SUPPORTING REPORT O

ECONOMIC/FINANCIAL ANALYSIS

SUPPORTING O : ECONOMIC/FINANCIAL ANALYSIS

TABLE OF CONTENTS

SUPPORTING O : ECONOMIC/FINANCIAL ANALYSIS

LIST OF TABLES

SUPPORTING O : ECONOMIC/FINANCIAL ANALYSIS

LIST OF FIGURES

SUPPORTING-O
ECONOMIC/FINANCIAL ANALYSIS

1. SOCIO-ECONOMIC BACKGROUND

1.1 GENERAL

The Republic of Honduras is located in the Central American region, and is bounded by the Republic of Guatemala on the West, El Salvador on the South and Nicaragua on the East and Southeast. It has a territorial extension of 112,088 km^2 and a population of approximately 6 million. Except for two coastal strips, one extending about 640 km along the Caribbean Sea and the other 64 km on the Pacific Ocean, Honduras is a plateau, consisting of broad, fertile plains broken by deep valleys, and traversed by mountain ranges in the northwestern to southwestern direction. The mountains, which are volcanic in origin, rise to maximum elevations of more than 2,800 m. Most of the country's rivers drain toward the north into the Caribbean Sea.

The Republic of Honduras takes the form of a representative democratic republic. It is operated through three authorities: Legislative, Administrative and Judicial authorities. The national administration is conducted by 15 Ministries.

The country is administratively divided into 18 departments under the jurisdiction of Central Government, and the Governor of each Department is appointed by the Central Government. The Department is further divided into several Municipalities which amounts to 298 units in the country as a whole. Respective municipalities have a right of self-government, and the head of Municipality is elected by the popular vote. The least unit of community in the Municipality is called Barrio or Colonia.

The Study Area extends over six (6) Municipalities, namely Distrito Central, Lepaterique, Ojojona, Santa Ana, Santa Lucia and Tatumbla of Francisco Morazan Prefecture and has an area of 820 km^2 in total (*FigureO.1.1*).

1.2 POPULATION

The latest reliable population estimates was carried out in the project entitled "The Study on Water Supply System for Tegucigalpa Urban Area", which was conducted by JICA in 2000. The study has concluded the present population of Tegucigalpa as 932,000, based on the number of households given by the pre-census 2000 and the average size of household given by the Permanent Multiple Purpose Questionnaire Survey of Families conducted by DGEC in 1999.

In July 2001, INE (Instituto Nacional de Estadísticas) conducted the Census 2001. During the census, the boundaries of colonia of Distrito Central have been confirmed by completing of residents' address based on the map, which was prepared by INE prior to the census.

Since the information collected through the census is being processed, only the preliminary information of population in Distrito Central and its urban area are obtained from INE. The figures are as follows (areas see *Figure O.1.1*).

Municipality Tegucigalpa area	849,000
Urban area (as most same as the Target Area of the Study)	763,000

1.3 ECONOMIC BACKGROUND

Honduras is the third poorest country in the Latin America and Caribbean Region and more than half of its population is in poverty, one third in extreme poverty and relatively weak social indicators. Gross domestic products (GDP) per capita has been stagnant at around $650 during 1990's. *Table O.1.1* shows the GDP of Honduras last ten years.

Table O.1.1 GDP of Honduras

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
GDP (million US$)	3,091	3,191	3,371	3,581	3,534	3,678	3,811	4,004	4,122	4,044
GDP per Cap (US$)	633.5	634.7	650.7	671.1	643.3	650.6	655.3	669.5	670.5	640.3

Source: IDB web page

Honduras obliges to rely on external debts in order to develop the country. *Table O.1.2* shows the situation concerning external debts.

Table O.1.2 External Debts

Unit: million USD

Year	1990	1991	1992	1993	1994	1995	1996	1997
Total debts	3,634	3,321	3,559	3,984	4,368	4,514	4,477	4,640
Bilateral public loan	1,401	1,089	1,163	1,307	1,470	1,455	1,412	1,368
Multilateral public loan	1,581	1,658	1,801	1,952	2,062	2,153	2,109	2,303
Total debt service	506	307	377	361	433	553	564	505
Debt service for bilateral loan	16	55	68	73	81	135	69	106
Debt service for multilateral loan	278	186	229	214	262	262	336	219
Total debt service ratio (%)	49.0	30.3	36.2	29.7	31.6	31.9	29.4	23.2

Source: IDB web page

The share of multilateral public loans to total debts has gradually increased and reached around 50 % in 1997. Total debt service almost always exceeded 10 % of GDP during 1990 to 1997 and oppressed national economy.

The economy of Honduras highly depends on the agricultural sector. Though a share of manufacturing industry sector to GDP is getting bigger, food products still occupied nearly 80 % of exports in 1998. From the viewpoint of nationwide labor force, an agriculture sector shared more than 40 % in 1990, however, the share dropped to 37 % in 1995. *Table O.1.3* shows nationwide labor force by sector.

Table O.1.3 Labor Force by Sector in Honduras

Unit: %

Year	1990	1991	1992	1993	1994
Agriculture	42.4	39.7	37.7	35.3	37.5
Industry	20.0	20.7	20.4	23.1	24.3
Service	37.5	39.6	41.9	41.6	38.2
Unemployment rate *	7.8	7.4	6.0	7.0	4.0

Source: Honduras Indicators of Labor Market, DGEC, 1996, * IDB web page

Table O.1.4 shows the labor force by sector in Tegucigalpa. Majority of labor force in Tegucigalpa is occupied by the service sector and the share of agricultural sector merely 1%.

Table O.1.4 Labor Force by Sector in Tegucigalpa

Unit: %

Year	1990	1991	1992	1993	1994
Agriculture	0.6	0.8	0.9	0.8	1.0
Industry	29.6	29.3	27.8	29.7	33.4
Service	69.8	70.0	71.3	69.5	65.5

Source: Honduras Indicators of Labor Market, DGEC, 1996

Like in many Latin American countries, severe inflation is one of the biggest economic problems in Honduras. *Table O.1.5* shows annual growth rate of consumer price index (CPI). Average annual inflation rate during 1990s was 19.0 % a year.

Table O.1.5 Consumer Price Index

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Annual growth rate of CPI (%)	23.3	34.0	8.7	10.8	21.7	29.5	23.8	20.2	13.7	11.6
CPI (year 1990 = 100)	100	134	146	161	196	254	315	379	430	480

Study on Water Supply System for Tegucigalpa Urban Area, JICA 2000

1.4 SOCIAL BACKGROUND

In the Tegucigalpa Metropolitan Area, the flatlands are located only limited areas along the Choluteca River and its tributaries and the most of urban areas has been developed on the slope of the mountains. Even the urban areas that have been developed in earliest days of the city, are exposed to the threat of natural disasters.

In the recent years, the urban areas of metropolitan area are rapidly expanding due to the rapid population growth and the massive migrant from rural areas. Due to lack of a proper urban development plan and an effective legislation system in Tegucigalpa, the migrants from outside the city have dwelled in the peripheral area of existing urbanized area (frequently originated in illegal land occupation) and have formed the developing communities. The communities are usually located in the unfavorable and risky areas, such as the areas on the steep slope having a possibility of landslide and/or slope failure or in the flood prone areas along the river. In addition, these communities are prone to have a poor basic infrastructure, building structure and community organization. Thus, the areas would have a high vulnerability against the natural disasters.

Based on population estimation in the Study of water supply master plan, the existing population in developing communities reached more than 500,000.

1.5 SOCIO-ECONOMIC IMPACT OF HURRICANE MITCH

1.5.1 NATIONAL LEVEL IMPACT

In October 1998, hurricane Mitch attacked whole country and caused the worst damage by hurricane to the country in its history. The human toll has been set at 5,657 deaths, 8,058 missing, 12,272 injured and a total of 1.5 million people (of the 6 million total population)

affected (evacuated). United Nations' ECLAC estimated material losses at around US$3.6 billion, of which US$2.05 billion in productive sectors while the rest represents damage to social infrastructure (US$ 1.02 billion) and economic infrastructure (US$ 0.51 billion).

With the effort by the government and other donor agencies, the evacuated people of 1.5 million have been reduced to 700,000 soon after the disaster and 285,000 of them was remained in provisional shelters until the end of November 1998. Almost all refugees in the shelters have already gone back home at present.

The breakdown of damages caused by Mitch and the estimated replacement cost by sectors are shown in *Table O.1.6.*

Table O.1.6 Damages Caused by Hurricane Mitch and Estimated Replacement Cost

Unit: million US$

	Dirct Damage	Indirect Damage	Total Damage	Replacement Costs
Total	**2,177.4**	**1,461.1**	**3,638.5**	**4,987.7**
Social Sectores	**305.4**	**719.4**	**1,024.8**	**580.5**
Housing	259.1	675.3	934.4	484.0
Health	25.6	36.7	62.3	64.5
Education	20.7	7.4	28.1	31.2
Infrastructure	**347.6**	**164.2**	**511.7**	**713.2**
Roads, Bridges, Telecommunications	314.1	140.0	454.1	571.4
Water and Sanitation	24.2	7.2	31.3	118.6
Energy	9.3	17.0	26.3	23.2
Productive Sectors	**1,477.6**	**577.1**	**2,054.8**	**3,694.0**
Agriculture, Livestock, Fisheries and Forestry	1,387.3	274.2	1,661.5	2,990.7
Manufacturing	15.8	196.3	212.1	381.8
Trade, Restaurants, Hotel	74.5	106.7	181.2	326.2
Environment	**46.8**	**0.4**	**47.2**	**n.a**

Source: Technical Annex for a Proposed Credit of SDR 144.3 million to the Republic Honduras for a Hurricane Emergency Project, December 14, 1998, World Bank

The economic estimates indicated that for 1999 the decline in GDP would be around 2.5 % instead of more than 3 % that predicted earlier in the year. The inflation rate was reaching to 10 percent during the second half of the year, while the average rate for the whole year was 11.6 percent, down from 13.7 percent in 1998. However, the negative impact of the disaster on the economic activities of Honduras have not been as severe as originally predicted because of the timely efforts to restore and reconstruction with the support of external financial resources. Even though, in 1999 the country suffered from full impact of destruction over productive capacity and exports, it was also the year when major effort to reconstruct and transform the Honduran economy was launched with the cooperation of the international community of donors and development financial agencies.

1.5.2 IMPACT ON TEGUCIGALPA

There is no complete information of the impacts/damage to Tegucigalpa City caused by Mitch. However, according to the report prepared by the World Bank, about 40 percent of the capital was damaged, half of its 1 million inhabitants were affected, and the city was cut off from the rest of the country for almost a week.

Based on the damage amount of the whole country and national GDP and regional GDP of Tegucigalpa, the estimated damage of Tegucigalpa City caused by Mitch would be set between US$410 million and US$760 million.

2. BASIS OF ECONOMIC ANALYSIS

2.1 GENERAL

The objective of economic evaluation is to evaluate the project efficiency from the viewpoint of economics of the whole country. An economic analysis is carried out using the economic benefits and the economic costs, which is not directly related to the cash flow of the projects. For example, subsidies or taxes, which are internal transfers of cash within the country, are not included in economic analysis.

The economic effects and feasibility of the project are examined by making a comparison between both present values of the economic cost and benefit, by means of the Cost Benefit Ratio (B/C), the Net Present Value (NPV) and the Economic Internal Rate of Return (EIRR).

2.2 ECONOMIC COST

It is necessary to require the various adjustments of project expenses to calculate the economic costs of the project, because the project expenses are influenced by economic policies like taxes and subsidies. It is, therefore, the following preconditions and assumptions will be applied for calculation of the economic costs in this Study.

- The inflation factor is not included
- Transfer payment factors such as taxes and duties are applied to goods and services procured locally with following rates:
  - Value added tax (VAT): 12 %
  - Income tax: 10 %
  - Import tax: 10 % (average)
- Standard conversion factor of 0.96 is applied for converting to the shadow price for all the costs except imported goods based on the Honduran external trade statistics and the values used for other studies[i].
- Adjustment factor for personal costs of unskilled laborers was not applied.
- The real exchange rate is assumed to be fixed because so far the government has not introduced any special protective measure for trade and its currency.

Under the preconditions and assumptions mentioned above, the economic costs of the project are estimated from the project costs provided in Supporting Report K.

2.3 ECONOMIC BENEFIT

2.3.1 GENERAL

Benefit of the disaster prevention project is generally defined as an economic difference between “with-project” and “without-project” situation. As for the Study, “With-project” means the condition that after the completion of all the structural measures and non-structural measures

[i] Study on Water Supply System for Tegucigalpa Urban Area, JICA 2000
The Tegucigalpa Urban Transport Study, JICA 1996
The Master Plan Study on the Erosion and Sediment Control in the Pilot River Basin, Choloma, San Pedro Sula, Cortes, JICA 1994

for flood damage mitigation and landslide damage mitigation proposed in the Study, and "Without-project" means the condition without any such measures.

There are two kinds of benefit, namely tangible benefit and intangible benefit. Further, tangible benefit would be classified into direct benefit and indirect benefit.

The direct/tangible benefits derived from the implementation of countermeasures will be estimated as a reduction in damage to assets such as building, household effects, livestock, crops, infrastructure and other facilities. Indirect/tangible benefit also would be estimated as a reduction in damage, which would be caused by the direct damage of disaster.

2.3.2 DAMAGE ESTIMATE

(1) General

According to the land use study, the Study Area is mostly urbanized. Although, most of the hazardous areas are classified into residential area, some areas could be classified into commercial areas, e.g. Comayaguela, where the commercial activities have highly been concentrated. However, no remarkable industrial activities are situated within the hazardous areas of inundation and landslide. Therefore, it is assumed that the assets in the hazardous area of natural disasters are general assets of household and commercial activities, public/social facilities and infrastructures. The household density of the area was estimated by the base map created in this Study.

The latest and the most reliable damage survey in Honduras is the damage survey of Hurricane Mitch, which was carried out by UNDP/ECLAC (the results are presented in the World Bank's Report[ii], refer to *Table O.1.6*). As mentioned in the previous section, the estimated damage of Tegucigalpa City caused by Mitch is between US$410 million and US$760 million using the survey results.

To confirm the appropriateness of damage amount of Tegucigalpa which have been estimated using the result of the above mentioned survey, the two direct damage amounts to housing, namely damage amount in the survey and damage estimated in this Study, were compared and no major difference have been observed. Meanwhile, it is supposed that most of the damage caused by Mitch to Tegucigalpa was caused by flood, landslide and slope failure.

It is, therefore, the total damage amount by various return periods of this Study are estimated based on the direct damage to housing and its ratio to the total damage resulted from the World Bank survey.

(2) Housing Asset

Based on the damage survey result, which is described in the Supporting Report N, the amount of assets and effects of the households and the commercial for the economic analysis are summarized in the tables below:

[ii] Technical Annex for a Proposed Credit of SDR 144.3 million to the Republic Honduras for a Hurricane Emergency Project, December 14, 1998, World Bank

Table O.2.1 Value of Housing Assets

	Buildings (US$)	Other Assets/Effects (US$)	Total (US$)
High	10,000	20,000	30,000
Middle	8,000	12,000	20,000
Low	5,000	5,000	10,000
Poor	3,000	2,000	5,000

(3) Flood Damage to Housing

The rate of damage caused by inundation to the assets is mainly related to water depth and duration of inundation.

Since the rivers in the Study Area have rather steep slopes of around 1/200, the duration of the inundation would be less than one (1) day with the assumption of without any blockage of the rivers, like the Berrinche Landslide. Accordingly, only the water depth is assumed to use as a representative parameter for estimating the damage rate.

The same values of the damage rate of "Manual for Survey for Flood Economy (the Manual)" which is being applied for the flood damage estimation in Japan will be applied as the rates of damage to assets by inundation depths, (see *Tables O.2.2* to *O.2.3*).

Table O.2.2 Rate of Flood Damage to Buildings

	Below floor	Abave floor				
		< 0.5 m	0.5 – 1.0 m	1.0 – 2.0 m	2.0 – 3.0 m	3.0 m <
Damage Rate	0.050	0.144	0.205	0.382	0.681	0.888

Table O.2.3 Rate of Flood Damage to Assets and Effects

	Below floor	Abave floor				
		< 0.5 m	0.5 – 1.0 m	1.0 – 2.0 m	2.0 – 3.0 m	3.0 m <
Damage Rate	0.021	0.145	0.326	0.508	0.928	0.991

The damage amount will be estimated using the value of buildings and assets/effects, the number of households counted by land use study and the damage rate presented in the tables above.

(4) Landslide Damage to Housing

The damage amount caused by landslide would be a same amount (damage rate = 1) of all assets of household because it is assumed that the landslide would destroy everything. The damage amount will be estimated using the value of buildings and assets/effects presented in *Table O.2.1* and the number of households counted by land use study.

3. ECONOMIC ANALYSIS FOR PROPOSED MASTER PLAN

3.1 ECONOMIC BENEFIT

3.1.1 FLOOD DAMAGE REDUCTION TO HOUSING (DIRECT DAMAGE)

Affected houses by flood were counted in the land use study by overlaying the simulated inundation area on orthophoto map, which was taken in February 2001 by this Study. Hydraulic simulations were carried out and the inundation area was identified for floods with the return periods of 5-, 10-, 15-, 50- and 500-year (Hurricane Mitch scale) floods. The simulation was made for both with-project case and without-project case. The number of houses affected by various return periods floods by inundation depth are shown in Supporting Report-J.

Using the result of the land use study and damage rate presented in *Tables O.2.2* and *O.2.3*, direct damages to housing were estimated and presented in the table below.

Table O.3.1 Flood Damage to Housing

Unit: US$ million

Return Perod	Without Project			With Project		
	Building	Assets	Total	Building	Assets	Total
5	1.2	1.5	2.7	0.0	0.0	0.0
10	1.5	1.9	3.4	0.0	0.0	0.0
15	2.1	2.8	4.9	0.4	0.6	1.0
50	3.7	5.1	8.8	1.5	2.0	3.5
Mictch (500)	8.9	13.4	22.3	3.7	5.4	9.1

3.1.2 LANDSLIDE DAMAGE REDUCTION TO HOUSING (DIRECT DAMAGE)

The Master Plan contains landslide structural measures for three landslide masses, namely Berrinche, Reparto and Bambu. As the structural measures were planed so that they have enough stability against sliding even with rainfall of Hurricane Mitch class, 250 mm per two days. Therefore, it is considered that those three blocks are stable even with all storms with return periods of less than 500-years with-project case. On the other hand, if the projects are not implemented, three blocks will slide and give damage to the area estimated as A rank dangerous area by a storm with a return period of 500-years.

According to the result of landslide analysis, only class “A” landslide blocks have a possibility of failure if the blocks receive the large amount of rainfall as hurricane “Mitch”. However, since it is difficult to assume the event magnitude which cause the failure, and all the blocks moved at the event of “Mitch”, it is assumed that the all landslide blocks will be moved by the same scale of rainfall of “Mitch”.

Thus, it is assumed that without projects all the households in A rank area of three landslide blocks are destroyed by 500-year storm, while all the households in the same area of three landslide blocks are safe against 500-year storm with the project.

The damage amount caused by landslide would be a same amount of all assets of household because the landslide would destroy everything. The damage amount is estimated using average value of buildings and assets/effects estimated by the damage survey and the number of

households counted by the land use study (refer to Supporting Report-J).

Table O.3.2 Landslide Damage to Housing

Unit: US$ million

Return Perod	Without Project			With Project		
	Building	Assets	Total	Building	Assets	Total
Mictch (1/500)	7.8	1.0	8.8	3.3	0.3	3.6

3.1.3 SLOPE FAILURE DAMAGE REDUCTION TO HOUSING (DIRECT DAMAGE)

Since no structural measures will be implemented for preventing the slope failure, the damage reduction to assets would not be occurred.

3.1.4 TOTAL DAMAGE REDUCTION BY STRUCTURAL MEASURES AND AVERAGE ANNUAL DAMAGE REDUCTION (ECONOMIC BENEFIT OF MASTER PLAN)

As mentioned in the Section 2.3.1, total damage caused by each flood scale in the case of with-project and without-project was estimated from the direct damages to housing and its ratio in total damage. The reduction of damage was calculated as a difference of damage between with-project and without-project. *Table O.3.3* shows the total damage reduction by structural measures proposed in the Master Plan.

Table O.3.3 Damage Reduction (Master Plan)

Unit: million US$

Return Perod	Without Project	With Project	Damage Reduction
5	14.30	0.00	14.30
10	20.58	0.00	20.58
15	29.65	6.05	23.60
50	59.91	23.83	36.08
Mictch (500)	235.26	96.07	139.19

Average annual damage reduction was estimated by multiplying probability of flood and damage reduction and was estimated at US$ 5.48 million as an annual benefit of the Master Plan Projects.

3.2 ECONOMIC COST

The economic costs for cost-benefit analysis are calculated using the cost estimated in Supporting-K and the standard conversion factor presented in Section 2.2 of this supporting report.

3.3 COST BENEFIT ANALYSIS

The project life is economically taken as 50 years after commencement of the project. The benefits together with the operation and maintenance (OM) cost were assumed to accrue throughout the period of project life after completion of the construction works. The partial benefit and OM cost under the construction period would be considered in this analysis.

Table O.3.4 shows the cash-flow statement for the economic analysis.

The estimated EIRR of Master Plan indicates 10.49 % and it can be said that the project is

economically feasible, from the viewpoint of the opportunity cost of capital (OCC) in Honduras of 4 % which is the same amount of the real yield of the Honduran state bond.

Table O.3.5 shows the Net Present Value (NPV) and Cost Benefit Ratio (B/C) of the Project with different discount rate.

Table O.3.5 NPV and B/C for the Master Plan Project

Discount Rate	NPV (US$ million)	B/C
4 %	47.40	2.11
8 %	9.30	1.28

Sensitivity analysis had also been conducted. The conditions of the analysis and results are summarized in *Table O.3.6*.

Table O.3.6 Sensitivity Analysis

Conditon of Analysis	IRR (%)
Original case	10.49
Case 1: Cost increase 20 %, Same Benefit	8.59
Case 2: Same Cost, Benefit decrease 20 %	9.45

3.4 INTANGIBLE SOCIO-ECONOMIC IMPACT OF THE PROJECT

The Study Area having a high socio-economic potential was affected floods and landslides and serious damages to the inhabitants and the infrastructures was caused. It is therefore essential to carry out the proposed projects to develop and improve the social and economic situation of the Study Area.

As it was confirmed in the previous section, the proposed projects would produce the direct economic effects, and it concludes economically feasible. Furthermore, it is expected that the project would have various intangible effects of reducing the socio-economic damage as follows:

Spread of Infectious Disasters

Natural disasters may frequently cause a spread of infectious diseases by destroying the water supply and drainage facilities.

Shortage of Goods

Natural disasters would cause shortage of goods in and around the area affected due to damage to products and manufacturing factories, standstills of distribution system of commodities and cutting of road network, and increase in demand of equipment and materials caused by damage to buildings, household effects and public facilities.

Steep Rise in Prices

The shortage of goods and standstills of traffic and distribution system of commodities would cause a steep rise in prices in and around the area. Further there is the possibility that such a steep rise in prices expands in the whole country.

Lowering of Administrative and Educational Activities

Administrative and educational activities in the affected area would drop due to the damages to public offices and schools.

Decline in Communication

Communications between the affected areas and other areas would decline due to damage to telecommunication facilities and standstill of traffic.

Decline in the Standard of Living

Inhabitants in the areas of affected would inevitably experience a decline in the standard of their living due to damage to their assets and public facilities, shortage of goods, steep rise in prices, lowering of administrative and educational activities, etc.

Time Lag of Social and Economic Development

Various negative factors mentioned above would cause a delay of social and economic developments in and around the areas affected by natural disasters. Further there is the possibility that the delay would expand in the country as a whole, because the area has the highest socio-economic potential in the country.

3.5 ECONOMIC EFFECTS OF NON-STRUCTURAL MEASURES

Economic effect of non-structural measures in short term is reduction of human casualty by establishing forecasting and warning system, however no decreasing in damage to housing is taken place in this stage.

By applying the land use regulation and structure code as well as other non-structural measures, houses located in the risk areas expected to be relocated to the safer places in the long term and it causes a decreasing of damage to housing and other infrastructures. Meanwhile, controlling new housing developments in the risk area prevents the creation of new dangerous house/area.

Economic effects of the non-structural measures are estimated from reduction in damage by relocation and land use regulation. However, it is difficult to assume properly the number of houses voluntary relocates by the target year of the Project and the number of houses newly constructed in the dangerous area without land use regulation.

By implementing of whole scale non-structural measures, it is possible to expect all houses located in the risk area (number of houses see *Table O.3.7*) might be voluntary relocated and relieved from natural disaster, and it should be a maximum effect of non-structural measures.

Table O.3.7 Houses in Risk Area

	Flood Risk Area	Landslide Risk Area	Slope Failure Risk Area	Total
Existing	3,151	1,543	24,586	29,280
Future *	4,442	2,175	34,663	41,280

4. ECONOMIC ANALYSIS FOR THE FEASIBILITY STUDY

4.1 GENERAL

Economic analysis for the Feasibility Study was carried out using the cost of the Priority Projects and the benefit derives from the implementation of the Priority Projects. The method of estimation of cost and benefit is same as the method applied in the Master Plan Study.

4.2 ECONOMIC ANALYSIS FOR PRIORITY PROJECT

The project life of 50 years is same as the Master Plan Study and the benefits together with the operation and maintenance (OM) cost were assumed to accrue throughout the period of project life. *Tables O.4.1* to *O.4.3* show the direct damage of housing by flood and landslide and the amount of damage reduction by the Priority Projects.

Table O.4.1 Flood Damage to Housing

Unit: US$ million

Return Perod	Without Project			With Project		
	Building	Assets	Total	Building	Assets	Total
5	1.2	1.5	2.7	0.0	0.0	0.0
10	1.5	1.9	3.4	0.49	0.67	1.16
15	2.1	2.8	4.9	0.51	0.70	1.21
50	3.7	5.1	8.8	1.5	2.0	3.5
Mictch (500)	8.9	13.4	22.3	3.7	5.4	9.1

Table O.4.2 Landslide Damage to Housing

Unit: US$ million

Return Perod	Without Project			With Project		
	Building	Assets	Total	Building	Assets	Total
Mictch (1/500)	7.8	1.0	8.8	3.3	0.3	3.6

Table O.4.3 Damage Reduction (Priority Projects)

Unit: million US$

Return Perod	Without Project	With Project	Damage Reduction
5	14.30	0.00	14.30
10	20.58	7.02	13.56
15	29.65	7.32	22.33
50	59.91	23.83	36.08
Mictch (500)	235.26	96.07	139.19

The economic costs of the Priority Projects for the analysis are calculated using the cost estimated in Supporting-K.

*Table*s *O.4.4* shows the cash-flow statement for the economic analysis of the Priority Projects.

The estimated EIRR for the Priority Projects indicates 13.44 % and it can be said that the project is economically feasible, even only the Priority Projects will be implemented.

Table O.4.5 shows the Net Present Value (NPV) and Cost Benefit Ratio (B/C) of the Project with different discount rate.

Table O.4.5 NPV and B/C for the Priority Project

Discount Rate	NPV (US$ million)	B/C
4 %	55.73	2.94
8 %	16.91	1.71

Sensitivity analysis had also been conducted. The conditions of the analysis and results are summarized in *Table O.4.6*.

Table O.4.6 Sensitivity Analysis

Conditon of Analysis	IRR (%)
Original case	13.44
Case 1: Cost increase 20 %, Same Benefit	11.36
Case 2: Same Cost, Benefit decrease 20 %	10.93

5. FINANCIAL ASPECT

5.1 RAISING OF THE PROJECT FUND

In order to examine a financial viability of the project, a consideration would be given on rising the construction fund in this section.

The project cost excluding O/M cost for the Master Plan Project is estimated at US$ 63.05 million in total. It is assumed that the fund for the project will be raised from two sources of local-fund and external debt, under following conditions:

- The external debt will cover the whole project cost except government administration and land acquisition cost. The government administration cost and land acquisition cost would be prepared from local-fund.
- The following loan conditions were assumed based on the actual conditions of IDB loan for Honduras.
  - Repayment period: 40 years
  - Grace period: 10 years (only for principal repayment)
  - Interest rate: 1 % for the first 10 years and 2 % afterward
- During the grace period, only interest is paid, and repayment of the debt with the interest is made after the grace period.
- Disbursement of external loan will be done in the beginning year of the priority project (year 2003) and the beginning year of remaining projects (year 2006) respectively.
- Repayment of principal was calculated based on an equal installment repayment method.

Table O.5.1 shows the repayment schedule and as shown in the table, the maximum disbursement of US$ 37.46 million will be accrue in 2006 which is the beginning year of the project and the maximum repayment of US$ 2.91 million in 2027.

5.2 REPAYMENT OF EXTERNAL DEBT

As mentioned in the previous section and shown in *Table O.5.1*, the annual maximum repayment would be US$ 2.91 million in 2027.

According to the repayment statistics of the external debt of Honduras, the average annual

repayment amount for multilateral loan is approximately US$ 240 million for the past 8 years.

The annual maximum repayment amount of US$ 2.91 million in 2027 for this project will be 1 % of the total annual repayment of Honduras.

Table O.3.4 Cash-flow Statement for the Economic Analysis of Master Plan

Unit: US$ million

Year	Economic Cost	Economic Benefit	Net Benefit
2001	0.00	0.00	0.00
2002	1.53	0.00	-1.53
2003	0.21	0.00	-0.21
2004	11.20	0.00	-11.20
2005	8.92	0.00	-8.92
2006	8.18	0.00	-8.18
2007	1.27	4.96	3.69
2008	0.32	4.96	4.64
2009	5.66	4.96	-0.70
2010	5.32	4.96	-0.35
2011	5.31	4.96	-0.35
2012	0.71	4.96	4.25
2013	0.50	4.96	4.46
2014	0.50	4.96	4.46
2015	0.50	4.96	4.46
2016	0.68	5.48	4.80
2017	0.17	5.48	5.30
2018	0.17	5.48	5.30
2019	0.17	5.48	5.30
2020	0.17	5.48	5.30
2021	0.17	5.48	5.30
2022	0.38	5.48	5.09
2023	0.17	5.48	5.30
2024	0.17	5.48	5.30
2025	0.17	5.48	5.30
2026	0.17	5.48	5.30
2027	0.17	5.48	5.30
2028	0.68	5.48	4.80
2029	0.17	5.48	5.30
2030	0.17	5.48	5.30
2031	0.17	5.48	5.30
2032	0.56	5.48	4.92
2033	0.17	5.48	5.30
2034	0.17	5.48	5.30
2035	0.17	5.48	5.30
2036	0.17	5.48	5.30
2037	0.17	5.48	5.30
2038	0.17	5.48	5.30
2039	0.17	5.48	5.30
2040	0.68	5.48	4.80
2041	0.17	5.48	5.30
2042	0.38	5.48	5.09
2043	0.17	5.48	5.30
2044	0.17	5.48	5.30
2045	0.17	5.48	5.30
2046	0.17	5.48	5.30
2047	0.17	5.48	5.30
2048	0.17	5.48	5.30
2049	0.17	5.48	5.30
2050	0.17	5.48	5.30
2051	0.17	5.48	5.30

Table O.4.4 Cash-flow Statement for the Economic Analysis of Priority Projects

Unit: US$ million

Year	Economic Cost	Economic Benefit	Net Benefit
2001	0.00	0.00	0.00
2002	1.53	0.00	-1.53
2003	0.21	0.00	-0.21
2004	11.20	0.00	-11.20
2005	8.92	0.00	-8.92
2006	8.33	0.00	-8.33
2007	0.10	4.96	4.86
2008	0.10	4.96	4.86
2009	0.10	4.96	4.86
2010	0.10	4.96	4.86
2011	0.10	4.96	4.86
2012	0.32	4.96	4.64
2013	0.10	4.96	4.86
2014	0.10	4.96	4.86
2015	0.10	4.96	4.86
2016	0.55	4.96	4.41
2017	0.10	4.96	4.86
2018	0.10	4.96	4.86
2019	0.10	4.96	4.86
2020	0.10	4.96	4.86
2021	0.10	4.96	4.86
2022	0.32	4.96	4.64
2023	0.10	4.96	4.86
2024	0.10	4.96	4.86
2025	0.10	4.96	4.86
2026	0.10	4.96	4.86
2027	0.10	4.96	4.86
2028	0.55	4.96	4.41
2029	0.10	4.96	4.86
2030	0.10	4.96	4.86
2031	0.10	4.96	4.86
2032	0.43	4.96	4.53
2033	0.10	4.96	4.86
2034	0.10	4.96	4.86
2035	0.10	4.96	4.86
2036	0.10	4.96	4.86
2037	0.10	4.96	4.86
2038	0.10	4.96	4.86
2039	0.10	4.96	4.86
2040	0.55	4.96	4.41
2041	0.10	4.96	4.86
2042	0.32	4.96	4.64
2043	0.10	4.96	4.86
2044	0.10	4.96	4.86
2045	0.10	4.96	4.86
2046	0.10	4.96	4.86
2047	0.10	4.96	4.86
2048	0.10	4.96	4.86
2049	0.10	4.96	4.86
2050	0.10	4.96	4.86
2051	0.10	4.96	4.86

Table O.5.1 Repayment Schedule

Unit: million US$

Year	Disbursement	Remaining Capital	Repayment		Total Repayment
			Capital	Interest	
2002	26.31	26.31	0.00	0.00	0.00
2003		26.31	0.00	0.26	0.26
2004		26.31	0.00	0.26	0.26
2005		26.31	0.00	0.26	0.26
2006	37.46	63.77	0.00	0.26	0.26
2007		63.77	0.00	0.64	0.64
2008		63.77	0.00	0.64	0.64
2009		63.77	0.00	0.64	0.64
2010		63.77	0.00	0.64	0.64
2011		63.77	0.00	0.64	0.64
2012		63.77	0.00	0.64	0.64
2013		62.90	0.88	0.64	1.51
2014		62.02	0.88	0.63	1.51
2015		61.14	0.88	0.62	1.50
2016		60.26	0.88	0.61	1.49
2017		58.14	2.13	0.60	2.73
2018		56.01	2.13	0.58	2.71
2019		53.89	2.13	0.56	2.69
2020		51.76	2.13	0.54	2.66
2021		49.64	2.13	0.52	2.64
2022		47.51	2.13	0.50	2.62
2023		45.38	2.13	0.65	2.78
2024		43.26	2.13	0.62	2.75
2025		41.13	2.13	0.59	2.72
2026		39.01	2.13	0.56	2.69
2027		36.88	2.13	0.78	2.91
2028		34.76	2.13	0.74	2.86
2029		32.63	2.13	0.70	2.82
2030		30.50	2.13	0.65	2.78
2031		28.38	2.13	0.61	2.74
2032		26.25	2.13	0.57	2.69
2033		24.13	2.13	0.53	2.65
2034		22.00	2.13	0.48	2.61
2035		19.88	2.13	0.44	2.57
2036		17.75	2.13	0.40	2.52
2037		15.62	2.13	0.35	2.48
2038		13.50	2.13	0.31	2.44
2039		11.37	2.13	0.27	2.40
2040		9.25	2.13	0.23	2.35
2041		7.12	2.13	0.18	2.31
2042		4.99	2.13	0.14	2.27
2043		3.75	1.25	0.10	1.35
2044		2.50	1.25	0.07	1.32
2045		1.25	1.25	0.05	1.30
2046		0.00	1.25	0.02	1.27

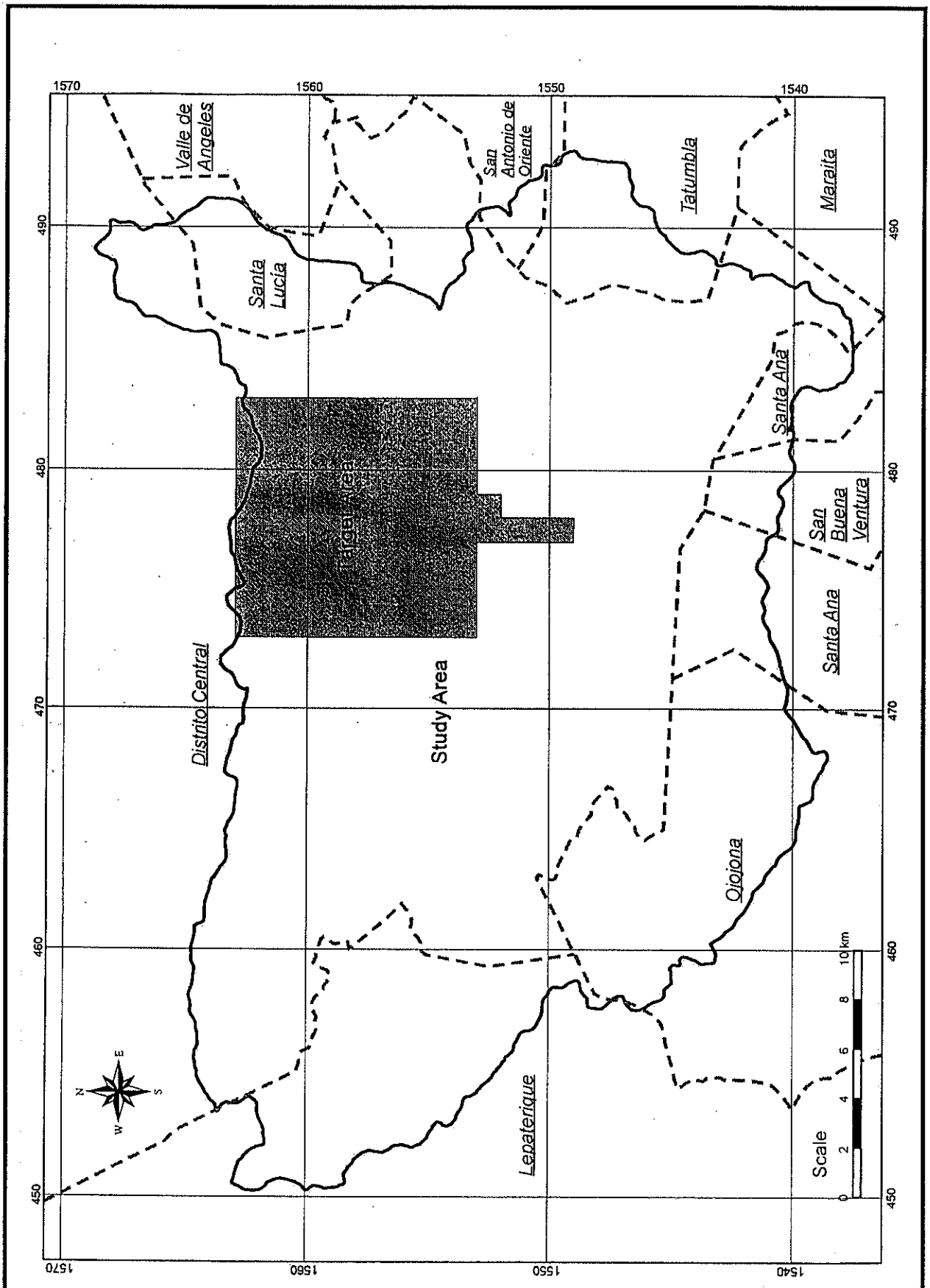

Figure O.1.1	Administrative Boundaries of the Study

REFERENCES

1) Presupuesto de ingresos y egresos Ejercicio Ejercicio Fiscal 2000, AMDC

2) Presupuesto General de la Nación de los años 1999-2000, mayo 2001, SOPTRAVI

3) Diseño final y construcción del colector principal para el saneamiento del Río Choluteca, mar.2001, SANAA

4) Indicadores generales de Honduras, AMDC

5) Project Portfolio, feb.2001, WORLD BANK