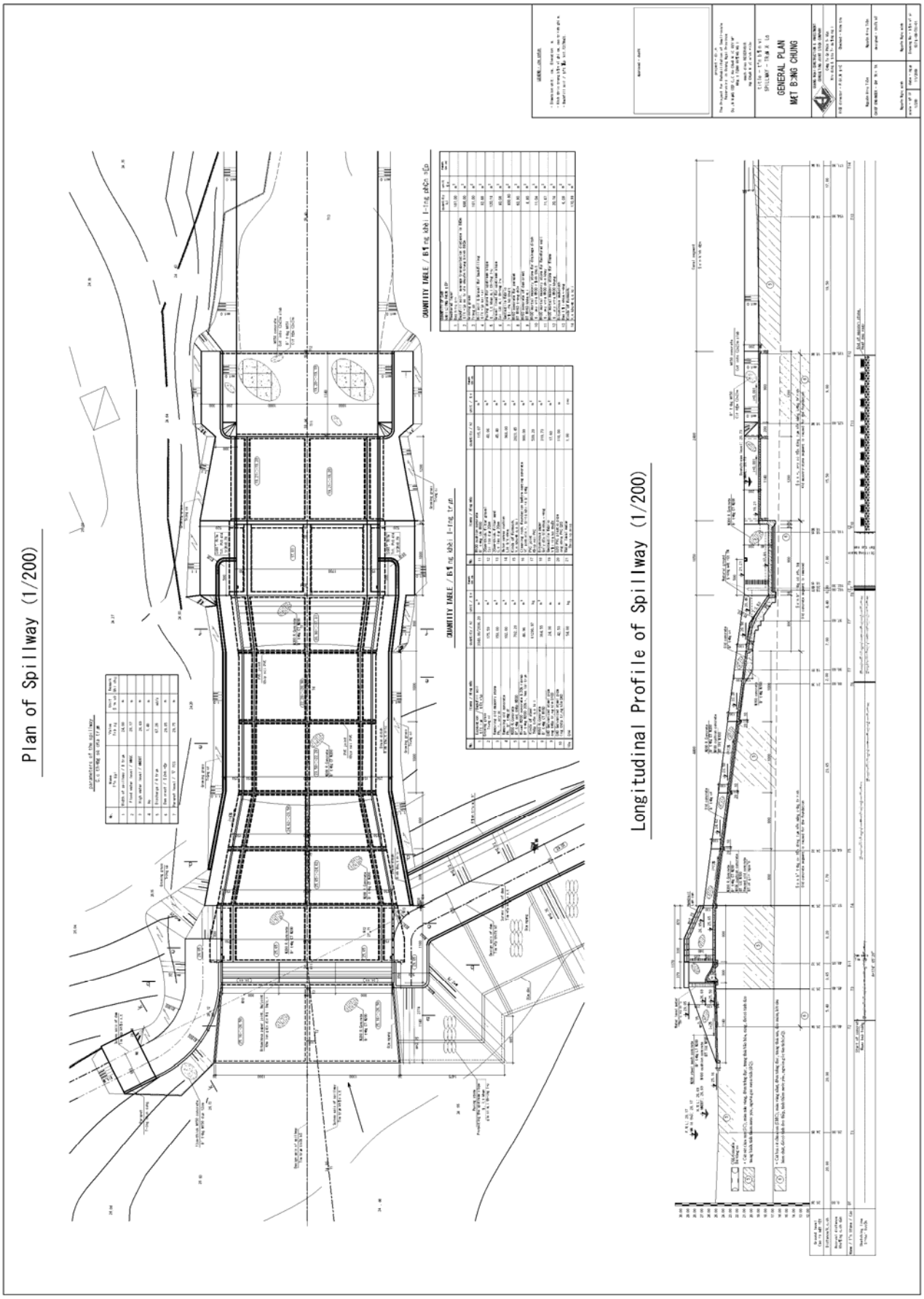
2-2-3 Outline Design Drawing (5. Mach Dieu Reservoir)

Table 2-21 List of Drawings

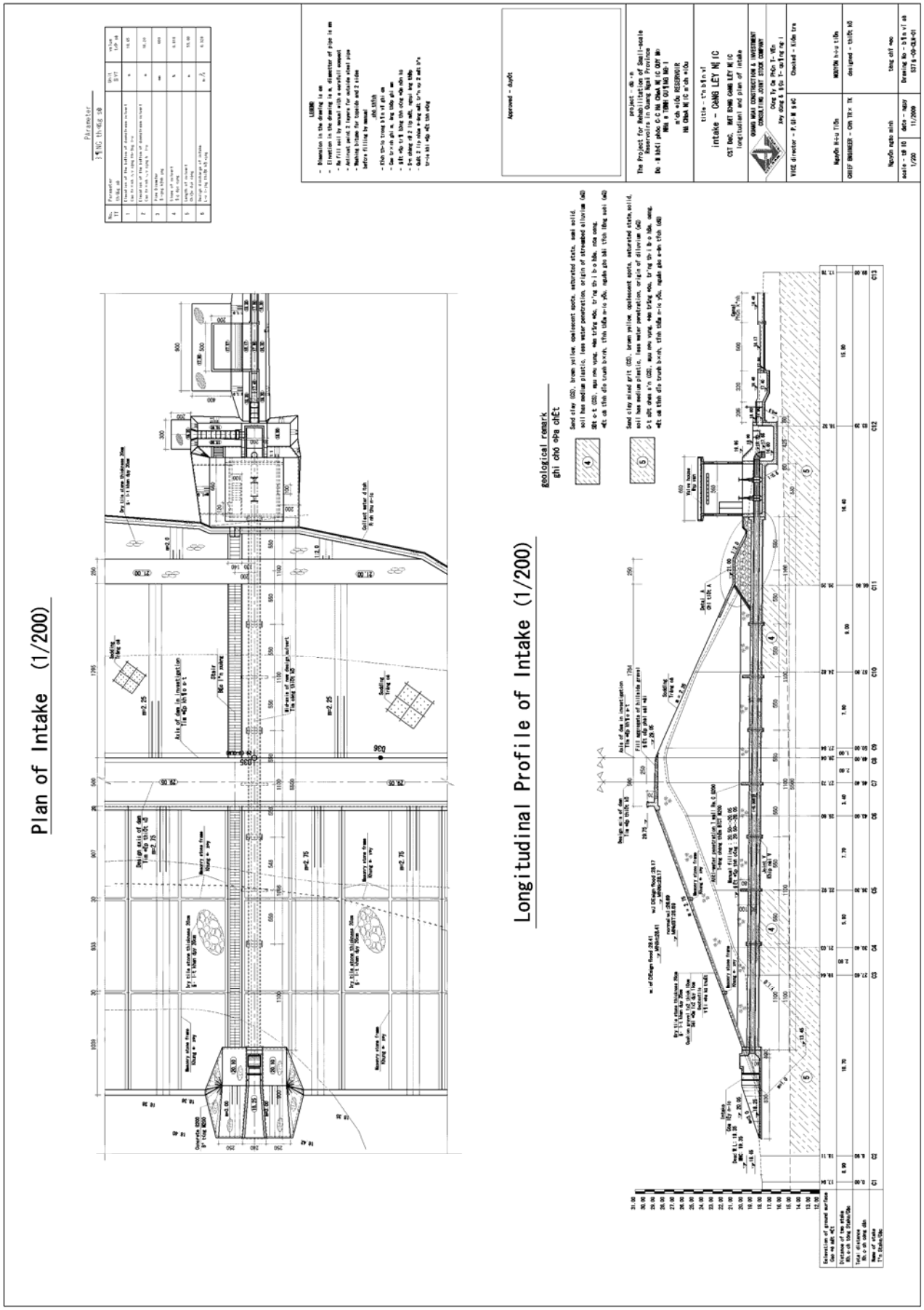
Drawing No.	Name of Drawing
Drawing-A	Dam body (Typical Cross Section and Detail of Dam Crest)
Drawing -B	Spillway (Plan and Longitudinal Profile)
Drawing -C	Intake (Plan and Longitudinal Profile)
Drawing -D	Main Canal and Access Road (Typical Cross Section)
Drawing -E	Maintenance House (Plan and Front View)



Drawing-A: Dam body (Typical cross section and Detail of crest)

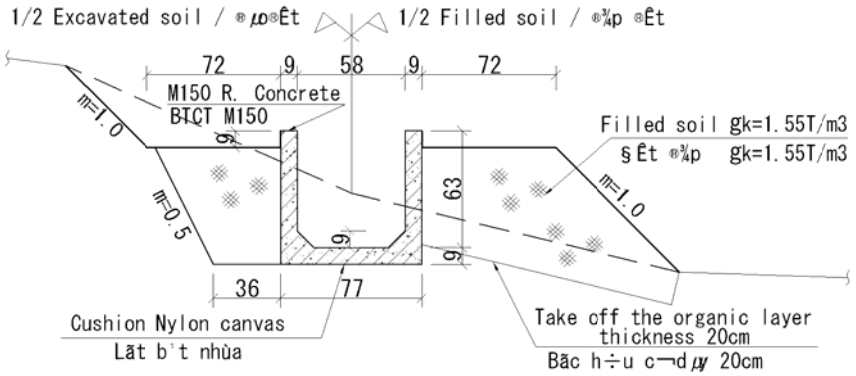


Drawing-B: Spillway (Plan and Longitudinal profile)

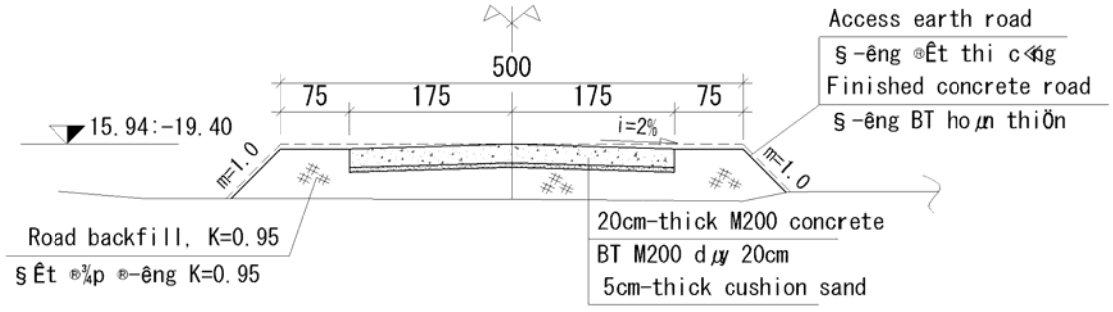


Drawing-C: Intake (Plan and Longitudinal profile)

Typical Cross Section of Main Canal (1/50)



Typical Cross Section of Access Road (1/50)



LEGEND

- Elevation, dimension in longitudinal section is m
- Dimension is cm
- Filled soil gk=1.55ton/m3.
- Take off an organic layer with thickness 20cm before filling

chó thÝch

- Cao tr×nh, kÝch th-íc tr°n c¾t dãc ghi m.
, kÝch th-íc ghi cm.
- §Êt ®¾p ®Çm nÐn kÕ gk=1.55T/m3.
- Bãc h÷u c¬ d¹y 20cm tr-íc khi ®¾p.

Approved - duyÖt

project - dù ,n
The Project for Rehabilitation of Small-scale Reservoirs in Quang Ngai Province
Dù ,n kh«i phôc c,c hå chøa n-íc quy m« NHá ë TØNH QU¶NG NG·I
MACH DIEU RESERVOIR
Hå CHøA N¦íC m'ch niÖu

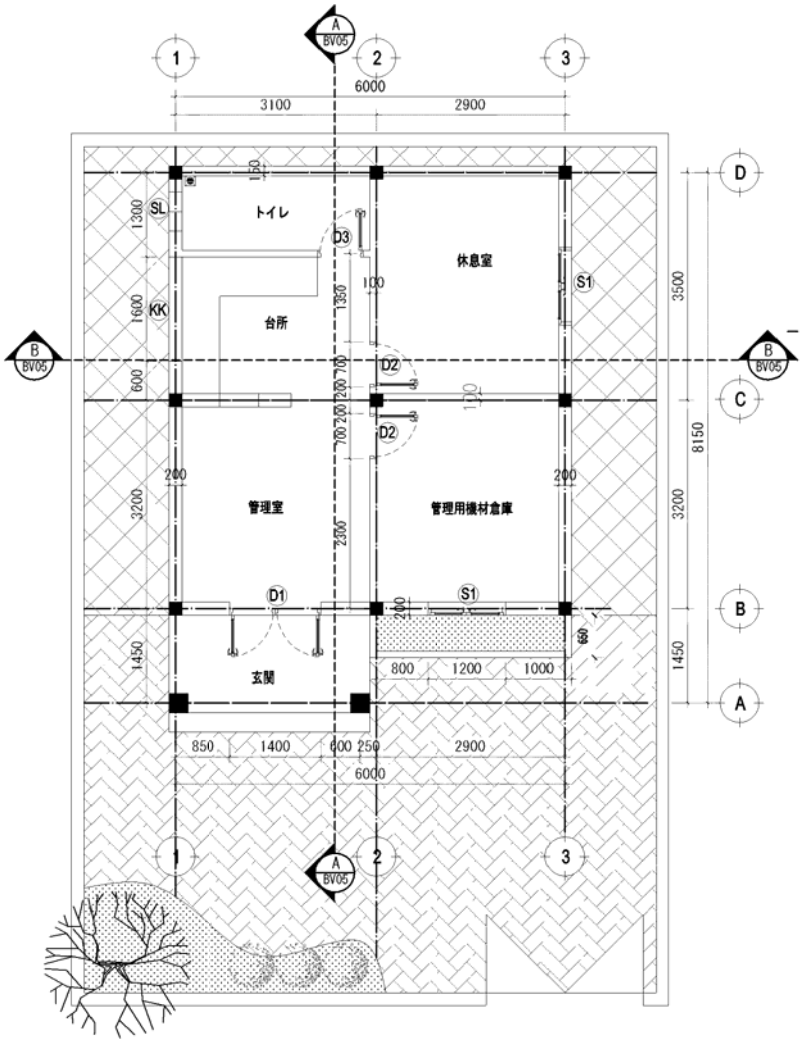
title - t°n b¶n vÏ
canal and access road
Typical Cross Section
c¾t dãc

QUANG NGAI CONSTRUCTION & INVESTMENT JOINT STOCK COMPANY
C«ng Ty Cæ PhÇn T- VÊn Xªy dùng & §Çu T- qu¶ng ng·i

VICE director - P.GI.M §èC	Checked - Kiểm tra
Nguyễn H÷u Tiễn	nguyễn h÷u tiễn
CHIEF ENGINEER - CHñ TR× TK	designed - thiết kế
nguyễn ngäc minh	nguyễn xu©n kh¶i

scale - tØ lÖ	date - ng¸y	Drawing No - b¶n vÏ sè
1/250, 1/200 1/50, 1/25, 1/5	11/2009	537÷09-KT-

Plan of Maintence House (1/100)



Front View of Maintenance House (1/100)

TECHNICAL DESCRIPTION

STRUCTURE: LOAD BEARING FRAME, BRICK WALL
ROOF STRUCTURE: CORRUGATED IRON ROOF
STEEL PURLIN: C145x50x10x2.5
THE WALL WILL BE PAINTED WITH WATER PAINT.

THUYEÂT MINH KYÕ THUAÄT

KC KHUNG CHÒU LÖÏC, TÖÔØNG BAO QUANH XAÂY GAÏCH
MAÙI LÔÏP TOLE SOÙNG VUOÂNG MAØU XANH REÊU
XAØ GOÀ THEÙP CHÖÕ C145x50x10x2.5
TÖÔØNG QUEÙT VOÂI 2 NÖÔÙC TRAÉNG 1 NÖÔÙC MAØU

LEGEND - chu thích

Approved - duyệt

project - dù .n
The Project for Rehabilitation of Small-scale Reservoirs in Quang Ngai Province
Dù .N KH-I PHßC C.C Hã CHßA NÍC GUY M:
Nhµ ø TØNH QU¶NG NG I
MACH DIEU RESERVOIR
Hã CHßA NÍC M'CH Ş ISU

title - t'n b¶n vÏ
MAINTENANCE HOUSE
NH µ QU ¶N Lý

QUANG NGAI CONSTRUCTION & INVESTMENT CONSULTING JOINT STOCK COMPANY
Công Ty Cæ Phần T- Vấn Xây dựng & ŞÇu T- qu¶ng ng i

VICE director - P.Gi.M ş¢c	Checked - Kiểm tra
Nguyễn Hữu Tiến	Nguyễn Hữu Tiến
CHIEF ENGINEER - CHñ TR× TK	designed - thiết kế
Nguyễn NGäC MINH	Nguyễn TRUNG HIẾU
scale - tØ lÖ 1/100	date - ng µy 11/2000
Drawing No - b¶n vÏ sè 537 s -09-	

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy and Procurement Policy by Procurement Agency

(1) Project implementation structure

After the completion of the Outline Design Study including detail design and draft tender documents and subsequent approval of Grant Aid from Japan Government, the Exchange of Notes (E/N) will be made between the government of two countries and PPC will enter into its implementation process formally for the project.

Following Grant Agreement (G/A), which will be concluded between JICA and PPC after the signing of E/N, a coordination committee will be established to decide and coordinate concerning matter for the implementation of the project. On the basis of G/A, PPC will make an Agent Agreement (A/A) with a procurement agency to procure the supervisory consultant and construction contractors and supervise the construction of the project.

Moreover, PPC will designate DARD (PMB) as an organization to undertake a role as a supporter/counterparts for the procurement agency and will be a contact organization for confirmation and approval procedures of the project in accordance with guideline of GACE and A/A. In addition, PMB will implement necessary works which are undertaken by PPC for proposed rehabilitation and described in the Outline Design Study other than the roles extended to procurement agency under A/A.

Below Figure 2-13(1) and Figure 2-13(2) indicates Project Implementation structure based on the understanding, one by DARD (PPC) and one by the procurement agency respectively

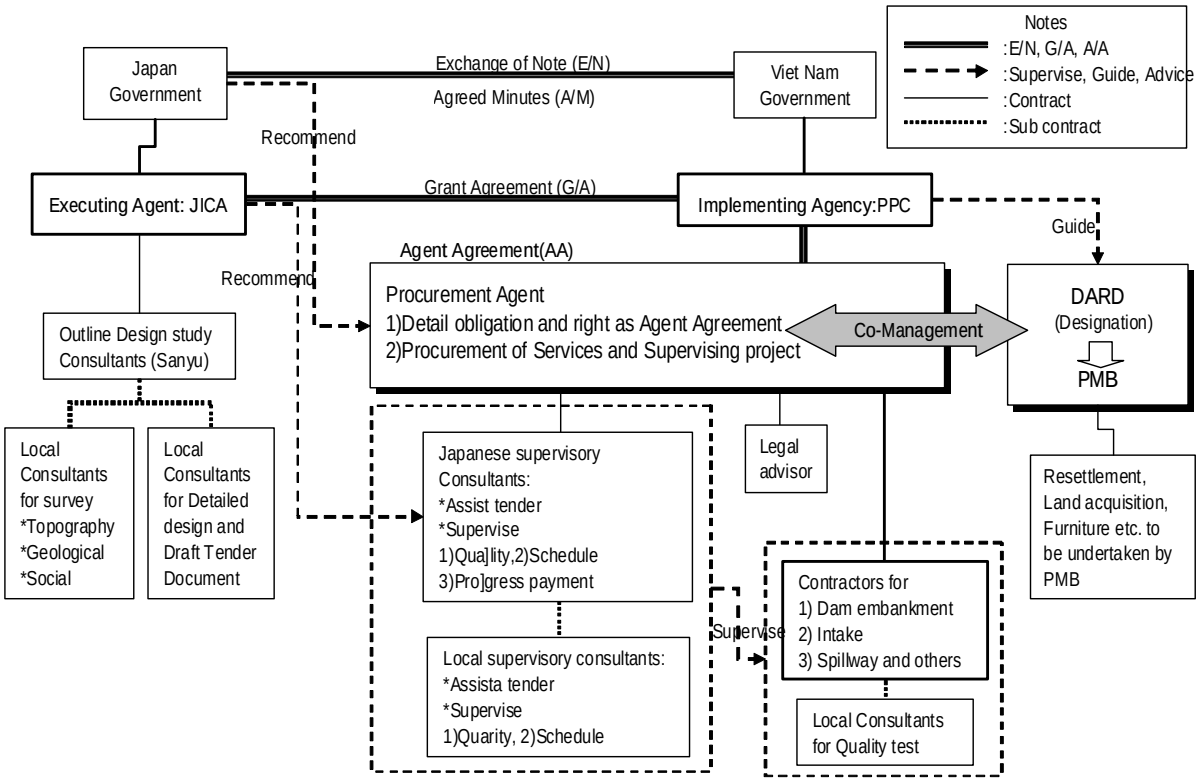


Figure 2-13(1) Project implementation structure (based on Vietnamese rule)

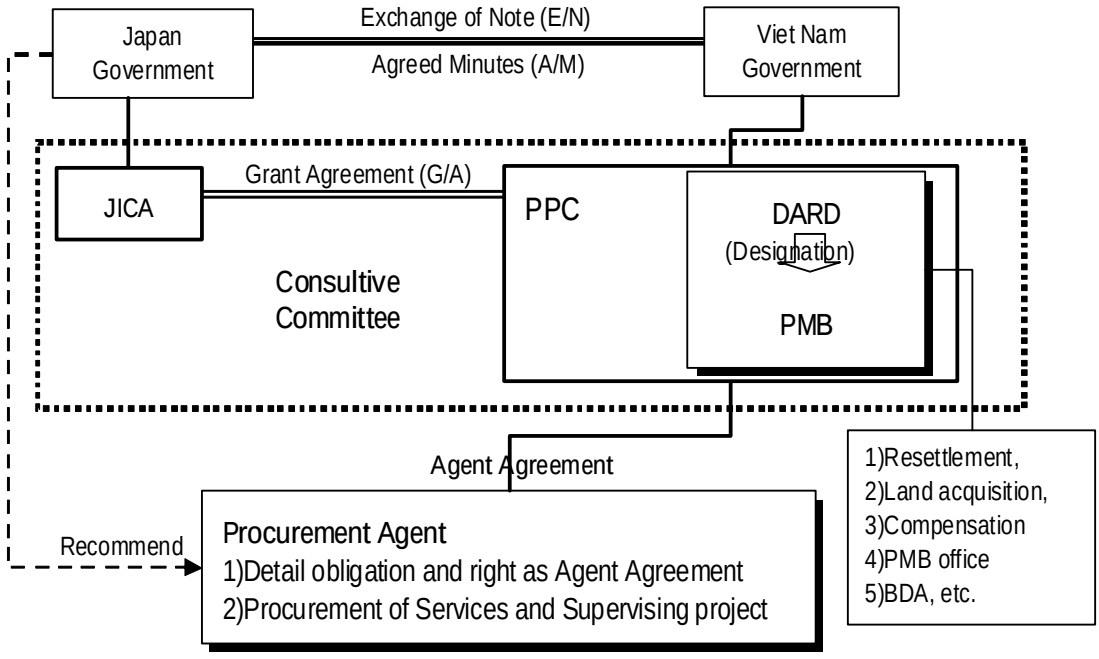


Figure 2-13(2) Project implementation structure (based on GACE guideline)

(2) Role of Procurement Agency

Detail design study was already concluded in the Outline Design Study for this project, so the role of procurement agency is as shown below.

1) Coordination and conclusion of A/A in accordance with E/N, G/A
2) Procurement of supervisory consultant
3) Tender arrangement for construction contracts
4) Procurement and conclusion of construction contracts
5) Supervision of construction
6) Financial Management
7) Reporting of project progress and design changes if any to JICA and PPC
8) Handing over the facilities after the completion of the project
9) Contractual advise for the construction contracts during the defects liability period

(3) Role of Compensation management by PPC and DARD/PMB

PPC will complete necessary land acquisition and compensation works as shown below.

1) Resettlement of Inhabitant（to complete by December 2010）
2) Land acquisition for borrow pit, disposal area and yards of temporary construction facilities and its compensation（to complete by December 2010）
3) Crop compensation due to disruption of irrigation water supply（to complete by December 2010）

It is necessary that land acquisition and crop compensation procedure should be completed before the conclusion of construction contracts between procurement agency and contractors after the conclusion of E/N.

Relevant parties, such as JICA, procurement agency and PPC, should have a progress meeting through the coordination committee and monitoring the progress of land acquisition and crop compensation works during tender stage and in case any delay of the schedule of these procedures are observed, relevant parties should review the implementation schedule and PPC should take measures to remedy it promptly if necessary in order to avoid the delay of project implementation schedule.

2-2-4-2 Important Points in the Management of Procurement and Construction (Construction contract and contractual dispute management)

It is necessary to take measures against potential conflicts which might be caused due to lump sum contract system and expecting variation of scope of works which might be caused due to non contingency budget system.

(1) Consequential delay of project implementation schedule caused by delay of land acquisition

It is planned to avoid delay of project implementation by strict monitoring and observation of land acquisition and compensation implementation program as aforesaid. The progress of land acquisition and compensation will be monitored during the period of tender preparation and to evaluate the risk of delay of construction schedule if any and take measures such that the contract will be made based on revised and rescheduled program or the contract may be delay to avoid contractual dispute between contractor and procurement agency.

(2) Amendment of the contract amount resulted from changing the design

The contract between procurement agency and contractors will be made based on the scope of the construction as shown in the tender document.

In the tender documents and construction contract, it will be clearly specified that this contract intends lump sum contract but not unit rate contract with re-measurement and the contractor has an obligation to make sure the work items and required quantities for the works by the contractor themselves, in order for the contractor not to misunderstand the intention of contract.

In order to make the design change promptly and smoothly if so required at the time of concluding the construction contracts and also during the construction time, the local consultants who has done detail design has a responsibility of its designing throughout the period of project implementation such as at the time of construction contracts, construction stage and defects liability stage. It will be clearly specified in the construction contracts that the procurement agency has a right to make any design changes at the time of concluding the contract and during construction stage and such amendment of contract amount will be determined by the procurement agency based on the reference BOQ which shall be required to submit at the time of tendering by the contractor.

(3) Recovery of Damage caused by Force Majeure such as natural disaster

In order to avoid the risks of contractual dispute arising from Force Majeure such as natural disaster during construction and maintenance period, the contract will require the insurance coverage for the works by the contractor.

(4) Financial matters(Taxes and its exemption) and Social Trouble

Procurement agency might be expected to involve in the dispute relating to taxes and its exemption and other social trouble with the neighbors during construction stage and to employ the legal specialist from adequate fields for dealing with.

2-2-4-3 Packaging of Contract lots in the Tendering

Taking into account the construction period, experience and ability of local contractors, complication of operation in same working place by having multiple contract lots in one reservoirs and

economical and efficient supervisory management by procurement agency and supervisory consultant, it is determined to allocate one lot of package in one reservoir.

2-2-4-4 Project Supervision

Project supervision will cover supervision of tender preparation, tender management and construction supervision.

During the whole construction period of 21.5 month, only one time of rainy season will be encountered. In rainy season (Oct-Dec), only limited works such as stone works and structure works in the dam downstream side, spillway, main canals and access roads except dam embankment will be carried out continuously from dry season. It will be slow progress and will be concentrated in monitoring leakage condition of dam embankment works done during dry season and carried out remedial works if any unsafe condition is observed. Therefore construction and supervision activities will be continued without disruption. Proposed construction period of individual reservoirs are determined based on the work volume designed by detail design consultants, timing of dry and rainy season and the experience in rehabilitated reservoirs in the past. Construction period of 12 months in four reservoirs, 18.5 months in one reservoir and 21.5 months in two reservoirs are determined and supervisory staffs for such period as well.

Project supervision plan is described as below;

(1) Supervision plan by Procurement Agency

Supervision plan by the procurement agency are determined as below in accordance with the guideline of Community Grant Aid and the system of employment of Japanese primary consultant for the supervision of construction.

(Tender stage)

・Japanese staffs allocation plan of procurement agent

Position	Grade	Duration(M/M)			Responsibilities
		On site	In Japan	Total	
Project Manager	2	5.00	－	5.00	Conclusion of A/A、Establishment of project office, Tender preparation、Coordination with PPC、Tender management, Tender evaluation and Conclusion of construction contract
Assistant Project Manager	3	5.00	－	5.00	Tender preparation 、 Coordination with PPC 、 Tender management (Public announcement and tender document arrangement etc), Tender, Evaluation, Obtaining PPC approval and Conclusion of construction contract
Tender document specialist	3	－	1.00	1.00	Tender document preparation
Contract and Financial specialist	4	－	1.49	1.49	Opening account, Transfer fund, Conclusion of Japanese primary consultant contract, Selection of legal advisor, Payment management to legal advisor and Primary consultant、Quarterly financial report
Total		10.00	2.49	12.49	

・Local staffs allocation plan of procurement agent

Position	Grade	Duration(M/M)			Responsibilities
		On site	In Japan	Total	
Legal Advisor		1.00	―	1.00	Advice for accounting , tax and agreement
Administration staff		5.00	―	5.00	Administration, interpreter
Administration staff		1.00	―	1.00	Administration, interpreter
Driver		500	―	5.00	
Security guard		5.00	―	5.00	
Total		17.00	―	17.00	

(Construction stage)

・Japanese staffs allocation plan of procurement agent

Position	Grade	Duration(M/M)			Responsibilities
		On site	In Japan	Total	
Project Manager	2	2.80	―	2.80	Intermediate progress inspection, Completion inspection
Assistant Project Manager	3	23.80	―	23.80	Supervision of progress, design change management etc, completion inspection, Completion report, Defects liability inspection, Defect liability inspection report
Contract and Financial specialist	3	―	4.83	4.83	Financial management for contractor, primary consultant and legal advisor, final payment after defect liability and Quarterly financial report
Total		26.60	4.83	31.43	

・Local staffs allocation plan of procurement agent

Position	Grade	Duration(M/M)			Responsibilities
		On site	In Japan	Total	
Legal advisor		2.00	―	2.00	Experts for accounting, tax and contract
Administrator		22.80	―	22.80	Administration, interpreter
Administrator (accounting)		21.50	―	21.50	Accounting, interpreter
Driver		23.80	―	23.80	Driver for procurement agency staff
Security guard		21.50	―	21.50	Security guard for office
Total		91.60	―	91.60	

(2) Supervision plan by Japanese primary consultant

(Tender stage)

・Japanese staffs allocation plan of Japanese primary consultant

Position	Grade	Duration(M/M)			Duration(M/M)
		On site	In Japan	Total	
Project manager	2	―	0.25	0.25	Tender evaluation and result reporting
Engineer (Tender management)	3	5.00		5.00	Assisting assistant Project manager of procurement agency for tendering management
Total		5.00	0.25	5.25	

・Local staffs allocation plan of Japanese primary consultant

Position	Grade	Duration(M/M)			Responsibilities
		On site	In Japan	Total	
Interpreter, Translator		5.00	―	5.00	Interpreter and translator for tender management and assistant of Engineer for tender management
Interpreter, Translator		5.00	―	5.00	Interpreter and translator for tender management and assistant of Engineer for tender management
Driver		5.00	―	5.00	Driver for the above staffs at tender stage
Total		15.00	―	15.00	

(Construction stage)

・Japanese staffs allocation plan of Japanese primary consultant

Position	Grade	Duration(M/M)			Responsibilities
		Onsite	In Japan	Total	
Project manager	2	1.80	―	1.80	Intermediate inspection、Design monitoring and inspection, Completion inspection
Resident Engineer	3	21.50	―	21.50	Site resident supervisory engineer for supervising and managing whole activities on site construction including safety, schedule, quality, contract and payment management and reporting progress of works and coordination works among relevant parties. Evaluation of progress payment and design change and advisory support to procurement agency.
Specialist, Engineer for foundation engineering	3	4.00	―	4.00	Site supervision in construction of dam embankment and spillway foundation, especially monitoring of foundation ground condition and material inspection of embankment soil including technical advice on changing material character of embankment soil.
Specialist, Engineer for hydraulic structure engineering	3	4.00	―	4.00	Site supervision in construction of hydraulic structure, especially monitoring of structure materials, construction drawings and construction method and providing technical advice on improvement of quality of workman ship.
Completion documents specialist	4	2.00	―	2.00	On preparation of completion inspection document and handing over the facilities to PPC, conduct coordination with PPC and contractors and providing guidance for the document preparation.

Inspector for defects liability	3	1.30	―	1.30	Attending inspection of defects liability and providing assistance for preparing report
Soft component manager	3	5.70	―	5.70	To provide advice for management of reservoir operation and maintenance
Total		40.30	―	40.30	

・Local staffs allocation plan of Japanese primary consultant

Position	Grade	Duration(M/M)			Responsibilities
		On site	In Japan	Total	
Chief Engineer		21.50	―	21.50	Assistant for Japanese resident Engineer、supervising and coordination with contractors for safety, schedule and quality of works
Supervisory Engineer, (Leader for each reservoir)		107.0	―	107.0	Stationed on site as an leader for supervision of each reservoir and conduct daily supervision, construction control and progress monitoring and reporting for safety, quality, construction and schedule and also progress of works done.
Supervisory Engineer, on site		129.0	―	129.0	Stationed on site as an section in charge for supervision of each reservoir and conduct daily supervision, construction control and progress monitoring and reporting for safety, quality, construction and schedule and also progress of works done.
Administrator		67.00	―	67.00	Collecting data from site and summarizing and presenting for resident Engineer supervision. One staff for two reservoirs.
Inspector		0.80	―	0.80	On completion inspection to assist Resident Engineer for inspection
Interpreter, Translator		22.80	―	22.80	Interpreter for Japanese Engineers to communicate with contractors and supervisory engineer. Translation of documents.
Soft component assistant		5.70	―	5.70	Assistant to soft component manager
Driver		22.80	―	22.80	Driver for the above staffs at construction stage
Driver		7.00	―	7.00	Driver for the above staffs at construction stage (spot)
Total		383.6	―	383.6	

2-2-4-5 Quality Control Plan

Main quality control items for earth work and concrete work are described as Table 2-22. In order to carry out effective supervision of quality control by supervisory consultant, required quality control items and required organization of quality control management by the contractor will be specified clearly.

Table 2-22 Quality control plan

Location	Inspection Items	Inspection Method	Inspection frequency
Foundation Ground	Inspection of soil condition	Visual, Comparison with geological survey soil characteristic	Per every construction block
	Foundation width/height	Measurement of width and height	Per every construction block
	Bearing condition of foundation ground	Visual, Comparison with geological survey soil characteristic	Per every construction block
Soil Filling	Soil material, base test	Density, Particle Sieving, water contents, Compaction density test	Before commencement and on changing fill soil material
	Permeability of Fill soil material and foundation ground	Permeability test	In case of encountering significantly different material from design and consultant request
	Layer compaction test	Field density test	Every $400m^2$, Max per $300m^3$
	Spread soil layer thickness	Thickness measurement	Every layer
	Contamination of foreign material in fill soil	Visual	Every layer
	Contact inspection of foundation ground and fill soil layer	Visual and layer thickness	Every contact layer
	Condition of dam embankment slope	Straightness, slope inclination	Every block before placing paving stone
Stone Works	Quality of rock material	Gravity, Absorption	Before commencement and on changing material
	Dimension	Measuring size of rock	Every block
	Layer thickness	Measuring thickness	Every block
	Mixing ration of mortar for mortar masonry	Ratio checking	Every block
Road base	Soil material, base test	Density, Particle Sieving, water contents, Compaction density test	Before commencement and on changing fill soil material
	Layer compaction test	Field density test	Every $100m^3$
Concrete	Aggregate material	Sieving test	On concrete trial mix test and on changing material source
	Cement	Physical test, Chemical test	On concrete trial mix test and on changing material source
	Flesh concrete	Slump, Air contents, Chloride test	Every placing concrete
	Concrete strength	Compressive strength test	Every $200m^3$concrete placing
Reinforcement steel bar	Strength	Tensile strength test	On delivery, On changing material source
	Bar installation	Bar size, pitching inspection	Every concrete placing
measurement of As build	Dimension and level of structure	Measuring dimension and level	Every main structure

2-2-4-6 Plan for Procurement of Construction Materials

Table 2-23 shows the procurement plan of main construction materials.

Table 2-23 Source of materials procurement

Item of Materials	Name of material	Source of material		Remarks
		In Vietnam	Import	
Construction Materials	Light weight shape steel	○		
	Deformed steel bar	○		
	Cement	○		
	Fine aggregate for concrete	○		
	Course aggregate for concrete	○		
	Additive for concrete	○		
	Stone material	○		
	Timber	○		
	Plywood	○		
	Steel form	○		
	Asphalt	○		
	Hand rail	○		
	Gasoline, Light oil	○		
	Oil and lubricant	○		
	Valve gate	○		
Equipment	Auto level	○		
	Flow meter	○		
	Rain gauge	○		
	Handy Talky	○		
Construction machinery	Bulldozer	○		
	Back hoe	○		
	Dump truck	○		
	Truck, Trailer	○		
	Crawler crane, Truck crane	○		
	Tire roller, Vibration roller	○		
	Portable concrete mixer	○		
	Steel bar cutter and bender	○		

2-2-4-7 Soft Component Plan

During and after rehabilitation of reservoirs, Soft component shall be executed to assist 1)Water Management targeting IMC, AC and WUG to support smooth implementation by using equipment which will be procured and installed under the Project, and to assist 2)Organizational Management targeting AC and WUG, and also 3)Strengthening Safety Management of Reservoirs targeting IMC, AC and WUG to support sustaining effects of the Project as minimum requirements. Contents of Soft component plan are shown in Table 2-24.

Soft component activities at three(3) stages are performed that is; 1)before commencing the construction works, 2)after finishing the construction works of four(4) reservoirs and 3)after finishing the construction works of three(3) reservoirs. The proposed input amount from Japan and Vietnam are 11.4 MM and 42.4 MM respectively. Details of the Soft component are shown in “Appendix 5.

Soft Component Plan".

Table 2-24 Contents of soft component plan

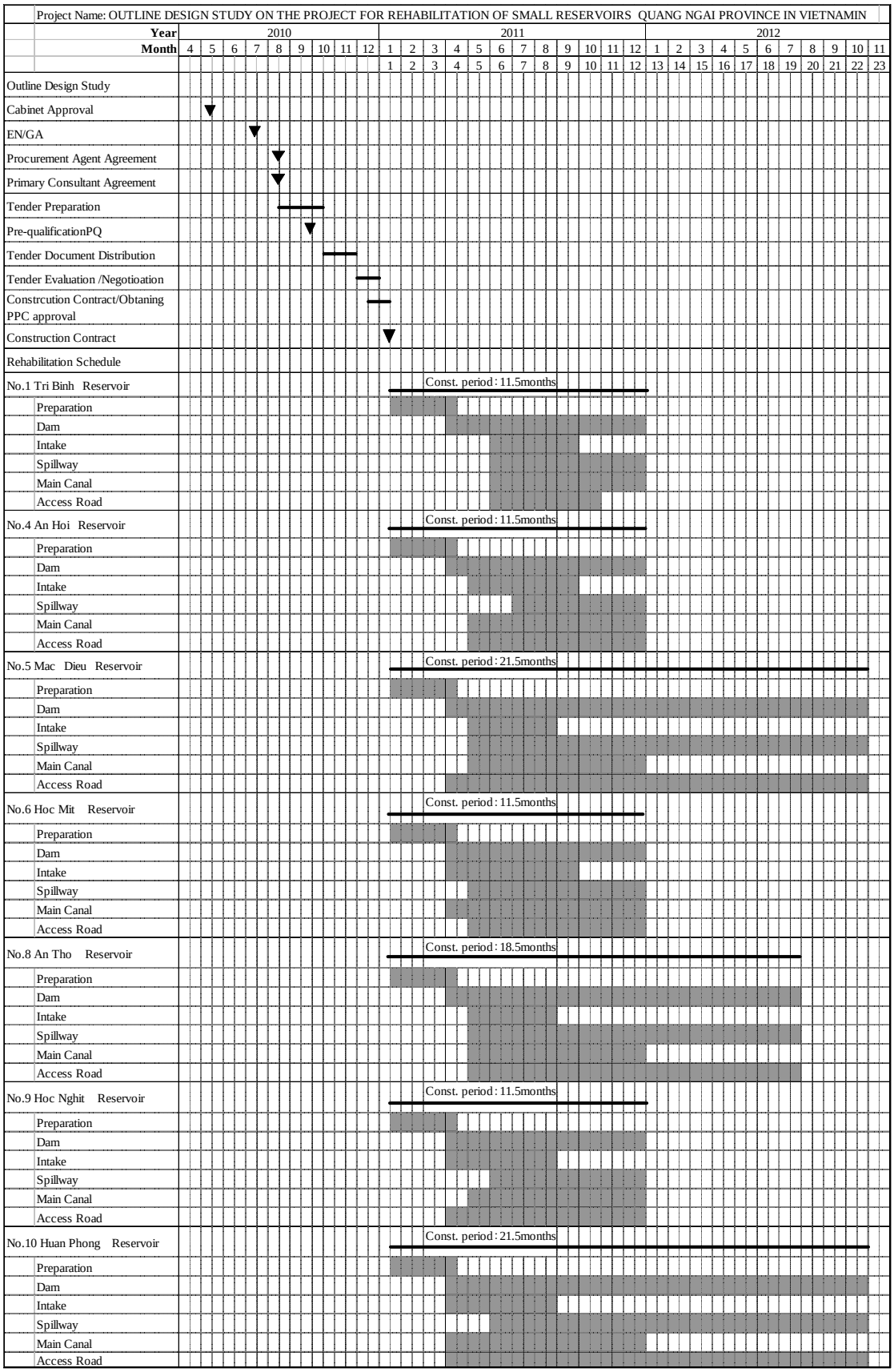
(1) Assistance for Water Management (by Japanese expert)
1) To clear constraints and measures to improve an existing irrigation method through workshops at the reservoir site 2) To enhance irrigation technology through workshop 3) To prepare the manuals of water management to distribute water impartially 4) To establish an annual operation rule of a reservoir and apply it at the site 5) To provide water level staffs and name plates showing diversion point and to carry out on-the-job training in terms of diversion.
(2) Assistance for Organizational Management (by Vietnamese local resource)
1) To explain management, duties and significance of WUG with intension of producing farmer's ownership through workshop 2) To carry out training for WUG in term of planning of regular maintenance, functional diagnosis of facilities, mowing and cleaning through workshop and to assist the preparation of O&M manual 3) To hold the workshop for WUG on management methods concerning finance, administration and information by using personnel computer and to support the preparation of application documents for receiving required subsidies
(3) Assistance for Strengthening Safety Management of Reservoirs (by Japanese expert)
1) To collect data and know-how concerning small scaled reservoir management and to explain them to reservoir managing staffs. 2) To analyze the factors affecting on collapse of a dam body and guide the observation method of rainfall and leakage through workshop and to carry out on-the-job training. 3) To hold the workshop at the site for related agencies in term of no trespassing of vehicles and inhabitants and livestock intrusion into a reservoir site 4) To hold the workshop for WUG and related persons concerning disaster prevention in terms of reservoir management at normal and emergency times and how to delivery the warning message to people and to prepare the draft of reservoir management manuals 5) To assist in the preparation of regulations on safety management of reservoirs

Manuals of 1)water management, 2)O&M and 3)regulation of safety management of reservoirs shall be prepared during the activities. And effectiveness of the activities will be conformed through questionnaire surveys after the Project implementation.

2-2-4-8 Implementation Schedule

From the experience of rehabilitated reservoirs, it was concluded that critical path on construction schedule of proposed reservoir rehabilitation will be the works for dam embankment at upstream side and intake construction. Taking into the consideration of following condition, project implementation schedule is planed as attached Figure 2-14.

1) It will be expected to have practicable progress of embankment works in dry season (February - August) and no progress in rainy season (October - December) in this region.
2) It is planed to disrupt irrigation water supply for the rehabilitation works only one time for summer-autumn crops.
3) It is planed to maintain supply of irrigation water to the firms except the disruption time of supply irrigation water for summer-autumn crops during rehabilitation works.
4) It is planed to maintain the function of spillway through the whole period of rehabilitation works.
5) To consider the ability and experience records on the progress of works of local contractors who



had experience in executing reservoir rehabilitation projects in this region

Figure 2-14 Project implementation schedule

2-3 Obligations of the Government of Viet Nam

PPC shall undertake to allocate budget for 1)Compensation of beneficiaries, 2)Project management fee by DARD/PMB, 3)Office expenditure of DARD/PMB 4)Commission for Blanket Disbursement Authorization (BDA) and 5)Soft Component after Exchange of Note (E/N) and Grant Agreement (G/A). Table 3-1 shows cost to be undertaken by PPC for each reservoir.

Table 2-25(1) Cost to be undertaken by Government of Viet Nam (Million J. Yen)

Items	1.Tri Binh	4.An Hoi	5.Mach Dieu	6.Hoc Mit	8.An Tho	9.Hoc Nghi	10.Huan Phong	Total
1)Compensation (sub-total)	8.9	4.0	16.6	4.0	9.3	5.8	9.8	58.4
- Land acquisition, resettlement	1.2	0.7	2.4	0.8	1.6	1.0	1.6	9.2
- Felling trees	3.0	0.7	4.4	1.0	1.7	0.9	1.1	12.8
- Subsidy of changing job	2.1	1.0	3.2	0.3	1.7	2.0	2.7	12.9
- Agriculture compensation	1.6	1.3	4.9	1.6	3.1	1.3	3.3	17.1
- Expense for the above Procedure	0.2	0.1	0.3	0.1	0.2	0.1	0.2	1.0
-Contingency (10%)	0.8	0.2	1.5	0.4	0.8	0.5	0.9	5.3
2) DARD/PMB Project management fee (2.391%)	1.1	0.7	2.5	1.1	1.6	1.3	2.6	10.9
3) Equipment for operation and management	1.1	1.1	1.1	1.1	1.1	1.1	1.1	7.7
4) One(1) vehicle for management of the Project	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	4.3
5) Commission for BDA (2%)	1.5	0.9	3.4	1.5	2.1	1.8	3.5	14.7
6) Soft component	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.4
Total	13.4	7.5	24.4	8.6	14.9	10.8	17.8	97.4

Table 2-25(2) Cost to be undertaken by Government of Viet Nam (Million VND)

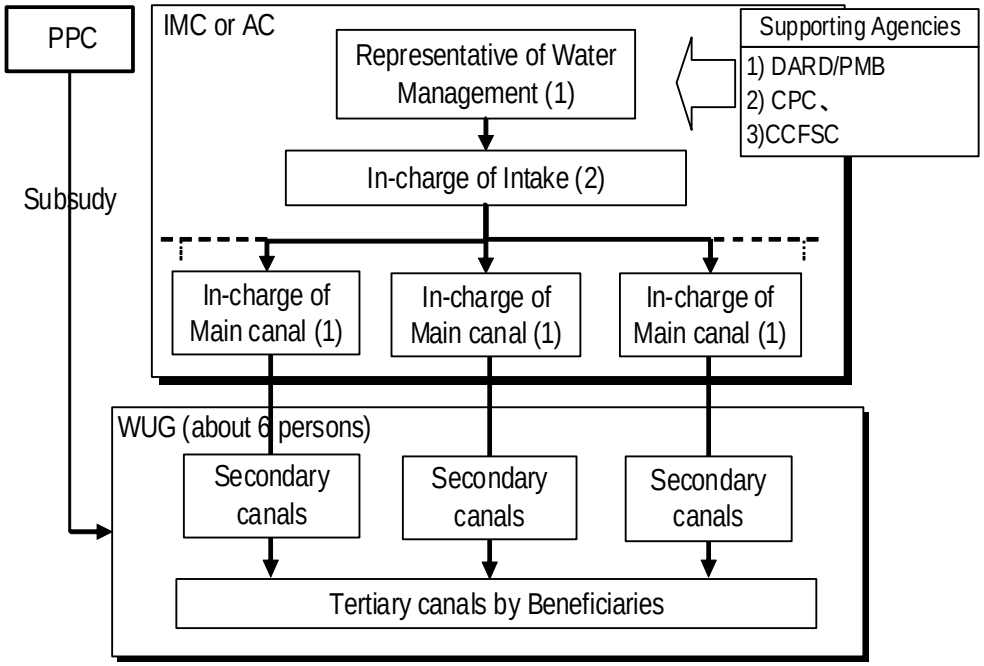
Items	1.Tri Binh	4.An Hoi	5.Mach Dieu	6.Hoc Mit	8.An Tho	9.Hoc Nghi	10.Huan Phong	Total
1)Compensation (sub-total)	1,635	741	3,066	745	1,709	1,068	1,809	10,774
- Land acquisition, resettlement	220	124	435	141	303	184	297	1,704
- Felling trees	548	120	816	179	320	167	212	2,362
- Subsidy of changing job	390	176	582	47	321	361	504	2,380
- Agriculture compensation	300	240	900	297	578	240	600	3,156
- Expense for the above Procedure	29	13	55	13	30	19	32	192
-Contingency (10%)	149	67	279	68	155	97	164	979
2) DARD/PMB Project management fee (2.391%)	201	127	462	203	292	244	472	2,001
3)Equipment for operation and management	200	200	200	200	200	200	200	1,400
4)One(1) vehicle for management of the Project	(114)	(114)	(114)	(114)	(114)	(114)	(114)	796
5)Commission for BDA (2%)	272	171	625	274	394	330	638	2,704
6)Soft component	(36)	(36)	(36)	(36)	(36)	(36)	(36)	254
Total	**2,458**	**1,389**	**4,503**	**1,573**	**2,745**	**1,992**	**3,269**	**17,929**

BDA: Blanket Disbursement Authorization

2-4 Project Operation Plan

Only "8. An Tho" reservoir is managed by IMC to operate and maintain it, and six(6) numbers of ACs are responsible for other six(6) reservoirs respectively. While government of Viet Nam has given policy "decree for Water resources" established in 1998 that WUA under IMC or AC should manage system below secondary canals and IMC, AC do above main canal including reservoir's management, most of reservoirs have been still managed by IMC and AC.

After implementation under the Project, structure of operation and maintenance (O&M) is proposed as Figure 2-15 in conformity with the decree. Soft component under the Project shall assist WUG coordinated by IMC and AC regarding on 1)Water management, 2)Strengthening of WUA organization and 3)Safety management of reservoir for securing minimum sustainability of the Project.



IMC: Irrigation Management Company
AC: Agricultural Coorporative
WUG: Water Users' Group
PPC: Quang Ngai Provincial People's Committee
DARD: Department of Agriculture and Rural Development
CPC: Commune People's Committee
SBFSCR Steering Board of Flood and Storm Control for Reservoir
PMB: Project Management Board

Figure 2-15 Operation and maintenance structure

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Estimated approximate Project cost of the GACE Japan's Grant scheme is given below;

(1) Overall Project cost: It is not open till approval of Contractor's contract

(2) Project cost to be undertaken by Japan: It is not open till approval of Contractor's contract

Table 2-26 Cost borne by GACE Japan's Grant scheme

Item		Million J.yen	Million VND
1.Construction works	7 reservoirs		
2.Procurement agent			
1)Procurement, Supervision			
2)Legal advisor			
3.Supervisory Consultant			
1)Supervision			
2)Soft component			
Total			

(3) Project cost to be undertaken by the Vietnamese side:

Approximate 97.4 Million J.yen (Million 17,929 VND)

Table 2-27 Cost borne by the Vietnamese side

Item	Japanese yen (Million yen)	Local currency (Million VND)
1)Compensation	58.4	10,774
2) DARD/PMB Project management fee	10.9	2,001
3)Equipment for operation and management	7.7	1,400
4)One(1) vehicle for management of the Project	4.3	796
5)Commission for BDA (2%)	14.7	2,704
6)Soft component	1.4	254
Total	**97.4**	**17,929**

1 US$=17,796 VND, 1 US$ =96.53 Japanese yen, 1 VND=0.00542 J.yen

(4) Condition of estimation

(a) Time of estimation :October 2009

(b) Currency exchange rate:

- 1 USD= 96.53 J. yen
- 1 VND= 0.00542 J. yen
- 1 VND= 17,796 VND

(c) Implementation period: Project period is given in the work schedule (21.5 months)

(d) Others: The cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

2-5-2 Operation and Maintenance Cost

Table 2-29 shows Operation and maintenance (O&M) cost of rehabilitated reservoir similar to requested reservoirs under the Project. O&M cost for the Project, therefore, is estimated 3,430 million VND (490 million VND x 7 reservoirs). This amount is only 0.98% of 350,161 million VND which is budget allocation of PPC in year 2009.

Table 2-28 O&M cost of rehabilitated similar reservoir /Reservoir /year

Item	Million VND	Remarks
1)Operation	290	Personnel expense (8), Gate operation, cutting grass, canal de-silting, etc.
2)Maintenance	120	Lubrication, lighting and fuel, communication, etc.
3)Long term repair	50	Repainting, revetment protection repair, etc.
4)Others	30	Meetings for flood protection measures, etc.
Total	490	

2-6 Other Relevant Issues

For implementation project, PPC shall undertake land acquisition for expanding area of reservoirs, access roads, main canals and so on. Since PPC has similar experience on land acquisition, there is no problem for implementation. However, while targeting seven(7) reservoirs are located wide area range in Quang Ngai province, PPC is required to start undertaking this issues immediate after E/N signing by and between governments of Viet Nam and Japan.

Chapter 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

3-1-1 Direct Effect

Direct effects of the Project shown in Table 3-1 are composed of Direct effect-1; "To be secured stability of irrigation water at 7 reservoirs" and Direct effect-2; "To be reduced risk by occurring collapse of 7 reservoirs" under the Project.

Table 3-1 Direct effects of the Project

Expected effects	Current status and issues	Activities under the Project	Objectively verifiable indicators
Direct effect-1 : To be secured stability of irrigation water at 7 reservoirs	There are more than 100 small-scale Reservoirs in Quang Ngai Province and most of them have degraded and been leading leakage through dam body. In addition, farmers are facing upon habitual deficiency of irrigation water for two(2) crops a year due to a lack of reservoir capacity, unimproved intake facilities and main canals.	To raise up height of dam bodies, To improve spillway, intake facilities and main canals of Reservoirs	1,260,000m^3 (8,020,100-6,754,000) of active capacity in total for 7 reservoirs will increase.
Direct effect-2 : To be reduced risk by occurring collapse of 7 reservoirs	People living in the Province are suffering from the risk of dam collapse brought by recurrent typhoons occurring from recent global warming phenomena.	To rehabilitate dam bodies and access roads to Reservoirs	Leakage from 7 reservoirs will decrease.

(1) Direct effect-1

It is expected that irrigation water for double crops will be secured by increasing active capacities in total from 6,754,000 to 8,020,000 m^3 (19 %) under the Project shown in Table 3-2.

Table 3-2 Present and planed active capacities of reservoirs

Name of reservoirs	Active capacities (m^3)		Increase rates
	Present	After Project	
1. Tri Binh	224,000	284,300	27%
4. An Hoi	448,500	448,500	0%
5. Mac Dieu	1,601,300	2,177,100	36%
6. Hoc Mit	290,000	580,000	100%
8. An Tho	2,050,000	2,390,000	17%
9. Hoc Nghi	310,900	310,900	0%
10. Huan Phong	1,829,300	1,829,300	0%
7 reservoirs in total	**6,754,000**	**8,020,100**	**19%**

(2) Direct effect-2

It is expected that risk by occurring collapse of dam bodies of 7 reservoirs will be reduced by reducing 235 litres/minute/100m of leakage in total from reservoirs.

Table 3-3 Leakage volume from 7 reservoirs

Name of reservoirs	Current leakage (Litres/minute/100m)	After project
1. Tri Binh	15	To be decreased
4. An Hoi	60	
5. Mach Dieu	67	
6. Hoc Mit	20	
8. An Tho	27	
9. Hoc Nghi	17	
10. Huan Phong	29	
7 reservoirs in total	**235**	

Source: Leakage surveys, JICA O/D Study Team

(3) Effect born of Soft component activities

It is expected that 1)appropriate water management will be performed by IMC, AC and WUG, and 2)WUG will manage irrigation facilities properly with necessary understanding of O&M by using water management and O&M Manuals which shall be prepared during activities of Soft component. And also 3)appropriate safety management of reservoirs will be executed by using regulation through the Soft component activities.

3-1-2 Indirect Effect

(1) Increase of irrigation area by annual double crops

It is expected that irrigation area with annual double cropping will be increased by securing stability of irrigation water after rehabilitation of dam bodies and improvement of main canals of 7 reservoirs. Since the irrigation area will be increased from 1,025 to 1,692 ha (65%) in total, agricultural productivity and livelihood in the Project area would be improved.

Table 3-4 Present and planed irrigation areas after the Project

Name of reservoirs	Present irrigation area (ha)			Planed irrigation area (ha)			Increase rates
	W-S crops	S-A crops	Total	W-S crops	S-A crops	Total	
1. Tri Binh	74	30	104	90	90	180	73%
4. An Hoi	40	40	80	40	40	80	0%
5. Mac Dieu	167	167	334	270	270	540	62%
6. Hoc Mit	7	40	47	70	70	140	98%
8. An Tho	90	90	180	161	161	322	79%
9. Hoc Nghi	40	40	80	50	50	100	25%
10. Huan Phong	100	100	200	165	165	330	65%
7 reservoirs in Total	**518**	**507**	**1,025**	**846**	**846**	**1,692**	**65%**

Sources: Baseline surveys, JICA O/D Study Team,
Remarks: W-S: Winter-Summer crops, S-A: Summer-Autumn crops

(2) Effects by reducing risk of dam collapse under the Project

Damages by dam collapse due to being inundated in communes downstream of the reservoirs are assumed by flood damages occurred in 1999 which was the biggest flood in the last 10 years, since information of dam collapse is not available. Table 3-5 shows amount of damages in each commune in relation with requested reservoirs by 1999 flood. Therefore, it is expected that approximately 28,310 million VND would be protected under five(5) communes with population of 47,595 (Statistics of year 2008) by risk of dam collapse.

Table 3-5 Damages and its amount caused by the flood in 1999

Commune name	Binh Nguyen	Binh Thanh Dong	Duc Phu	Pho Ninh	Pho Cuong	Amount of damages (Million VND)		
Population:47,595	10,431	2,734	8,395	10,519	15,516	Unit	Unit cost	Amount
Related reservoirs	1.Tri Binh	4.An Hoi	5.Mac Dieu, 6.Hoc Mit	8.An Tho	9.Hoc Nghi, 10.Huan Phong			
1)Death	2	0	4	0	1	people	20	140
2)Injury	6	8	5	11	6	people	5	180
Washed away or destroy								
3)House	8	2	9	15	4	House	100	3,800
4)Crop	233	25	254	69	431	ha	2	2,025
5)Land	3.0	8.5	2.3	1.2	3.0	ha	180	3,240
6)Road	4.0	3.5	10.4	12.0	6.0	km	500	17,925
7)Canal	112	60	154	42	50	m	0.3	125
8)Reservoir	3	1	2	1	2	dam	50	450
9)Spillway	2	0	1	0	1	dam	100	400
Amount (Million VND)	4,260	3,638	7,373	7,972	5,067		Total	28,310

Source: Flood and storm protection department of DARD

3-1-3 Other Anticipated Effects

(1) Labor burden on O&M will be mitigated by improving water management efficiency through the rehabilitation of intake facilities.

(2) Roads to reservoirs will be accessible even during rainy season and O&M of reservoirs will be simple by improving access roads to reservoirs.

(3) Living environment will be improved while access road is utilized for agriculture as well as communication among communes.

(4) Damage of agricultural products will be minimized by reducing risk of reservoir collapse.

3-2 Recommendations

Ministry of Agriculture and Rural Development (MARD) is the reliable government Agency in Viet Nam in partnership with Japanese assistance, international organization and other donors as

supporting agency for water resources and agricultural development projects. Department of Agriculture and Development (DARD) under Quang Ngai Provincial People's Committee (PPC) has many experiences on rehabilitation of reservoirs financed by JBIC, ADB, WB and the Natural Disaster Mitigation Project funded by AusAID, Australia. During implementation of those projects, Quang Ngai PPC has steadily executed allocation of the budget for such purposes as staffing, equipment, O&M, etc. And while there are more than 100 reservoirs in the Province, the PPC has performed their management of reservoirs by their own budget. Therefore, it is evaluated that the Project will be implemented appropriately with remarkable assistance from the PPC. And also, after implementation, DARD will carry out O&M of facilities to be rehabilitated under the Project.

Quang Ngai PPC , however, has no experience to undertake Japan's grant aid scheme. In case of this Project, based on the Grant Agreement (G/A) which will be concluded between JICA and the PPC, Quang Ngai PPC shall make an Agent Agreement (A/A) with a Procurement agency of Japan to procure the supervisory consultant and construction contractors and supervise the construction of the Project, in accordance with guideline of Grant Aid for Community Empowerment (GACE) and A/A.

While it is found that discrepancy of business custom between Viet Nam and Japan in financial management, procedure of design changes during construction, handling of surplus fund and so on, immediately after approval of GOJ for the Project implementation, it is required that the PPC and concerned organizations shall start to discuss about contents of A/A with the Procurement Agency of Japan.

[Appendices]

Appendix-1 Member List of the Study Team

Responsibility		Name	Position
1	Team Leader	Mr. Yoshiyuki GOYA	Executive Technical Adviser to the Director General, Rural Development Department, the Japan International Cooperation Agency (JICA)
2	Rehabilitation of Reservoir	Mr. Yoshiyuki MOURI	Chief of Soil Engineering Lab., National Institute for Rural Engineering , National Agriculture and Food Research Organization
3	Procurement Management 1	Mr. Toshio SUGAWARA	Director, Second Construction Management Division, First Management Department, Japan International Cooperation System (JICS)
4	Procurement Management 2	Ms. Yuka SUGAWARA	Second Construction Management Division, First Management Department, Japan International Cooperation System (JICS)
5	Planning Management 1	Ms. Mari MIURA	Project Officer, Division II, Paddy Field Based Farming Area Group, Rural Development Department, the Japan International Cooperation Agency (JICA)
6	Planning Management 2	Mr. Kentaro NISHIYAMA	Project Officer, Division I, Paddy Field Based Farming Area Group, Rural Development Department, the Japan International Cooperation Agency (JICA)
7	JICA Expert	Mr. Shigeo KARIMATA	Irrigated Agriculture and Rural Development Adviser, Ministry of Agriculture and Rural Development, International Cooperation Department, Socialist Republic of Viet Nam
8	JICA Officer	Mr. Shohei MATSUURA	Officer of Vietnam office, the Japan International Cooperation Agency (JICA)
9	Chief Engineer / Embankment Rehabilitation Planning / Capacity Building Planning	Mr. Kazumitsu TSUMURA	Executive Officer, International Department, Sanyu Consultants Inc. (SCI)
10	Spillway and Main Canal Rehabilitation Planning / Maintenance Planning / Irrigation and Water Management Planning	Mr. Fumimichi OBU	Sanyu Consultants Inc. (SCI)
11	Reservoir Management Facility Planning / Irrigation and Water Management Planning(2)	Mr. Kazuhisa OKADA	Sanyu Consultants Inc. (SCI)
12	Access Road Rehabilitation Planning	Mr. Haruo HIKI	Sanyu Consultants Inc. (SCI)
13	Construction Planning / Procurement Planning / Cost Estimation	Mr. Masanori NARUKAWA	Sanyu Consultants Inc. (SCI)
14	Coordinator / Embankment Rehabilitation Planning(2) / Access Road Rehabilitation Planning (2)	Mr. Toru NAKAGAWA	Sanyu Consultants Inc. (SCI)

Appendix-2 Study Schedule

date	day	No.	Official Members	No.	Consultant Members: Chief Engineer / Embankment Rehabilitation Planning / Capacity Building Planning Mr. Kazumitsu TSUMURA	Spillway and Main Canal Rehabilitation Planning / Maintenance Planning / Irrigation and Water Management Planning Mr. Fumimichi OBU	Reservoir Management Facility Planning / Irrigation and Water Management Planning(2) Mr. Kazuhisa OKADA	Access Road Rehabilitation Planning Mr. Haruo HIKI	Construction Planning / Procurement Planning / Cost Estimation Mr. Masanori NARUKAWA	Coordinator / Embankment Rehabilitation Planning(2) / Access Road Rehabilitation Planning(2) Mr. Toru NAKAGAWA
Aug.17	Mon			1	Move (Narita-Hanoi)					Move (Narita-Hanoi)
Aug.18	Tue			2	Meeting at JICA Viet Nam Office Meeting with MARD Move (Hanoi-Danang)					Meeting at JICA Viet Nam Office Meeting with MARD Move (Hanoi-Danang)
Aug.19	Wed			3	Move (Danang-Quang Ngai) Meeting with DARD (Ic/Re)					Move (Danang-Quang Ngai) Meeting with DARD (Ic/Re)
Aug.20	Thu			4	Field Survey (10.Huan Phong, 9.Hoc Nghi, 8.An Tho)					Field Survey
Aug.21	Fri			5	Field Survey (4.An Hoi, 5.Mach Dieu, 6.Hoc Mit)					Office Setting
Aug.22	Sat			6	Field Survey (1.Tri Binh, 2.Nam Binh Thuong)					Field Survey
Aug.23	Sun			7	Internal Meeting					Internal Meeting
Aug.24	Mon			8	Meeting with DARD (Entrustment)					Meeting with DARD
Aug.25	Tue			9	Preparation of Entrustment					Preparation of entrustment
Aug.26	Wed			10	〃					〃
Aug.27	Thu			11	〃					〃
Aug.28	Fri			12	Meeting with DARD					〃
Aug.29	Sat			13	Preparation of Entrustment					〃
Aug.30	Sun			14	Internal Meeting					Internal Meeting
Aug.31	Mon			15	Meeting with JICA Expert Team (The Project for Building Disaster Resilient Societies in Central Region in Vietnam)					Meeting with JICA Expert Team
Sep.1	Tue			16	Preparation of Entrustment				Move (Narita-Hanoi)	Preparation of entrustment
Sep.2	Wed			17	Internal Meeting				Move (Hanoli-Danang)	Internal Meeting
Sep.3	Thu			18	Preparation of Entrustment				Move (Danang-Quang Ngai)	Preparation of entrustment
Sep.4	Fri			19	〃				Construction Planning, Procurement, Cost Estimation Survey	〃
Sep.5	Sat			20	Meeting with DARD				Meeting with DARD	
Sep.6	Sun			21	Internal Meeting				Internal Meeting	
Sep.7	Mon			22	Field Survey	Irrigation and Social Survey	Field Survey		Construction Planning, Procurement, Cost Estimation Survey	Preparation of entrustment
Sep.8	Tue			23	〃	〃	〃		〃	〃
Sep.9	Wed			24	〃	〃	〃		〃	〃
Sep.10	Thu			25	〃	〃	Arrangement of Collected Documents		〃	〃
Sep.11	Fri			26	Preparation of Entrustment	〃	〃		〃	〃
Sep.12	Sat			27	Meeting with DARD				Meeting with DARD	
Sep.13	Sun			28	Internal Meeting				Internal Meeting	
Sep.14	Mon			29	Trend Survey of The Other Donors				Trend Survey of The Other Donors	Preparation of entrustment
Sep.15	Tue			30	Capacity Building Survey	Irrigation and Social Survey	Field Survey	Move (Nagoya-Hanoi-Danang)	Construction Planning, Procurement, Cost Estimation Survey	〃
Sep.16	Wed			31	Preparation of Entrustment	〃	〃	Move (Danang-Quang Ngai) Field Survey	Trend Survey of The Other Donors	
Sep.17	Thu			32	Contract with Local consultants, Meeting with Local Consultants					
Sep.18	Fri			33	Arrangement of Collected Documents					
Sep.19	Sat			34	Meeting wit DARD					
Sep.20	Sun			35	Internal Meeting					
Sep.21	Mon			36	Field Survey	Meeting with DARD Irrigation and Social Survey	Field Survey			
Sep.22	Tue			37	Arrangement of Collected Documents, Internal Meeting					
Sep.23	Wed			38	Capacity Building Survey	Irrigation and Social Survey	Arrangement of Collected Documents	Field Survey		Arrangement of Collected Documents
Sep.24	Thu			39	Arrangement of Collected Documents, Internal Meeting			〃		Field Survey
Sep.25	Fri			40	〃			〃		〃
Sep.26	Sat			41	Meeting with DARD					
Sep.27	Sun			42	Internal Meeting					
Sep.28	Mon	1	Move (Narita-Hanoi)	43	Meeting with Local Consultants and DARD					
Sep.29	Tue	2	Meeting at JICA Viet Nam Office	44	Internal Meeting					
Sep.30	Wed	3	Internal Meeting	45	Internal Meeting					
Oct.1	Thu	4	Move (Hanoi-Danang-Quang Ngai)	46	Ceration of Filed Survey Report					
Oct.2	Fri	5	Field Survey (An Toi(JIBIC), 4.An Ho, 5.Mac Dieu, 6.Hoc Mit, 8An Tho) Meeting with PPC and DARD Procurement Survey	47	Accompanying JICA				Accompanying JICS	Arrangement of Collected Documents Accompanying JICA
Oct.3	Sat	6	Field Survey (10,Huan Phong) Procurement Survey	48	〃				Arrangement of Collected Documents	Arrangement of Collected Documents
Oct.4	Sun	7	Internal Meeting Field Survey (1.Tri Bin, 2.Nam Binh Thuong) Move (Mr.Mouri) (Quang Ngai-Danang-Bangkok-Cairo)	49	〃				〃	Accompanying JICA
Oct.5	Mon	8	Meeting with PPC and DARD (Discussion and Signing of Minutes)	50	〃	〃	Ceration of Filed Survey Report	Ceration of Filed Survey Report	Accompanying JICA	〃
Oct.6	Tue	9	Field Survey (1.Tri Binh) Move (Quang Ngai-Danang-Hanoi)	51	〃 Ceration of Filed Survey Report	Ceration of Filed Survey Report	Accompanying JICA Ceration of Filed Survey Report	〃	Ceration of Filed Survey Report	Ceration of Filed Survey Report
Oct.7	Wed	10	Meeting with MARD (Signing of Minutes) Report to JICA Viet Nam Office Report to Embassy of JAPAN in Viet Nam Move (Mr.Goya and JICS) (Hanoi-) Move (Ms.Miura) (Hanoi-Ho Chi Minh City)	52	Ceration of Filed Survey Report					
Oct.8	Thu	11	(Mr.Goya and JICS) (-Narita) (Ms.Miura) (Biomass Project)	53	〃					
Oct.9	Fri	12	(Ms.Miura) Biomass Project Move (Ho Chi Minh City-)	54	〃					
Oct.10	Sat	13	(Ms.Miura) (-Narita)	55	〃					
Oct.11	Sun			56	〃					
Oct.12	Mon			57	Meeting with DARD, Local Consultants and JICA Expert Team (The Project for Building Disaster Resilient Societies in Central Region in Vietnam)			Move (Quang Ngai-Danang-Hanoi)		
Oct.13	Tue			58	Move (Quang Ngai-Danang-Hanoi)			Move (Hanoi-Nagoya)	Move (Quang Ngai-Danang-Hanoi)	
Oct.14	Wed			59	Meeting at JICA Viet Nam Office Move (Hanoi-)				Meeting at JICA Viet Nam Office Move (Hanoi-)	
Oct.15	Thu			60	(-Narita)				(-Narita)	
					Analysis in JAPAN					

date	day	No.	Official Members	Consultant Members						
				No.	Chief Engineer / Embankment Rehabilitation Planning / Capacity Building Planning Mr. Kazumitsu TSUMURA	Spillway and Main Canal Rehabilitation Planning / Maintenance Planning / Irrigation and Water Management Planning Mr. Fumimichi OBU	Reservoir Management Facility Planning / Irrigation and Water Management Planning(2) Mr. Kazuhisa OKADA	Access Road Rehabilitation Planning Mr. Haruo HIKI	Construction Planning / Procurement Planning / Cost Estimation Mr. Masanori NARUKAWA	Coordinator / Embankment Rehabilitation Planning(2) / Access Road Rehabilitation Planning(2) Mr. Toru NAKAGAWA
Nov.29	Sun			1	Move (Narita-Hanoi-Danang)		Move (Narita-Hanoi-Danang)			
Nov.30	Mon			2	Move (Danang-Quang Ngai)		Move (Danang-Quang Ngai)			
Dec.1	Tue			3	Meeting with DARD and Local Consultants		Meeting with DARD and Local Consultants			
Dec.2	Wed			4	〃		〃			
Dec.3	Thu			5	〃		〃			
Dec.4	Fri			6	〃		〃		Move (Narita-Hanoi)	
Dec.5	Sat			7	Internal Meeting		Internal Meeting		Move (Hanoi-Danang-Quang Ngai)	
Dec.6	Sun			8	Internal Meeting Move (Quang Ngai-Danang-Hanoi) Move (Hanoi-)		Internal Meeting Move (Quang Ngai-Danang-Hanoi) Move (Hanoi-)		Internal Meeting	
Dec.7	Mon			9	(-Osaka)		(-Osaka)		Meeting with DARD and Local Consultants	
Dec.8	Tue			10					〃	
Dec.9	Wed			11					〃	
Dec.10	Thu			12					〃	
Dec.11	Fri			13					Move (Quang Ngai-Danang-Hanoi) Move (Hanoi-)	
Dec.12	Sat			14					(-Narita)	
				Analysis in JAPAN						
Mar.4	Thu			1	Move (Narita-Hanoi-Danang)				Move (Narita-Hanoi-Danang)	
Mar.5	Fri	1	Move (Narita-Hanoi)	2	Move (Danang-Quang Ngai) Meeting with DARD				Move (Danang-Quang Ngai) Meeting with DARD	
Mar.6	Sat	2	Move (Hanoi-Danang-Quang Ngai) Field Survey (1.Tri Binh, 2.Nam Binh Thuong)	3	Meeting with Local Consultants				Meeting with Local Consultants	
Mar.7	Sun	3	Field Survey (On Toi(JBIC), Hoc Sum(ADB), 5.Mach Dieu, 6Hoc Mit) Internal Meeting	4	Arrangement of Documents				Arrangement of Documents	
Mar.8	Mon	4	Meeting with DARD (Explanation of Draft Outline Design Report)	5	Accompanying JICA				Accompanying JICA	
Mar.9	Tue	5	Meeting with PPC/DARD (Explanation of Draft Outline Design Report)	6	〃				〃	
Mar.10	Wed	6	Meeting with PPC/DARD (Signing of Minutes)	7	〃				〃	
Mar.11	Thu	7	Move (Quang Ngai-Danang) Meeting with MARD (Signing of Minutes)	8	Meeting with Local Consultants				Meeting with Local Consultants	
Mar.12	Fri	8	Report to Vietnam Embassy of Japan Report to JICA Viet Nam Office Move (Hanoi-)	9	Meeting with Local Consultants Move (Quang Ngai-Danang-Hanoi)				Meeting with Local Consultants Move (Quang Ngai-Danang-Hanoi)	
Mar.13	Sat	9	(-Narita)	10	Move (Hanoi-Narita)				Move (Hanoi-Narita)	
				Analysis in JAPAN						
Apr.24	Sat								Move (Singapore-Hanoi)	
Apr.25	Sun			1	Move (Narita-Hanoi-Danang -Quang Ngai)				Move (Hanoi-Danang-Quang Ngai)	
Apr.26	Mon			2	Meeting with DARD and Local Consultants				Meeting with DARD and Local Consultants	
Apr.27	Tue			3	〃				〃	
Apr.28	Wed			4	〃				〃	
Apr.29	Thu			5	〃				〃	
Apr.30	Fri			6	〃				〃	
May.1	Sat			7	Move (Quang Ngai-Danang-Hanoi)				Move (Quang Ngai-Danang-Singapore)	
May.2	Sun			8	Move (Hanoi-Narita)				Move (Singapore-Narita)	
									Analysis in JAPAN	

Appendix-3 List of Parties Concerned in the Recipient Country

1. JICA Viet Nam Office

Yasuhiro TOJO	Senior Representative
Katsuhiro ANDO	Officer
Shohei MATSUURA	Officer

2. Ministry of Agriculture and Rural Development: MARD

Vu Van Thang	General Director
Dang Van Ban	Head of Dam Division
Pham Quoc Hung	Deputy Head of Science Division
Truong Manh Tien	Officer of planning Division
Shigeo KARIMATA	JICA Expert

3. Quang Ngai Provincial People's Committee: PPC

Truong Ngoc Nhi	Vice-Chairman
Tran Van The	Deputy office of PPC
Nguyen Dinh Trinh	Staff of Office
(Department of Foreign Affair: FAD)	
Nguyen Minh Tri	Vice Director of FAD
Huynh My Hanh	Vice Head of International Cooperation Office
(Department of Plan and Investment: DPI)	
Huynh Minh	Head of Economic Office
Ho Minh Hoa	Deputy Division of Relation of External

4. Quang Ngai Agriculture and Rural Development Department: DARD

Truong Quang Viet	Director of DARD
Pham Van Son	Vice Head of DARD Office
Nguyen Co	Vice Head of Planning and Financial Section
Nguyen Mau Van	Director of the project management board
Huynh Khuong	Vice Director of the project management board
Ngenyen Ngoc Hung	Staff of the project management board
Nguyen Ngoc Hung	Technician from the project management board
Le Van Son	Head of DARD Financial Planning Department
Vo Quoc Hung	Hydraulic technician from Water Resource Department
Lam Dinh Hoe	DARD Office
Nguyen Nhung	Director of Hydraulic Work Exploitation One Partner Lt. Company

(Agricultural Division of DARD)

Pham Van Tuan	Head of Office
Bui Van Triet	Technician
Nguyen Van Nam	Technician

(Irrigation Management Company: IMC)

Nguyen Nhung	Director
Nguyen Lap	Vice Director
Huynh Tan Ngoc	Head of the technical department
Truong Le Hoai Linh	Head of the business planning department
Do Duc Y	Head of No.6 Sub-Station (8.An Tho reservoir management group)
Nguen Van Chau	Vice-head of No.6 Sub-Station (8.An Tho reservoir management group)

5. Agricultural Cooperative: AC

(1.Tri Binh reservoir, 2.Nam Binh Thuong reservoir)

Bui Xuan Cuu	Chairman
Nguyen Chanh Viet	Auditor
Can Anh	Accountant

(4.An Hoi reservoir)

Cruong Van Hien	Chairman
Nguyen Phuong	Accountant
Phou Duc An	Head of Inspection Board

(5.Mach Dieu reservoir)

Minh	Chairman
Duong	Vice Chairman
Chau	Accountant

(6.Hoc Mit reservoir)

Nguyen Xuan Tuoi	Chairman
Pham Dinh Chinh	Vice Chairman
Nguyen Cuong	Casher

6. Commune Peoples' Committee (CPC)

(Binch Nguyen CPC: 1.Tri Binh reservoir, 2..Nam Binh Thuong reservoir)

Nguyen Van Cong	Vice Chairman
Nguyen Tan Anh	Accountant
Nguyen Thanh Viet	Supervise

(Pho Cuong CPC: 9.Hoc Nghi reservoir, 10.Huan Phong reservoir)

Bui Van Chuyen	Vice Chairman
Nguyen Chanh Tram	Staff

7. Tax Department, Quang Ngai

Nguyen Tan Kien	Vice Head of Tax Department
Pham Cong Hung	Vice Head of Support and Propaganda office
Pham Van Ben	Vice Head of General affairs office
Bach Thanh Lin	Technician from General affair office

8. Local Consultants

Le Tan Son	Director Consultation and Construction Center Central Region College of Technology-Economics and Water Resources *1.Tri Binh reservoir
Nguyen Duc Minh	Director Quang Ngai Construction and Investment Consulting Joint-Stock Company *2.Nam Binh Thuong reservoir, 4.An Hoi reservoir, 5.Mach Dieu reservoir, Irrigation and social survey)
Bui Quy	Director Construction and Investment Development Consultancy Company *6.Hoc Mit reservoir, 8.An Tho reservoir
Nguyen Van Thong	Director Trung Long Limited Company of Consultancy and Construction *9.Hoc Nghi reservoir, 10.Huan Phong reservoir

9. Local Contractor

Tran Xuan Tho	Chairman of Governors - General Director Quang Ngai General Construction Development Joint-Stock Company
Vo Chau Long	Director Tin Nghia Constructive Enterprise
Luong Huu Hoa	Director Tien Bo Construction Company
Phan Ba Binh	Director Construction Joint-Stock Company No.25
Pham Thi Hang	Chief Plan and Technology Construction Joint-Stock Company No.25

10. JICA Expert Team (The Project for Building Disaster Resilient Societies in Central Region in Vietnam)

Satoshi NAKAMURA	Chief Adviser / Capacity Development
Hirohisa MIURA	Disaster Management Policy
Lolita Caparas GARCIA	Community Disaster Management

Appendix-4 Minutes of Discussions

Appendix-4.1 At Outline Design Survey (October 5, 2009)

MINUTES OF DISCUSSIONS
ON
OUTLINE DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION OF SMALL-SCALE RESERVOIRS
IN QUANG NGAI PROVINCE
IN SOCIALIST REPUBLIC OF VIET NAM

In response to a request from the Government of Socialist Republic of Viet Nam (hereinafter referred to as "Vietnam"), Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to conduct a Outline Design Study on "The Project for Rehabilitation of Small-scale Reservoirs in Quang Ngai Province" (hereinafter referred to as "the Project").

JICA sent the Outline Design Study Team (hereinafter referred to as "the Team") to Vietnam, which is headed by Mr. Yoshiyuki Goya, Executive Technical Advisor to the Director General, Rural Development Department, JICA, and is scheduled to stay in the country from 17th August, to 14th October, 2009.

The Team held discussions with the officials concerned of the Government of Vietnam and conducted a field survey at the study area.

As a result of discussions and field survey, both parties confirmed the main items described in the attached sheets. The confirmed items will be proceeded accordingly to formal procedures of both parties when the Project is accepted and approved by both Governments.

Quang Ngai, October 5, 2009

Mr. Yoshiyuki Goya
Leader
The Outline Design Study Team
Japan International Cooperation Agency
Japan

Mr. Truong Ngoc Nhi
Vice-Chairman
Quang Ngai Provincial People's Committee
Vietnam

Mr. Vu Van Thang
Director
Department of Water Resources
Ministry of Agriculture and Rural Development
Vietnam

ATTACHMENT

1. Objective of the Project

The objective of the Project is to rehabilitate the small-scale reservoirs and relevant facilities as well as activities for proper management of reservoirs in order to improve the livelihood of farmers by securing of stable agricultural water supply and to ensure the safety of inhabitant by reduction of the risk of flooding caused by collapse of reservoirs.

The Project aims to be a "model" of rehabilitation of reservoirs. The "model" includes the method of survey, rehabilitation, operation and maintenance of reservoirs, and effective water use with farmer's participation. The "model" is expectedly adopted by Vietnamese side for the rehabilitation of other reservoirs.

2. Project Sites

The Project Sites will be selected based on the result of the Study from the following sites as requested by Vietnamese Government.

- Binh Son District: Binh Nguyen Commune, Binh Thanh Dong Commune
- Mo Duc District: Duc Phu Commune
- Duc Pho District: Pho Cuong Commune, Pho Ninh Commune

The location map is shown in ANNEX I.

3. Vietnamese Implementing and Cooperating Agencies

3-1. The Vietnamese implementing agency is Quang Ngai Province People's Committee (Quang Ngai PPC)

3-2. The Vietnamese cooperating agency is Department of Water Resources, Ministry of Agriculture and Rural Development (MARD).

4. Items Requested by the Government of Vietnam

After discussions with the Team, the items described in ANNEX II were finally requested by Vietnamese side. JICA will asses the appropriateness of each item and recommend to the Government of Japan for approval.

4-1. Requested Rehabilitation of Reservoirs

The Team surveyed eight (8) reservoirs from ten (10) reservoirs which originally requested by Vietnamese Government, based on the priority given in the Preliminary Study implemented in February, 2009 with its current situation, degree of damage, risk of collapse and so forth. The Team considers that the priority of rehabilitation of target reservoir(s) will be given in accordance with; a) improvement of water use for agriculture production, b) damaged situation of embankment, spillway and intake works, and c) influence to downstream such as households, national highway, railway and so forth in case of embankment collapse.

The priority is given in case that cost exceeds the budget for the Project during the cost estimation.

4-2. Requested Access Roads to each Reservoir

The Team surveyed the current situation and problems of access roads. These roads will be also used as construction road so that material is basically considered to be gravel paving, but steeply part such as connected points to reservoirs and so forth might be concrete paving.

4-3. Requested Houses for Management of Reservoirs

As agreed by Preliminary Study Team and Vietnamese side on, the houses for management of reservoirs with necessary equipments are useful in order to maintain the reservoirs properly with participation of farmers.

4-4. Requested Equipments for Irrigation

The following requested equipments are considered to be covered by Japanese side.

- Auto level meter (1/reservoir)
- Rainfall gauge (1/reservoir)
- Current meter (1/reservoir)
- Handy speaker (2/reservoir)
- Reservoir water level staff (2/reservoir)
- Canal water level staff (2/reservoir)
- Water leakage device (1/reservoir)

4-5. Capacity Building of Irrigation Management Company (IMC), Water Users' Group (WUG) and Agricultural Cooperative (AC)

As the Preliminary Study Team and Vietnamese side agreed, capacity building for personnel for the reservoirs' management and appropriate water use are important. The necessary contents of capacity building are as follows;

- Target personnel: Staff of IMC, members of WUG and AC
- Purpose of the trainings: To strengthen the capacity for stable and effective management of reservoirs and water use
- Contents of the trainings: Reservoir management and water management by using requested equipments mentioned in 4-4. Requested Equipments for Irrigation.

5. Operation and Management of Reservoirs and Related Facilities

Appropriate operation and management of reservoirs and related facilities by Vietnamese side are necessary for safe and effective use of these facilities. .

Also, aquaculture by farmers using spillway should be basically prohibited, however, strictly allowed under the control of Vietnamese side for safe operation.

6. Japan's Grant Aid for Community Empowerment Scheme

6-1. The Vietnamese side understood and agreed to follow the Japan's Grant Aid for Community Empowerment Scheme (hereinafter referred to as "the GACE") explained by the Team, as described in ANNEX III-1 and III-2.

6-2. The items descried in "4. Items Requested by the Government of Vietnam" will be covered by Japan's Grant Aid, and major undertakings to be taken by each Government is shown in ANNEX IV. The Vietnamese side will take necessary measures, as described in ANNEX IV, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

7. Schedule of the Study

7-1. The Team will proceed to further studies in Vietnam until October 14.

7-2. JICA will prepare the draft report in English and dispatch a mission to Vietnam to explain its contents around February, 2010.

7-3. In the case that the contents of the report are accepted in principal by the Government of

Vietnam, JICA will complete the final report and send it to the Government of Vietnam around July, 2010.

8. Other Relevant Issues

8-1. Important Actions for Project Implementation

The following actions will be taken by Vietnamese Government with appropriate timing upon its necessity.

- Compensation for impossibility of farming during the rehabilitation work
- Compensation for moving of houses for rehabilitation work
- Security of land for collection of soil for materials to rehabilitate the dam body
- Permit approval of rehabilitation of reservoirs
- Permit approval of road use for rehabilitation work, and safety of the traffic through the target villages

8-2. Responsibilities of the DARD after Detailed Design completed by JICA

After Detailed Design completed by JICA, Department of Agriculture and Rural Development (DARD) shall be responsible for taking necessary measures required by Vietnamese side.

8-3. Initial Environmental Examination (IEE)

As Preliminary Study Team confirmed, the expected impacts of the Project is Rating; C (having minimal or little adverse impacts on the environment and society), in accordance with the "JICA's Environmental and Social Consideration Guideline" and Environmental Impact Assessment (EIA) is not required by Vietnamese side for the rehabilitation of reservoirs based on the Prime Minster's Decision; 80/2006/ND-CP.

8-4. Possible linkage with "Project for Building Disaster Resilient Societies in Central Region in Vietnam"

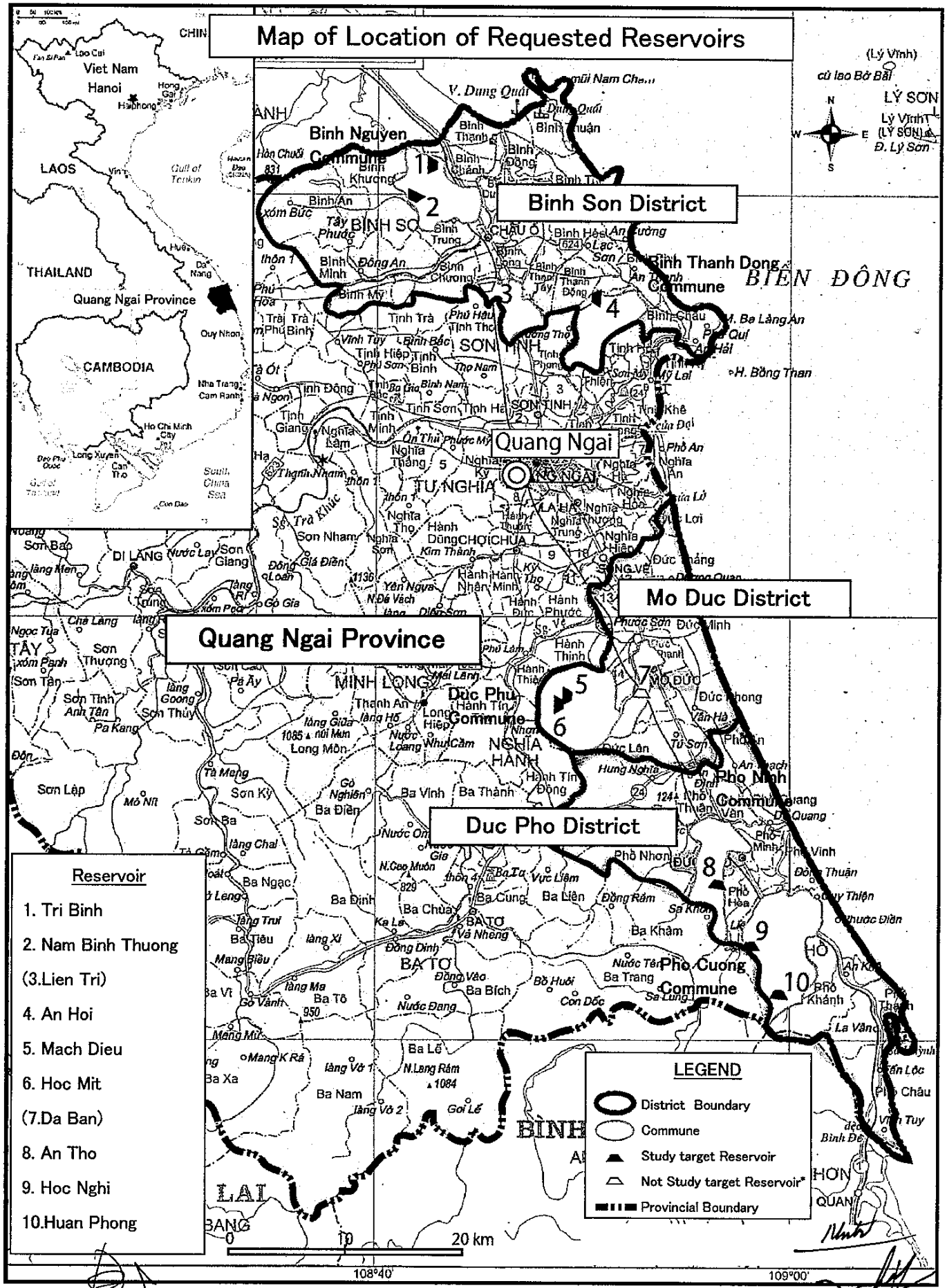
The possible linkage with the Project mentioned above which is implemented from 2008 for three (3) years in Hue, Quang Nam and Quang Ngai Provinces will be considered with the study result of the Team and Project Team of Building Disaster Resilient Societies in Central Region in Vietnam.

ANNEX

I Map of Location of Requested Reservoirs
II Components Requested by the Vietnamese Government
III-1 Flow Chart of Japan's Grant Aid for Community Empowerment Procedures
III-2 Flow of Funds for Implementation Under The Japan's Grant Aid For Community Empowerment
IV Major Undertakings to be taken by Each Government (Grant Aid for Community Empowerment Version: Provisional)

ANNEX-I

Map of Location of Requested Reservoirs



ANNEX II

Components Requested by the Vietnamese Government

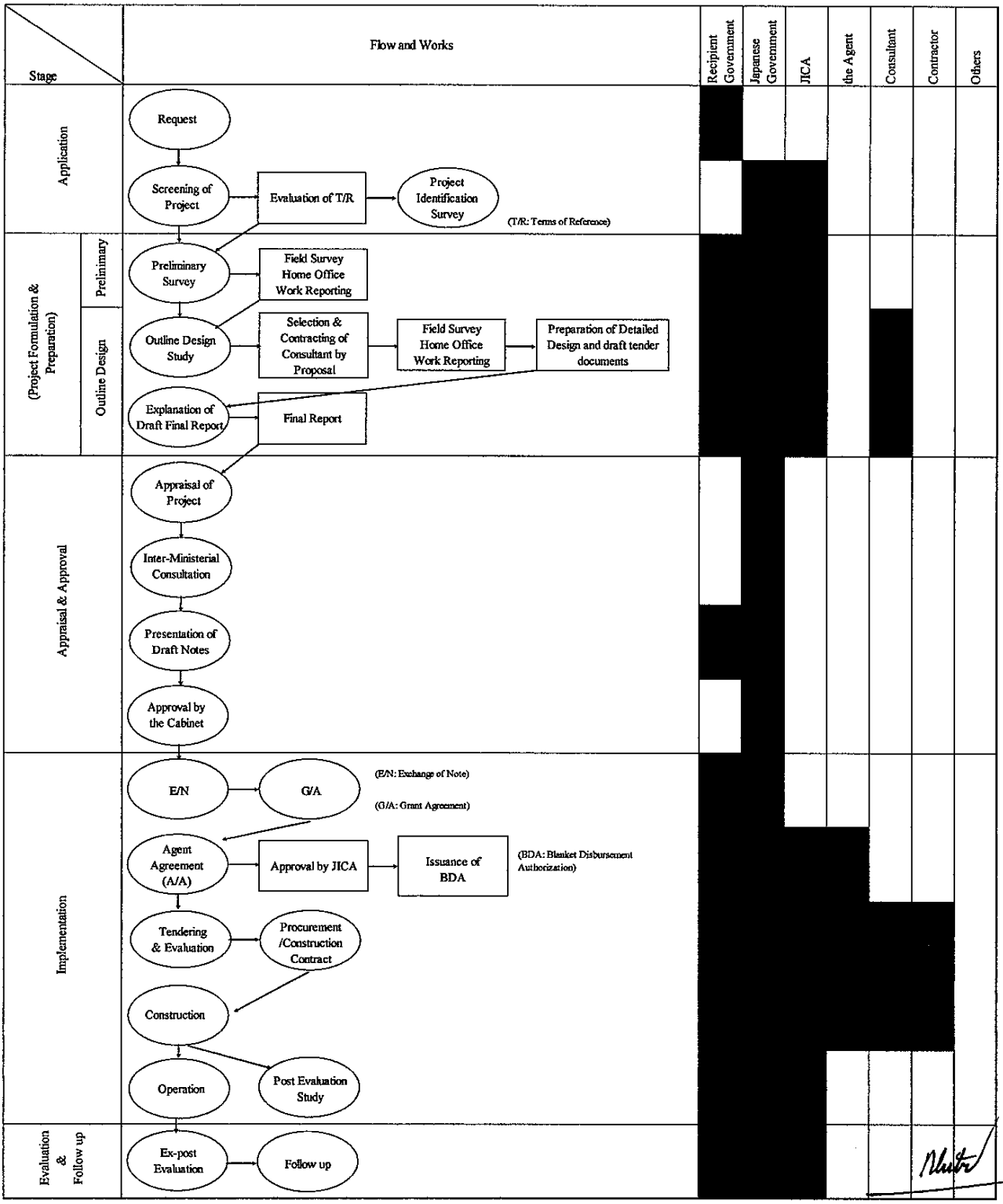
	Requested Subject	Original Request	Preliminary Study Stage	Outline Design Study Stage
1.	Rehabilitation of reservoirs	Rehabilitation of 10 reservoirs (*) (Dam body, Spillway, Embankment, Intake Work, and Main canal)	Same with the original request	Rehabilitation of 8 reservoirs with high priority (Reservoir No. 1, 2, 4, 5, 6, 8, 9 and 10)
2.	Access road to reservoir	Rehabilitation of access road to 10 reservoirs (Total length:16.8 km, Pavement: Concrete, Pave width: 3.5m)	Rehabilitation of access road to 10 reservoirs (Total length : 13.7 km)	Rehabilitation of access road (Total length : 13.7 km)
3.	Center for Mitigation and Management of Natural Disaster	Construction of 2 Centers of Mitigation and Management of Natural Disaster in Binh Son and Mo Duc Districts	10 houses for management of reservoirs	8 houses for management of each Reservoir with area of 40 m2
4.	Equipment for Operation and Management of Reservoirs	PC, Printer, Digital camera, Photocopier, Telephone/FAX, Gradienter, GPS instrument, Rainfall meter, Flow velocity instrument, Furniture, Motorbike, and Television	Auto level meter, Rainfall gauge, Current meter, Alarm devise	Auto level meter (1/reservoir), Rainfall gauge (1/reservoir), Current meter (1/reservoir), Handy speaker (2/reservoir), Reservoir water level staff (2/reservoir), Canal water level staff (2/reservoir), Water leakage device (1/reservoir)
5.	Capacity building of IMC and WUG staff (Soft Component)	Training and workshops for management staff and WUG members	Same with original request	Same with original request (Target personnel: Staff of IMC, members of WUG and AC)

* Name of Reservoirs

	Name	District	Community
1	Tri Binh	Binh Son	Binh Nguyen
2	Nam Binh Thuong		Binh Nguyen
3	Lien Tri		Binh Hiep
4	An Hoi		Binh Thanh Dong
5	Mach Dieu	Mo Duc	Duc Phu
6	Hoc Mit		Duc Phu
7	Da Ban		Duc Tan
8	An Tho	Duc Pho	Pho Ninh
9	Hoc Nghi		Pho Cuong
10	Huan Phong		Pho Cuong

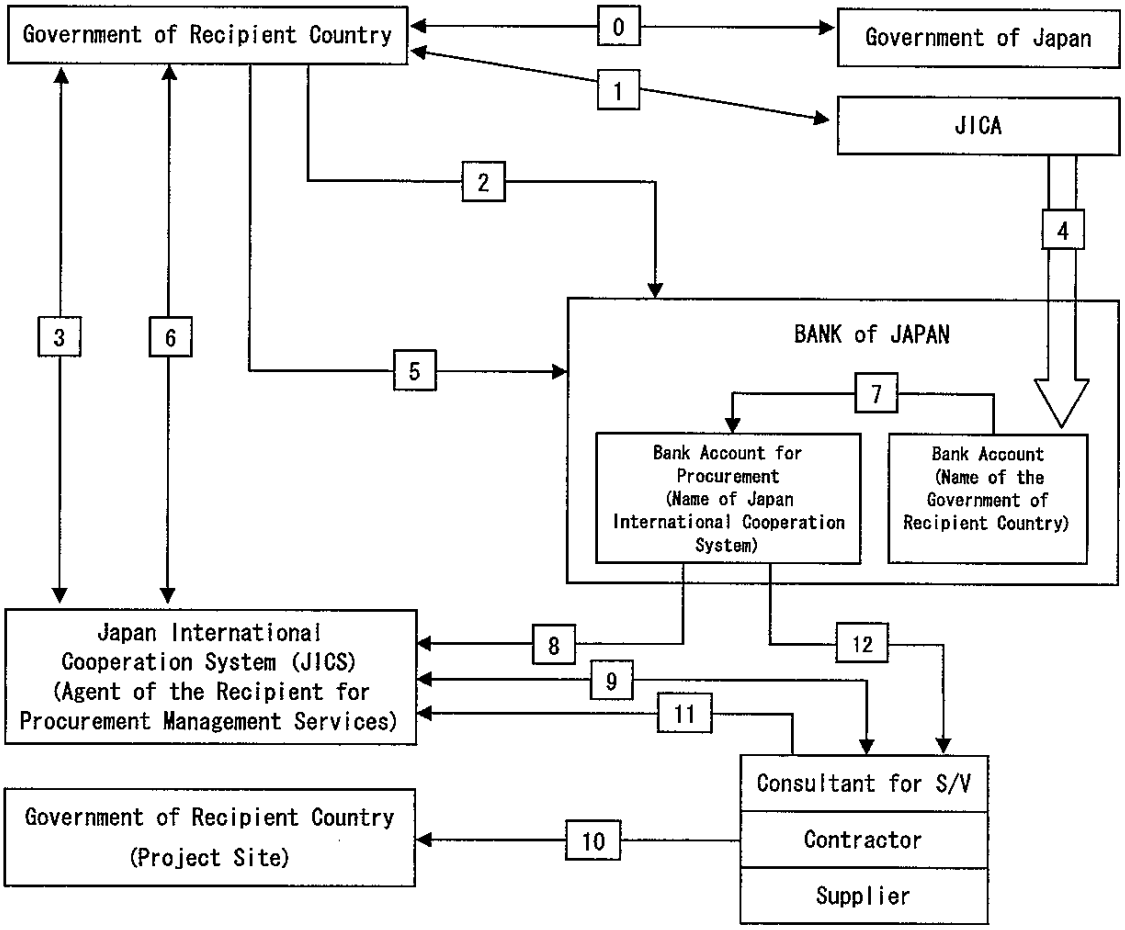
ANNEX III-1

Flow Chart of Japan's Grant Aid for Community Empowerment Procedures



ANNEX III-2

Flow of Funds for Implementation
Under The Japan's Grant Aid For Community Empowerment



0 Signing of Exchange of Notes (E/N)
1 Signing of Grant Agreement (G/A)
2 Banking Arrangement (B/A)
3 Signing of Agent Agreement (A/A)
4 Disbursement of Funds
5 Issue of Blanket Disbursement Authorization (BDA)
6 Decision of Components of Products and Service
7 Transfer of Funds
8 Payment of the Remuneration for the Agent
9 Conclusion of Contract
10 Construction and/or Supply of Equipment
11 Application for Payment
12 Payment

ANNEX IV

Major Undertakings to be taken by Each Government

(Grant Aid for Community Empowerment Version: Provisional)

	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the sites		●
4	To construct the parking lot		●
5	To construct roads		
	1) Within the site	●	
	2) Outside the site		●
6	To construct the building	●	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (from storm sewer and other to the site)		●
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site	N/A	N/A
	b. The gas supply system within the site	N/A	N/A
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
8	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Payment commission		●
9	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products to the recipient	●	
	2) To exempt or bear tax and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	●
10	To accord all concerned parties, whose service may be required in connection with the supply of the products and the services under the contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
11	To exempt or bear on behalf of all concerned parties from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the contract		●
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant		●
13	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

MINUTES OF DISCUSSION
ON
OUTLINE DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION OF SMALL- SCALE RESERVOIRS IN QUANG NGAI PROVINCE IN SOCIALIST REPUBLIC OF VIETNAM

(Explanation of draft Outline Design Report)

In August 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Outline Design Study Team on the Project for Rehabilitation of Small-Scale Reservoirs in Quang Ngai Province (hereinafter referred to as "the Project") to the Socialist Republic of Vietnam (hereinafter referred to as "Vietnam"), and through discussions, field survey and technical examination of the results in Japan, JICA prepared the draft Outline Design report of the study.

In order to explain and to consult with the concerned officials of the Government of Vietnam on the components of the draft report, JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshiyuki Goya, Executive Technical Advisor to the Director General, Rural Development department of JICA to Vietnam, from March 5 to March 12, 2010. As a result of discussions, both sides confirmed the main items described in the attached sheets.

Quang Ngai, March 10, 2010

Mr. Yoshiyuki Goya
Leader
The Outline Design Study Team
Japan International Cooperation Agency
Japan

Mr. Truong Ngoc Nhi
Vice-Chairman
Quang Ngai Provincial People's Committee
Vietnam

Witness

Mr. Vu Van Thang
Director
Department of Water Resources
Ministry of Agriculture and Rural Development
Vietnam

ATTACHMENT

1. Components of the Draft Report

The Vietnam side agreed and accepted in principle the components of the draft Outline Design report explained by the Team.
The Project Components are shown in Annex-1.

2. Cost Estimation of the Project

2-1. The Team explained the cost estimation of the Project as described in Annex-2.
2-2. Both sides agreed that cost estimation of the Project as attached in Annex-2 should never be duplicated or released to any third parties before the signing of all the contract(s) for the Project.
2-3. The Vietnam side understood that cost estimation of the Project described in Annex-2 is a provisional one as a result of the study and could be subject to change according to further examination by the Government of Japan.

3. Japan's Grant Aid Scheme for Community Empowerment

3-1. The Vietnam side understood the Japan's Grant Aid scheme for Community Empowerment explained by the Team as described in Annex- III of the Minutes of Discussions signed on March 11, 2009 and in Annex- III -1 and III-2 of the Minutes of Discussions signed on October 5, 2009
3-2. The Japanese side explained to the Vietnam side that the number of structures to be rehabilitated under the Project is subject to the total budget, the result of tender and the other conditions. The Vietnam side understood it.
3-3. The Vietnam side will take necessary measures, as described in Annex-IV of Minutes of Discussions signed on October 5, 2009, for smooth implementation of the Project as a condition for the Japan's Grant Aid to be implemented.

4. Schedule of the Outline Design Study

4-1. To explain the tender documents, JICA will send a team by April 2010.
4-2. JICA will prepare a Outline Design final report in English and send it to the Government of Vietnam around July 2010.

5. Obligations of the Government of Vietnam(Quang Ngai PPC)

5-1 To execute the Project smoothly, the following actions shall be taken by the Vietnam side and completed by October 2010.

- To approve all permission needed for execution of rehabilitation works in Vietnam (rehabilitation of reservoirs, access roads, main canals)
- To explain the Project details to the municipalities, communities in and around the Project sites, and the person who become object of compensation for moving of houses, and obtain their consents.
- To explain interruptions of irrigation water supply to the beneficiaries of 7 reservoirs, and obtain their consents

5-2 To execute the Project smoothly, the following actions shall be taken by the Vietnam side and completed by January 2011.

- To secure the land for collection of soil for materials to rehabilitate the dam body
- To execute all compensation caused by execution of the Project

The estimated cost for above mention measure by Vietnam side is described in Annex-2, and the provisional schedule is described in Annex-3.

6. Other Relevant Issues

6-1 .The Team explained the Vietnam side has to submit annual reports described in Annex-4 on the use of the facilities constructed and equipments procured under the said grant every year after completion of the Project.

6-2.Vietnam side requested that in order to secure the quality of project management DARD' s coordination with such agencies as the Agent is important and the roles of DARD should be clarified.

6-3.Vietnam side made a comment that when changes to the scope of the project need to be made due to changes in currency exchange rate and /or price escalation, both side will discuss and mutually make a decision following the methods as mentioned in the E/N and G/A.

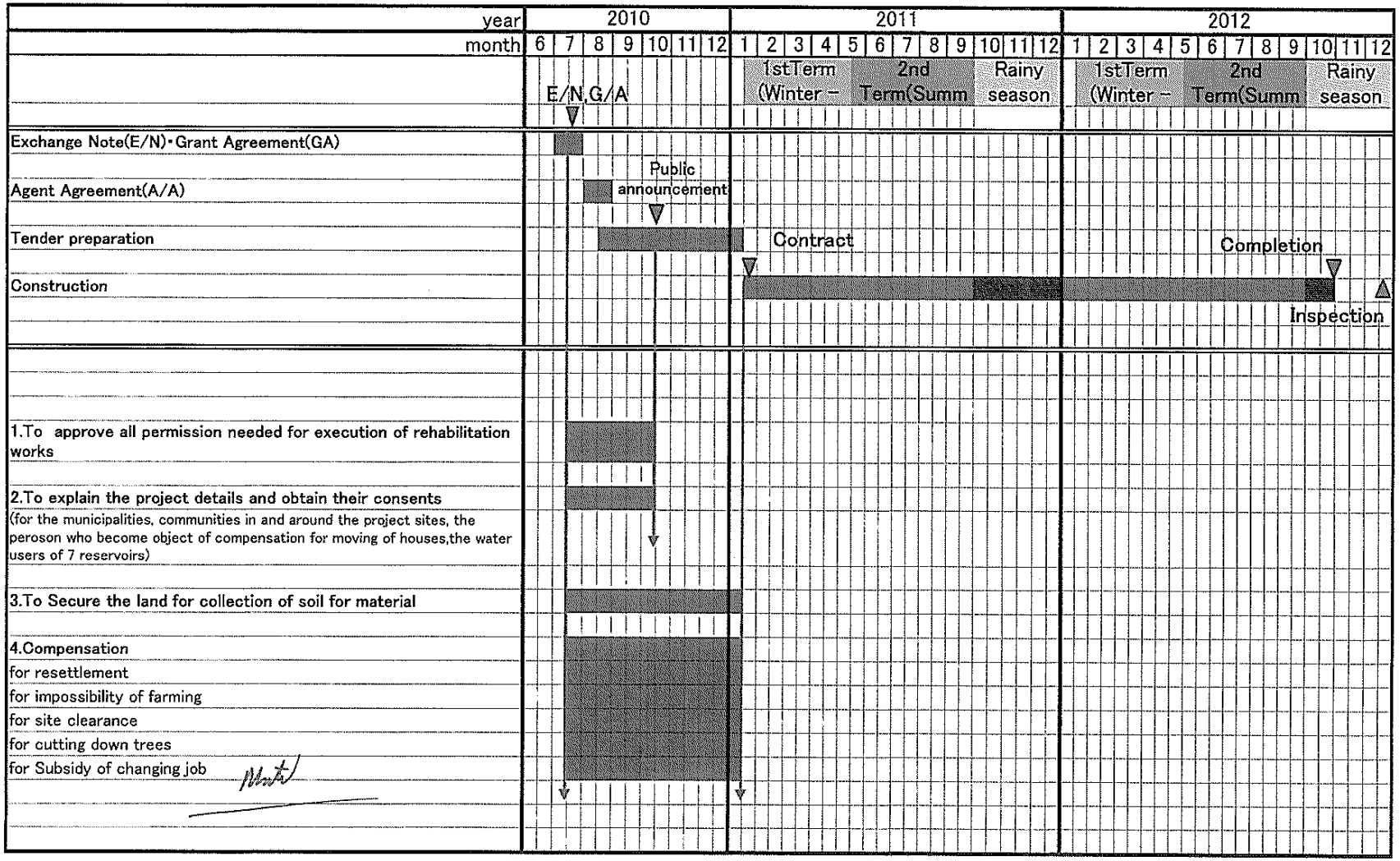
Annex-1

Project Components

	Requested Subject	Original Request	Preliminary Study Stage	Outline Design Study Stage
1.	Rehabilitation of reservoirs	Rehabilitation of 10 reservoirs (Dam body, Spillway, earth dam, Intake Work, and Main canal)	Same with the original request	Rehabilitation of 7 reservoirs with high priority (Reservoir No. 1.Tri Binh, 4.An hoi, 5.Mac Dieu, 6.Hoc Mit, 8.An Tho, 9.Hoc Ngni and 10.Huan Phong)
	Main canal length	The length is not specified	The length is not specified	Concrete; Total length: 18.4 km
2.	Access road to reservoir	Rehabilitation of access road to 10 reservoirs (Total length: 16.8 km, Pavement: Concrete, Pave width: 3.5m)	Rehabilitation of access road to 10 reservoirs (Total length : 13.7 km)	Rehabilitation of access road; Concrete pavement (Total length : 7.8 km, Pavement: Concrete, Pave width: 3.5m)
3.	Center for Mitigation and Management of Natural Disaster	Construction of 2 Centers of Mitigation and Management of Natural Disaster in Binh Son and Mo Duc Districts	10 Operation and Maintenance (O&M) houses for reservoirs	7 Operation and Maintenance (O&M) houses for reservoir with total area of 42 m^2 for each reservoir, and out of 7 houses, to be added a meeting room (15m^2) at "6.Hoc Mit" considering DRSC program under JICA
4.	Equipment for Operation and Management of Reservoirs	PC, Printer, Digital camera, Photocopier, Telephone/FAX, Gradient, GPS instrument, Rainfall meter, Flow velocity instrument, Furniture, Motorbike, and Television	Auto level meter, Rainfall gauge, Current meter, Alarm devise	Auto level meter (1/reservoir), Rainfall gauge (1/reservoir), Current meter (1/reservoir), Handy speaker (2/reservoir), Reservoir water level staff (2/reservoir), Canal water level staff (2/reservoir), Water leakage device (1/reservoir)
5.	Capacity building of IMC and WUG staff (Soft Component)	Training and workshops for management staff and WUG members	Same with original request	Same with original request (Target personnel: Staff of IMC, AC and members of WUG)

Project Implementation Schedule (Draft)

Annex-3



Annex-4

Annual Report on the Use of Japan's Grant Assistance (submitted on ○○○)

1. Outline of the Project
(1) Name of Country:
(2) Name of the Project:
(3) Date of the Grant Agreement:
(4) Name of the Executing Organization:

2. General Situation (how the facilities and/or equipments are used in general)

3. Detailed Explanation

Facilities and/or equipments;	How they are being used;	In case they haven't been used as planned	
		Reason for it; (Please specify the reason such as budgetary problems and problems in employing appropriate staffs etc.)	Measures to be taken to redress the situation;

4. Photos (please attach photos of the facilities and/or equipments)

Appendix-5 Soft Component (Technical Assistance) Plan

1. Background of the Soft Component Plan

Irrigation of Quang Ngai Province in the central Vietnam depends upon small-scale reservoirs. Most of these reservoirs have been degrading and unable to supply the stable agricultural water to fields due to leakages through the dam body and deficiency of reservoir storages. With the progress of dam body-deterioration, the risk of collapse of reservoirs becomes more remarkable.

Taking into consideration such constraints, the Project of the rehabilitation of small-scale reservoirs in Quang Ngai Province in Vietnam aims to rehabilitate major irrigation facilities such as reservoir-dam, spillway, intake, main canals and access roads, in addition, to construct operation and maintenance (O&M) houses for reservoirs and to provide the equipment for carrying out water management and safety management of reservoirs at the normal and flooding times for seven(7) reservoirs.

In Quang Nagai Province, DARD under PPC is in charge of development and management of water resources within the province. Under DARD, IMC is so organized as to have duties on O&M of irrigation facilities, water management, collection of water fees and safety management of reservoirs.

Under the guidance of IMC, water user's groups (IMC/WUG) are organized and managing reservoirs having the each capacity of less than 500,000 cubic meters and related irrigation facilities. Out of services, An Tho reservoir with 2,280,000 cubic meters was constructed by DARD and been managed by IMC.

The other six(6) reservoirs have been managed under the irrigation management section of AC (AC/WUG). Most of these reservoirs were constructed by farmers themselves and have been managed by AC/WUG in spite of the scale of a reservoir capacity. AC/WUG is now in charge of reservoirs, main canals, secondary and tertiary canals as well as collection of water fees and maintenance of those facilities.

Although IMC/WUG and AC/WUG have been managing the reservoirs through the accumulated experience and knowledge, the following issues are pointed out in connection with the management efficiency for irrigation facilities.

(1) Water Management (IMC/WUG, AC/WUG)

Two paddy cropping systems such as winter-spring and summer-autumn paddies are prevailing over the project area. Though irrigation water for winter-spring paddy is supplied enough from the reservoir, summer-autumn paddy is always facing the shortage of irrigation water due to the insufficient storage of the reservoir. Due to the lack of equipment for maintenance of irrigation facilities provided by IMC/WUG and AC/WUG, discharge observation from intake to related canals have not been carried out, resulting in inefficient water management.

(2) Organization Management (AC/WUG)

a) Most of the AC/WUG staffs have not sufficient technical knowledge for irrigation and hydraulics

and have not been trained by IMC or other related agencies. AC/WUG is managing six(6) reservoirs of the Project according to traditional management by experience and scent. Duties on O&M works between AC and WUG are indefinite, therefore efficient water management have not been carried out.

b) The provincial government has been started to subside the water fee to IMC/WUG or AC/WUG since 2008. In Quang Ngai Province, PPC decided to pay 600,000VND/ha/year for AC/WUG, but until now AC/WUG in Communes could not receive such subsides due to improper request documents of the water fee.

(3) Safety Management of Reservoirs (IMC/WUG,AC/WUG)

Concerning the disaster prevention organization for reservoirs, commune people's committee (CPC) organizes the Steering Board of Flood and Storm Control for Reservoirs (SBFSCR) to execute duties on disaster prevention pre-training, securing safety of dam body and rescuing at flooding time. Every year, CPC nominate the board members and chairman of AC will be many times selected as the head of the board. One to four AC staffs participate in the board and observe leakage situations through the reservoir and inform the board to prepare against the state of emergency. However, due to lack of regulations on safety management of a reservoir and equipment of maintenance, staffs are managing only according to experiences. The risk management organization is weak, considering the negative factors such as entry into reservoirs by livestock, vehicle and people giving damages to dam slope as well as insufficient alarm issuing systems.

2. Needs of Soft Component Plan

In order to solve the above issues, the following assistance for soft components is necessary in order to support the smooth implementation and to sustain effects of the project cooperation as minimum requirements.

(1) Water Management

After rehabilitation of reservoirs, 1) Intake facility will be improved to a valve-type from an existing inclined or a tower type in order to operate and manage intake -discharge simply and easily. 2) Equipment such as current meters to measure the discharge through a main canal will be procured.

To carry out efficient water management under the improved facilities, technical training on overall water management method covering the head works to farm fields will be requisite for IMC/WUG and AC/WUG staffs.

(2) Organizational Management

In order to enhance the organizational management of AC/WUG, it is necessary to assist the capacity building for AC/WUG staffs in terms of irrigation technology and administrative works and water management systems between AC and AC/WUG so as to carry out proper water supply and safety reservoir

management based on established overall water management systems and reservoir regulations.

(3) Safety Management of Reservoirs

It is necessary to assist preparing regulations and the organization on safety management of reservoirs for IMC/WUG and AC/WUG under a consensus of CPC.

3. Effects of Soft Component Plan

Goal, effect, contents of monitoring and evaluation method of the soft component plan is shown in Table-1.

4. Activities of Soft Component Plan (Input)

(1) Contents of Activities

The working group will be organized under the DARD, consisting of key officers such as DARD, IMC, AC, CPC and Steering Board of Flood and Storm Control for Reservoir (SBFSCR). This group will work together with one Japanese consultant and one local expert and transfer relevant technologies to trainees by means of OJT. Main trainees will be AC/WUG. The Japanese Consultant will monitor and evaluate activities for the soft component plan and prepare the final report of activities and submit Vietnamese executing agencies and Japanese side. The contents of activities of the soft component is planned Table-2.

(2) Trainee

a) Disciplinary in Terms of Water Management (35 persons)

- IMC/WUG staff in charge of An Tho reservoir operation (1 person)
- AC/WUG staffs in charge of other 6 reservoirs (6 persons)
- WUG staffs in charge of 7 reservoirs (each reservoir 2 persons: 14 persons)
- WUG staffs in charge of turnout operation (each reservoir 2 persons: 14 persons)

b) Disciplinary in terms of Organizational Management(18 persons)

- AC/WUG key staffs in charge of 6 reservoirs (each reservoir 3persons: 18 persons)

c) Disciplinary in terms of Strengthening Safety Management of Reservoirs (35 persons)

- IMC/WUG staff in charge of An Tho reservoir operation (1 person)
- AC/WUG staffs in charge of other 6 reservoirs (6 persons)
- WUG staffs in charge of 7 reservoirs (each reservoir 2 persons: 14 persons)
- CPC staffs in charge of 7 reservoirs (each reservoir 1 person: 7 persons)
- Member of SBFSCR (each reservoir 1person: 7 persons)

Table-1 Goal, Effect, Contents of Monitoring and Evaluation Method of the Soft Component

Goal	Effect of Soft Component (Direct Benefit)	Contents of Monitoring	Evaluation Method
(1) Disciplinary in terms of Water Management			
Proper intake and water management is carried out for eight reservoirs by IMC/WUG and AC/WUG in 7 reservoirs.	1) Problems will be solved logically in place of experience and scent	Understanding of maintenance staffs	Questionnaire survey (before and after soft component activities 2 times)
	2) Water balance between demand and supply will be kept.	Satisfaction of beneficiaries	Confirmation through implementation (before and after soft component activities 2times)
	3) Impartial distribution of irrigation water will be carried out to beneficial areas.	1) Water management manual 2) Satisfaction of beneficiaries	1) Preparation of water management manual 2) Confirmation through implementation (before and after soft component activities 2 times)
	4) Proper water management of the reservoir will be performed (Operation recording on Gate and Valves and water level observations will be strictly done.	Appropriateness of records	Confirmation of records
	5) Exact diversion will be made and water troubles will be solved.	Understanding of beneficiaries	Confirmation through implementation (after soft component activities1 time)
(2) Disciplinary in terms of Organizational Management			
1) In order to produce a stable yield, AC/WUG is aware of proper organizing WUG and Sound activities are performed by AC/WUG in 6 reservoirs.	1)Awareness of Necessity of operation and maintenance for reservoir facilities by AC/WUG	Understanding of beneficiaries	Questionnaire survey8before and after soft component activities 2 times)
2) Operation of maintenance is carried out according to preparation of the plan to produce a stable yield in 6 reservoirs.	2) Manual (draft) of operation and maintenance will be prepared and proper management of reservoirs and irrigation canals will be implemented.	1) Manual of operation and maintenance 2) Understanding of AC/WUG	1) Preparation of manual of operation and maintenance 2) Questionnaire survey and confirmation through implementation
3) Smooth management of AC/WUG organization will be performed by receiving subsidy in 6 reservoirs.	3) Smooth office works and quick reporting to relevant agencies will be done.	1) Subsidy application 2) Satisfaction of CPC	1) Subsidy application 2) Questionnaire survey (after soft component activities)
(3) Disciplinary in terms of Strengthening Safety Management of Reservoirs			
Proper safety management is carried out by IMC/WUG and AC/WUG in 7 reservoirs.	1)Necessity of safety management of the reservoir is recognized by ownership of IMC/WUG and AC/WUG.	Understanding by IMC/WUG and AC/WUG	Questionnaire survey (before soft component activities)
	2) An advance forecasting the collapse of a dam body can be made.	Understanding by IMC/WUG and AC/WUG	Confirmation through implementation (before and after soft component activities 2times)
	3) Inhabitants understand reasons why risks of collapsing the dam body will mitigate.	Understanding by inhabitants	Confirmation through implementation (before and after soft component activities 2times)
	4) Preventive preservation for collapse of a dam body will be established and downstream inhabitants' fair will mitigate.	Satisfaction of inhabitants	Confirmation through implementation (before and after soft component activities 2times)
	5) Regulations on reservoir safety management(draft) will be prepared and be applied.	Regulations on reservoir safety management	Preparation of regulations on reservoir safety management

Table-2 Effects and Activities of the Soft Component

(1) Assistance for Water Management
1) To clear constraints and measures to improve an existing irrigation method through workshops at the reservoir site 2) To enhance irrigation technology through workshop 3) To prepare the manuals of water management to distribute water impartially 4) To establish an annual operation rule of a reservoir and apply it at the site 5) To provide water level staffs and name plates showing diversion point and to carry out on-the-job training in terms of diversion.
(2) Assistance for Organizational Management
1) To explain management, duties and significance of WUG with intension of producing farmer's ownership through workshop 2) To carry out training for WUG in term of planning of regular maintenance, functional diagnosis of facilities, mowing and cleaning through workshop and to assist the preparation of O&M manual 3) To hold the workshop for WUG on management methods concerning finance, administration and information by using personnel computer and to support the preparation of application documents for receiving required subsidies
(3) Assistance for Strengthening Safety Management of Reservoirs
1) To collect data and know-how concerning small scaled reservoir management and to explain them to reservoir managing staffs. 2) To analyze the factors affecting on collapse of a dam body and guide the observation method of rainfall and leakage through workshop and to carry out on-the-job training. 3) To hold the workshop at the site for related agencies in term of no trespassing of vehicles and inhabitants and livestock intrusion into a reservoir site 4) To hold the workshop for WUG and related persons concerning disaster prevention in terms of reservoir management at normal and emergency times and how to delivery the warning message to people and to prepare the draft of reservoir management manuals 5) To assist in the preparation of regulations on safety management of reservoirs

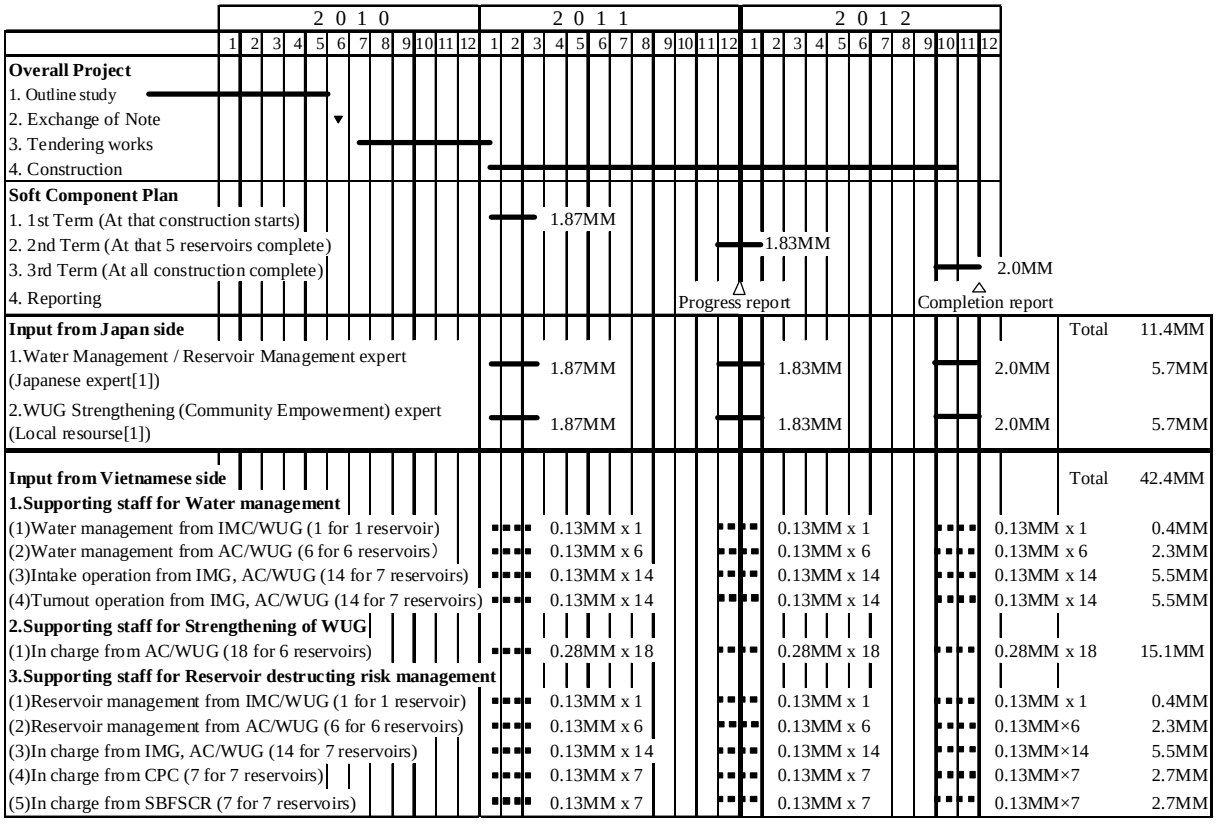


Figure-1 Implementation schedule of Soft component

5. Implementation Schedule of Soft Component Plan

The figure-1 shows implementation schedule and input plan. Soft component activities at three(3) stages are performed i.e. first -before commencing the construction works, second-after finishing the construction works of five reservoirs and the third-after finishing the construction works of three reservoirs. The proposed input amount from Japan and Vietnam are 11.4 MM and 42.4 MM, respectively.

6. Documents and Reports

The following documents and reports will be prepared and submitted to Vietnamese and Japanese sides.

1) Manual of Water Management (Draft) (English and Vietnamese)
2) Manual of Operation and Maintenance (English and Vietnamese)
3) Regulations of Safety Management of Reservoirs (English and Vietnamese)

7. Duties of Vietnamese Implementing Agencies

The soft component plan is essential to be implemented out by DARD under the executing agency of the project, PPC in close cooperation with IMC/WUG and AC/WUG. The working groups consisting of DAR, IMC, CPC and SBFSCR should be inevitably organized before commencing soft component activities by PPC and will work together with Japanese Consultant (water management / safety management of reservoirs expert) and local consultant (WUG organization expert). The required expenses for activities of WUG such as per diem and transportation fees are born by PPC.

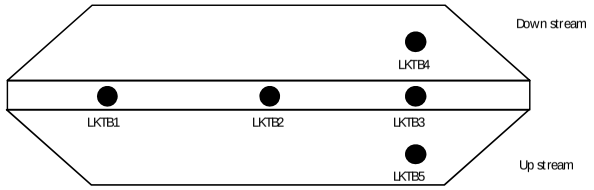
In respect to water management, WUG is expected to continue impartial distribution of irrigation water from the head works to farm fields and to carry out the proper reservoir management at normal and flood times according to the established regulations. At present, farmers' ownership has been producing, considering most of reservoirs were constructed and maintained by farmers themselves.

Manuals and regulations in terms of water management, countermeasures for drought and risk forecast for habitual flooding should be so adjusted as to apply for the coming conditions. In this connection, WUG should held discussion meeting with relevant agencies such as DARD, IMC, DPC, SBFSCR and take necessary measures to solve the problems.

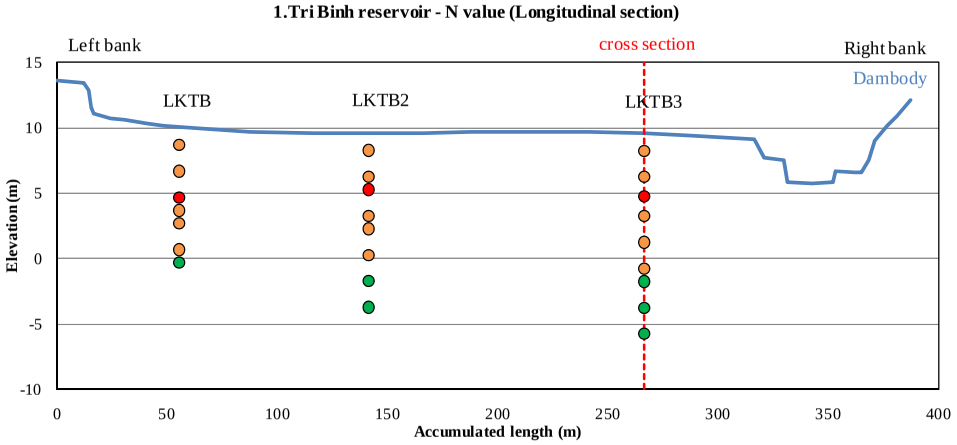
Appendix-6 Other Relevant Data

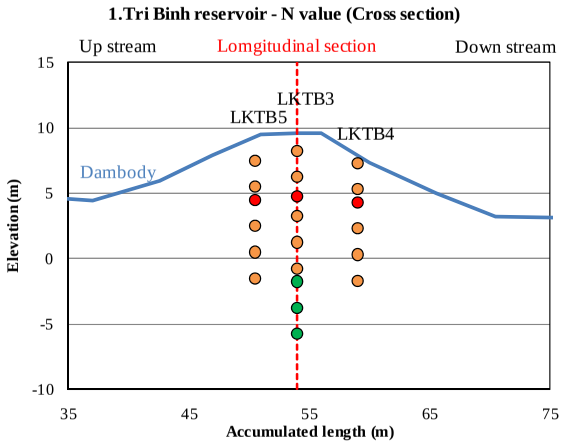
Appendix-6.1 Results of drilling borehole tests

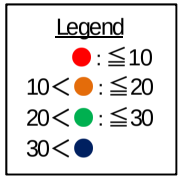
Drilling boreholes of 5.Mach Dieu Reservoir (except LK9) and 8.An Tho Reservoir have already been carried out in previous survey. At those boreholes, PST and Permeability testing were not conducted.

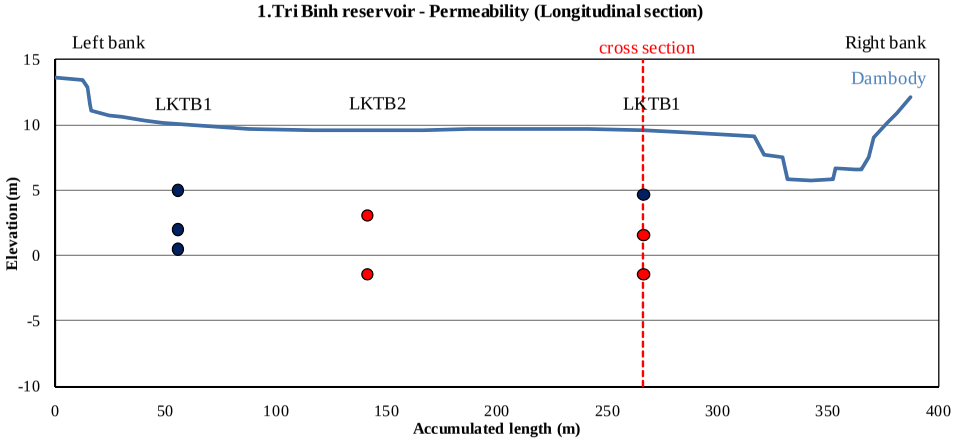


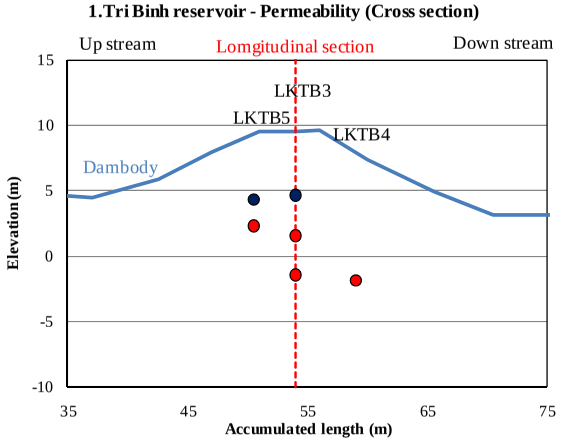
Drilling Borehole Location











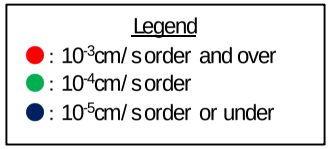
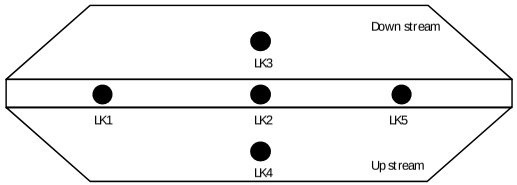
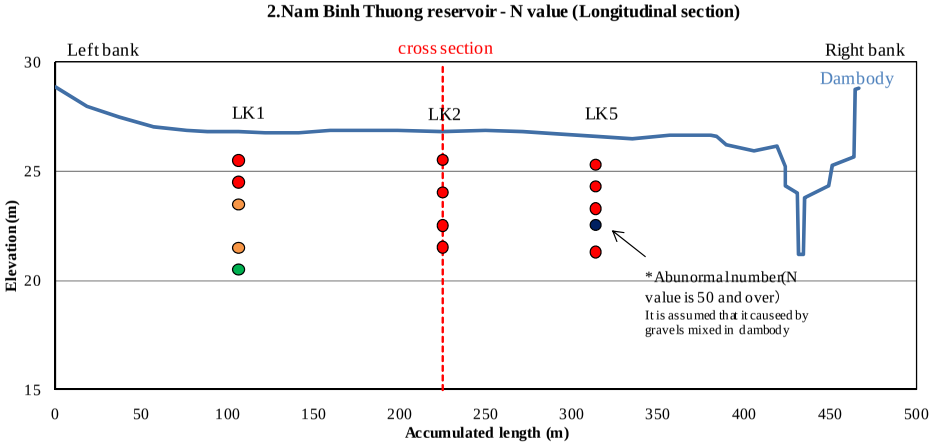
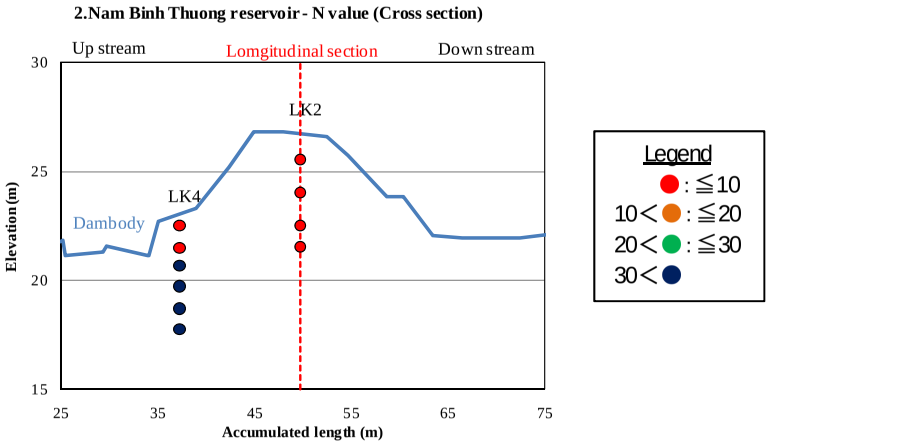


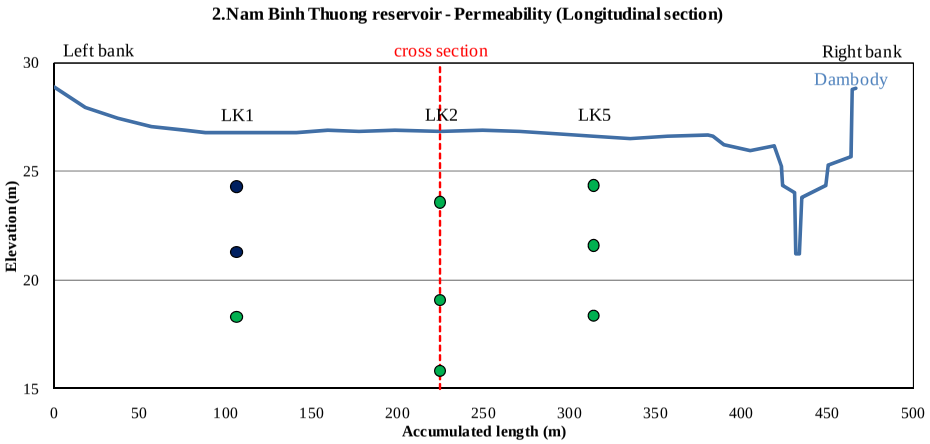
Fig-1 Results of drilling borehole tests (1.Tri Binh reservoir)



Drilling Borehole Location







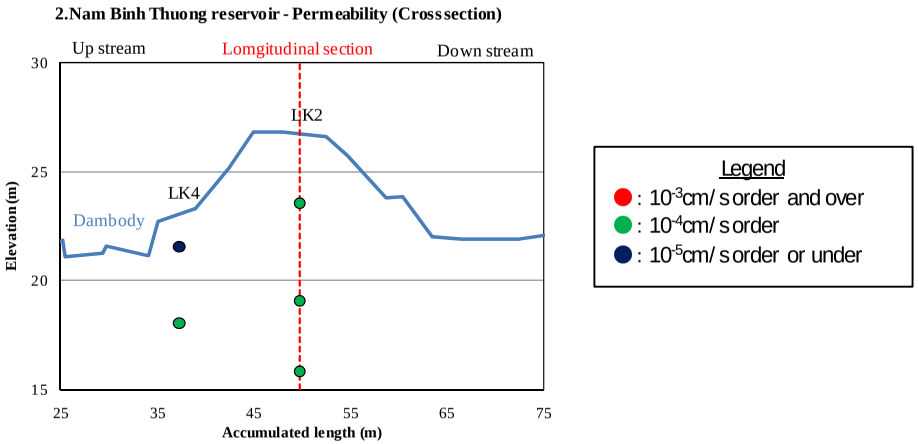
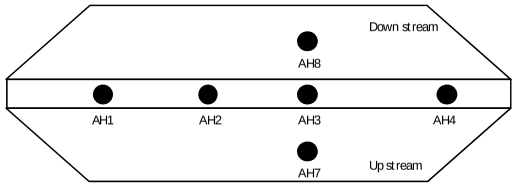
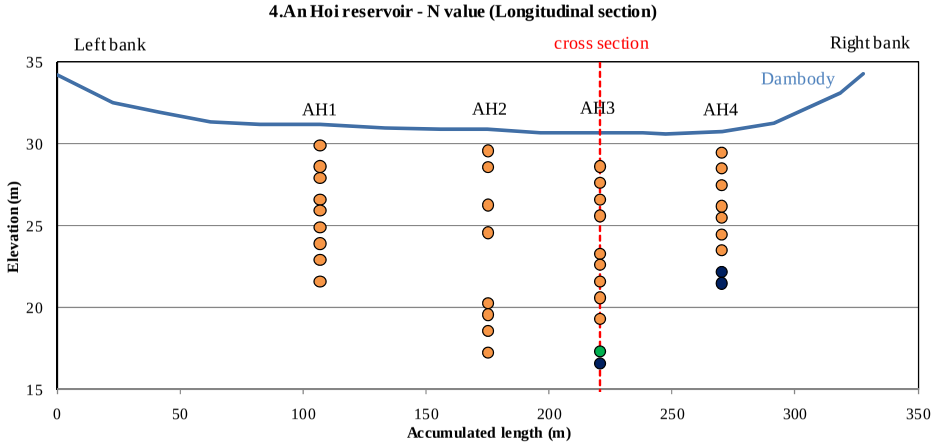
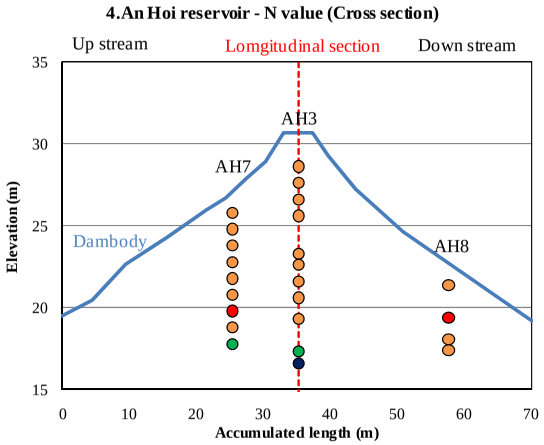


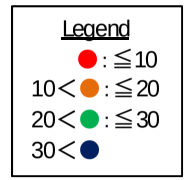
Fig-2 Results of drilling borehole tests (2.Nam Binh Thuong reservoir)

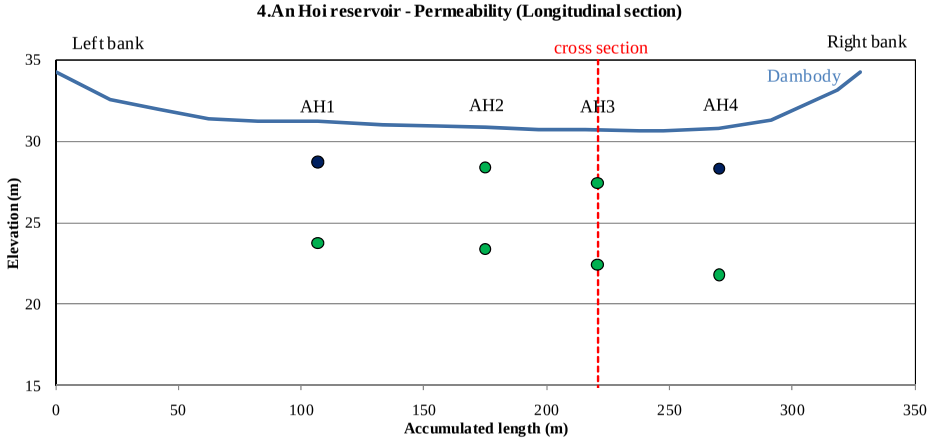


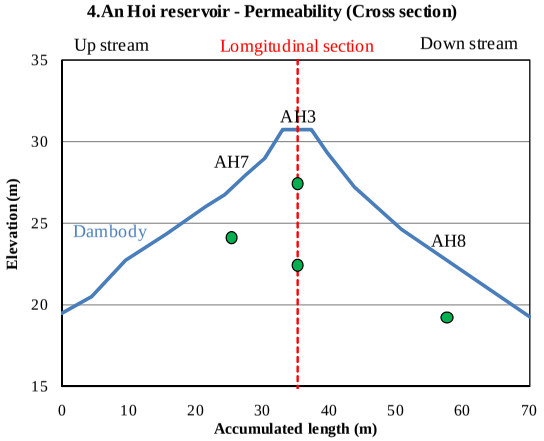
Drilling Borehole Location











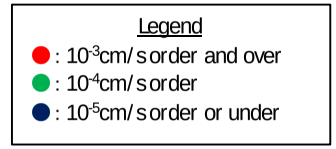
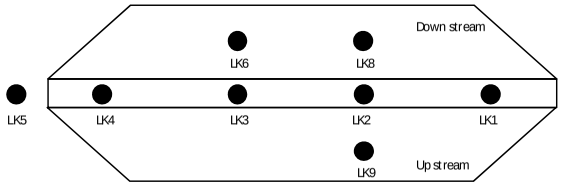
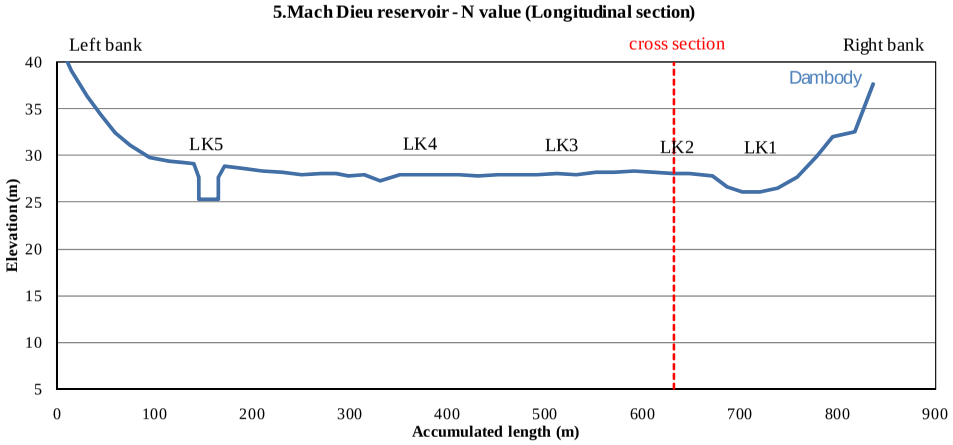
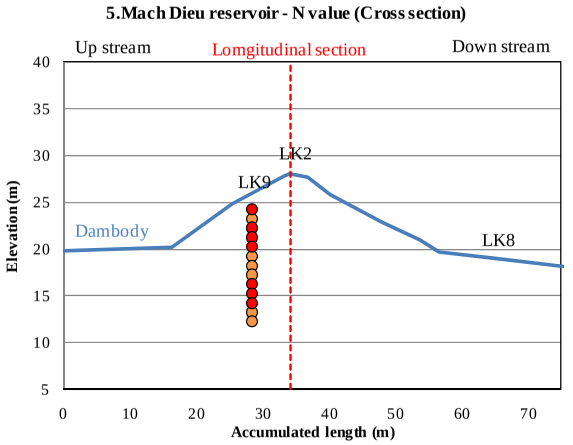


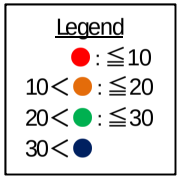
Fig-3 Results of drilling borehole tests (4.An Hoi reservoir)

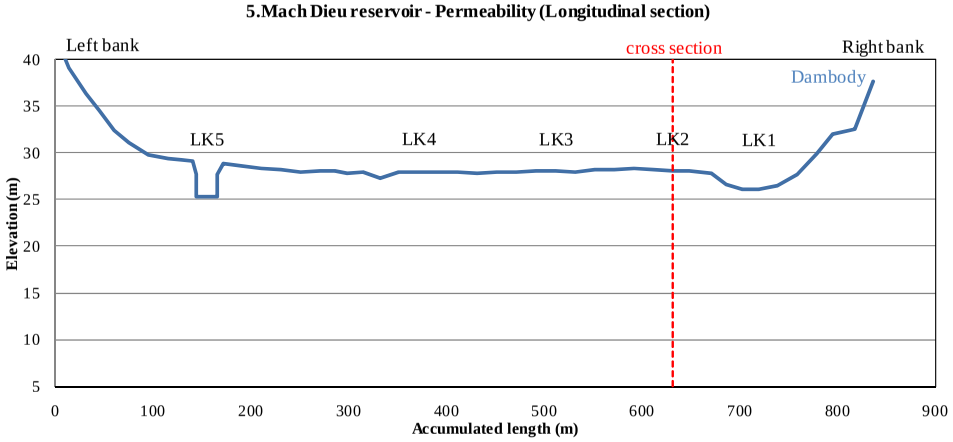


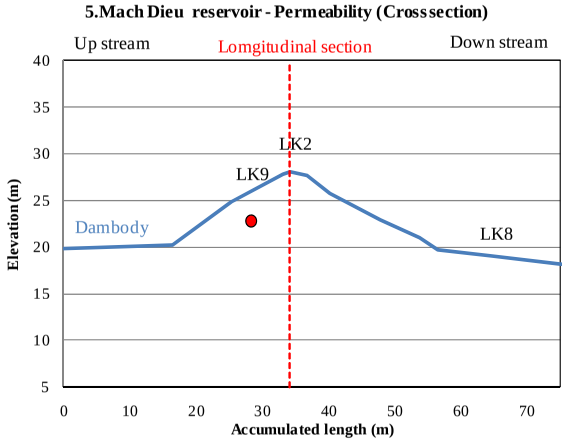
Drilling Borehole Location











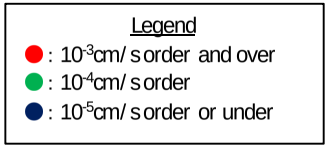
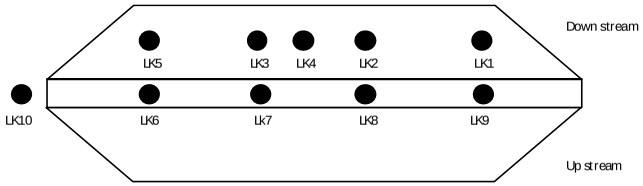
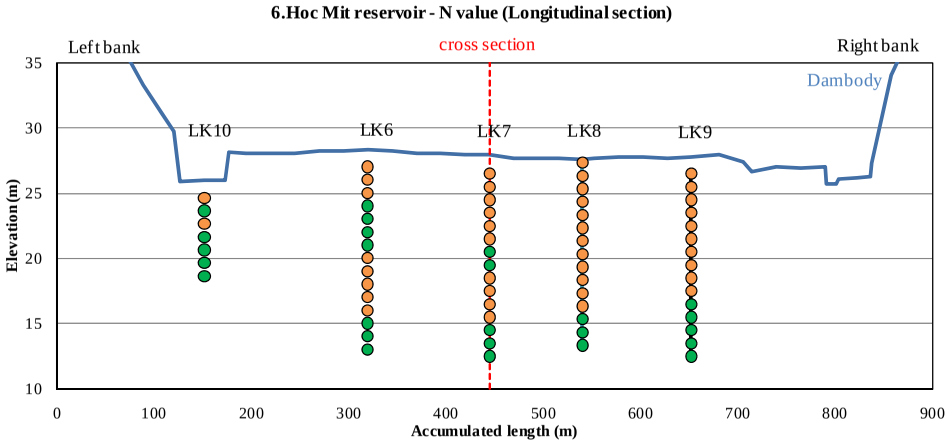
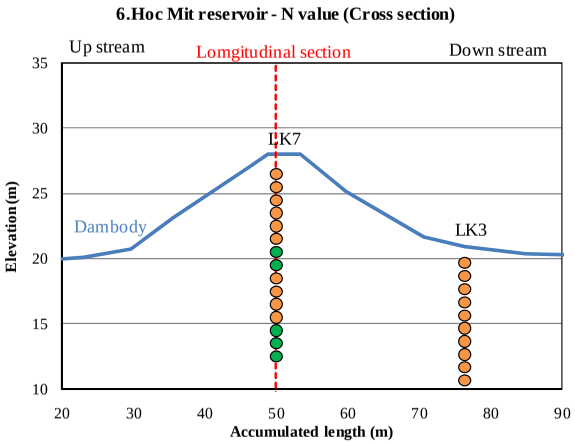


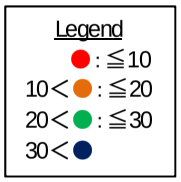
Fig-4 Results of drilling borehole tests (5.Mach Dieu reservoir)

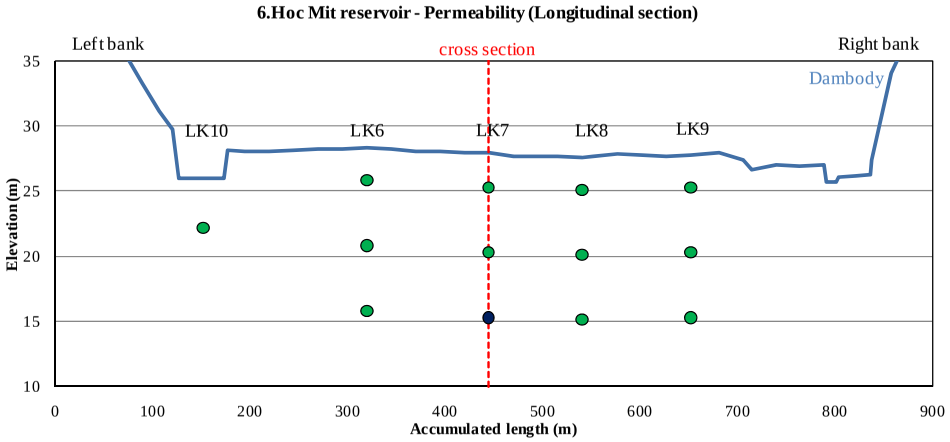


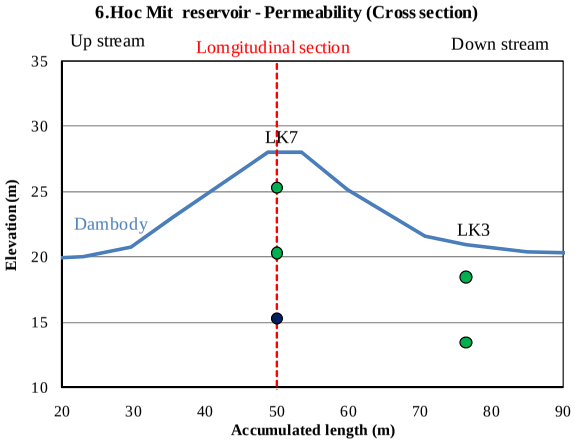
Drilling Borehole Location











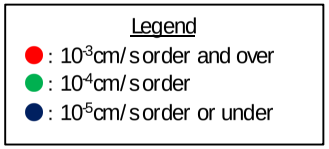
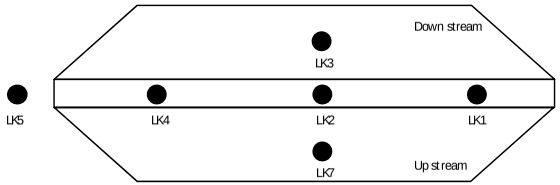
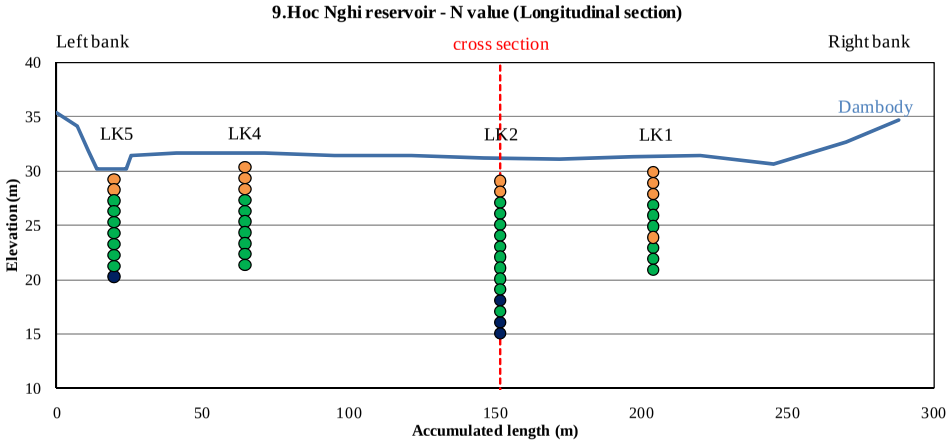
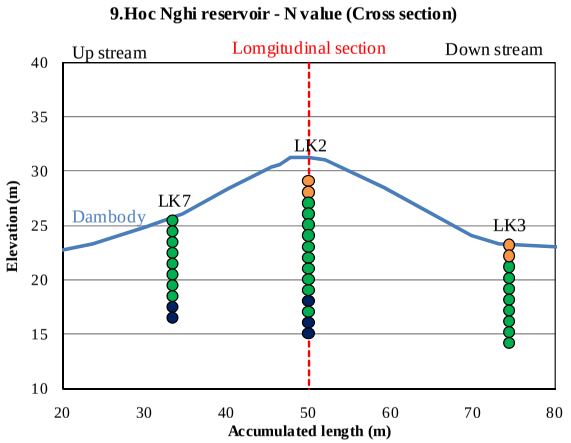


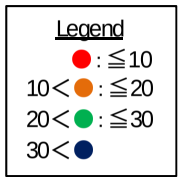
Fig-5 Results of drilling borehole tests (6.Hoc Mit reservoir)

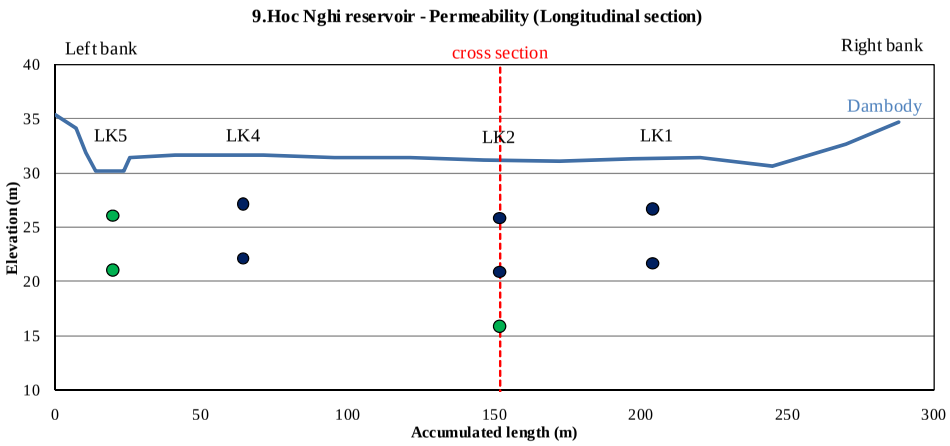


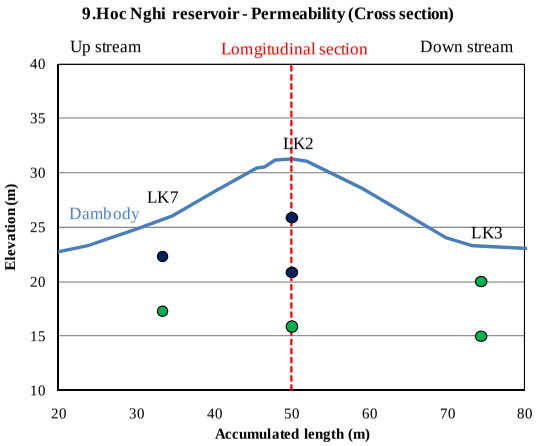
Drilling Borehole Location











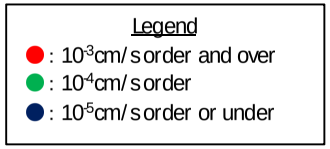
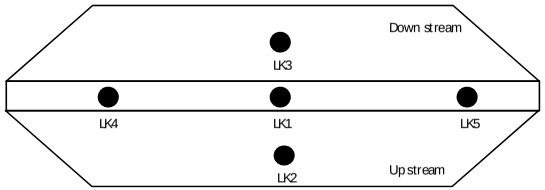
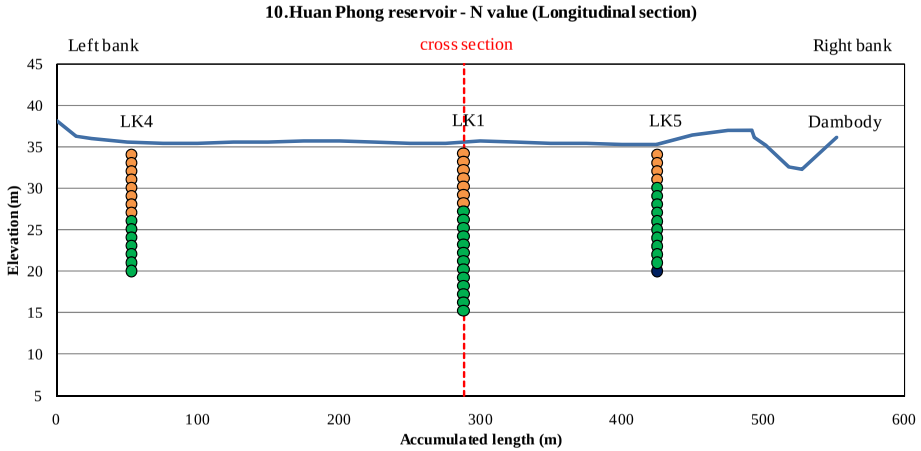
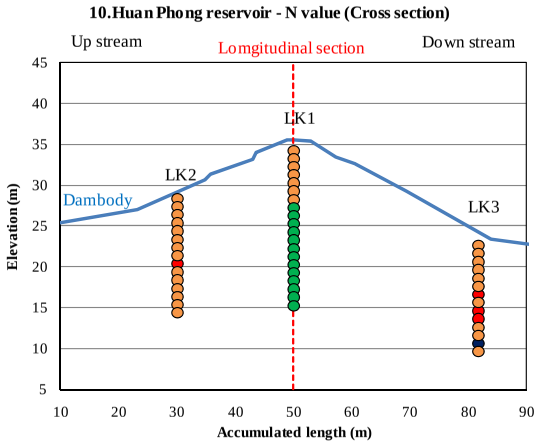


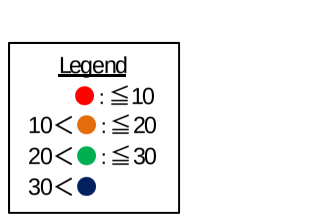
Fig-6 Results of drilling borehole tests (9.Hoc Nghi reservoir)

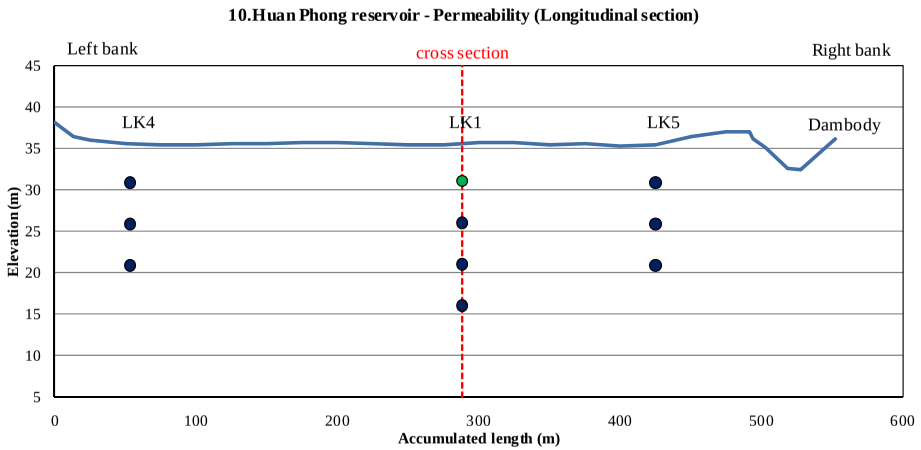


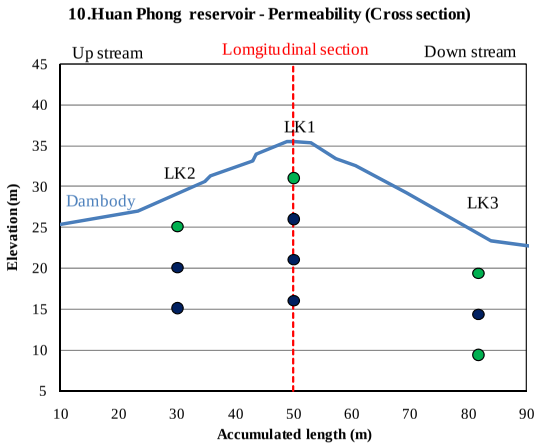
Drilling Borehole Location











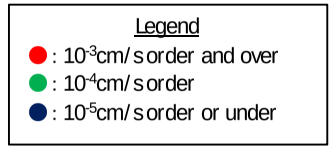


Fig-7 Results of drilling borehole tests (10.Huan Phong reservoir)

Appendis-6.2 Results of laboratory tests

Table-1 Results of Laboratory tests (1.Tri Binh reservoir)

	Layer 1	Layer 2	Layer 3	Layer 4	Borrow Area	Borrow Area
	(filled soil)	(foundation)	(foundation)	(foundation)	(A)	(B)
Specific gravity: Gs	2.72	2.71	2.67	2.65	2.70	2.72
Natural moisture: Wn(%)	20.9	28.9	21.4	18.2	25.7	23.1
Dry density: γd(t/m^3)	1.57	1.52	1.50	1.54		
Grain size						
Clay grading <0.005mm (%)	33.1	22.5	8.6	9.4	32.1	32.7
Silt grading <0.05mm (%)	22.9	32.4	12.3		37.2	36.4
Sand grading <2.0mm (%)	27.6	40.9	79.1	90.6	25.7	26.2
Gravel grading >2.0mm (%)	16.4	4.2	0.0	0.0	5.0	4.7
Liquid limit: W_L(%)	36.1	40.1			40.5	39.2
Plastic limit: Wp(%)	19.3	25.0			22.2	20.7
Plasticity index: Ip(%)	16.8	15.1			18.3	18.5
Compaction test						
Optimum moisture: Wop(%)					19.6	19.5
Max dry density: γdmax (t/m^3)					1.54	1.64
Cohesion: C(kg/cm^2)	0.16	0.12	0.05	0.01	0.28	0.28
Friction angle: φ(°)	18.2	15.5	21.3	32.2	18.5	17.7
Permeability: K (cm/s)	$3.5x10^{-6}$	$3.4x10^{-5}$	$7.0x10^{-3}$	$2.1x10^{-2}$	$2.8x10^{-5}$	$4.8x10^{-6}$

Table-2 Results of Laboratory tests (2.Nam Binh Thuong reservoir)

	Layer 1a	Layer 4	Borrow Area	Borrow Area
	(filled soil)	(foundation)	(3b)	(3c)
Specific gravity: Gs	2.72	2.74	2.86	2.69
Natural moisture: Wn(%)	19.2	22.6	26.7	26.7
Dry density: γd(t/m^3)	1.65	1.59		
Grain size				
Clay grading <0.005mm (%)	19.0	13.1	16.0	19.8
Silt grading <0.05mm (%)	12.5	18.9	7.0	12.5
Sand grading <2.0mm (%)	47.2	43.8	13.5	26.3
Gravel grading >2.0mm (%)	21.3	24.2	63.5	41.4
Liquid limit: W_L(%)	26.7	31.7	52.1	47.2
Plastic limit: Wp(%)	16.6	18.0	29.8	27.8
Plasticity index: Ip(%)	10.1	13.7	22.3	19.4
Compaction test				
Optimum moisture: Wop(%)			17.9	20
Max dry density: γdmax (t/m^3)			1.73	1.66
Cohesion: C(kg/cm^2)	0.18	0.17	0.19	0.21
Friction angle: φ(°)	13.0	15.0	17.3	16.1
Permeability: K (cm/s)	$2.0x10^{-4}$	$4.0x10^{-4}$	$5.0x10^{-5}$	$2.0x10^{-5}$

Table-3 Results of Laboratory tests (4.An Hoi reservoir)

	Layer 1 (filled soil)	Layer 2 (foundation)	Layer 3 (foundation)	Layer 4 (foundation)	Layer IA1 (foundation)	Borrow Area
Specific gravity: Gs	2.72	2.72	2.70	2.70	2.70	2.71
Natural moisture: Wn(%)	27.9	28.7	31.8	25.9	25.6	26.4
Dry density: $\gamma d(t/m^3)$	1.41	1.47	1.37	1.41	1.41	
Grain size						
Clay grading <0.005mm (%)	28.0	32.6	20.6	21.1	19.3	22.6
Silt grading <0.05mm (%)	20.4	19.3	20.1	28.2	27.9	18.4
Sand grading <2.0mm (%)	32.0	48.1	40.2	43.3	46.6	41.4
Gravel grading >2.0mm (%)	19.6	0.0	19.1	7.4	6.2	17.6
Liquid limit: $W_L(\%)$	42.2	46.8	37.7	37.1	35.1	40.2
Plastic limit: Wp(%)	25.9	27.5	25.4	24.0	23.2	26.8
Plasticity index: Ip(%)	16.3	19.3	12.3	13.1	11.9	13.4
Compaction test						
Optimum moisture: Wop(%)						18.3
Max dry density: $\gamma dmax (t/m^3)$						1.78
Cohesion: $C(kg/cm^2)$	0.2	0.22	0.15	0.16	0.17	0.21
Friction angle: $\varphi(°)$	14.6	18.3	15.2	15.9	16.9	19.4
Permeability: K (cm/s)	$5.3x10^{-5}$	$3.1x10^{-5}$	$3.0x10^{-4}$	$2.7x10^{-4}$	$4.1x10^{-4}$	$5.5x10^{-5}$

Table-4 Results of Laboratory tests (5.Mach Dieu reservoir)

	Layer 1 (filled soil)	Layer 2 (filled soil)	Layer 3 (foundation)	Layer 4 (foundation)	Layer 5 (foundation)	Borrow Area (1&3)
Specific gravity: Gs	2.71	2.72	2.68	2.72	2.71	2.70
Natural moisture: Wn(%)	22.0	22.6	18.2	23.2	20.2	18.2
Dry density: $\gamma d(t/m^3)$	1.53	1.57	1.61	1.51	1.62	
Grain size						
Clay grading <0.005mm (%)	20.3	27.6	11.7	23.2	22.5	19.8
Silt grading <0.05mm (%)	13.9	19.7	16.6	18.1	17.2	15.7
Sand grading <2.0mm (%)	53.6	46.6	69.9	54.2	53.0	48.0
Gravel grading >2.0mm (%)	12.2	6.1	1.8	4.5	7.3	16.5
Liquid limit: $W_L(\%)$	33.8	38.5	23.2	35.5	36.0	36.4
Plastic limit: Wp(%)	20.0	21.9	16.9	20.2	20.9	23.9
Plasticity index: Ip(%)	13.8	16.6	6.3	15.3	15.1	12.5
Compaction test						
Optimum moisture: Wop(%)						19.6/15.3
Max dry density: $\gamma dmax (t/m^3)$						1.76/1.84
Cohesion: $C(kg/cm^2)$	0.17	0.2	0.13	0.21	0.18	0.18/0.18
Friction angle: $\varphi(°)$	17.3	16.2	22.0	14.9	18.7	20.0/21.0
Permeability: K (cm/s)	$5.5x10^{-5}$	$2.2x10^{-5}$	$2.5x10^{-4}$	$4.6x10^{-5}$	$4.1x10^{-5}$	$7.0/3.0x10^{-6}$

Table-5 Results of Laboratory tests (Hoc Mit reservoir)

	Layer 1a	Layer 1b	Layer 2	Layer 3	Borrow Area
	(filled soil)	(foundation)	(foundation)	(foundation)	(1)
Specific gravity: Gs	2.71	2.71	2.71	2.71	2.71
Natural moisture: Wn(%)	22.3	26.8	23.2	29.9	24.3
Dry density: $\gamma d(t/m^3)$	1.72	1.44	1.64	1.51	
Grain size					
Clay grading <0.005mm (%)	19.1	23.8	24.0	21.8	24.2
Silt grading <0.05mm (%)	11.0	19.2	24.4	23.2	25.3
Sand grading <2.0mm (%)	57.6	43.5	41.4	51.1	34.0
Gravel grading >2.0mm (%)	12.3	13.5	10.2	3.9	16.5
Liquid limit: $W_L(\%)$	39.4	48.4	48.0	44.5	55.4
Plastic limit: Wp(%)	28.1	30.0	29.5	26.5	38.2
Plasticity index: Ip(%)	11.3	18.4	18.5	18.0	17.2
Compaction test					
Optimum moisture: Wop(%)					20.2
Max dry density: $\gamma dmax\ (t/m^3)$					1.65
Cohesion: $C(kg/cm^2)$	0.16	0.21	0.19	0.22	0.20
Friction angle: $\varphi(°)$	19.4	18.5	17.1	17.2	17.5
Permeability: K (cm/s)	$3.7x10^{-5}$	$8.8x10^{-6}$	$2.2x10^{-5}$	$3.5x10^{-5}$	$3.7x10^{-5}$

Table-6 Results of Laboratory tests (8.An Tho reservoir)

	Layer 1-1	Layer 1-2	Layer 2-1	Layer 2-2	Borrow Area
	Main dam		Sub dam		
	(filled soil)	(foundation)	(filled soil)	(foundation)	(Site.2)
Specific gravity: Gs	2.68	2.59	2.65	2.65	2.70
Natural moisture: Wn(%)	26.1	18.4	18.0	18.3	23.4
Dry density: $\gamma d(t/m^3)$	1.45	1.71	1.68	1.72	
Grain size					
Clay grading <0.005mm (%)	34.2	23.1	22.0	23.0	24.3
Silt grading <0.05mm (%)	21.0	18.4	11.5	20.0	21.5
Sand grading <2.0mm (%)	33.7	48.3	39.5	53.0	44.3
Gravel grading >2.0mm (%)	11.1	10.2	27.0	4.0	12.0
Liquid limit: $W_L(\%)$	42.2	24.1	30.1	23.3	54.2
Plastic limit: Wp(%)	24.2	13.5	17.0	13.5	34.4
Plasticity index: Ip(%)	18.0	10.6	13.1	9.8	19.8
Compaction test					
Optimum moisture: Wop(%)					18.4
Max dry density: $\gamma dmax\ (t/m^3)$					1.74
Cohesion: $C(kg/cm^2)$	0.30	0.24	0.24	0.23	0.12
Friction angle: $\varphi(°)$	13.4	13.4	17.1	11.7	17.1
Permeability: K (cm/s)	$3.1x10^{-5}$	$6.0x0^{-5}$	$1.5x10^{-4}$	$5.1x10^{-5}$	$1.0x10^{-5}$

Table-7 Results of Laboratory tests (9.Hoc Nghi reservoir)

	Layer 1 (filled soil)	Layer 2 (foundation)	Borrow Area
Specific gravity: Gs	2.72	2.71	2.71
Natural moisture: Wn(%)	20.2	19.5	19.6
Dry density: $\gamma d(t/m^3)$	1.49	1.55	
Grain size			
Clay grading <0.005mm (%)	18.4	13.2	15.9
Silt grading <0.05mm (%)	26.5	20.5	27.4
Sand grading <2.0mm (%)	48.3	54.0	48.3
Gravel grading >2.0mm (%)	6.8	12.3	8.4
Liquid limit: W_L(%)	28.5	30.2	27.9
Plastic limit: Wp(%)	18.1	19.8	18.5
Plasticity index: Ip(%)	10.4	10.4	9.4
Compaction test			
Optimum moisture: Wop(%)			16.2
Max dry density: $\gamma dmax (t/m^3)$			1.74
Cohesion: $C(kg/cm^2)$	0.14	0.15	0.17
Friction angle: φ(°)	14.5	15.7	17.0
Permeability: K (cm/s)	$6.9x10^{-5}$	$8.1x10^{-5}$	$5.9x10^{-5}$

Table-8 Results of Laboratory tests (10.Huan Phong reservoir)

	Layer 1 (filled soil)	Layer 2 (foundation)	Borrow Area
Specific gravity: Gs	2.72	2.73	2.72
Natural moisture: Wn(%)	20.6	20.1	19.2
Dry density: $\gamma d(t/m^3)$	1.43	1.42	
Grain size			
Clay grading <0.005mm (%)	18.6	12.3	18.2
Silt grading <0.05mm (%)	24.3	15.2	26.3
Sand grading <2.0mm (%)	54.8	66.3	46.3
Gravel grading >2.0mm (%)	2.3	6.2	9.2
Liquid limit: W_L(%)	28.6	28.2	27.9
Plastic limit: Wp(%)	18.5	18.0	18.1
Plasticity index: Ip(%)	10.1	10.2	9.8
Compaction test			
Optimum moisture: Wop(%)			16.3
Max dry density: $\gamma dmax (t/m^3)$			1.74
Cohesion: $C(kg/cm^2)$	0.14	0.14	0.15
Friction angle: φ(°)	14.5	14.6	15.4
Permeability: K (cm/s)	$6.3x10^{-5}$	$8.0x10^{-5}$	$7.1x10^{-5}$