Annex H6.2.5 Economic and Financial Analysis of Drainage Improvement Project in Palembang

(1) Introduction

Preliminary economic evaluation has been conducted for the drainage improvement projects in two drainage systems, Bendung and Buah Systems, which have the most serious drainage issues in Palembang City. The objective of the economic evaluation is to analyze the feasibility of the proposed measures from the viewpoint of national economy. The Projects are analyzed by quantitative method by cost-benefit analysis deriving such indices as EIRR, B/C ratio, and NPV, which are commonly used for economic analyses of the same types of development projects.

(2) Results of Economic Analysis

Results of economic analysis indicated that the project for Bendung System has rather low economic efficiency with EIRR of 11%. However, the project for Buah System has good economic efficiency with EIRR of 19.3%, which is by far higher than the opportunity cost of capital in Indonesia (12%), while implementation of both the projects also indicated sufficient economic efficiency with EIRR of 12.6%. As a flood mitigation project to improve water environment in urban areas, the projects can be justified from the economic viewpoint. The cash flow of the analysis is shown in **Attachment H8** and the results are summarized in **Table AH1**.

Table AH1 Results of Economic Analysis

Project	EIRR (%)	B/C ratio	NPV (Rp. million)
1. Bendung system	11.0	0.91	-1,389
2. Buah system	19.3	1.69	2,451
3. Both Bendung & Buah systems	12.6	1.06	1,062

(3) Basic Conditions for Economic Analysis

The economic analyses of the projects are examined based on the following basic conditions:

a) Price Level and Exchange Rate

The analyses are made at the price level of September 2002 and applied foreign exchange rates are one U.S. dollar equivalent to Rp.9,035 and 100 Japanese Yen equivalent to Rp.7,405.

b) Project Life

The project life depends on the insurability of the facilities. The project life of 50 years after construction of all the facilities is assumed for the economic analysis. The residual value of the facilities at the end of project life was neglected since it does not give significant effect for the results of the analyses.

c) Discount Rate

A discount rate of 12% is applied. The rate has been adopted for economic analyses of similar projects in Indonesia.

d) Standard Conversion Factor (SCF)

The standard conversion factor (SCF) of 0.90 is applied to adjust the effects of trade distortion and the local costs for non-traded goods and services. The process to estimate SCF is presented in **Attachment H1**.

e) Transfer Payment

From the viewpoint of national economy, the transfer payment such as taxes, duty, subsidy and interest is merely a domestic monetary movement without direct productivity. Therefore, it is excluded from the costs of goods and services in the economic analysis.

f) Economic Project Cost

The economic project costs are estimated from the financial project cost adjusting by SCF after deducting the direct transfer payment.

g) Operation and Maintenance Cost

For the civil construction works such as river facilities, 0.5% of construction cost is assumed as operation and maintenance cost of the facilities.

(4) Flood Condition in Palembang City

According to "Program Jangka Menengah Sektor Drainase (Middle-term Drainage Sector Program), Project Preparation of Palembang Urban Development Program II, ADB Loan 1383 INO", there are 59 locations which suffer frequent inundation. The major causes of the inundation are heavy rainfalls when water level of the Musi River is high due to high tide, low-lying geography, and insufficient drainage capacity. The city consists of 19 drainage systems. The flood prone locations and flood conditions by drainage system are presented in **Attachment H2** and **H3**.

As seen in **Attachment H2**, though depth of inundation is not very deep, frequency of inundation is quite often. According to people in the areas, inundation occurs several times a year. As a result, living environment in the inundation areas, especially sanitary condition, is very poor. The children in the area suffer skin diseases, stomachache, and flu frequently after inundation.

Before, people used to build wooden stilt houses in such areas. However, since the price of wood has risen remarkably these years, people tend to build common

semi-permanent and permanent houses and these houses suffer from frequent inundation.

After review of all the 19 drainage systems by site reconnaissance and hearing from KIMPRASWIL Kota Palembang, it became evident that drainage improvement works and construction of new retention ponds have been implemented little by little and the flood conditions of several locations have already been improved. Land uses of suburb areas remain agricultural lands, fallow lands, or swampy areas, facility measures are not always necessary. Based on these circumstances, taking into consideration of present and future land uses, facility measures, rehabilitation of trunk drainage channels, and non-facility measures including community drainage management are proposed by the Study Team as summarized in **Attachment H4**.

As shown in **Attachment H4**, Bendung (No.6) and Buah (No.8) systems need urgent facility measures in order to mitigate habitual inundation and improve living environment. Economic evaluation is conducted for the facility measures for these two drainage systems.

(5) Estimation of Flood Damages

Benefit of flood control project is estimated from difference of flood damages between those with and without project conditions. In other words, it is flood damage reduction benefit. For estimation of the benefit, thus, it is the first step to identify and to quantify potential flood damages in the flood prone areas under without-project condition. Methodology for estimation of the probable flood damage is discussed in the following sections.

a) Damages to General Assets

(i) Houses

Major land use of the two drainage systems is settlement and services & trade areas. Almost all the areas are built-up areas. Due to low lying topography and insufficient drainage capacity, the locations suffer from frequent inundation after a few hours of intensive rainfall.

There are lots of shops and traders in the area and most of them are shop-houses (rumah-toko or ruko). As a result of interview with shop owners, merchandise damage is not significant since they usually use shelves or elevated showcases to store their merchandise. Therefore, only damages to houses and household goods are taken into consideration. Damages to business (decrease of income) are considered in estimation of indirect damages.

Types of houses are generally classified into three types, i.e. permanent house made by brick masonry walls, semi permanent

house with brick masonry and wooden walls, and simple house with wood or bamboo walls. The values of houses are estimated as shown in **Table AH2**.

Table AH2 Estimation of Average Value of House.

Type of house	Average floor area (m2)	Unit const. cost per m2 (Rp.1,000)	Value of new house (Rp. million)	Depre-ciation Rate	Present value of house (Rp. million)	Compo-sition	Ave. value of house (Rp. million)
Permanent & semi permanent	56	957	53.6	50%	26.8	45%	13.8
Simple house	42	150	6.3	50%	3.2	55%	

Average floor area is estimated by weighted average floor area of houses in Palembang based on statistical data of "Penduduk Sumatera Selatan, Hasil Survei Penduduk Antara Sensus 1995". Since there is no statistical data on floor area by type of house, the same size is assumed for both permanent and semi permanent houses. The size of "simple house" is assumed based on information through site reconnaissance.

Information on standard unit construction cost of house is obtained from Housing Division in Department of Urban Development (Dinas PU Cipta Karya) of the province. Depreciation rate of residence is assumed 0.5 considering period of use. The composition of the types of houses is also taken from "Penduduk Sumatera Selatan, Hasil Survei Penduduk Antara Sensus 1995".

It can be imagine that quality of the houses will be upgraded according to economic development of the area in the future. Therefore, the unit value of house is assumed to increase according to growth of per capita GDP estimated in the socioeconomic framework of this Study (2.5% p.a. for Palembang).

- The number of houses in the flood prone areas is estimated from average housing density in the sub-districts (kelurahans) located in the respective drainage system as shown in **Table AH3**.

Table AH3 Estimated Number of Household in Drainage Systems

Drainage system	Total area of sub-districts in drainage system (ha)	No. of household in 2001 (household)	Average housing density (house/ha)
Bendung	1,272	23,505	19
Buah	1,795	20,586	12

Note: Total areas of sub-districts in the drainage systems are different from areas of drainage systems.

- In the area, there still are some unused land or swampy areas. Actually, housing development is seen at many places in the areas. It is sure that the areas will be densely

populated built-up areas in the future. Therefore, the future density of houses is estimated according to the population projection made in the socioeconomic framework plan of this Study. The future housing density is estimated as shown in **Table AH4**:

Table AH4 Future Housing Density in Drainage Systems

Drainage system	Housing density (house/ha)		Average annual growth
	2002	2020	
Bendung	19	26	1.75%
Buah	12	16	1.75%

(ii) Household Goods

The households located in the flood prone area have various kinds of household goods such as bedding, cupboard, table and chairs, cooking stove, carpets, radio-cassette player, clothes, and food stock. Many of them also have color TVs. The study team estimated the value of the household goods, which are most commonly owned by households in Palembang as shown in **Table AH5**.

Table AH5 Value of Household Equipment

Household goods	Price (new condition) (Rp.)	Depreciation rate	Present value (Rp.)
Cupboard (wooded)	850,000	0.5	425,000
Bed (2 units)	725,000	0.5	362,500
Table & chair	600,000	0.5	300,000
Kerosene stove	75,000	0.5	37,500
Radio-cassette player	263,000	0.5	131,500
Television	1,050,000	0.5	525,000
Other (clothes, foods)			500,000
Total			2,281,500 **rounded 2,280,000**

The household goods are selected by the study team based on information during site reconnaissance. The household goods were estimated from the market price depreciating by 50% considering period of use.

Future value of the household goods is also assumed to increase according to growth of per capita GDP estimated in the socioeconomic framework of this Study (2.5% p.a.).

(iii) Estimation of Flood Damages to General Assets

<u>Flood Condition</u>

The flood simulation analysis for Palembang City has been conducted by the Study Team as described in **Chapter 6** of

Supporting Report Sector G. Average inundation depth and area have been estimated by magnitude of flooding as summarized below:

Table AH6 Probable Inundation Area by Magnitude of Flooding (ha)

System	Inundation depth (m)	2-year	3-year	5-year	10-year	15-year
Bendung	0<D<0.5	56	58	63	70	79
	0.5=<D<1.0	3	3	3	3	3
	Total	59	61	66	73	82
Buah	0<D<0.5	37	38	42	46	52
	0.5=<D<1.0	-	-	-	-	-
	Total	37	38	42	46	52

Damage Rate

For estimation of probable flood damages to general assets (houses and household goods), standard flood damage rates developed by Ministry of Land, Infrastructure and Transport, Japan is applied since no such damage rate is available in Indonesia.

Table AH7 Damage Rate

	Inundation Depth above Floor Level				
	Less than 0.5m	0.5-0.99m	1.0-1.99m	2.0-2.99m	More than 3.0m
1. Building	0.092	0.119	0.266	0.380	0.834
2. Household goods	0.145	0.326	0.508	0.928	0.991

Source: Manual for Economic Study on Flood Control, Ministry of Land, Infrastructure, and Transport, Japan, May 2000

Estimation of Probable Flood Damage

Flood damages to general assets are estimated from the damageable property in inundated area multiplied by the damage rate corresponding to inundation condition under various magnitudes of flood events. According to the actual situation of houses through site reconnaissance, it is assumed that the floor level of the houses in the flood prone area is approximately 20 cm elevated from ground level. Therefore, shallow inundation area (up to 0.2 m) has been excluded from the inundation area since flood damage to general assets will not be significant in that area. The adjusted inundation area is presented blow:

Table AH8 Adjusted Inundation Area by Magnitude of Flooding (ha)

System	Inundation depth (m)	2-year	3-year	5-year	10-year	15-year
Bendung	0.2<D<0.7	39	40	48	53	72
	0.7=<D<1.2	3	3	3	3	3
	Total	42	43	51	56	75
Buah	0.2<D<0.7	27	27	41	44	48
	0.7=<D<1.2	-	-	-	-	-
	Total	27	27	41	44	48

The flood damages under present (2002) and future conditions (2020) by magnitude of flood are estimated as shown in **Attachment H5** and summarized in **Table AH9**.

Table AH9 Probable Flood Damage by Magnitude of Flood (Rp. million)

Drainage system /flood condition	Present condition (2002)			Future condition (2020)		
	House	Hh goods	Total	House	Hh goods	Total
Bendung						
2-year	1,034	287	1,322	411	107	1,322
3-year	1,059	294	1,352	411	107	1,352
5-year	1,251	344	1,595	625	163	1,595
10-year	1,372	375	1,747	670	175	1,747
15-year	1,830	495	2,325	731	190	2,325
Buah						
2-year	2,205	614	2,819	854	223	1,077
3-year	2,257	627	2,884	854	223	1,077
5-year	2,668	735	3,403	1,298	339	1,636
10-year	2,925	802	3,727	1,393	363	1,756
15-year	3,902	1,057	4,959	1,519	396	1,916

Note: Hh goods: household goods

Flood damage - probability curve under without project condition is presented in **Attachment H6**.

Annual mean flood damage is estimated as accumulation of flood damage segments derived from various magnitude of probable flood damage multiplied by the corresponding probability of occurrence, from non-damageable flood up to design probable flood. The annual mean flood damage against both present assets and projected future assets in the year 2020 has been calculated based on the probable flood damage discussed above as shown in **Attachment H7**. Since the proposed measures aim to mitigate flood damages up to 15-year probable flood, the estimated annual mean flood damage is the expected flood reduction benefit of general assets with implementation of the proposed measures. The expected flood reduction benefit of general assets is summarized in **Table AH10**.

Table AH10 Flood Reduction Benefit for General Assets (Rp. million)

	2002	2020
Bendung	985	2,100
Buah	414	860

b) Damages to Infrastructure

Major flood damages to infrastructure are damages to national, provincial, and city roads.

Trunk roads such as national and provincial roads are maintained by Provincial Road Department (Dinas PU Bina Marga). Maintenance costs consist of the following three kinds: 1) regular maintenance, 2) rehabilitation, and 3) betterment. Out of these, inundation of roads increases the rehabilitation cost. There is no accurate statistical data on relation between inundation and rehabilitation cost of roads. However, according to the department, generally rehabilitation of road is necessary every 5 years if there is no inundation, but in inundation area, rehabilitation is needed every 2 to 3 years. Unit rehabilitation cost of major roads is approximately Rp.500 million/km.

On the other hand, the city roads are maintained by Department of Road, KIMPRASWIL Kota Palembang. According to the department, unit rehabilitation cost is approximately Rp.500 million/km and 20 to 30 km of city roads are rehabilitated annually.

Based on the information above, it is assumed that rehabilitation cost of the roads in inundation section can be saved 50% by drainage improvement works. It means that the rehabilitation cost of Rp.50,000,000/km/year can be saved by improvement of drainage condition.

Length of road inundation section and reduction of road maintenance cost by drainage improvement have been estimated based on the map showing inundation area discussed above. Expected reduction of road maintenance cost is shown in **Table AH11**.

Table AH11 Expected Reduction of Road Maintenance Cost

Drainage System	Road Inundation Length (m)			Reduction of road maintenance cost (Rp. million)
	Trunk road	City road	Total	
Bendung	2,400	2,700	5,100	255
Buah	2,250	2,700	4,950	248
Total	4,650	5,400	10,050	503

c) Indirect Damages

The indirect flood damages are the net economic losses to the nation due to interruption of economic activities in the affected areas. In this study the following indirect damages are taken into consideration:

- Economic loss due to work absence of the flood affected people who have to take care of their home during and after inundation.

- Economic loss due to time loss caused by traffic jam in inundation areas.
- Loss of medical cost for the children suffer from flu, stomachache, and/or skin diseases due to unsanitary condition during and after inundation.

(i) Economic Loss due to Work Absence of Flood Affected People

According to people live in flood prone areas, they have to stay at home and take care of their home and properties during flood. After flood, they have to clean their houses and household goods submerged. During these periods, they cannot go for work and cannot do any productive activities. Therefore, these activities are considered as economic loss of the society. The loss is estimated from decrease of regional income on assumption that working population in the flood affected area has to stop productive work for two days due to flood. Based on the socioeconomic framework in the target year 2020, future economic loss is also estimated applying population projection and future per capita GDP. Average family size and ratio of working population are assumed to be the same as present condition. Process of estimation is shown in **Table AH12**.

Table AH12 Economic Loss due to Work Absence

	Bendung		Buah	
	2002	2020	2002	2020
Houses in flood prone areas	1,064	1,456	768	1,024
Average family size	4.2	4.2	4.3	4.3
Total population in flood prone areas	4,469	6,115	3,302	4,403
Ratio of working population	31%	31%	31%	31%
Total working population	1,385	1,896	1,024	1,365
GDP per working person per day (Rp.)	50,000	77,983	50,000	77,983
Loss due to 2 days absence (Rp.million)	**139**	**296**	**102**	**213**

(ii) Economic Loss due to Traffic Jam Caused by Inundation

During flood, traffic of major roads in the city is paralyzed. Heavy traffic jams are seen in many places in the city and they usually last for half a day to one day. There is no accurate information on traffic jam due to inundation but it is sure that the paralyses of the traffic have given negative impact to the economic activities of the region. Therefore, the economic loss is estimated on assumption that half of daily traffic of major road runs into traffic jam and has to spend two more hours to reach destinations. It means that the people caught by traffic jam loose two hours of productive activities. Here, the loss due to increase of vehicle operation cost is not considered since it is generally by far smaller than loss of travel time cost. Since there is no data on number of passengers per vehicle, one person per vehicle is assumed. Average annual mean traffic of major roads is obtained from Provincial Road Department (Dinas PU Bina Marga). Based on the socioeconomic framework in the target year 2020, future

economic loss is also estimated applying population projection and future per capita GDP. Results of estimation are presented in **Table AH13**.

Table AH13 Loss due to Traffic Jam cause by Inundation

	Bendung		Buah	
	2002	2020	2002	2020
Average annual daily traffic (AADT)				
- Jl. Jenderal Sudirman	4,000	7,964	-	-
- Jl. Veteran	3,600	7,168	-	-
- Jl. Basuki Rachmad	24,200	48,183	-	-
- Jl. Yos Sudarso	-	-	750	1,493
Total of AADT	31,800	63,315	750	1,493
Half of total traffic	15,900	31,658	375	747
GDP per working person per two hours (Rp.)	14,000	20,351	14,000	20,351
Loss due to traffic jams (Rp.million)	**223**	**644**	**5**	**15**

(iii) Detriment to Health

One of the most serious issues, which were stated by the people live in flood prone area, is that children suffer skin disease, stomachache and/or flu due to unsanitary living condition caused by frequent inundation. According to a statistical data, more than 100,000 people had medical treatment due to waterborne and water-related diseases in Palembang in 1986.

When medical treatment is necessary, people usually go to public health center (PUSKUSMAS), which is subsidized by the government. People have to pay approximately Rp.2,000 or even some people are exempted from medical cost including medicine. The actual cost of the medical treatment and medicine is several times higher than this.

Table AH14 Estimation of Loss of Medical Cost due to Flood

	Bendung		Buah	
	2002	2020	2002	2020
Houses in flood prone areas	1,064	1,456	768	1,024
Average family size	4.2	4.2	4.3	4.3
Total population in flood prone areas	4,469	6,115	3,302	4,403
Ratio of population under 9 years old	20%	20%	20%	20%
Total population under 9 years old	894	1,223	660	881
Assumed medical cost including medicine (Rp.)	20,000	20,000	20,000	20,000
Loss of medical cost due to flood (Rp.m)	**18**	**24**	**13**	**18**

The loss of medical cost for detriment to health caused by flood is estimated based on the following assumptions:

- Children under 9 years in inundation area have medical treatment once a year due to skin disease, flu, and/or stomachache caused by inundation,

- Ratio of population under 9 years old is taken from the actual ratio of age-group distribution in Palembang from the results of the Population Census 2000, and
- Medical cost of Rp.20,000 is assumed including medicine cost.

Based on the socioeconomic framework in the target year 2020, future loss of medical cost is also estimated applying population projection. Average family size and ratio of population under 9 years old are assumed the same as present condition.

(6) Benefit of the Projects

After implementation of the proposed projects, flood damages of the two drainage systems will be mitigated and the population in the drainage systems will directly benefit from the project:

- Bendung System: 100,000 people (in 2002) 166,000 people (in 2020)
- Buah System: 90,000 people (in 2002) 150,000 people (in 2020)
Total: 190,000 people (in 2002) 311,000 people (in 2020)

Other than inhabitants in the areas, many people will directly and indirectly benefit from projects by securing road traffic, communication, public services and various types of economic activities.

The tangible project benefits are summarized in **Table AH15**.

Table AH15 Summary of Flood Reduction Benefit (Rp. million/year)

Reduction of Damage	Bendung		Buah	
	2002	2020	2002	2020
1. General Assets (houses & household goods)	985	2,100	414	860
2. Infrastructure	255	255	248	248
3. Indirect Damage	380	964	120	246
Flood Reduction Benefit	**1,620**	**3,319**	**782**	**1,354**

Other than the tangible benefits discussed above, implementation of the projects bring about the following benefits:

- To prevent paralyses of capital city's function in social, economical, and political activities,
- To save the cost of emergency measures taken by central and/or rural government for flood fighting and assisting affected people,
- To prevent termination of public services such as transportation, communication, electricity, and water supplies,
- To avoid inconvenience of citizens' life,
- To ease people's mental stress due to habitual inundation,

- To stabilize people's livelihood,
- To improve living environment and to decrease danger of infectious diseases, and
- To create new job opportunity during construction

The benefits listed above are very valuable, they are nevertheless virtually impossible to value satisfactory in monetary terms.

(7) Economic Project Cost

The economic project cost has been estimated from the financial project cost adjusting by SCF (0.9) after deducting the direct transfer payment. The financial and economic costs of the projects are shown in **Table AH16**.

Table AH16 Financial and Economic Project Costs (Rp.million)

Cost Item	Bendung System		Buah System	
	Financial	Economic	Financial	Economic
1. Construction Cost	19,609	17,648	4,470	4,023
2. Land Acquisition Cost	0	0	0	0
3. Administration Cost	980	882	224	202
4. Engineering Cost	2,941	2,647	671	604
5. Physical Contingency	2,353	2,118	537	483
Total	**25,883**	**23,295**	**5,902**	**5,312**

Annual project costs are estimated as shown in **Table AH17** based on a proposed implementation schedule.

Table AH17 Annual Project Costs (Economic Price, Rp.million)

Cost Item	Total (Rp. million)	Year			
		2004	2005	2006	2007
Bendung System					
1. Construction Cost	17,648	0	5,883	5,883	5,882
2. Land Acquisition Cost	0	0	0	0	0
3. Administration Cost	882	45	279	279	279
4. Engineering Cost	2,647	1,060	529	529	529
5. Physical Contingency	2,118	111	669	669	669
Total	**23,295**	1,216	7,360	7,360	7,359
Buah System					
1. Construction Cost	4,023	0	1,341	1,341	1,341
2. Land Acquisition Cost	0	0	0	0	0
3. Administration Cost	202	10	64	64	64
4. Engineering Cost	604	241	121	121	121
5. Physical Contingency	483	24	153	153	153
Total	**5,312**	275	1,679	1,679	1,679

(8) Cost-Benefit Analysis

Based on the benefits and costs discussed above, economic viability of the projects are examined by cost-benefit analysis. The analysis is conducted by the discounted cash flow analysis. The cash flow of the projects is presented in **Attachment H8**. The benefit of the projects are assumed to accrue after a completion of a partial works since the drainage capacity can be increased according to progress of channel improvement works such as excavation of

channels and construction of drainage sluices. The benefit of the project is assumed to increase gradually after completion of the project up to the year 2020 as estimated in **Table AH15**. The results of the economic analysis are summarized in **Subsection (2)** of this **Annex H5.2.5**.

(9) Necessity of Garbage and Sediment Removal from Micro-drainage

Even after implementation of the projects, inundation may occur from time to time due to clogging of micro-drainage. In order to enjoy the maximum benefit of the project, it is indispensable to remove garbage and sediment from the micro-drainage with residents participation. Such activities with residents participation also have effect to give incentive for people to keep the rivers clean.

(10) Financial Evaluation of Drainage Improvement Project of Palembang

(A) Introduction

From the financial point of view, a flood mitigation project is different from other public works projects. Benefit of the project is mitigation of loss and no direct business income accrues from the project. Therefore, this section deals with whether or not the project costs can be allocated from public finance.

(B) Financial Project Cost

Financial project cost is estimated on the following basic conditions:

- Administration cost is 5% of the construction cost,
- Engineering service cost is 10% of the construction cost
- Physical contingency is 10% of sum of construction cost, administration cost, and engineering service cost, and

Annual disbursement schedule (financial cost) is shown in **Table AH18**.

Table AH18 Annual Disbursement Schedule (Financial Cost, 2002 Constant Price)

Cost Item	Total (Rp. million)	Year			
		2004	2005	2006	2007
Bendung System					
1. Construction Cost	19,609	0	6,536	6,536	6,537
2. Land Acquisition Cost	0	0	0	0	0
3. Administration Cost	980	50	310	310	310
4. Engineering Cost	2,941	1,177	588	588	588
5. Physical Contingency	2,353	123	743	743	744
Total	**25,883**	1,350	8,177	8,177	8,179
Buah System					
1. Construction Cost	4,470	0	1,490	1,490	1,490
2. Land Acquisition Cost	0	0	0	0	0
3. Administration Cost	224	11	71	71	71
4. Engineering Cost	671	269	134	134	134
5. Physical Contingency	537	27	170	170	170
Total	**5,902**	307	1,865	1,865	1,865
Grand Total	**31,785**	**1,657**	**10,042**	**10,042**	**10,044**

(C) Financial Evaluation

Development expenditure of Palembang Municipality was Rp.100 billion in 2002. The annual required funds for implementation of the projects are Rp.10,050 million or approx. 10% of the development expenditure of the Municipality. It is almost four times larger than regular expenditure of the Municipality for water resources sector (Rp.2.7 billion in 2002). There will be the following schemes to allocate necessary fund for implementation of the projects:

- Financial arrangement of the development budget of the municipality,
- Grant aid scheme, and
- Soft loan

Land acquisition or resettlement of households generally becomes a heavy burden on local government finance. In this project, since it needs no land acquisition or resettlement, if one of the above-mentioned schemes is applicable, implementation of the projects will be financially possible.

Attachment H1 Calculation of Standard Conversion Factor

	Total Import Value			Total Import Tax	Total Export Value		Total Export Taxes
	Value (c.i.f.) (US$ million)	Exchange rate	Equivalent (Rp. billion)	(Rp. billion)	Value (f.o.b.) (US$ million)	Equivalent (Rp. billion)	(Rp. billion)
1997	41,680	2,909	121,247	3,322.0	53,443	155,466	100
(2001 price)			275,230	7,541		352,907	227
1998	27,337	10,014	273,752	5,495.0	48,848	489,160	943
(2001 price)			384,347	7,715		686,780	1,324
1999	24,003	7,855	188,546	2,950.0	48,665	382,267	2595
(2001 price)			213,057	3,334		431,961	2,932
2000	33,515	8,422	282,262	4,976.0	62,124	523,208	923
(2001 price)			319,238	5,628		591,749	1,044
2001	30,962	10,261	317,702	9,975.0	56,321	577,909	397
Average of 5 years (2001 price)	6,192		301,915	6,838	11,264	528,261	1,185

Standard Conversion Factor = $\frac{301{,}915 + 528{,}261}{(301{,}915 + 6{,}838) + (528{,}261 - 1{,}185)}$ = 0.99

Standard Conversion Factor Considering VAT: = 0.90

Note: Data on import and export value and taxes on import and export are based on data obtained from Statistical Yearbook of Indonesia 2000 and 2001

Attachment H2 Major Inundation Locations in Palembang City (Several Times a Year) (1/2)

No.	Inundation Locations by Drainage System	Kecamatan	Kelurahan	Condition of Inundation		
				Area (ha)	Duration (hour)	Depth (m)
02	**Gasing System**			**1.50**		
	Around Terminal Alang-alang Lebar	Sukarami	Alang-alang Lebar	1.50	4	0.25
03	**Lambidaro System**			**7.00**		
	Settlement area between Jl. Musi II and Jl. Hulubalang, and a part of Hilir Sungai Lambidaro	Ilir Barat I	Bukit Lama	4.50	6	0.30
	Around Jl. Musi II	Ilir Barat I	Bukit Lama	2.50	4	0.20
04	**Boang System**			**8.50**		
	Around Sungai Kedukan Bukit	Ilir Barat II	35/36 Ilir	5.50	4	0.15
	Around Jl. Ki Gede Ing Suro	Ilir Barat II	32 Ilir	3.00	2	0.20
05	**Sekanak System**			**16.75**		
	Around Jl. Letnan Yasin	Ilir Timur I	20 Ilir III	1.00	2	0.20
	Around Sekanak Primary Canal, a part of Hulu/the area of Kancil Putih	Ilir Barat I	Bukit Lama	2.00	6	0.50
	Along Sahang Secondary Canal	Ilir Barat I	Lorok Pakjo	4.00	3	0.30
	Around Hilir Part of Pakjo Secondary Canal	Ilir Barat I	Lorok Pakjo	6.00	4	0.30
	Around Jl. Puncak Sekuning	Ilir Barat I	Lorok Pakjo	1.60	3	0.20
	Around Jl. Sumpah Pemuda	Ilir Barat I	Lorok Pakjo	0.35	1	0.15
	Around part of Hilir Sungai Sekanak	Ilir Barat II	27/28 Ilir	1.80	4	0.20
06	**Bendung System**			**14.62**		
	Around Jl Basuki Rachmat/Simpang Polda	Kemuning	Ario Kemuning	1.50	9	0.40
	Around Jl. Kol H. Burlian, Simpang Jl. AKBP H. Umar, In front of KOREM Office	Kemuning	Ario Kemuning	0.37	2	0.20
	Around Jl. Veteran/ Mitsubishi Dealer	Ilir Timur I	20 Ilir D I	1.50	6	0.50
	Around Bendung Primary Canal-Tengah part/Jl Rawa Bendung	Ilir Timur I	20 Ilir D I/20 Ilir D III	4.50	9	0.50
	Around Jl Seduduk Putih Secondary Canal-Hilir Part	Ilir Timur II	8 Ilir	3.50	4	0.50
	Around Jl. Letda Rozak	Ilir Timur II	5 Ilir	2.00	2	0.30
	Around Jl. Kol. H Burlian, Simpang Jl. Kamil	Kemuning	Ario Kemuning	1.25	6	0.25
08	**Buah System**			**6.30**		
	Around Jl. Tos Sudaraso, near PDAM	Ilir Timur II	3 Ilir	0.45	1	0.20
	Around Jl. Ratu Sianom	Ilir Timur II	1 Ilir	0.30	1.5	0.15
	Around Tali Gawe Primary Canal-Hulu Part	Ilir Timur II	1 Ilir	0.75	2	0.40
	Around Rengas Primary Canal-Hulu Part	Ilir Timur II	1 Ilir	0.80	2	0.30
	Around Buah Secondary Canal-hilir Part	Ilir Timur II	Sei. Buah and 1 Ilir	2.50	6	0.50
	Around Jl. Simapng Tiga Patal PUSRI/ Settlement of PHDM II	Kalidoni	Kalidoni	1.50	2	0.20
09	**Juaro System**			**13.50**		
	Around Jl. Harapan I	Kalidoni	Sei. Layur	5.00	12	0.30
	Around Juaro Primary/Secondary Canal	Kalidoni	Sei. Selayur	8.50	12	0.50
10	**Batang System**			**0.80**		
	Around Jl. Madya until Jl. Sukamulya	Kalidoni	Sei. Selincah	0.20	4	0.20
	Around Jl. Mata Merah, around SD 53 (elementary school # 53)	Kalidoni	Sei. Selincah	0.60	4	0.30
12	**Borang System**			**8.60**		
	Around Jl. K H Burlian, Jl. Perindustrian II/In front of DAMRI	Sukarami	Sukarami	0.10	6	0.20
	Around Jl. Suka Mulya	Sako	Suka Mulya	0.15	12	0.15
	Around Jl. Jepang, near to PDAM Borang	Sako	Sako	1.50	1.5	0.15
	Around settlement of Multiwahana	Sako	Sako/Lebong Gajah	1.50	4	0.15
	Around Jl. Lematang	Sako	Lebong Gajah	0.35	3	0.15
	Settlemet of Sako Kenten	Sako	Sako	3.50	6	0.15
	Around Jl. Kenten Laut, in front of Kompleks Kenten Indah	Sako	Sukamaju	1.50	4	0.15

Attachment H2 Major Inundation Locations in Palembang City (Several Times a Year) (2/2)

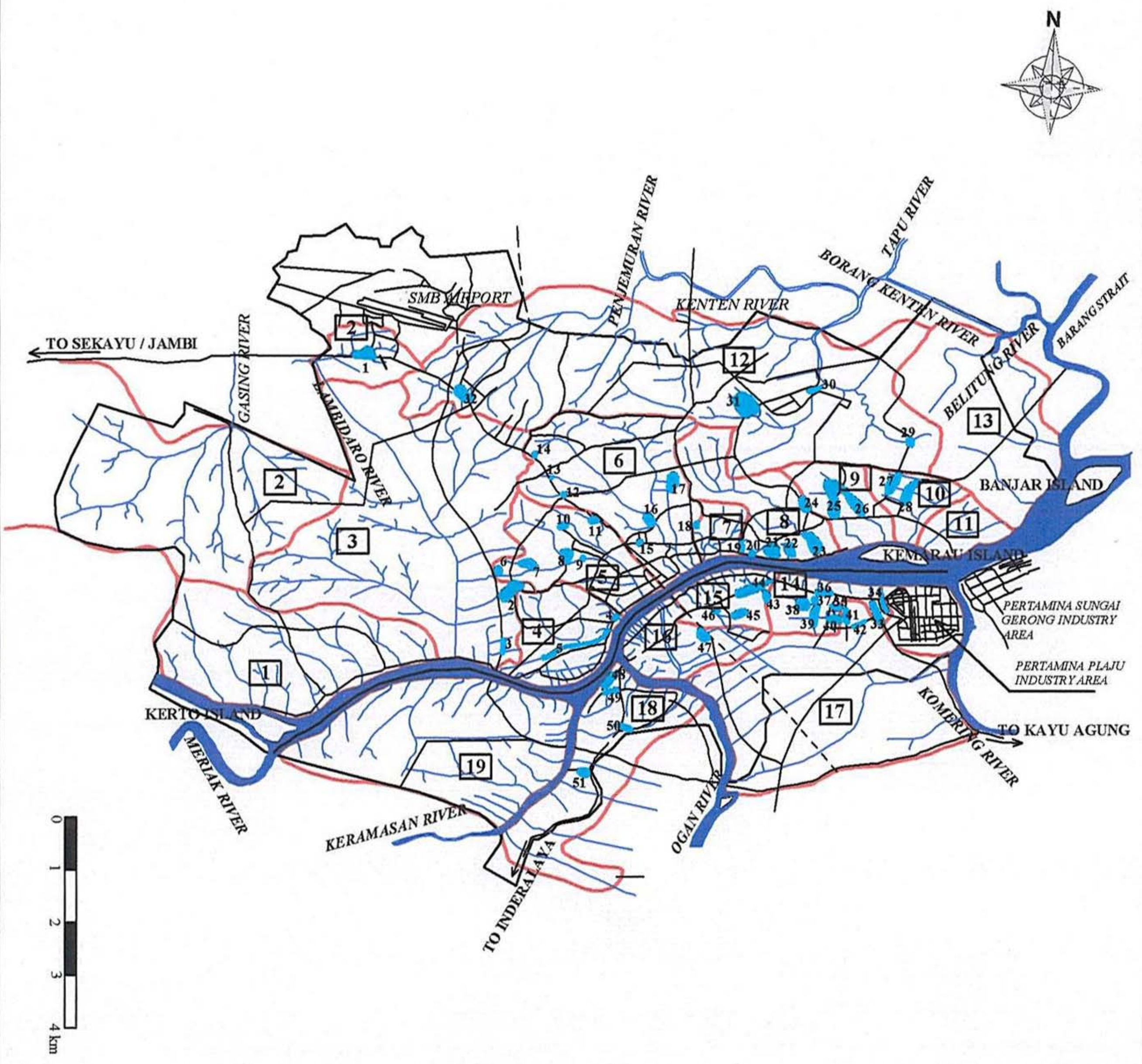
No.	Inundation Locations by Drainage System	Kecamatan	Kelurahan	Condition of Inundation		
				Area (ha)	Duration (hour)	Depth (m)
14	**Sriguna System**			**11.00**		
	Around STM, Lorong Pegagan	Seberang Ulu II	16 Ulu	0.80	4	0.20
	Around Jl. DI Panjaitan RT 15, 49, 45, 34	Plaju	Plaju Ilir	2.25	4	0.15
	Around Simapng Tiga Jl. Kapten Abdullah	Plaju	Plaju Ilir/Plaju Darat	0.60	6	0.15
	Around Jl D I Panjaitan with Jl Pintu Besi	Plaju	Plaju Ilir	1.85	3	0.15
	Around Jl Palapa	Plaju	Plaju Ulu	0.15	3	0.15
	Around Jl. Sudirja	Seberang Ulu II	Sentosa	0.85	4	0.20
	Around Lorong Asli	Seberang Ulu II	16 Ulu	2.50	6	0.20
	Around Primary Canal-part of Tengah	Seberang Ulu II	16 Ulu	2.00	3	0.20
15	**Aur System**			**9.50**		
	Around Jl. Mahameru	Seberang Ulu II	16 Ulu	1.50	6	0.20
	Around Jl. A Yani until Simpang Tiga Jl K H Azhari	Seberang Ulu II	16 Ulu	3.00	4	0.15
	Around Jl. Jaya Indah RT 21A	Seberang Ulu II	14 Ulu	2.00	4	0.20
	Around Aur Secondary Canal Jl Siantan	Seberang Ulu II	14 Ulu	1.50	3	0.15
	Around Aur Primary Canal-Part of Tengah	Seberang Ulu I	9/10 Ulu	1.50	2	0.20
16	**Kedukan System**			**3.90**		
	Around Jl. Majapahit RT 13 near to Kompleks SD Negeri (state elementary School)	Seberang Ulu I	Tuan Kentang	1.60	5	0.20
	Around the meeting between Jl. Pangeran ratu and Jl Bungaran	Seberang Ulu I	5 Ulu	0.85	12	0.25
	Around Sungai Kademangan RT 37, 38, 39, 42	Seberang Ulu I	7 Ulu	0.70	4	0.20
	Around Sungai Semajid RT. 06, 08, 09	Seberang Ulu I	3/4 Ulu	0.75	4	0.20
17	**Jaka Baring System**			**9.50**		
	Around Jl Sri Raya	Plaju	Plaju Ulu	1.15	4	0.15
	Around Jl Darulhama	Plaju	Plaju Ulu	6.50	6	0.15
	Around Jl. Darulhama and Lorong Perguruan	Plaju	Plaju Ulu/Talang Bubuk	1.85	4	0.10
18	**Kertapati System**			**15.00**		
	Around Jl. Dipo, the continuing of Secondary Canal Jl. Ki Merogan, Sungai Kencong	Kertapati	Kertapati	10.00	6	0.20
	Around Jl. Abikusno Cokrosuyoso	Kertapati	Kertapati	2.50	6	0.20
	Around Jl. Karya Jaya and Terminal Terpadu	Kertapati	Karya Jaya	2.50	6	0.20
	TOTAL			**126.47**		

Note: Nuber of households in the flood prone areas are estimated at 70 households/ha on the following assumptions:

1) Settlement area accounts for 70% of land and roads, drainage canals, and other lands account for 30%.

2) Average size of land per household is 100m^2.

DRAINAGE SYSTEM	CATCHMENT AREA
1. GANDUS SYSTEM	23, 946 Km2
2. GASING SYSTEM	52, 108 Km2
3. LAMBIDARO SYSTEM	50, 515 Km2
4. BOANG SYSTEM	8, 668 Km2
5. SEKANAK SYSTEM	11, 395 Km2
6. BENDUNG SYSTEM	19, 186 Km2
7. L. KIDUL SYSTEM	2, 343 Km2
8. BUAH SYSTEM	10, 442 Km2
9. JUARO SYSTEM	6, 864 Km2
10. BATANG SYSTEM	5, 586 Km2
11. SELINCAH SYSTEM	4, 830 Km2
12. BORANG SYSTEM	71, 210 Km2
13. SP. NYIUR SYSTEM	22, 854 Km2
14. SRIGUNA SYSTEM	4, 910 Km2
15. AUR SYSTEM	6, 578 Km2
16. KEDUKAN SYSTEM	9, 316 Km2
17. JAKA BARING SYSTEM	37, 067 Km2
18. KERTAPATI SYSTEM	25, 008 Km2
19. KERAMASAN SYSTEM	30, 092 Km2



LEGEND

- ADMINISTRATIVE AREA BOUNDARY
- MAIN ROAD
- DRAINAGE SYSTEM BOUNDARY
- RIVER
- INUNDATION AREA

THE STUDY ON COMPREHENSIVE WATER MANAGEMENT OF MUSI RIVER BASIN

CTI ENGINEERING INTERNATIONAL Co. Ltd.

NIKKEN Consultants, Inc.

Attachment H3

Flood Prone Locations in Palembang City

Attachment H4 Flood Condition and Proposed Measures in Palembang City (1/3)

No.	Drainage System	Present Land Use	Future Land Use based on Palembang M/P	Flood Condition	Proposed Measures
1.	Gandus	- Agriculture - Settlement - Services & trade - Fallow	- Recreation - Agriculture - Industry with low emission - Services & trade - Settlement	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
2.	Gasin	- Agriculture - Settlement - Services & trade - Fallow	- Agriculture - Industry with low emission - Settlement - Services & trade	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
3.	Lambidaro	- Agriculture - Settlement - Services & trade - Fallow	- Settlement - Industry with low emission - Services & trade	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
4.	Boang	- Settlement - Services & trade - Swamp	- Settlement - Services & trade - Culture & heritage	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
5.	Sekanak	- Governmental offices - Services & trade - Settlement	- Governmental offices - Services & trade - Settlement	No significant flood affect reported except some local inundation. There is a plan to construct one retention pond (1 ha).	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
6.	Bendung	- Settlement - Service & trade - Government offices - Sports facilities	- Settlement - Service & trade - Government offices - Sports facilities	Relatively large flood affect reported including traffic interruption for national and provincial main roads.	- Improvement of drainage canals - Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
7.	Kidul	- Settlement - Services & trade	- Settlement - Services & trade	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures

Attachment H4 Flood Condition and Proposed Measures in Palembang City (2/3)

No.	Drainage System	Present Land Use	Future Land Use based on Palembang M/P	Flood Condition	Proposed Measures
8.	Buah	- Settlement - Services & trade - Fertilizer factory - Swamp	- Settlement - Services & trade - Industry with high emission	Houses and major city roads are suffered from frequent inundation around fertilizer factory.	- Improvement of drainage canals - Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
9.	Juaro	- Settlement - Services & trade - Fertilizer factory - Swamp	- Industry with high emission - Settlement	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
10.	Batang	- Settlement - Services & trade - Swamp	- Industry with high emission - Settlement	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
11.	Selincah	- Settlement - Services & trade - Swamp	- Industry with high emission - Services and trade	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
12.	Borang	- Settlement - Agriculture - Services & trade	- Settlement - Industry with low emission	After construction of drainage canal by army, flood affect is effectively mitigated. There is a plan to construct two retention ponds.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
13.	SP. Nyiur	- Bush - Agriculture - Settlement	- Industry with high emission - Industry with low emission - Agriculture	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
14.	Sriguna	- Settlement - Services & trade - Oil & gas industry	- Settlement - Services & trade - Oil & gas industry	Due to frequent inundation, living condition, especially sanitary condition, is poor. However, cause of flood is due to malfunction of micro-drainage.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures

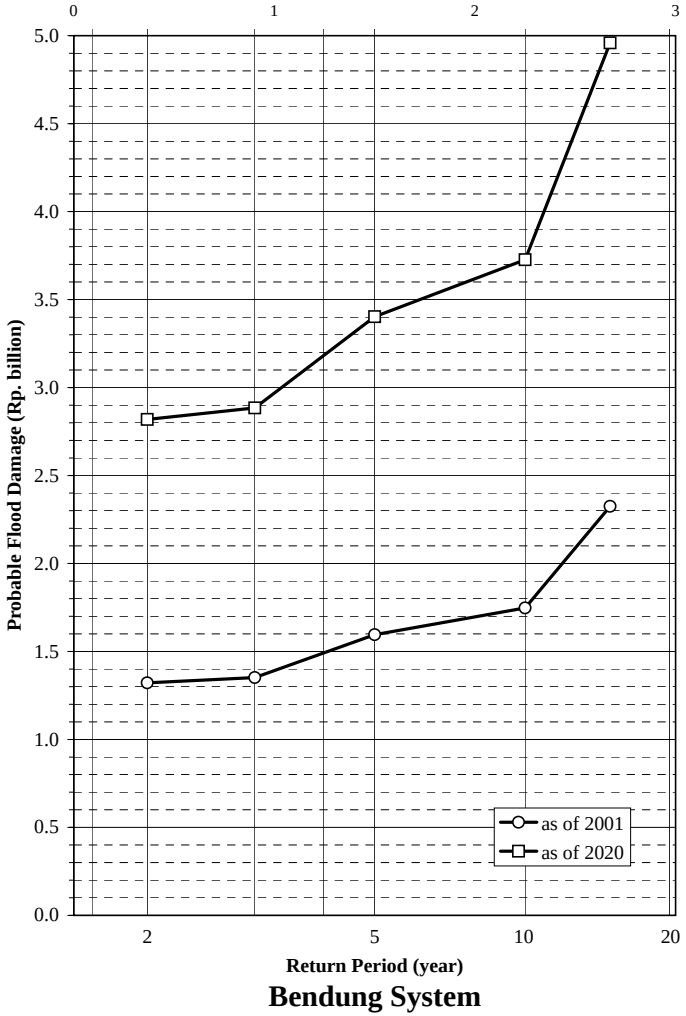
Attachment H4 Flood Condition and Proposed Measures in Palembang City (3/3)

No.	Drainage System	Present Land Use	Future Land Use based on Palembang M/P	Flood Condition	Proposed Measures
15.	Aur	- Settlement - Services & trade	- Settlement - Services & trade	Due to lack of secondary canal, city roads are frequently inundated. There is a plan to construct the secondary canal.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
16.	Kedukan	- Settlement - Agriculture	- Settlement - Services & trade	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
17.	Jaka Baring	- Settlement - Agriculture - Swamp - Trade and services	- Settlement - Urban forest - Agriculture - Trade and services	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
18.	Kertapati	- Settlement - Agriculture	- Services & trade - Settlement - Industry with low emission	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures
19.	Keramasan	- Agriculture - Bush - Swamp - Settlement	- Agriculture - Industry with high emission - Settlement	No significant flood affect reported except some local inundation.	- Community drainage management - Trunk drainage channels rehabilitation - Non facility measures

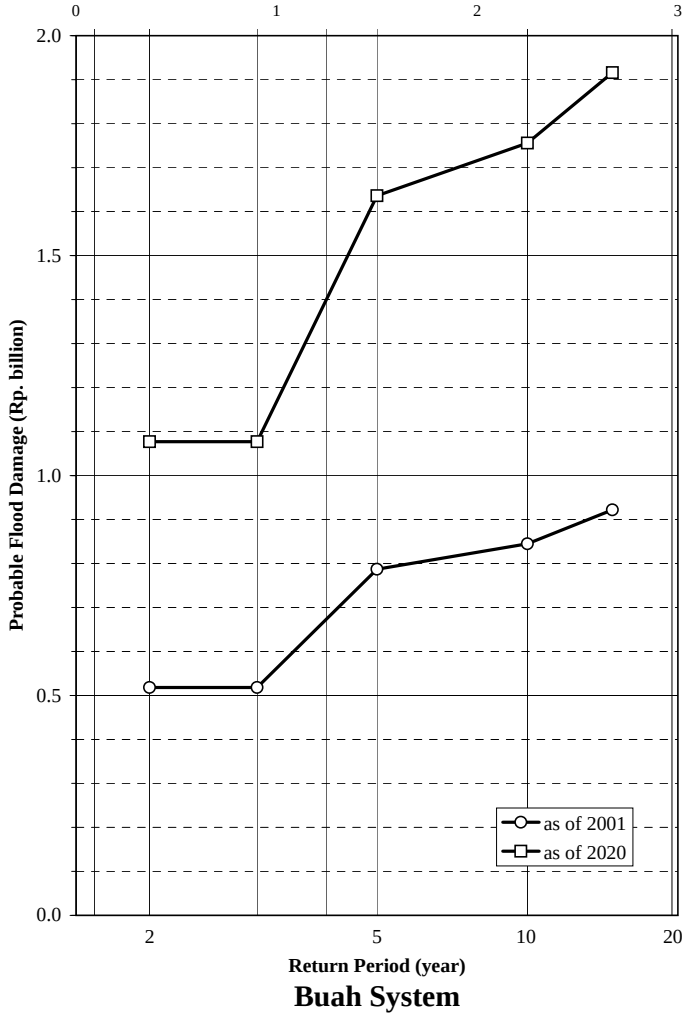
Note: Present land use: based on BAPPEDA 1:50,000 Land Use 2000
Future land use: based on Rencana Tata Ruang Wilaya Kota Palembang Tahun 1999 - 2009, Pemerinta Kota Palembang
Non-facility measures includes such measures as:
- Land use regulation (15m from riverbank in Palembang City),
- Implementation of local government regulation that force the developers to conserve swamp area and to control runoff increase,
- Removal of garbage and sediment from drainage canals by public participation,
- Encouragement of stilt houses in flood prone areas,
- Public advertisements not to dispose garbage into the river, etc.

Attachment H5 Estimation of Flood Damage to General Assets (House and Household Goods)

Drainage System/ Flood Condition	Inundation depth (m)	Area of Inundation (ha)	Houses			Household Goods			Total
			Unit value (Rp. m)	Q'ty (house)	Damage (Rp. m)	Unit value (Rp. m)	Q'ty (house)	Damage (Rp. m)	(Rp. m)
I. Present Condition (2002)									
1. Bendung System									
2-year	0<0.5	39	13.8	741	941	2.28	741	245	1,186
	0.5<1.0	3	13.8	57	94	2.28	57	42	136
	Total	42		798	1,034		798	287	1,322
3-year	0<0.5	40	13.8	760	965	2.28	760	251	1,216
	0.5<1.0	3	13.8	57	94	2.28	57	42	136
	Total	43		817	1,059		817	294	1,352
5-year	0<0.5	48	13.8	912	1,158	2.28	912	302	1,459
	0.5<1.0	3	13.8	57	94	2.28	57	42	136
	Total	51		969	1,251		969	344	1,595
10-year	0<0.5	53	13.8	1,007	1,278	2.28	1,007	333	1,611
	0.5<1.0	3	13.8	57	94	2.28	57	42	136
	Total	56		1,064	1,372		1,064	375	1,747
15-year	0<0.5	72	13.8	1,368	1,737	2.28	1,368	452	2,189
	0.5<1.0	3	13.8	57	94	2.28	57	42	136
	Total	75		1,425	1,830		1,425	495	2,325
2. Buah System									
2-year	0<0.5	27	13.8	324	411	2.28	324	107	518
3-year	0<0.5	27	13.8	324	411	2.28	324	107	518
5-year	0<0.5	41	13.8	492	625	2.28	492	163	787
10-year	0<0.5	44	13.8	528	670	2.28	528	175	845
15-year	0<0.5	48	13.8	576	731	2.28	576	190	922
II. Future Condition (2020)									
1. Bendung System									
2-year	0<0.5	39	21.5	1,014	2,006	3.56	1,014	523	2,529
	0.5<1.0	3	21.5	78	200	3.56	78	91	290
	Total	42		1,092	2,205		1,092	614	2,819
3-year	0<0.5	40	21.5	1,040	2,057	3.56	1,040	537	2,594
	0.5<1.0	3	21.5	78	200	3.56	78	91	290
	Total	43		1,118	2,257		1,118	627	2,884
5-year	0<0.5	48	21.5	1,248	2,469	3.56	1,248	644	3,113
	0.5<1.0	3	21.5	78	200	3.56	78	91	290
	Total	51		1,326	2,668		1,326	735	3,403
10-year	0<0.5	53	21.5	1,378	2,726	3.56	1,378	711	3,437
	0.5<1.0	3	21.5	78	200	3.56	78	91	290
	Total	56		1,456	2,925		1,456	802	3,727
15-year	0<0.5	72	21.5	1,872	3,703	3.56	1,872	966	4,669
	0.5<1.0	3	21.5	78	200	3.56	78	91	290
	Total	75		1,950	3,902		1,950	1,057	4,959
2. Buah System									
2-year	0<0.5	27	21.5	432	854	3.56	432	223	1,077
3-year	0<0.5	27	21.5	432	854	3.56	432	223	1,077
5-year	0<0.5	41	21.5	656	1,298	3.56	656	339	1,636
10-year	0<0.5	44	21.5	704	1,393	3.56	704	363	1,756
15-year	0<0.5	48	21.5	768	1,519	3.56	768	396	1,916



Bendung System



Buah System

Attachment H6 Flood Magnitude - Damage Curve
(Damages to General Assets Only)

Attachment H7 Calculation of Annual Mean Flood Damages (Without Project Condition)

I. Present Condition (as of 2002)

1. Bendung System

Return period	Exceedance	Difference of exceedance	Damage (Rp. million)		Annual Damage (Rp.million)	
			Amount	Mean	Segment	Cumulative
-	1.00					
2	0.50	0.50	1,322	661	331	331
3	0.33	0.17	1,352	1,337	223	553
5	0.20	0.13	1,595	1,474	196	750
10	0.10	0.10	1,747	1,671	167	917
15	0.07	0.03	2,325	2,036	68	**985**

2. Buah System

Return period	Exceedance	Difference of exceedance	Damage (Rp. million)		Annual Damage (Rp.million)	
			Amount	Mean	Segment	Cumulative
-	1.00					
2	0.50	0.50	518	259	130	130
3	0.33	0.17	518	518	86	216
5	0.20	0.13	787	653	87	303
10	0.10	0.10	845	816	82	384
15	0.07	0.03	922	884	29	**414**

II. Future Condition (as of 2020)

1. Bendung System

Return period	Exceedance	Difference of exceedance	Damage (Rp. million)		Annual Damage (Rp.million)	
			Amount	Mean	Segment	Cumulative
-	1.00					
2	0.50	0.50	2,819	1,410	705	705
3	0.33	0.17	2,884	2,852	475	1,180
5	0.20	0.13	3,403	3,144	419	1,599
10	0.10	0.10	3,727	3,565	357	1,956
15	0.07	0.03	4,959	4,343	145	**2,100**

2. Buah System

Return period	Exceedance	Difference of exceedance	Damage (Rp. million)		Annual Damage (Rp.million)	
			Amount	Mean	Segment	Cumulative
-	1.00					
2	0.50	0.50	1,077	539	269	269
3	0.33	0.17	1,077	1,077	180	449
5	0.20	0.13	1,636	1,357	181	630
10	0.10	0.10	1,756	1,696	170	799
15	0.07	0.03	1,916	1,836	61	**860**

Attachment H8 Cost-Benefit Analysis (1/3)

Drainage Improvement: Bendung System **Unit: Rp. million**

Yeear in order	Year	Benefit	Cost									Net Cash Flow
			Investment						O/M	Replace-ment	Total Cost	
			Direct constr.	Resettle-ment	Engring service	Adminis-tration	Phisical conti.	Sub-total				
0	2002	-	-	-	-	-	-	-	-	-	-	-
1	2003	-	-	-	-	-	-	-	-	-	-	-
2	2004	-	-	-	1,060	45	111	1,216	-	-	1,216	-1,216
3	2005	-	5,883	-	529	279	669	7,360	-	-	7,360	-7,360
4	2006	729	5,883	-	529	279	669	7,360	29	-	7,389	-6,661
5	2007	1,093	5,882	-	529	279	669	7,359	44	-	7,403	-6,310
6	2008	2,186	-	-	-	-	-	-	88	-	88	2,098
7	2009	2,281	-	-	-	-	-	-	88	-	88	2,192
8	2010	2,375	-	-	-	-	-	-	88	-	88	2,287
9	2011	2,470	-	-	-	-	-	-	88	-	88	2,381
10	2012	2,564	-	-	-	-	-	-	88	-	88	2,476
11	2013	2,658	-	-	-	-	-	-	88	-	88	2,570
12	2014	2,753	-	-	-	-	-	-	88	-	88	2,664
13	2015	2,847	-	-	-	-	-	-	88	-	88	2,759
14	2016	2,941	-	-	-	-	-	-	88	-	88	2,853
15	2017	3,036	-	-	-	-	-	-	88	-	88	2,948
16	2018	3,130	-	-	-	-	-	-	88	-	88	3,042
17	2019	3,225	-	-	-	-	-	-	88	-	88	3,136
18	2020	3,319	-	-	-	-	-	-	88	-	88	3,231
19	2021	3,319	-	-	-	-	-	-	88	-	88	3,231
20	2022	3,319	-	-	-	-	-	-	88	-	88	3,231
21	2023	3,319	-	-	-	-	-	-	88	-	88	3,231
22	2024	3,319	-	-	-	-	-	-	88	-	88	3,231
23	2025	3,319	-	-	-	-	-	-	88	-	88	3,231
24	2026	3,319	-	-	-	-	-	-	88	-	88	3,231
25	2027	3,319	-	-	-	-	-	-	88	-	88	3,231
26	2028	3,319	-	-	-	-	-	-	88	-	88	3,231
27	2029	3,319	-	-	-	-	-	-	88	-	88	3,231
28	2030	3,319	-	-	-	-	-	-	88	-	88	3,231
29	2031	3,319	-	-	-	-	-	-	88	-	88	3,231
30	2032	3,319	-	-	-	-	-	-	88	-	88	3,231
31	2033	3,319	-	-	-	-	-	-	88	-	88	3,231
32	2034	3,319	-	-	-	-	-	-	88	-	88	3,231
33	2035	3,319	-	-	-	-	-	-	88	-	88	3,231
34	2036	3,319	-	-	-	-	-	-	88	-	88	3,231
35	2037	3,319	-	-	-	-	-	-	88	-	88	3,231
36	2038	3,319	-	-	-	-	-	-	88	-	88	3,231
37	2039	3,319	-	-	-	-	-	-	88	-	88	3,231
38	2040	3,319	-	-	-	-	-	-	88	-	88	3,231
39	2041	3,319	-	-	-	-	-	-	88	-	88	3,231
40	2042	3,319	-	-	-	-	-	-	88	-	88	3,231
41	2043	3,319	-	-	-	-	-	-	88	-	88	3,231
42	2044	3,319	-	-	-	-	-	-	88	-	88	3,231
43	2045	3,319	-	-	-	-	-	-	88	-	88	3,231
44	2046	3,319	-	-	-	-	-	-	88	-	88	3,231
45	2047	3,319	-	-	-	-	-	-	88	-	88	3,231
46	2048	3,319	-	-	-	-	-	-	88	-	88	3,231
47	2049	3,319	-	-	-	-	-	-	88	-	88	3,231
48	2050	3,319	-	-	-	-	-	-	88	-	88	3,231
49	2051	3,319	-	-	-	-	-	-	88	-	88	3,231
50	2052	3,319	-	-	-	-	-	-	88	-	88	3,231
51	2053	3,319	-	-	-	-	-	-	88	-	88	3,231
52	2054	3,319	-	-	-	-	-	-	88	-	88	3,231
53	2055	3,319	-	-	-	-	-	-	88	-	88	3,231
54	2056	3,319	-	-	-	-	-	-	88	-	88	3,231
55	2057	3,319	-	-	-	-	-	-	88	-	88	3,231

EIRR= 11.0%

B/C = 0.91 (at a discount rate of 12%)

NPV= -1,389 (at a discount rate of 12%)

Attachment H8 Cost-Benefit Analysis (2/3)

Drainage Improvement: Buah System **Unit: Rp. million**

Yeear in order	Year	Benefit	Cost									Net Cash Flow
			Investment						O/M	Replace-ment	Total Cost	
			Direct constr.	Resettle-ment	Engring service	Adminis-tration	Phisical conti.	Sub-total				
0	2002	-	-	-	-	-	-	-	-	-	-	-
1	2003	-	-	-	-	-	-	-	-	-	-	-
2	2004	-	-	-	241	10	24	275	-	-	275	-275
3	2005	-	1,341	-	121	64	153	1,679	-	-	1,679	-1,679
4	2006	324	1,341	-	121	64	153	1,679	7	-	1,686	-1,361
5	2007	486	1,341	-	121	64	153	1,679	10	-	1,689	-1,203
6	2008	973	-	-	-	-	-	-	20	-	20	953
7	2009	1,004	-	-	-	-	-	-	20	-	20	984
8	2010	1,036	-	-	-	-	-	-	20	-	20	1,016
9	2011	1,068	-	-	-	-	-	-	20	-	20	1,048
10	2012	1,100	-	-	-	-	-	-	20	-	20	1,080
11	2013	1,132	-	-	-	-	-	-	20	-	20	1,111
12	2014	1,163	-	-	-	-	-	-	20	-	20	1,143
13	2015	1,195	-	-	-	-	-	-	20	-	20	1,175
14	2016	1,227	-	-	-	-	-	-	20	-	20	1,207
15	2017	1,259	-	-	-	-	-	-	20	-	20	1,239
16	2018	1,290	-	-	-	-	-	-	20	-	20	1,270
17	2019	1,322	-	-	-	-	-	-	20	-	20	1,302
18	2020	1,354	-	-	-	-	-	-	20	-	20	1,334
19	2021	1,354	-	-	-	-	-	-	20	-	20	1,334
20	2022	1,354	-	-	-	-	-	-	20	-	20	1,334
21	2023	1,354	-	-	-	-	-	-	20	-	20	1,334
22	2024	1,354	-	-	-	-	-	-	20	-	20	1,334
23	2025	1,354	-	-	-	-	-	-	20	-	20	1,334
24	2026	1,354	-	-	-	-	-	-	20	-	20	1,334
25	2027	1,354	-	-	-	-	-	-	20	-	20	1,334
26	2028	1,354	-	-	-	-	-	-	20	-	20	1,334
27	2029	1,354	-	-	-	-	-	-	20	-	20	1,334
28	2030	1,354	-	-	-	-	-	-	20	-	20	1,334
29	2031	1,354	-	-	-	-	-	-	20	-	20	1,334
30	2032	1,354	-	-	-	-	-	-	20	-	20	1,334
31	2033	1,354	-	-	-	-	-	-	20	-	20	1,334
32	2034	1,354	-	-	-	-	-	-	20	-	20	1,334
33	2035	1,354	-	-	-	-	-	-	20	-	20	1,334
34	2036	1,354	-	-	-	-	-	-	20	-	20	1,334
35	2037	1,354	-	-	-	-	-	-	20	-	20	1,334
36	2038	1,354	-	-	-	-	-	-	20	-	20	1,334
37	2039	1,354	-	-	-	-	-	-	20	-	20	1,334
38	2040	1,354	-	-	-	-	-	-	20	-	20	1,334
39	2041	1,354	-	-	-	-	-	-	20	-	20	1,334
40	2042	1,354	-	-	-	-	-	-	20	-	20	1,334
41	2043	1,354	-	-	-	-	-	-	20	-	20	1,334
42	2044	1,354	-	-	-	-	-	-	20	-	20	1,334
43	2045	1,354	-	-	-	-	-	-	20	-	20	1,334
44	2046	1,354	-	-	-	-	-	-	20	-	20	1,334
45	2047	1,354	-	-	-	-	-	-	20	-	20	1,334
46	2048	1,354	-	-	-	-	-	-	20	-	20	1,334
47	2049	1,354	-	-	-	-	-	-	20	-	20	1,334
48	2050	1,354	-	-	-	-	-	-	20	-	20	1,334
49	2051	1,354	-	-	-	-	-	-	20	-	20	1,334
50	2052	1,354	-	-	-	-	-	-	20	-	20	1,334
51	2053	1,354	-	-	-	-	-	-	20	-	20	1,334
52	2054	1,354	-	-	-	-	-	-	20	-	20	1,334
53	2055	1,354	-	-	-	-	-	-	20	-	20	1,334
54	2056	1,354	-	-	-	-	-	-	20	-	20	1,334
55	2057	1,354	-	-	-	-	-	-	20	-	20	1,334
EIRR=		19.3%										
B/C =		1.69	(at a discount rate of 12%)									
NPV=		2,451	(at a discount rate of 12%)									

Attachment H8 Cost-Benefit Analysis (3/3)

Drainage Improvement: Both Bendung & Buah System **Unit: Rp. million**

Yeear in order	Year	Benefit	Cost									Net Cash Flow
			Investment						O/M	Replace-ment	Total Cost	
			Direct constr.	Resettle-ment	Engring service	Adminis-tration	Phisical conti.	Sub-total				
0	2002	-	-	-	-	-	-	-	-	-	-	-
1	2003	-	-	-	-	-	-	-	-	-	-	-
2	2004	-	-	-	1,301	55	135	1,491	-	-	1,491	-1,491
3	2005	-	7,224	-	650	343	822	9,039	-	-	9,039	-9,039
4	2006	1,053	7,224	-	650	343	822	9,039	36	-	9,075	-8,022
5	2007	1,580	7,223	-	650	343	822	9,038	54	-	9,092	-7,513
6	2008	3,159	-	-	-	-	-	-	108	-	108	3,051
7	2009	3,285	-	-	-	-	-	-	108	-	108	3,177
8	2010	3,411	-	-	-	-	-	-	108	-	108	3,303
9	2011	3,538	-	-	-	-	-	-	108	-	108	3,429
10	2012	3,664	-	-	-	-	-	-	108	-	108	3,555
11	2013	3,790	-	-	-	-	-	-	108	-	108	3,681
12	2014	3,916	-	-	-	-	-	-	108	-	108	3,808
13	2015	4,042	-	-	-	-	-	-	108	-	108	3,934
14	2016	4,168	-	-	-	-	-	-	108	-	108	4,060
15	2017	4,295	-	-	-	-	-	-	108	-	108	4,186
16	2018	4,421	-	-	-	-	-	-	108	-	108	4,312
17	2019	4,547	-	-	-	-	-	-	108	-	108	4,438
18	2020	4,673	-	-	-	-	-	-	108	-	108	4,565
19	2021	4,673	-	-	-	-	-	-	108	-	108	4,565
20	2022	4,673	-	-	-	-	-	-	108	-	108	4,565
21	2023	4,673	-	-	-	-	-	-	108	-	108	4,565
22	2024	4,673	-	-	-	-	-	-	108	-	108	4,565
23	2025	4,673	-	-	-	-	-	-	108	-	108	4,565
24	2026	4,673	-	-	-	-	-	-	108	-	108	4,565
25	2027	4,673	-	-	-	-	-	-	108	-	108	4,565
26	2028	4,673	-	-	-	-	-	-	108	-	108	4,565
27	2029	4,673	-	-	-	-	-	-	108	-	108	4,565
28	2030	4,673	-	-	-	-	-	-	108	-	108	4,565
29	2031	4,673	-	-	-	-	-	-	108	-	108	4,565
30	2032	4,673	-	-	-	-	-	-	108	-	108	4,565
31	2033	4,673	-	-	-	-	-	-	108	-	108	4,565
32	2034	4,673	-	-	-	-	-	-	108	-	108	4,565
33	2035	4,673	-	-	-	-	-	-	108	-	108	4,565
34	2036	4,673	-	-	-	-	-	-	108	-	108	4,565
35	2037	4,673	-	-	-	-	-	-	108	-	108	4,565
36	2038	4,673	-	-	-	-	-	-	108	-	108	4,565
37	2039	4,673	-	-	-	-	-	-	108	-	108	4,565
38	2040	4,673	-	-	-	-	-	-	108	-	108	4,565
39	2041	4,673	-	-	-	-	-	-	108	-	108	4,565
40	2042	4,673	-	-	-	-	-	-	108	-	108	4,565
41	2043	4,673	-	-	-	-	-	-	108	-	108	4,565
42	2044	4,673	-	-	-	-	-	-	108	-	108	4,565
43	2045	4,673	-	-	-	-	-	-	108	-	108	4,565
44	2046	4,673	-	-	-	-	-	-	108	-	108	4,565
45	2047	4,673	-	-	-	-	-	-	108	-	108	4,565
46	2048	4,673	-	-	-	-	-	-	108	-	108	4,565
47	2049	4,673	-	-	-	-	-	-	108	-	108	4,565
48	2050	4,673	-	-	-	-	-	-	108	-	108	4,565
49	2051	4,673	-	-	-	-	-	-	108	-	108	4,565
50	2052	4,673	-	-	-	-	-	-	108	-	108	4,565
51	2053	4,673	-	-	-	-	-	-	108	-	108	4,565
52	2054	4,673	-	-	-	-	-	-	108	-	108	4,565
53	2055	4,673	-	-	-	-	-	-	108	-	108	4,565
54	2056	4,673	-	-	-	-	-	-	108	-	108	4,565
55	2057	4,673	-	-	-	-	-	-	108	-	108	4,565
EIRR=		12.6%										
B/C =		1.06	(at a discount rate of 12%)									
NPV=		1,062	(at a discount rate of 12%)									