

## 4 PRELIMINARY DESIGN OF BANK PROTECTION FACILITIES

Preliminary design of the riverbank protection facility is carried out for four (4) sites including the stretches proposed as Urgent Projects in Chapter 3. The sites are Sithantai Site, Ban Hom Site, Bo O Site and Sibounheuang-Muang Wa Site.

### 4.1 Sithantai Site

#### 4.1.1 Location

Riverbank along Ban Sithantai, from KM-1553+0.85km to KM-1555+1.28 km (3,320m), is bearing riverbank erosion with high priority of bank protection work in the Master Plan.

#### 4.1.2 Assumption of Bank Erosion Mechanism

Riverbank along Sithantai site is suffered from the main river current scoring the toe of the riverbank as shown in Figure 4.1, based on the bathymetric survey conducted by JICA Study team with MCTPC counterparts in December 2003. Soil mass of riverbank slope is assumed to fall down due to undermining of the slope that makes the riverbank unstable to collapse. The geological formation consists of top soil layer with a thickness of approximately 1.2m, underneath silty clay / silty sand with a thickness of approximately 6 m, below that silty sand layer with relatively weak comparing with the above silty clay/silty sand layer as shown in Figure 4.2. The upper silty clay / silty sand layer can stand nearly vertical, but the lower shows mild slope as shown in Figures 4.1 and 4.3.

#### 4.1.3 Riverbank Protection Work as Measures

The lower part of the riverbank slope is to be kept away from scoring induced by the fast current of the Mekong river in the flood season, by putting a group of groynes made of stones. The method is suitable to keep the present riverbank line by correctly arranging groynes, that are relatively low cost riverbank protection work and suitable at the site around Sithantai, in considering the sparse distribution of properties behind the riverbank. The arrangement of the groynes is as below:

Length	: Approximately 50m
Interval of groynes	: 150m (approximately 3 times of groyne length)
Height	: 4.5 m – 2.0 m (approximately 0.1 – 0.4 times of water depth in the flood season)

The plan layout is as shown in Figure 4.4. By putting a group of groynes, main river flow will shift away from the riverbank and the groynes make the flow current speed low near the riverbank, those could reduce the scoring of the toe of riverbank. As a result, the riverbank erosion will stop / reduce.

Construction of groynes should be started from the up-stream end and auxiliary groynes between the existing groynes is added if necessary by monitoring the change of topography / bathymetry after construction of groynes. Construction of each groyne could be divided into

2 stages, that is, initial half stretch is constructed in the first stage and while monitoring the effect of the first half groyne, remaining half is done at second stage.

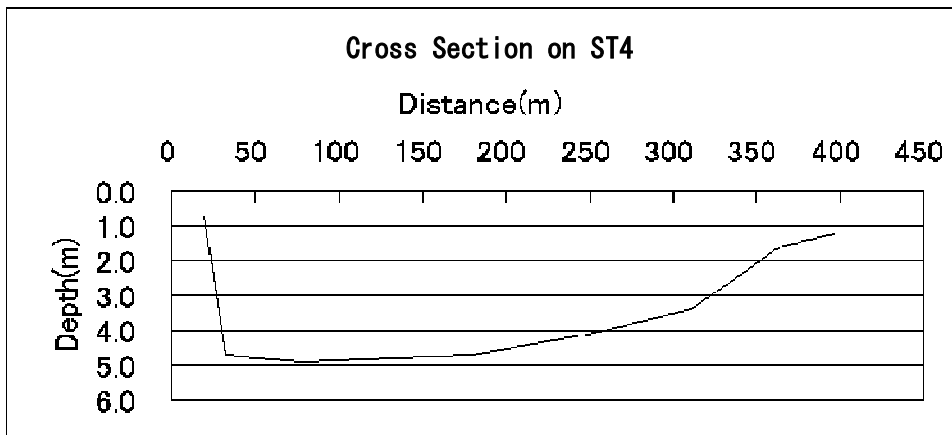


Figure 4.1 (1/2) Typical River Cross Section at Sithantai Site (whole section)

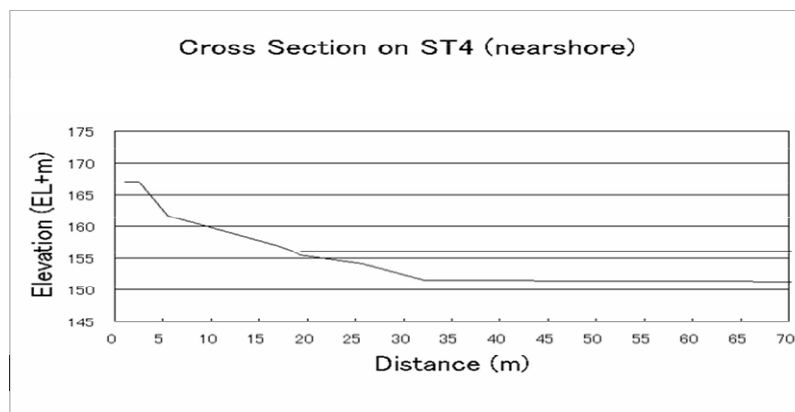


Figure 4.1 (2/2) Typical River Cross Section at Sithantai Site (near bank)

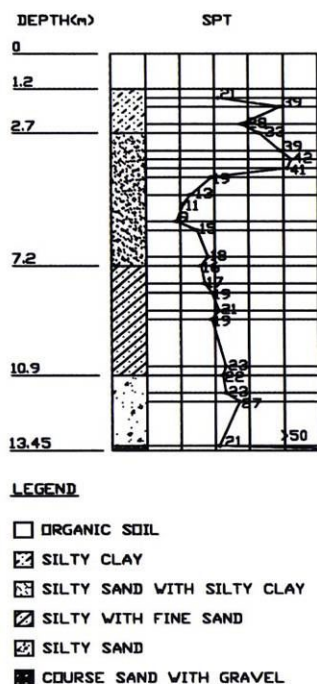


Figure 4.3 Typical Riverbank around Sithantai Site

Figure 4.2 Boring Log at Sithantai Site

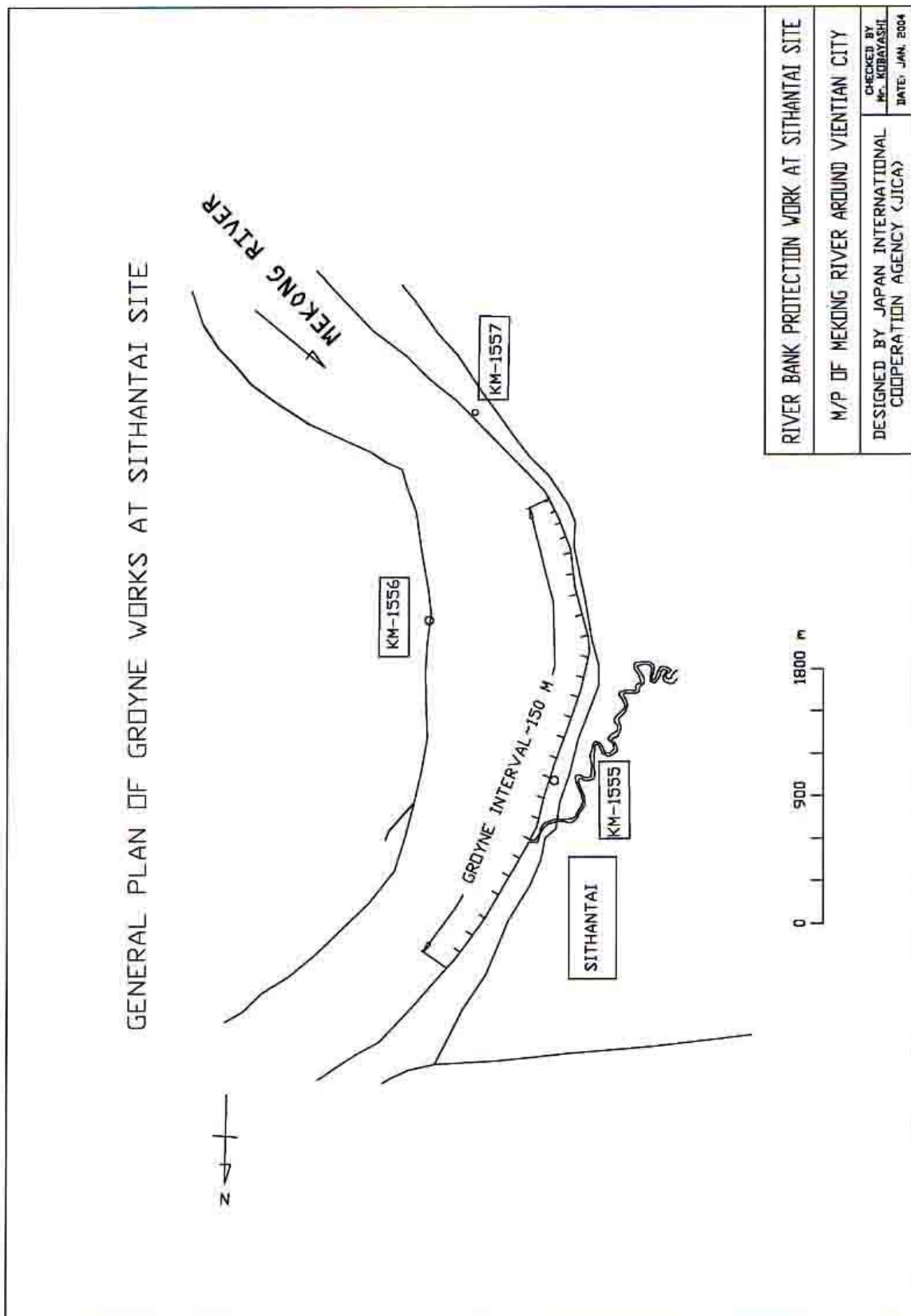


Figure 4.4 General Plan of Groyne Works at Sithantai Site

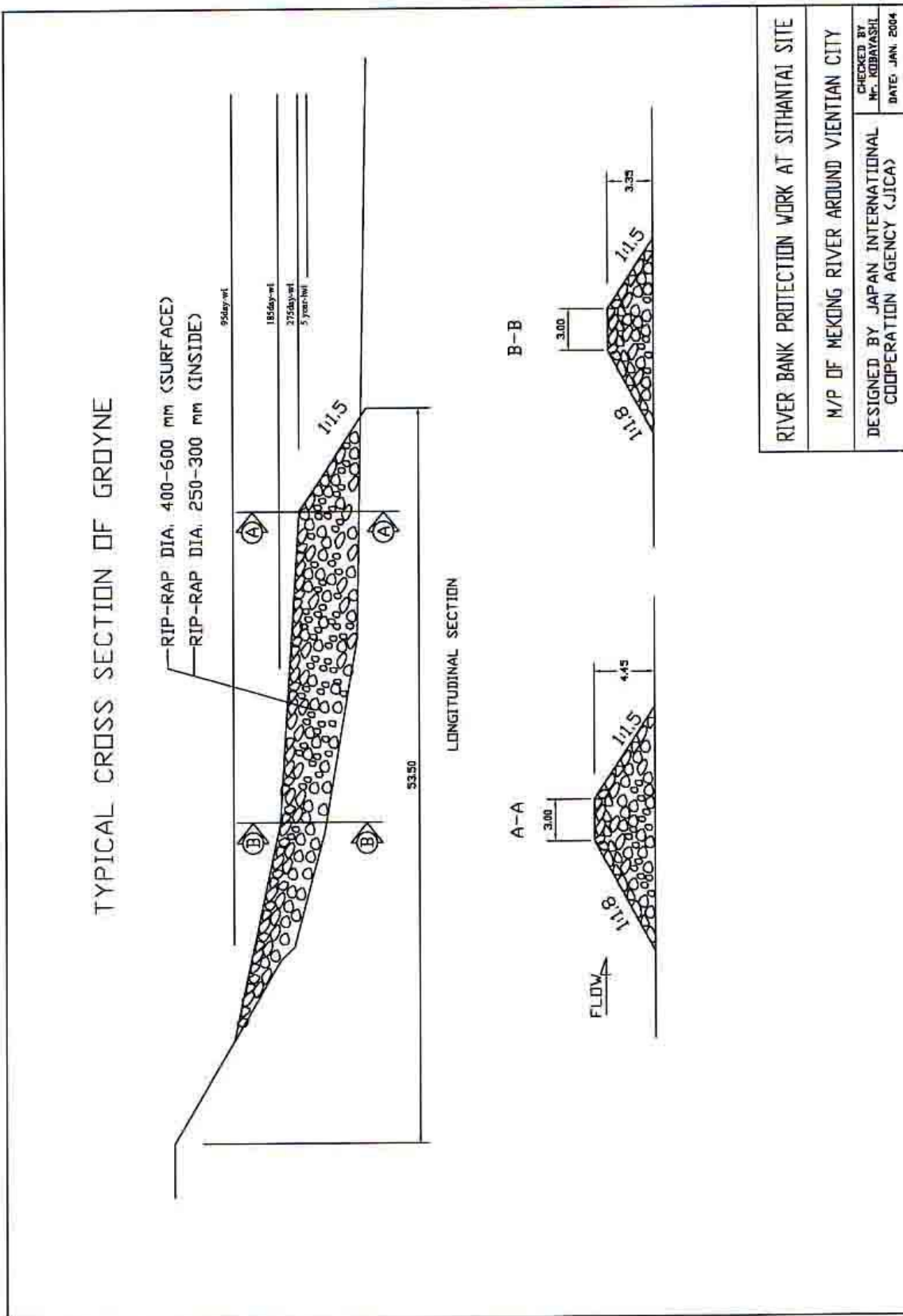


Figure 4.5 Typical Cross Section of Groyne Works at Sithantai Site

## **4.2 Ban Hom Site**

### **4.2.1 Location**

Riverbank along Bam Hom from about KM-1564 to about KM-1566 (2,450m) is suffered from severe riverbank erosion. Especially the riverbank in front of Wat Thongthat is the most severely eroded, where the recession of the bank of 25m was recorded in a year of 2003.

### **4.2.2 Assumption of Riverbank Erosion Mechanism**

Main stream flow of the Mekong river changes its location from the right bank, Thai side, to the left bank, Lao side, and flows down near the left bank of Ban Hom site as shown in figure 4.6 (1/2), based on the bathymetric survey conducted by JICA Study team with MCTPC counterparts in December 2003. The riverbank between Wat Chom Ton and Wat Thakhek as shown in Figure 4.6 is assumed to be undermined by fast river current in the flood season to cause upper part of the cliff falling down due to relatively weak soil material characteristics consisting of the riverbank. The geological condition around the site is as shown in Figure 4.7, top soil of approximately 1.6m thickness, underneath the silty clay of approximately 7m thickness, and below silty sand layer, relatively weak layer exist. The upper silty clay layer has relatively hard and can keep nearly vertical cliff as shown in Figure 4.6 (2/2) and Figure 4.8.

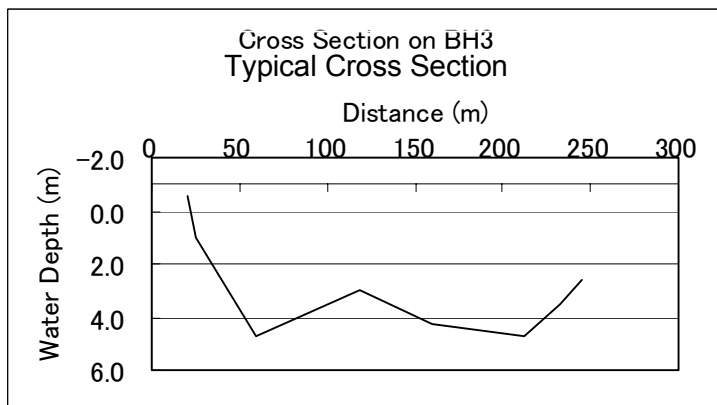
On the contrary, since the lower layer is vulnerable to erosion in the flowing water, it is considered that the soil mass fallen down at the foot of the cliff is gradually eroded due to river current and the lower portion of the cliff forms its shape according to the balance of supplied soil from the bank and tractive force of the river current.

### **4.2.3 Riverbank Protection Work as Measures**

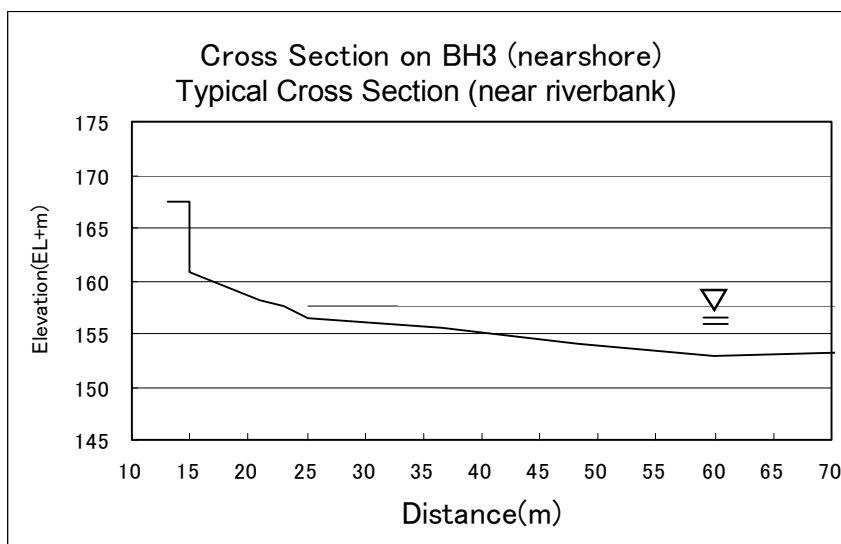
As described in Chapter 3, the Ban Hom site area is faced with Don Tam island and the Mekong river width is slightly narrow and the riverbed near left bank side is deeply scored. A slope protection work with foundation work and foot protection work is suited for this site, since this type of riverbank protection work has less impact to the opposite bank, comparing with a groynes type work.

In this context, the lower weak silty sand layer is covered by a slope protection work to reduce the upper silty clay layer falling down vertically. The slope protection work is supported by a foundation work with a foot protection work to avoid possible local scoring near the toe of the foundation work. Foundation work by wooden pile type is not applicable due to relatively deep-water depth near the toe of the slope. The layout and the typical cross section of the riverbank protection work are as shown in Figure 4.9 and Figure 4.10. Along the riverbank with relatively low-density distribution of properties behind the riverbank, the riverbank slope is protected at about half of the slope, considering the upper part of the slope could stand vertically due to its geological condition as shown in Figure 4.10(1/2). In front of Wat Thongthat, the whole riverbank slope is protected to avoid possible riverbank erosion

and assure an access to river water at the site as shown in Figure 4.10(2/2).



**Figure 4.6(1/2) Typical River Cross Section at Ban Hom Site (whole section)**



**Figure 4.6(2/2) Typical River Cross Section at Ban Hom Site (near riverbank)**

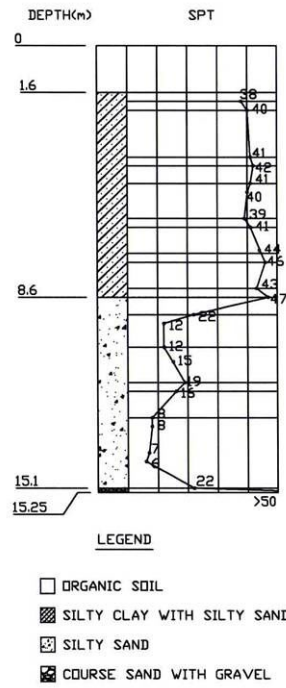


Figure 4.7 Boring Log at Ban Hom Site



Figure 4.8 Typical Riverbank at Ban Hom Site

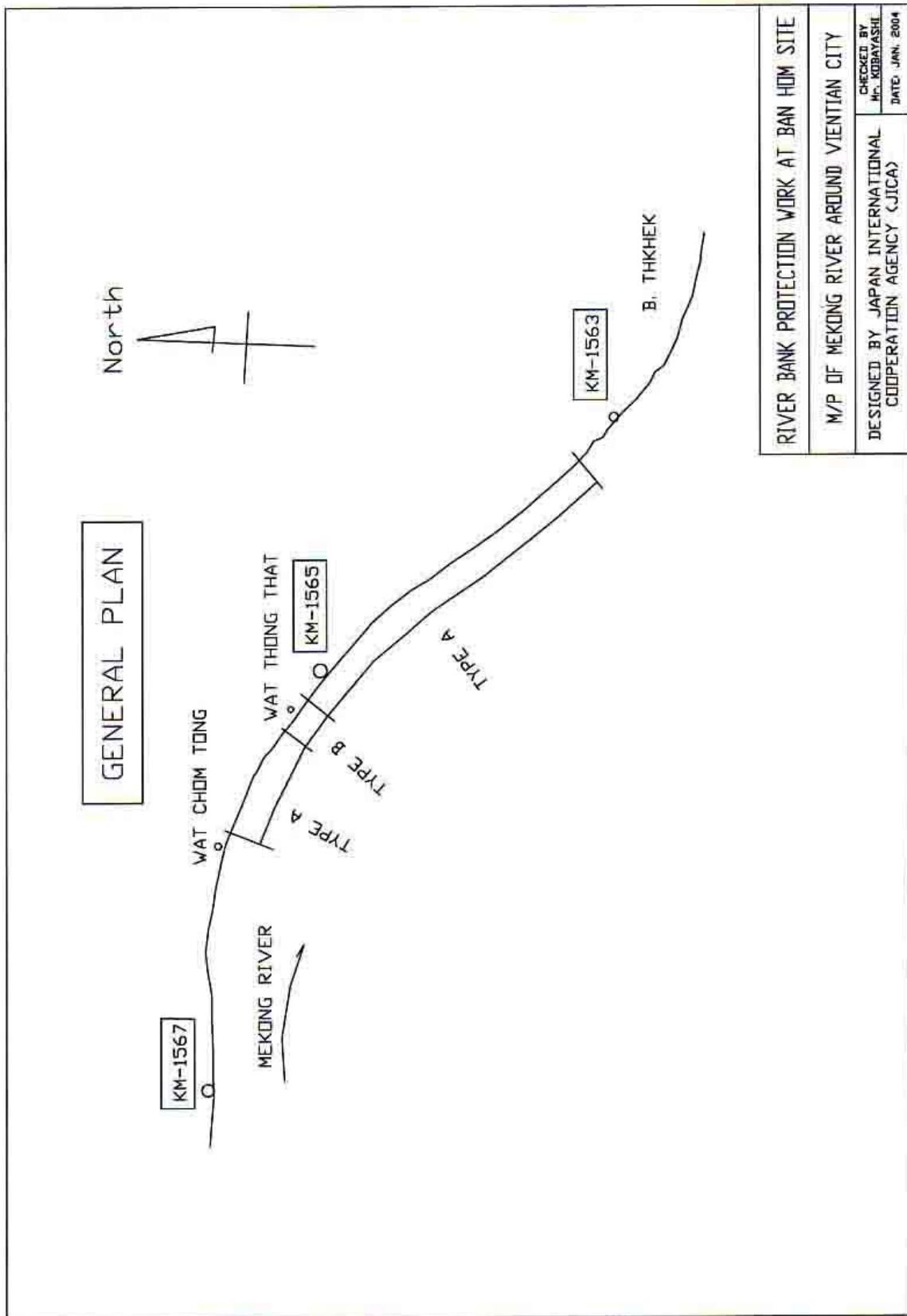


Figure 4.9 General Plan of Riverbank Protection Work at Ban Hom Site



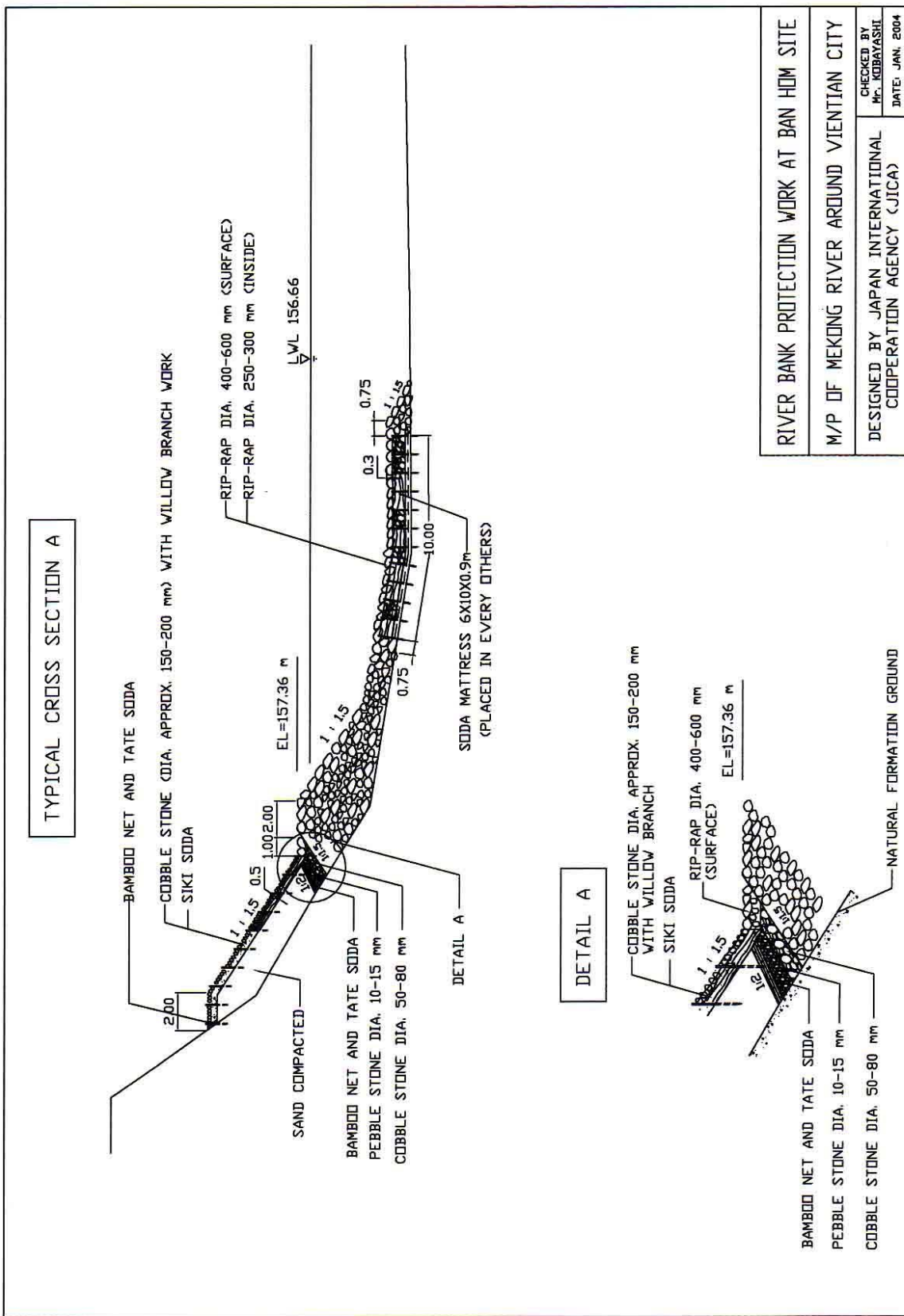


Figure 4.10 (1/2) Typical Cross Section of Riverbank Protection Work (Type A) at Ban Hom Site

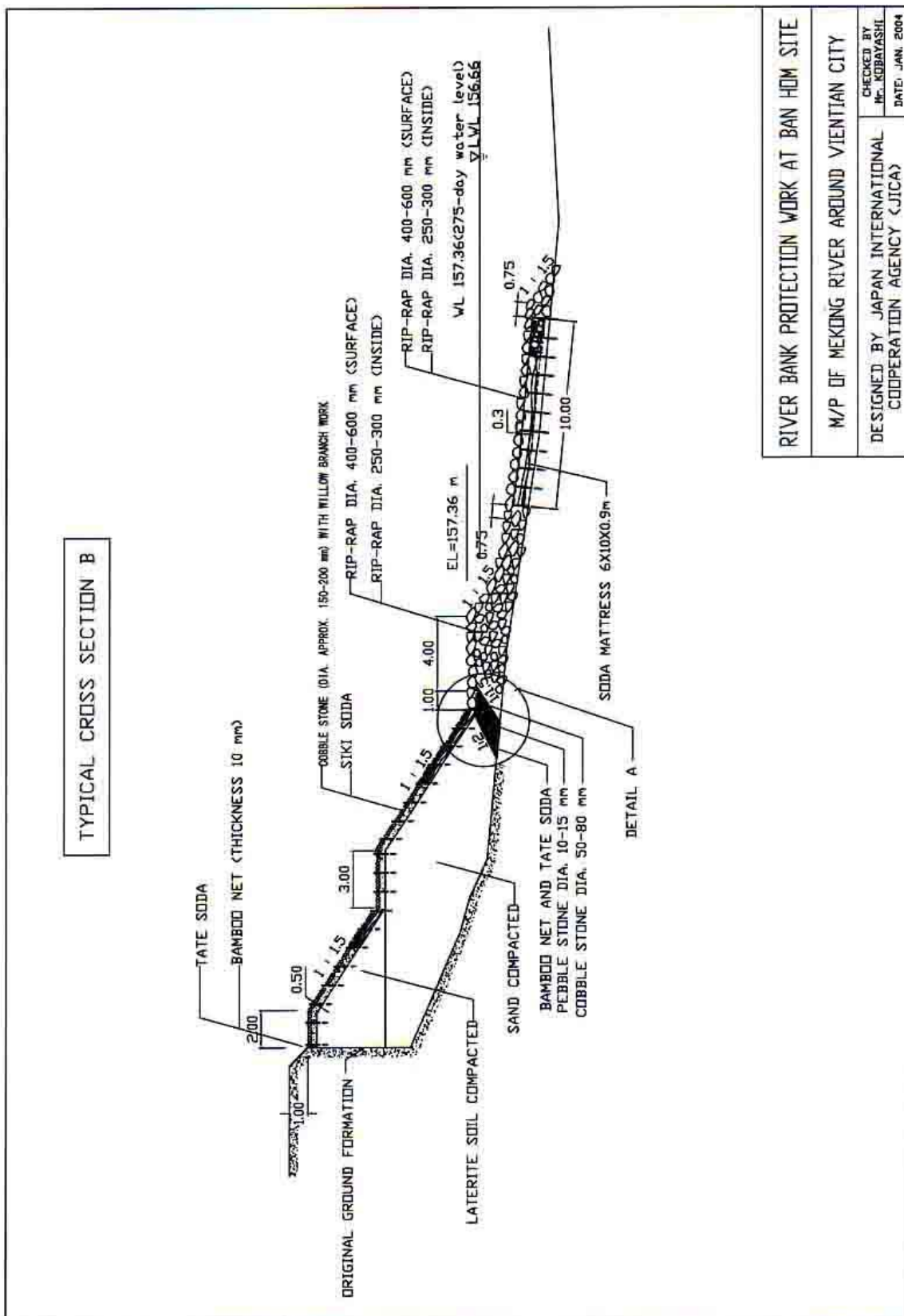


Figure 4.10 (2/2) Typical Cross Section of Riverbank Protection Work (Type B) at Ban Hom Site

### **4.3 Bo O Site**

Riverbank protection at Bo O Site is a part of the on-going project; Lao-Flanders River works Project of MCTPC with cooperation from Flanders International Technical Agency (hereinafter referred to as "FITA"). The location of the riverbank protection is just downstream of existing riverbank protection work in front of Bo O Temple. Length is approximately 200m. Riverbank slope protection work is planned by using gabion box and rip-rap works. The draft of general layout and typical cross section as of January 2004 under reviewing by FITA are as shown in Figure 4.11 and Figure 4.12, respectively.

JICA Study team esteems the FITA's existing plan of the riverbank protection work at Bo O Site and incorporates them into the Master Plan as it is.

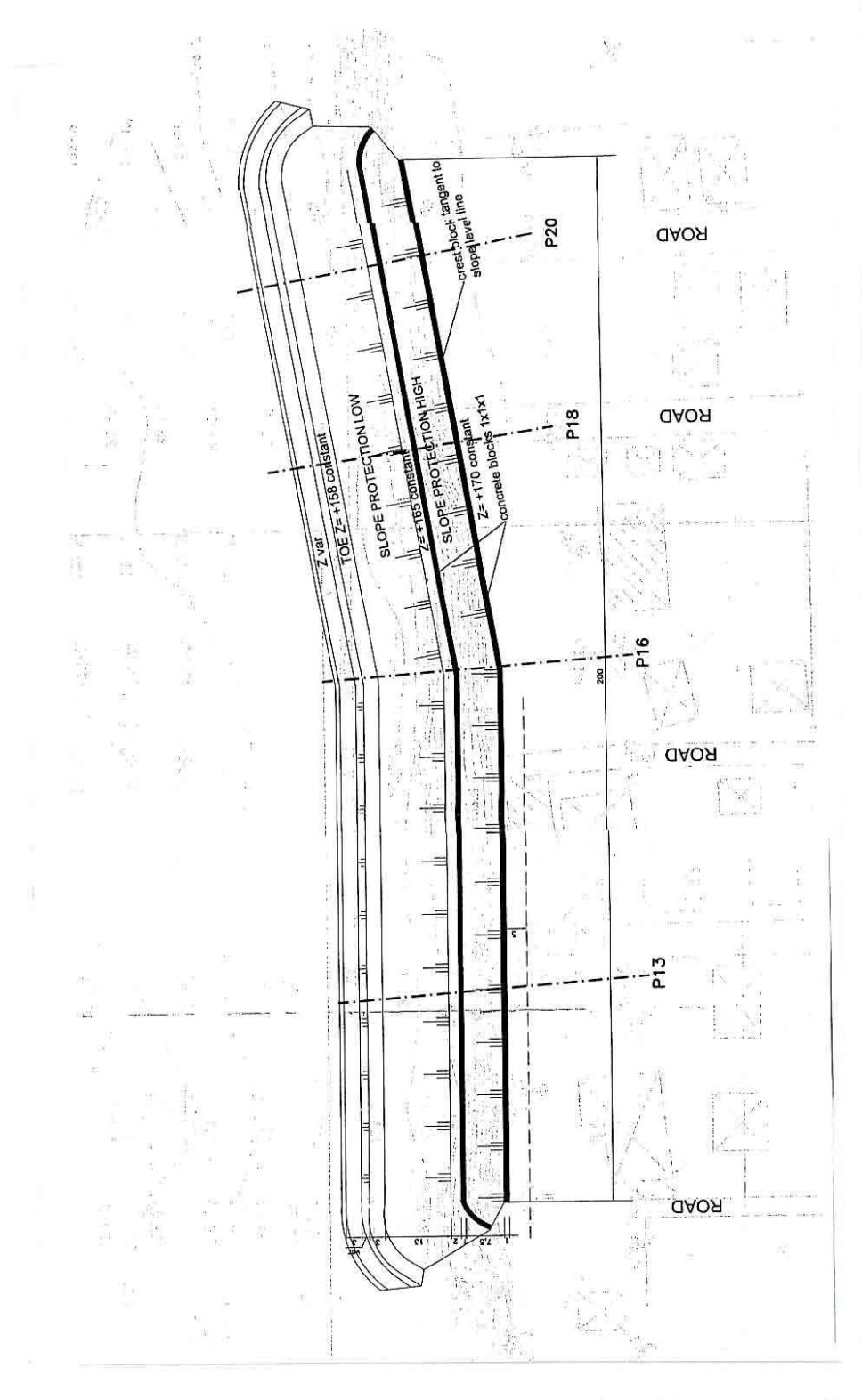


Figure 4.11 General Layout of Riverbank Protection Work at Bo O Site

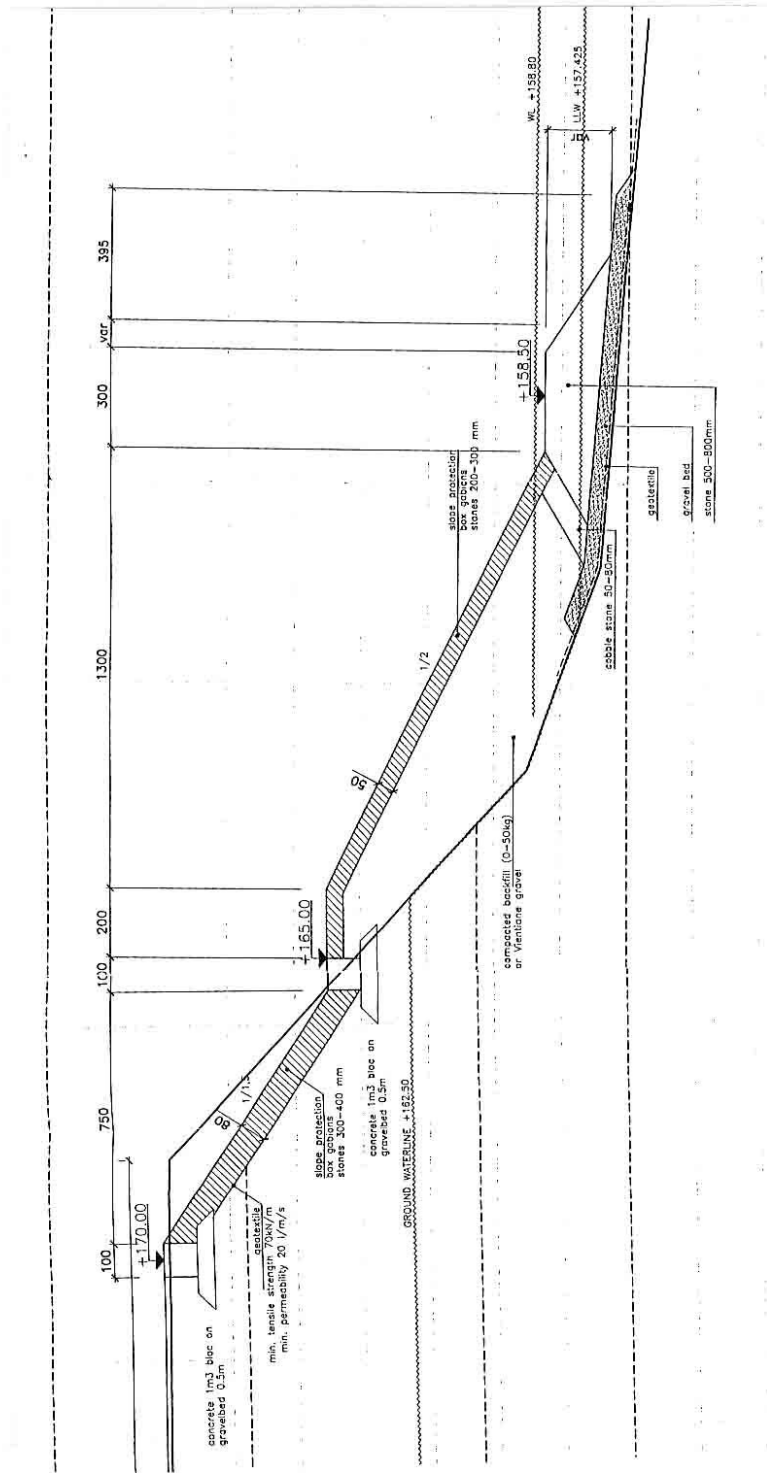


Figure 4.12 Typical Cross Section of Riverbank Protection Work at Bo O Site

#### 4.4 Sibounheuang – Muang Wa Site

##### 4.4.1 Location

The riverbank between Sibounheuang Site (JICA Pilot Work site) and the existing riverbank protection work at Wat Muang Wa is the site of Sibounheuang – Muang Wa site. The length of the site is approximately 410m.

##### 4.4.2 Assumption of Riverbank Erosion Mechanism

At the foot of the riverbank is remarkably notified as development of notches along the site area as shown in Figure 4.13. The geological boring log in Figure 4.14 shows that a layer of clayey sandy gravel exists below the sandy silt (thickness approximately 4.5m) and silty clay layer (thickness of approximately 0.5m). It is considered that the clayey sandy gravel layer is easily loose its fine materials during flood and gravels in the layer flushed away. While the notches develop during flood time, the upper sandy silt and silty clay layer falls down after attaining the internal stress exceeds the cohesive force in the upper layer and cannot keep its position, especially in the recession of flood period.

##### 4.4.3 Riverbank Protection Work as Measures

By protecting, the lower part of the cliff could be effective measures to stop / reduce the progress of notch development leading the riverbank erosion along the site. Similar riverbank protection work with that at Sibounheuang Pilot Work Site has been effective. The general layout and typical cross section of the riverbank protection work are as shown in Figure 4.15.

The lower part of the cliff is covered by the Cobble Stone with Willow Branch Work, the toe of which is supported by the Log Hurdle Work as a foundation work. The foundation work is protected by SODA Mattresses.

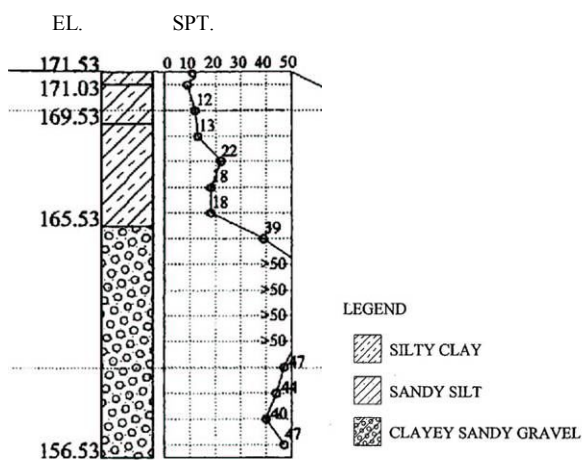


Figure 4.14 Boring Log near Sibounheuang Site



Figure 4.13 Notches Development at the foot of Riverbank Slope at Sibounheuang Site



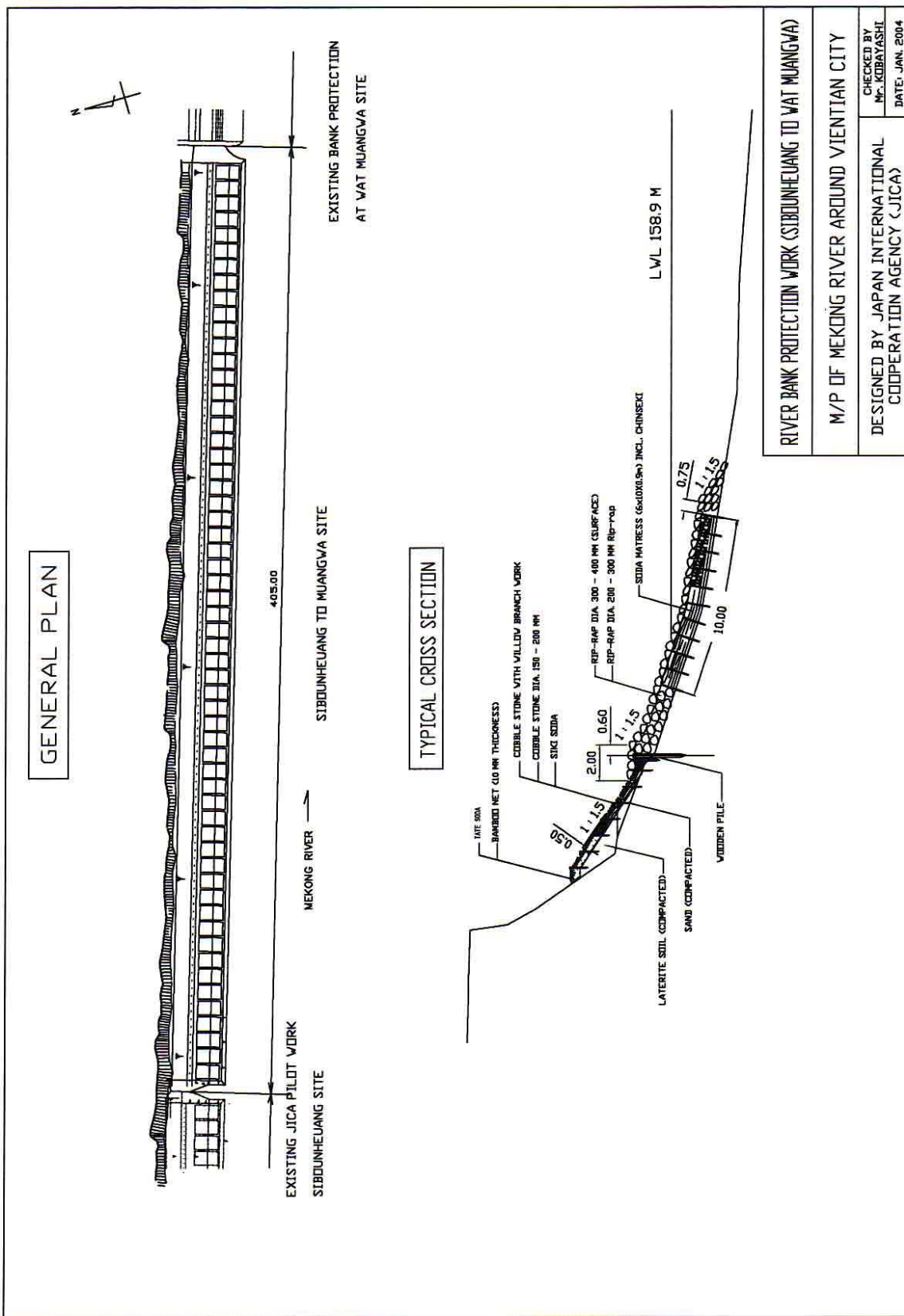


Figure 4.15 General Plan and Typical Cross Section of Riverbank Protection Work at Sibounheuang Site

## 5 INSTITUTION AND ORGANIZATION

Key issues to implement sustainable bank protection project by GOL according to the Master Plan (2005-2020) is as follows; Out of above, items 1 - 3 are discussed here:

1. Set up of organization and institution
2. Human resources arrangement
3. Human resources development
4. Budgetary allocation (based on national budget in principle)
5. Resident's participation

### 5.1 Set up of New Permanent Organization

The Department of Roads (hereinafter referred to as "DOR") in MCTPC (the counterpart agency for the Study) and DCTPC Vientiane City deal with the riverbank protection activities of the Mekong River in the Study Area. MCTPC has been responsible for the planning, budgeting and management, and DCTPC implements the construction work in principle.

The organization chart of MCTPC and that of DOR, MCTPC is as shown in Figures 5.1 and 5.2, respectively. As can be seen in the figures, no permanent organization and the engineer in charge of bank protection activities has been exist in MCTPC. Inland Waterways Administration Division in DOR has usually dealt with bank protection projects on an ad hoc basis in parallel with their main task, fluvial navigation. A temporary counterpart organization for the Study on a project basis has been established since 2001 as shown in Figure 5.2, however, the organization and the office will be closed on the completion of the Study. On the other hand, DCTPC has permanent organization named "Bank Protection Project" as shown in Figure 5.3, the organization chart. MCTPC has built good partnership with DCTPC; however, the demarcation has been sometimes unclear in reality. One of the reasons of the unclear demarcation might be caused by the present organization of MCTPC relating to bank protection.

MCTPC and the Study Team formed the consensus through the enthusiastic discussion on this issue that "Mekong Riverbank Protection Unit (tentative name)" as new permanent organization for riverbank protection should be established in MCTPC:

1. to realize sustainable implementation of the project proposed by the Master Plan,
2. as the preparation to receive possible future donor's technical assistance after year 2005 to assist the implementation, and
3. to manage other river related issues.

The new organization in MCTPC is expected to perform following activities relevant to the bank protection:

1. Planning and implementation of new bank protection works and rehabilitation of the existing works.



2. Monitoring conditions of riverbanks and bank protection works
3. Operation and maintenance of the existing bank protection works
4. Study and research works to improve and develop bank protection works fit well with the Mekong River and Lao PDR
5. Enhancement of public awareness on the bank erosion damages and works
6. Guidance and assistance to the protection activities implemented by private organizations and individuals
7. Hydrological observation and hydrographic survey
8. Regulation and coordination regarding land use on riverbank to reduce damageable properties and artificial impact which may adversely influence the bank protection
9. A base to spread Japanese traditional river works including Soda method around Lao P.D.R. then the countries in the Mekong River basin
10. A base to have the training course of Japanese traditional river works inviting trainee from the Southeastern Asian region

## **5.2 Human Resources Arrangement**

Proper human resources arrangement to the New Organization proposed in Sub-section 5.1 is one of the crucial precondition for the success of sustainable implementation of the bank protection projects according to the Master Plan with reliability. It is suggested that present MCTPC counterpart personnel for the Study be the core of the new permanent organization especially in the early stage of the implementation. The present counterpart personnel have accumulated the experience and knowledge on the riverbank protection through the collaboration work with the Study Team for around three (3) years. The important point here is to fix and transfer of technology in the new organization.

## **5.3 Human Resources Development**

The implementation of the bank protection projects according to the Master Plan is quite long-sustained effort for 16-year (2005 - 2020). Therefore, continuous human resources development is also the essentials to transfer technology and knowledge on river bank protection from one generation to the next in GOL. The following activities will be necessary for the human resources development for sustainable bank protection activities:

1. Proper arrangement of new employees to the New Organization at regular year intervals,
2. Practical training of the new employees by the manager of the New Organization,
3. Development of the teaching material for the training on the basis of the “Manual for Riverbank Protection” prepared by the Study Team.
4. Various public education for young generation to disseminate the information on the importance of the river bank protection and for future recruitment as follows:
  - a) Receiving the trainee from various educational institutions such as National University of Laos. (The MCTPC counterpart personnel for the Study received 10 students from National University of Laos several days in February 2004. This activity is very much in line with the policy.)
  - b) Making lectures and/or having seminar on riverbank protection related topics at various educational institutions and/or relating government agencies by the manager

class staff of the New Organization and the experts of donors. (River engineering course in university was closed around 10 years ago.)

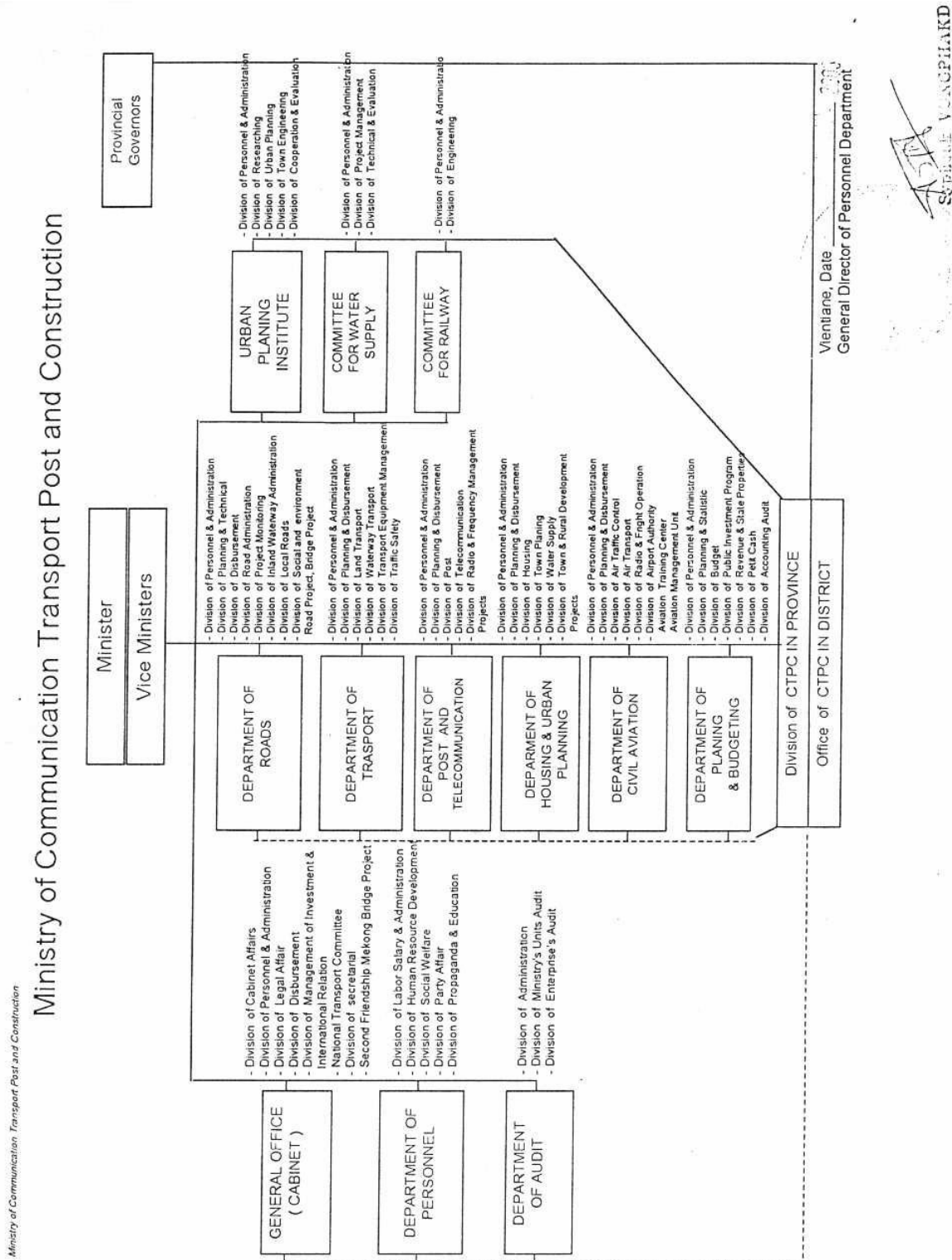
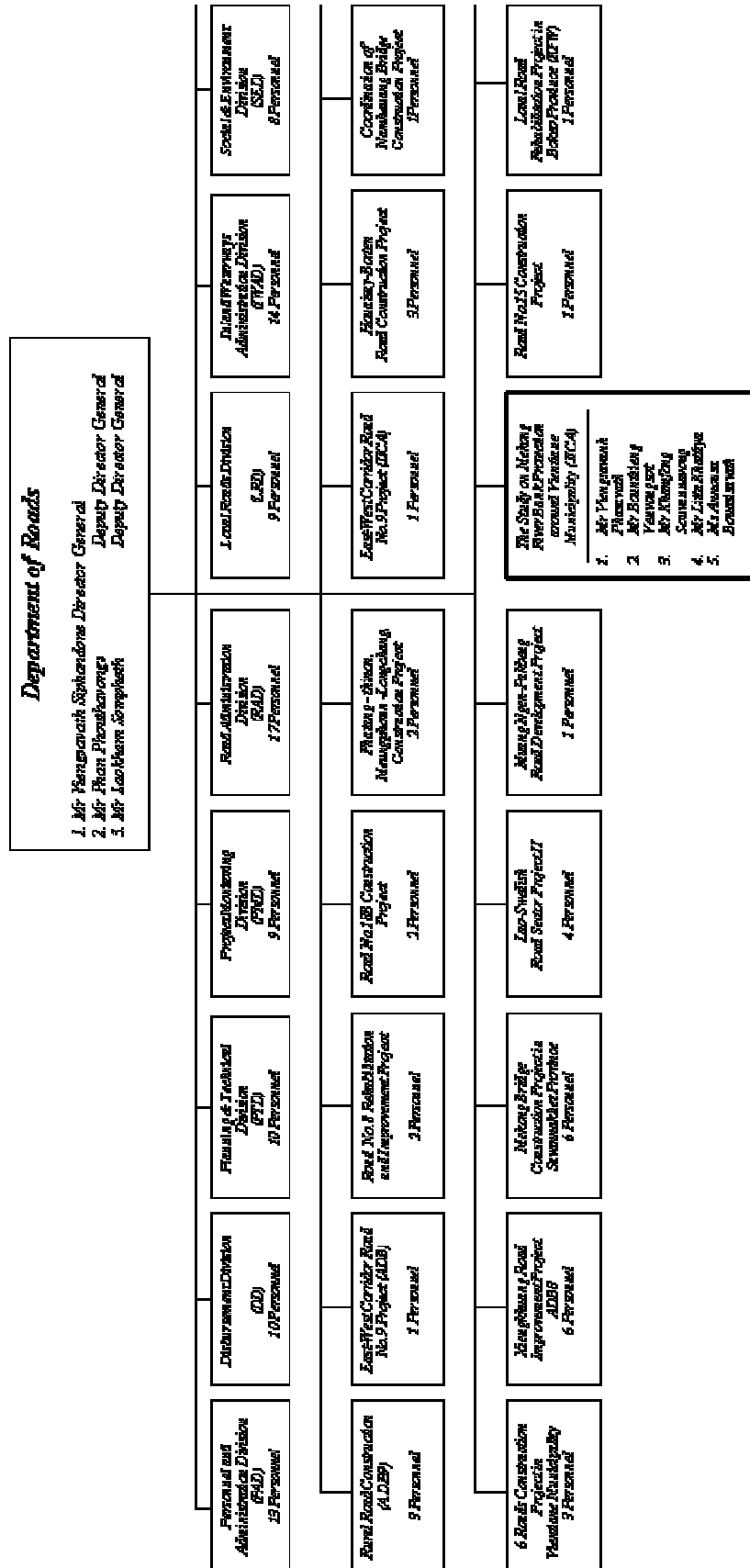


Figure 5.1 Organization Chart of MCTPC

**The Organisation Chart of the Department of Roads**



**Remarks:** There are 150 personnel in the Department of Roads

Figure 5.2 Organization Chart of DOR, MCTPC

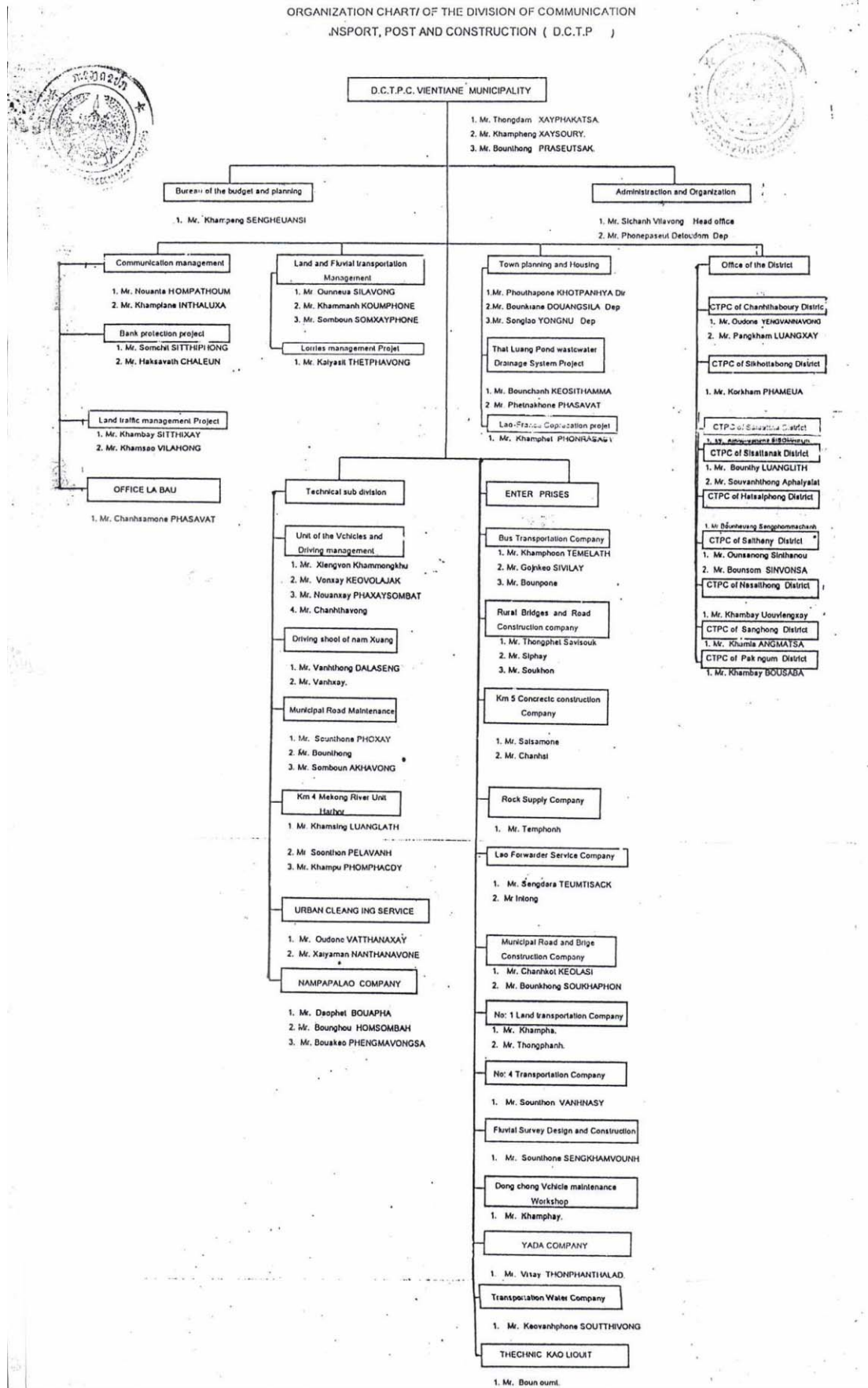


Figure 5.3 Organization Chart of DCTPC

## **6 NON-STRUCTURAL MEASURES**

### **6.1 Public Awareness Campaign**

One of the important activities by GOL is to launch a campaign to educate the population of Vientiane City on the importance to protect the Mekong riverbank from erosion and to create environmental friendly riparian zone by the construction of nature-oriented bank protection works. In this context, present positive public relations on the bank protection related activities such as the Pilot Works and Soda technique demonstration by MCTPC using newspaper and TV should be continued and expanded.

Prior to the construction of the bank protection projects of the Master Plan, GOL should ask representatives of local residents at each project site to understand the contents and importance of the works by having a highly illustrated and easy-to-understand presentation.

### **6.2 People's Involvement**

It is virtually impossible for GOL to construct bank protection works throughout the Cliffy riverbanks (16.03 km; excluding the existing protection works) and Mild-slope riverbanks (20.71 km) in the Study Area owing mainly to the budgetary limitation of GOL as discussed in Sector A Chapter 8. Therefore, an approach by involvement of community people is also essential. The basic principles of objective riverbanks for people's involvement are as shown in Table 9.1 in Chapter 9. In this approach, GOL shall assist the followings:

1. to organize the local community for bank protection activities,
2. to train local community leaders (practical training at objective site, seminar using video and/or easy-to-understand manual),
3. to provide guidance, data and information required (such as the information on Soda material collection sites),
4. to coordinate with relevant communities and government agencies, and
5. to provide any other assistance necessary for the activities by the community people.

The protection measures to be carried out by the local community would be stabilization of bank slope by simple vegetation riverbank protection works executed by the Study Team in 2003 as described in Chapter 3 and demonstrated by the Study Team through the field session in February 2004 (refer to Sector J (Transfer of Technology) of this Supporting Report). These works can be implemented only by manpower using Soda materials, small wooden piles (Kogui), some steel wire, tools and a pickup to transport collected Soda materials to the site. These activities involving the local people are expected to enhance the people's concerns and understanding on the functions and importance of the bank protection works as well.

### **6.3 Riparian Land Use Regulation**

Changes in plan-form of river are not so much, as a whole. This however does not indicate less damage. Seemingly stable riverbank is apt to invite the people and their properties

close to the bank edge. In parallel with implementation of the bank protection works, land use regulation near the riverbank should also be implemented to reduce damageable properties on the riverbank.

The revision work of Vientiane Urban Development Master Plan formulated in 1991 with UNDP/UNCHS support starting from 1998 by URI-MCTPC was completed in 2003 and the draft report is available at present. The 1991 plan covers various sectors including land use zoning and road construction plan for objective 150 villages in six districts. The revised master plan includes 189 villages in seven districts.

According to the revised master plan, the area along the Mekong River in the city center (L=20 km) is categorized as single riparian zone (UC) (refer to Sector A (Present Condition in the Study Area) of this Supporting Report. The land use principle of the riparian zone is proposed as follows in the revised plan:

1. Construction of new building and heavy weight facilities is not allowed in principle except for light weight public facilities.
2. Present resident can live as usual except for GOL require resettlement for bank protection works.
3. Temple and cultural assets should be preserved as it is.

This principle is judged appropriate in view of riverbank protection and is applied to the policy of riparian land use regulation in the JICA Master Plan as it is. On item 2 mentioned above, it is advisable to avoid resettlement as much as possible on the construction of bank protection. The Pilot Works of the Study (L= approx. 1 km in total) completed with no resettlement by introducing proper construction method.

#### **6.4 Preservation and Planting of Riparian Trees**

The riparian trees should be preserved as much as possible unless caused negative impact to riverbank stability, for example, trees hanging down from the edge of riverbank. Shade of trees along riverbank can protect riverbank soil from drying and helps plant grows on the bank. Future ideal image of the riverbank in Vientiane City is attractive greenbelt for local residents and foreign tourist. It is recommended that tree planting on riverbank be implemented positively, especially on the riverbanks with no shade of trees like present Ban Dongphosi Site.

#### **6.5 Monitoring and Maintenance System**

##### **6.5.1 Regular Inspection of Riverbank and Existing Protection Works**

Early diagnosis is of great importance in riverbank protection. The maintenance and repair cost (US\$20,000/ year for the existing works, 5% per/year of the project cost for new construction) and some balance can be utilized according to the investment schedule of the Mater Plan discussed in Section 8.2. However, the following monitoring inspection (visual and photograph) should be systematically conducted by GOL mainly to reduce total

maintenance/rehabilitation cost by detecting abnormal change in riverbanks like damaged and vegetation condition in its earliest stages:

1. General visual inspection of the Study Area by boat in the dry season (once a year),
2. Regular visual inspection of the existing bank protection works, especially these in damaged and/or dangerous condition like Hatdokkeo and National Culture Park (2 times/year),
3. Regular visual inspection of natural riverbanks, especially cliffy riverbanks in a dangerous condition, the objective stretches for the Master Plan (2 times/year)

### **6.5.2 Regular Monitoring and Maintenance of the Pilot Works**

Monthly or bimonthly regular visual inspection of the Pilot Works should be continued by MCTPC until the vegetation and sedimentation on the works is stabilized. The necessary period is at least 5 years after the completion in 2003, i.e. until 2008. The objective is 1) to monitor the changes in the condition of sedimentation and vegetation growth/covering on the works and 2) to detect damaged portion and rehabilitate in earliest stage. This monitoring is essential to localize Japanese traditional river works to Lao P.D.R., and to review and revise the Master Plan every five years by reflecting the result.

As for Wat Chom Cheng Site, the work is implemented as “essential test work” and accordingly the inspection should be continued without any rehabilitation work unless serious negative influence to local residents happens by unforeseen erosion.

### **6.5.3 Monitoring Survey on Riverbed Fluctuation**

Cross-sectional survey for the monitoring of the riverbed fluctuation extending probably several meters during the high water period is necessary (3 - 4 times/ year) to reflect the result for the detailed design of the objective Mater Plan projects to be conducted by GOL after 2005. It is recommended that the survey be conducted at least one time at the representative sections in the objective stretches of the Master Plan, namely, Sithantai, Ban Hom and Sibounheuang - Muang Wa.

### **6.5.4 Other Desirable Items for the Future Planning**

Flood and sediment issues including bank erosion have to be studied as phenomena of whole river section. Therefore, physical and social data of Thailand relevant to the Mekong River are indispensable to the study. Among others, installation of permanent KM-posts along the river and river section survey over the whole extent from right to left banks are required. These data can be commonly used and contribute for the rational river management of both countries.



## **7 PRELIMINARY ESTIMATION OF PROJECT COST**

### **7.1 Outline**

Preliminary cost of the bank protection project nominated for the Master Plan is estimated preliminary based on the following information and condition around Vientiane City:

1. Project cost of past various bank protection projects starting from Thadeua project by MRC in 1989 up to date,
2. Unit cost used in past bank protection projects,
3. First Soda mattress works executed by IDI, Japan in 2000 - 2001,
4. Pilot Works at three (3) sites completed as a component of this JICA Study in May 2003,
5. High Priority Stretches (L=8.77 km) nominated for the protection in the Master Plan from the technical viewpoint (refer to Chapter 3), and
6. Preliminary design of bank protection facilities proposed in Chapter 4 for the High Priority Stretches, which is further divided into four (4) individual sites including 14 individual stretches (refer to Chapter 3).

### **7.2 Bank Protection Type**

The proposed work type of 14 stretches in the High Priority Stretches (L=8.77 km in total) is summarized as shown in Table 7.1.

Among the preliminary design proposed in Chapter 4, Planning and design of “Lao-Flanders river works project” at Bo O site is underway by MCTPC with the assistance of the Government of Belgium (GOB). The project is incorporated into the JICA Master Plan as it is in principle and is given high priority in the Master Plan. However, the design at Bo O site has not been completed by GOB and accordingly no definite cost estimate is available so far. It is noted that Japanese traditional river works proposed by the Study is temporarily applied for the preliminarily cost estimate at Bo O site in this Study instead. The cost in the Master Plan shall be reviewed by GOL in future upon the definite cost based on the final design is determined by GOB.

**Table 7.1 Bank Protection Type for High Priority Stretches**

Stretch	Length (m)	Bank Protection Type					
		CSWB (A)	CSWB (B)	LH	SF	SM	RG
<b>1. Urgent Projects</b>							
(1) Sithantai (1)	1,280						○
(2) Ban Hom (1)	50		○		○	○	
(3) Ban Hom (2)	760	○			○	○	
(4) Bo O	200	○		○		○	
(5) Sibounheuang-Muang Wa	410	○		○		○	
Sub-total of 1	2,700						
<b>2. Second Priority Projects</b>							
(6) Sithantai (2)	2,040						○
(7) Ban Hom (3)	880	○			○	○	
(8) Ban Hom (4)	760	○			○	○	
(9) Hatdokkeo	770						○
(10) Upper Sibounheuang (1)	810	○		○		○	
(11) Upper Sibounheuang (2)	190	○		○		○	
(12) Upper Sibounheuang (3)	350	○		○		○	
(13) Upper Sibounheuang (4)	40	○		○		○	
(14) Upper Sibounheuang (5)	230	○		○		○	
Sub-total of 2	6,070						
Sub-total (1+2)	8,770						

Note: CSWB(A): Cobble Stone with Willow Branch Type (A)

CSWB(B): Cobble Stone with Willow Branch Type (B)

LH: Log Hurdle Work

SM: Soda Mattress

SF: Stone Foundation

RG: Rirrap Groyne

### 7.3 Material and Equipment

#### 7.3.1 Specification of Materials

The specification of main materials used for the various works categorized similar to the Pilot Works is listed in Table 7.2. For Japanese traditional river works, Japanese standard is arranged for the local material to be procured in the market or on the site. The river sand, gravel, laterite soil and the crushed stone using as the embankment and deposition are similar to local standard used for the past bank protection projects.

**Table 7.2 Specification of Main Material used for Protection Work**

<b>Item</b>	<b>Specification</b>	<b>Unit</b>
<b>Soda Mattress</b>		
Soda	Length: 2.7m, 45cm rise peripheral: 60cm 200cm rise peripheral:55cm	bundle
Taisya	Length:2.7m, $\phi 2 \sim 3$ cm at butt end $\phi 1.0$ cm at 2.7m rise, 25 twigs per bundle	bundle
Kogui (Short Pile)	Length: 1.2m, $\phi 3 \sim 5$ cm at butt end	pieces
Rubble stones	$\phi 400 \sim 200$ mm, $\phi 150 \sim 50$ mm	m <sup>3</sup>
Straw rope	$\phi 10$ mm	m
Zinc-coated whip	10# & 12#	m
<b>Log Hurdle Work</b>		
Wooden pile	Length:3 – 4.0 m, tip end: $\phi 15$ cm (primary pile) Length:3.5m, tip end: $\phi 9$ cm (secondary pile)	piece
Bolt	L=30 cm, d=13 mm	unit
Nail	L=15 cm	kg
Back rubble stone	$\phi 150 \sim 50$ mm	m <sup>3</sup>
<b>Embankment Work</b>		
River sand & Gravel	Procured from pit in the Mekong river	m <sup>3</sup>
Laterite	Procured from borrow area	m <sup>3</sup>
<b>Foundation Riprap Work</b>		
Rubble	$\phi 200 \sim 150$ mm (riprap), $\phi 400 \sim 200$ mm (deposition)	m <sup>3</sup>
Bamboo net	B=2.5 m L=1.0 m	m <sup>2</sup>
<b>Slope Protection Work</b>		
Soda	L=3.0 m, S=0.7 m	bundle
Taisya	L=3.0 m, 1 bundle =25 unit	bundle
Kogui (Short Pile)	L=1.2 m, $\phi =4$ cm	unit
Willow	L=1.2 m, S=0.9 m (collected from the Mekong River)	bundle
Pebble	$\phi =150 - 200$ mm	m <sup>3</sup>
<b>Piling (Groynes) Work</b>		
Wooden pile	Length:4.0 – 6.0 m, tip end>> $\phi 15$ cm	piece
Tie-beam	L=3.2 m, tip end>> $\phi 9$ cm	piece
Bolt	L=30 cm, d=13 mm	piece

### 7.3.2 Procurement

The location of material procurement sites is as shown in Figure 7.1. Soda fascine can be collected from Nong Pen, Donloun, Laksamsip and Danxi. The woods for the log hurdle work, log piling and riprap work with willow fascine is supplied in market. The crushed stone for deposition work etc. is procured under State Company only in Vientiane Province at Ban Sakai or the contractor arranges the crushed stone by the production plant installed individually. Laterite soil is collected at the borrow site near Ban Dongphosi. The river sand and gravel is collected at Xiangkhouan along the Mekong. Metal material such as zinc-coated whip, bolt, nail is easily procured by the suppliers in Vientiane City.

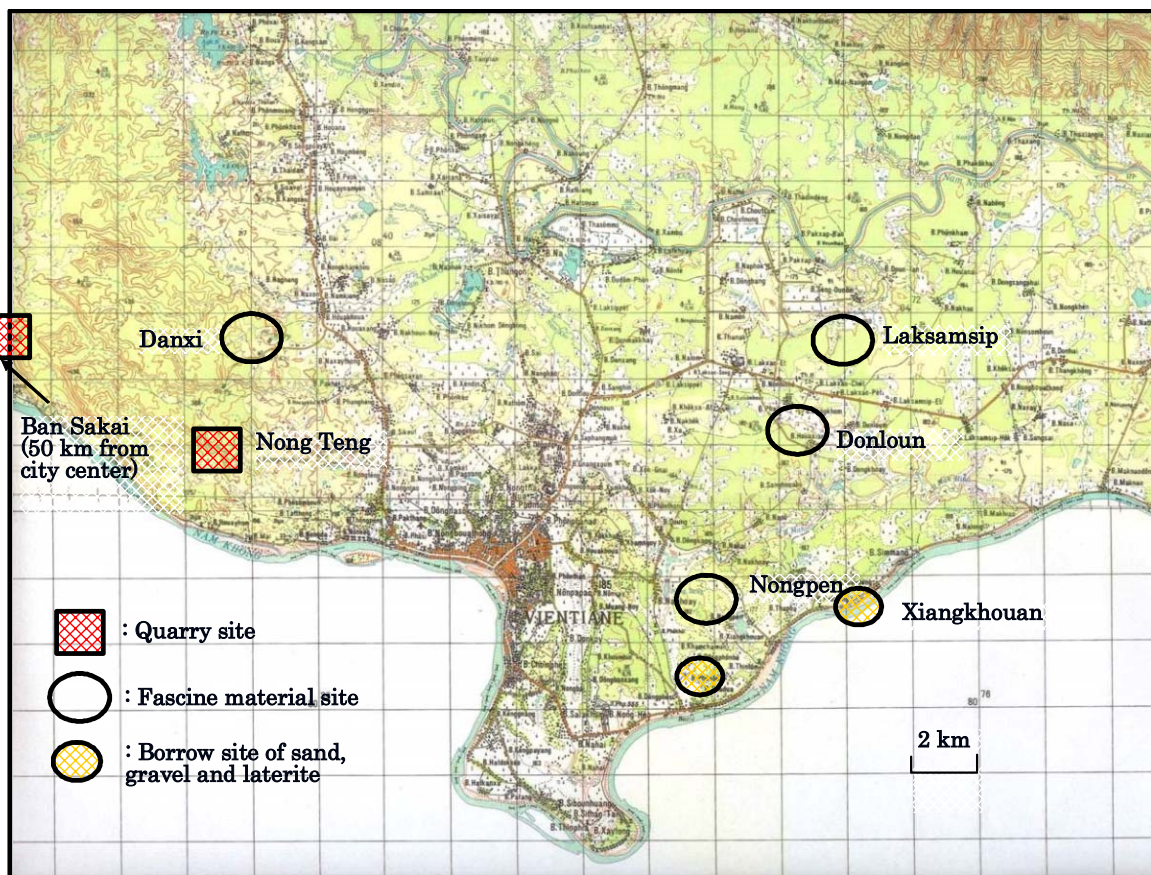


Figure 7.1 Location of Material Collection Sites

### 7.3.3 Equipment

The main equipments utilized in the past riverbank protection projects are summarized in Table 7.3. Among these projects, the floating dock, barge, and crane were utilized for the installation of Soda Mattress in the IDI Test Work and JICA Pilot Works.

**Table 7.3 Main Equipments in Past Bank Protection Projects**

Project Name	Thadeua Phase II	Phanmanh Phase II	Wattay	IDI & JICA Pilots
Bank Length (m)	250	63	250	1120
Construction Year	1992-1993	2001-2001	1995-1996	2000-2003
Main Work Type	Gabions Wall	Reno Mattress Embankment/Riprap	Reno Mattress Gabions Wall	Soda Mattress, Gabions Wall, Tie-twigs Hurdle, Log Hurdle, Cobble Stone with Willow Branch, Wooden Pile etc.
Main Equipment	Rough Terrain Crane Bulldozer Motor Grader Motor Excavator & Loader Truck and Crane Damp Track	Bulldozer Wheel Loader Backhoe Loader Roller Compacter Tractor Grader Tanker Dump Track	Excavator Bulldozer Motor Grader Roller Compacter Water Tank Dump Track Plate Compacter	Rough Terrain Crane Crawler Crane Floating Dock Material Barge Wheel Loader Backhoe Dump Track

The equipments listed in the above table is applied for riverbank protection projects in Master Plan Study. Some local contractor has above-mentioned major equipments. Rental service of the equipment is also commonly in Vientiane market.

### 7.3.4 Unit Cost

Unit cost survey is conducted through the interview from local contractors and various tender documents of past bank protection works in the Mekong River. The result is as shown in Tables 7.4 and 7.5.

**Table 7.4 Unit Cost of Material and Equipment Rental**

	Description	Applicable	unit	unit price( us \$)
1	Rubble Stone including Transportation from Sakai-VT	> 500 mm	m <sup>3</sup>	20~26
		300-500 mm	m <sup>3</sup>	20~26
		< 300 mm	m <sup>3</sup>	20~26
2	Clean Sand		m <sup>3</sup>	8~12
3	Transportation (L=30-40 Km)	10T Dump	Per Day	100~130
4	Unit crane		Per Day	100~140
5	Floating Dock		per Month	3000~3700
6	Barge		per Month	3000~4000
7	Tag Boat		Per Day	450~600
8	River sand and gravel		m <sup>3</sup>	4~7
9	Piling of Wood	5 m	10 unit	20~30
		Depth=2-3m		

**Table 7.5 Unit Cost of Major Work**

	Description	unit	unit price ( us \$)
1	Common Excavation	m <sup>3</sup>	1.0~1.47
2	Supply and fill laterite	m <sup>3</sup>	4.02~4.50
3	Supply and fill gravel	m <sup>3</sup>	4.02~4.92
4	Supply and fill gravel below water	m <sup>3</sup>	10~15
5	Assemble, place Reno mattress	Unit	2~8
6	Supply and place rock	m <sup>3</sup>	27~31
7	Supply and place Geotextile	m <sup>2</sup>	1~3
8	Gabion Rockfill	m <sup>3</sup>	30~38
9	Supply and riprap (φ=12-20 cm)	m <sup>3</sup>	18~26
10	Log piling (l=3-5m, φ=5-10 cm )	Unit	3~7

#### 7.4 Preliminary Project Cost

Preliminary project costs of 14 projects nominated for Master Plan are composed of construction costs and administration cost. It is defined that administration cost includes costs of engineering service, survey, design, supervise and administration by government staffs.

Preliminary construction cost are estimated as similar procedure to three (3) Pilot Works executed in 2003. The construction cost items are composed of works such as preparatory works, earthworks, foot protection, log hurdle, slope protection, finishing, material quality control and contingency. The contingency is assumed as 5% of sub-total of other items, including physical volumes for future erosion. Administration cost is assumed as 5% of construction cost.

Each 14 projects is implemented by one contract even the project is implemented over several years to avoid the increment of preparatory work cost due to new equipment installation every year. Preliminary project cost estimated for each project is summarized in Table 7.6.

**Table 7.6 Project Cost for High Priority Stretches nominated for Master Plan**

Phasing by Priority Stretch No.	Urgent Projects				Second Priority Projects									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Site Name	Sithantai	Ban Hom (1)	Ban Hom (2)	Bo O	Sibounheuang-Muang Wa	Sithantai (2)	Ban Hom (3)	Ban Hom (4)	Hatdokkae	Upper Sibounheuang (1)	Upper Sibounheuang (2)	Upper Sibounheuang (3)	Upper Sibounheuang (4)	Upper Sibounheuang (5)
Project Name	Sithantai (1)	Ban Hom (1)	Ban Hom (2)	Bo O	Sibounheuang-Muang Wa	Sithantai (2)	Ban Hom (3)	Ban Hom (4)	Hatdokkae	Upper Sibounheuang (1)	Upper Sibounheuang (2)	Upper Sibounheuang (3)	Upper Sibounheuang (4)	Upper Sibounheuang (5)
Location (KM+ km)	KM-1555 +0.0	KM-1565 +0.38	KM-1565 +0.33	KM-1575 +0.10	KM-1587 +1.80	KM-1553 +0.85	KM-1565 +2.03	KM-1563 +1.15	KM-1571 +0.97	KM-1590 +0.25	KM-1590 +0.02	KM-1589 +1.02	KM-1589 +0.87	KM-1589 +0.56
Stretch Length (meters)	1280	760	50	200	410	2040	760	880	770	810	190	350	40	230
Bank Protection Type														
CSWB-Work (A)		○		○	○		○	○		○	○	○	○	○
CSWB-Work (B)			○											
LH-Work		○		○	○		○	○		○	○	○	○	○
SF-Work		○		○	○		○	○		○	○	○	○	○
SM-Work		○		○	○		○	○		○	○	○	○	○
RG-Work	○					○			○					
Unit: US\$														
Construction Cost (A)	228,410	914,000	61,360	139,070	272,110	363,070	914,000	1,105,690	141,730	528,310	129,570	233,940	34,690	163,410
(1) Preparatory	7,430	4,510	2,080	6,740	5,910	8,040	4,510	3,110	3,520	4,550	3,740	6,360	6,060	8,770
(2) Earthwork	3,800	62,510	4,190	12,850	26,370	6,140	62,510	72,200	2,360	52,070	12,220	22,500	2,580	14,790
(3) Foot Protection	194,400	715,370	42,350	82,600	171,390	315,900	715,370	876,400	121,500	343,050	79,910	145,560	13,990	97,130
(4) Log Hurdle	0	0	0	7,300	14,970	0	0	0	0	29,570	6,940	12,780	1,460	8,400
(5) Slope Protection	0	80,030	5,310	16,200	33,210	0	80,030	92,670	0	65,610	15,390	28,350	3,240	18,630
(6) Finishing	8,900	5,050	1,500	3,750	4,300	12,700	5,050	5,650	4,600	5,300	2,200	4,250	2,700	4,900
(7) Quality Control	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
(8) sub total	217,530	870,470	58,430	132,440	259,150	345,780	870,470	1,053,030	134,980	503,150	123,400	222,800	33,030	155,620
(9) Contingency	10,880	43,530	2,930	6,630	12,960	17,290	43,530	52,660	6,750	25,160	6,170	11,140	1,660	7,790
Administration Cost (B)	11,420	45,700	3,060	6,950	13,600	18,150	45,700	55,280	7,080	26,410	6,470	11,690	1,730	8,170
Total (A)+(B)	239,830	959,700	64,420	146,020	285,710	381,220	959,700	1,160,970	148,810	554,720	136,040	245,630	36,420	171,580
Project Cost (US\$)	240,000	960,000	65,000	147,000	286,000	382,000	960,000	1,161,000	149,000	555,000	137,000	246,000	37,000	172,000

NOTE: CSWB-Work (A) Cobble Stone with Willow Branch Type (A) SF-Work Stone Foundation  
 CSWB-Work (B) Cobble Stone with Willow Branch Type (B) SM-Work Soda Mattress  
 LH Work Log Hurdle RG-Work Riprap Groynes

## 8 ALTERNATIVE STUDY

Alternative study is conducted here to find out sustainable and realistic Master Plan. The optimum plan is determined not only by technical viewpoint but also by financial viewpoint in consideration of the basic principles of the Master Plan discussed in Chapter 1 that GOL will conduct riverbank protection activity after 2005 by using national budget in principle. Therefore, two (2) kinds of alternatives, i.e. 1) Work Type Alternatives and 2) Financial Alternatives are examined here.

### 8.1 Work Type Alternatives

Riverbank protection work type is selected considering the following:

- i) Using local construction material as much as possible.
- ii) Using manpower of Lao P.D.R. as much as possible.
- iii) Construction work can be done by people of Lao P.D.R. as much as possible.
- iv) To pay attention to keep riverine environment

Type of the riverbank protection work, therefore, will be one without using imported materials such as wire-meshed basket, geo-textile and cement, and construction work can be done mainly by manual work. Gabion mattress of wire-meshed basket and concrete block are excluded from the selection of work type.

Some of Japanese traditional methods of river works are satisfied with the above criteria, such as Soda mattress, Cobble stone with willow branch work, wooden pile groyne, etc.

Considering features of each type of riverbank protection work, the easiness of material supply for the protection work and suitability to the selected site of the bank protection work, alternative types of bank protection work for each site are chosen as shown in Table 8.1.

For each site, the alternative types of riverbank protection work are compared with respect to strength, lifetime, weight, flexibility, etc., as shown in Table 8.2. As shown in the table, the most suitable type for each site is as below:

For Sithantai Site: Riprap Groyne Work

For Ban Hom Site: Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work

For Sibounheuang – Muang Wa Site: Cobble Stone with Willow Branch Work, Log-Hurdle Work and Soda Mattress Work.



**Table 8.1 Type Selection of Bank Protection Work**

Item	Sithantai Site	Location	Sibounheuang-Muang Wa Site
Length of riverbank protection work	3,320m	Bon Hom Site 2,450m	410m
Conditions of river bank slope	Upper vertical cliff and lower slopes of relatively new aged silt layer on the layer of gravel and silt mixture. Both layers are vulnerable to erosion	Vertical high cliff of relatively new aged silt layer on the layer of gravel and silt mixture. Both layers are vulnerable to erosion	Vertical cliff of relatively old aged silt layer on the layer of gravel and silt mixture. Lower layer is vulnerable to erosion
Type of erosion	Falling of cliff material accompanied with set-back of lower layer of gravel and silt that is vulnerable to scoring during flood period.	Falling of cliff material accompanied with set-back of lower layer of gravel and silt that is vulnerable to scoring during flood period.	Falling of cliff material as block undermined through lower layer of gravel and silt forming notches at the foot of slope during flood
Conditions of river bank slope	To reduce erosion at lower gravel and silt mixture layer.	To protect not only lower gravel and silt mixture layer, but upper silt layer.	To protect the lower gravel and silt mixture layer
Major bank protection work type	Groyne work / foot protection and slope protection work	Foot protection and slope protection work	Foot protection work and lower part of slope protection
Candidate type of Slope protection works	1) Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work	1) Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work	1) Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work
	2) Wooden Pile Groyne work	2) Cobble Stone with Willow Branch Work, Log-Hurdle Work and SODA Mattress Work	2) Cobble Stone with Willow Branch Work, Log-Hurdle Work and SODA Mattress Work
	3) Rip-rap groyne work	3) Rip-rap groyne work	3) Rip-rap groyne work

Table 8.2 Evaluation of Work Type Alternatives

Site Name	Type of Construction Work	Strength	Life time	Stability	Flexibility	Easiness of Material Collection	Construction Difficulty	Affection to Opposite	Riverine Environment /Landscape	Economical view	Priority
Sithantai Site	1)Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work	○	○	○	◎	○	△	○	◎	△	2
	2) Wooden Pile Groyne work	○	△	△	○	○	△	△	○	○	3
	3) Rip-rap groyne work	○	○	○	○	○	◎	△	○	◎	1
Bon Hom Site	1)Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work	○	○	○	◎	○	△	○	◎	△	1
	2)Cobble Stone with Willow Branch Work, Log-Hurdle Work and SODA Mattress Work	○	○	○	◎	○	△	○	◎	○	3
	3) Rip-rap groyne work	○	○	○	○	○	◎	△	○	○	2
Sibounheuang -Muang Wa Site	1)Cobble Stone with Willow Branch Work, Rip-rap foundation and SODA Mattress Work	○	○	○	◎	○	△	○	◎	△	2
	2)Cobble Stone with Willow Branch Work, Log-Hurdle Work and SODA Mattress Work	○	○	○	◎	○	△	○	◎	○	1
	3) Rip-rap groyne work	○	○	○	○	○	◎	△	○	○	3

## 8.2 Financial Alternatives

### 8.2.1 Results of Financial Alternative Study

Financial affordability is a crucial precondition for successful implementation of the Master Plan. In order to formulate sustainable Master Plan, the Study Team conducted financial alternative study by preparing five financial alternatives. As a result of discussion with MCTPC on the alternatives, “Alternative 3” with total project cost of around US\$4.9 million and total length of new bank protection works of around 7.4 km has been selected as the most appropriate plan from the financial viewpoints.

### 8.2.2 Financial Alternatives

The Study Team prepared five alternative budgeting plans for riverbank protection around Vientiane City by national budget. The budgeting plans consist of the base year budgets (FY2002/04) and annual growth rates. It is assumed that tax revenue of the Government will increase according to the economic development of the country and the budget for riverbank protection will also be increased according to the tax revenue increase.

The budgeting alternatives for riverbank protection around Vientiane City are assumed as shown in Table 8.3.

**Table 8.3 Alternative Budgeting Plans**

	Unit	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1. Base Year Budget (FY2003/04)	M Kip	2,800	2,300	2,300	2,300	1,000
		Calculated budget to complete all the priority projects by 2020.	MCTPC's investment plan for bank protection around Vientiane City in FY2003/04.			Actual average investment by national budget for bank protection around Vientiane City for last 4 years.
2. Budget in the 1st year of the Master Plan (FY2004/05)	M Kip	3,000	2,450	2,445	2,392	1,063
		7% increase from FY2003/04	6.5% increase from FY2003/04 based on NPEP	6.3% increase from FY2003/04	4% increase from FY2003/04	6.3% increase from FY2003/04
3. Growth rate of the budget from FY2004/05 to FY2019/20	%	7	7	6.3	4	6.3
		Economic development target of the country for 2020 stated in National Poverty Eradication Programme (NPEP)		Average annual economic growth for the last 10 years	The lowest annual economic growth for the last 10 years	Average annual economic growth for the last 10 years

### 8.2.3 Annual Investment Schedule

Based on the budgeting alternatives discussed above, the annual investment schedules of the priority projects are prepared according to technical priority and financial affordability. The

basic conditions for preparation of the schedule are as follows:

- a) Fourteen projects are proposed as priority projects from the technical viewpoints as discussed in Chapter 3. Out of the projects, five projects are classified as the Urgent Projects and the remaining nine projects are classified as the Second Priority Projects.
- b) Each project is implemented by one contract even the project is implemented over several years for efficient implementation,
- c) Increase of work volume due to progress of riverbank erosion is assumed to be covered by physical contingency included in the Project Cost,
- d) Price escalation is not considered in neither investment plan nor budgeting plan. Since both the project cost and budget are estimated in US Dollars, the price escalations is not very significant as far as foreign exchange rate is stable,
- e) As maintenance and repair cost, 0.5% per annum of the project cost is assumed after completion of the facilities,
- f) As maintenance and repair cost of the existing riverbank protection facilities, US\$20,000 per annum is assumed, and
- g) The proposed annual budget plans still have some balance even after implementation of the proposed projects so that unexpected urgent projects can be implemented.

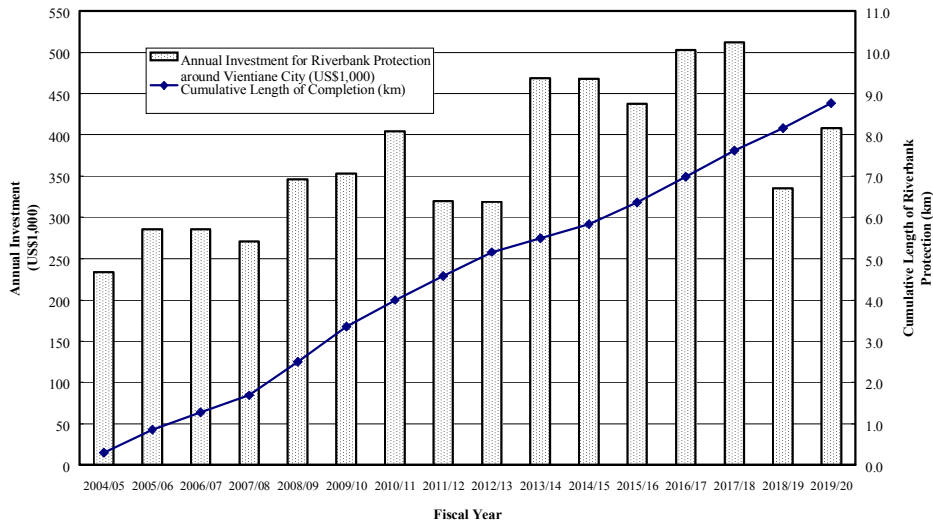
The annual investment and cumulative length of riverbank protection by alternative is illustrated in Figure 8.1 and summarized in Table 8.4

**Table 8.4 Project Cost and Length of Riverbank Protection by Alternative**

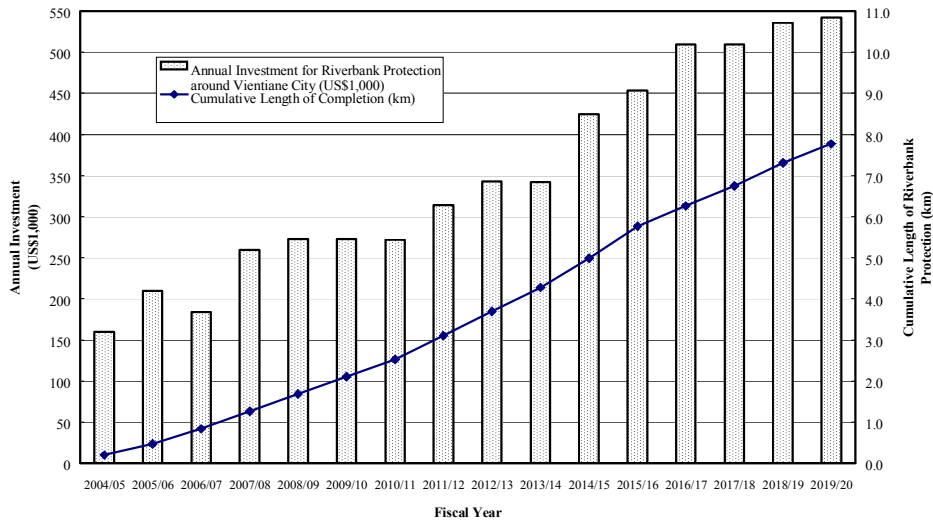
Item\Alternative	Unit	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1. Total Project Cost	US\$1,000	5,497	5,176	4,893	3,634	1,698
2. Length of Riverbank Protection	km	8.77	7.77	7.38	5.95	2.70
(1) Urgent Projects	km	2.70	2.70	2.70	2.70	2.70
(2) Second Priority Projects	km	6.07	5.07	4.68	3.25	0.00

Through the discussion with MCTPC with consideration of the balance of necessary budget and achievable length of riverbank protection, Alternative 3 has been selected as the most appropriate and practical plan from the financial viewpoints. Annual investment schedule of Alternative 3 is presented in Table 8.5.

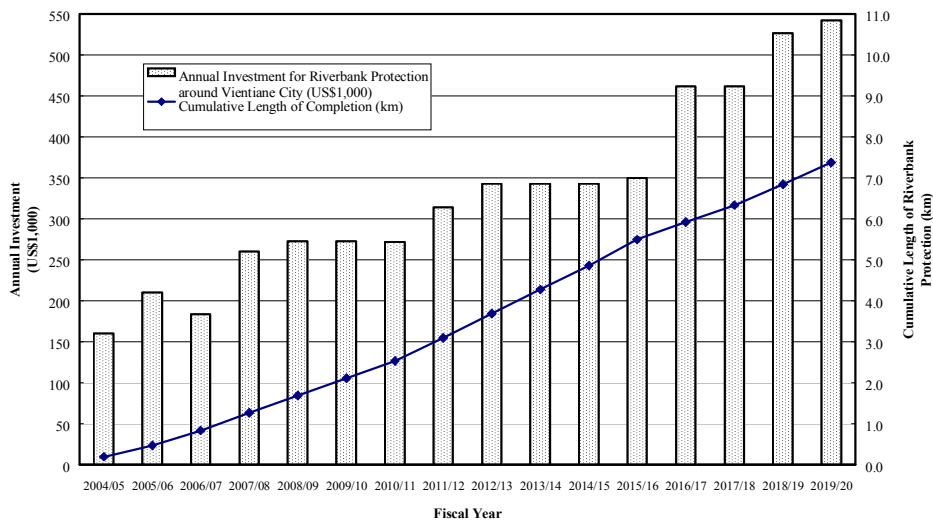
As discussed previously, the budgeting plans have been prepared only depending on national budget. If external assistance is available in the future, it will help the Government to accelerate the implementation of the Master Plan.



Alternative 1: Large Budget with 7% annual growth, all the Projects

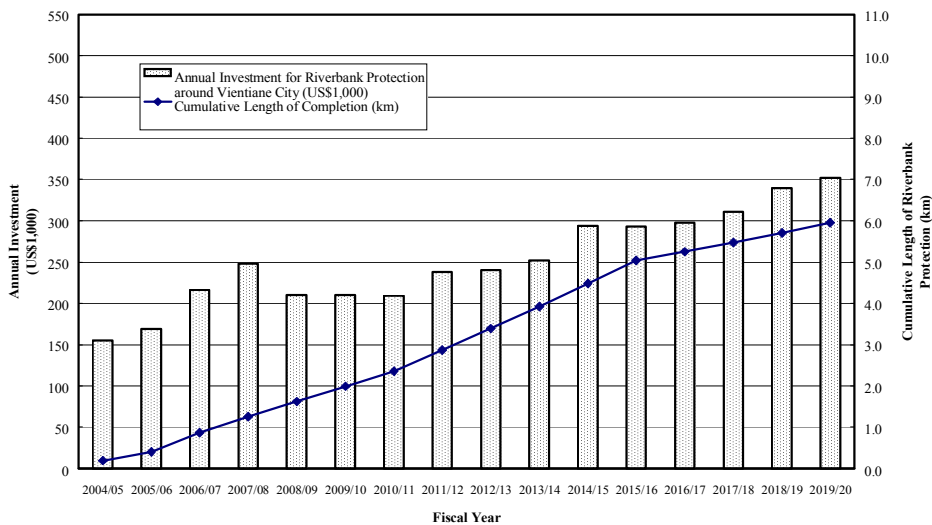


Alternative 2: Moderate Budget with 7% annual growth, projects within budget

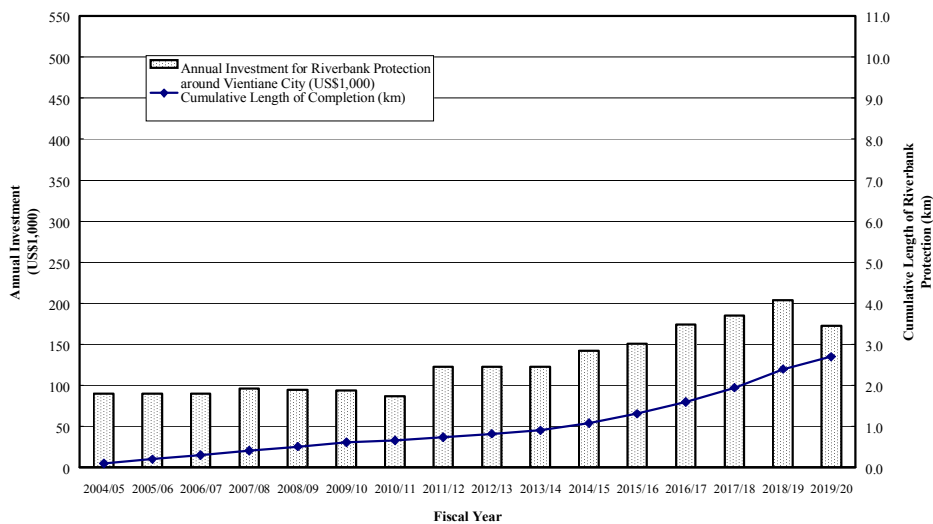


Alternative 3: Moderate Budget with 6.3% annual growth, projects within budget

Figure 8.1 (1/2) Annual Investment and Cumulative Length of Riverbank Protection around Vientiane City by Financial Alternative



Alternative 4: Moderate Budget with 4% annual growth, projects within budget



Alternative 5: Low Budget with 6.3% annual growth, projects within budget

Figure 8.1 (2/2) Annual Investment and Cumulative Length of Riverbank Protection around Vientiane City by Financial Alternative

**Table 8.5 Investment and Budgeting Plan for River Bank Protection around Vientiane City  
(Alternative 3: Moderate Budget with 6.3% growth, projects within budget)**

Project	Total Cost (US\$1,000)	Length (m)	Annual Investment (US\$1,000)																
			2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	
<b>I. Investment Plan</b>																			
<b>1. Urgent Projects</b>																			
(1) Sithantai (1)	240	1,280	-	47	47	49	49	48	-	-	-	-	-	-	-	-	-	-	
(2) Ban Hom (1)	960	760	-	-	139	202	202	202	215	-	-	-	-	-	-	-	-	-	
(3) Ban Hom (2)	65	50	-	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(4) Bo O	147	200	-	44	51	52	-	-	-	-	-	-	-	-	-	-	-	-	
(5) Sibounheuang-Muang Wa	286	410	140	146	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sub-total of 1	1,698	2,700	140	190	163	238	251	250	215	-	-	-	-	-	-	-	-	-	
<b>2. Second Priority Projects</b>																			
(6) Sithantai (2)	382	2,040	-	-	-	-	-	-	75	75	75	75	82	-	-	-	-	-	
(7) Ban Hom (3)	960	760	-	-	-	-	-	-	-	240	240	240	240	-	-	-	-	-	
(8) Ban Hom (4)	1,161	880	-	-	-	-	-	-	-	-	-	-	-	290	290	290	290	291	
(9) Hatdokkae																			
(10) Upper Sibounheuang (1)	555	810	-	-	-	-	-	-	-	-	-	-	-	137	137	137	137	144	
(11) Upper Sibounheuang (2)	137	190	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	
(12) Upper Sibounheuang (3)																			
(13) Upper Sibounheuang (4)																			
(14) Upper Sibounheuang (5)																			
Sub-total of 2	3,195	4,680	-	-	-	-	-	-	75	315	315	315	315	322	427	427	492	507	
Sub-total (1+2)	4,893	7,380	140	190	163	238	251	250	290	315	315	315	315	322	427	427	492	507	
<b>3. Maintenance &amp; repair</b>																			
Total (1+2+3)			160	210	184	260	273	272	314	343	343	343	343	350	462	462	527	542	
<b>II. Budgeting Plan (Million Kip)</b>			2,445	2,599	2,763	2,937	3,122	3,319	3,528	3,750	3,986	4,237	4,504	4,788	5,090	5,411	5,752	6,114	
(Equiv. US\$1,000)			235	249	265	282	300	319	339	360	383	407	432	460	488	519	552	587	
Balance by Fiscal Year (US\$1,000)			75	39	81	22	27	46	67	46	40	64	89	110	26	57	25	45	

**Basic Condition of Estimation:**

- 1) Each project is implemented by one contract even the project is implemented over several years.
- 2) Increase of work volume due to progress of riverbank erosion is assumed to be covered by physical contingency.
- 3) The budget for riverbank protection around Vientiane City in FY2004/05 is estimated by 6.3% increase from 2,300 million Kip, investment plan of MCTPC for riverbank protection in Vientiane City for FY2003/04.
- 4) The budget for riverbank protection around Vientiane City is assumed to increase 6.3% per annum in accordance with the average economic growth rate for the last 10 years.
- 5) Price escalation are not included in neither investment plan nor budgeting plan.
- 6) Applied foreign exchange rate: US\$1 = 10,420 Kip (February 1, 2004).
- 7) As maintenance and repairing cost, 0.5% per annum of the project cost is assumed after completion of the facilities.
- 8) As maintenance and repairing cost of the existing riverbank protection facilities, US\$20,000 per annum is assumed.
- 9) The proposed annual budget plans still have some balance even after implementation of the proposed projects so that unexpected urgent projects can be implemented.

## **9 PROPOSED MASTER PLAN**

The optimum Riverbank Protection Master Plan around Vientiane City is proposed here as the result of the 1) Work Type (technical) and 2) Financial alternative study discussed in Chapter 8. The Master Plan is to be implemented by GOL by themselves using national budget in principle after the year 2005. The financial issues are the key determinant of the scale of the Master Plan rather than technical ones. Consequently, the financial Alternative 3 is selected as the most appropriate, sustainable and practical plan.

General layout of the proposed Master Plan is as shown in Figure 9.1 and the basic features are as shown in Table 9.1.

The principles of protection measures by riverbank type in the Study Area are summarized as shown in Table 9.2.



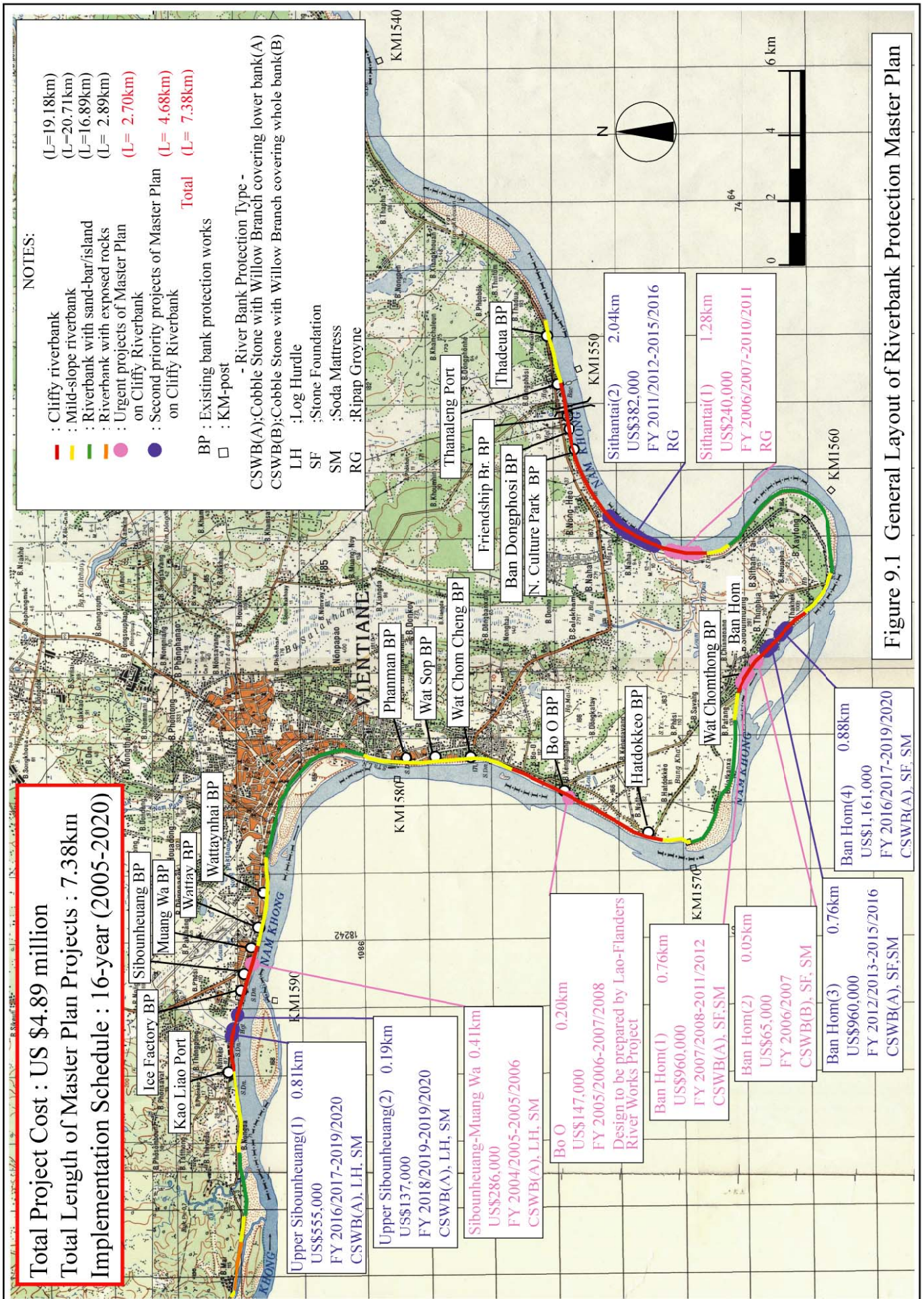


Figure 9.1 General Layout of Riverbank Protection Master Plan

**Table 9.1 Basic Features of Riverbank Protection Master Plan**

Phase	Site Name	Project Name	Location by KM post (km)		Length (meter)	Project Cost (US\$1,000)	Implementation Fiscal Year	Riverbank Protection Type											
			From	To				CSWB(A)	CSWB(B)	LH	SF	SM	RG						
Urgent Projects	Sithantai	Sithantai (1)	1555+0.00	1555+1.28	1,280	240	2006/07-2010/11												
	Ban Hom	Ban Hom (1)	1565+0.38	1565+1.14	760	960	2007/08-2011/12												
		Ban Hom (2)	1565+0.33	1565+0.38	50	65	2006/07												
	Bo O	Bo O	1575+0.01	1575+0.21	200	147	2005/06-2007/08												
	Sibounheuang - Muang Wa	Sibounheuang - Muang Wa	1587+1.80	1589+0.28	410	286	2004/05-2005/06												
	Sub-total				2,700	1,698													
	Sithantai	Sithantai (2)	1553+0.85	1555+0.00	2,040	382	2011/12-2015/16												
Ban Hom	Ban Hom (3)	Ban Hom (3)	1563+2.03	1565+0.33	760	960	2012/13-2015/16												
	Ban Hom (4)	Ban Hom (4)	1563+1.15	1563+2.03	880	1161	2016/17-2019/20												
2nd Priority Projects	Upper Sibounheuang	Upper Sibounheuang (1)	1590+0.25	1591+0.00	810	555	2016/17-2019/20												
		Upper Sibounheuang (2)	1590+0.02	1590+0.21	190	137	2018/19-2019/20												
	Sub-total				4,680	3,195													
	Total				7,380	4,893													

Note: - Project cost is estimated on the price level at the beginning of February 2004.

- Applied foreign currency exchange rate: US\$1=Lao Kip 10,420 (Middle rate on February 1, 2004)

- Project cost does not include price escalation.

- Riverbank Protection Types:

CSWB(A) Cobble Stone with Willow Branch covering lower bank (A) SF Stone Foundation  
 CSWB(B) Cobble Stone with Willow Branch covering whole bank (B) SM Soda Mattress  
 LH Log Hurdle RG Riprap Groynes  
 SF Stone Foundation  
 SM Soda Mattress  
 RG Riprap Groynes

-Bo o site Design to be prepared by On-going Lao-Flanders River Work Projects of MCTPC in future.

Therefore, work type concept of the Master Plan is temporarily applied for the preliminarily cost estimate at the site instead.

**Table 9.2 Basic Principles of Protection Measures of Master Plan**

Type of Riverbank	Classification of Cliffy riverbanks	Length (km)	Principles of Bank Protection Measures
1)Cliffy Riverbanks	Existing riverbank protection works	3.15 (5.3%)	This stretches is to be monitored and rehabilitated if necessary by GOL (O&M).
	Objective stretches for Urgent Projects of the Master Plan	2.70 (4.6%)	*This stretches is to be implemented by GOL from 2004/2005 to 2011/2012.
	Objective stretches for Second Priority Projects of the Master Plan	4.68 (7.9%)	*This stretches is to be implemented by GOL from 2011/2012 to 2019/2020. *This stretches would also be protected by people's involvement as the need arises until the start of the Projects by GOL at each sites.
	Remaining Stretches	8.65 (14.6%)	*This stretches is to be protected by GOL after 2020/2021 *This stretches would be protected by people's involvement as the need arises.
Sub-total	19.18 (32.4%)		
2)Mild-slope riverbanks	20.71 (35.0%)		This stretches with no active erosion in general would be protected by people's involvement as the need arises.
3) Riverbanks with sand bar and island	16.89 (28.5%)		These stretches would not require specific bank protection activities.
4) Riverbanks with exposed rocks	2.46 (4.2%)		
Total	59.24(100%)		

As a selection guideline of the M/P construction method, the combination of construction methods and its reason for application in consideration of mechanism of bank erosion and situation of the property distributed on eroded riverbanks is shown in the following table 9.3

**Table 9.3 Combination of construction methods and its reason for application**

Property and land use situation on cliffy bank	Typical M/P project sites	Mechanism of bank erosion	Construction method combination and the reason for application			Note
			Foot protection work	Foundation work	Slope protection work	
High density of properties (important property, such as factory, national road, temple and public facilities)	-Wat Thong That (Ban Hom) -Bo O temple	Falling of cliff material accompanied with setback of lower layer of gravel and silt that is vulnerable to scoring during flood period	Soda mattress work<SM>  [Reason] -Executable by using only local material and equipment -Mattress are so flexible, that they can change the form and follow the riverbed changes	Riprap work <SF>  [Reason] To protect foot of slope firmly united with foot protection work	Cobblestone with willow branch work <CSWB(B)> (covering whole bank to secure high safety level taking the importance of property into consideration) [Reason] -Executable by using only local material and equipment -Adaptable to gentle slope river as the M/P area -Environmental friendly by using natural material	-Applied for the Pilot Works for oil stockyard at Ban Dongphosi -Design at Bo O temple was already prepared using conventional gabion with the assistance of the Government of Belgium
Middle density of properties (Although private houses in urban area is distributed, there are relatively little important properties)	-Bo O -Sibounheuang ~Muang Wa -Upper Sibounheuang	Falling of cliff material as block undermined through lower layer of gravel and silt forming notches at the foot of slope during flood period	-Environmental friendly by using natural material	Log hurdle work<LH>  [Reason] lower cost by using less riprap than stone foundation	Cobblestone with willow branch work <CSWB(A)> (covering lower half of the cliffy bank to lower construction cost in consideration of the balance between safety level and density of property)	Applied for the Pilot Works at Sibounheuang
Low density of properties (peripheral part of important facilities, or farmland with low dense distribution of houses)	Ban Hom	Falling of cliff material accompanied with setback of lower layer of gravel and silt that is vulnerable to scoring during flood period	Soda mattress work<SM> (installed in every others for cost reduction taking the balance of safety level and the property density into consideration)  [Reason] as above	Stone foundation work<SF>  [Reason] difficulty of construction because of the relation between bank topography and river water level	[Reason] -as above -capable of stabilizing upper cliffy bank by prevention of scouring based on covering lower bank	-Applied for the Pilot Works at peripheral part of Ban Dongphosi site -Applied as alternative of riprap groyne to avoid the influence of groyne to opposite bank due to narrow river width
	Sithantai		Riprap groyne work<RG>			This method was not tested in the Pilot Works.



## 10 PROJECT EVALUATION

### 10.1 Economic Evaluation

#### 10.1.1 Economic Effect of the Projects

Riverbank protection along the Mekong River around Vientiane City is an indispensable public investment to conserve national land, to maintain the border, and to protect Buddhist temple which is an integral part of people's life, trunk roads, houses and housing lands, farmlands, etc. The Government of Lao PDR has implemented the riverbank protection mainly by gabion works. The gabion works, however, are costly because of their structural characteristics and imported iron materials. The riverbank protection method introduced in this Master Plan uses the most materials, which are procured domestically, is moderate in price, and has advantage of environmentally friendly. Implementation of the Master Plan is expected to bring about but not limited to the following effects, they are nevertheless virtually impossible to value satisfactory in monetary terms, though.

- 1) To reduce construction cost comparing with those by gabion works,
- 2) To conserve national land and to maintain the border,
- 3) To protect Buddhist temples which is an integral part of people's life,
- 4) To protect houses, factories, shops and their lands,
- 5) To protect trunk roads from erosion and to prevent traffic interruption,
- 6) To prevent flood disaster caused by overflow due to collapse of bank road,
- 7) To protect farmlands (paddy and upland crops), and
- 8) To protect transmitting facilities of electricity and communication

Other effects:

- To reduce material imports and to save foreign exchange holdings,
- To protect riparian trees and forests,
- To improve safer playing environment for children,
- To create rest and relaxing environment for people by better access to waterfront areas,
- To improve convenience of local people by easier access to riverside areas and it may reduce load of washing by women and children,
- To reduce the cost of emergency measures taken by central and/or local government,
- To invigorate economic activities in riverside areas (small restaurants and kiosks),
- To ease mental stress of riverine people due to fears of bank erosion disaster, and
- To create new job opportunity during construction.

#### 10.1.2 Preliminary Economic Evaluation

As discussed above, the riverbank protection along the Mekong River is given the status of an indispensable public investment to conserve national land and to maintain the border. For economic evaluation of this type of project, least cost method is normally applied. Therefore, the project costs are compared between conventional gabion method and the traditional river works of Japan including Soda method proposed in this Master Plan. Table 10.1 shows average construction costs of conventional gabion works implemented around

Vientiane City and the works proposed in the Master Plan. Average construction costs of the Pilot Works are also shown in the table for reference.

**Table 10.1 Average Construction Cost by Type of Construction Works**

Construction Method		Average Construction Cost (US\$/meter)
1.	Conventional Gabion Works implemented around Vientiane City	2,000
2.	Work Types proposed in the Master Plan	
(1)	Riprap groyne work (L=50m, interval=150m)	190
(2)	1) Cobble stone with willow branch work covering whole bank, 2) stone foundation and 3) soda mattress	1,300
(3)	1) Cobble stone with willow branch work covering lower bank, 2) stone foundation and 3) soda mattress (in every other)	1,290
(4)	1) Cobble stone with willow branch work covering lower bank, 2) log hurdle work and 3) soda mattress	700
3.	JICA Pilot Works (Reference)	
(1)	Ban Dongphosi Site <1) Cobble stone with willow branch work covering whole bank, 2) stone foundation and 3) soda mattress>	1,690
(2)	Wat Chom Cheng Site <Wooden pile groyne work>	200
(3)	Sibounheuang Site <1) Cobble stone with willow branch work covering lower bank, 2) log hurdle work and 3) soda mattress>	810

According to the past actual construction works, average construction cost of the conventional gabion method is approximately US\$2,000 per meter and the total project cost is estimated at US\$14.8 million. Meanwhile, the total construction cost of the Master Plan is estimated at US\$4.9 million, which is US\$9.9 million or 66% cheaper than that by the conventional gabion works as summarized in Table 10.2.

**Table 10.2 Comparison of Construction Cost by Type of Construction Works**

Construction Method	Average Unit Constr. Cost (US\$/meter)	Length (m)	Construction Cost (US\$1,000)
1. Conventional Gabion Method	2,000	7,380	14,760
2. Work Types proposed in the Master Plan	663	7,380	4,893
(1) Riprap groyne work with a length of 50m and an interval of 150m	187	3,320	622
(2) Cobble stone with willow branch covering whole bank with stone foundation and soda mattress	1,300	50	65
(3) Cobble stone with willow branch covering lower bank with stone foundation and soda mattress in every other	1,284	2,400	3,081
(4) Cobble stone with willow branch covering half bank with log hurdle and soda mattress	699	1,610	1,125
3. Difference (1.- 2.)			9,867

As discuss in "(1) Economic Effects of the Projects", the Master Plan Projects bring about various positive economic effects, which are not always successfully valued in money term. From the above-mentioned consideration, the Master Plan is justifiable from the economical viewpoints.

### 10.1.3 Creation of New Job Opportunity

Other than the cost reduction effects discussed above, the construction works will create new job opportunities for skilled and unskilled labors during construction period, as shown in Table 10.3. The job opportunities are expected to directly benefit local population as cash income.

**Table 10.3 Creation of New Job Opportunity**

	Quantity (man-day)	Unit Price (Kip)	Cash Income	
			(Million Kip)	(Equiv. US\$)
1. Urgent Projects				
(1) Skilled labor	2,200	50,000	110	10,557
(2) Unskilled labor	8,800	20,000	176	16,891
Sub-total of 1.	11,000		286	27,447
2. 2nd Priority Projects				
(1) Skilled labor	4,000	50,000	200	19,194
(2) Unskilled labor	16,000	20,000	320	30,710
Sub-total of 2.	20,000		520	49,904
Total (1.+ 2.)	31,000		806	77,351

## 10.2 Initial Environmental Examination

Initial Environmental Examination (IEE) is conducted based on the preparatory environmental assessment conducted in January - February 2003 and the investigation of the four (4) sites involving the Objective Stretches for the proposed Master Plan.

### 10.2.1 Environmental Impact

#### (1) General impact on local people

Construction works for the riverbank protection including Soda mattress will mostly conducted only on the slops of the riverbank or within the river. Because the some riverbank slopes including areas inundated in rainy season are utilized and possessed by the local people, the some riverbank protection plans will require land acquisitions including clopping areas. However, the riverbank protection works will not require resettlement of the local people in all areas.

Small boats are used for movement, transportation and fishery by the local people in the most areas. Many access paths to landing places, wharves and fishponds are constructed by the local people on the most riverbank including steep bank. Unsuitable riverbank protection designs will disturb the access to Mekong River of the local people. Soda mattress may

disturb landing of these boat. However, these disturbances will be avoidable or mitigable by the discussions with the affected people, explains about structures and proper bank protection designs.

## **(2) General impact on forest resources**

Soda mattresses require plenty of wooden branches. The branches used for the Soda mattresses of the pilot works conducted in February – March 2003 was provided from degraded forests allocated to personals and villages in Vientiane suburbs. According to the monitoring of these forests, because the collection of these branches did not require major tree-felling, cutting big trees and a large quantity to the total forest biomass, the impact on the forest resources was negligible. Judging from this result, the forest damages caused by the branch collection will be limited and recoverable. However, the excessive collections from the restricted forests may have an ecological affect on the forests. The forest damages will be avoidable by the collection works conducted widely and shallowly.

Some protected areas and district forest reserves are located in Vientiane Prefecture. Because tree-felling in these protected forests is prohibited by the Forestry Law, the branch collection from the protected forests including the buffer zone should be avoided.

## **(3) General impact of construction works**

Convey of construction materials, especially rocks from the quarry site, heavy equipment operation and earthworks will generate harmful dust. Earthworks and placing rocks will generate turbid water and may cause a temporary increase of soil erosion. Heavy equipment operation will generate noise and vibration. Moreover, construction waste such as fragments of wood, surplus soil, left ropes, trash and garbage from construction workers will generate during construction works. These problems caused by construction works are unavoidable to some degree. These impacts will be mitigable the proper construction plans, advance explains to the local people about the construction plan and discussions with the affected people.

Because of the construction works, the economic activity by the local people or entities near the riverbank and the access to Mekong River of the local people may be disturbed. However, these disturbances are temporary and limited, and will be avoidable through the discussions between the contractors and the affected people.

According to the interviews to the local people during the pilot works in the sites, the respondents fully agreed on the pilot works and had no complaints to the construction works.

## **(4) Initial environmental examination (IEE)**

This section describes the environmental impacts of the four (4) sites with cliffy riverbanks involving the Objective Stretches of the Master Plan proposed in Chapter 10. The environmental check items are based on “JICA Environmental Guideline on Rivers and Sediment Control”. Only check items concerned with the projects in the Master Plan are selected. The results of the initial environmental examination (IEE) on the bank protection projects in four (4) sites are summarized in Table 10.4.



**Table 10.4 (1/4) Result of IEE (Ban Dongphosi - Ban Sithantai Site)**

Project Components Riverbank Length : 7.51 km (Ban Dongphosi - Sithantai) Land Use / Riverbank Type of Site : Industrial Area, Farmland / Cliff Major Facilities of Site : Lao State Fuel Company, National Culture Park, Intake facility for irrigation, Rural road				
Check Item	During Construction		Operation	
	Assessment of Impact	Mitigating Measures	Assessment of Impact	Mitigating Measures
Social Environment				
Resettlement	D		D	
Economic Activity	C	Construction might impose inconvenience to the activity	D	Proper construction plan, measures against complaint
Traffic and public facilities	B	Construction might impose inconvenience to traffic	D	Proper construction plan, measures against complaint
Split of communities	D		D	
Cultural property	B	Construction might cause accidental damage	D	Proper construction plan, measures against complaint
Water rights, Right of common	D		D	
Public health condition	D		D	
Waste	B	Littered construction waste	D	Proper disposal plan
Hazard	B	Risk of fire at Soda stockyard	D	Fire management
Natural Environment				
Topography and geology	D		D	
Soil erosion	B	Erosion caused by excessive cutting of Soda material	C	Erosion by damage of bank protection works
Groundwater	D		D	
Hydrological situation	D		D	
Coastal zone	D		D	
Flora and fauna	B	Impact caused by excessive cutting of Soda material	D	Proper tree-felling management
Landscape	D		C	Change by vegetation growth on bank protection works
Public Nuisance				
Air pollution	B	Dust by heavy equipment	D	Water spray during operation
Water pollution	D		D	
Soil contamination	D		D	
Noise and vibration	C	Heavy equipment operation affects residents near site	D	Proper construction plan, measures against complaint
Ground subsidence	D		D	
General Assessment: Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion and landscape will be needed during operation.				
Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact				

**Table 10.4 (2/4) Result of IEE (Ban Hom Site)**

Project Components		: Riverbank protection works			
Riverbank Length		: 2.61 km			
Land Use / Riverbank Type of Site		: Residential Area, Farmland / Cliff			
Major Facilities of Site		: Rural road			

Check Item	During Construction		Operation	
	Assessment of Impact	Mitigation Measures	Assessment of Impact	Mitigation Measures
Social Environment				
Resettlement	D		D	
Economic Activity	C	Construction might impose inconvenience to the activity	D	Proper construction plan, measures against complaint
Traffic and public facilities	B	Construction might impose inconvenience to traffic	D	Proper construction plan, measures against complaint
Split of communities	D		D	
Cultural property	C	Construction might cause accidental damage	D	Proper construction plan, measures against complaint
Water rights, Right of common	D		D	
Public health condition	D		D	
Waste	B	Littered construction waste	D	Proper disposal plan
Hazard	C	Risk of fire at Soda stockyard	D	Fire management
Natural Environment				
Topography and geology	D		D	
Soil erosion	B	Erosion caused by excessive cutting of Soda material	C	Erosion by damage of bank protection works
Groundwater	D		D	
Hydrological situation	D		D	
Coastal zone	D		D	
Flora and fauna	B	Impact caused by excessive cutting of Soda material	D	Proper tree-felling management
Landscape	D		D	
Public Nuisance				
Air pollution	B	Dust by heavy equipment	D	Water spray during operation
Water pollution	D		D	
Soil contamination	D		D	
Noise and vibration	B	Heavy equipment operation affects residents near site	D	Proper construction plan, measures against complaint
Ground subsidence	D		D	
General Assessment: Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion will be needed during operation.				

Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact

**Table 10.4 (3/4) Result of IEE (Ban Hatdokkeo - u/s Bo O Site)**

Project Components Riverbank Length : 5.12 km (Hatdokkeo - Bo O) Land Use / Riverbank Type of Site : Residential Area, Farmland / Cliff Major Facilities of Site : Bo O Temple, Rural road, Fish farm				
Check Item	During Construction		Assessment	Operation
	Assessment	Mitigation Measures		
Social Environment				
Resettlement	D		D	
Economic Activity	C	Construction might affect residential area and fish farm	D	
Traffic and public facilities	B	Construction might obstruct access to river	Proper construction plan, Measures against complaint	
Split of communities	D		D	
Cultural property	C	Construction might cause accidental damage	Proper construction plan and management	
Water rights, Right of common	D		D	
Public health condition	D		D	
Waste	B	Littered construction waste	Proper disposal plan	
Hazard	D		C	Steep slope in residential area
Natural Environment				Proper periodical monitoring
Topography and geology	D		D	
Soil erosion	B	Erosion caused by excessive cutting of Soda material	Proper design and construction plan	Erosion by damage of bank protection works
Groundwater	D		D	
Hydrological situation	D		D	
Coastal zone	D		D	
Flora and fauna	B	Impact caused by excessive cutting of Soda material	Proper tree-felling management	
Landscape	D		D	
Public Nuisance				
Air pollution	B	Dust by heavy equipment	Water spray during operation	D
Water pollution	D			D
Soil contamination	D			D
Noise and vibration	B	Heavy equipment operation affects residents near site	Proper construction plan, measures against complaint	D
Ground subsidence	D		D	
General Assessment: Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion and safety will be needed during operation.				
Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact				

**Table 10.4 (4/4) Result of IEE (Muang Wa - Kaoliao Port Site)**

Project Components : Riverbank protection works  
 Riverbank Length : 3.94 km (Muang Wa - Kaoliao Port)  
 Land Use / Riverbank Type of Site : Residential Area, Industrial area, Farmland / Cliff  
 Major Facilities of Site : Temples, Kaoliao Port, Factories, Intake facility for water supply (Kaoliao Plant), Rural road

Check Item	During Construction		Operation	
	Assessment	Mitigation Measures	Assessment	Mitigation Measures
Social Environment				
Resettlement	D		D	
Economic Activity	C	Proper construction plan, measures against complaint	D	
Traffic and public facilities	B	Proper construction plan, measures against complaint	D	
Split of communities	D		D	
Cultural property	C	Proper construction plan and management	D	
Water rights, Right of common	D		D	
Public health condition	D		D	
Waste	B	Littered construction waste	D	
Hazard	D		C	Steep slope in residential area
Natural Environment				
Topography and geology	D		D	
Soil erosion	B	Erosion caused by excessive cutting of Soda material	C	Erosion by damage of bank protection works
Groundwater	D		D	
Hydrological situation	D		D	
Coastal zone	D		D	
Flora and fauna	B	Impact caused by excessive cutting of Soda material	D	
Landscape	D		D	
Public Nuisance				
Air pollution	B	Dust by heavy equipment	D	
Water pollution	D		D	
Soil contamination	D		D	
Noise and vibration	B	Heavy equipment operation affects residents near site	D	
Ground subsidence	D		D	
General Assessment: Major environmental impacts will occur at only construction stage. However, the monitoring program of the riverbank from a viewpoint of erosion and safety will be needed during operation.				

Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact

## **10.2.2 Conclusion and Recommendation**

The four (4) sites involving the Objective Stretches for the proposed Master Plan are farmland, residential area or industry area. The construction works will be foot protection works of riverbank and slope pavement works, and executed in limited steep riverbank slope areas. Therefore, the considerations for natural environment and resettlement of the local people will not be required. The environmental impacts such as disturbance of daily activity, construction waste, air pollution, noise and vibration will occur at the construction stage. However, these impacts will not become a serious problem by adopting the proper construction plan. The operation stage will not also have serious impacts. Consequently, the projects in four (4) different sites have no serious impacts potentially.

According to the interviews to the local people in the JICA's Pilot Work sites, the residents had not been got so much information of the works before the beginning of the construction. The riverbank protection works are a very important matter of concern to the local people, especially the residents living along riverbanks with critical situation and without protection works. In case of the riverbank protection conducted by DCTPC, the contents of the protection works are generally informed to the local people through the village chief in advance and the serious troubles related to the informing have not occurred. Therefore, the riverbank protection plan should be thoroughly disclosed to the local people as soon as possible.

The MCTPC/DCTPC engineers do not have so much experience about forest management. Therefore, to manage the tree-felling activities from a viewpoint of forest ecology, it is advisable to ask an expert of forest management's advice at the stage of Soda material collection as the occasion demands.

Based on the findings and results from the questionnaire survey, other recommendations for "Study on Mekong Riverbank Protection around Vientiane Municipality" are as follows:

The design and construction of riverbank protection should be harmonized with the social and natural conditions of each area.

The participation of local organizations and villagers in management of the riverbank protection should be included in the future plans.

Issuing and promulgating village regulations for the use, management and protection of the riverbank should be considered.

The conditions of riverbank protection should be annually monitored and evaluated in order to conduct maintenance.

## **10.3 Overall Evaluation**

The proposed Master Plan is evaluated feasible, sustainable and appropriate from the technical, financial, economical and environmental viewpoint through the alternative study discussed in Chapter 9 and the project evaluation discussed in this section.

The riverbank protection projects to be implemented by GOL for 16-year (2005-2020) using national budget in principle according to the Master Plan are with total cost of around US\$4.9

million and total length of new bank protection works of around 7.4 km.

The Master Plan activities not only by GOL projects mentioned above but also local resident's participation for simple vegetation bank protection would greatly contribute to the prosperity of social and economic activities and the people's welfare in Vientiane Capital City as the center of the political and socio-economic activities in Lao P.D.R. by protecting riverbanks certainly as well as creating rich riparian greenbelt.

## **11 IMPLEMENTATION SCHEDULE**

Implementation schedule of the Master Plan is prepared based on the following consideration:

- Priority of the projects is based on both technical viewpoints discussed in Chapter 3 and intention of MCTPC,
- Projects are implemented dividing into several years so as to fit within proposed annual budgets,
- Projects with groyne works are schedule to be implemented in 5 years so that adjustment of lengths and interval can be made based on the monitoring results of the effects of the partial works,
- The implementation schedule is only a target. If urgent necessity occurs, which should be prioritized, and
- It is advisable to review the implementation schedule in accordance with the national socio-economic development plans (5-years, 10-years, and 20-years) considering the changes of the priority and financial condition of the Government and socioeconomic situation of the country.

The proposed implementation schedule is presented in Figure 11.1.

Project	Length (m)	Implementation (meters)																
		2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	
<b>I. Implementation</b>																		
<b>1. Urgent Projects</b>																		
(1) Sithantai (1)	1,280		250	250	260	260	260											
(2) Ban Hom (1)	760			110	160	160	160	170										
(3) Ban Hom (2)	50			50														
(4) Bo O	200		60	70	70													
(5) Sibounheuang-Muang Wa	410	200	210															
Sub-total of 1	2,700	200	270	370	430	420	420	170	-	-	-	-	-	-	-	-	-	
<b>2. Second Priority Projects</b>																		
(6) Sithantai (2)	2,040							400	400	400	400	440						
(7) Ban Hom (3)	760							190	190	190	190							
(8) Ban Hom (4)	880												220	220	220	220	220	
(9) Hatdokkeo																		
(10) Upper Sibounheuang (1)	810												200	200	200	210	210	
(11) Upper Sibounheuang (2)	190															90	100	
(12) Upper Sibounheuang (3)																		
(13) Upper Sibounheuang (4)																		
(14) Upper Sibounheuang (5)																		
Sub-total of 2	4,680	-	-	-	-	-	-	400	590	590	590	630	420	420	510	530	530	
Total (1+2)	7,380	200	270	370	430	420	420	570	590	590	590	630	420	420	510	530	530	
<b>II. Maintenance works</b>																		

Figure 11.1 Implementation Schedule of Master Plan



**SECTOR I**  
**ENVIRONMENTAL CONSIDERATION**

**THE STUDY ON MEKONG RIVERBANK PROTECTION  
AROUND VIENTIANE MUNICIPALITY  
IN THE LAO PEOPLE’S DEMOCRATIC REPUBLIC**

**FINAL REPORT  
VOLUME 4  
-SUPPORTING REPORT-**

**SECTOR I**

**ENVIRONMENTAL CONSIDERATION**

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## **SECTOR I**

### **ENVIRONMENTAL CONSIDERATION**

#### **1 PRE-EIA FOR PILOT WORKS**

##### **1.1 Brief Description**

This Preliminary Environmental Impact Assessment (Pre-EIA) for the Pilot Works is concerned with the pilot riverbank protection works executed in the Study.

According to “Environmental Protection Law of Lao P.D.R.”, major development project is required to prepare the Environmental Impact Assessment (EIA) Report for the environmental compliance certificate. Because the Pilot Works are not major projects mentioned in the Law, the EIA report is not necessary to be prepared officially. The objectives of this Pre-EIA are as follows:

1. To provide the baseline information of the existing environmental conditions in the Study Area
2. To indicate the potential environmental impacts and issues associated with the Pilot Works
3. To point out the key environmental mitigation associated with the Pilot Works
4. To use as a basic information source to draw the Initial Environmental Examination (IEE) for the riverbank protection Master Plan

The basic information mentioned in this section on the existing environmental conditions of the Study area was obtained the existing relevant reports and documents. Several field surveys were conducted to identify the present environmental situation of the Study area. Moreover, the questionnaire survey to grasp the attitude of the local people on the Mekong riverbank protection was conducted in January - February 2002.

##### **1.2 Pilot Works Site**

The Pilot Work Sites are as follows:

###### **1. Ban Dongphosi**

Ban Dongphosi site is located in industrial area between Friendship Bridge and Culture Park. There are a major fuel factory, military camp and several houses on the riverbank. A high-tension power line supplying to Thailand passes above the site. A main road along the site passes at a distance of about 200m from the shore. There are PEPSI Factory and CALTEX Fuel Warehouse near the construction site. The riverbank forms cliff and has been eroded severely. The fuel factory has faced the serious erosion problem. The residences are at a distance of over 50m from the cliff.

###### **2. Wat Chom Cheng**

Wat Chom Cheng site is located in residential area. There is Wat Chom Cheng Temple close to the riverbank in the construction site. The riverbank forms gentle slope and has no serious erosion. There are some residences nearby the shore. A rural road along the riverbank passes through the residential area. The some lands along the riverbank

including the inundated bank slopes are used as vegetable garden by the local people. Landing places and wharves for the residents are set the riverbank all year round.

### 3. Sibounheuang

Sibounheuang site is located in residential area. There is Sibounheuang Temple close to the riverbank in the upper edge of the construction site. The riverbank forms cliff and has been eroded. There are some residences nearby the shore. A rural road along the riverbank passes through the residential area. Access paths to the Mekong River, landing places and wharves for the residents are set to the steep riverbank.

## 1.3 Questionnaire Survey at Pilot Work Sites

### 1.3.1 Methodology

The field survey was carried out on the three pilot work sites nearby the Mekong Riverbank that belong to three different districts within Vientiane City in January – February 2002.

The sites are:

Sibounheuang Village, Sikhottabong District.

Chomcheng Village, Sisattanak District.

Thanaleng that cover of two villages: Nong Heo and Dongphosi, Hatxaifong District (Area between PEPSI Factory and Thanaleng CALTEX Fuel Warehouse)

The relevant data (primary data required for the study) were gathered through the questionnaire survey of residents. Most head of the families/households who live along Mekong Riverbank within 50m from the shore were all interviewed. To understand the attitude of local villagers regarding the utilization that is directly related to their daily life, the resettlement and compensation for the land and houses as well as current status of fishery along the Mekong River, on-site interviews (face-to-face) were conducted within the three sites together with our survey team.

Before conducting the process, a list of families/households especially for those people who settled very close to the bank, or the owner of the land located along the within 50 meters from the shore was collected from Chiefs of the villages. Some relevant secondary data such as total number of population, houses, households, the ownership and area of land were also collected. When the head of the families/households were absent, the person present at the house provided the relevant information. Each respondent was interviewed separately in order to keep his/her responses free from others' influence.

### 1.3.2 Main Outputs

#### The purposes of the land use by local people along Mekong Riverbank:

The results in Table 7.1 showed that there are differences in current use of the land. Most of the local people in Sibounheuang and Chom Cheng villages use the land for housing and small-scale constructions. These areas are used for housing and are integral part of Vientiane City. They use the same land for domestic animal such as pigs, chickens and

ducks. The home sites have a few fruit trees i.e. mango, coconut, longan and other species. Most of the local people in Nong Heo village (Ban Dongphosi site, from Leather factory to National Culture Park) use the land for crops. At Dongphosi village (from National Culture Park to Thanaleng Fuel Store), most of the land from the riverbank to main road (approximately 100m) is used for housing and construction purposes including National Culture Park. National Culture Park has some indigenous tree species and has already set bank protection.

**Table 1.1 The Current Use of Land by Local People in the Three Pilot Work Sites**

Statement	Survey Sites (Villages)			Total	
	Sibounheuang (%)	Chom Cheng (%)	Thanaleng (Nongheo & Dongphosi) (%)		
Total Population	1,233	813	2,406	4,452	
Total Number of House/Household	195/202	134/146	444/435	773/783	
Total No. of Respondent	34	15	19	68	
Current Use of Land	Building Houses	34 (100)	15 (100)	9 (47)	58 (85)
	Cropping/vegetable	0 (0)	0 (0)	8 (42)	8 (12)
	Planting fruit trees	18 (53)*	8 (53)*	1 (5)*	27 (40)*
	Livestock	12 (35)*	5 (33)*	0 (0)*	17 (25)*
	Restaurant/small shop	3 (9)	1 (7)	0 (0)	4 (6)
	Factory/industry	6 (18)	0 (0)	3 (16)	9 (13)
	Rubbish disposal	0 (0)	0 (0)	1 (5)	1 (1.5)

Note: The number of respondent or household for those who have land/houses along the within approximately 50m from the riverbank.

The label “ \* “ indicates fruit trees and livestock in the same area.

Attitude of people regarding the benefits from using land along the Mekong Riverbank:

Respondents were asked how they used the land along the Mekong Riverbank. The results in Table 1.2 indicated that most of the local people in three sites benefit by using the land for housing, in particular the local people in Chom Cheng, Sibounheuang and Dongphosi villages. Some of them in Sibounheuang and Dongphosi village made a living from the use of land for business such as small factories, fuel station/store and other trades.

More than half of respondents in Nong Heo village get their income from the use of land for crops such as various kinds of vegetable and rice in dry season. This area is known as agricultural area. Average income from cropping/growing vegetable of the villagers on the riverbank in Nong Heo village is about 25,000,000 - 30,000,000 kip per season (at least two seasons per year) per household.

**Table 1.2 Attitude on the Benefits from Using Land by Local People**

No	Statement (Benefits)	Villages			Total (3 sites) (N=68)
		Sibounheuang (%) (n=34)	Chom Cheng (%) (n=15)	Thanaleng (Nongheo & Dongphosi) (%) (n=19)	
1	No benefit	0 (0)	0 (0)	0 (0)	0 (0)
2	Income generation from crops and growing vegetable	0 (0)	0 (0)	7 (37)	7 (10)
3	Income generation from selling goods/restaurant	03 (9)	0 (0)	0 (0)	3 (4)
4	Income generation from other business	06 (18)	0 (0)	3 (16)	9 (13)
5	Housing or Accommodation	34 (100)	15 (100)	9 (47)	85)

Attitude of local people on use and management of the Mekong Riverbank:

In terms of the local people's attitudes to the uses, the management and the development of Mekong Riverbank as riverbank protection, the results from individual interviewing as shown in Table 1.3 indicated that 100% of respondents in three sites fully agreed to the development plan and wanted concrete constructions.

One third of respondents in Chom Cheng village also wanted natural grasses and/or planting vegetation that could assist to consolidate soil and to prevent bank erosion. This may be due to little erosion of the bank in Chom Cheng village. Compared with the other sites of Sibounheuang and Thanaleng, the erosion of Chom Cheng is not serious.

**Table 1.3 Attitude on the Use, Management and Future Development of the Riverbank**

No	Statement	Villages			Total Three sites (%) (N=68)
		Sibounheuang (%) (n=34)	Chom Cheng (%) (n=15)	Thanaleng (%) (n=19)	
1	Leave it as it is	0 (0)	0 (0)	0 (0)	0 (0)
2	Rehabilitation of natural vegetation along the bank to protect bank shore erosion	0 (0)	5 (33)	0 (0)	5 (7)
3	Growing natural grass/vegetation to protect bank erosion	0 (0)	0 (0)	0 (0)	0 (0)
4	Planting trees/fruit trees to protect bank shore erosion	0 (0)	0 (0)	0 (0)	0 (0)
5	Clearance land crops and vegetable	0 (0)	0 (0)	0 (0)	0 (0)
6	Concrete construction to prevent banks erosion	34 (100)	15 (100)	19 (100)	68 (100)
7	Allow local to use and manage	0 (0)	0 (0)	0 (0)	0 (0)
8	Concession for using or selling bank earth/soil	0 (0)	0 (0)	0 (0)	0 (0)

Attitudes and Opinions on Resettlement and Compensation of the land and houses:

Respondent were specifically asked on their attitudes and opinions related to the resettlement and compensation for their land and houses for the construction of the Mekong Riverbank protection.

The results of the survey showed that most of the respondents preferred to get the compensation for their land, houses and resettlement on a suitable or acceptable compensation. Some of them need to be compensated for their land and houses, and referred to the current market prices. Only few of them agreed to be compensated with the valuation determined by government authorities.



**Table 1.4 Attitudes and Opinions on Resettlement and Compensation of Lands/Houses**

No	Statement	Villages			Total (%) (N=68)
		Sibounheuang (%) (n=34)	Chom Cheng (%) (n=15)	Thanaleng (%) (n=19)	
1	Resettlement of inhabitants to new site	34 (100)	15 (100)	18 (95)	67 (98)
2	Compensation of land and houses must be based on market prices	5 (15)	4 (27)	3 (16)	12 (18)
3	Compensation of land and houses must be based on Gov. prices	6 (18)	0 (0)	0 (0)	6 (9)
4	Compensation of land and houses acceptable at suitable prices	23 (68)	11 (73)	16 (84)	50 (74)
5	No resettlement but cash compensation with market prices	0 (0)	0 (0)	0 (0)	0 (0)
6	Not resettlement or compensate at all	0 (0)	0 (0)	0 (0)	0 (0)

Acquisition of land and houses along the Mekong Riverbank:

In terms of land acquisition, the results from field survey and on-site interviewing showed that all three sites have a total of households is 68. 30 households have received land by inheritance, while 14 households bought from others and 17 households are used as public land (including land for building temples, enterprise companies/factories).

**Table 1.5 Acquisition of Land and Houses of Local People in the Three Surveyed Sites**

No	Statement	Villages			Total (%) (N=68)
		Sibounheuang (%) (n=34)	Chom Cheng (%) (n=15)	Thanaleng (%) (n=19)	
1	Bought from others	9 (26)	2 (13)	3 (16)	14 (21)
2	Inheritance	19 (56)	9 (60)	2 (11)	30 (44)
3	Rent	0 (0)	0 (0)	6 (32)	6 (9)
4	Use of public land	6 (18)	3 (20)	8 (42)	17 (25)
5	Government allocated	0 (0)	1 (7)	0 (0)	1 (1)
6	Unknown owners	0 (0)	0 (0)	0 (0)	0 (0)

Note: - “Use of public land” means the land still belong to the Government ownership, but it is allocated legally by the state or the ministry concerned for the retired personal/public and private companies/factories to use for the development or for the production purposes.

- “Government allocated” means the land is provided by the government or the ministry according to decree no 194/PM (Prime Minister).

Main Species of Fish in the Mekong River based on a survey through interviews:

Respondents were also asked on current situation of fishery along Mekong River including main species, fishing tools, fishing spots and purposes of fishing. Only one third of total respondents usually did fishing along the Mekong River. Based on the obtained results, the fishing tools were fishhooks, fishing rods and fishing nets sizes varied 2-5cm in the dry season for small fish and 5-25cm in the rainy season for big fish.

The fishing activities are done for daily consumption in the household. Only a few households can sell the catch at the market. The fishing spots are within their own village. The main species are shown in Table 1.6.

**Table 1.6 Main Catch Species of Fish in the Mekong River**

No	Main Catch Fish Species Lao Name/Scientific Name		Villages			Rare Species
			Sibounheuang (12/34)	Chomcheng (7/15)	Thanaleng (5/19)	
1	Pa Pak	<i>Puntius gonionotus</i>	✓	✓	✓	
2	PaKheung	<i>Mystus wyckil (Bleeker)</i>	✓	✓		✓
3	Pa Khaou	<i>Wallogonia attu (bloch)</i>		✓		✓
4	Pa Phia	<i>Morulus chrysophekadion</i>	✓	✓	✓	
5	Pa Kot	<i>Mystus wyckil</i>	✓	✓	✓	
6	Pa Nhone	<i>Pangasius macronema</i>			✓	
7	Pa Khe	<i>Bagarins bagarius</i>	✓	✓		
8	Pa Namou	<i>Helicophagus wandersii</i>	✓			
9	Pa Leum	<i>Pangasius sanitwongsei</i>	✓			✓
10	Pa Nay	<i>Cyprinus capio</i>	✓	✓		
11	Pa Va	<i>Labeo dyocheilius</i>	✓			
12	Pa Eeun	<i>Probarbus jullieni</i>	✓			✓
13	Pa Keng	<i>Anabus tesudineus</i>		✓		✓
14	Pa Souay	<i>Cirrhinus lineatus</i>		✓		✓
15	Pa Phone	<i>Cirrhinus microlipis</i>		✓		
16	Pa Tong	<i>Notopterus notopterus</i>		✓		
17	Pa Khao	<i>Wallogonia attu</i>	✓	✓	✓	
18	Pa Nang	<i>Krytoptrus apogon</i>	✓			
19	PaKhoune	<i>Wallago leerii</i>				✓
20	Pa Savay	<i>Pangasianodon hypophthalmus</i>		✓		
21	Pa Yang		✓			
22	PaSagnua			✓		
23	Pa Phor	<i>Panagasius bocourt</i>		✓		✓

Note: The figures in the parenthesis indicate the number of fishermen per total number of respondents/households.

### **1.3.3 Overview of Survey**

In general, it was found that the majority of local people are satisfied with the development plan of Mekong Riverbank and preferred concrete constructions for bank protection and to protect their own properties. This might be possible because most of the local people using land along the riverbank for housing and other constructions except for the respondents at Nong Heo village who used their land for crops, vegetable and for rice production.

In terms of resettlement and compensation of land and houses, most people expressed their own attitudes and opinions. If they have to move out of their own lands and houses, the resettlement of new places and compensation of their own houses with suitable or acceptable prices were preferred. The people who owned land by inheritance or purchase wanted the compensation prices to be reasonable and acceptable to them. The people who used public land considered that resettlement to new land was desirable.

## **1.4. Environmental Impact and Mitigation**

This section describes the environmental impacts of implementing the three pilot works. The environmental mitigation measures against each environmental impact are also referred to. The environmental check items are based on “JICA Environmental Guideline on Rivers and Sediment Control”. Only check items concerned with the pilot works are selected. The results of the impact assessment on the three pilot works are summarized in Table 1.7~1.9.

### **1.4.1 Social Environment**

Resettlement:

The pilot works does not require resettlement of the local people.

Economic Activities:

Because of the construction works, the economic activity by the local people in Wat Chom Cheng and Sibounheuang site might be slightly disturbed. The production activity of the fuel factory in Ban Dongphosi site might also be disturbed. However, these disturbances are temporary and limited, will be avoidable through the introduction of proper construction method and the dissections between the contractors and the affected people.

Traffic and Public Facilities:

The access to Mekong River of the local people in Wat Chom Cheng and Sibounheuang site will be disturbed during the construction works. The convey activity of the fuel factory in Ban Dongphosi site may not be disturbed. However, the affected people and activities will be limited.

If the affected people complain about this matter, the engineers of supervision and the contractors should consider the countermeasures immediately.

Split of Communities:

Impacts on spilt of communities will not occur.

Cultural Property:

There is Wat Chom Cheng (Temple) behind Wat Chom Cheng site and Sibounheuang Temple near Sibounheuang site. The proposed construction works will be conducted in the outside of these temple areas. However, these temples may be damaged by accidents, especially during moving construction machines and large materials.

To avoid the accidents, the engineers of supervision should consider the proper construction plan and manage the construction activities carefully.

Water Rights/Right of Common:

Impacts on water right/right of common will not occur.

Public Health Condition:

Impacts on public health condition will not occur.

Waste:

Because the earthworks of the pilot works will be only filling soil and gravel, the surplus soil will not generate. Other construction waste such as fragments of wood, left ropes, trash and garbage from construction workers will generate.

The engineers of supervision should consider the proper disposal plan and manage the construction waste. Some construction waste such as fragments of wood and ropes may be available for the local resident use.

Hazards:

A major fuel factory and high-tension power line are located in Ban Dongphosi site. Accidents to these facilities during the construction will lead to a terrible disaster. The Sibounheuang site is a steep slope and located in residential area. The neighboring children play on the exiting gabion wall. Therefore, if the riverbank breaks down, the accident may concern human life.

Firearms use including smoking near the fuel factory and crane works below the power line must be prohibited. The riverbank monitoring from a viewpoint of safety should be executed.

#### **1.4.2 Natural Environment**

Topography and Geology:

Large quantity of filling works will be executed in Ban Dongphosi site. The original topography will alter. However, this site is not topographic or geological area with academic or scenic value. Because the stone used by the pilot works will be collected from existing quarry site, a development of new quarry site will not be required. Consequently, the impacts on topography and geology will be negligible.

Soil Erosion:

The construction works may cause a temporary increase of soil erosion. This erosion is unavoidable to some degree. Main purpose of the pilot works is to decrease the soil erosion with the bank protection works. Therefore, the positive impact will be anticipated after construction.

To decrease the soil erosion during the construction, the engineers of supervision should consider the proper construction plan and manage the construction activities.

Groundwater:

Impacts on groundwater will not occur.

Hydrological Situation:

Impacts on hydrological situation will not occur.

Coastal Zone:

Impacts on coastal zone will not occur.

Flora and Fauna:

The wood for the log hurdle work and log piling will be supplied in market. Soda fascine will be collected from Ban Dongphosi, Ban Naxone and Ban Thanghone. Because the collection of these branches will not require major tree-felling and cutting big trees, the damages of the forests will be limited and recoverable. However, the excessive collections from the restricted forests will have an ecological affect on the forests. As positive impact, Soda mattress may provide new habitats to the aquatic life.

Dongphosi Forest Protected Area is located near the Ban Dongphosi site. Besides this protected areas, some district forest reserves are located in Vientiane Prefecture. Because tree-felling in these protected forests is prohibited by the Forestry Law, the branch collection from the protected forests including the buffer zone should be avoided. To minimize the forest damages, the collection works should be conducted widely and shallowly. Moreover, to preserve the forest resources, the engineers of supervision should consider the proper collecting plan and manage the tree-felling activities from a viewpoint of forest ecology.

Landscape:

Because the pilot works are mainly foundation works of the riverbanks, most of the structure will be under the water level except for short period of dry season. The impacts on landscape will be negligible. However, there is Friendship Bridge near the Ban Dongphosi site, which is scenic spot from National Culture Park. In the future, the landscape should be considered in the Ban Dongphosi.

### **1.4.3 Public Nuisance**

Air Pollution:

Convey of construction materials, especially rocks from the quarry site, heavy equipment operation and earthworks will generate harmful dust. Dust caused by construction works is unavoidable to some degree.

If the residents including along the roads where the construction materials are conveyed complain about the dust, the measures such as water spray to reduce dust should be taken during construction period.

**Water Pollution:**

Earthworks and placing rocks will generate turbid water. Turbid water caused by construction works is unavoidable to some degree. Mekong River water has high Suspended Solids level by nature. The impact of the turbid water on the aquatic life will be negligible.

**Soil Contamination:**

Impacts on soil contamination will not occur.

**Noise and Vibration:**

Heavy equipment operation will generate noise and vibration. There is Wat Chom Cheng (Temple) behind Wat Chom Cheng site and Sibounheuang Temple near Sibounheuang site. However, noise and vibration caused by construction works is unavoidable to some degree.

To mitigate the nuisance by noise and vibration, the engineers of supervision should consider the proper construction plan. If the priests and residents complain about noise and vibration, the engineers of supervision and the contractors should reconsider the construction method.

**Land Subsidence:**

Impacts on land subsidence will not occur.

**Table 1.7 Result of Impact Assessment on Pilot Works at Ban Dongphosi**

Project Components	
Construction Type	: Pebble stone with willow branch + Soda mattress work
Construction Length	: 650 m
Location	: Dongphosi village, Hatxaifong District
Land Use / Riverbank Type of Site	: Industrial Area / Cliff
Major Facilities of Site	: Lao State Fuel Company, National Culture Park, Friendship Bridge.

Check Item	During Construction		Operation		Remarks
	Assesment	Mitigating Measures	Assesment	Mitigating Measures	
<b>Social Environment</b>					
Resettlement	D		D		
Economic Activity	C		D		Near fuel factory
Traffic and public facilities	B	Proper construction plan Countermeasure against complaint	D		Near fuel factory
Split of communities	D		D		
Cultural property	D		D		
Water rights, Right of common	D		D		
Public health condition	D		D		
Waste	B	Proper disposal plan	D		Construction waste
Hazard	B	Fire management	D		Near fuel factory
<b>Natural Environment</b>					
Topography and geology	D		D		
Soil erosion	B	Proper design and construction plan	C	Monitoring program	
Groundwater	D		D		
Hydrological situation	D		D		
Coastal zone	D		D		
Flora and fauna	B	Tree-felling management	D		Soda Mattress needs many branches.
Landscape	D		B	Monitoring program	Near view spot (Friendship Bridge)
<b>Public Nuisance</b>					
Air pollution	B	Water spray	D		Dust
Water pollution	D		D		
Soil contamination	D		D		
Noise and vibration	C	Proper construction plan Countermeasure against complaint	D		Near recreation and residential area
Ground subsidence	D		D		
<b>General Assessment:</b>					
Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion and landscape will be needed during operation.					

Assessment: A:High Negative Impact, B:Low Negative Impact, C:Unknown Impact, D:No Impact

**Table 1.8 Result of Impact Assessment on Pilot Works at Wat Chom Cheng**

Project Components	
Construction Type	: Wooden pile groin work + (partial) Soda Mattress work
Construction Length	: 240 m
Location	: Chomcheng village, Sisattanak District
Land Use / Riverbank Type of Site	: Residential Area / Moderate slope
Major Facilities of Site	: Wat Chom Cheng (Temple)

Check Item	During Construction		Operation		Remarks
	Assesment	Mitigating Measures	Assesment	Mitigating Measures	
<b>Social Environment</b>					
Resettlement	D		D		
Economic Activity	C		D		In residential area
Traffic and public facilities	B	Proper construction plan Countermeasure against complaint	D		Obstruction of access to river
Split of communities	D		D		
Cultural property	C	Proper construction plan and management	D		Accidental damage
Water rights, Right of common	D		D		
Public health condition	D		D		
Waste	B	Proper disposal plan	D		Construction waste
Hazard	D	Fire management	D		
<b>Natural Environment</b>					
Topography and geology	D		D		
Soil erosion	B	Proper design and construction plan	C	Monitoring program	
Groundwater	D		D		
Hydrological situation	D		D		
Coastal zone	D		D		
Flora and fauna	B	Tree-felling management	D		Soda Mattress needs many branches.
Landscape	D		D		
<b>Public Nuisance</b>					
Air pollution	B	Water spray	D		Dust
Water pollution	D		D		
Soil contamination	D		D		
Noise and vibration	B	Proper construction plan Countermeasure against complaint	D		In residential area
Ground subsidence	D		D		
<b>General Assessment:</b>					
Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion will be needed during operation.					

Assessment: A:High Negative Impact, B:Low Negative Impact, C:Unknown Impact, D:No Impact



**Table 1.9 Result of Impact Assessment on Pilot Works at Sibounheuang**

Project Components	
Construction Type	: Soda mattress work + Pebble stone with willow branch work
Construction Length	: 150 m
Location	: Sibounheuang village, Sikhottabong District
Land Use / Riverbank Type of Site	: Residential Area / Steep slope
Major Facilities of Site	: Sibounheuang Temple

Check Item	During Construction		Operation		Remarks
	Assesment	Mitigating Measures	Assesment	Mitigating Measures	
<b>Social Environment</b>					
Resettlement	D		D		
Economic Activity	C		D		In residential area
Traffic and public facilities	B	Proper construction plan Countermeasure against complaint	D		Obstruction of access to river
Split of communities	D		D		
Cultural property	C	Proper construction plan and management	D		Accidental damage
Water rights, Right of common	D		D		
Public health condition	D		D		
Waste	B	Proper disposal plan	D		
Hazard	D		C	Monitoring program	Steep slope in residential area
<b>Natural Environment</b>					
Topography and geology	D		D		
Soil erosion	B	Proper design and construction plan	C	Monitoring program	
Groundwater	D		D		
Hydrological situation	D		D		
Coastal zone	D		D		
Flora and fauna	B	Tree-felling management	D		Soda Mattress needs many branches.
Landscape	D		D		
<b>Public Nuisance</b>					
Air pollution	B	Water spray	D		Dust
Water pollution	D		D		
Soil contamination	D		D		
Noise and vibration	B	Proper construction plan Countermeasure against complaint	D		In residential area
Ground subsidence	D		D		
<b>General Assessment:</b> Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion and safety will be needed during operation.					

Assessment: A:High Negative Impact, B:Low Negative Impact, C:Unknown Impact, D:No Impact

## **1.5 Conclusion and Recommendation**

The three pilot work sites are residential area or industry area. The construction works will be executed in limited area. Therefore, the considerations for natural environment will not be required. The environmental impacts, such as disturbance of daily activity, construction waste, air pollution, noise and vibration will occur at the construction stage. However, these impacts will not become a serious problem by adopting the proper construction plan. The operation stage will not also have serious impacts. Consequently, the pilot works in three different sites have no serious impacts potentially.

The riverbank protection works are a very important matter of concern to the local people, especially the residents living along riverbanks with critical situation and without protection works. These residents hope the riverbank to be protected as early as possible. After the construction of the pilot works starts, some questions and opinions will be offered from the residents for the works and riverbank protection. Some residents who live in the outside of the area executed the bank protection may complain about the pilot works. To consider these residential emotions and explain the details of the pilot works, the exclusive person in charge should be had in Department of Roads, Ministry of Communication, Transport, Post and Construction (MCTPC). These questions, opinions and complaints will be available information to formulate a master plan for bank protection of the Mekong River around Vientiane City.

The management of forests and protected areas is fully under the responsibility of the Ministry of Agriculture and Forestry, the Department of Forestry and Provincial/District Forestry Office. The engineers in the MCTPC have little experience about forest management. Therefore, to manage the tree-felling activities from a viewpoint of forest ecology, an expert of forest management should be employed during the pilot works. The reports from the expert will be available data to formulate the master plan.

## 2 IEE FOR RIVERBANK PROTECTION MASTER PLAN

### 2.1. Environmental Impact Assessment System in Lao PDR

Environmental Impact Assessment (EIA) is prescribed by “Environmental Protection Law, Chapter II Article 8”. The descriptions on EIA in “Environmental Protection Law” are as follows;

1. Science Technology and Environment Agency shall issue General regulation on procedures and methods for EIA.
2. Each Sector that is responsible for the development projects and activities shall issue its own regulations on procedures and methods for EIA, based on the EIA regulation issuing by the Science Technology and Environment Agency.
3. Development projects and activities that have or will have the potential to affect the environment shall submit an EIA report according to the paragraphs 1 and 2 above to the concerned environmental management and monitoring unit for issuance of an environment compliance certificate before starting the project.
4. Development projects and activities to operating prior to the enactment of this law that have caused losses to the environment shall propose measures, procedures and action to mitigate such losses to the concerned environmental management and monitoring unit for issuance of an environment compliance certificate.
5. EIA shall include the participation of the local administration, mass organizations, and population likely to be affected by the respective development project or activity.

### 2.2 Present Environmental Condition

#### 2.2.1 Natural Environment

##### Climate:

The climate around Vientiane has two characteristics of savanna and monsoon. The dry season is from November to April. The rainy season is from May to October. The annual rainfall is about 1,600 mm. About 80 percent of the annual rainfall is concentrated in the rainy season. Table 2.1 shows the average monthly rainfall in Vientiane City. Table 2.2 shows the average monthly temperature in Vientiane City.

**Table 2.1 Average Monthly Rainfall in Vientiane City**

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
7.0	15.9	35.7	84.5	254.2	243.7	248.6	340.3	299.8	96.3	7.4	1.9	1635.3

(mm)

**Table 2.2 Average Monthly Temperature in Vientiane City**

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
22.1	24.1	27.0	28.7	28.5	28.2	28.0	27.5	27.4	26.8	24.8	22.6	26.3

(°C)

### Protected Area:

The government of Lao PDR is acutely aware of biodiversity conservation particularly in protected forest areas. Therefore, aiming to conserve land in sustainability and natural resources, the Prime Minister's Cabinet promulgated several decrees and regulations. Few projects applied for forest and land conservation was created.

There are two National Biodiversity Conservation Areas (NBCAs) as national level and four Forest Protected Areas as prefectural level in and around Vientiane Prefecture. Besides these protected areas, some forest reserves of district level are located in and around Vientiane Prefecture. Protected areas of national and prefectural level are as follows:

Phou Phanang NBCA  
Phou KhaoKhouay, National Forest Park (NBCA)

Houay Yang, Forest Protected Area  
Dong Ban Xay, Forest Protected Area  
Dongphosi, Forest Protected Area  
Pa Paek Ban Donxangphay, Forest Protected Area

There are two general principles of the needs for protected area system. They are:

That protection needs to be provided to the full range of ecosystem and species communities occurring within the country.

The total area under protective management needs to be adequate to prevent or minimize species extinction.

### Fauna and Flora:

Natural vegetation areas remain well in and around the NBCAs. There are no natural vegetation areas along Mekong River bank in Vientiane Prefecture. The identified large mammal and bird species listed in International Union for the Conservation of Nature and Natural Resource (IUCN) in Phou Khao Khoay NBCA are as follows:

Pangolin sp, Pig-tailed Macaque, Rhesus Macaque, Phayre's Langer, White-checked Crested Gibbon, Dhole, Bear sp, Clouded Leopard, Asian Elephant, East Asian Porcupine, Siamese Fireback, Green Peafowl, Red-collared Woodpecker, Coral-billed Ground Cuckoo, Grey-headed Lapwing, Jerdon's Baza

The identified fishes in main Mekong River in Lao reach more than 200 species, which are mainly *Cyprinidae*, *Siluridae*, *Bagridae* (*Siluriformes*) and *Pangasiidae* (*Siluriformes*). There are more than hundred and twenty-seven fish species found in the Mekong River around Vientiane City, in which seven are rare and endangered fish species reported by the Department of Livestock and Veterinary. Because the current using fishery tools have little impact on the aquatic life habitat, there will not be a highly reduction in fish resources.

The Center for Protected Areas and Watershed Management (CPAWM) under the Department of Forestry, as the national agency, is responsible for management of protected areas and other biodiversity-related matters, supervises of 20 declared NBCAs and some provincial protected areas.

Water Level and Water Quality of Mekong River:

The maximum, minimum and average water level and discharge at Vientiane City from 1960 to 2001 are shown in Table 2.3 according to Lower Mekong Hydrologic Yearbook published by Mekong River Commission.

**Table 2.3 Annual Max., Min. and Ave. Water Level and Discharge**

	Vientiane KM4 (Zero of gauge elevation 158.040m above M.S.L. Ko Lak Datum)			
	Water Level (m)		Discharge (m <sup>3</sup> /s)	
	Max.	Min.	Max.	Min.
Max.	12.71	0.93	22,900	1,220
Min.	6.67	-0.28	7,500	598
Ave.	10.68	0.43	16.120	1,010

Period: 1960-2001

The water quality of Mekong River at Vientiane City is good on organic substance and nutrient level. In Vientiane, Mekong River water is used as water resources for public water supply. The total suspended solids are changeable by year and generally tend to increase in the high-water season. Table 2.4 shows the water quality of Mekong River at Vientiane City. Table 2.5 shows the total suspended solids of Mekong River at Vientiane city.

**Table 2.4 Water Quality of Mekong River at Vientiane City**

	Teem. (°C)	pH	Conductivity (μ S/m)	Total Fe (mg/l)	NO <sub>3</sub> -N (mg/l)	NH <sub>4</sub> -N (mg/l)	Total P (mg/l)	DO (mg/l)	COD Mn (mg/l)
Ave.	26.0	7.9	227	0.243	0.184	0.039	0.081	7.6	1.4
Min.	19.8	6.0	114	0.000	0.001	0.000	0.005	5.6	0.0
Max.	34.3	8.7	325	1.922	0.528	0.332	0.494	9.5	6.6

Period: May 1985-April 1997

**Table 2.5 Total Suspended Solids of Mekong River at Vientiane City**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Ave.	132	63	60	79	137	470	1263	1262	1546	1199	697	261
Min.	18	5	7	1	10	42	80	8	524	32	284	104
Max.	290	153	284	360	468	1468	5716	4074	3013	3204	1987	553

Period: May 1985-April 1997

**2.2.2 Social Environment**

Mekong Riverbank Utilization by Local People:

The Mekong Riverbank in Vientiane city is variously utilized by the local people and entities. Secondary or rural roads are constructed on the most part of the riverbank. Some parts of the riverbank are reclaimed by the local people and used for construction of barns or cultivation. In some area of the city center, restaurants and pubs stand in a row on the riverbank. Most areas along the riverbank in the suburbs of Vientiane are used as farmlands. Some riverbanks including inundated areas are directly planted farm products.

There are three major intake facilities, two facilities for water supply and one facility for irrigation, in Vientiane city. Besides these major intake facilities, some local people set a small pump and directly take water from Mekong River. Some local people also set a thin drainpipe for family use and directly drain their wastewater to Mekong River.

Many access paths to landing places, wharves and fishponds are constructed by the local people on most of the riverbank including steep bank. Shade of big trees such as pipal on the riverbank presents a place of recreation and relaxation to the local people. Some gabion banks have the playing spots for the local children.

#### Forest Utilization:

Natural forests and forestlands are the property of the nation represented by the government in their management and the distribution to individuals or organizations for rational use. Individual or organizations are entitled to process and use trees and forestlands only when authorized by the authorizing agencies.

Trees and forests planted or regenerated by individuals or organizations using their own labor or capital and with the recognition of the state, become the property of the planters or regenerators. The planter then assumes the rights of processing, using, transferring and inheritance as provided by the forestry law.

The management of the protected forests or areas in Lao PDR is fully under the responsibility of the Ministry of Agriculture and Forestry and managed through the Department of Forestry (DOF) at the National level and through Provincial and District Forestry Offices (PAFO and DAFO respectively) at the Local level. DOF is responsible for the policy and plays role as the National coordinator, while the management and field level implementation is in the hands of the PAFOs and DAFOs.

Within DOF, the Division of Forest Resource Conservation (DFRC) has technical responsibility for country's protected area system. DFRC is charged with liaison and coordination among the NBCAs, and providing technical support or assistance as required. DFRC also administers all external technical assistance programs involved with the management and conservation of protected areas.

## **2.3. Questionnaire Survey in Village along Mekong River**

### **2.3.1 Objective of the Survey**

The objective of the survey is to obtain basic data and information concerning “The Mekong River Bank Protection around Vientiane Municipality”. The results of the study were utilized for the initial environmental examination for the Master Plan. The survey was not to assess the impacts of the riverbank protection project.

The survey consisted of three main parts as follow:

- 1 Opinions of local people living along the riverbank on the usages of land along the riverbank and protection of the riverbank.
- 2 Current situation of fishery by local people along the riverbank.
- 3 Local people’s attitudes and opinions on the utilization of the riverbank.

### **2.3.2 Methodology**

Selection of the Survey Areas:

The following four villages were selected for conducting the survey on opinions of local people living along the riverbank for bank protection construction and current situation of fishery. The villages are within approximately 50 meters from the bank and located in Vientiane City. The four villages are:

- 1 Wattay-Nay, Sikhottabong District.  
This site is located in urban residential area. The riverbank forms cliff and has been eroded severely. Residences stand in line along the shore. A rural road along the riverbank passes between these residences and the shore.
- 2 Sithane-Neua, Sikhottabong District.  
This site is located in urban residential area. The riverbank forms gentle slope and has no serious erosion. Residences stand in line along the shore. A rural road along the riverbank passes between these residences and the shore or through the residential area.
- 3 Bo-O, Hatsaiphong District.  
This site is located in residential area of Vientiane suburbs. The riverbank forms cliff and has been eroded severely. There are some residences nearby the shore.
- 4 Ban Hom, Hatsaiphong District.  
This site is rural village of Vientiane suburbs. The riverbank forms cliff and has been eroded severely. There are no residences very close to the shore. The some lands along the riverbank are used as vegetable fields by the local people.

In addition, Ban Muang Wa, Sikhottabong District was also selected for conducting survey on the utilization of existing riverbank protected. This site is located in urban residential area. The riverbank was protected with gabion and reno mattress in 1997. The area around Muang Wa Temple on the protected riverbank is used like a park by the local people.

Design of Survey:

To achieve the objectives of the survey, sufficient information and data was needed. The information and data was obtained by series interviews. The questionnaire was prepared to

suit the local villagers and the local environment in Laos. It was developed in consultation with survey team from Dongsay Consultants Co. and the JICA Study Team. In developing the questionnaire, previous related studies on local people's opinions, perceptions and attitudes were reflected. Additional ideas expressed by respondents beyond the questionnaires were noted separately.

#### Survey Period:

Based on the conditions that most family members are home on weekend, the interview was conducted only on weekends (Saturdays and Sundays) in August 2002 – February 2003.

#### Data Collection:

In order to get information on the opinions of local people living along the riverbank, the data with regard to the utilization of land along the bank, the construction of bank protection and current situation of fishery, was obtained through the questionnaire survey of the residents. Most of the heads of households who live along the riverbank within approximately 50m from the bank were all interviewed. On-site interview (face-to-face interview) was conducted in the four sites. The interviews focused on the perceptions and opinions of the local villagers regarding the riverbank and land utilization, which is directly related to their daily life and current status of fishery along the Mekong River.

In terms of the opinions on utilization of existing protected riverbank, especially in Muang-Wa village, all of local people who visited and used the area for any different purposes were randomly interviewed (through questionnaire). Face to face interview was also conducted within one selected village (Muang-Wa village) where riverbank protection had been constructed.

Before conducting the interviews, the required list of households, especially for those people who settled very close to the bank or the owners of the land located along the riverbank within approximately 50 meters from the bank were obtained from Chief of the villages. Some relevant secondary data such as total number of population, houses, households, ownership of land along the bank was also obtained. However, in case of the absence of the head of the families/households (either at work or away), reliable data were obtained from knowledgeable family members. Each respondent was interviewed separately in order to keep his/her responses free from each other's influence (the survey form is attached).

To obtain more comprehensive information on the entire socio-economic activities, based on the number of families/households who settled very close to the bank, a systematic sampling procedure was used for the interviews. Due to a small number of households in the area, it was possible that all of them were interviewed.

### **2.3.3 Main Output**

#### **(1) Survey of Local People Living along the Mekong Riverbank**

##### The purposes of the land use by local people along Mekong Riverbank:

Most villagers from each household, particularly those who are settled along the riverbank



within approximately 50m from the bank were asked about the type of existing land use along the riverbank. From the survey, the results in Table 2.6 show that there are not much different in current use of land between the four villages. Most local people in four villages, particularly those people who live nearby the riverbank use land mainly for housing. However, some of them use the same land for animal raising such as chickens, ducks, pigs etc. as well as a few numbers of fruit trees such as mango, coconut, longan and tamarind. Vegetable garden especially on the slope of the bank in Bo-O and Ban Hom villages were also one of the main villagers activities. Meanwhile apart from the use of land for housing, some of the local villagers in Wattay-Nay and Sithane-Neua use the land for conducting small business such as restaurants and small shops.

According to the survey, in the dry season when the water level is decreased, although the land on the slope of the bank is a public land, some of villagers use that land to grow vegetable for daily food. The clearing of land on the bank slop for such purpose is a main cause leading to bank erosion in the rainy season. However, the numbers of household that are conducted growing vegetable on the bank slope among four villages are not available due to that land is not their own. The figures of Table 2.6 only indicate the villagers' private lands with their legal ownership.

**Table 2.6 The Current Land Use by Local People in the Four Surveyed Villages**

Statement	Surveyed Sites (Villages)				Total	
	Wattay-Nay	Sithane-Neua	Bo-O	Ban Hom		
Number of Households within 50m from the Mekong bank	21	32	46	45	144	
Number of Respondents (n)	21	28	35	32	116	
Current Use of Land	Cropping/vegetable	0 (0)	0 (0)	5 (14.3)	8 (25)	13 (11.2)
	Planting fruit trees	0 (0)	0 (0)	8 (22.8)*	15 (46.8)*	23 (19.8)
	Planting trees	0 (0)	0 (0)	0 (0)	0 (0)	0
	Livestock	0 (0)	0 (0)	0 (0)	3 (9.4)*	3 (2.5)
	Building Houses	21 (100)	28 (100)	34 (97.1)	30 (93.7)	113 (97.4)
	Restaurant/small shop	2 (9.5)	8 (28.5)	0 (0)	0 (0)	10 (8.6)
	Factory/industry	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Building port	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rubbish disposal	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	

Note: The number of respondents or households who own land/houses along the riverbank within approximately 50m from the riverbank.

( ):%

The label “ \* “ indicates fruit tree and livestock in the same area with home land.

**Opinions of people regarding the benefits from using land along the riverbank:**

Respondents were asked on what kind of benefits that they have been setting from the use of land along the riverbank (their own land only). The results as shown in Table 2.6 and Table 2.7 indicate that most of the local people in four villages seemed to get benefits mainly from

the use of lands for housing (situated in the centre of the community) and its values were not estimated at this stage. Only some of them in Sithane-Neua village made a direct income from the use of land for business such as restaurant, small shop and guesthouse. While some of respondents in Ban Hom and Bo-O villages could get their income from the use of land for cropping, dry season paddy rice and planting various kind of vegetable.

The riverbank from Sithan-Neua Village to Watchan are dedicated for outdoor recreation and for conducting small business mainly outdoor restaurants and shops. Although income from such business is not much but enough for their daily livelihoods (average about 500,000-1,500,000 kip per month per household). Their income depends also largely on the seasonal conditions, while in the dry season income might be higher than rainy season. However, during the survey time, some restaurants in Sithan-Neua village were being removed because of the part of the planning and redevelopment of this area.

**Table 2.7 Opinions on the Benefits from Using Land by Local People**

No	Statement (Benefits)	Villages				Total (4 sites) (N=116)
		Watay-Nhay (n=21)	Sithan-Neua (n=28)	Bo-O (n=35)	Ban Hom (n=32)	
1	No benefit	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	Income generation from cropping and growing vegetable	0 (0)	0 (0)	0 (0)	13 (40.6)	13 (11)
3	Income generation from restaurant, selling goods	0 (0)	15 (53.6)	0 (0)	1 (3.1)	16 (14)
4	Income generation from other business (guest-house)	0 (0)	1 (3.6)	0 (0)	0 (0)	1 (0.8)
5	Housing or Accommodation	21 (100)	28 (100)	35 (100)	31 (96.8)	115 (99)

Note: n (N) = Number of respondent, ( ):%

#### Villagers' perceptions on the bank conditions:

This section describes the findings from the assessment of villagers' perceptions on the existing conditions of Mekong Riverbank. The findings reflect the current conditions or changes of the Mekong Riverbank in the four villages within Vientiane City. Respondents were asked on what change (erosion) occurred to the bank every year during the last 5 years. The results shown in the Table 2.8 indicate that all the four sites (four villages) seemed to have serious problems on bank erosion particularly for Wattay-Nay, Bo-O and Ban Hom villages. However, Sithan-Neua villages faced also quite serious problem on erosion of the bank. Although this survey did not aim to assess impact on the bank and its causes, the results of these findings reflected the local people' perceptions and concerns of Mekong Riverbank conditions. However, the impact on the bank were found to be depending on many factors including natural and manmade factors such as climate change, the change of Mekong water level each year, type of land use along the bank, drainage system from the villages/town and the socio-economic development within the areas.

**Table 2.8 Villagers’ Perceptions on the Bank Conditions**

No	Bank Conditions	Villages				Total (4 sites) (N=116)
		Watay-Nhay (n=21)	Sithan-Neua (n=28)	Bo-O (n=35)	Ban Hom (n=32)	
1	Bank erosion (average/year):					
	Less than 1m/year	1 (4.8)	25 (89.3)	0 (0)	0 (0)	26 (22.4)
	1 - 3m per year	13 (61.9)	3 (10.7)	22 (62.8)	2 (6.2)	40 (34.5)
	More than 3m/year	7 (33.3)	0 (0)	13 (37.2)	30 (93.8)	50 (43.1)
2	Bank extension	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	No change	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Note: n (N) = Number of respondent, ( ):%

Villagers’ opinions on the uses, protection, management and development of the riverbank:

Generally, most people among four villages are concerned about erosion of the riverbank. The erosion directly affects the people living along the riverbank within 50m from the bank. The loss of housing and cultivated land in this way affects their livelihood, lifestyle and economy. It is generally agreed by all concern that the banks of Mekong River must be secured against high water level and floods from the monsoon rain.

In terms of the local people’s opinions on the uses, management and development of Mekong riverbank protection, the results from individual interviewing as shown in Table 2.9 indicated that 91% of respondents in four surveyed villages fully agreed to the development plan as the Mekong riverbank protection and preferred to build bank protection by using gabions in order to protect the bank from being eroded. Meanwhile, concrete construction to protect bank erosion was the next choice (40%) for all four sites. This might be for reason that building concrete structures for bank protection was costly and taken more time.

Only a few respondents in Sithan-Neua village preferred to rehabilitate or use natural grasses and/or plant vegetation to protect the soil along the riverbank from being eroded. This might be for reason that the erosion conditions of the bank in this village was not severe in comparison to the other sites (Sithan-Neua, Bo-O and Ban Hom). It must be also noted that generally the villagers (or people throughout Laos) unlike people of the developed world are still romanticizing about concrete structure as being “high-tech”, “sophistication”, and even “aesthetically pleasing” compared with anything natural.

According to the survey conducted with some senior villagers in Sithan-Neua village, the survey team was told that about fifty years ago in Sithan-Neua village there had been a bank protection built by using stone boulders. The boulders were dropped along the affected area. No sign of these boulders remained visible at the time of the interview.

**Table 2.9 Opinions on the Uses, Protection, Management and Development of the Riverbank**

No	Statement	Villages				Total (4 sites) (N=116)
		Watay-Nhay (n=21)	Sithan-Neua (n=28)	Bo-O (n=35)	Ban Hom (n=32)	
1	Leave it as before	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	Growing vegetable on the bank slop and quarrying sand and gravel under MR should not be allowed	9 (42.9)	5 (17.8)	0 (0)	14 (43.8)	28 (24)
3	Rehabilitation or planting natural grass and vegetation along the bank	5 (23.8)	1 (3.6)	2 (5.7)	0 (0)	8 (7)
4	Planting trees or fruit trees	2 (9.5)	0 (0)	0 (0)	1 (3.1)	3 (2)
5	Build concrete to protect bank	7 (33.3)	11 (39.3)	13 (37.1)	15 (46.9)	46 (40)
6	Use gabion weir to protect bank	19 (90.5)	25 (89.3)	33 (94.3)	29 (90.6)	106 (91)
7	Allocate to local people for using and managing	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Note: n (N) = Number of respondent, ( ):%

**Main catch species of fish in the Mekong River based on the interview of key respondents:**

Respondents were also asked on current situation of fishery along Mekong River including main catch species, fishing tool, fishing spot and purposes of fishing. Only a few respondents usually engaged in fishing along the Mekong River particularly for villagers in Sithan-Neua (14%), Bo-O (35%) and Ban Hom (44%). Based on the obtained results from interviewing of the four local villagers, the fishing tools which were very popular in the Mekong River were fishhooks (fish rod), fishnets, nets (with different sizes) and some other traditional fishing tools such as Chane, Khar, Tum-lane and Sadung.

The fishing along the Mekong River is done individually or non-group (no fisher person's association) and fishing for daily consumption in the household. Only some of them managed to sell the surplus to the neighbors or to the nearest markets. Therefore, the income from river fishes is not always. The fishing areas were within their own village. The main catch species is shown in Table 2.10.

**Table 2.10 Main Catch Species of Fish in the Mekong River**

No	Main Catch Fish Species (Lao Name and Scientific Name)		Villages				Rare Species
			Watay-Nhay (0/21)	Sithan-Neua (4/28)	Ban Bo-O (7/35)	Ban Hom (14/32)	
1	Pa Pak	<i>Puntius gonionotus</i>		✓	✓	✓	✓
2	PaKheung	<i>Mystus wyckil (Bleeker)</i>			✓	✓	✓
3	Pa Khaou	<i>Wallogonia attu (bloch)</i>			✓	✓	✓
4	Pa Phia	<i>Morulius chrysophekadion</i>		✓	✓	✓	
5	Pa Kot	<i>Mystus wyckil</i>		✓	✓	✓	
6	Pa Nhone	<i>Pangasius macronema</i>					
7	Pa Khe	<i>Bagarins bagarius</i>		✓	✓	✓	✓
8	Pa Nou			✓	✓	✓	✓
9	Pa Leum	<i>Pangasius sanitwongsei</i>					
10	Pa Nay	<i>Cyprinus capio</i>		✓	✓	✓	✓
11	Pa Va	<i>Labeo dyocheilius</i>					
12	Pa Eeun	<i>Probarbus jullieni</i>		✓	✓	✓	✓
13	Pa Keng	<i>Anabus tesudineus</i>			✓	✓	✓
14	Pa Souay	<i>Cirrhinus lineatus</i>					
15	Pa Phone	<i>Cirrhinus microlipis</i>			✓		✓
16	Pa Tong	<i>Notopterus notopterus</i>					
17	Pa Khao	<i>Wallogonia attu</i>		✓	✓	✓	
18	Pa Nang	<i>Kryopterus apogon</i>		✓	✓	✓	✓
19	PaKhoune	<i>Wallago leerii</i>					
20	Pa Savai	<i>Pangasianodon hypophthalmus</i>					
21	Pa Yang				✓	✓	
22	Pa Fa-ong					✓	
23	Pa KaYeng			✓			
24	Pa Phor	<i>Panagasius bocourt</i>			✓	✓	✓

Note: The figures in the parenthesis indicate the number of fishermen per total number of respondents

## (2) Survey for Local People's Attitudes and Opinions on Utilization of Protected Riverbank

Based on the characteristics in the survey site (Muang-Wa Village), especially for those visitors who came from other villages, the survey was conducted only on weekends (Saturdays and Sundays), holidays and after working hours.

### Profile of respondents:

The background information of local people who visited the survey site is summarized in Table 2.11. From the results as shown in the below table, more than half of total number of respondents were from other villages and most of them were female between ages of 15 - 50. They were mainly students and government and private employees.

**Table 2.11 Profile of Respondents**

No	Characteristics	Frequency (Percentage)	Remark
1	Age group:		
	15 - 25	16 (35.6)	
	26 - 35	14 (31.1)	
	36 - 50	11 (24.4)	
	51 - 60	3 (6.7)	
	> 60	1 (2.2)	
	Sub Total	45 (100)	
2	Gender:		
	Male	19 (42.2)	
	Female	26 (57.8)	
	Sub Total	45 (100)	
3	Occupation:		
	Student	13 (28.9)	
	Government/private employee	12 (26.7)	
	Worker/driver	5 (11.1)	
	Business/trader	6 (13.3)	
	Housewife/villager	9 (20.0)	
	Sub Total	45 (100)	
4	Residence/village:		
	Ban Muang Wa	21 (46.7)	
	Other Villages	24 (53.3)	Most of them came from Si-Khay-Tha village, only two came from Thadluang
	Sub Total	45 (100)	

**Opportunities motivated people to the area:**

Opportunities are identified as attractions that motivate people to visit the area. The motivations for a visit and the eventual choice of area are interrelated. People who are motivated to “enjoy beautiful scenery or nature” may choose to visit an area where the surrounding environment is attractive to them, whereas people who are concerned with “facilities” may visit an area where facilities are available. Table 2.12 shows that “get rest/relaxation” was the most popular motive for visiting the area, meanwhile “sight-seeing/nature observation” and “enjoy fresh air/relieve stress” were the next motivation of visit respectively.

**Table 2.12 Opportunities Motivated People to the Area**

No	Motivation of Visit	Frequency (Percentage) (n=45)	Rank
1	Get rest/relaxation	25 (55.5)	1
2	Sight-seeing/nature observation	19 (42.2)	2
3	Enjoy fresh air/relieve stress	16 (35.5)	3
4	Local residents	15 (33.3)	4
5	Visiting friend /relatives	11 (24.4)	5

Note: One respondent could choose not more than two choices of answers (two motivations of visit)

Frequency of visits:

Respondents were asked on the frequency of their visit to the area. The result in Table 2.13 indicates that almost half (42%) of the total respondents were resident at Muang-Wa village, therefore they could visit the area almost every evening. Meanwhile, for those people who were from other villages, they were able to visit the area only on weekend evening once or twice a week.

**Table 2.13 Frequency of Visits**

No	Frequency of Visit	Frequency (Percentage) (n=45)	Remark
1	Almost every evening	19 (42.2)	Most of them are resident in Muang-Wa Village
2	Every weekend evening	11 (24.5)	
3	Sometimes or at least once a week	15 (33.3)	

Note: n = Number of respondent

Current land use by local people of Muang-Wa Village:

When respondents were asked on whether they occupy land or house along the riverbank within 50m from the bank in Muang-Wa village, 46.7% of total respondents show the answer “Yes”. The type of land use along the riverbank as shown in Table 2.14 indicates that most local villagers use the land mainly for housing (houses, restaurants). The use of land for other businesses (e.g. house for rent or guesthouse) was categorized in the same type of land use as for housing.

**Table 2.14 Current Land Use by Local People of Muang-Wa Village**

No	Statement	Frequency (Percentage) (n=21)	Remark
1	Houses (for residential housing)	21 (100)	
2	Restaurants or small shops	3 (14.3)*	
3	For other businesses (e.g. for rent etc.)	2 (9.5)*	

Note: “ \* “ indicates restaurants and conducting other businesses at the same area with residential home.

Local people’ perceptions on the impacts of riverbank protection:

This section describes the findings from the assessment of local villagers’ perceptions on the existing conditions of riverbank protection or its impacts. The findings reflect the current conditions of riverbank protection in Muang-Wa village.

Respondents were asked on what they perceived as a problem or impact from the construction of riverbank protection along the Mekong River within Muang-Wa village as well as benefits that they could get from it. The results from the survey as shown in Table 2.15 indicate that 100% of respondents (villagers) perceived that the construction of riverbank protection provided them only positive impacts. As it was shown in Table 2.8, almost 62% of total respondents in Wattay-Nay village believed that the Mekong riverbank has been destroyed by erosion every year (average about 1-3m/year). However, Wattay-Nay and Muang-Wa villages locate nearby each other, the conditions of riverbank before construction of the

riverbank protection might be similar. Therefore, it might be said that most villagers who live along the riverbank are highly concerned about bank erosion, the construction of riverbank protection is very important for their livelihood and would have beneficial impact. On the other hand, none of the respondents believed that the construction of riverbank protection would cause negative impacts. Among the positive impacts, “protection of public properties from destruction by erosion’ was the first ranking in terms of acceptance, while ‘protect soil/bank erosion”, “increase scenery and beautiful view of Mekong riverbank” and so on were the next consecutive ranking statements.

**Table 2.15 Perceptions on the Impacts of Riverbank Protection**

No	Statement	Frequency (Percentage) (n=45)	Rank
a).	<u>Positive Impacts:</u>		
1	Protect public properties from destruction by erosion	43 (96)	1
2	Protect soil/bank erosion	38 (84)	2
3	Increase scenery and beautiful view of Mekong Riverbank	27 (60)	3
4	Provide space for recreation or relaxation	14 (31)	4
5	Easier for accessing the river	10 (22)	5
b).	<u>Negative Impacts:</u>		
1	No land for cropping/planting vegetable	NA	
2	Decrease income from cropping and conducting business	NA	
3	Reduce natural scenery/view of Mekong Riverbank	NA	
4	Endanger vegetation, terrestrial life species and ecosystem	NA	

Note: NA = No Answer.

Local people’ opinions on the management and protection of riverbank:

According to the survey on the condition of riverbank protection at Muang-Wa village, it was found that, generally, the conditions of riverbank protection were quite a serious problem due to villagers’ behavior and activities. The most evidence for example were rubbishes, removing stone from the gabions, using gabions as post to secure boats, no maintenance, leaving trees growing on it etc..

When respondents were asked on what they considered important for the protection of bank erosion and management of riverbank protection. The results from the survey as shown in Table 2.16 indicate that all of the respondents were highly concerned about management of riverbank protection as indicated in their answers on the statements below. The respondents believed that any activities and constructions which might cause destruction of riverbank protection should be prohibited. At the same time, the participation in management of riverbank protection by local organizations and villagers are seen as very important. In order to enhance the effective management of riverbank protection, village regulations related to the use and management of riverbank protection should be issued and promulgated parallel with annual monitoring and evaluation of riverbank protection condition to conduct maintenance.



**Table 2.16 Local People’ Opinions on the Management and Protection of the Riverbank**

No	Statement	Frequency (Percentage) (n=45)	Rank
1	Throwing rubbish into the Riverbank Protection should be prohibited	45 (100)	1
2	Any constructions on the Riverbank Protection (RBP) which might cause destruction of RBP should be prohibited	40 (89)	2
3	Villagers should be owned and participated in management and protection of the Riverbank Protection	39 (87)	3
4	Riverbank Protection condition must annually be monitored and evaluated in order to conduct maintenance	31 (67)	4
5	Issue and promulgate village regulation for the use, management and protection of the Riverbank Protection	25 (55)	5
6	Conducting any activities on the Riverbank which may lead to cause impacts or destroy the Riverbank Protection should not be allowed, except for recreation and/or relaxation	23 (51)	6
7	Planting big trees on the Riverbank Protection should not be allowed	19 (42)	7

### 2.3.4 Overview of Survey

In general, it was found that the majority of local people are highly satisfied with the development and construction of Mekong riverbank protections and most of them preferred to construct riverbank protection by using Gabion in order to protect in a sustainable way the bank erosion as well as to protect public and their own properties. This might be for reason that the condition of bank erosion was quite serious problem for most of the local people using land for housing and other construction except for the respondents at Bo-O and Ban Hom villages who used the land for both housing and planting fruit trees, growing crops/vegetables. However, additional opinions from respondents of two villages (Bo-O and Ban Hom) showed that riverbank protection might be used technical methods in order to integrate between natural and manmade methods.

In terms of local people’s attitudes and opinions on the utilization of protected riverbank which conducted survey at Muang-Wa village, most of the respondents coming to the area was mainly for rest and relaxation, sight-seeing, nature observation and enjoy fresh air. More than half of them were from nearby villages and visited the area at least once to twice a week except for those respondents who are residents at Muang-Wa village who visits the area every evening. In terms of visitors’ opinions on the management of riverbank protection, it can be concluded that all of the respondents were highly concerned about the destruction of protected riverbank. All of them strongly agreed that the existing protected riverbank must be protected and kept in good condition without any destruction by any activities or constructions. They also agreed that any actions that could lead to changes and cause damages to the protected riverbank should be prohibited.

In terms of villagers’ perceptions on importance of soil management and soil erosion protection, the results generally indicated that most villagers had some knowledge and awareness of the importance of the bank protection.

Various aspects of the findings and results from this survey can be used for consideration or as references for the construction and management of riverbank protection within Vientiane City, particularly in the four survey villages.

## **2.4. Environmental Impact**

### **2.4.1 General Impact on Local People**

Construction works for the riverbank protection including Soda mattress will mostly conducted only on the slopes of the riverbank or within the river. Because the some riverbank slopes including areas inundated in rainy season are utilized and possessed by the local people, the some riverbank protection plans will require land acquisitions including clopping areas. However, the riverbank protection works will not require resettlement of the local people in all areas.

Small boats are used for movement, transportation and fishery by the local people in the most areas. Many access paths to landing places, wharves and fishponds are constructed by the local people on the most riverbank including steep bank. Unsuitable riverbank protection designs will disturb the access to Mekong River of the local people. Soda mattress may disturb landing of these boat. However, these disturbances will be avoidable or mitigable by the discussions with the affected people, explains about structures and proper bank protection designs.

### **2.4.2 General Impact on Forest Resources**

Soda mattresses require plenty of wooden branches. The branches used for the Soda mattresses of the pilot works conducted in February – March 2003 was provided from degraded forests allocated to personals and villages in Vientiane suburbs. According to the monitoring of these forests, because the collection of these branches did not require major tree-felling, cutting big trees and a large quantity to the total forest biomass, the impact on the forest resources was negligible. Judging from this result, the forest damages caused by the branch collection will be limited and recoverable. However, the excessive collections from the restricted forests may have an ecological affect on the forests. The forest damages will be avoidable by the collection works conducted widely and shallowly.

Some protected areas and district forest reserves are located in Vientiane Prefecture. Because tree-felling in these protected forests is prohibited by the Forestry Law, the branch collection from the protected forests including the buffer zone should be avoided.

### **2.4.3 General Impact of Construction Works**

Convey of construction materials, especially rocks from the quarry site, heavy equipment operation and earthworks will generate harmful dust. Earthworks and placing rocks will generate turbid water and may cause a temporary increase of soil erosion. Heavy equipment operation will generate noise and vibration. Moreover, construction waste such as fragments of wood, surplus soil, left ropes, trash and garbage from construction workers will generate during construction works. These problems caused by construction works are

unavoidable to some degree. These impacts will be mitigable the proper construction plans, advance explains to the local people about the construction plan and discussions with the affected people.

Because of the construction works, the economic activity by the local people or entities near the riverbank and the access to Mekong River of the local people may be disturbed. However, these disturbances are temporary and limited, and will be avoidable through the discussions between the contractors and the affected people.

According to the interviews to the local people during the pilot works in the sites, the respondents fully agreed on the pilot works and had no complaints to the construction works.

#### **2.4.4 Initial environmental examination (IEE)**

This section describes the environmental impacts of the four (4) sites with cliffy riverbanks involving the Objective Stretches of the Master Plan proposed in Chapter 10. The environmental check items are based on “JICA Environmental Guideline on Rivers and Sediment Control”. Only check items concerned with the projects in the Master Plan are selected. The results of the initial environmental examination (IEE) on the bank protection projects in four (4) sites are summarized in Table 2.17.

**Table 2.17 (1/4) Result of IEE (Sithantai Site)**

Project Components	: Riverbank protection works
Riverbank Length	: 7.51 km (Ban Dongphosi - Sithantai)
Land Use / Riverbank Type of Site	: Industrial Area, Farmland / Cliff
Major Facilities of Site	: Lao State Fuel Company, National Culture Park, Intake facility for irrigation, Rural road

Check Item	During Construction		Operation	
	Assessment of Impact	Mitigating Measures	Assessment of Impact	Mitigating Measures
Social Environment				
Resettlement	D		D	
Economic Activity	C	Construction might impose inconvenience to the activity	D	
Traffic and public facilities	B	Construction might impose inconvenience to traffic	D	
Split of communities	D		D	
Cultural property	B	Construction might cause accidental damage	D	
Water rights, Right of common	D		D	
Public health condition	D		D	
Waste	B	Littered construction waste	D	
Hazard	B	Risk of fire at Soda stockyard	D	
Natural Environment				
Topography and geology	D		D	
Soil erosion	B	Erosion caused by excessive cutting of Soda material	C	Erosion by damage of bank protection works
Groundwater	D		D	
Hydrological situation	D		D	
Coastal zone	D		D	
Flora and fauna	B	Impact caused by excessive cutting of Soda material	D	
Landscape	D		C	Change by vegetation growth on bank protection works
Public Nuisance				
Air pollution	B	Dust by heavy equipment	D	
Water pollution	D		D	
Soil contamination	D		D	
Noise and vibration	C	Heavy equipment operation affects residents near site	D	
Ground subsidence	D		D	
General Assessment: Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion and landscape will be needed during operation.				

Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact

**Table 2.17 (2/4) Result of IEE (Ban Hom Site)**

Project Components	: Riverbank protection works
Riverbank Length	: 2.61 km
Land Use / Riverbank Type of Site	: Residential Area, Farmland / Cliff
Major Facilities of Site	: Rural road

Check Item	During Construction		Assessment of Impact	Mitigation Measures	Operation
	Assessment of Impact	Mitigation Measures			
Social Environment					
Resettlement	D				
Economic Activity	C	Construction might impose inconvenience to the activity		Proper construction plan, measures against complaint	D
Traffic and public facilities	B	Construction might impose inconvenience to traffic		Proper construction plan, measures against complaint	D
Split of communities	D				D
Cultural property	C	Construction might cause accidental damage		Proper construction plan, measures against complaint	D
Water rights, Right of common	D				D
Public health condition	D				D
Waste	B	Littered construction waste		Proper disposal plan	D
Hazard	C	Risk of fire at Soda stockyard		Fire management	D
Natural Environment					
Topography and geology	D				
Soil erosion	B	Erosion caused by excessive cutting of Soda material		Proper design and construction plan	C
Groundwater	D				D
Hydrological situation	D				D
Coastal zone	D				D
Flora and fauna	B	Impact caused by excessive cutting of Soda material		Proper tree-felling management	D
Landscape	D				D
Public Nuisance					
Air pollution	B	Dust by heavy equipment		Water spray during operation	D
Water pollution	D				D
Soil contamination	D				D
Noise and vibration	B	Heavy equipment operation affects residents near site		Proper construction plan, measures against complaint	D
Ground subsidence	D				D

General Assessment: Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion will be needed during operation.  
 Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact

**Table 2.17 (3/4) Result of IEE (Bo O Site)**

Project Components : Riverbank protection works Riverbank Length : 5.12 km (Hatdokka - Bo O) Land Use / Riverbank Type of Site : Residential Area, Farmland / Cliff Major Facilities of Site : Bo O Temple, Rural road, Fish farm				
Check Item	During Construction		Assessment	Operation
	Assessment	Mitigation Measures		
<b>Social Environment</b>				
Resettlement	D		D	
Economic Activity	C	Construction might affect residential area and fish farm	D	
Traffic and public facilities	B	Construction might obstruct access to river	D	
Split of communities	D	Proper construction plan, Measures against complaint	D	
Cultural property	C	Construction might cause accidental damage	D	
Water rights, Right of common	D		D	
Public health condition	D		D	
Waste	B	Littered construction waste	D	
Hazard	D		C	Steep slope in residential area
<b>Natural Environment</b>				
Topography and geology	D		D	
Soil erosion	B	Erosion caused by excessive cutting of Soda material	C	Erosion by damage of bank protection works
Groundwater	D		D	
Hydrological situation	D		D	
Coastal zone	D		D	
Flora and fauna	B	Impact caused by excessive cutting of Soda material	D	
Landscape	D		D	
<b>Public Nuisance</b>				
Air pollution	B	Dust by heavy equipment	D	
Water pollution	D		D	
Soil contamination	D		D	
Noise and vibration	B	Heavy equipment operation affects residents near site	D	
Ground subsidence	D		D	
General Assessment: Major environmental impacts will occur at only construction stage. But the monitoring program of the riverbank from a viewpoint of erosion and safety will be needed during operation. Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact				

**Table 2.17 (4/4) Result of IEE (Sibounheuang - Muang Wa Site)**

Project Components		: Riverbank protection works			
Riverbank Length		: 3.94 km (Muang Wa - Kaoliao Port)			
Land Use / Riverbank Type of Site		: Residential Area, Industrial area, Farmland / Cliff			
Major Facilities of Site		: Temples, Kaoliao Port, Factories, Intake facility for water supply (Kaoliao Plant), Rural road			
Check Item	During Construction		Operation		
	Assessment	Mitigation Measures	Assessment	Mitigation Measures	
<b>Social Environment</b>					
Resettlement	D		D		
Economic Activity	C	Construction might affect residential or industrial areas	D	Proper construction plan, measures against complaint	
Traffic and public facilities	B	Construction might obstruct access to river	D	Proper construction plan, measures against complaint	
Split of communities	D		D		
Cultural property	C	Construction might cause accidental damage	D	Proper construction plan and management	
Water rights, Right of common	D		D		
Public health condition	D		D		
Waste	B	Littered construction waste	D	Proper disposal plan	
Hazard	D		C	Steep slope in residential area	
<b>Natural Environment</b>					
Topography and geology	D		D		
Soil erosion	B	Erosion caused by excessive cutting of Soda material	C	Erosion by damage of bank protection works	
Groundwater	D		D		
Hydrological situation	D		D		
Coastal zone	D		D		
Flora and fauna	B	Impact caused by excessive cutting of Soda material	D		
Landscape	D		D		
<b>Public Nuisance</b>					
Air pollution	B	Dust by heavy equipment	D	Water spray during operation	
Water pollution	D		D		
Soil contamination	D		D		
Noise and vibration	B	Heavy equipment operation affects residents near site	D	Proper construction plan, measures against complaint	
Ground subsidence	D		D		
General Assessment: Major environmental impacts will occur at only construction stage. However, the monitoring program of the riverbank from a viewpoint of erosion and safety will be needed during operation.					

Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact

## **2.5 Recommendation**

According to the interviews to the local people in the Pilot Work sites, the residents had not been got any information of the pilot works before the beginning of the construction. The riverbank protection works are a very important matter of concern to the local people, especially the residents living along riverbanks with critical situation and without protection works. In case of the riverbank protection conducted by DCTPC, the contents of the protection works are generally informed to the local people through the village chief in advance, the serious troubles related to the informing have not occurred. Therefore, the riverbank protection plan should be thoroughly disclosed to the local people as soon as possible.

The engineers in the MCTPC do not have enough experience about forest management. Therefore, to manage the tree-felling activities from a viewpoint of forest ecology, The engineers in the MCTPC should consult an expert of forest management at the stage of Soda material collection.

Based on the findings and results from the questionnaire survey, other recommendations for “The Study on Mekong Riverbank Protection around Vientiane Municipality” are as follows:

The design and construction of riverbank protection should be harmonized with the social and natural conditions of each area.

The participation of local organizations and villagers in management and protection of the riverbank protection is very important.

Issuing and promulgating village regulations for the use, management and protection of the riverbank is also important.

The conditions of riverbank protection must annually be monitored and evaluated in order to conduct maintenance.



## **SECTOR J**

### **TRANSFER OF TECHNOLOGY**

**THE STUDY ON MEKONG RIVERBANK PROTECTION  
AROUND VIENTIANE MUNICIPALITY  
IN THE LAO PEOPLE’S DEMOCRATIC REPUBLIC**

**FINAL REPORT  
VOLUME 4  
-SUPPORTING REPORT-**

**SECTOR J**

**TRANSFER OF TECHNOLOGY**

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## SECTOR J

### TRANSFER OF TECHNOLOGY

#### 1 TECHNOLOGY TRANSFER SEMINAR

Technology transfer seminars were held twice at Lao Plaza Hotel, Vientiane in the course of the Study, i.e., the first seminar on October 4, 2002 before the execution of the Pilot Work and the second seminar on October 12, 2004 after the formulation of riverbank protection master plan. The objective of the seminars was to exchange technical ideas as well as to transfer technology by promoting further understanding of bank protection works and the Study results. The JICA Study Team organized the Seminars in cooperation and assistance with MCTPC to include various bank protection-related themes presented by both Laotian and Japanese speakers and free discussion sessions by all attendants.

The program of the seminars including themes, speakers and schedule are presented in Appendixes 1 and 2.

#### 2 INDOOR AND FIELD SESSION

The following two small sessions was held in January and February, 2004 (4th Work in Lao P.D.R.) to transfer technology and to exchange technical ideas. The agendas are appended to this Sector as Appendixes 3 and 4.

Type	Date	Venue	Objective and Contents
Indoor Session	2004/01/26 (14:00~18:00)	Meeting Room in MCTPC	Presentation and discussion to exchange technical ideas with the Laotian relating agencies and to make the Study information public by promoting the process & results up to date
Field Session	2004/02/10 (13:30~15:30)	Nongheo site (along Thadeua road)	Demonstration of simple vegetation riverbank protection works by the Study Team using Soda technique, that is expected to be applied to the independent bank protection activities by resident's participation

#### 3 TECHNICAL GUIDANCE FOR SODA TECHNIQUE

Technical guidance for Soda (fascine) technique, traditional river works of Japan was held by

Soda Technique experts of the Study Team as a part of technical transfer through the execution of the pilot works. The outline of guidance is as follows:

1. Period: February and March 2003 (2nd Work in Lao P.D.R.)
2. Location: pilot work sites including Soda stock yards and Soda material collecting sites
3. Items:
  - a) Soda Mattress work: 1) preparation works (selection, collection and trimming of materials), 2) assembling of mattress and 3) installation of mattress
  - b) Cobble stone with willow branch work (Demonstration of assembling was conducted by using a model slope prepared at Ban Dongphosi site attended by many participants from counterpart personnel of MCTPC/DCTPC, contractor and the Study Team.)

#### **4 COUNTERPART TRAINING IN JAPAN**

Counterpart training in Japan was conducted in 2002 mainly to learn “Soda Technique” prior to the execution of the Pilot Works in the Study Area as follows:

1. Trainee:
  - a) Mr. Viengsavanh PHASAVATH, MCTPC
  - b) Mr. Somchith SITHIPHONG, DCTPC
2. Period:
  - a) Mr. Viengsavanh PHASAVATH (2002/08/15 - 2002/09/28)
  - b) Mr. Somchith SITHIPHONG (2002/08/26 - 2002/09/28)
3. Main training items:
  - a) Learning Soda technique, traditional river works in Japan by outdoor training in Niigata, Japan
  - b) Learning traditional/ modern river works in Japan by indoor lecture and field tour
4. Training institutes:
  - a) Hokuriku Regional Development Bureau, Ministry of Land, Infrastructure and Transport
  - b) Kinki Regional Development Bureau, Ministry of Land, Infrastructure and Transport
  - c) Foundation for Riverfront Improvement and Restoration
  - d) NIKKEN Consultants, Inc.
  - e) NEWJEC Inc.
  - f) Hokuriku Soda Industry Development Association

## **5 TRANSFER OF TECHNOLOGY TO COUNTERPART**

The contents and result of the technology transfer to the MCTPC counterpart (C/P) through the teamwork with the Study Team are shown in Table 4.1. It is considered that in general good result was obtained. However, in view of the challenge described in Table 5.1, in order for Lao side to be able to implement the M/P project independently in the future, continuous Japanese technical cooperation will be desired for several years.

**Table 5.1 Transfer of Technology to Counterpart**

	Contents	Result	Future Challenge
Study and Planning	A series of basic study and planning work relating to the Master Plan	C/P understood the procedure and outline of work required for M/P planning.	-Future M/P revision by themselves -Systematic study of river engineering
	Preparation of manual for riverbank protection	C/P understood the contents of the manual.	The revision and the Laotian translation by themselves
	Field investigation for the design of the M/P project	C/P carried out topographical survey by themselves under conditions similar to the Pilot Work (Sibounheuang – Muang Wa Site).	Investigation for other M/P project sites with some unknown factor
	Explanation of contents of the Study and the Pilot Works to the agencies concerned	-C/P prepared PowerPoint materials (Laotian) by themselves and performed effective presentation at the technology transfer seminar and the MCTPC departmental meeting. -C/P carried out the explanation to related research group and the seminar for provincial MCTPC with the assistance of JICA experts.	C/P plans and organized seminars for public relations of the M/P projects.
Design	Preparation of the plan of bank protection facilities by CAD	C/P created the plan of simple bank protection works by themselves, and assisted the Study Team (when basal condition was ready).	Design under conditions with some unknown factor
	Design of the M/P projects	C/P designed a M/P project by themselves under conditions similar to the Pilot Work (Sibounheuang – Muang Wa Site).	Design for other M/P project sites with some unknown factor
Construction	Acquisition of Soda technique required for execution of traditional river works of Japan	C/P mastered collection of Soda material, and the assembling of Soda mattress to some extent through on-the-job training in Japan.	Spread, tradition and localization of Soda Technique
	Acquisition of bank protection works through execution of the Pilot Works	-C/P understood detailed process of bank protection works practically by teamwork with the Study Team. -C/P assisted the supervision by the Study Team. -C/P conducted quality control of Soda material based on training experience in Japan.	Sustainable implementation of the M/P project by themselves
	Acquisition of simple vegetation bank protection works	C/P understood the construction process practically by teamwork with the Study Team.	Spread and support of the construction by C/P to riverine local community
Monitoring and Maintenance	Periodical visual inspection of the completed Pilot Works	C/P carried it out and reported the result to the Study Team by e-mail.	Correspondence at the M/P project site with some unknown factor
	Arrangement with the chart of monitoring result (change in water level and topography) of the Pilot Works	C/P arranged the result with charts (MS Excel, AutoCAD) by themselves.	
	Acquisition of data of automatic water gauge	C/P performed the computer processing by themselves.	
	Installation of staff gauge and observation of daily water level	C/P have observed the water level and repaired the gauge after damaged, which was originally installed by the Study Team.	
Organization and Institution	The necessity for permanent organization establishment for the M/P implementation	C/P recognizes necessity and is working towards setting up the organization.	Setting up a permanent organization for riverbank protection
Human Resources Development	Explanation to the public of the contents of the Study and the Pilot Works	C/P gave lectures on the Study content to the trainee of faculty of technology, National university of Laos on their own.	<ul style="list-style-type: none"> <li>• Giving lectures at the university</li> <li>• Continuous acceptance of the trainee</li> <li>• Enlightenment of local residents</li> </ul>

# **APPENDICES**

**APPENDIX 1**

**PROGRAM OF FIRST TECHNOLOGY  
TRANSFER SEMINAR**



**JICA STUDY  
ON  
MEKONG RIVERBANK PROTECTION AROUND  
VIENTIANE MUNICIPALITY  
IN  
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC**

**FIRST TECHNOLOGY TRANSFER SEMINAR**

**TABLE OF CONTENTS**

- I. BACKGROUND OF THE STUDY
- II. OBJECTIVES OF THE SEMINAR
- III. ORGANIZATION OF THE SEMINAR
- IV. PARTICIPANTS
- V. DATE AND VENUE
- VI. PROGRAM
- VII. APPENDICES:
  - A List of Attendants

## **I. BACKGROUND OF THE STUDY**

Vientiane Municipality has been suffering from damages due to bank erosion of the Mekong River. The damages extend to municipal roads, urban lands, houses and electric cables. The national road, Route 13, has a menace of the erosion. In order to cope with this erosion situation, the Government of Lao P.D.R. executed the bank protection works mainly with gabions. The gabion works, however, are costly because of imported iron wire mesh basket.

JICA Expert dispatched to Government of Lao P.D.R. from 1997 implemented, in a tentative manner, low-cost groin works in Bokeo Province with local materials and labor forces. In addition, Infrastructure Development Institute Japan implemented bank protection test works at Sibounheuang in Vientiane Municipality from 1999 to 2001 introducing Soda mattress works, a traditional bank protection works in Japan. These works proved the favorable results.

With these backgrounds, the Government of Japan has decided to conduct the Study on Mekong Riverbank Protection around Vientiane Municipality in the Lao P.D.R. (hereinafter referred as to “the Study”). JICA, who is responsible for the implementation of the technical cooperation of the Government of Japan, has entrusted the Study work with the cooperation of the Ministry of Communication, Transport, Post and Construction (MCTPC), who acts as a coordinating body in relation with relevant organizations concerned for the smooth implementation of the Study

## **II. OBJECTIVES OF THE SEMINAR**

Technology transfer to the Laotian counterpart personnel and relating agencies is one of the major objectives of the Study to implement a series of bank protection activities such as planning, designing, construction, management and maintenance in sustainable manner by themselves. Technology transfer seminar is one of effective approaches not only to transfer technology but exchange technical ideas by promoting further understanding of the bank protection works and the results of the Study. The seminars are scheduled twice, i.e., this first seminar before the execution of pilot bank protection works as an major component of the Study and the second seminar after formulation of the bank protection master plan around Vientiane Municipality.

This is the first seminar covering the following themes:

1. To introduce the concept and general results of the JICA Study during first work in Lao P.D.R.
2. To introduce existing riverbank protection works implemented in Lao P.D.R. by Laotian engineer
3. To introduce the outline of the pilot riverbank protection works to be executed by the Study Team
4. To introduce “Soda Mattress Work in Japan Now” (by Video)
5. To introduce the result of counterpart training in Japan by Laotian counterpart
6. To introduce river bank protection work with low cost materials

### **III. ORGANIZATION OF THE SEMINAR**

The JICA Study Team organizes the Seminar in cooperation and assistance with MCTPC. The Seminar is organized to include various bank protection-related themes to be presented by both Laotian and Japanese speakers and free discussion sessions by all attendants. Constructive comments and discussions will be highly appreciated for the implementation of this JICA Study as well as any related projects that may be carried out in near future.

### **IV. PARTICIPANTS**

Around 80 participants attend the Seminar. They represent the Laotian side including MCTPC, the Department of Communication, Transport, Post and Construction, Vientiane Municipality (DCTPC), Vientiane Urbane Development and Administration Authority (VUDAA), Lao National Mekong Committee, the Ministry of Agriculture and Forestry and National University of Laos. They also represent the Japanese side including Embassy of Japan, JICA Laos Office and JICA Study Team. List of the participants and their corresponding body are shown in Appendix A.

**V. DATE, VENUE AND FACILITIES**

Date : October 4, 2002  
Duration: One Day (9:00~15:30)  
Venue : Grand Ballroom of Lao Plaza Hotel, Vientiane, Lao P.D.R.  
Equipments: Multimedia Projector, Overhead Projector, TV & Video Set, etc.  
Interpreter: An English /Laotian interpreter is available

**VI. PROGRAM**

The themes, speakers and schedule of the Seminar are presented in Attachment 1.

Attachment 1

**Ministry of Communication,  
Transport, Post and Construction**

**Japan International Cooperation Agency**

**Study Team for Mekong Riverbank  
Protection around Vientiane  
Municipality in the Lao P.D.R.**

**Vientiane, 4 October 2002 – Grand Ballroom of Lao Plaza Hotel**

**Program:**

<b>Time</b>	<b>Theme</b>	<b>Speaker</b>
<b>&lt;Session I&gt;</b>		
9:00 ~ 9:15	Key Notes Opening Speech	Mr. Sommad Pholsena, Vice Minister of MCTPC
9:15 ~ 9:45	Introduction of the Study on Mekong Riverbank Protection around Vientiane Municipality	Mr. Yasuhiko Kato, Team Leader of the Study Team
9:45 ~ 10:15	Introduction of Existing Riverbank Protection Works in Lao P.D.R.	Mr. Somchith Sithiphong, Bank Protection Project Manager, DCTPC
10:15 ~ 10:30	Break	
10:30 ~ 11:00	Outline of Pilot Riverbank Protection Works as a Major Component of the Study	Dr. Rokuro Kobayashi, Co-Team Leader of the Study Team
11:00 ~ 11:30	“Soda Mattress Work in Japan Now” (Introduction of the Latest Traditional River Work Method in Japan)	Showing of TV Program in Japan (Video)
<b>&lt; Buffet Lunch &gt; 11:30 ~ 13:00</b>		
<b>&lt;Session II&gt;</b>		
13:00 ~13:45	Introduction of the Result of Counterpart Training in Japan	Mr. Viengsavanh Phasavath, Leader of the Counterpart for the JICA Study Team, MCTPC
13:45 ~ 14:30	River Bank Protection Work with Low Cost Materials	Mr. Bounthieng Venvongsoth, Co-leader of the Counterpart for the JICA Study Team, MCTPC
14:30 ~ 14:50	Break	
14:50 ~ 15:20	Free Discussion	Chaired by Mr. Yasuhiko Kato, Team Leader of the Study Team
15:20 ~ 15:30	Closing Address	Mr. Sommad Pholsena, Vice Minister of MCTPC

**APPENDIX 2**

**PROGRAM OF SECOND TECHNOLOGY  
TRANSFER SEMINAR**

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
THE GOVERNMENT OF LAO P.D.R.

**THE STUDY**  
**ON**  
**MEKONG RIVERBANK PROTECTION AROUND**  
**VIENTIANE MUNICIPALITY**  
**IN**  
**THE LAO PEOPLE'S DEMOCRATIC REPUBLIC**

**SECOND TECHNOLOGY TRANSFER SEMINAR**

**ON**

**MEKONG RIVERBANK PROTECTION**  
**AROUND VIENTIANE CITY**

**TABLE OF CONTENTS (DRAFT)**

- VIII. BACKGROUND OF THE STUDY
- IX. OBJECTIVES OF THE SEMINAR
- X. ORGANIZATION OF THE SEMINAR
- XI. PARTICIPANTS
- XII. DATE AND VENUE
- XIII. PROGRAM

## **I. BACKGROUND OF THE JICA STUDY**

Vientiane City has been suffering from damages due to riverbank erosion of the Mekong River. The damages extend to main roads, urban lands, houses, oil stockpiling bases, factories and electric cables. In order to cope with this erosion situation, the Government of Lao P.D.R. (the GOL) executed the bank protection works mainly with gabions. The gabion works, however, are costly because of imported iron wire mesh basket.

JICA Expert dispatched to the GOL from 1997 implemented, in a tentative manner, low-cost groin works in Bokeo Province with local stone materials and labor forces. In addition, Infrastructure Development Institute Japan (IDI) implemented bank protection test works at Sibounheuang in Vientiane City from 1999 to 2001 introducing Soda mattress works, a traditional river works in Japan. These works proved the favorable results.

With these backgrounds, the Government of Japan (the GOJ) decided to conduct “The Study on Mekong Riverbank Protection around Vientiane Municipality in the Lao P.D.R. (the Study)”. JICA, who is responsible for the implementation of the technical cooperation of the Government of Japan, has entrusted the Study work since 2001 with the cooperation of the Ministry of Communication, Transport, Post and Construction (the MCTPC), who acts as a coordinating body in relation with relevant organizations concerned for the smooth implementation of the Study.

The overall work schedule of the Study is as follows and the Study has nearly reached its final stage:

1. 1st year (Dec. 2001-Mar. 2002): Basic study in the Study area
2. 2nd year (Oct. 2002- Mar. 2003): Execution of Pilot Riverbank Protection Works at 3 sites (L=1,040 m in total) in Vientiane, Ban Dongphosi, Wat Chom Cheng and Sibounheuang Sites, introducing Japanese traditional river works
3. 3rd year (Apr. 2003- Feb.2004)
  - (1) Execution of the Pilot Works (remaining part) (Apr- May 2003)
  - (2) Monitoring of the Pilot Works (June 2003 -)
  - (3) Formulation of “Riverbank Protection Master Plan around Vientiane City”



(Dec.2003- Feb. 2004)

4. 4th year (Aug. 2004- Dec. 2004): Monitoring of the Pilot Works
  - (1) Draft Final Report & 2nd Technology Transfer Seminar: October 2004
  - (2) Final Report: December 2004

## **II. OBJECTIVES OF THE SEMINAR**

Exchange technical ideas with the Laotian counterpart personnel and relating agencies is one of the essentials of the Study to implement a series of bank protection activities such as planning, designing, construction, management & maintenance in sustainable manner by the GOL according to the Master Plan formulated by the Study. The Seminar is one of effective approaches not only to exchange technical ideas but make the Study information public by promoting further understanding of the bank protection works and the process & results of the Study.

## **III. ORGANIZATION OF THE SEMINAR**

JICA Study Team organizes the 2nd Seminar in cooperation and assistance with the MCTPC. The Seminar is organized to include several bank protection-related themes by both Laotian and Japanese speakers and free discussion sessions by all attendants. Constructive comments and discussions will be highly appreciated for the future riverbank protection activities by the GOL as well as any related projects that may be carried out in near future.

## **IV. PARTICIPANTS**

Around 100 participants will attend the Seminar. They represent the Laotian side including MCTPC, the Department of Communication, Transport, Post and Construction, Vientiane Municipality (DCTPC), Vientiane Urbane Development and Administration Authority (VUDAA), Lao National Mekong Committee, National University of Laos. They represent relating donors and NGO's including ADB, Flanders International Technical Agency (FITA), World Wide Fund for Nature (WWF) and Japan International Volunteer Center (JVC). They also represent the Japanese side including Embassy of Japan, JICA Laos Office and JICA Study Team.

**V. DATE, VENUE AND FACILITIES**

Date : 12<sup>th</sup> October, 2004  
Duration: One Day (9:00~17:00)  
Venue : Conference Hall of NOVOTEL Hotel,  
Vientiane, Lao PDR  
Dress: Comfortable  
Equipments: Multimedia Projector, Overhead Projector, etc.  
Interpreter: English /Laotian and Japanese /Laotian interpreters are available

**VI. PROGRAM**

The themes, speakers and schedule of the Seminar are presented in Attachment 1.

**Ministry of Communication,  
Transport, Post and Construction**

**Japan International Cooperation Agency**

**JICA Study Team for Mekong Riverbank  
Protection around Vientiane  
Municipality in the Lao P.D.R.**

**-Vientiane, 12<sup>th</sup> October , 2004-**

**Conference Hall of NOVOTEL VIENTIANE**

**Program:**

<b>Time</b>	<b>Theme</b>	<b>Speaker</b>
<b>&lt;Session I&gt;</b>		
9:00 ~ 9:15	Keynote Opening Speech	Mr. Sommad Pholsena, Vice Minister, MCTPC
9:15 ~ 10:00	Keynote Lecture (Riverfront Improvement and Restoration in Japan Now)	Mr. Masamitsu Mizuno, Leader of the Advisory Committee for the Study (Foundation for Riverfront Improvement and Restoration, Japan)
10:00 ~ 10:45	Introduction of the Study on Mekong Riverbank Protection around Vientiane City	Mr. Yasuhiko Kato, Team Leader of the Study Team
10:45 ~ 11:00	Coffee Break	
11:00 ~ 11:45	Introduction of Design Procedure on Riverbank Protection Works and Technical Guidance of Soda Technique	Dr. Rokuro Kobayashi, Co-Team Leader of the Study Team
11:45 ~ 12:15	Test of Riverbank Protection by Willow Planting in the Mekong River	Dr. Sengdeuane Wayakone, National University of Laos
<b>&lt; Buffet Lunch &gt; 12:15 ~ 13:30: for every participants free of charge</b>		
<b>&lt;Session II&gt;</b>		
13:30 ~ 14:15	Special Lecture (River Morphology and Natural Disaster around Vientiane City)	Dr. Masahiko Oya, Honorary Professor of Waseda University, Japan
14:15 ~ 14:45	History of Riverbank Protection Works around Vientiane City	Mr. Somchith Sithiphong, Bank Protection Project Manager, DCTPC
14:45 ~ 15:00	Coffee Break	
15:00 ~ 15:45	Introduction of Future Riverbank Protection Activities around Vientiane City by the Government of Lao PDR	Mr. Viengsavanh Phasavath, Leader of the MCTPC Counterpart for the JICA Study
15:45 ~ 16:55	Free Discussion	Chaired by Mr. Viengsavanh Phasavath, Leader of the MCTPC Counterpart for the JICA Study
16:55 ~ 17:00	Closing Address	Mr. Viengsavath Siphandone, Director General of Department of Roads, MCTPC

**APPENDIX 3**


**SESSION ON MEKONG RIVERBANK  
PROTECTION AROUND VIENTIANE CITY**

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
THE GOVERNMENT OF LAO P.D.R.

**THE STUDY  
ON  
MEKONG RIVERBANK PROTECTION AROUND  
VIENTIANE MUNICIPALITY  
IN  
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC**

**SESSION ON  
MEKONG RIVERBANK PROTECTION  
AROUND VIENTIANE CITY**

**TABLE OF CONTENTS**

- XIV. BACKGROUND OF THE JICA STUDY
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  - XVI. ORGANIZATION OF THE SESSION
  - XVII. PARTICIPANTS
  - XVIII. DATE AND VENUE
  - XIX. PROGRAM
- 

## I. BACKGROUND OF THE JICA STUDY

Vientiane City has been suffering from damages due to riverbank erosion of the Mekong River. The damages extend to main roads, urban lands, houses and electric cables. In order to cope with this erosion situation, the Government of Lao P.D.R. (the GOL) executed the bank protection works mainly with gabions. The gabion works, however, are costly because of imported iron wire mesh basket.

JICA Expert dispatched to the GOL from 1997 implemented, in a tentative manner, low-cost groin works in Bokeo Province with local stone materials and labor forces. In addition, Infrastructure Development Institute Japan (IDI) implemented bank protection test works at Sibounheuang in Vientiane City from 1999 to 2001 introducing Soda mattress works, a traditional river works in Japan. These works proved the favorable results.

With these backgrounds, the Government of Japan (the GOJ) has decided to conduct the Study on Mekong Riverbank Protection around Vientiane Municipality in the Lao P.D.R. (the Study). JICA, who is responsible for the implementation of the technical cooperation of the Government of Japan, has entrusted the Study work since 2001 with the cooperation of the Ministry of Communication, Transport, Post and Construction (the MCTPC), who acts as a coordinating body in relation with relevant organizations concerned for the smooth implementation of the Study.

The overall work schedule of the Study is as follows and the Study is now during the Master Plan formulation stage:

5. 1st year (Dec. 2001-Mar. 2002): Basic study in the Study area
6. 2nd year (Oct. 2002- Mar. 2003): Execution of Pilot Riverbank Protection Works at 3 sites (L=1,040 m in total) in Vientiane, Ban Dongphosi, Wat Chom Cheng and Sibounheuang Sites, introducing Japanese traditional river works
7. 3rd year (Apr. 2003- Feb.2004)
  - (1) Execution of the Pilot Works (remaining part) (Apr- May 2003)
  - (2) Monitoring of the Pilot Works (June 2003 -)
  - (3) Formulation of “Riverbank Protection Master Plan around Vientiane City” (Dec.2003- Feb. 2004) : Interim Report
8. 4th year (Nov. 2004- Mar. 2005): Monitoring of the Pilot Works
  - (1) Draft Final Report: January 2005

(2) Final Report: March 2005

## **II. OBJECTIVES OF THE SESSION**

Exchange technical ideas with the Laotian counterpart personnel and relating agencies is one of the essentials of the Study to implement a series of bank protection activities such as planning, designing, construction, management & maintenance in sustainable manner by the GOL. The Session is one of effective approaches not only to exchange technical ideas but make the Study information public by promoting further understanding of the bank protection works and the process & results of the Study.

The Session covers the following themes:

7. To introduce the general process & results of the JICA Study especially focusing on the execution of the Pilot Riverbank Protection Works completed in May 2003.
8. To introduce the outline of the design procedure on riverbank protection works
9. To introduce the experience of counterpart training in Japan on riverbank protection in 2002 by Laotian counterpart

## **III. ORGANIZATION OF THE SESSION**

JICA Study Team organizes the Session in cooperation and assistance with the MCTPC. The Session is organized to include several bank protection-related themes to be presented by both Laotian and Japanese speakers and free discussion sessions by all attendants. Constructive comments and discussions will be highly appreciated for the implementation of this JICA Study as well as any related projects that may be carried out in near future.

## **IV. PARTICIPANTS**

Around 30 participants will attend the Session. They represent the Laotian side including MCTPC, the Department of Communication, Transport, Post and Construction, Vientiane Municipality (DCTPC), Vientiane Urbane Development and Administration Authority (VUDAA), Lao National Mekong Committee, National University of Laos. They represent relating donors and NGO's including ADB, Flanders International Technical Agency (FITA), World Wide Fund for Nature (WWF) and Japan International Volunteer Center (JVC). They also represent the Japanese side including Embassy of Japan, JICA Laos Office and JICA Study Team.

**V. DATE, VENUE AND FACILITIES**

Date : January 26, 2004  
Duration: A half day (14:00~17:00)  
Venue : Meeting room in Department of Roads, MCTPC, Vientiane  
Equipments: Multimedia Projector, etc.  
Interpreter: An English /Laotian interpreter is available

**VI. PROGRAM**

The themes, speakers and schedule of the Session are presented in Attachment 1.



**Ministry of Communication,  
Transport, Post and Construction**

**Japan International Cooperation Agency**

**JICA Study Team for Mekong Riverbank  
Protection around Vientiane  
Municipality in the Lao P.D.R.**

**Vientiane, 26 January 2004 – Meeting Room in DOR, MCTPC**

**Program:**

<b>Time</b>	<b>Theme</b>	<b>Speaker</b>
14:00	Opening Address	Mr. Yasuhiko Kato, Team Leader of the Study Team
14:00 ~ 14:45	Introduction of the Study on Mekong Riverbank Protection around Vientiane Municipality	Mr. Yasuhiko Kato, Team Leader of the Study Team
14:45 ~ 15:30	Introduction of Design Procedure on Riverbank Protection Works	Dr. Rokuro Kobayashi, Co-Team Leader of the Study Team
15:30 ~ 15:40	Tea Break	
15:40 ~ 16:20	Introduction of the Counterpart Training in Japan in 2002	Mr. Viengsavanh Phasavath, Leader of the Counterpart for the JICA Study Team, MCTPC
16:20 ~ 17:00	Free Discussion	Chaired by Mr. Yasuhiko Kato, Team Leader of the Study Team
17:00	Closing Address	Mr. Viengsavanh Phasavath, Leader of the Counterpart for the JICA Study Team, MCTPC

**APPENDIX 4**

**SESSION ON SIMPLE VEGETATION  
RIVERBANK PROTECTION WORK**

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
THE GOVERNMENT OF LAO P.D.R.

**THE STUDY  
ON  
MEKONG RIVERBANK PROTECTION AROUND  
VIENTIANE MUNICIPALITY  
IN  
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC**

**SESSION ON  
SINMLE VEGETATION RIVERBANK  
PROTECTION WORK**

**By Mr. Shingo OHASHI  
(JICA SODA Work Expert)**

February 10, 2004

# **Demonstration on Simple Vegetation Riverbank Protection Work**

Objective :

Technical transfer of simple vegetation riverbank protection works using SODA techniques, that is expected to be applied to the riverbank protection by resident people, monks of Temple, and others by themselves.

Demonstrator: Mr. Shingo Ohahshi (JICA Soda expert)  
Assisted by : JICA Study Team and  
National University of Laos

Participants : MCTPC, DCTPC, VUDAA, LNMC, National University of Laos, Embassy of Japan, JICA Laos Office, and others

Location: Nongheo site (Thadeua Road) (Next to the site of simple vegetation riverbank protection test by JICA in 2003-present)

Schedule:

Feb.10 (Tue), 2004:

13:00 Start from MCTPC Parking Lot for the demonstration site  
13:30-15:30 Demonstration

Content of Demonstration:

Simple Vegetation Riverbank Protection Method by Soda Bundle Work and Soda Hurdle Work (see Attachment)

Contact:

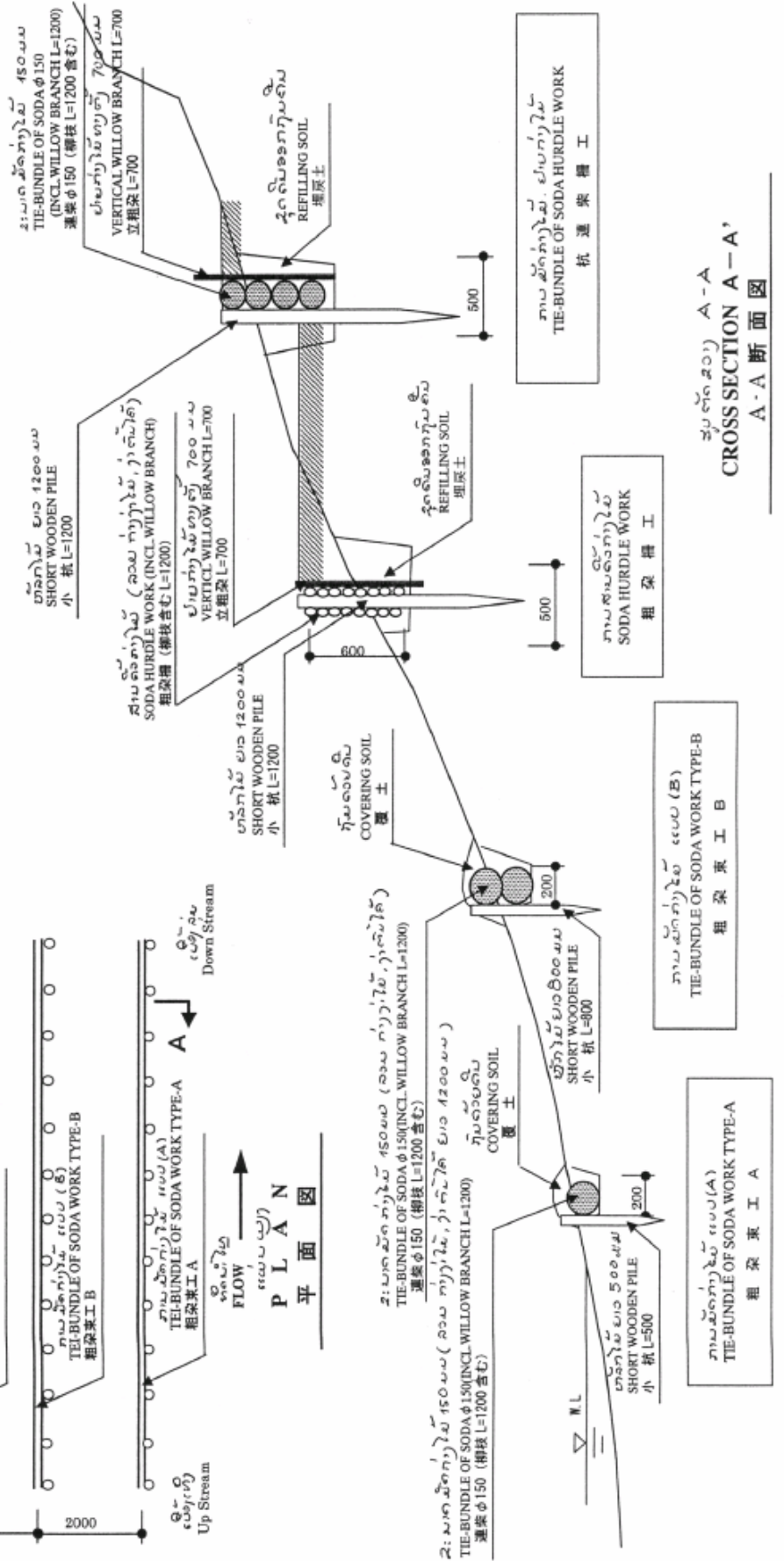
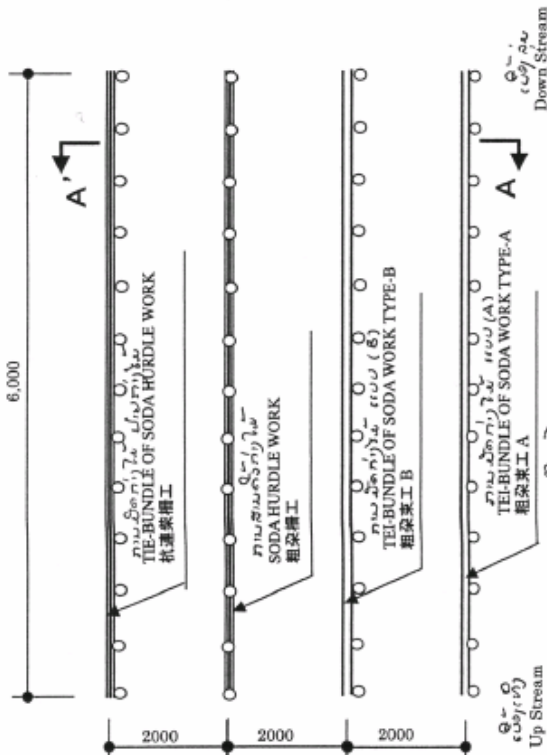
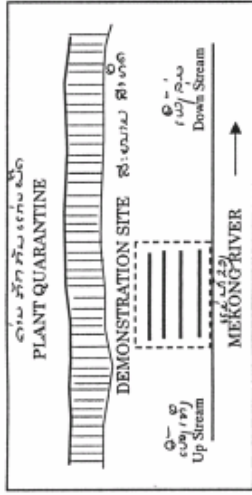
JICA Study Team Office(MCTPC): Tel 021-452482  
Mr. R.Kobayashi(mobile:020-5509028)  
Mr. Viengsavanh(Lao Counterpart) (Tel:021-412288)

Attachment

10/February/2004

ເຕັມພຽງ ການປຸກ ທົ່ມໄກ້ ເພື່ອ ປ້ອງກັນ ຕາຍູ້ເຮືອ

SIMPLE VEGETATION RIVERBANK PROTECTION WORKS



**Location**

