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**GUATEMALA: ASSESSMENT OF THE DAMAGE CAUSED
BY HURRICANE MITCH, 1998**

*Implications for economic and social development
and for the environment*

CONTENTS

	<u>Page</u>
PREFACE	1
I. BACKGROUND	3
1. The mission	3
2. Description of the phenomenon and its effects	4
3. Population affected	9
4. Emergency actions	17
II. ASSESSMENT OF THE DAMAGE	19
1. Social sectors	19
2. Infrastructure	26
3. Damage in productive sectors	35
4. Effects on the environment	42
5. Summary of damage	52
III. OVERALL EFFECTS OF THE DAMAGE	55
1. Economic evolution prior to the disaster	55
2. Macroeconomic effects of the disaster	66
IV. GUIDELINES FOR A REHABILITATION AND RECONSTRUCTION PROGRAMME	61
1. Project generation	62
2. Rehabilitation stage	63
3. Reconstruction stage	63
<u>Appendix</u> : Project profiles for the rehabilitation and reconstruction stage	69

PREFACE

This study forms part of United Nations support for Central America following the disaster caused by hurricane Mitch, which struck the region in October 1998. A request for this social, environmental and economic impact assessment was submitted to the Economic Commission for Latin America and the Caribbean (ECLAC) by the Planning and Programming Secretariat of the Presidency of the Republic (SEGEPLAN) through the United Nations Development Programme (UNDP).

The study carries out a sectoral analysis leading to an overall assessment of the damage; it appraises the macroeconomic and environmental effects and proposes guidelines for rehabilitation and reconstruction programmes; it complements other sectoral or partial assessments conducted by national and international institutions, and financial and bilateral cooperation agencies.

National authorities, coordinated by SEGEPLAN, UNDP and other United Nations agencies, as well as international institutions and agencies, collaborated in the preparation of the study. Officials and consultants of the Pan American Health Organization (PAHO/WHO) and of the United Nations Children's Fund (UNICEF) joined the mission. Valuable contributions were also made by the United Nations Verification Mission in Guatemala (MINUGUA). This assessment complements the data collected by the Office of the United Nations Disaster Assistance Coordinator (UNDAC) through the Office of the Coordinator for Humanitarian Assistance (OCHA).

The direct and indirect damage has been assessed in accordance with the methodology developed by ECLAC. The results are based on the mission's estimates; the study incorporates the information available and evidence collected in interviews and visits to affected locations. It is estimated that the magnitude of the losses exceeds the country's capacity to address reconstruction needs on its own, particularly if the aim is also to reduce the impact of similar events in the future, and therefore international cooperation is considered essential.

This appraisal is designed to provide the government and the international community with guidelines for setting national and regional priorities in rehabilitation and reconstruction programmes. An economic approach would be very limited, and such programmes should therefore include actions of a social nature designed to alleviate the suffering of broad segments of the population who were already in a situation of poverty and vulnerability before the disaster occurred. Special attention and priority should be placed on including sustainability and increased-governance criteria in making social and productive investments, and on allocating resources to the reconstruction and replacement of infrastructure.

Guatemalan society and government face the opportunity of undertaking the reconstruction with renewed values and criteria, consolidating the peace process and embarking at the same time on institutional, legal and structural reforms to reduce economic, social and environmental vulnerability. An important aspect of such reforms will be to strengthen the country's savings, investment and management capacity as part of the reconstruction.

I. BACKGROUND

Hurricane Mitch was one of the most violent hydrometeorological phenomena to have struck Central America this century, owing to its force on reaching the region's coasts, its diameter, the accumulation of humidity and rain it carried, and the erratic path it followed for several days. In Guatemala the hurricane occurred when the country was resuming a path of sustained growth and development after a long period of violence and armed confrontation which had caused setbacks and stagnation in society.

Natural disasters, whether climatic, seismic or volcanic, are frequent in the region. In Latin America, annual losses caused by such phenomena are estimated at more than US\$1.5 billion and almost 6,000 lives.¹ These effects are exacerbated by structural disparities in societies, which place population segments already living in precarious economic and social conditions at greater risk.

The extent of the damage and the enormous efforts required for the recovery point up the need for the country—and the region as a whole—to receive cooperation from the international community. This involves the creation of more favourable conditions for its integration into world trade and access to its principal markets. International funds will be needed to complement national efforts—both public and private—to carry out the reconstruction programme. The attached project profiles show the magnitude of the efforts involved and indicate the degree of urgency and the priorities to be set, with the participation of the international community

1. The mission

UNDP requested ECLAC's cooperation in carrying out a project to assess the environmental, social and economic impact of hurricane Mitch on the countries of Central America.²

Two technical teams coordinated by ECLAC were established to carry out the assessment in the four countries most affected; one of the teams was entrusted with the work in Honduras and El Salvador and the other in Guatemala and Nicaragua. The mission had the full support of the UNDP national offices and representatives of various United Nations agencies, and of three international financial institutions: the Inter-American Development Bank (IDB), the World Bank and the International Monetary Fund (IMF). PAHO/WHO and UNICEF provided officials or consultants to support the mission.

The work was carried out as a contribution to Guatemala and the United Nations in response to bilateral and multilateral cooperation initiatives to enable the countries of Central America, and Guatemala in particular, to address the challenges of rehabilitation and reconstruction.

¹ See, for example, Jovel, R. and R. Zapata (1993), *Macroeconomic effects of natural disasters in Latin America and the Caribbean*, a paper presented at the Fortieth North American Meeting of the International Association of Regional Science, Houston, 11-14 November.

² Project RLA/98/020, "Socio-economic impact assessment of natural disasters (hurricane Mitch)".

The mission visited Guatemala from 15 to 21 November 1998. The team was made up of the following ECLAC officials, external consultants and officials of other international organizations who joined the team:

- Jorge Máttar, coordinator.
- Óscar Zamora, consultant, commodities sector (agriculture, livestock, fisheries, forestry).
- René Hernández, macroeconomic effects and industrial, trade and services sectors.
- Oriol Olivares, consultant, transport infrastructure sector.
- Ruth Urrutia, population affected, education and health sectors, with the support of UNICEF and PAHO/WHO, in the health sector and dealing with the emergency.
- Daniel Bitrán, consultant, housing and health sectors.
- José Javier Gómez, environmental impact.
- Jaime Baraqui, consultant, design of reconstruction projects.
- Hugo Ventura, energy sector.

Additionally, consultants Roberto Jovel and Antonio Tapia reviewed the assessments and were instrumental in making damage estimates more precise.

The mission followed a previous visit by ECLAC officials in which liaisons with government entities and technical collaboration with various multilateral agencies and the United Nations were established, with the support of the government and the Resident United Nations Coordinator in Guatemala.

This document contains an independent and objective assessment of the disaster which sets forth the overall magnitude of direct and indirect damages and their effects on the behaviour of the economy as a whole. It will serve as a basis in drawing up proposals for reconstruction priorities and needs, one of which should be the explicit incorporation of measures to reduce the country's high social, economic and structural vulnerability to such disasters.

2. Description of the phenomenon and its effects

The hurricane season in the northern hemisphere and the Atlantic Ocean (July to November) was unusually strong in 1998 and caused enormous devastation, loss of life, and economic, social and environmental damage. The concentration of very violent meteorological phenomena between August and October was historic: ³ a dozen tropical cyclones were given names during that period and affected densely populated areas throughout the Caribbean basin, including both the island countries ⁴ and the States of the Central American Isthmus. Table 1 shows the dates on which they occurred and their wind velocity. Their effects heighten and form part of other climatic disturbances affecting the

³ National Hurricane Center (NHC) (1998), Monthly Tropical Weather Summary, prepared by the US National Weather Service (NWS) and posted on the Internet for October and November.

⁴ For an assessment of the damage caused in the Caribbean islands, see ECLAC (1998), *República Dominicana: Evaluación de los daños ocasionados por el huracán Georges, 1998. Sus implicaciones para el desarrollo del país* (LC/MEX/R.668), 29 October.

region, such as the droughts and floods resulting from the El Niño phenomenon in the Pacific Ocean,⁵ all of which have caused major damage throughout Latin America and the Caribbean.

Table 1
MAIN HURRICANES IN THE ATLANTIC OCEAN, 1998

Name	Dates	Maximum wind velocity (kilometres per hour)
Danielle	24 August-3 September	170
Earl	31 August-3 September	160
Frances	8-13 September	105
Georges	15-29 September	240
Hermine	17-20 September	75
Ivan	20-27 September	145
Jeanne	21-30 September	170
Karl	23-28 September	170
Lisa	5-9 October	120
Mitch	21 October- 4 November	290

Source: ECLAC, based on US National Weather Service (NWS-NHC) data, October and November 1998.

Hurricanes Lisa and Mitch originated in the Atlantic basin in October. Lisa moved north-east from 5 to 9 October and became a minimum-level extra-tropical system with winds of 140 kilometres per hour, but did not touch land. Mitch, in contrast, arose from a tropical front between Monday 19 and Tuesday 20 October. In Guatemala there was a north wind due to its cyclonic movement, and the atmosphere became unstable. The phenomenon developed into a low-pressure zone and, at noon on 21 October, was classified as the thirteenth tropical depression of the season. At that time, it was located in the south-western Caribbean, some 580 kilometres south of Jamaica, with steady 50 km/h winds, moving west-north-west at 15 km/h.

On Thursday 22 October, it was upgraded to a tropical storm (named Mitch); its centre was located 704 kilometres south-east of the Nicaraguan city of Bluefields, with sustained winds of 72 km/h and gusts of more than 90 km/h. From then on, it followed an apparently erratic path, varying in intensity and changing course several times between 23 October and 4 November (see Table 2 and figures 1 and 2).

⁵ These climatic disturbances have affected Latin American and Caribbean countries, such as Mexico, which has been afflicted by droughts and floods at different times, and the consequences of the El Niño phenomenon have been felt in the Andean countries and Central America. See ECLAC (1998a), *Ecuador: Evaluación de los efectos socioeconómicos del fenómeno El Niño en 1997-1998* (LC/R.1822/Rev.1 and LC/MEX/R.657/Rev.1), 16 July, and ECLAC (1998b), *El fenómeno El Niño en Costa Rica durante 1997-1998. Evaluación de su impacto y necesidades de rehabilitación, mitigación y prevención ante las alteraciones climáticas* (LC/MEX/L.363), 3 November.

Table 2

PATH AND EVOLUTION OF HURRICANE MITCH

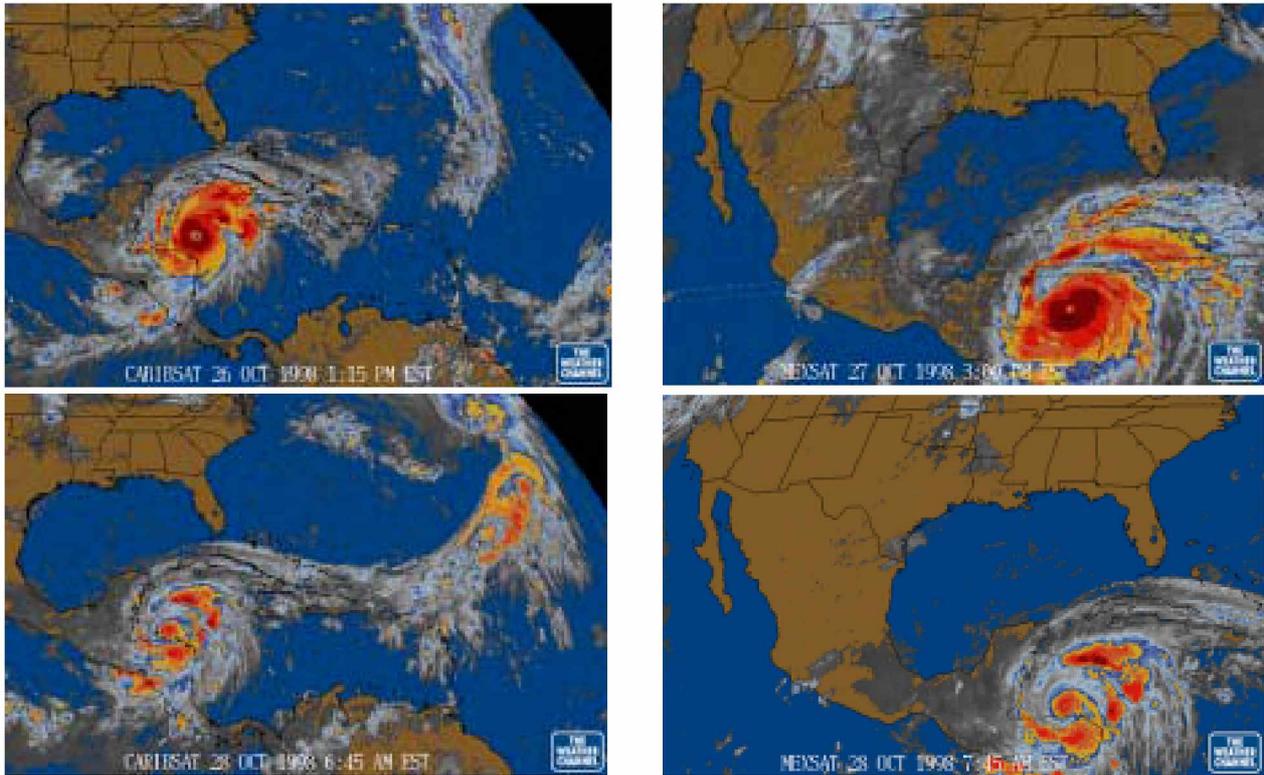
Date (day and local time)	Wind velocity (Maximum sustained km/h)	Category (Saffir-Simpson Scale)	Location		
			Latitude (north)	Longitude (west)	Barometric pressure (BM)
23 October, 10 a.m.	95	Tropical storm	12.7	77.9	999
10 p.m.	95	Tropical storm	13.0	78.1	997
24 October, 10 a.m.	160	2	14.9	77.9	987
10 p.m.	195	3	15.7	78.4	965
25 October, 12 a.m.	200	3	15.9	78.9	953
12 p.m.	235	4	16.4	80.3	929
26 October, 12 a.m.	240	4	16.3	82.0	922
12 p.m.	273	5	17.0	83.2	906
27 October, 12 a.m.	285	5	17.4	84.5	918
12 p.m.	250	5	16.9	85.4	928
28 October, 12 a.m.	220	4	16.5	85.6	933
12 p.m.	195	3	16.4	85.6	948
29 October, 12 a.m.	160	2	16.3	86.0	970
12 p.m.	120	1	15.9	85.6	990
30 October, 12 a.m.	65	Tropical storm	15.3	86.5	997
12 p.m.	85	Tropical storm	14.0	87.0	1,000
31 October, 8 a.m.	55	Tropical depression	14.5	88.7	1,001
8 p.m.	55	Tropical depression	14.6	90.5	1,002
1 November, 8 a.m.	45	Tropical depression	14.9	91.6	1,005
3 November, 5 p.m.	70	Tropical storm	20.0	90.6	997
8 p.m.	65	Tropical storm	20.2	90.2	997
4 November, 12 a.m.	65	Tropical storm	20.3	89.9	997
2 a.m.	55	Tropical depression	20.8	89.4	998
8 a.m.	75	Tropical storm	21.8	88.3	998

Source: ECLAC, based on Internet data, <http://dyred.sureste.com>.

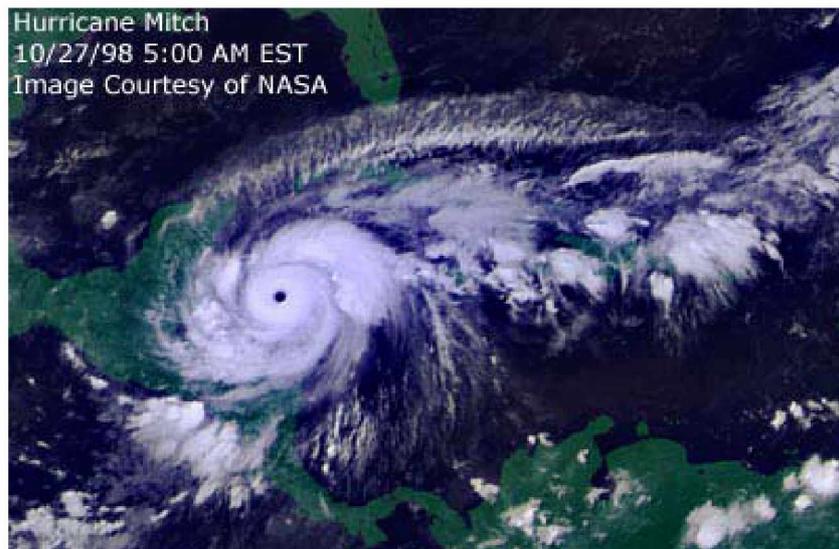
As a result of the presence of two high pressure fronts —the anticyclone in the Gulf of Mexico and the inter-tropical convergence zone (ITCZ)— Mitch slowed down and gradually took a south-westerly path. On Friday 23 October the centre of the storm was 660 kilometres south-east of Puerto Cabezas and 785 km north-west of Bluefields, Nicaragua, moving slowly north at an estimated 11 km/h, with steady 95-km/h winds and 108 km/h gusts. On Saturday 24 it was upgraded to hurricane —in less than 24 hours the pressure in the eye fell 52 millibars to reach 924—, with steady winds of up to 150 km/h, moving at 9 km/h in a north-north-westerly direction. That day it was located at a point south-south-west of Jamaica (415 km) and to the east of Puerto Cabezas (600 km).

Figure 1

IMAGES OF THE PATH TAKEN BY HURRICANE MITCH
(Between 26 and 28 October 1998)



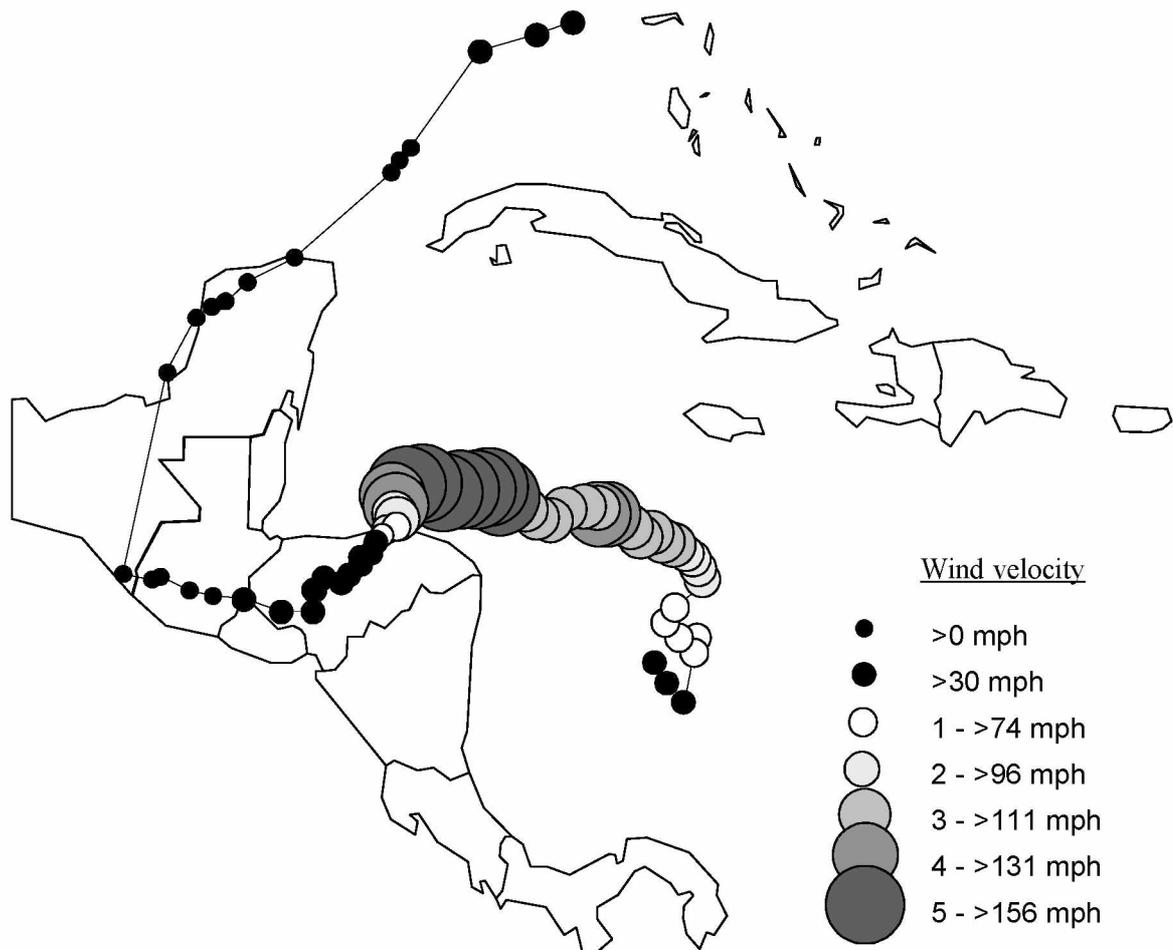
Source: The Wather Channel, Internet.



Source: NASA image, taken from the Internet.

Figure 2

ROUTE OF HURRICANE MITCH
(Between 22 October and 5 November 1998)



Source: Johns Hopkins University Applied Physics Laboratory. Copyright 1998 Ray Sterner and Steve Babin.

That same day (24 October), Guatemala's National Institute of Seismology, Vulcanology, Meteorology and Hydrology (INSIVUMEH) initiated the alert phase by issuing the first bulletin on the hurricane, which reached category 2 on the Saffir-Simpson scale. The alert was coordinated with the National Disaster-Reduction Committee (CONRED); all assistance units, relevant institutions and the public at large were notified through the media.

Mitch gained strength (category 3) on Sunday 25 as the pressure fell to the fourth lowest level recorded for Atlantic hurricanes so far this century. It began to affect the coast of Honduras and

warnings for Guatemala's Caribbean coast were intensified. With maximum steady winds of 221 km/h that afternoon, it was upgraded to category 4. On 26 October Izabal, El Petén, Alta Verapaz, Chiquimula, Zacapa, north of El Quiché and Huehuetenango were alerted; the hurricane was then 55 km south-east of Swan Island (off the northern Atlantic coast of Honduras), moving west-north-west with steady 288-km/h winds, as a result of which it acquired category 5.

The following day it followed the same path and at 21:00 hours came close to the coast of Honduras, reducing its wind speed. On 28 October it remained stationary and weakened progressively, dropping through categories 3, 2 and 1 and becoming a tropical storm on the following day, with winds under 100 km/h, moving west. Heavy rains were recorded in Petén, Izabal and Cobán. On 30 October it entered Honduran territory, became a tropical depression and moved rapidly into Guatemala on October 31, with its centre approximately level with Morazán and El Progreso; it caused very heavy rainfall in Puerto Barrios, Cobán and Zacapa. The Puerto Barrios station recorded 319 mm of rainfall between 28 and 30 October (see Chart 1).

On 1 November the depression moved slowly across the country from east to west, causing heavy rains on that day and the following day. On 3 November its intensity increased again and the depression became a tropical storm; its path was north-easterly, towards Campeche, Mexico, and on 4 November it left Guatemalan territory. The heaviest rainfall was registered between 1 and 3 November in the Department of Guatemala (308 mm on days 1 and 2) and Escuintla (799 mm on 2 and 3 November, see Graphs 2 and 3). During that period rainfall was higher than the total for the entire year.

The damage caused by Mitch is extensive as regards loss of life, infrastructure (highway, health care, housing and education), agricultural output and the environment. The severe effects of the rains were magnified by man's previous actions: deforestation, intensive land use, and human settlements on hillsides or riverbanks and lake shores. As frequently occurs in such disasters, the poorest and most marginalized groups were the most affected, since they tend to live in precarious dwellings in the high-risk areas mentioned above. This highlights the pressing need to adopt measures to alleviate poverty and marginalization on the one hand, and to prevent and mitigate disasters on the other.

3. Population affected ⁶

An estimated total of almost 750,000 people were affected by the hurricane; more than 106,000 had to be evacuated and were left homeless. There were 268 deaths and a similar number of injured. At the end of November 121 people were reported still missing. The districts with the greatest number of people in shelters were Alta Verapaz, Escuintla, Guatemala, Izabal and Zacapa. During the second week of November almost 55,000 people were staying in shelters all over the country.

⁶ This section is based on the preliminary report prepared by UNICEF "Impact of hurricane Mitch on Guatemalan children", November 1998.

The number of victims might have been higher if warning systems had not urged communities to evacuate two days before the hurricane hit. Damage to communication routes due to flooding left over 16,000 people completely isolated for several days.

The municipalities where the hurricane caused the greatest damage were Los Amates (Izabal), Morales (Izabal), Panzos (Alta Verapaz), and the Amatlán Valley (Petapa, Amatlán, Villa Canales). Less badly hit, but also at great risk were the municipalities of El Estor (Izabal), Puerto Barrios (Izabal), Cahabon (Alta Verapaz), Chisec (Alta Verapaz), Sayaxche (Petén), Gualan (Zacapa), Chiquimulilla (Santa Rosa), Guazacapan and Taxisco (Santa Rosa) Nueva Concepción and La Gomera (Escuintla), San José and Iztapa (Escuintla).

Damage in Izabal (Morales and Los Amates) and Panzos is particularly serious because of the risks faced by their inhabitants. The destruction of banana plantations has not only caused economic problems and unemployment but has also affected housing and social services, because the main settlements in the area were situated within the plantations. In the municipality of Panzos pollution of the water supply is posing serious threats to health; it is the only area covered by UNICEF field visitors where children have died of diarrhoea (particularly infants under one year of age); high levels of malaria-carrying mosquito larvae have also been recorded in the area.

Of the 750,000 people affected, an estimated 120,000 are children under five and 37,500 are pregnant women. Nearly 54,725 people were housed in temporary shelters initially, but the number subsequently decreased as many families returned to their homes or were received by friends or relatives. By the fourth week of November 14,000 children were reported to be in temporary shelters, mainly in the districts of Guatemala and Izabal. At the end of the month UNICEF field visitors reported that the number of people in temporary shelters had decreased substantially in all districts except Izabal.

The thousands of dwellings partially or totally destroyed are mainly in Izabal, Zacapa (Gualan), the Polochic Valley (Panzos, El Estor, Cahabon), and on the Pacific coast (Escuintla and Santa Rosa). The destruction of water supply systems and latrines, pollution of wells and accumulation of stagnant water has become a serious health problem. Water pollution has caused severe cases of diarrhoea, and stagnant water is an ideal breeding ground for carriers of malaria and dengue, which are endemic diseases in the lowlands of Izabal and the South Coast.

The greatest damage to crops for on-farm consumption was in areas where they had not yet been harvested (Chisec, for example). Fishing for family consumption has also been affected in coastal areas. In the lowlands of the Motagua and Polochic rivers the worst hit were banana plantations and cattle ranches, with the resulting unemployment (an estimated 10,000 people in banana-growing areas). Basic grain crops were not seriously affected (losses in corn and bean crops were under 2 per cent), so the cost of a basic food basket should not increase significantly. The most negative effects on family economy will be caused by unemployment and food shortages in certain low-lying areas, which may lead affected families to migrate to urban areas.

a) Poverty and the risk of disaster

As mentioned above, low-income groups are among the most affected. At least four factors increase the risks they face when natural disasters occur.

First, some of the areas in which they have settled have little or no commercial value due to their high risk: these include mountain slopes or ravines, river banks, and plains frequently subject to flooding in the rainy season, which place communities at great risk due to landslides and overflowing rivers. The rains caused by Mitch brought into evidence this structural problem, which has built up over decades.

Secondly, due to the characteristics of plots and limited sanitary infrastructure, many areas inhabited by the poor favour the propagation of pests and diseases. Malaria, dengue, diarrhoea, severe respiratory infections and skin problems are endemic diseases that place burdens on health services. Morbidity (and eventually mortality) levels resulting from this situation are even greater due to the poor nutrition of most of the population, particularly small children (under five) and pregnant or nursing mothers.

Thirdly, the poor do not have access to the social services required to address their vulnerable health conditions. They are particularly affected by the limited availability of drinking (or at least safe) water supplies and proper waste disposal systems. The hurricane highlighted the fragility of infrastructure to remedy these deficiencies, which was built in the same high-risk areas. Many latrines and water mains were destroyed by floods or landslides, and water supplies (wells and water mains) were polluted at the same time.

Finally, the poor lack information on the risks they face. Some communities have traditional ways of dealing with disasters, based on previous experiences, which are inadequate when faced with a situation such as that caused by Mitch.

Vulnerability of women and children. Poverty and environmental deterioration increase the risks stemming from natural disasters, and women and children are usually the most affected. The destruction of their homes, worse health conditions and loss of jobs and crops have a direct effect on their living conditions. Children are exposed to higher health risks, which can even lead to death; greater economic risks, as their education is cut short by their need to enter the labour market at an early age, and greater psychosocial risks, since they are highly sensitive to changes in their surroundings. Women face greater challenges in the day-to-day running of their homes, as the task of organizing family resources becomes all the more difficult. Pregnant and nursing mothers suffer the effects of their deteriorated environment (particularly affecting their nutrition), which places them at great risk of contracting lethal diseases.

b) Short and medium term risks to the population

The risks faced by the population not only refer to their health conditions but also to other factors which affect their normal development. A balance of the problems they face as a result of the hurricane follows below.

i) Health and sanitary risks. Health and sanitary conditions in the most affected areas have led to a morbidity profile characterised by acute respiratory infections (over 50 per cent of the diseases reported to health centres and brigades), diarrhoea (approximately 20 per cent), and skin diseases (20 per cent). A month after the hurricane struck, the greatest risk of mortality was from cases of diarrhoea among children under five, and particularly those under a year old in the Polochic (Panzos) basin. Polluted and stagnant water have increased the possibility of outbreaks of cholera, malaria and dengue over the medium term, and these tend to be more fatal than acute diarrhoea. The destruction of latrines and other waste-disposal means has also increased health risks in affected areas.

ii) Nutritional risks. Malnutrition and micronutrient deficiencies (particularly iron and vitamin A) are chronic, particularly among children and pregnant and nursing mothers in poor rural areas, and are further increasing the risk of morbidity and mortality. The problem has been aggravated by the effects of Mitch, as the destruction of small crops for on-farm consumption and the loss of jobs has placed many families in a state of high nutritional risk. Here again, children are the most vulnerable group, particularly those in temporary shelters (especially in Izabal) and groups living in isolation on the right bank of the Polochic and Motagua rivers.

iii) Educational risk (school drop-outs). Approximately 37,500 children have been affected by damage to schools. Some 3,000 boys and girls attended schools that have sustained partial damages, and 2,500 were in schools that were completely destroyed. Apart from these infrastructure-related problems, there is also a risk of children not returning to classes at the beginning of the new school year due to the economic pressures arising in homeless families; this is one of the most serious dangers facing these children, since they are unlikely to return to school once they join the labour force. UNICEF has calculated that about 20,000 boys and girls could be affected in this way.⁷

iv) Housing and psychosocial risks. Destruction of dwellings, temporary abandon of small towns and villages and loss of loved ones have had a strong effect on psychosocial welfare. In Izabal, for example, stress-induced migraines were the second cause of morbidity during the days following the tragedy. At present, the greatest psychosocial risk is suffered by families still in shelters. Apart from overcrowding, children suffer from changes in their daily routines and a lack of expressive and recreational activities common to their age. Their families can also be affected by emotional stress resulting from a lack of employment prospects and the daily need to meet basic necessities such as food.

v) Unemployment. In banana-growing areas, the destruction of plantations has meant loss of employment for thousands of women, many of whom are unmarried mothers. An estimated 40 per cent of the total work force (13,000 people) in the banana industry are women, who clean, select and pack the fruit. Their chances of finding employment in agricultural activities are remote, as these are mainly men's jobs.

⁷ Estimates based on the number of families whose homes were affected by the hurricane. All these families are considered have at least one 10-13 year-old child (the group at the greatest risk of leaving school to take up paid employment).

c) Programmes to deal with the effects of hurricane Mitch on the population

Actions to support disaster victims should focus on the areas at greatest risk, placing particular priority on immediate needs in the lower reaches of the Polochic and Motagua rivers (municipalities of Panzos, El Estor, Morales and Los Amates). Suggestions for programmes to complement the actions contained in the government's 100-day Agenda follow below. Of prime importance are the initiatives aimed at the most vulnerable sectors of the population.

i) Prevention of school attrition. Families should receive assistance for their children to remain in school. Apart from logistic support to schools, direct aid is needed in the form of school materials and even small monetary subsidies (grants) to families in exchange for allowing their children to continue their studies.

ii) Psychosocial recovery. Girls and boys need to recover from the trauma caused by the hurricane; a central factor in this process is the reconstruction of their play areas. This is particularly important for children who are still in temporary shelters and will probably remain there for several months.

iii) Attention to unemployed women. As they are particularly at risk, women who lost their jobs in banana plantations should be helped through a job-creation programme.

iv) Support for very isolated areas. Many small communities on the right bank of the Polochic and Motagua rivers have been practically cut off. A logistical support programme should be implemented to establish ongoing communication with them.

v) Provision of drinking water and cleaning of wells. Drinking water needs in the worst affected areas will have to be met as long as water supplies remain polluted, to reduce children's morbidity and mortality rates from diarrhoea. The most urgent need for support is in the Polochic area and the municipalities of Los Amates and Morales (Izabal). It is also important to continue to extend support to communities in cleaning wells and restoring water systems.

vi) Fortified food. As well as distributing food to victims, it is also important to check the population's nutrition levels to assess malnutrition risks (particularly among boys and girls). This could be complemented by providing them with food supplements to overcome nutritional deficiencies.

vii) Strengthening communities' disaster-preparedness capacity. In order to deal with the emergency more efficiently, a community organization primarily responsible for implementing programmes locally should be promoted. An organization of this kind could subsequently be used to establish local disaster-prevention committees, thus creating capacity at the local level for future emergencies.

Dealing with the consequences of the hurricane does not merely involve rebuilding destroyed social infrastructure, but also stepping up social investment to address the vulnerability condition of low-income groups, so as not to leave them as exposed as they were prior to the hurricane.

4. Emergency actions

a) Government actions

Through a decree issued on 31 October 1998, the government declared a national state of emergency and a two-day cease of normal activities, in order to organize emergency relief and reduce pressure on the demand for certain goods, such as food, gasoline and other fuels. The decree established sanitary cordons to prevent epidemics, restricted unnecessary road travel and authorised the obligatory evacuation of people living in high risk areas.

Once the danger represented by hurricane Mitch had been confirmed, on 1 November CONRED evacuated nearly 6,000 people from areas considered to be of high risk (mainly on the Atlantic coast), thus helping to save lives and mitigate the effects of the hurricane. The government's response was timely and efficient; acting in coordination with the private sector, it took emergency actions which were decisive in helping to mitigate the impact of Mitch.

Various ministries and public, civil and military organizations participated in dealing with the emergency. As a result, electric power was restored in a matter of hours, the road network was rehabilitated and the injured and homeless attended, among other actions.

The government requested aid from the international community to cope with the emergency and with repairs and reconstruction. Financial organizations were requested to negotiate debt interest-payment terms and redirect the funds made available to emergency-related areas.

Distribution of food and other aid was carried out by the Social Investment Fund (FIS) and the National Fund for Peace (FONAPAZ). FIS soon redirected its funds and was extending credits for repairs in rural areas by mid-November. This Fund has set itself the goal of repairing damaged schools in 100 days, and has already allocated 131 million quetzals to rehabilitation projects within the framework of the 100-day Agenda. Mention should be made of the extensive participation of civil society in various phases of the emergency and, more recently, in rehabilitation. Aid reception and distribution was efficiently organized; FONAPAZ tackled the emergency by extending its coverage from the area originally planned to emergency zones. Rapid action in each of the affected municipalities made it possible to establish contact with victims and distribute materials to enable communities to begin repairing their homes immediately.

On 18 November, the government announced the creation of a rehabilitation and reconstruction programme, with three basic objectives: normalising victims' living conditions, repairing the damage caused by Mitch, and restoring and developing productive capacity. The aim is to accomplish the first two objectives within 100 days, as of 12 November 1998, whereas the third is expected to be completed over the medium to long term.⁸

⁸ See SEGEPLAN, *Programa de reconstrucción "Huracán Mitch"*, Guatemala, 18 November 1998, and Government of Guatemala, *Programa de reconstrucción, report prepared for the Meeting of the Emergency Advisory Group for Central America*, Washington D.C., 10 - 11 December 1998.

b) International cooperation

The magnitude of the disaster and the rapid dissemination of information sparked an immediate response from the international community. Humanitarian aid was soon on its way, in cash and in kind, from countries, multilateral organizations, civil groups, non-governmental organizations (NGOs) and individuals.

i) International organizations. The office of the United Nations Resident Coordinator took on the task of coordinating UN response, supported by a team from UNDAC. Daily reports were issued on the emergency and helped direct the actions of the international community.

According to OCHA, by the end of November donations in cash and in kind from international organizations totalled US\$60 million,⁹ and by 12 November the World Food Programme (WFP) had delivered 120,000 food rations in affected departments. Other cash contributions from international organizations are as follows: UNDP: US\$100,000, UNICEF: US\$86,000, WFP: US\$200,000, Organization of Petroleum Exporting Countries (OPEC): US\$100,000, IDB: US\$50,000. International financial organizations, such as the World Bank and the IDB began to re-channel previously allotted resources towards the emergency and to negotiate extra lines of credit. The Central American Bank for Economic Integration (CABEI) provided funds to begin rebuilding the Pan American highway, which crosses Central America.

ii) Foreign governments. The Office of US Foreign Disaster Assistance (OFDA) of the United States' Agency for International Development (AID) donated US\$1 million to NGOs to create relief programmes for the water and drainage sectors, emergency shelters, medicines, hygiene and agriculture. At the beginning of December, the total aid received from USAID/OFDA was estimated at US\$1.257 billion. During his official visit to Guatemala, the President of France, Jacques Chirac, announced the cancellation of Guatemala's US\$55 million debt with France.

By mid-November, cash aid and other types of support totalled US\$1.4 million, not including material aid—the value of which has not been calculated—from the governments of various countries which sent human resources (doctors, rescue teams, engineers, brigades, among others) and materials such as light aircraft, helicopters, food, medicines, blankets, clothes, etc.

iii) Civil organizations. In response to the Government of Guatemala's appeal for assistance, numerous civil organizations from many different countries came to the aid of victims. Apart from uncalculated donations, they sent rescue equipment, material for shelters, medicines, drinking water, food, clothes and blankets.

⁹ According to official figures, foreign aid received by 31 December totalled US\$20.8 million (6.5 million in cash and 14.3 million in kind), not including other donations in kind, the value of which has not been calculated

II. ASSESSMENT OF THE DAMAGE

This chapter contains an assessment of the damage caused by hurricane Mitch to the social (housing, education, health), infrastructure (energy, transport and communications, water and sewerage) and production sectors (agriculture, fisheries, industry and services), and to the environment. The assessment was carried out on the basis of information available during the mission and incorporates aspects that became known soon afterwards.

Direct damages or effects were assessed, i.e., to physical infrastructure and the country's capital reserves, and indirect damages or effects, such as lower production of goods and services and emergency outlays. Direct damages have been assessed on the basis of capital assets prior to the disaster; i.e., taking into account depreciation and normal use of capital goods.

In keeping with ECLAC methodology, the loss of crops, either about to be harvested or stored for distribution, is calculated as direct damage, and damages to inventories and production under way in the industrial sector are classified as direct costs.

The cost of rebuilding damaged assets has also been calculated. If the aim were to return to the situation prior to the hurricane, the value would be the same as the direct cost according to this methodology. However, for the purpose of a reconstruction programme, the assessment should also take into account the **value of improved replacement**, including disaster prevention and mitigation criteria, such as better technology and quality and more resistant structures. The country now has an opportunity to rebuild on sounder economic, social and environmental bases while simultaneously reducing its vulnerability to natural disasters.

The ECLAC mission interviewed representatives of the government, the private sector, international organizations, UNDP and other United Nations agencies, who frequently provided information and valuable suggestions for the preparation of this document.

The figures used in this chapter were calculated in local currency and in US dollars, based on the exchange rate at the time: 6.6 quetzals to the dollar.

1. Social sectors

a) Housing

The overall damage sustained by the housing sector totals 233.2 million quetzals; this compounds the country's housing deficit, estimated at 1.4 million units in 1995, including construction, extension and improvement.¹⁰

¹⁰ Ministry of the Economy, Under Ministry of Housing and SEGEPLAN, *Estrategia de desarrollo del sector vivienda, 1996-2000*.

The situation is exacerbated by a long-standing problem: many settlements (some 200,000 families) are located in inappropriate, vulnerable sites, with 6,000 in very high-risk areas. The sector's medium-term programmes are designed to address this problem. The government's priority over the short term and during the emergency has been to restore families' minimum living conditions prior to the disaster. Nevertheless, families living in particularly unsuitable sites, such as the banks of the Polochic River, will have to be relocated as soon as possible.

According to SEGEPLAN information, corroborated by other sources (victims in shelters), around 6,000 dwellings were totally destroyed, of which approximately 1,100 were in the capital and the Department of Guatemala. Some 20,000 additional homes were damaged to differing degrees.

Judging by the number of people living in shelters, the provinces with the greatest damage to housing were, in their order, Alta Verapaz, Escuintla, Guatemala, Izabal, Zacapa and Sacatepéquez.

The dwellings destroyed completely were generally made of flimsy materials and very precariously built. Their estimated average area ranged between 15 and 20 square metres, with an average value of under 10,000 quetzals.¹¹ If this value is accepted as representative, the 6,000 dwellings completely destroyed caused direct losses of some 60 million quetzals. If we add 12 million—20 per cent of the value of housing so as roughly to include lost household goods—the direct damage for destroyed dwellings totals 72 million quetzals (see Table 3).

Using these same parameters for partially destroyed housing (20,000) and also assuming that the damage amounted to an average of 30 per cent of the value of dwellings, including household items, these damages reach 90 million quetzals, which, added to the above 72 million, bring total direct losses in the sector to 162 million quetzals (see Table 3).

Indirect damages were mainly calculated on the basis of the expenses generated in shelters while the homeless victims remained there.

On the basis of information from FONAPAZ, the budget for shelters housing an estimated 25,000 people, who will take between 30 and 60 days to gain access to housing, totals 70 million quetzals (50 million for resettlement, 10 million for equipment and 10 million for logistic support).

An estimate of rent paid or attributed and lost for some 60 days corresponding to destroyed housing was included as indirect damage (see Table 3).

An average area of 100 square metres per lot has been estimated for rebuilding the 6,000 dwellings that must be relocated in less risky areas; each lot will cost US\$3,000, making a total of US\$18 million for the land, in addition to 25 million for the cost of building the new housing.

¹¹ From January to September 1998 the Guatemalan Housing Fund (FOGUAVI) had financed some 16,500 housing solutions valued at 10,800 quetzals each on average.

Table 3

GUATEMALA: DAMAGE TO THE HOUSING SECTOR

	Damage			Cost of reconstruction
	Totals	Indirect	Direct	
Total (thousands of US\$)	35,333	10,788	24,545	38,000
Total (thousands of quetzals)	233,200	71,200	162,000	250,800
Destroyed dwellings	60,000		60,000	
Furnishings and household goods	12,000		12,000	
Damaged dwellings a/	90,000		90,000	
Spending on shelters b/	70,000	70,000		
Attributed rent c/	1,200	1,200		
Reconstruction of 6,000 dwellings				99,000
Cost of land				118,800
Fixtures				33,000

Source: ECLAC, based on official figures and own estimates.

- a/ An average loss of 30 per cent of the value of the dwelling was assumed, plus 10 per cent of the value of the dwelling for furniture and fixtures.
- b/ According to FONAPAZ information, some 25,000 persons will remain in shelters for 30 to 60 days. The total budget assigned to that end includes resettlement (50 million quetzals), equipment (10 million) and logistic support (10 million).
- c/ Refers to estimated losses for real and attributed rents —100 quetzals per dwelling— for 60 days in the case of destroyed housing.

Although many settlements had been declared vulnerable areas (more than 200,000 dwellings) by FOGUAVI prior to the disaster, the government does not have the capacity to address that problem and the disaster simultaneously. The initial actions contained in the government's "100-day Agenda" therefore placed priority on normalising the situation of the homeless and returning them to their places of origin, where their employment sources are, leaving their relocation to comparatively risk-free areas for the following stage.

The Ministry of Communications, Transport, Public Works and Housing provides direct subsidies to low-income families through FOGUAVI. Each subsidy consists of a 12,000-quetzal loan, to which the beneficiary must add 4,000 quetzals, to be repaid over a period of up to two years, in order to acquire homes built by the private sector to standard specifications, with a value ranging from 16,000 to 60,000 quetzals.

Furthermore, in keeping with the Agreement on Socio-Economic Aspects and Agrarian Situation adopted within the framework of the peace process, the government pledged to "assign the equivalent of not less than 1.5 per cent of the Tax Revenue Budget to housing development policy, giving priority to the demand for low-cost housing solutions".¹²

¹² Ministry of the Economy, Under Ministry of Housing and SEGEPLAN, *Estrategia de Desarrollo...*, op. cit.

One of the programme's priorities is to promote private-sector participation in housing construction and financing, together with the legalisation of State lands and their systematic registration in a land-use databank through FOGUAVI.¹³

b) Education

Education infrastructure, which includes archaeological sites and churches, suffered considerable losses as a result of the hurricane. Of a total of 13,500 schools, 311 (2.3 per cent) were affected. According to Ministry of Education information, 27 schools were completely destroyed, 175 semi-destroyed (destruction of roofs and other damages), 111 were flooded and 73 school premises were adapted as shelters. Direct losses were estimated at 51.8 million quetzals (US\$7.851 million), 35 million of which accounts for partly or totally destroyed classrooms; the remainder includes school materials, furnishings and cultural sites (see Table 4).

The minor damage to Guatemala's cultural heritage was concentrated in the Quiriguá archaeological site and the Alameda del Calvario complex in Antigua Guatemala. Stelae, zoomorphs and altars at Quiriguá were covered in mud but not damaged. The flooding caused by a water conveyance ditch that overflowed in one of the sector's banana plantations affected the administrative area, store rooms and researchers' living quarters.

The amount of total damage corresponds mainly to direct costs; indirect costs were lower, as many of the schools used as shelters were vacated two weeks after the disaster. Damage to infrastructure centred on semi-destroyed schools (68 per cent).

The departments with the most damage to educational facilities were Izabal, (19 per cent of the total), Sololá (16.3) and Guatemala (10.6), followed by Alta Verapaz (7.9 per cent) and Santa Rosa (7.2). The departments with the least damage were Huehuetenango and Baja Verapaz (see Table 5).

Irrespective of the damage to infrastructure in the education sector, the impact of Mitch has other connotations. The impairment of 311 schools will place added pressure on the already deficient coverage and could leave thousands of children and youths out of classrooms. Loss of materials and equipment could affect educational quality.

Numerous rural families who lost their croplands and other means of livelihood and production may be forced to emigrate to other communities, and this could raise the school drop-out rate. Survival concerns may lessen the importance of children's school attendance even further, thereby increasing illiteracy rates in rural areas and reducing school enrolment.

¹³ Guatemalan Housing Fund, Ministry of Communications, Transport, Public Works and Housing, *Juntos para dar soluciones habitacionales*.

Table 4

GUATEMALA: DAMAGE IN THE EDUCATION SECTOR *a/*

	Damage			Cost of reconstruction	Imported component
	Total	Direct b/	Indirect		
Total US\$ (thousands)	7,851	7,368	483	12,250	2,917
Total quetzals (thousands)	51,816	48,631	3,185	80,850	19,252
Damage to school infrastructure	35,125	35,125		64,791	16,033
Classrooms totally destroyed (135)	7,484	7,484		24,052	6,013
Classrooms with severe damage (865)	23,978	23,978		34,767	8,692
Classrooms with slight damage (555)	3,663	3,663		5,971	1,328
Damage to texts and furnishings	11,753	11,753		12,723	2,545
Damage to cultural and recreational facilities	1,752	1,752		3,336	674
Damage caused by use of schools as shelters <i>c/</i>	858		858		
Higher operation costs in affected schools	2,327		2,327		

Source: ECLAC, based on Ministry of Education figures and own estimates.

a/ Includes cultural sites and churches.

b/ Direct damage was calculated on the basis of 311 affected schools and 135 classrooms totally destroyed. A unit cost per classroom of US\$4,400 has been assumed; 865 semi-destroyed classrooms at US\$4,200 each and 555 slightly affected classrooms at US\$1,000 each. Finally, 54,425 desks at US\$18.80 have been included, and 10 per cent of texts destroyed.

c/ 73 school premises were fitted out as shelters.

Efforts must therefore be redoubled and the national and international community called upon to rebuild the educational system from a new perspective. School is more than just a facility; it should be a focal point to strengthen communities. The aim should be to improve what was already in existence, while taking advantage of education as an essential factor in reconstruction.

c) Health sector

i) Evaluation of the damage. Health sector infrastructure did not sustain significant damage, according to reports from international and national organizations and ECLAC inspections. Most of the damage was to furnishings and equipment. The hurricane affected seven health centres, among them one with maternity facilities, and 48 rural clinics, which served some 50,000 people in total. These facilities are in poor areas, some of which are hard to reach, and far away from larger population centres.

The main damage to infrastructure consists of partial destruction of sewerage systems and damaged walls, floors and ceilings in some health centres. There are no reports of facilities totally destroyed.

Table 5

GUATEMALA: DAMAGE IN PUBLIC SCHOOLS BY DEPARTMENT

Department	Schools destroyed and partially damaged a/				Direct costs (thousands of quetzals) b/
	Total	Destroyed	Semi-destroyed	Flooded	
Total	311	27	173	111	35,125
Jalapa	20	1	16	3	2,594
Izabal	45	18	6	19	6,725
Santa Rosa	41	-	11	30	2,515
Alta Verapaz	45	-	12	33	2,752
Quiché	8	-	8	-	1,109
Guatemala	27	-	27	-	3,742
Escuintla	26	-	9	17	1,808
Zacapa	8	-	8	-	1,109
El Progreso	2	-	2	-	277
Jutiapa	16	-	12	4	1,795
Chimaltenango	15	1	14	-	2,217
San Marcos	5	-	5	-	693
Retalhuehu	2	1	1	-	416
Sololá	40	2	37	1	5,716
Huehuetenango	1	-	1	-	139
Baja Verapaz	1	-	1	-	139
Petén	9	4	1	4	1,379

Source: ECLAC, based on Ministry of Education figures and own estimates.

a/ The information supplied by municipalities does not specify the type of damage reported.

b/ Direct costs were estimated on the basis of the unit costs in Table 4, assigning an average of five classrooms to totally destroyed schools and 3.5 to semi-destroyed and flooded schools.

The country's chronic epidemiological situation worsened in the areas most affected by the disaster, all of which reported cases of respiratory infections, diarrhoea and pneumonia. Sixty-seven per cent reported suspected outbreaks of cholera and 59 per cent confirmed such cases. In 78 per cent there were instances of animal bites from potential rabies carriers, and 56 per cent notified cases of hepatitis and malaria; 44 per cent of all affected areas registered cases of dengue.

The main impact on the health sector concerns its operation, which was complicated by the extra tasks it had to take on to address the emergency; the main challenge lay in sanitation. The sector's institutions took action to deal with decomposing animal carcasses and plants left by the devastation in fields and the proliferation of disease-carrying vectors due to flooding and partial damage to drinking water systems. These actions were carried out with the assistance of external cooperation.

Timely action by the health authorities to control epidemics and vectors, in conjunction with foreign medical brigades, made it possible to lessen their potential sequels. Epidemiological monitoring measures remained in place until the end of November. Outlays in this area, which may be considered indirect effects, amounted to some 25 million quetzals (see Table 6).

In regard to direct damages, flooding and mud caused damage to structures, equipment, furnishings and installations, with losses estimated at 7.1 million quetzals. Total damage has been calculated at over 32 million quetzals (US\$4.9 million, see Table 6).

Visits by the mission to damaged units revealed that the San Pedro Carchá health centre in the Department of Cobán was completely paralysed owing to the total destruction of equipment by the mud and water that inundated the premises. The centre has 10 hospital beds and serves a population of 140,000 people. It deals mainly with maternity cases and general outpatient visits. Around 90 per cent of its clinical laboratory equipment was severely damaged and the dentistry equipment was totally destroyed; both had been operating for about 18 years.

According to the three doctors in charge, the centre frequently suffers from partial and slight flooding problems even in normal rainy seasons, since it stands on a low piece of ground close to the main river, which carries outflows from three municipalities. Bearing in mind the almost complete destruction of its furnishings and equipment, this would be a good opportunity to relocate it. The municipal mayor has offered a piece of land for the centre's new installations.

The Ministry of Public Health and Social Welfare sent brigades to make a more precise assessment of direct and indirect damage to hospitals in the most affected departments. Aside from the San Pedro Carchá hospital and probably one in Puerto Barrios, most of the damage registered was to non-structural components, i.e., installations and medical equipment seriously damaged or rendered useless by flooding. Such damage was registered in 11 health centres.

Table 6

GUATEMALA: DAMAGE IN THE HEALTH SECTOR

	Damage			Cost of reconstruction (thousands of quetzals)
	Total	Indirect	Direct	
Total US\$ (thousands)	4,868	3,790	1,078	1,928
Total quetzals (thousands)	32,120	25,000	7,120	12,710
Structures and equipment	7,120		7,120	
Epidemiological campaigns, emergency tasks	25,000	25,000		
Recovery programme				12,710
Rehabilitation				8,900
Reconstruction				500
Expansion				550
New hospital, San Pedro Carchá				2,000
Equipment				600
Sololá Hospital				160

Source: ECLAC, based on Ministry of Public Health and Social Welfare figures and own estimates.

ii) Rehabilitation and reconstruction programme.¹⁴ The Ministry of Health, in close conjunction with provincial and district authorities, is in charge of infrastructure and human-resource planning, coordination, transport and support for rehabilitation and reconstruction tasks. As a general health-sector strategy, greater emphasis will be placed on health prevention rather than on clinical treatment.

After dealing with priority health issues stemming from the hurricane (care of traumas, deterioration of water supply systems and basic sanitation, and control of epidemics, among others), the Ministry of Health turned to the task of evaluating damage to infrastructure and equipment, with a view to designing a rehabilitation and reconstruction programme. Hospitals, small clinics and health centres in 107 communities were assessed to make an estimate of the needs involved.

The communities covered are located in the regions of Alta Verapaz, Izabal, Zacapa, Jalapa, Jutiapa, Santa Rosa, Escuintla, Suchitepéquez, Retalhuleu, San Marcos, the municipalities of Amatitlán and Villanueva in the Department of Guatemala, and the municipalities of Sayaxche, Poptún and San Luis in the Department of El Petén.

The aim of the Ministry of Health's programme is to restore health care infrastructure to optimal operating conditions as regards water-supply and electricity systems and other aspects related to health system operations. The programme has six components: rehabilitation, reconstruction, expansion, new buildings, equipment and reconstruction of the wall surrounding Sololá Hospital.¹⁵

The component that requires the highest investment is rehabilitation (an estimated 8.9 million quetzals), which will be allocated to meeting the needs of 50 health centres evaluated by Health Ministry brigades. The reconstruction component refers to two buildings with damaged roofs, structures, and water and sanitation systems, among others. The breakdown of investment for each component is shown in Table 6.

Overall investment for the programme totals an estimated 12.7 million quetzals (US\$1.9 million), 2.9 million of which will be provided by the Ministry of Health itself, with the remainder to be financed with other funds.

2. Infrastructure

a) Transport and communications

Hurricane Mitch affected Guatemala as an atmospheric depression, with heavy, prolonged rainfall that caused flooding in rivers, estuaries and gullies.

Due to Guatemala's irregular relief, most highways and roads are located on slopes, and their cuttings and embankments are highly vulnerable. Traffic flow was interrupted in many places by

¹⁴ See Ministry of Public Health and Social Welfare (1998), *Programa de recuperación física de la infraestructura de salud capaz de dar respuesta a la demanda de la población ocasionada por desastres naturales*, Guatemala, 11 December.

¹⁵ For a description of each component, see Ministry of Public Health and Social Welfare (1998), op. cit.

landslides on the most unstable banks, and on high embankments, especially those built beside river banks with no adequate protection. Other vulnerable points are highway bridges, generally built too short for economic reasons, with embankments to make up for deficiencies. These rarely have adequate river defences to resist extreme conditions.

Assessment of the damage to highways and roads was complicated by the institutional situation: responsibility for infrastructure work is not concentrated in a single body, but divided among several government agencies. Within the Ministry of Communications, Transport, Public Works, and Housing (MCTOPV), roadwork is carried out by the Directorate of Roads and the Executive Road Maintenance Unit (COVIAL), which is independent of the Directorate and was created to administer the Road Fund. Secondary and tertiary roads are the responsibility of FIS and FONAPAZ.

The first reports provided by government authorities described the damage to road infrastructure, including 121 bridges, 90 sections of roads and 34 sections of rural roads. As information was collected from each of the bodies mentioned above, it became clear only 37 of these bridges were totally destroyed, whereas 60 suffered damage to access embankments. Twenty-two of these 97 bridges are on main roads; the other 75 are located on secondary and tertiary roads. This should be taken into account on assessing indirect damage. Initial reports did not include pedestrian bridges or footbridges, a total of 57 of which sustained damages.

On assessing direct damage, a current value of 60 per cent of the reconstruction cost was assigned to destroyed or collapsed bridges. For bridges with damaged accesses, the replacement cost of the embankments at market prices was taken into account. Pedestrian bridges were assessed at 10 per cent of the cost of a vehicle bridge. An average cost per kilometre was used to determine direct damage to main roads, based on a percentage of the reconstruction cost, since damage only occurred on certain stretches rather than on the entire sections reported. This is the case with the Ruta CA-9 Norte, one of the worst affected roads, which sustained damages at the accesses to six of its bridges (the bridges themselves were submerged but structurally unharmed). Direct damage amounts to 265 million quetzals, or US\$40.2 million (see Table 7).

The indirect-damage assessment for bridges only includes the cost of building provisional crossings and of replacing embankments, since the cost stemming from interrupted traffic flow was included in the section on indirect damage to roads and calculated on the basis of increased operating costs due to traffic suspension, using figures for annual average daily traffic (AADT) and the type of traffic (cars, trucks, and buses). It also includes the extra operating costs of using roads in poor condition or unpaved detours while repairs are being made. Indirect damage totals 327 million quetzals (US\$49.6 million; see Table 7).

The cost of rebuilding destroyed bridges was determined on the basis of local unit costs and estimates of at least twice the original bridge length. An average per-kilometre investment was used to calculate costs for highways and roads. This is lower than the replacement cost, because damage was partial.

Table 7

GUATEMALA: DAMAGE IN TRANSPORT AND TELECOMMUNICATIONS

Sector and subsector	Damage			Reconstruction cost	Imported component
	Total	Direct	Indirect		
Total (thousands of US\$)	89,785.1	40,191.9	49,593.2	60,430.0	15,602.7
Total (thousands of quetzals)	592,581	265,266	327,315	398,838	102,977
Bridges destroyed (37)	18,790	14,478	4,312	43,794	13,138
Bridges with damaged accesses (60)	14,042	10,500	3,542	11,904	2,381
Footbridges (57)	2,445	2,445		4,075	407
Main roads (633 km)	406,948	136,095	270,853	205,725	61,717
Secondary and tertiary roads (718 km)	110,355	61,748	48,607	93,340	9,334
Railways	40,000	40,000		40,000	16,000

Source: ECLAC, based on figures from MCTOPV, COVIAL, and own estimates.

A railway reconstruction cost for the Guatemala City-Puerto Barrios line was included to cover the severe damage to bridges and track, reported at an estimated US\$6 million and included as direct damage, which will have to be paid by the government, despite the recent concession of the line to Compañía Desarrolladora Ferroviaria (CODEFE, S. A.). Indirect damage was not assessed because trains were not in operation when the hurricane struck. Reconstruction costs are estimated at almost 400 million quetzals, or US\$60.4 million (see Table 8).

Table 8

GUATEMALA: ASSESSMENT OF RECONSTRUCTION COSTS IN TRANSPORT INFRASTRUCTURE

	Length/volume/ area	Unit cost (quetzals)	Total (quetzals)
Total (US\$)			60,430,037
Total (quetzals)			398,838,250
1. Bridges on main roads:			
a) Bridges destroyed (12)	600 m	35,750	21,450,000
b) Bridges with damaged ramps (10)	10,000 m ³	30	3,000,000
Repaving of accesses	360 m ²	65	234,000
2. Bridges on secondary and tertiary roads:			
a) Bridges destroyed (25)	625 m	35,750	22,343,750
b) Bridges with damaged ramps (50)	5,000 m ³	30	7,500,000
3. Footbridges (57)	1,140 m	3,575	4,075,500
4. Main roads	633 km	325,000	205,725,000
5. Secondary and tertiary roads	718 km	130,000	93,340,000
6. Railways			40,000,000

Source: ECLAC, based on figures from MCTOPV, COVIAL and own estimates.

No major damage was reported to telecommunications. Direct damage was minor and absorbed by the TELGUA telephone company. Installation works for the fibre optic network suffered some damage, but no information was available in this regard.

b) Energy¹⁶

i) Electricity subsector. In the energy sector the electricity industry suffered the worst damages, caused by intense rainfall, floods, and landslides; hydroelectric power stations, distribution lines and networks and, to a lesser degree, transmission lines, were the most affected. Direct and indirect damages amount to 66.1 million quetzals (US\$10 million; see Table 9). Losses in each area of the electricity subsector are described below.

1) Distribution. Electricity distribution is managed by public, municipal, and private companies. The central region (departments of Guatemala, Sacatepéquez, and Escuintla, including the metropolitan area) is the most heavily populated and has the most complete electric power coverage. Services in this area are provided by the recently privatised Empresa Eléctrica de Guatemala, S. A. (EEGSA). With the exception of 11 cities that have their own municipal companies, the rest of the country is supplied by the National Electrification Institute (INDE); however, the electricity industry is being restructured and INDE distribution will be privatised in mid-December 1998.

Table 9

GUATEMALA: DAMAGE IN THE ELECTRICITY SUBSECTOR

	Damage			Reconstruction cost b/
	Total	Indirect a/	Direct	
Total (thousands of US\$)	10,012	4,263	5,749	8,026
Total (thousands of quetzals)	66,081	28,139	37,942	52,968
Distribution	32,702	11,270	21,432	28,814
Transmission and transformation	5,605	1,511	4,094	6,298
Generation	26,758	15,358	11,400	16,840
Others	1,016	-	1,016	1,016

Source: ECLAC, based on official figures from INDE, EEGSA and own estimates.

a/ Indirect costs for distribution (unbilled power); calculations for transmission include power not conveyed on binational interconnections, and for generation, excess production costs.

b/ Part of this expense has already been paid.

The main damage occurred after 1 November, when several departments and towns were left without electricity. Distribution lines and networks were most commonly downed by undermined structures and substations, collapses, damage to posts, cables, fuses, and transformers, and trees and branches falling onto installations.

¹⁶ Assessments are for the electricity and oil subsectors. Information was based on reports and interviews with Ministry of Energy officials (Directorates of Energy and Oil) and the National Electrification Institute (INDE and its distribution, transmission, and generation affiliates). A report prepared by the private distribution company EEGSA was used for the central area.

In the central region 40 major failures were reported in 69 kV transmission lines, 13.8 kV primary distribution networks, and substations. In the region served by INDE damage was reported in the departments of Zacapa, Chiquimula, Izabal, Santa Rosa, and Alta Verapaz, with losses of long stretches of 13.8 and 34.5 kV primary distribution lines and damage to many structures. Only one municipal company reported major damage to its distribution networks, and was assisted in repair work by INDE.

Repairs were made to distribution networks in the first three weeks of November, after which time supplies were almost completely restored; this was the result of a major effort by the personnel involved and of inter-institutional coordination, which made it possible to secure the cooperation of the different distribution companies. Many permanent repairs are still provisional, and temporary solutions such as re-routing between substations have been adopted. No shortages of materials were reported and the emergency was handled using stocks in warehouses and supplies from the local market; nevertheless, some distribution works could be delayed by up to two months.

In short, given the size of Guatemala's distribution system, damages, although considerable, were on a relatively small scale, so they should not affect the privatisation process unduly.

2) Transmission. The main problems in this segment were caused by landslides and overflowing rivers, which brought down several high-voltage electricity pylons. The main failure was over an approximately 110-km stretch of the 230 kV Guatemala–El Salvador interconnection (the damage was mostly on the Guatemalan side), where steel pylons were destroyed by the swollen waters of the river María Linda and a collapsed bridge. Repairs have already been made and service was restored around 20 November. The 138 kV Escuintla-Jutiapa line (from Escuintla to Chiquimulilla and El Progreso) also suffered pylon damage.

3) Generation. The problems reported are mostly due to overflowing rivers and silting, which limited water-conveyance capacity and substantially reduced output at various hydroelectric power stations (despite open dam gates). Major damage only occurred at one plant, where the turbine room was flooded.

The Jurún Marinalá hydroelectric power station (60 MW) was damaged by the silting of the Michatoya river bed, which made it impossible to operate the gates to lake Amatitlán (the station's natural reservoir) and reduced generation capacity substantially. The rains raised the level of the Zanjón Malena considerably and saturated the soil, causing major landslides; mud, refuse, trees, and rocks were dragged along by the Zanjón and the river Mico, completely blocking three km of the river Michatoya, into which they flow. Since lake Amatitlán's outlet was blocked, it rose above the reservoir's operating level and flooded homes on the banks.

The damage described above goes beyond the electricity subsector and has increased flooding in the towns around the lake and in the Michatoya river basin as described in the section on environmental damage. Nevertheless, it is important to stress the need for inter-institutional coordination in watershed management and recovery. In the case of the lake Amatitlán and river Michatoya basins, at least 10 municipalities and institutions are directly involved, including the National Environmental Commission (CONAMA) and the Authority for Sustainable Lake Management (AMSA). Some two million inhabitants live in the basin but insufficient resources have been assigned to protect it and INDE has done the most to address the silting of the Michatoya river.

Other hydroelectric stations affected included Los Esclavos (13 MW), Río Hondo, (4 MW) and Chixoy (300 MW). Los Esclavos suffered silting in the reservoir, intake, and desanders, which has reduced output capacity. According to reports, access roads were undermined and the regulation reservoir was damaged by landslides. At Río Hondo, the turbine room was also affected, putting the station out of operation for around four months. At Chixoy no physical damage was reported but the station cut back production for a few days because the outlet level rose almost to the height of the turbines. Minor damage was reported at the Chichaic (0.5 MW) and El Salto (2 MW) hydroelectric power stations.

4) Others. Buildings and warehouses were damaged; an INDE storehouse was flooded, as were two recreational centres for EEGSA workers.

5) Indirect costs. In the electricity subsector these costs stem from the need to resort to more expensive power, generated by thermoelectric power stations, to compensate for lost or unavailable hydroelectric power, and losses due to energy not supplied or invoiced because of a reduction in electricity sales.

The costs to users stemming from power outages have not been included. These are assessed globally and included as indirect costs incurred by different sectors of the economy, mostly due to failures in different services, for example roads and communications.

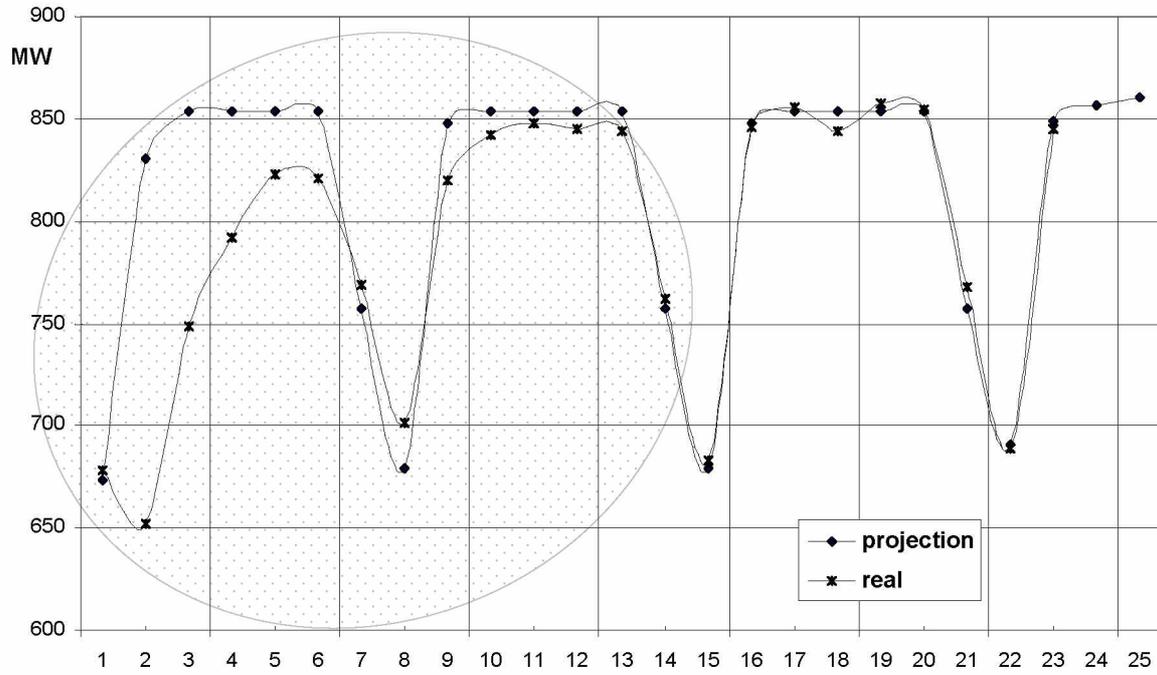
The greatest indirect cost is due to lost energy sales. The drop in consumption in November 1998 is estimated at 23 GWh on average, and is included as an indirect cost from distribution failures, pricing power at 0.49 quetzals/kWh. This represents a 6 per cent drop in electricity consumption for November. Graphs 4 and 5 show how demand quickly picked up again in the 20 days after Mitch struck.

The second largest indirect cost under generation stems from the use of more expensive power, estimated at 36 GWh, mostly for November, and has been included at the marginal price of the most expensive plant (0.065 dollars/kWh) in the country's wholesale electricity market.

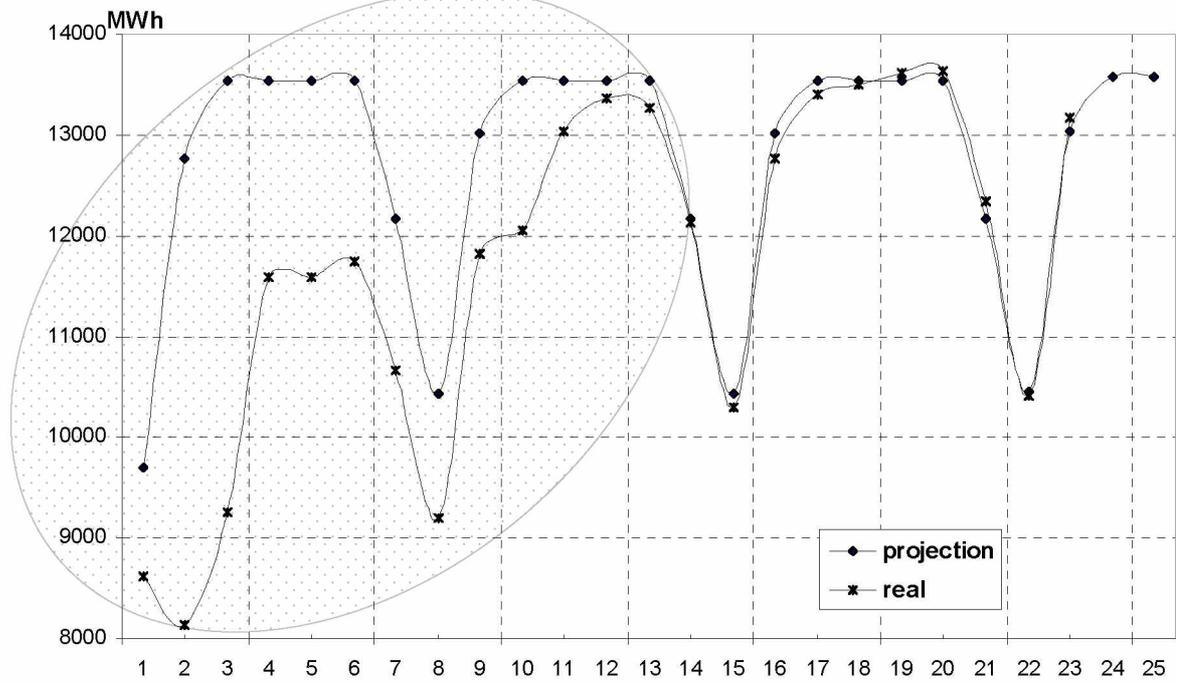
Finally, there are indirect costs related to transmission, involving only the binational Guatemala–El Salvador interconnection, which was out of service for approximately 20 days; the assessment compared average interconnection transactions in 1997 and priced power at 0.045 dollars/kWh.

The benefits of the hurricane were minimal, because when the rains came the country's main reservoir (Chixoy) was full and the extra water had to be released. Although at Jurún Marinalá extra water was gathered due to the increased level of lake Amatitlán —approximately 15 GWh in power terms—, it cannot be used due to the negative impact this would have on other sectors.

Graph 4
GUATEMALA: EFFECTS OF HURRICANE MITCH ON ELECTRIC POWER



Graph 5
GUATEMALA: EFFECTS OF HURRICANE MITCH ON ELECTRIC ENERGY



ii) Oil subsector.¹⁷ Imports, refining, storage, distribution and marketing are private-sector activities. Damage was minor and related to the flooding of Esso's storage facility in the port of San José, which led to the temporary suspension of its operation (two to three days, for industrial security reasons). Information is not available to quantify this damage, but it is not substantial. There were reports of minor damage to exploration and drilling activities in El Petén and Alta Verapaz.

Efficient coordination at the Oil Directorate and rapid repairs on roads to the Atlantic and Pacific coasts prevented shortages of oil products. Careful management of aviation fuel stocks was equally important and made it possible to ensure continuity in rescue operations. The suspension of everyday activities decreed by the government on 2 and 3 November, also served to reduce demand for fuel and electricity.

c) **Water and sewerage**

Water and sewerage services are run by various national, departmental and municipal authorities. In urban areas they are operated by municipalities whereas in rural areas they are also managed by community organizations. In both cases support is provided by the Municipal Promotion Institute (INFOM), through the Drinking Water and Environmental Health Unit (UNEPAR). Assistance for the development and maintenance of drinking water services is also provided by FIS, the Public Health Ministry, other governmental and non-governmental organizations, and international cooperation agencies.

Problems in this sector include inadequate legislation governing the use of water, and relations among the many institutions and organizations that have a bearing on its use. Moreover, most towns are experiencing severe problems in drinking water and sewerage system management, reflected in some cases in the poor quality of the water supplied, deficient control, operation, and maintenance systems, excessive leakage, and inappropriate rates and collection systems.¹⁸ The lack of trained personnel is also apparent, especially in the provinces.

Most damage to drinking water and sewerage systems is in the municipalities worst affected by the hurricane. One of the greatest challenges posed by the emergency was in reaching areas at the end of near-impassable roads. The short-term aims of the institutions involved are to re-establish damaged drinking water and sewerage systems, and to carry out health and education actions to prevent and reduce the risk of epidemics in affected areas; in the medium term, actions will focus on the total reconstruction and repair of damaged systems. By the end of the third week of November, 328 affected communities had been identified, 79 of which had already had their systems rehabilitated. The remaining 249 towns had been assessed and were in the reconstruction stage. Another 300 communities have yet to be assessed. Total damage amounts to 106.4 million quetzals (US\$16.1 million), with around 91 million quetzals (US\$13.8 million) needed for reconstruction (see Table 10).

¹⁷ Information provided by the Directorate of Oil at the Ministry of Energy and Mines.

¹⁸ See INFOM, EMPAGUA, SRH, *Situación del Sector Agua Potable y Saneamiento en Guatemala*, a report by Douglas, F.A., Tobar Castro, M.A., and Aragón Soto, E., presented at the Regional Seminar: "Privatización de los Servicios Basados en Agua", Mérida, Venezuela, October 1996.

Table 10

GUATEMALA: DAMAGE TO DRINKING WATER SYSTEMS,
WATER MAINS, SEWERS AND ENVIRONMENTAL HEALTH

	Damage			Reconstruction cost
	Total	Indirect	Direct	
Total (thousands of US\$)	16,128	5,632	10,497	13,811
Total (thousands of quetzals)	106,446	37,169	69,278	91,154
INFOM/UNEPAR a/	62,346	24,939	37,408	57,054
FIS b/	34,100	10,230	23,870	34,100
EMPAGUA and others c/	10,000	2,000	8,000	

Source: ECLAC, based on figures from INFOM, FIS, EMPAGUA and own estimates.

a/ Throughout the country.

b/ Only in the departments of Santa Rosa, Escuintla, Jutiapa, El Progreso and Izabal.

c/ In the capital and some neighbouring municipalities.

Most damaged drinking water and sewerage systems are in the provinces. Indirect costs include an estimate of the cost of inputs provided to communities for water purification, as well as the cost of tanker transports and provisional water storage tanks.

3. Damage in productive sectors

This section includes estimates of damage to the agricultural, fisheries, industrial, and services sectors. Severe weather often causes serious disruptions, particularly in commodity-producing sectors. Crops tend to be the most affected due to excess water, and crop damage depends on various factors, which are described below.

Apart from losses of infrastructure and capital goods (tractors, combine harvesters, etc.), direct damage in the farming sector includes lost harvests and stored produce. The effect of the hurricane on future farming output is considered indirect damage, whereas in the industrial sector, inventories and goods in process affected by the hurricane are counted as direct damage.

Farming and fisheries play an important role in Guatemala's economy. They account for 22 per cent of total GDP, provide around 50 per cent of the country's foreign currency earnings, and make a major contribution to food supplies and employment. Hurricane Mitch caused severe damage in these areas. The intense rain, sometimes accompanied by wind, caused collapses, flooding, and strong currents. More than 98,000 hectares were affected throughout the country, mainly in the departments of Izabal, Guatemala, Zacapa, Escuintla and El Progreso.

The impact on the economy was significant, because apart from lost production, plantations, productive infrastructure and soil, the foreign sector and food supplies were also affected. The country's already deteriorated environment also suffered further damage, which is described in a separate section.

a) Agriculture

Agriculture suffered the greatest primary-sector losses, amounting to a total of 3,294 million quetzals, of which 3,244 million are in agriculture, particularly export crops (bananas and coffee), but also basic grains and agricultural assets.

i) Crops for domestic consumption. In 1998 Guatemala had 898,000 hectares turned over to crops for domestic consumption. Basic grains accounted for an estimated 830,000 hectares, with 49,000 devoted to fruit trees and vegetables and 19,000 to other crops. Of these, 14,000 hectares of maize sustained damages, mainly in Chiquimula (3,600 ha), Alta Verapaz (2,600 ha), Zacapa (2,100 ha), Jutiapa (2,000 ha), and Escuintla (2,000 ha).

Some 4,700 hectares of sesame were damaged, 2,800 in Escuintla and 1,200 in San Marcos; 3,500 ha of rice were also affected, with 2,100 in the Department of Izabal alone. Smaller areas of sorghum (1,700 ha), beans (2,200 ha) and soya (153 ha) also suffered damage (see Table 11).

Table 11

GUATEMALA: AREA OF MAIN CROPS AFFECTED BY HURRICANE MITCH

Crop	1998 Production area (hectares)	Area affected	
		Area (hectares)	Percentage of total
Total	1,245,270	98,089	7.9
Domestic consumption	897,764	34,562	3.8
Maize	587,930	14,269	2.4
Beans	122,780	2,218	1.8
Rice	12,000	3,461	28.8
Sorghum	39,620	1,703	4.3
Sesame	50,260	4,700	9.4
Soya	17,400	1,703	34.4
Tobacco	4,550	1,865	4.6
Vegetables	40,640	517	3.7
Fruit	14,144	3,632	54.2
Plantains	6,700		
Peanuts	1,540		
Peppers	200		
Export crops	347,506	63,527	18.3
Bananas	23,000	6,500	28.3
Coffee	270,000	55,778	20.7
Cardamom	49,650	883	1.8
Snow peas	3,290	280	8.7
Okra	780	43	5.5
Berries	786	37	4.7

Source: ECLAC, based on official figures and field inspections.

Sixty-six thousand tonnes of plantain, 29,000 tons of fruit, 25,000 tons of maize, 22,000 tons of tomatoes and 16,000 tons of vegetables were lost (see Table 12). In most cases, losses were caused

by rain or flood that damaged plantations; in others, plants were buried by landslides and silt carried by floodwaters.

Table 12

GUATEMALA: ESTIMATED PRODUCTION LOSSES IN THE AGRICULTURAL SECTOR
CAUSED BY HURRICANE MITCH

(Tons)

Crop	Forecast 1998 production	Estimated losses
Bananas	1,446,700	409,000
Coffee	214,772	8,600
Tomatoes	219,800	20,000
Plantains	122,122	66,273
Tobacco	9,182	3,434
Maize	1,053,217	25,277
Fruit	783,079	29,000
Rice	41,090	11,834
Beans	111,100	2,000
Sesame	31,617	2,972
Vegetables	487,500	17,550
Cardamom	192,300	3,462
Snow peas	15,000	1,300

Source: ECLAC, based on Ministry of Agriculture and Forestry (MAG-FOR) data.

Losses in crops for domestic consumption total 300 million quetzals (US\$45.5 million), 210 million of which are direct costs and 90 million, indirect costs. The highest monetary losses were in tomatoes, maize, fruit and rice (see Table 13).

Apart from the monetary losses stemming from the hurricane, the precarious situation of small farmers must also be taken into consideration, since they have lost grains, fruit, and vegetables both for family subsistence and for income to cover basic needs. The poverty and extreme poverty in which many live have been exacerbated by the hurricane's effects. Therefore, it will be a priority during the emergency stage to provide them with the material and financial resources to recover their productive capacity and a means of subsistence until they reap their next harvest. Approximately 50,000 small farmers are in this situation. The needs of medium-sized farmers, who need new sources of financing to reactivate production, must also be taken into account, since they will experience difficulties in repaying loans contracted prior to Mitch.

ii) Industrial and export crops. Crops for international markets suffered the worst losses. The Motagua and Polochic rivers —both in the Atlantic basin of the country— overflowed, causing losses of vegetables, fruit, tobacco, and basic grains in the departments of El Progreso, Zacapa and Chiquimula due to soil slides and flooding. Later, in the Department of Izabal rice and banana plantations were also flooded, spoiling some 10,000 hectares.

Table 13

GUATEMALA: LOSSES IN AGRICULTURE AND FISHING
DUE TO HURRICANE MITCH

(Millions of quetzals)

	Damage			Impact on the foreign sector	
	Total	Direct	Indirect	Increase in imports	Reduction in exports
Total (millions of US\$)	499.4	187.6	311.8	136.7	307.0
Total (millions of quetzals)	3,295.4	1,237.9	2,057.5	902.0	2,026.0
Agriculture	3,245.2	1,214.9	2,030.3		
Domestic consumption	300.4	209.5	90.9	150.0	
Maize	30.6	30.6			
Beans	13.7	13.7			
Rice	20.5	20.5			
Sorghum	2.4	2.4			
Sesame	13.2	13.2			
Soya	1.0	1.0			
Vegetables	23.1	23.1			
Fruit	35.4		35.4		
Plantains	48.1		48.1		
Tomatoes	60.5	60.5			
Peppers	7.4		7.4		
Others	44.5	44.5			
For export and agro-industry	2,143.8	285.4	1,858.4	500.0	2,000.0
Bananas	1,887.6	195.0	1,692.6		
Coffee	221.0	56.0	165.8		
Cardamom	16.5	16.5			
Melon	9.2	9.2			
Snow peas	4.7	4.7			
Others	4.0	4.0			
Assets	801	720	81.0	250	
Plantation losses	720	720			
Soil losses	81.0		81.0		
Livestock	26.0	16.0	10.0	2.0	6.0
Cattle	12.0	10.0	2.0		
Poultry	6.5	6.0	0.5		
Others	7.5	7.5			
Fisheries	24.2	7.0	17.2		20.0
Farmed shrimp	20.0	4.0	16.0		
Trolling	4.2	3.0	1.2		

Source: ECLAC, based on official figures and own estimates.

In the departments of Guatemala and Alta Verapaz 55,000 hectares of coffee were affected. The prolonged rainfall and high winds blew berries from bushes and caused landslides that destroyed plantations. In Alta Verapaz 730 hectares of cardamom were lost. Snow peas and other crops were also affected (Table 11).

The 10,000 hectares of banana plantations totally lost to flooding will need replanting and an annual 400,000 tons of fruit (850 million quetzals) will be lost. No bananas will be harvested for two years, because it will take a year to replant the 10,000 hectares; losses will total 1,900 million quetzals. Reports indicate 20,000 tons of fallen coffee berries were lost. The worst damage was caused by landslides, which destroyed some 1,000 hectares of plantations.

Reduction in agricultural exports is valued at 2,144 million quetzals; bananas account for 1,888 million, coffee 222 million, and other crops 34 million quetzals (Table 13).

Farming losses will have strong repercussions on the economy. Firstly, more than US\$300 million in foreign currency earnings will be lost because of a drop in foreign sales from 1998 to 2000 (around 6 per cent of the country's total exports). Approximately 11,000 people employed by companies that suffered losses may lose their jobs in banana and coffee plantations. Farmers and businessmen may fall behind with loan repayments. Immediate solutions must be found to these problems to ensure the reactivation of the agricultural export sector.

Reactivation faces two serious problems. The first is financing: lost income will affect the ability of farmers and businessmen to repay loans invested in damaged or lost harvests, making them less creditworthy. However, additional financing is required to reactivate production, since employment and foreign currency earnings will be endangered if it is not made available; the situation must therefore be addressed as soon as possible through the domestic and foreign financial system.

The other problem is perhaps more important and concerns international markets, and the banana market in particular. As supplies from other producer regions substitute Guatemalan bananas this year and the following two years, there is a risk foreign sales will not recover, so trade negotiations must be held to ensure markets for Guatemalan exports. It would be advisable for European countries to adopt a flexible approach to restrictions on Central American bananas and for Guatemala to enter into negotiations with the United States to grant preferential treatment to the region's products, along the lines of regulations for Mexico under the North American Free Trade Agreement (NAFTA).

iii) Lost assets. Substantial agricultural assets were lost as a result of Mitch. Particularly hit were the plantations of continuous crops and the soil affected by landslides or sand and other deposits, which will either prevent farming over the short and medium terms or involve high recovery costs. The worst damages were sustained by banana, coffee, and fruit plantations. Lost agricultural assets are estimated at 800 million quetzals, or US\$121 million (Table 13).

Flooded banana plantations will have to be replanted, because the shoots that reproduce annually after cutting at harvest-time were lost. The cost per hectare of a new plantation is approximately 65,000 quetzals, so the 10,000 hectares lost in the Department of Izabal will require outlays of 650 million quetzals. It will be two years for these plantations to produce marketable fruit, because replanting will take a whole year. Losses in coffee and fruit plantations total another 70 million.

The hurricane also washed away soil. More than 4,500 hectares of land were affected by landslides or flooding, and will require investments of some 80 million quetzals for rehabilitation.

iv) The livestock sector. Livestock sector losses were lower than in agriculture. The most affected department was Izabal, where 40,000 hectares of grazing and 10,000 head of cattle were lost (mostly calves and dual-purpose cows). Poultry farming was badly hit in the Department of Escuintla, where 361,000 poultry were lost. Losses were relatively low in other branches of the sector.

Total damage in the sector was 26 million quetzals, of which 14 million were in cattle (Table 13). This includes 2 million quetzals of indirect damage in lost dairy production due to lower yields. Damage in poultry is estimated at 6.5 million quetzals, and amounted to US\$800,000 in hog farming. Lost pastureland is estimated at 4 million quetzals.

v) Fisheries. Most damage was to shrimp farming in ponds, mainly in the departments of Santa Rosa and Escuintla. Deep-sea and small-scale fishing were less affected. Overall, the sector suffered losses totalling more than 24 million quetzals (Table 13).

In shrimp farming, the main damage was to the walls (mostly made of concrete) of ponds, which will have to be repaired as soon as possible to be able to reactivate shrimp production and exports. Flooding also led to the loss of 500 tons of larvae and shrimp. Damage to this subsector amounts to 20 million quetzals.

Production was also lost in deep-sea fisheries and in small-scale fish and shrimp fishing; in the latter currents and tides dragged fishing equipment and tackle away and caused damage to unloading facilities. Losses are valued at 4.2 million quetzals, with 2.2 million pertaining to industrial fisheries and 2 million to small-scale activities.

The reactivation of fisheries requires two types of actions: one is to secure financing for companies that lost shrimp-farming and trolling assets, the other to replace the equipment and tackle lost by small-scale fishermen.

b) Industry, trade, and tourism

The damage caused by hurricane Mitch in industry, trade, and tourism was less severe than in agriculture. Manufacturing suffered damage totalling US\$18.7 million, mainly in the garment and furniture industries. In tourism losses are estimated at US\$15 million; although hotel facilities were not damaged, tourist flows are expected to decrease. Damage in mining amounts to US\$300,000.

i) Manufacturing sector. Although industrial infrastructure was affected by heavy rains and flooding, the damage was relatively minor. However, output will be significantly reduced due to shortages in primary sector inputs extending beyond the period of temporary closures. In other words, the indirect effects were felt not only in the last two months of 1998, but will continue in 1999.

Direct damage consists mainly of broken-down machinery and equipment in the municipalities of Amatitlán, Mixco, Villa Nueva and Guatemala. Some companies that export to Honduras have not been able to make shipments and those that export perishables have suffered losses. There is no information on insurance amounts for such goods. One of the factors that affected trade flows was the suspension of activities on 2 and 3 November, which delayed clearance for exports.

The agroindustrial branch sustained losses in infrastructure, with damaged facilities and machinery; the main damage, however, was to production. Losses in the farming sector —described and quantified in the previous section— led to reduced processing of farming and fish products that will last several months.

Given the lack of quantitative information, an estimate was made of the combined volumes of goods lost and the difference between unit prices paid to producers and wholesalers. That difference was considered to be representative of the agroindustrial value added.

Indirect damage in agroindustry is calculated at 281.3 million quetzals (US\$42.6 million, see Table 14). The processing of food commodities accounts for 71 per cent of this total, fish products 24 per cent, and meat packing 5 per cent. Of all indirect losses in agro-based industry (not counting fishing or cattle farming), 59 per cent was in processed goods for export.

In arts and crafts, producers in the highlands were unable to deliver their goods due to impassable roads and bridges, which delayed shipments. Sales also fell due to fewer tourists. Total damage in this area was 1.3 million quetzals.

In the garment industry, direct damage was small but indirect losses are considerable, especially due to lost working days and delays in deliveries of raw materials in ports and loading zones. Fifty-six export containers and 65 import containers carrying clothing and other raw materials were detained. Lost profits and the inability to supply raw materials are the main problems facing the sector. Total damage is calculated at 66 million quetzals (see Table 14).

Manufacturers of furniture and wood products had supply problems due to impassable access roads or the isolation of companies in the Zacapa and Alta Verapaz areas. Overall losses are estimated at 10 million quetzals. Other types of manufacturing suffered estimated losses of 46 million quetzals.

In mining salt production was lost and companies located in the Department of Santa Rosa (Pacific coast of Guatemala) suffered damage to infrastructure.

Table 14

GUATEMALA: DAMAGE IN THE MANUFACTURING, MINING AND TOURISM SECTORS

Branches	Damage			Cost of reconstruction	Increase in imports	Reduction in exports
	Total	Indirect	Direct			
Total (thousands of US\$)	79,614	73,814	5,800	6,200	5,180	4,500
Total (thousands of quetzals)	525,450	487,170	38,280	40,920	34,188	29,700
Manufactures	404,670	388,170	16,500	21,120	34,188	29,700
Agro-based industry	281,250	281,250				
Crafts	1,320	1,320			528	
Garments	66,000	66,000			26,400	19,800
Furniture	9,900	6,600	3,300	1,320	660	
Other manufactures	46,200	33,000	13,200	19,800	6,600	9,900
Mining	1,980		1,980			
Tourism	118,800	99,000	19,800	19,800		

Source: ECLAC, based on official figures and own calculations.

ii) Tourism sector. The hurricane affected 20 per cent of the tourism industry, which is significant given that Guatemala is one of the main destinations in Central America and that tourism is the country's second highest source of foreign exchange. Direct damage is smaller, because 60 per cent of hotel facilities and services are in the country's central region (Guatemala City and Antigua Guatemala), where flooding was slight; indirect damages stem from fewer tourists, cancelled trips and reduction in reservations, lost foreign-currency earnings and lower handicraft sales.

In 1998 tourism activities were expected to bring approximately US\$400 million in foreign exchange into the country. According to tourism authorities, indirect losses due to lower numbers of tourists will total US\$15 million. The sites affected include the Quiriguá ceremonial centre in Morales and some churches in Antigua Guatemala. Tourism losses as a whole are estimated at almost 119 million quetzals.

4. Effects on the environment

a) Definitions and methods used in environmental assessment

Natural disasters can cause moderate or serious damage to the environment, or even the total deterioration of a natural heritage that provides society with environmental benefits. Quantifying the environmental impact of natural disasters on this heritage on the basis of relative indicators or in monetary terms is a relatively recent practice. This type of assessment has been applied, for example,

in analysing the impact of El Niño (1997-1998) on Costa Rica ¹⁹ and of hurricane Georges on the Dominican Republic. ²⁰

The theory is that natural habitats or ecosystems are generally in a state of ecological balance; natural phenomena involving high energy dissipation are normal, although they may only occur once in several years or decades and affect geographical areas at random; these processes are believed to shape biosphere physiography over time. Their main impact is therefore on an ecosystem's sensitivity, depending on its geophysical characteristics and its environmental conditions, and its vulnerability to neighbouring regions with human settlements, particularly if such settlements lack appropriate preventive land-use measures and planned, sustainable management of natural resources.

This diagnosis is based on the average value of environmental services provided by forests in terms of carbon fixation, water protection and production, biodiversity, ecosystems and scenic quality. These values are relative, since economic assessment of the effects of damage on the natural environment still requires further studies. Preliminary assessment of the damage was based on a rapid field study (touring the most affected areas by helicopter) and on studies of photographs and films, in addition to other information provided by technicians, specialists and Guatemalan government authorities, local NGOs (Defensores de la Naturaleza) and technicians from international missions participating in measures to address the emergency and optimise the country's recovery (UNDP, IDB, UNICEF, FAO).

The alterations caused by hurricane Mitch to Guatemalan territory are measured as direct impact in this study, since they specifically altered natural assets through losses or serious damage, in just a few hours (by the hurricane's wind impact) or several days (by the persistent rains). Impacts are classified as primary and secondary; the primary impact is caused by the storm's *in situ* energy dissipation, whereas the secondary impact refers to subsequent, cumulative dissipation, such as the major flooding that occurred in densely populated alluvial valleys and near the rivers that run through them.

Two types of hurricane impact were defined:

i) Immediate or primary direct impact (PDI) on the environment. Harmful or noxious impacts of a large-scale natural phenomenon, which occur during the event itself and have a direct effect on the state of natural assets as they were when the disaster began. Examples include strong winds that knock down, twist and defoliate plants, disturb fauna, and produce large waves and groundswell; landslides and large-scale erosion of topsoil caused by heavy, sustained rainfall on mountain slopes (erosion is particularly strong when trees have fallen); and immediate erosion of beaches or coastal damage stemming from intense waves or from groundswell.

ii) Secondary direct impact (SDI) on the environment. In addition to their local impact, the direct effects can also have an impact on the vicinity and areas some distance away from where a disaster initially broke out; these may be felt immediately, in a few hours or even days later, with explicit damage caused in areas rendered vulnerable by human activities. Examples include

¹⁹ ECLAC (1998), *El fenómeno El Niño en Costa Rica durante 1997-1998* (LC/MEX/L.363), 3 November.

²⁰ ECLAC (1998), *República Dominicana: Evaluación de los daños ocasionados por el huracán Georges, 1998* (LC/MEX/L.365), 1 December.

landslides, the formation of gullies and ravines left barren by waterlogging of the topsoil after losing its original vegetation, large sedimentary deposits in river beds and estuaries, sedimentary deposits on beaches and reefs, the formation of river islands that subsequently flood, drowning animal species, and floods and avalanches, among others. These effects may be intensified by other factors resulting from primary direct damage, such as rivers dragging vegetation uprooted by gusts or sustained winds, mud and accumulated rubble from cave-ins and landslides.

iii) Indirect impacts (II) on the environment. These stem from the action of weather phenomena involving major energy dissipation, and their effects depend on the type and extent of primary and secondary direct impacts, both of which indirectly affect the condition of natural assets when the disaster struck. These consequences can arise as soon as the direct impact takes place, or may appear and continue over a period of days, months or even years. One example is the disappearance of nutrients in an aquatic system, thus causing changes in the food chain; another is the disappearance of seed, fruits or flowers, the food source of birds and mammals, owing to the lack of a habitat, such as a forest. Although a tree can regenerate and sprout new leaves when it has lost its branches in hurricane winds, it will take longer to flower and produce fruit. Additionally, the lack of natural insect predators, such as bats, when they have been driven from an area, owing to the lack of a forest habitat, encourages the proliferation of insects that could be harmful to crops adjacent to the forest or to river banks. The lost habitat could also have been producing pollinating insects or insects generally beneficial to the agricultural environment of neighbouring man-made surroundings.

b) Impacts on the environment prior to 1998: occurrence of natural disasters and impacts caused by man

Guatemala has suffered the consequences of destructive natural phenomena throughout its history. The tropical storms and hurricanes that form between August and November cause high death tolls and enormous damage in the environment, forests and coasts, producing mountain landslides and flooding valleys. Most storms have entered the country from the east.

A combination of human activities and unplanned settlements (a direct cause), together with relatively high population growth, (an intensifying or magnifying factor), have made the environment increasingly vulnerable to natural phenomena, leading to major disasters.

Human activities that have a particularly strong impact on vulnerability are the disorderly expansion of the agricultural frontier based on felling and burning natural forests, and the expansion of pasturelands for extensive livestock-raising. The following practices also increase vulnerability to natural phenomena: agricultural production on mountain slopes (without soil conservation), in stream beds and river terraces (including primary activities), the opening of roads and the construction of highway, urban or other types of infrastructure, without taking into account environmental protection and land-use management measures (for agriculture and urban settlements).

Guatemala's forests cover an area of approximately 4,375,000 ha, 80 per cent of which is latifoliate forest,²¹ and annual deforestation has been estimated at 82,000 ha.²² Looking at the

²¹ Office of the Coordinator of Guatemala's Forestry Action Programme (1991), *Plan de Acción Forestal para Guatemala*.

positive side, watershed management projects are under way, such as in the Chixoy (5,000 km²) and Lake Amatitlán watersheds, and financial mechanisms have been devised to conserve water-producing forests with a minimum amount of felling, through direct payments to landowners (project financed by the IDB). From the institutional point of view, legal uncertainty regarding the right of use of natural resources (a major problem in some areas of Guatemala) should be considered one of the factors that discourages soil conservation practices and contributes to deforestation.

In the urban environment, the practice of dumping refuse into gullies in unplanned settlements lacking refuse collection services, coupled with inappropriate sand-extraction systems, have contributed to silting in riverbeds and drainage systems, either causing or aggravating flooding; such is the case in Lake Amatitlán.

In this context, future increases in population density will inexorably lead to extensive, indiscriminate territorial occupation, with all the infrastructure and human activities this entails, which will unquestionably increase vulnerability to natural disasters, unless alternative land use and resource-management approaches are taken. "One of the key factors in the recent catastrophe is deforestation and the expansion of the agricultural frontier, due largely to the interaction between poverty, demographic pressure and environment" (UNFPA). The situation must also therefore be addressed from the standpoint of population, land-use policies and regulations, nature conservation and environmental education, among others.

c) **Direct impact on the environment**

Official information was very limited when this report was written. The severity of the disaster in Guatemala and the prolonged emergency stage have hindered the identification and assessment of overall damage to the environment. An overflight of the Sierra de Minas Biosphere Reserve and information from the officials in charge show that the damage caused by fallen trees is insignificant.

No serious damage has been reported in protected areas. The only information received has been of flooding in buffer zones of the Sierra de Minas Reserve (in deforested agricultural frontier areas) and in the Complejo I southern reserve buffer zone in Petén.

i) Ocean impact.

1) Coastal geodynamics. Hydrometeorodynamic effects generate a primary direct impact through large waves and groundswell. No official data are available on the duration and size of the waves, or on the height of the groundswell. In Punta de Manabique several fishermen's families were evacuated prior to the arrival of Mitch and their dwellings were destroyed by the groundswell. Certain beaches where sea turtles lay their eggs were also eroded.

2) Coastal ecosystems. Deposits of debris, consisting mainly of branches, trunks, refuse and dead animals swept downstream by rivers, have accumulated in estuaries in the Pacific region (departments of Retalhuleu, Suchitepéquez and Escuintla). Coastal currents tend to carry fresh

water loaded with sediment from inland floods further into the sea, burying some benthic marine ecosystems entirely. This type of problem was detected in brine shrimp breeding grounds. Some mangrove swamps were affected by silt deposits and erosion.

ii) Impact of rain. The consequences of hurricane Mitch had direct impacts (mostly secondary) on soil, forests, water resources and fauna. The effects of Mitch on the Lake Amatitlán watershed are being treated as a separate item owing to the importance of its human settlements.

1) Soil resources. Soil loss (washing away of the fertile layer) occurred mainly in the upper and middle parts of several watersheds as a result of concentrated erosion, landslides, and flooding of areas near river banks. The most affected areas were the Motagua River watershed and other basins on the Pacific side.

2) Water resources. Various types of effects on water resources were registered:

– Water pollution due to: a) washing away of agrochemicals used in agriculture; b) flooding of sewerage systems, septic tanks and latrines; c) decomposing animal corpses and refuse. Assessing the negative effects of these pollutants is no easy matter, since the enormous volumes of water have a great dissolving capacity.

– The increase in water turbidity, which reduces penetration of sunlight and the concentration of oxygen dissolved in water, and lower water conveyance capacity can have negative effects on aquatic ecosystems.

– The dragging of sediments led to changes in river channels (in the banana-growing area of the Motagua River, for instance) and in general to landscape changes.

3) Forestry resources and protected areas. Considerable damage was registered in forests situated on the banks of affected rivers. The little available information on protected areas does not reveal significant damage to primary forests. Cave-ins and landslides occurred mainly in agricultural areas, precisely because of the lack of permanent plant cover.

4) Fauna. Animal life has been affected by alterations and loss of habitat, although it is impossible to identify and assess these effects. One of the main causes of high mortality among land-based species (reptiles, mammals) is the formation of river islands that are subsequently swept away by the high waters.

5) Lake Amatitlán Watershed.²³ This is a sub-watershed of the María Linda River, covering 381 km². Most of it (62 per cent) is considered susceptible to serious erosion and around 40 per cent contains high-risk areas prone to floods and landslides. Although the majority of the land is suitable for forestry, perennial crops, grazing and natural reserves, 41 per cent of the watershed has been urbanised and only 8 per cent is forested. The population of municipalities within the basin is estimated at 1,200,000 and some 800 industries (textiles, metal-working, chemicals, food and others) operate in the area. No treatment plant for either industrial or domestic waste water exists. Only 30 per cent of the 250 tons of refuse produced daily is collected; the rest is disposed of in gullies

²³ Information supplied by the Amatitlán Lake and Watershed Sustainable Management Authority (AMSA).

and ravines. The lake is suffering from a process of hypereutrophication; native species of fish such as pepesca practically no longer exist and species such as tilapia and pompano have been introduced. The lead levels in fish caught in the lake are very high.

In this basin, the rains caused by hurricane Mitch resulted in loss of human lives, housing and crops, and damage to infrastructure. The silting of drainage systems and river beds caused by sediment and refuse aggravated the watershed's problem of loss of seepage caused by urbanisation and heightened the effects of the rain. An area of five km² was flooded. The lake received the sewage accumulated in septic tanks of flooded dwellings, in addition to refuse buried in a sanitary landfill which suffered a landslide. An indirect effect is an increase in the lake's eutrophication.

The Lake Authority has carried out works —mainly the construction of settling tanks—which have diminished the effects of the hurricane. Action is also being taken in the area of environmental education; a project financed by IDB (US\$40 million), made up of different components: refuse and sewage management, watershed management, reforestation, environmental education and support for municipalities, is due to be launched next year.

Although most of the watershed's environmental problems have little to do with the hurricane, what occurred exemplifies the manner in which human activities (settlements in high-risk areas, unplanned urbanisation, deforestation, lack of garbage collection) can magnify the effects of natural disasters.

d) Indirect impact of Mitch on the environment

Since only two weeks have passed between the hurricane and this study, the effects that damage to plants, fallen fruit in forests and loss of foliage may have had on birds and mammals is still unknown; in fact, virtually nothing is known about the food sources (seeds, fruits, etc.) of various species. No information is available either on the status of small species (batrachians and fish) that are the food sources of mammals, reptiles and other creatures, owing to possible alterations in wetlands.

This study also places emphasis on including the environmental value lost in rivers, since they are highly productive ecosystems that extend throughout the country's farmlands. Other effects on important and valuable aspects of these habitats could be occurring or will occur, and should be studied. Research conducted in Guanacaste National Park, Costa Rica, has shown that the environmental services provided by protected areas to singlecrop farming are highly beneficial.

With regard to biodiversity, exotic species such as bullfrog, tilapia and Venezuelan alligator which were introduced and were being exploited commercially escaped in areas close to the Monterrico and Hawaii protected areas. It is impossible to gauge the effects, although the introduction of exotic species is one of the main causes of loss of biodiversity.

Another effect that should be borne in mind is the invasion of new lands by small farmers who lost their fields, especially near protected areas. This poses a real threat to the buffer zones of the Sierra de las Minas Biosphere Reserve.

e) Calculation of environmental damage

In addition to covering agriculture, health, housing and other sectors, an economic assessment of the damage caused by hurricane Mitch should also consider the effects on natural assets of the loss of benefits provided by natural areas. “Environmental services” are benefits derived from natural ecosystems, such as timber, the genetic bank, medicinal plants and biodiversity in general, carbon fixing, oxygen production, soil protection, water production, and scenic and recreational areas; it is becoming widely accepted that such services should be paid for, since they are necessary for sustainable development now and in the future.

This is a new market or export product that is being used to fund environmental conservation and sustainable development; for instance in Guatemala and Costa Rica important progress is being made in the area of carbon sequestration.

Four types of environmental services are considered in this assessment: i) reduction of greenhouse gas emissions; ii) protection of water for urban, rural or hydroelectric purposes; iii) protection of biodiversity as a valuable genetic resource for future development and global stability, sustainable scientific and pharmaceutical uses, and genetic research and improvement; and iv) protection of ecosystems, living organisms and natural scenic beauty for scientific, tourism and environmental education purposes. Some countries are issuing forestry conservation bonds as an important means of maintaining these services and ensuring ongoing production, thereby compensating the owners of environmental resources for the use of environmental services that benefit society. These bonds are for a minimum of 20 years and are a recent instrument since they were not previously available on the stock market.

One way of appraising the environmental damage caused by Mitch is to estimate the environmental benefits provided by an ecosystem in complete balance. Reference is made to the studies used by ECLAC to assess the environmental damage from the effects of El Niño,²⁴ and to recent assessments carried out in the Dominican Republic.²⁵

Table 15 shows an estimate of the forested area destroyed by hurricane Mitch. Only river bank forests, which are the most affected, have been included. Forests in protected areas have not been taken into account, since preliminary reports do not indicate damage of any significance. Damage to other resources (soil, bodies of water) has not been assessed.

Table 16 shows the average values for each type. The values for Guatemala are considered similar to those of tropical latifoliate forests.

Table 17 shows damage to the natural heritage in annual terms and over a period of 20 years. Although total recovery time has not been established in many cases, approximate figures have been included; the estimated recovery period ranges from 15 to 20 years. The overall cost of damages throughout the period is around US\$5.1 million. It should be stressed that this estimate is based on

²⁴ Based on Carranza, C.F. et al. (1996), *Valoración de los servicios ambientales de los bosques de Costa Rica* (CCT/ODA/MINDA), San José, Costa Rica, Centro Científico Tropical; and Echeverría, J., et al. (1997), *Valoración económica de los beneficios del Área de Conservación Guanacaste* (CCT/PNUD), San José.

²⁵ ECLAC (1998), *op. cit.*

incomplete preliminary information; moreover, it does not take into account the value of lost soil resources and other unassessed damage (to water resources and fauna). Costs do not include an annual discount for differentiated carbon absorption.

Table 15

GUATEMALA: FOREST DESTROYED BY RAINS AND RIVER FLOODING AS A
RESULT OF HURRICANE MITCH

Type of area (affected area a/)	Direct impact b/ and percentage of trees blown down, destroyed or swept away	Remarks
Riverside forests (63 km ²) c/	Severe (M), 70	Damage due to overflows, rock deposits, boulders, sand and silt

- a/ ECLAC, own estimate based on *Mapa de Cuencas y Vertientes del Plan de Acción Forestal de Guatemala*, 1990. The watersheds most severely affected by Mitch have been taken into account.
- b/ As defined in this study. Minimum = Minor impact, Severe = Medium damage due to flooding; (M) = Damage with recovery over the medium term, (L) = Damage with recovery over the long term.
- c/ Human interference of approximately 30 per cent has been taken into account.

Table 16

GUATEMALA: AVERAGE VALUES OF ENVIRONMENTAL FORESTRY SERVICES

(Dollars per hectare per year)

Environmental service a/	Primary forest b/	Secondary forest b/
Total	58	41.76
Carbon fixing	38	29.26
Water protection	5	2.50
Biodiversity protection	10	7.50
Ecosystem protection	5	2.50

Source: ECLAC, based on estimates.

a/ Based on: Echeverría *et al.* (1996), Carranza *et al.* (1995), op. cit.

b/ Values for the Republic of Costa Rica.

Table 17

GUATEMALA: ESTIMATES OF THE DAMAGE CAUSED BY HURRICANE MITCH TO ENVIRONMENTAL SERVICES, 1998

Type of area (percentage of average damage)	Affected area (km ²)	Equivalent total damage (km ²) a/	Cost (thousands of US\$)					Total per year	Total b/
			CO ₂ capture	Water protection	Biodiversity	Ecosystem protection			
Total	63.0	44.1	167.6	22	44	22	255.6	5,112	
Riverside forests (70%), c/	63.0	44.1	167.6	22	44	22	255.6	5,112	

a/ The area equal to total destruction based on actual area and percentage of trees fallen or swept away was calculated for each area.

b/ The overall cost for a 20-year recovery period is approximately US\$5.1 million.

c/ The level of human interference in riverside forests was estimated at 30 per cent and does not include the lowest part of the lower basin and estuary of the main rivers. The system is initially estimated at 2,100 km, which corresponds to the most affected watersheds, and 30 m of riverside forest have been considered for the entire length.

River and river bank systems should also be assessed, since they were greatly affected throughout the country by high flows. Estimates indicate that 2,100 kilometres of river systems, 30 per cent of which have been altered by human interference (fragmentation, destruction, logging, etc.), were affected.

i) Carbon dioxide fixation. CO₂ absorption from the atmosphere through photosynthesis is a crucial link in the biogeochemical carbon and oxygen cycle. This process of accumulation as organic plant matter helps to prevent carbon dioxide levels from rising while simultaneously producing oxygen, for which highly industrialised countries are willing to pay to compensate for their own gas emissions. The loss of environmental services from the organic dysfunction of forests lost or

washed away (in the alluvial gullies of medium and high sub-basins) is taken into account in the calculations; such carbon will return to the atmosphere through rotting or burning, since it cannot be made use of except in certain cases.

A value of US\$38 per hectare/year has been given to dense and logged forest; in other places, carbon fixation in brush areas and swamps has a low value (US\$0.76, which hardly merits consideration), although they are obviously rich in biodiversity (insects, birds, etc.).

ii) Water protection. The qualitative and quantitative protection of forests has different repercussions on their water cycle, depending on physiography, land quality, amount of incoming and outgoing water, seasonal flows, erosion, sedimentation, nutrient flows, etc. The value of brush areas is negligible.

iii) Biodiversity protection. Biodiversity provides innumerable benefits for science, recreation, the pharmaceutical industry, pollinating species, insect and pest control, genetic heritage, etc. The time taken for the environment to recover from damage to biodiversity is still not known precisely.

iv) Protection of ecosystems and natural scenic beauty. This category covers numerous subjects: biocenosis protection, ecological processes, corridors, recreation, tourism, etc., and is closely associated with the previous section.

The last important factor in this calculation concerns the intrinsic value of an ecosystem, since it is what provides environmental services. Damaged forests are considered a lost service, at least in the amount that will no longer be earned until the ecosystem returns to full production.

f) Short-term projection

If human activities that make use of the environment are carried out without taking into account their possible adverse consequences on natural resources, they will almost certainly affect the stability or sustainability of natural resources by making them more susceptible to alteration and destruction when the environment suffers the impact of a natural disaster. In other words, human technological activities can easily worsen the effects of natural disasters. Moreover, if human settlements are not planned, do not take into consideration land-use management, prevailing biophysical factors and the risk involved in settling in high-risk areas, vulnerability increases in direct proportion to the lack of foresight.

For example, a basin that has been placed under strain through construction, road building, extensive farming, logging in natural forests, etc. will be unable to absorb exceptional, prolonged amounts of rainfall as well as it would under conditions of controlled and planned use. Water flows will be lower than their natural minimum during the dry season and rise excessively when it rains, even when there are no extraordinary weather patterns. If the dry season lasts longer than usual, groundwater storage will be insufficient; conversely, when there are large amounts of rainfall, the water flowing through the destabilised basin will be excessive. Either situation can be disastrous.

Another example is excessive population growth, a factor that heightens the impact of any disaster when a human settlement is located in an unstable area that can be devastated by the effects

of exceptional natural phenomena. Here the consequences of a natural impact are multiplied by man's alteration of environmental conditions, by the precarious living conditions of victims, such as poorly constructed housing built on slopes subject to landslides), and by causes stemming from a lack of foresight, management and social improvement.

Urban planning, land-use management, land conservation measures, environmental restoration, structural prevention measures for roads, bridges, reservoirs and other works, and any other technical measures designed to change or improve a natural setting within a framework of sound and respectful use of the environment and the laws of nature are certain to improve the quality of life through sustainable development. These aims require scientific research, databases on natural phenomena and early-detection measures whenever possible, as well as continuous education to create awareness of environmental management in society and provide an orderly response to natural disasters. These actions are in fact long-term preventive measures and will help to streamline efforts and improve coordination during the initial stages of an emergency, particularly if the country has good warning and civil-defence mechanisms.

Measures taken during the reconstruction stage following a natural disaster should be added to everyday conservation activities, so as to achieve an optimum approach to sustainable development.

Government and international agencies have stated the need for a change of attitude in dealing with natural disasters, focusing on disaster prevention, reduction of vulnerability and early warning. The International Decade for Natural Disaster Reduction (thus declared for the nineties by the United Nations General Assembly) has undertaken the task of incorporating multidisciplinary approaches in order to gain further understanding of the actions needed to deal with these phenomena and reduce negative effects through prevention.

5. Summary of damage

In keeping with the calculations presented in the preceding sections, hurricane Mitch is estimated to have caused damages totalling US\$748 million (4,937 million quetzals), 40 per cent of which is direct damage. Partial or total damage to infrastructure should be rebuilt or repaired as soon as possible to prevent the country's economic-growth and social-development capacity from being hampered over the medium term. As previously stated, the reconstruction should be undertaken from the standpoint of improvement and disaster prevention and mitigation.

Direct (67 per cent) and indirect damages (84 per cent) alike were concentrated in the productive sectors. Most of the damage here was to the primary sector, particularly agriculture, which will have a strong impact on the country's balance of payments due to a larger amount of imports and lower exports of around US\$444 million during the 1998-2000 period (forecasts indicate that exports will drop by US\$307 million and imports, mainly of capital goods, will increase by US\$137 million).

Losses in the infrastructure sector (US\$116 million) basically refer to damaged roads and bridges. Although damage to the social sectors is relatively minor, the unmeasured effects on the welfare being of people who lost their homes, livelihood, etc. must be taken into account, i.e., in qualitative terms, the harm caused to the social sectors has a special significance which should be borne in mind upon embarking on rehabilitation and reconstruction activities.

Table 18 includes a column showing the estimated cost of reconstruction, which serves as a rough indication of the amount required to improve transport, health care, housing, education, production and environmental infrastructure. The appendix contains project profiles that include a time frame for the reconstruction efforts, which is important in that it has a bearing on the country's capacity to absorb and manage resources. Finally, the table includes an estimate of the imported component of reconstruction costs, which provide an approximate indication of foreign-exchange needs.

Table 18

GUATEMALA: SUMMARY OF DAMAGE AND COST OF RECONSTRUCTION

(Millions of US\$)

	Total damage	Direct damage	Indirect damage	Cost of reconstruction	Imported component
Total	748.0	287.8	460.2	415.5	
Social sectors	48.1	33.0	15.1	52.2	
Housing	35.3	24.5	10.8	38.0	3.0
Health	4.9	1.1	3.8	1.9	1.0
Education	7.9	7.4	0.5	12.3	2.9
Infrastructure	115.8	56.3	59.5	82.2	
Roads, bridges, railways	89.7	40.1	49.6	60.4 b/	15.6
Water and sanitation	16.1	10.5	5.6	13.8	
Electricity	10.0	5.7	4.3	8.0	
Productive sectors	579.0	193.4	385.6	217.2	
Agriculture, fisheries, forestry	499.4	187.6	311.8	211.3	
Manufacturing a/	61.6	2.8	58.8	3.2	
Commerce, restaurants, hotels	18.0	3.0	15.0	3.0	
Environment	5.1	5.1		63.9	

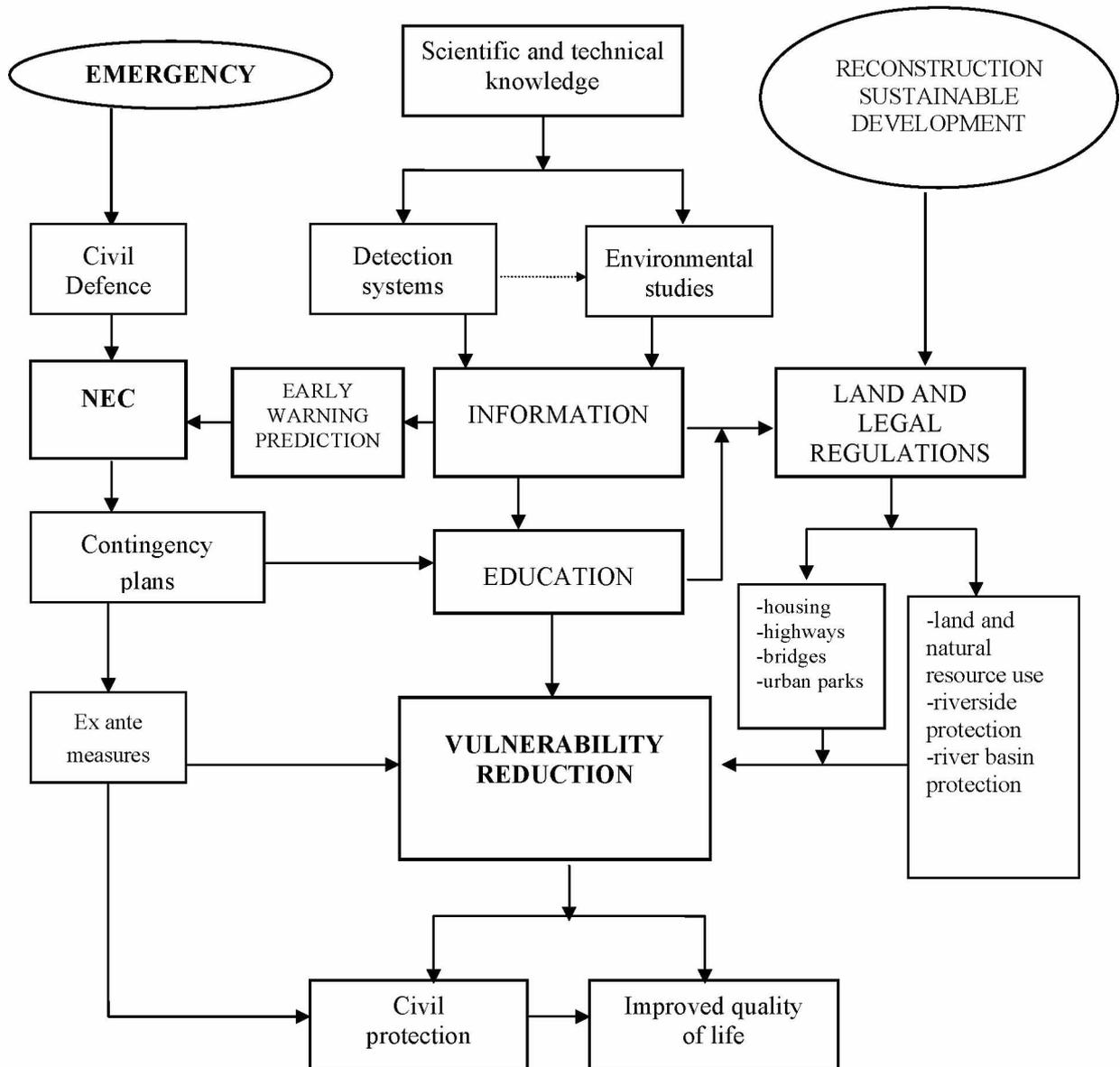
Source: ECLAC, based on figures shown in tables 3 to 15.

a/ Includes mining.

b/ Does not include railways.

Figure 3

POSITIVE LINKAGE FOR INFORMATION, REACTION AND DEVELOPMENT PROCESSES TO REDUCE VULNERABILITY AND PROMOTE SUSTAINABLE DEVELOPMENT



III. OVERALL EFFECTS OF THE DAMAGE

This section contains a brief overview of Guatemala's economic performance in the months prior to the hurricane and the latter's future effects on the economy. Impact on activity levels, public finances, the foreign sector, prices, wages and employment is assessed. The foreign sector is expected to be the hardest hit —due to the drop in exports and the need for additional imports— along with fiscal accounts, owing to the extra funds allocated to the emergency, rehabilitation and reconstruction.

1. Economic evolution prior to the disaster

In 1998 Guatemala's growth prospects showed favourable export trends, a 4.5 per cent GDP growth rate, and inflation ranging between 8 and 10 per cent, with an overall public sector deficit of about 1 per cent of GDP.²⁶

These developments are taking place within the framework of the Global Agreement for a Firm and Lasting Peace, and have favoured the effective fulfilment of the Agreement.²⁷ One of the main achievements of economic policy in the nineties has been to maintain the tax burden above 8 per cent in 1996 and 1997, while keeping inflation moderate through a stable exchange rate and restrictive monetary and fiscal policies.²⁸ Higher investment by the private sector and the government —encouraged by lower interest rates— was a key factor of economic performance.

Fiscal policy has focused on meeting tax-collection targets, and spending has been redirected towards social sectors, while maintaining fiscal balance. The goal in 1998 was to raise the tax burden to 10 per cent, a difficult aim in a pre-election year when pressures to increase public spending are stronger.

The economy was expected to grow 4.8 per cent,²⁹ but is now estimated at 4.6 per cent, mainly because the hurricane struck towards the end of the year; the impact is expected to be stronger in 1999 and to continue to a lesser extent in subsequent years.

The agricultural sector showed a 3 per cent growth rate, on a par with industry. Exports — particularly sugar cane and coffee— played an important role in the sector's performance, and basic grain production continued at a normal rate. Non-traditional exports also benefited from favourable agricultural trends.

²⁶ ECLAC (1998), *Guatemala: Evolución económica durante 1997* (LC/MEX/L.354), 16 July.

²⁷ MINUGUA (1998), *Informe del Secretario General de las Naciones Unidas sobre la Verificación de los Acuerdos de Paz de Guatemala*, Guatemala City.

²⁸ ECLAC (1998), *Guatemala: Evolución económica...*, op.cit.

²⁹ ECLAC (1998), *Guatemala: Balance preliminar de la economía, 1998*, mimeo.

The industrial sector continued to benefit from increased trade with other Central American countries; intra-regional exports, most of which are manufactured goods, increased 11 per cent. The in-bond (maquila) processing industry, especially textiles, also grew as a result of its exports. Mining output continued to show vigorous growth, particularly as concerns oil production and exploration. The construction sector grew 9.5 per cent as a consequence of public investment in roads and the promotion of certain housing and hotel projects.

In terms of aggregate supply and demand, the vigorous growth of gross capital formation and favourable development of public and private consumption account for sectoral performance.

2. Macroeconomic effects of the disaster

The macroeconomic impact of hurricane Mitch is likely to be stronger in 1999 and 2000, with a direct effect on real sectors and foreign and fiscal accounts; this should be borne in mind to be in a position to fulfil the specific goals laid down in the Peace Agreement.³⁰

The strongest impact on the economy will take place in 1999, with a 1.5 per cent drop in GDP and losses of US\$40 million in export-oriented production, in addition to lower prices for the country's main export products, among them coffee (5 per cent lower), bananas (20 per cent) and non-traditional exports (5 per cent).

The most serious losses were in the agricultural sector, particularly in exports, leading to a deterioration in the commodity balance and a greater imbalance in the foreign sector, which are likely to raise the prices of green goods and vegetables.

The temporary scarcity of certain produce (tomato and onion, among others) made prices rise at the beginning of November and led to a general increase in price levels of 2.6 per cent during the second week of the month; this pushed annual inflation trends up from 6 to 7.5 per cent. Preliminary estimates indicate a 15 per cent drop in agricultural employment levels and of 6.8 per cent in output.

a) Effects on economic growth

Official preliminary estimates place the 1998 GDP growth rate at 4.6 per cent, which is similar to forecasts made at the outset of the year, and a little higher than 1997 (4.3 per cent). However, it could rise to 5 per cent with suitable conditions for construction-sector growth and the reactivation of the agricultural sector. Economic performance in 1998 has been due to more expansive monetary and fiscal policies and the strong performance of exports throughout most of the year.

Real growth rates in 1998 and 1999 will largely depend on the impact of Mitch on the agricultural sector and on the combined effects of lower international demand, a decrease in Central American trade and the scope of reconstruction programmes in each country. The negative effects of

³⁰ It states that the tax burden should increase from 7.5 per cent of GDP in 1995 to 12 per cent in 2000; the goal for 1998 is 10 per cent.

the hurricane may be partly offset by an increase in investment stemming from the reconstruction process.

The Bank of Guatemala had estimated a growth rate of 5.2 per cent for 1999 prior to Mitch and subsequently lowered it to 3.6 per cent, but it may reach 3.9 per cent. The real reduction in output will stem from the combined effect of the factors mentioned above, income losses owing to higher unemployment levels —estimated at 5 per cent of the economically active population— the loss of agricultural exports and lower export prices, stemming in part from the international financial crisis.³¹ A 1.5 per cent drop in GDP growth in 1999 seems a reasonable forecast.

b) Effects on public finances

Fiscal policy showed signs of expansion in 1998. The deficit rose from 0.6 to 1.4 per cent of GDP, owing to the decision to halt open market operations. Near-fiscal losses dropped from 0.5 to 0.2 per cent of GDP, and the overall deficit rose from 1.1 to 1.6 per cent of GDP.

Government expenditures showed a marked rise (27 per cent), partly due to health and education spending commitments entered into in the Peace Agreement, but also to higher spending on public safety and significant investment outlays, mainly on roads and transport. Recurrent expenses increased at an approximate rate of 28 per cent, and investment spending at 24 per cent.

Public revenues remained in a highly vulnerable position. The Peace Agreement called for a 10 per cent tax burden in 1998, but the net burden only reached some 9.1 per cent.³² The target for annual revenues (12,435 million quetzals prior to Mitch) is still the same; 79.7 per cent from indirect taxes, especially value added tax (VAT), and the rest from direct taxation, such as income tax. Conversely, spending is expected to increase 2.3 per cent by year end, from 14,130.9 million quetzals (prior to Mitch) to 14,451.9 million (after Mitch). A 4.8 per cent increase in investment under this heading is expected for 1998 alone.

Emergency and reconstruction programmes will raise the fiscal deficit, particularly in 1999, when budget financing restrictions are likely to be greater; measures will probably be required to balance public spending in such a way as to prevent financing of reconstruction costs from competing with financing to comply with the commitments entered into in the Peace Agreement. Raising concessional funds from national or regional Advisory Groups and non-refundable, bilateral or multilateral technical-cooperation funds will obviously be of key importance for financing reconstruction activities, either in part or in full.

No changes are expected in total revenues (estimated at 13,649.6 million quetzals) due to Mitch. However, total spending is likely to increase 8.4 per cent because of higher foreign-debt levels stemming from loans to finance the reconstruction programme; real direct investment in particular will probably increase 16 per cent in 1999. The fiscal deficit may rise 0.9 per cent due to the proportional growth in public spending, thus growing from 12 per cent to 12.9 per cent in 1999.

³¹ ECLAC (1998), *Guatemala: Evolución económica...* op.cit.

³² Net tax revenues from fiscal credit repayments, mainly of VAT. Gross tax burden amounted to 9.5 per cent of GDP.

The gross tax burden has been adjusted from 10.3 per cent originally to 9.6 per cent in 1999, which is likely to lead to a greater drop in tax burden unless measures are adopted over the very short term to meet the rescheduling agreement. Furthermore, the Peace Agreement called for a more balanced evolution between direct and indirect taxation, in order to rectify the government's tendency to rely disproportionately on indirect taxes. Nevertheless, preliminary data for 1998 show that the latter have become more significant.

c) Effects on the balance of payments

The increase in the current-account deficit, stemming from higher imports for the reconstruction process and lower exports of agricultural products, will affect the balance of payments. The current-account deficit will reach US\$700 million in 1998—in contrast to US\$547 million in 1997—due to the impact of Mitch.

A substantial increase (more than 50 per cent) in the trade deficit will have a strong negative effect on the current-account deficit. The lower rise in the value of exports (8.8 per cent) as compared to that of imports (20 per cent) has a bearing on this unfavourable performance. In short, the deficit in the balance of trade will stand at US\$1.423 billion. The increase in liquidity witnessed in 1998 played a central role in the growth of the trade deficit, in addition to the relative stability of the nominal exchange rate.

d) Effects on other variables

As the strongest impact was on the farming sector, unemployment and poverty levels are likely to rise among rural population, particularly since the hurricane affected the most vulnerable, poverty-stricken areas, such as Alta Verapaz, Izabal and Zacapa.

Table 19 shows the possible consequences and the behaviour of the main economic variables in 1998 and 1999, prior to and after Mitch.

e) Consequences on monetary and financial policy

No significant changes are expected to be made to monetary policy following the hurricane. A growth policy was implemented in 1998, and during the first half of the year a programme was launched to reduce the cash reserves approved in 1997: effective reserves were drastically reduced from 24.6 to 19.6 per cent between December 1997 and June 1998. As a result, more than 1,600 million quetzals were injected into the economy.

Table 19

GUATEMALA: ECONOMIC OUTLOOK FOR 1998-1999

(Percentages)

	1997	1998		1999	
		Prior to Mitch	After Mitch	Prior to Mitch	After Mitch
Growth rates					
GDP	4.3	4.8	5.0	5.2	3.9
Average consumer prices	9.2	6-8	6.0	6-7	n.d.
December-December consumer prices	7.1	6-8	n.d.	6-7	n.d.
Percentages of GDP					
Fiscal deficit	1.5	2.1	1.7	2.4	2.6
Public spending	10.4	11.8	12.0	12.0	13.0
Gross tax burden	9.3	9.6	9.5	10.3	9.7
Net tax burden (with measures) a/	8.8	9.2	9.1	9.3	8.7
Net tax burden (without measures)	8.8	9.2	9.1	8.6	8.0
Current account balance	3.1	2.7	2.7	2.6	2.3
Budget balance	-0.6	-1.4	-1.7	-1.6	-2.6
Net foreign financing	1.6	1.8	1.9	2.6	3.3
Net domestic financing	-1.0	-0.4	-0.2	-1.0	-0.7
Total financing	0.6	1.4	1.7	1.6	2.6

Source: ECLAC, based on official figures and own estimates.

a/ Refers to the measures submitted to the Accompanying Commission.

The policy of suspending open-market operations remained in effect, and monetary regulation instruments led to a net removal of some 200 million quetzals from the market. In contrast, net credit from the central bank to the government showed a slight drop of approximately 200 million quetzals.

33

It is worth noting, however, that average borrowing and lending rates remained similar to their 1997 levels despite the growth in available financial assets. As a result, the financial margin showed an excessive 10-point spread. An increase in the delinquent portfolio is to be expected, owing to the financial insolvency of farmers and businessmen affected by the hurricane, so refinancing options are being studied in the financial system.

During the fourth quarter the banking system began to show signs of a lack of liquid assets, which made interest rates rise; they reached their highest levels during the second week of November. This was probably due to an hasty placement of new funds in the financial system, so portfolio quality may have deteriorated; it may also have been the result of an imbalance between fund

33

At the end of the year the negative variation was substantial, but this was due to extraordinary income from the privatisation of the electricity company, which was deposited by the government in the Central Bank.

attraction and placement terms. These developments took place within a framework of insufficient supervision.

To prevent greater problems, the authorities decided to reduce banks' obligatory investment in the Central Bank slightly, while also accepting new removals of monetary regulation instruments. A series of changes designed to strengthen banking supervision were also announced, and at the outset of December the lack of liquid assets appeared to be under control.

f) Effects on inflation and employment

Inflation remained within the range forecast by the authorities for 1998 due to relative exchange-rate stability. Inter-annual inflation stood at 5 per cent from October 1997 to October 1998. The average annual rate was expected to be 6 per cent, but after the hurricane the cumulative level to 5 November rose to 6.9 per cent, after which it diminished and stabilised again at 6 per cent. The inflation rate was very high in education (18 per cent), housing (9.5 per cent) and household items (14 per cent).

Employment levels had been improving throughout the year, but the widespread destruction of banana plantations in November 1998 led to mass unemployment in affected areas; similar situations are also expected in other areas.

IV. GUIDELINES FOR A REHABILITATION AND RECONSTRUCTION PROGRAMME

Although different emphasis is required in each country depending the type of damage and the vulnerability existing prior to the disaster, the devastating consequences of hurricane Mitch in Central America call for the adoption of new rehabilitation and reconstruction criteria to prevent the inhabitants of the region from being as exposed to damages as they were in this case.

It will be important to set priorities and consider the time frame and the necessary changes to design, construction and land use regulations in keeping with the situation in each country. In any event, reconstruction should be carried out on the basis of a significant qualitative improvement over the previous circumstances. Another fundamental factor regarding the viability of any reconstruction process is a country's internal capacity to conduct the process and programme it so that national capacity is not exceeded. Each country must decide on the time frame and priority of its actions and strike a balance between the urgent task of replacing what has been lost and its capacity to accomplish such works.

Once the emergency phase is over, rehabilitation and reconstruction programmes must be established in order to restore the facilities, assets and services damaged or destroyed by the devastating effects of the hurricane in each country. The content, priorities and scope of such programmes must necessarily be a national, sovereign decision of each country and respond as much to the magnitude of the damages as to a country's pre-existing conditions and economic and social policy criteria. Its foreign debt commitments and stabilisation policies must also be taken into account on determining the content, scope and scheduling of the programmes.

On addressing this topic, it is important to compile and analyse extensive background data so as to draw up investment and management programmes that will make optimum use of available resources while following the country's economic and social development objectives.

One factor to be borne in mind at this stage is that reconstruction cannot be carried out by a country on its own; it requires international cooperation. Each country's rehabilitation and reconstruction programme must therefore be structured in line with the international community's offers, which are due to take shape within the framework of the special Advisory Group convened by the IDB; after an initial session in December 1998, the Group will meet again to establish the bases for cooperation in reconstruction work. This section was included in this report to provide an idea of the investment projects deemed pertinent for repair and reconstruction, but are merely profiles at this stage. The list of projects neither replaces nor runs counter to the proposals submitted by national authorities to the Advisory Group. In many cases the proposals encompass more than just actions to tackle the damage caused by the hurricane, since each country's development strategy must also establish bases for sustained, less vulnerable development with growth, including components to reduce vulnerability to natural disasters and promote a more effective, competitive integration into a globalised world.

Consequently, rather than focusing on a national strategy —which, as stated above, must be devised by each country— the purpose of the following sections is to develop the guiding principles

behind the generation of projects and the basic guidelines to be followed on preparing rehabilitation and reconstruction plans and programmes. We believe this could be of assistance to national authorities on defining their strategy, which should be devised on the basis of consensus-reaching with society, particularly civil society, economic players, academic and non-governmental organisations and local authorities, among others.

1. Project generation

The main aims of the proposed projects are to attend to victims of the disaster, rebuild and improve destroyed and damaged assets, re-establish productive and export processes, and in general help to reactivate the process of economic and social development.

The initiatives presented here are a list of investment projects currently being developed as profiles to provide basic information on their aims, scope, expected results, activities and tasks to be carried out, investment to be made, expected financing, and the special characteristics of each project.

Each profile will subsequently be analysed in depth in order to draw up definitive projects and prioritise them so as to design repair and reconstruction programmes. This will make it possible firstly to improve the living conditions of disaster victims and recover the material and economic losses stemming from hurricane Mitch's devastating effects; secondly to enhance the design standards in use prior to the disaster, and thirdly to carry out works and establish mechanisms to control and mitigate the enormous damage caused by hurricanes and floods.

It should be mentioned in that regard that the main physical damage caused by the hurricane—aside from its tragic aftermath of death and suffering—was to infrastructure and agriculture and livestock production facilities. The after-effects are not limited to such losses, however, since the initial damages unleashed a multiplier effect with serious economic and social consequences; rural and semiurban population groups lost their housing, livelihoods and access to public services, and were subjected to other equally serious hardships stemming from environmental and sanitary crises, in addition to food shortages.

As a result, many victims that were already poor prior to the hurricane were left in conditions of extreme poverty. Government and international community support should therefore focus on addressing the problems described above and in preceding chapters.

To carry out the projects efficiently—once they have been definitively assessed and ranked—it will be essential to develop execution programmes so as to bring resources into line with needs. It would first be advisable to draw up a rehabilitation programme to deal with the emergency situations facing disaster victims, followed by a reconstruction programme to overcome economic and social adversities, restore and improve infrastructure and production facilities, and prevent or reduce the effects of similar events.

2. Rehabilitation stage

This initial phase will focus on normalising the living conditions of victims—while also reactivating the economy—by meeting their vital needs and delivering basic services. The victims' food, health

care and employment needs must take priority, and should be met expeditiously through the following actions:

- a) Provision of food.
- b) Provision of potable water.
- c) Medical attention to the wounded.
- d) Control and thorough prevention of diseases, particularly contagious diseases.
- e) Housing repair.
- f) Establishment, albeit provisional, of sanitation services.
- g) Generation of productive jobs.
- h) Provisional repair of access roads to affected areas.
- i) Supply of seeds and basic inputs to affected small and medium-scale farmers, along with financial support and soft loans.
- j) Repair of different types of infrastructure.

The suggested rehabilitation programme should be implemented as swiftly as possible, partly to meet vital and basic needs that are an ethical imperative, and partly due to the need to control and check the spread of diseases and epidemics in order to prevent hardships from becoming more acute. It is important to remember that the rainy season begins in April, so the rehabilitation programme must be concluded by that time.

Timely implementation of the above actions will bring the victims' living conditions back to relative normality and help to reactivate the country's economy.

3. Reconstruction stage

This is the most crucial stage in economic and social terms, since it will lead to the full re-establishment of normal living conditions and the country's economic and social development momentum prior to hurricane Mitch.

This phase will bring about the implementation of specific projects —duly assessed, ranked, and coordinated— in line with available resources, i.e., fully programmed and provided for in the reconstruction programme, which should be worked out as soon as possible.

The main aim of the reconstruction stage and the projects thereof is to effectively overcome the direct and indirect problems stemming from the hurricane, although hurricane-prevention infrastructure and management deficiencies and flaws will also have to be addressed. For instance, the effects of the hurricane showed that a number of structures were unsafe and that other types of

infrastructure, such as roads, bridges, hospitals, potable water systems, schools, etc. were inappropriately located; there is also an absence of watershed, infrastructure and environmental management schemes, and a lack of natural disaster prevention and control facilities —particularly for floods— to manage and mitigate their after-effects.

Moreover, on designing the reconstruction programme it will be important to take into account macroeconomic principles so as to prevent the undesirable consequences of overly ambitious reconstruction programmes. These include inflation, divergences in the exchange rate or in the supply and demand of certain resources such as labour and building materials, or undesired, disorderly migration.

There follows a summary of the basic considerations that should guide the process of designing the reconstruction programme.

a) Restoring lost support infrastructure

This mainly implies building the infrastructure needed to conduct economic and social activities, and includes roads and bridges, potable water and sewerage systems, power networks, and other lesser works.

It should be borne in mind that current conditions call for new approaches in designing infrastructure works. The aim is not merely to replace the facilities in existence prior to the floods, but to take advantage of the opportunity to modernise infrastructure by building it to meet current and future demand, incorporating recent technological developments, and constructing on sites that will minimise the after-effects of future disasters; the idea is to construct modern, adequate, efficient and safe structures.

For example, numerous bridges are located in places where they can be swept away by high water flows; this risk can be reduced by building them on higher ground, which in turn means rerouting roads. Similarly, many works in existence prior to the hurricane were built many years ago and were defectively laid out, whereas recent technological developments have reduced costs, thus providing the possibility of building works of much greater magnitude. Moreover, many facilities in existence prior to the hurricane already lacked the capacity to meet current demand.

It will also be important to establish alternate routes to prevent similar events from paralysing regions left inaccessible, or from leaving productive areas without access to the capital or export-shipping ports. In short, the country's highway system needs to be expanded.

b) Replacing lost social infrastructure

This guideline is similar to the one above and focuses on providing the population with basic services and facilities such as housing, hospitals and schools. As above, improving design and capacity will be an important consideration, particularly as regards hospital and school services.

Ironically, natural disasters often damage or destroy the facilities needed to deal with emergency situations, and this must be taken into account in the reconstruction programme. New hospitals should be built in safe, risk-free locations, since their services are essential in emergency situations. Schools must be made safe for the same reason, since they are often turned into shelters for disaster victims.

It is a known fact that many facilities were already overburdened prior to the hurricane, so it will be necessary to increase their capacity. Technological improvements must also be made, particularly in hospitals.

The main consideration in regard to the housing sector is to extend support to the most disadvantaged groups by securing them relocation and housing to meet their basic needs. This can be achieved through donations, material contributions, "work for food" programmes, and other such mechanisms. Less needy groups can be given support in the form of soft loans.

c) Re-establishing agricultural activities

The hurricane led to the partial or total loss of many agricultural assets; much cropland (bananas, sugar cane, palm, pineapple, grains, etc.) became unusable. Earth dikes, feeder roads and farm roads were seriously damaged by overflowing rivers, mud and debris such as large rocks, tree trunks and sand. Many rivers are full of silt, stones, trees and other material swept along by the current, and large deposits have formed where rivers meet the ocean. The living standards of farmers have also deteriorated significantly, since many lost their livelihood and housing.

Investment should therefore focus on reclaiming farmland and restoring production infrastructure —irrigation and drainage systems, fruit packaging and canning facilities, etc.— and on facilitating fruit crops.

d) Food support

One of the most severe consequences of the hurricane is that many subsistence farmers lost their crops, and their land will remain unproductive for many years. This group lost their housing, livelihood and income. Semiurban and low-income population groups are in a similar position, since they also lost their homes and jobs. It is therefore imperative to support them, especially by satisfying their basic needs.

As suggested above, "work for food" plans could be put into practice in view of funding shortages and the need for efficiency and equity. People working to improve their housing or fields could thus be given food in exchange for work performed in their own benefit.

e) Generating productive jobs

This is a very important social consideration, since one of the worst indirect consequences of the hurricane was the loss of thousands of jobs.

The main idea is to create efficient jobs in productive activities, among them the construction of support infrastructure, community facilities and housing, and agricultural jobs.

Programming of construction works and of work in general should therefore focus on making intensive use of unemployed workers, in accordance with their skills.

f) Control of epidemic risks

The aim here is to make every effort to provide medical care to infected patients and check the spread of diseases. Cases of cholera, malaria, rabies, hepatitis and classic dengue, among others, have been reported in most disaster areas, so there is risk that contagious diseases will spread.

g) Waterbasin management and environmental conservation

There are some initiatives related to this issue aiming to the rational and efficient usage of existing natural resources and to environmental management works. Thus, there is a need for improving the information network, strengthening the protected areas system, adopting proper management and sustainable development techniques on the country's waterbasins, strengthening those institutions in charge of sanitation and urban solid waste management services, controlling environmental pollution, promoting reforestation in wide areas and training public servants and farmers on reforestation methods and advantages.

h) Flood control and prevention

The countries of Central America have been suffering the consequences of natural disasters for many years. However, the frequency and intensity of such disasters have increased to an alarming degree in recent years, and the material damage and victims are higher every time.

In the past large sums were not invested in disaster prevention, partly because statistical records showed disasters to be relatively infrequent, so prevention measures were not considered a worthwhile investment.

The situation today has obviously changed, since hurricanes are more frequent (Joan, Georges, Cesar, and Mitch among them), as are forest fires, the effects of El Niño, etc. It would therefore be advisable to carry out an in-depth study of this complex subject so as to design policies to prevent natural disasters, particularly floods.

A fundamental aim would be to ensure that prevention policies contain appropriate guidelines to regulate and manage a country's natural resources.

Another would be to identify socially beneficial investment options to prevent or reduce the costly consequences of natural disasters. Studies should focus on the type, location and scale of infrastructure designed for that purpose.

In keeping with that approach, it will be important to conduct studies in the following fields: identifying which areas are prone to disasters (floods, landslides, droughts, fires and earthquakes), establishing land use management measures to prevent settlements and construction on land frequently subject to the effects of natural disasters, designing infrastructure to control the forces of nature (drainage, river dikes, dams, etc.), establishing appropriate design and layout criteria for civil works threatened by river overflows and floods (road routing, bridges, potable water and sewerage systems, public services works , etc.), restructuring and extending the highway system to provide alternative routes, etc.

It is worth noting that reservoir construction is becoming increasingly easier to justify, partly because natural disasters are occurring more frequently, and partly because reservoirs can be used for several purposes by different sectors. For example, a flood-prevention reservoir can also be used for irrigation during the dry season, and for interannual regulation of the El Niño and La Niña phenomena, among others. Moreover, since natural disasters are becoming more frequent and more intense, they are leading to ever higher losses, so one of the benefits of multipurpose infrastructure works is that they reduce building costs.

i) Strengthening national emergency or civil defence committees

In view of the recurrence of disasters and the experience gained as a result of hurricane Mitch, it will be essential to strengthen national emergency and civil defence institutions, not only by increasing their budgets but also by adapting their regulatory frameworks whenever necessary. These institutions should also establish regional links and an effective network for early warning and cooperation purposes; existing regional institutions as CEPREDENAC could extend support in this regard.

Appendix

PROJECT PROFILES FOR THE REHABILITATION AND
RECONSTRUCTION STAGE

Table 1

GUATEMALA: LIST OF PROJECTS

Sector	Title of project	Investment required (millions of US\$)
1. Agriculture and livestock		
1.1	Prolonged food assistance for affected families	31.1
1.2	Reactivation of basic grain cultivation	8.0
1.3	Recovery of banana farming	105.0
1.4	Reactivation of fruit farming	15.0
1.5	Reactivation of fisheries	4.0
1.6	Training on reforestation for government officials, technicians and farmers	33.0
1.7	Pilot reforestation programme	15.0
	Sectoral subtotal	211.1
2. Technical assistance		
2.1	Design of disaster-prevention policies and identification of investments	1.0
2.2	Programming of works	0.1
	Sectoral subtotal	1.1
3. Education		
3.1	Reconstruction of damaged schools	1.5
3.2	Rehabilitation of schools	10.0
3.3	Equipment recovery and natural disaster preparedness training	1.5
3.4	Strengthening of the National Self-Management Programme for Educational Development (PRONADE)	3.6
3.5	Reform of basic education	46.8
	Sectoral subtotal	63.4
4. Emergency		
4.1	Emergency epidemiological control	5.0
4.2	Emergency food assistance for affected families	3.4
4.3	Resettlement of victims	7.5
4.4	Traffic rehabilitation on main roads	3.9
	Sectoral subtotal	19.8
5. Energy		
5.1	Development and promotion of productive uses	10.0
	Sectoral subtotal	10.0

/Cont.

Table 1 (Cont.)

Sector	Title of project	Investment required (millions of US\$)
6. Environment		
6.1	Improvement of the National Natural-Resource Information System	0.3
6.2	Strengthening of institutions in charge of sanitary services, collection and disposal of urban solid waste and control of environmental pollution	1.0
6.3	Environmental management and sustainable development of river basins	60.0
6.4	Strengthening of the meteorological network	2.0
6.5	Installation of real-time networks	0.6
	Sectoral subtotal	63.9
7. Health		
7.1	Reconstruction, rehabilitation and upgrading of primary care infrastructure	13.5
7.2	Construction of a new hospital in San Pedro Carchá, Department of Alta Verapaz	0.7
7.3	Mobile plants for water treatment	0.3
7.4	Acquisition of ambulances	0.2
	Sectoral subtotal	14.7
8. Sanitation		
8.1	Strengthening of control and monitoring of drinking water quality in the most affected departments	0.7
8.2	Sewer rehabilitation and maintenance	4.0
8.3	Rehabilitation of drinking water systems in urban and rural areas	8.0
8.4	Sanitary waste disposal in urban, marginalized and rural areas	1.2
8.5	Development of the sector's natural-disaster prevention and mitigation capacity	0.6
	Sectoral subtotal	14.5
9. Transport		
9.1	Identification of alternative routes to both coasts	0.9
9.2	Engineering studies to rebuild destroyed bridges on main highways	0.2
9.3	Engineering studies to rebuild destroyed bridges on secondary and tertiary roads	0.2
9.4	Engineering studies to rehabilitate damaged main highways	1.0

/Cont.

Table 1 (Cont.)

Sector	Title of project	Investment required (millions of US\$)
9.5	Engineering studies to rehabilitate secondary and tertiary roads	0.5
9.6	Reconstruction of secondary and tertiary roads	10.0
9.7	Reconstruction of destroyed bridges on secondary and tertiary roads	3.4
9.8	Reconstruction of destroyed bridges on main highways	3.3
9.9	Reconstruction of footbridges	0.8
9.10	Reconstruction of isolated sections of damaged highways	31.0
9.11	Reconstruction of sections of the railway system	6.0
9.12	Sustained rehabilitation of main and rural roads	136.5
9.13	Planning and feasibility studies to expand the main system highway and feeder roads	0.6
	Sectoral subtotal	194.4
10. Housing		
10.1	Relocation of human settlements	0.1
10.2	Basic studies for the construction of low-cost housing	0.5
10.3	Construction of 6,000 destroyed dwellings and repair of 20,000 damaged houses	30.0
	Sectoral subtotal	30.6
	TOTAL	623.5

GUATEMALA**No. 1.1****Prolonged food assistance for affected families****Sector: AGRICULTURE AND LIVESTOCK****Subsector: FOOD**

Background: Many victims' living conditions will continue to be inadequate for a considerable time. Even after the emergency stage is over, food support for these people will have to continue.

Project objectives: Provide food rations to 60,000 victims on the basis of "work for food".

Tentative duration: 36 months
Estimated starting date: Second quarter of 1999

National agency in charge: Ministry of Agriculture, Livestock and Food, Social Investment Fund and National Fund for Peace.

Description of activities and tasks: Food rations will be exchanged for labour in reconstruction and rehabilitation of housing, bridges, roads, irrigation systems, wells and latrines, soil conservation, reforestation, and establishment of agroforestry and forestry systems.

Expected results: Food security and productive work for many victims.

Total investment required (US\$):	31,100,000
• Labour (person/months)	
• Domestic inputs:	
• Imported inputs: _____	
Financing (US\$)	
• Local:	20,000,000
• Foreign:	
• Donation: _____	11,100,000
Potential financing sources:	
External credit:	
Donor: United Nations Food Programme.	

Special observations:

GUATEMALA**No. 1.2****Reactivation of basic grain cultivation****Sector: AGRICULTURE AND LIVESTOCK****Subsector: BASIC GRAINS****Background:** Around 50,000 subsistence farmers and small farmers lost their harvests and their income.**Project objectives:** Provide funds for such groups to re-establish their normal farming activities; covers grains, vegetables, bananas and tubers.

Tentative duration: 12 months
Estimated starting date: December 1998

National agency in charge: Ministry of Agriculture.**Description of activities and tasks:** Procure financing to cover the equivalent of US\$200 per hectare and organize farmer cooperatives and associations to select beneficiaries and distribute aid.**Expected results:** Recovery of small and medium-scale farming output.

Total investment required (US\$):	8,000,000
• Labour (16,000 person/months)	4,800,000
• Domestic inputs:	1,600,000
• Imported inputs: _____	1,600,000
Financing (US\$)	
• Local:	2,400,000
• Foreign:	2,800,000
• Donation: _____	2,800,000
Potential financing sources:	
External credit: IDB and CABEL.	
Donor: European international agencies.	

Special observations:

GUATEMALA**No. 1.3****Recovery of banana farming****Sector: AGRICULTURE AND LIVESTOCK****Subsector: EXPORT****Background:** Banana farmers in the department of Izabal lost 10,000 hectares of plantations to flooding.**Project objectives:** Recover plantations, generate employment and re-establish banana exports to enable farmers to pay their current loans.

Tentative duration: 12 months
Estimated starting date: December 1998

National agency in charge: Agro-industrial companies and farmers.**Description of activities and tasks:** Procurement of long-term financing responsive to farmers' current limitations (grace-periods, low interest rates).**Expected results:** Recovery of production; 10,000 permanent productive jobs; recovery of banana exports.

Total investment required (US\$):	105,000,000
• Labour (180,000 person/months)	54,000,000
• Domestic inputs:	21,000,000
• Imported inputs: _____	30,000,000
Financing (US\$)	
• Local:	30,000,000
• Foreign:	75,000,000
• Donation: _____	
Potential financing sources:	
External credit: IBRD and IDB and national and international private banks.	
Donor:	

Special observations: Banana enterprises will have to recover the market share already occupied by other firms, as they were not able to deliver its produce. Countries adopting restrictive policies as regards banana imports -as is the case in the European Union- should free their markets to favour Central American production.

GUATEMALA**No. 1.4****Reactivation of fruit farming****Sector: AGRICULTURE AND LIVESTOCK****Subsector: FRUIT****Background:** Around 5,000 hectares of fruit trees were lost to Mitch.**Project objectives:** Restore plantations to pre-hurricane conditions.**Tentative duration: 24 months****Estimated starting date: May 1999****National agency in charge:** Businessmen and farmers.**Description of activities and tasks:** Plant 5,000 hectares with different fruit species, especially banana and citrus trees.**Expected results:** Re-establishment of previous stocks and resumption of domestic supplies and fruit exports.**Total investment required (US\$):** 15,000,000

- Labour (30,000 person/months) 6,000,000
- Domestic inputs: 4,500,000
- Imported inputs: 4,500,000

Financing (US\$)

- Local: 6,000,000
- Foreign: 9,000,000
- Donation: _____

Potential financing sources:

External credit: IBRD, IDB, CABEL and national private banks.

Donor:

Special observations: Financing must be complemented by international agreements to eliminate fruit import restrictions or at least grant conditions on a par with favoured countries.

As exporting becomes easier, farmers will be more able to repay their loans.

GUATEMALA**No. 1.5****Reactivation of fisheries****Sector: AGRICULTURE AND LIVESTOCK****Subsector: FISHERIES**

Background: On the Pacific coast, shrimp farming lost infrastructure and small-scale fishing suffered equipment losses.

Project objectives: Restore output capacity, generate jobs and recover exports.

Tentative duration: 12 months
Estimated starting date: November 1998

National agency in charge: Fishing companies and cooperatives.

Description of activities and tasks: Replacement of shrimp farming infrastructure, and of small-scale fishing vessels and equipment.

Expected results: Re-establishment of shrimp-farming income, employment and output, and fisheries exports.

Total investment required (US\$):	4,000,000
• Labour (2,400 person/months)	1,000,000
• Domestic inputs:	1,000,000
• Imported inputs: _____	2,000,000
Financing (US\$)	
• Local:	2,000,000
• Foreign:	1,000,000
• Donation: _____	1,000,000
Potential financing sources:	
External credit: CABEL.	
Donor: International development agencies.	

Special observations:

GUATEMALA**No. 1.6****Training on reforestation for government officials, technicians and farmers****Sector: AGRICULTURE AND LIVESTOCK****Subsector: FORESTRY**

Background: Farmers have been using land that should be reserved for forests. This has had serious environmental consequences, that were highlighted by hurricane Mitch.

Farmers are unaware of the importance of reforesting forest areas, and lack the required technological knowledge.

As a reference, in the past when exports of agricultural products were being promoted, those interested were offered training and technology transfers.

Project objectives: Create awareness among public officials, agricultural technicians, and especially farmers, of the need for and importance of reforestation; transfer technical knowledge in planting of timber-yielding, forest-grazing, and fruit-bearing species to allow natural regeneration of forests.

Tentative duration: Ongoing**Estimated starting date: 1999****National agency in charge:** Government, NGOs and farmers' associations and cooperatives.

Description of activities and tasks: Creating training and technology-transfer facilities; acquiring financial and technological resources; promoting initiative among farmers, and holding the corresponding courses over a ten-year period.

Expected results: Training of the people involved and creation of awareness.

Total investment required (US\$):	33,000,000
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- | | |
|--|-----------|
| • Infrastructure | 3,000,000 |
| • Technology transfer and training the needs | 1,000,000 |

Financing (US\$)

- Local:
- Foreign:
- Donation:

Potential financing sources:

External credit:

Donor: Governments and international institutions.

Special observations: It would be inconsistent to reforest and improve the environment without first meeting the needs of the farmers involved.

GUATEMALA**No. 1.7****Pilot reforestation programme****Sector: AGRICULTURE AND LIVESTOCK****Subsector: FORESTRY****Background:** At least one million hectares used for farming must be reclaimed for forestry.**Project objectives:** Reforestation beginning with a 20,000-hectare nationwide pilot programme.

Tentative duration: 24 months
Estimated starting date: May 1999

National agency in charge: Government, NGOs, and farmer associations and cooperatives.

Description of activities and tasks: Plant 8,000 hectares with timber-yielding, firewood, grazing and fruit species, and permit natural regeneration of 12,000 hectares that protect river basins.

Expected results: 20,000 hectares of improved forest lands; re-establishment of environmental conditions.

Total investment required (US\$): 15,000,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit:

Donor:

Special observations:

GUATEMALA**No. 2.1****Design of disaster-prevention policies and identification of investments****Sector: TECHNICAL ASSISTANCE****Subsector:**

Background: Guatemala and the rest of Central America have suffered the adverse consequences of various types of natural disasters for years. The recurrence and intensity of these phenomena have been increasing in recent years, and material and personal damages are becoming alarmingly progressive and cumulative.

No major disaster-prevention investments were made in the past, partly because disasters were statistically infrequent, making prevention investment insufficiently profitable. The situation has changed, since hurricanes (Joan, Georges, Cesar, Mitch, etc.), forest fires and the El Niño phenomenon are occurring frequently.

Efforts and resources must therefore be invested in a formal and exhaustive study of this complex subject-matter, so as to establish well-grounded data for subsequent policy setting.

Project objectives: Carry out studies to design an appropriate natural-disaster prevention policy, especially for floods. An important aim is to provide authorities with criteria and guidelines for natural-resource management and regulation. Another is to identify socially profitable investment options to prevent or reduce the negative and costly effects of natural disasters. Studies will focus on the identification, location and sizing of various infrastructure works.

Tentative duration: 24 months**Estimated starting date:****National agency in charge: UNDP.****Description of activities and tasks:**

- -Identification of critical areas (floods, mudslides, droughts, fires and earthquakes);
- -Sound land-use management to prevent settlements, irregular or otherwise, on land subject to the effects of natural disasters;
- -Preliminary design of infrastructure works to control the forces of nature, such as drainage works, river levées, dams, etc.;
- -Design criteria for civil works often threatened by floods (road routing, bridges, drinking water and sewerage systems, public service facilities, etc.);
- -Formulation of proposals to rebuild the highway system and extend it to provide alternative links, especially between the country's central region and the coast.

As extreme weather becomes more frequent, reservoirs must be built that can also be used for irrigation in the dry season or in years of drought and to regulate inter-annual phenomena (such as El Niño and La Niña). The intensity of such phenomena is increasing and becoming more frequent so investment in prevention infrastructure will be easier to justify in that it will offset natural-disaster losses.

Expected results: Expert studies for use in adopting a disaster-prevention policy.

Total investment required (US\$):	1,000,000
<ul style="list-style-type: none"> • Labour (person/months) • Domestic inputs: • Imported inputs: _____ 	
Financing (US\$)	
<ul style="list-style-type: none"> • Local: • Foreign: • Donation: _____ 	
Potential financing sources:	
External credit:	
Donor:	

Special observations: Resources must first be assigned to scaling and describing the scope of the project, following the corresponding terms of reference. This prior stage should take around two months, and once it is completed, it will be easier to determine the amount of pre-investment required. This project is of regional scope, because some river basins extend to two or more countries.

GUATEMALA**No. 2.2****Programming of works****Sector: TECHNICAL ASSISTANCE****Subsector:**

Background: The process of rebuilding and repairing damaged assets is based on the prior execution of various urgently needed works, so this document contains numerous building-project proposals.

However, there is a shortage of certain goods and inputs, such as building materials, machinery and equipment, and skilled labour.

Works must therefore be programmed accordingly, on the basis of available resources.

The disaster has paralysed many productive activities, leading to high levels of unemployment, so programming must be brought into line with available resources.

Project objectives: Programming of works to be executed, giving priority to labour-intensive activities as far as possible; this mainly applies to construction and agricultural activities.

Tentative duration: 6 months**Estimated starting date:****National agency in charge: UNDP.**

Description of activities and tasks: Carry out labour market studies and determine quantity and skills of manpower required in programming works.

Expected results: Technical data for efficient labour use in programming of works.

Total investment required (US\$): 100,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit:

Donor:

Special observations:

GUATEMALA**No. 3.1****Reconstruction of damaged schools****Sector: EDUCATION****Subsector: INFRASTRUCTURE AND
EQUIPMENT**

Background: 16 schools in various affected regions were severely damaged and must be rebuilt, bearing in mind that their capacity had already been insufficient for some years.

Project objectives: Rebuild schools and extend and improve infrastructure. Provide schools with texts, furnishings and education materials. Ensure new facilities can be used as shelters when necessary.

Tentative duration: 18 months**Estimated starting date: April 1999****National agency in charge:** Ministry of Education.

Description of activities and tasks: Study and obtain suitable risk-free sites, design infrastructure, build schools with intensive use of unemployed labour, and equip them.

Expected results: Modern schools in affected areas.

Total investment required (US\$):	1,500,000
• Labour (3,000 person/months)	600,000
• Domestic inputs:	600,000
• Imported inputs:	300,000
Financing (US\$)	
• Local:	
• Foreign:	300,000
• Donation:	1,200,000
Potential financing sources:	
External credit: To be defined.	
Donor: To be defined.	

Special observations:

GUATEMALA**No. 3.2****Rehabilitation of schools****Sector: EDUCATION****Subsector: INFRASTRUCTURE AND
EQUIPMENT**

Background: 311 schools in various affected regions must be refurbished, bearing in mind that their capacity had already been insufficient for some years.

Project objectives: Re-establish infrastructure and significantly increase school capacity.

Tentative duration: 24 months

Estimated starting date: January 1999

National agency in charge: Ministry of Education,
FONAPAZ and FIS.

Description of activities and tasks: Carry out improvement works with intensive use of unemployed labour.

Expected results: Adequate educational infrastructure.

Total investment required (US\$): 10,000,000

- Labour (18,000 person/months) 3,600,000
- Domestic inputs: 3,200,000
- Imported inputs: 3,200,000

Financing (US\$)

- Local: 2,000,000
- Foreign: 8,000,000
- Donation: _____

Potential financing sources:

External credit: Under study.
Donor:

Special observations:

GUATEMALA**No. 3.3**

Equipment recovery and natural disaster preparedness training

Sector: EDUCATION**Subsector: EQUIPMENT AND TRAINING****Background:** School textbooks and equipment must be replaced.

In various disasters the rural population have lacked disaster preparedness, so it is important to provide the required training.

Project objectives: Furnish schools with textbooks and equipment, and incorporate disaster preparedness into curricula.

Tentative duration: 24 months**Estimated starting date: January 1999****National agency in charge:** Ministry of Education, FONAPAZ and FIS.

Description of activities and tasks: Make necessary purchases and adapt curricula.

Expected results: Improved education and training.

Total investment required (US\$): 1,500,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit:

Donor:

Special observations:

GUATEMALA**No. 3.4****Strengthening of the National Self-Management Programme
for Educational Development (PRONADE)****Sector: EDUCATION****Subsector: TEACHING****Background:** This Programme is aimed at isolated rural communities lacking primary education services.

PRONADE provides funds to support education in traditionally marginalized communities.

Project objectives: Lower illiteracy levels among isolated groups, thus helping them to overcome poverty.**Tentative duration: 24 months****Estimated starting date: 1999****National agency in charge:** PRONADE.**Description of activities and tasks:** Make an inventory of damages, identify needs in infrastructure and initial facilities, support school construction with furnishings and equipment, expand initial facilities and provide pre-primary education.**Expected results:** Pre-primary education for 10,000 five and six-year-olds, training of 300 teachers, services for 300 communities and reduction of school non-passing and drop-out rates.**Total investment required (US\$):** 3,600,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit: World Bank (IBRD).

Donor: UNICEF.

Special observations:

GUATEMALA**No. 3.5****Reform of basic education****Sector: EDUCATION****Subsector: TEACHING**

Background: The government, in conjunction with the World Bank, was carrying out an education-reform programme, mainly in indigenous and very poor communities, in response to the Peace Agreements. These aims are considered essential to the national strategy of equity and unity.

The consequences of the hurricane have spurred the government to reconsider the project's coverage and speed up its implementation.

Project objectives: Expand and consolidate PRONADE to improve coverage and equity in rural areas; improve efficiency and quality in rural basic education, and strengthen the Ministry of Education's organization and administration.

Tentative duration: 60 months**Estimated starting date: Ongoing****National agency in charge:** Ministry of Education.

Description of activities and tasks: Expand PRONADE actions; train teachers and administrators in multi-grade and bilingual education programmes; develop and provide teaching materials and promote education initiatives by creating a fund to support innovations; strengthen the Education Ministry in the areas of assessment, financial management, human resources and purchasing; develop and improve its information system and design and establish an evaluation system.

Expected results: Attainment of sustained peace; substantial increase in school attendance; increase in equal-opportunity education; reduction of illiteracy; increased internal efficiency; improvement of human capital.

Total investment required (US\$): 46,800,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local: 16,800,000

- Foreign: 30,000,000

- Donation: _____

Potential financing sources:

External credit: IBRD.

Donor:

Special observations: This project is a complement to others aimed at improving and expanding infrastructure and is currently being reformulated to give priority to areas affected by Mitch.

GUATEMALA**No. 4.1****Emergency epidemiological control****Sector: EMERGENCY****Subsector: HEALTH**

Background: Cases of cholera, malaria, rabies, hepatitis and dengue have been reported and are increasing the risk of spreading contagious diseases.

Project objectives: Provide medical treatment to infected patients and contain contagious diseases.

Tentative duration: 3 months

Estimated starting date: Immediate

National agency in charge: Health Ministry.

Description of activities and tasks: Bury the dead in accordance with health regulations, incinerate dead animals, vaccinate the population, and treat and monitor the sick.

Expected results: Curing of patients and containment of contagious diseases.

Total investment required (US\$): 5,000,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local: 1,000,000

- Foreign:

- Donation: _____ 4,000,000

Potential financing sources:

External credit:

Donor:

Special observations: This project is already under way and the relevant programmes should be reinforced. The initiative should have regional scope to prevent trans-border epidemics.

GUATEMALA**No. 4.2****Emergency food assistance for affected families****Sector: EMERGENCY****Subsector: FOOD**

Background: Numerous rural families devoted to subsistence farming lost their crops and livelihood, as did semi-urban families who lost their homes and jobs. Both groups are in high-risk situations due to their lack of food security, among other threats.

Project objectives: Provide food rations to 65,000 individuals on the basis of "work for food" programmes.

Tentative duration: 6 months
Estimated starting date: 1 November 1998

National agency in charge: Ministry of Agriculture, Livestock and Food, National Agricultural Marketing Institute and FIS.

Description of activities and tasks: The agencies in charge will provide food rations to selected groups, who in turn will rehabilitate their housing and basic social infrastructure, and productive capacities in the case of rural groups.

Expected results: Provision of adequate food rations during the reconstruction period, while accelerating and reducing the cost of social and productive infrastructure works —related to low income social groups— and creating temporary jobs.

Total investment required (US\$): 3,356,600

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____ 3,356,600

Potential financing sources:

External credit:

Donor: United Nations World Food Programme.

Special observations:

GUATEMALA**No. 4.3****Resettlement of victims****Sector: EMERGENCY****Subsector: SETTLEMENTS**

Background: Hundreds of thousands of people, most of them already living in poverty, were left homeless by the hurricane.

Project objectives: Improve victims' living conditions and prevent migration from rural areas to cities and abroad by resettling the homeless on the basis of comprehensive actions to provide them with acceptable, sustainable living conditions; promote equal access and opportunities to project beneficiaries of both sexes.

Tentative duration: 24 months**Estimated starting date: January 1999****National agency in charge:** International Organization for Migration.

Description of activities and tasks: Carry out studies and actions to resettle affected groups, including labour training, technical and financial support, employment opportunities in productive, full-time activities, support men's and women's community organizations, and the most vulnerable groups, particularly the elderly and the handicapped.

Expected results: Labour training and employment for project beneficiaries, and reincorporation into communities.

Total investment required (US\$): 7,500,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit:

Donor:

Special observations: Due to its high social content, this project should secure financing through donations in order to expand coverage.

GUATEMALA**No. 4.4****Traffic rehabilitation on main roads****Sector: EMERGENCY****Subsector: ROADS**

Background: Numerous breaks on roads stopped traffic flow, so machinery and equipment had to be mobilized to different areas to re-establish the flow of vehicles provisionally.

Project objectives: Execute minor works to re-establish traffic flow as expeditiously as possible, thus diminishing transport costs.

Tentative duration: 1 month
Estimated starting date: 2 November 1998

National agency in charge: Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Clear landslides, replace approaches to bridges, provide provisional passages, rebuild damaged embankments, and generally re-establish transport flows wherever necessary.

Expected results: Re-establish normal traffic.

Total investment required (US\$):	3,900,000
• Labour (6,000 person/months)	1,200,000
• Domestic inputs:	1,100,000
• Imported inputs: _____	1,600,000
Financing (US\$)	
• Local:	3,900,000
• Foreign:	
• Donation: _____	
Potential financing sources:	
External credit:	
Donor:	

Special observations:

GUATEMALA**No. 5.1****Development and promotion of productive uses of electricity****Sector: ENERGY****Subsector: ELECTRICITY**

Background: Mitch severely affected the country's physical and productive infrastructure, including considerable damage to main electric power lines and secondary distribution networks, caused mainly by landslides. Before the disaster, electricity coverage reached an average of only 50 per cent of the population; electrification is lower in the provinces and rural areas, and the country as a whole has the lowest electrification rate in the region, with one of the lowest per capita electricity consumption in Latin America. Reconstruction of damaged networks has already been undertaken by INDE and EEGSA. A mass electrification project was already under consideration before the hurricane –with investments of around US\$100 million over a period of two to three years– to be partly financed by the funds obtained from the privatization of the metropolitan distribution company. The authorities aim to make electricity a driving force for development, but no projects have yet been proposed to achieve that goal.

Project objectives: Design and implement a programme to promote and develop productive uses of electricity in provincial towns and rural communities to make electrification a driving force for development, and ensure that government electrification projects are sustainable.

Tentative duration: 3 years**Estimated starting date: April 1999**

National agency in charge: Ministry of Energy (MEM); members of non-traditional export trade associations and one small-business development financial institution.

Description of activities and tasks:

- i) Design a programme for productive uses of electricity in towns and rural communities.
- ii) Create a fund to finance small businesses.
- iii) Disseminate and promote productive uses of electricity.
- iv) Provide financing and advisory services for small businesses and cooperatives.
- v) Evaluate the programme and propose mechanisms for the fund's expansion and self-management.

Expected results:

- i) Financing for around 1,000 small companies in the provinces.
- ii) Generation of about 10,000 jobs, directly benefiting the same number of families and some 60,000 individuals.
- iii) Strengthening of rural localities' economies, including direct benefits.

Total investment required (US\$):	10,000,000
• Labour (person/months)	6,000,000
• Domestic inputs:	4,000,000
• Imported inputs:	
Financing (US\$)	
• Local:	2,000,000
• Foreign:	6,000,000
• Donation:	2,000,000

Potential financing sources:

External credit: IDB, AID, EU and CABEL.
Donor: Under study.

Special observations:

GUATEMALA**No. 6.1**

Improvement of the National Natural-Resource Information System

Sector: ENVIRONMENT**Subsector:**

Background: Information on the most important natural assets from the standpoint of provision of environmental services (water resources, plant cover, biodiversity) is largely outdated, and data gathering is not systematic, although the country has a number of professionals specialising in teledetection and geographical information systems, processing of satellite images, etc.

Project objectives: Compile information for timely decision-making on natural assets.

**Tentative duration: Results at least
every 10 years**

Estimated starting date: January 1999

National agency in charge: Institute of Seismology, Vulcanology, Meteorology and Hydrology (INSIVUMEH) and/or National Commission on the Environment (CONAMA)

Description of activities and tasks: Acquire satellite images; process satellite and terrestrial data; create a geographical information system to integrate such data in reference to population, protected areas, etc., and periodically update databases.

Expected results: Maps showing plant cover, animal life, river basins and water replenishment areas, erosion-prone areas, etc.

Total investment required (US\$): 250,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit: Government and international cooperation.

Donor:

Special observations:

GUATEMALA**No. 6.2**

**Strengthening of institutions in charge of sanitary services,
collection and disposal of urban solid waste and control
of environmental pollution**

Sector: ENVIRONMENT**Subsector: INSTITUTIONAL
STRENGTHENING**

Background: Improper disposal of solid waste has a negative environmental impact on water resources and poses the risk of contaminating drinking-water reservoirs. Much evidenced that the widespread practice of dumping refuse into creeks and gullies heightens the disastrous effects of heavy rainfall by blocking river beds and drains.

Project objectives: Strengthen the technical, managerial and administrative capacity of the sector's institutions, especially at the municipal level, so as to provide efficient community services, with emphasis on the organizational, functional, technical and financial aspects of refuse collection and disposal units.

Tentative duration: 5 years**Estimated starting date: July 1999****National agency in charge:** Municipal Development Institute.

Description of activities and tasks: Provide education and training for technicians on comprehensive solid-waste management, including legal, institutional, economic, financial, managerial, land-use, technological, educational and participatory aspects.

Expected results: Proper operative and technical training of solid-waste management personnel at both national and municipal levels.

Total investment required (US\$): 1,000,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit: Government and Development Banks,

Donor:

Special observations:

GUATEMALA**No. 6.3****Environmental management and sustainable development
of river basins****Sector: ENVIRONMENT****Subsector:**

Background: Many of the country's river basins erosion and loss of plant cover, thus altering water cycles and severely silting rivers and watercourses.

This affects aquifer replenishment, puts water supply at risk and also modifies water cycles and other environmental parameters (carbon fixing, protection of biological diversity, etc.) The loss of plant cover has also worsened river basin deterioration, heightening the impact of natural disasters such as Mitch on water and soil resources.

These effects can be seen in specific river basins such as the Motagua River, Xaja-Piscaya, Samala, Lake Amatitlán and Chixoy.

Project objectives: Define a national strategy on the use of water resources and for sustainable natural resource management to protect vulnerable areas and strengthen environmental management, while also improving the utilization of these resources and hence the quality of life of the affected population.

Tentative duration: 5 years**Estimated starting date: July 1999****National agency in charge:** Ministry of Agriculture and Department of Forest Resources.

Description of activities and tasks: Carry out research on water and forestry resources in each river basin under study, and request international technical assistance to strengthen the institutions in charge of the project execution and outcome assessment.

Expected results: Comprehensive river basin management plans, including protection of existing forests and ravaged forest lands through natural regeneration, reforestation and agroforestry systems.

New plantations on approximately 100,000 hectares; establishment of natural regeneration and fire protection systems and conservation plans for their management. Training of around 10,000 people in fire fighting and control.

Total investment required (US\$): 60,000,000

- Labour
(person/months)
- Domestic inputs:
- Imported inputs: _____

Financing (US\$)

- Local:
- Foreign:
- Donation: _____

Potential financing sources:

External credit: Government and Development Banks.
Donor:

Special observations: This project will be carried out over a five-year period.

GUATEMALA**No. 6.4****Strengthening of the meteorological network****Sector: ENVIRONMENT****Subsector:**

Background: The hurricane caused some damage to meteorological stations, but above all highlighted many of the network's weaknesses. The demand from the productive sectors for reliable real and quasi-real-time climatic, meteorological and hydrological information for decision-making has increased rapidly (air, land and sea navigation, agriculture, fisheries, forestry, livestock-raising, ecotourism, construction, health care and disaster prevention activities). Records this century show that the country is continuously beset by adverse weather phenomena (hurricanes, frosts, strong winds, droughts, flooding, red tide and El Niño) which have had human and economic consequences.

Project objectives: Upgrade the meteorological network to optimize national coverage and obtain automatic data for short, medium and long-term activities; provide real-time information and produce detailed climatological studies.

Tentative duration: 24 months**Estimated starting date: March 1999****National agency in charge: INSIVUMEH.**

Description of activities and tasks: Verify INSIVUMEH's equipment plan; analyse the risks and geographic location of new meteorological stations; establish a network of 12 new automated stations with real-time follow-up and consultation; incorporate additional monitoring sensors in certain existing stations, especially for control of hydrometrical activity and environmental pollution; review and redesign the database and develop and acquire new software; and train personnel in maintenance and repair of new equipment.

Expected results: A modern hydrometeorological network in line with current national needs.

Total investment required (US\$): 2,000,000

- Labour (person/months)
- Domestic inputs: 500,000
- Imported inputs: 1,500,000

Financing (US\$)

- Local: 500,000
- Foreign: 1,500,000
- Donation:

Potential financing sources:

External credit: Under study.

Donor:

Special observations:

GUATEMALA**No. 6.5****Installation of real-time networks****Sector: ENVIRONMENT****Subsector: METEOROLOGY**

Background: Central American and the Caribbean countries have suffered the consequences of natural disasters for many years, but disasters are now occurring more frequently.

A large part of the physical infrastructure is destroyed in each case, in addition to the tragic toll of human lives and victims. Production stockpiles are also destroyed, leading to considerable economic losses and the elimination of productive jobs.

Despite recent progress made in economic, social and technological activities, hurricane Mitch pointed up the need for increased efforts and resources on the part of the countries involved, and the international community in the field of meteorological forecasting and precautions in Latin America.

Project objectives: Specify, design and install early-warning networks on adverse meteorological conditions in the most vulnerable Central American and Caribbean countries in order to improve the timeliness and quality of information to prevent and mitigate the effects of potential natural disasters.

Tentative duration:

**Estimated starting date: December
1998**

National agency in charge: INSIVUMEH.

Description of activities and tasks: Evaluate the current condition of the region's hydrological and meteorological networks; determine minimum geographical and strategic coverage needs by country as regards number and type of stations; acquire and install automatic stations to measure parameters by satellite; acquire and install in each country a receiving station to gather data from automatic measuring stations, and train personnel in management and maintenance.

Expected results: An effective early-warning system to facilitate decision-making to protect the exposed population. Each country will also have the necessary information to evaluate situations of regional or trans-border scope, such as flood control and dam management.

Total investment required (US\$): 600,000

- Labour
(person/months)
- Domestic inputs:
- Imported inputs: _____

Financing (US\$)

- Local:
- Foreign:
- Donation: _____

Potential financing sources: Under study.

External credit:

Donor:

Special observations:

- 1) Funds should be earmarked for this initiative, since its benefits will be significantly greater than the small investment required to establish the system.
- 2) The project will have technical assistance from the World Meteorological Organization.

GUATEMALA**No. 7.1****Reconstruction, rehabilitation and upgrading of primary care infrastructure****Sector: HEALTH****Subsector: HOSPITAL ESTABLISHMENTS**

Background: Primary care infrastructure sustained considerable hurricane damage, which added to the regular deterioration already apparent in these facilities.

Facilities were also insufficient to attend to the population.

Project objectives: Reduce existing deficiencies by building new installations, and re-establish pre-hurricane hospital infrastructure, while improving, expanding and upgrading it.

Tentative duration: 24 months

Estimated starting date: March 1999

National agency in charge: Ministry of Health.

Description of activities and tasks: Detailed evaluation of damage in each facility under study; design of blueprints and building and equipment plans, based on national and international disaster-prevention standards; setting of priorities and programming of works; construction and repair; acquisition and installation of equipment; development of maintenance training programmes; design and application of maintenance routines.

Expected results: Restoration of the necessary hospital infrastructure.

Total investment required (US\$): 13,500,000

- Labour (12,000 person/months) 2,500,000
- Domestic inputs: 4,500,000
- Imported inputs: 6,500,000

Financing (US\$)

- Local: 2,000,000
- Foreign: 6,000,000
- Donation: 5,500,000

Potential financing sources:

External credit: IBRD, IDB and CABEL.

Donor: Under study.

Special observations:

GUATEMALA**No. 7.2**

Construction of a new hospital in San Pedro Carchá, Department of Alta Verapaz

Sector: HEALTH**Subsector: HOSPITAL ESTABLISHMENTS**

Background: San Pedro Carchá has a 10-bed hospital, built in 1965, which suffered severe structural damage and lost practically all its equipment.

The premises are on a flat piece of ground below the level of this 100,000-inhabitant city's open sewer. The hospital has been afflicted by frequent, serious flooding by sewage, making it vulnerable and unhealthy.

Project objectives: Relocate and rebuild the hospital on a suitable site. The local authorities have offered land plots in risk-free areas for this purpose. Increase the hospital's capacity, which is clearly insufficient to meet current demand, in terms of number of beds and range of services.

Tentative duration: 12 months
Estimated starting date: First quarter of 1999

National agency in charge: Ministry of Health and Social Welfare.

Description of activities and tasks: Find an appropriate location for the new hospital, draw up its plans and characteristics in conjunction with the hospital's authorities, execute the building works and provide the necessary equipment.

Expected results: A suitable, safe medical centre that can fully meet current needs.

Total investment required (US\$):	700,000
• Labour (500 person/months)	150,000
• Domestic inputs:	300,000
• Imported inputs: _____	250,000
Financing (US\$)	
• Local:	550,000
• Foreign:	150,000
• Donation: _____	
Potential financing sources:	
External credit: IDB.	
Donor: PAHO and European Union Hospital Financial Assistance Fund.	

Special observations: When the current premises were rendered useless, the local population was left without timely health care, which justifies the urgency of the project.

GUATEMALA**No. 7.3****Mobile plants for water treatment****Sector: HEALTH****Subsector: WATER**

Background: Equipment to potabilize water quickly and efficiently wherever necessary is important in emergencies, and this was insufficient during the recent disaster.

Project objectives: Lower the incidence of diarrhoea-related epidemics and in general provide drinking water to disaster victims.

Tentative duration: 6 months**Estimated starting date: January 1999****National agency in charge:** Ministry of Public Health and Social Welfare.

Description of activities and tasks: Acquisition of equipment, transport to vulnerable places and training on its use.

Expected results: Availability of means to prevent diarrhoea-related diseases.

Total investment required (US\$): 300,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____ 300,000

Potential financing sources:

External credit:

Donor: Several countries.

Special observations:

GUATEMALA**No. 7.4****Acquisition of ambulances****Sector: HEALTH****Subsector: EQUIPMENT**

Background: The emergency highlighted the country's shortage of ambulances, which prevented victims from being transported with the required speed.

Project objectives: Provide the country with enough ambulances to rescue disaster victims quickly.

Tentative duration:**Estimated starting date:**

National agency in charge: Ministry of Public Health and Social Welfare.

Description of activities and tasks: Acquisition of ambulances.

Expected results: Availability of the necessary health care equipment, especially during natural disasters.

Total investment required (US\$): 225,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____ 225,000

Potential financing sources:

External credit:

Donor: Several countries.

Special observations:

GUATEMALA**No. 8.1****Strengthening of control and monitoring of drinking water quality in the most affected departments****Sector: SANITATION****Subsector: DRINKING WATER**

Background: Sewers overflowed and latrines and septic tanks became waterlogged as a result of flooding. This poses a high risk of contamination of surface and underground sources of water for human consumption. In view of the prevalence of cholera and leptospirosis in various regions, water must be disinfected to ensure its microbiological quality.

Project objectives: Protect the health of one million people in high-risk areas by ensuring drinking water quality, thereby diminishing morbidity and mortality rates due to waterborne diseases.

Tentative duration: 9 months
Estimated starting date: December 1998

National agency in charge: Ministry of Health and INFOM.

Description of activities and tasks: Update the Ministry of Health's and INFOM's water quality control programmes; assess damage to water chlorination systems; draw up plans to install and improve water disinfection systems; install basic water disinfection equipment; organize production and distribution of disinfectants through sanitary education and community mobilization; train officials and users in the use of water disinfectants.

Expected results: Improved drinking water quality for 1.3 million people; monitoring of water quality; promotion of hygiene among the population; community participation in drinking-water disinfection, control and monitoring programmes.

Total investment required (US\$):	650,000
• Labour (person/months)	
• Domestic inputs:	
• Imported inputs:	
Financing (US\$)	
• Local:	200,000
• Foreign:	200,000
• Donation:	250,000
Potential financing sources:	
External credit:	
Donor: Under study.	

Special observations: The project will have technical assistance from PAHO/WHO.

GUATEMALA**No. 8.2****Sewer rehabilitation and maintenance****Sector: SANITATION****Subsector: SANITATION**

Background: Floods damaged sewer systems in many parts of the country, thus increasing the risk of contaminated drinking water. In view of outbreaks of cholera and leptospirosis, sewerage systems must be rehabilitated.

Project objectives: Rehabilitate sewerage systems damaged by floods in 50 provincial localities; rehabilitate rainwater drainage systems in 30 provincial localities, and clean up and maintain existing sewer systems.

Tentative duration: 6 months**Estimated starting date: January 1999****National agency in charge:** INFOM and municipal authorities.

Description of activities and tasks: Clean up and maintain wells, trunk sewers and outfalls in city sewerage systems; acquire suction-pressure engines, rotorooters and dewatering pumps, and rehabilitate manholes, trunk sewers and outfalls.

Expected results: Sewerage systems in 50 affected localities will recover functionality, and all existing systems will be reviewed and restored.

Total investment required (US\$):	4,000,000
• Labour	
(person/months)	475,000
• Domestic inputs:	2,250,000
• Imported inputs:	1,275,000
Financing (US\$)	
• Local:	1,200,000
• Foreign:	2,000,000
• Donation:	800,000
Potential financing sources:	
External credit: IBRD, IDB and CABEL.	
Donor: Under study.	

Special observations:

GUATEMALA**No. 8.3****Rehabilitation of drinking water systems in urban and rural areas****Sector: SANITATION****Subsector: DRINKING WATER**

Background: Basic social infrastructure was damaged by the hurricane, including severe damage to drinking water systems, which urgently require rehabilitation, due to the high risk of an increase in diseases such as cholera and leptospirosis.

Project objectives: Rehabilitate and restore affected drinking water systems; rehabilitate drinking water treatment plants already damaged and inefficient prior to the hurricane, and ensure quality in drinking water served to affected population.

Tentative duration: 18 months**Estimated starting date: January 1999****National agency in charge:** INFOM and municipal authorities.

Description of activities and tasks: Draw up a rehabilitation programme for damaged drinking water systems; prepare specific designs; secure financing and execute works.

Expected results: Rehabilitation of around 300 mostly rural drinking water systems, and satisfactory service in quantity and quality for 300 localities and communities with damaged systems.

Total investment required (US\$):	8,000,000
• Labour (16,000 person/months)	3,200,000
• Domestic inputs:	3,200,000
• Imported inputs:	1,600,000
Financing (US\$)	
• Local:	3,200,000
• Foreign:	3,200,000
• Donation:	1,600,000
Potential financing sources:	
External credit: IBRD, IDB and CABEL.	
Donor: Under study.	

Special observations:

GUATEMALA**No. 8.4****Sanitary waste disposal in urban, marginalized and rural areas****Sector: DRINKING WATER AND SANITATION****Subsector: SANITATION**

Background: Flooding waterlogged latrines and septic tanks, which must be replaced urgently due to the high risk of waterborne diseases and water, air and soil pollution.

Project objectives: Improve health and sanitary conditions for affected population by building individual sanitary waste disposal systems through community participation.

Tentative duration: 12 months**Estimated starting date: January 1999****National agency in charge:** INFOM and municipal authorities.

Description of activities and tasks: Define the execution programme; train communities in technical aspects; determine the best solutions in communities; secure funding; execute works with community participation, and develop sanitary and environmental education programmes.

Expected results: *In situ* or cistern-flush sanitary waste disposal systems for 5,500 families, benefiting 33,000 inhabitants who will also have bath-houses with sullage filters and 5,500 laundry sinks. Improved personal hygiene through intensive community sanitary and environmental education programmes.

Total investment required (US\$):	1,175,000
• Labour (2,500 person/months)	490,000
• Domestic inputs:	470,000
• Imported inputs:	215,000
Financing (US\$)	
• Local:	470,000
• Foreign:	470,000
• Donation:	235,000
Potential financing sources:	
External credit: IBRD, IDB and CABEL.	
Donor: Under study.	

Special observations:

GUATEMALA**No. 8.5**

Development of the sector's natural-disaster prevention and mitigation capacity

Sector: SANITATION**Subsector:**

Background: Drinking water and sewerage services were severely damaged by the hurricane.

Project objectives: Strengthen and consolidate the sanitation sector's national, departmental and local structure so as to deal effectively with emergencies and disasters; strengthen coordination mechanisms in national and departmental institutions; define priorities and vulnerable areas and prepare emergency plans as a sectoral contribution to the national disaster-preparedness programme; provide community training in plumbing, inspection and basic maintenance of drinking water and sewerage systems.

Tentative duration: 24 months

Estimated starting date: July 1999

National agency in charge: INFOM and municipal authorities, and coordination with the Ministry of Health and CONRED.

Description of activities and tasks: Assess the human and material resources and the administrative structure of drinking water and sewerage services institutions, including those provided for in the new regulations; evaluate past disasters to establish potential risks, vulnerability and institutional response capacity; review design standards in main installations; estimate the actions and investments needed to strengthen institutions (training of human resources, investment in equipment and communications, etc.); develop organizational and legal instruments to strengthen the disaster prevention and mitigation system; develop a communication and information system to follow up on main drinking water and sewerage installations and service centres, and formulate prevention and mitigation plans, including coordination with other institutions.

Expected results: Strengthened organizational and legal framework of institutions in charge of drinking water and sanitation services to ensure effective disaster prevention and response; awareness of risks and vulnerability; increased operative and response capacity, and well-publicized national, departmental and local plans.

Total investment required (US\$): 600,000

- Labour
(person/months)
- Domestic inputs:
- Imported inputs: _____

Financing (US\$)

- Local: 56,000
- Foreign:
- Donation: 544,000

Potential financing sources:

External credit: European countries.
Donor: Under study.

Special observations: The project will have technical assistance from PAHO/WHO.

GUATEMALA**No. 9.1****Identification of alternative routes to both coasts****Sector: TRANSPORT****Subsector: PRE-INVESTMENT**

Background: Main highways were blocked as a result of the hurricane, making road transport to both coasts difficult and costly.

Project objectives: Study alternative road-linkage options from Guatemala City and the centre of the country to various places, including seaports.

Tentative duration: 6 months**Estimated starting date: March 1999**

National agency in charge: Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Carry out basic engineering studies (aerial photographic surveys, geology, soil mechanics, hydrology and topography) to identify viable routes; design highway alternatives; make a socio-economic assessment of proposed alternatives and choose the best option.

Expected results: Technical and economic criteria to make well-founded decisions.

Total investment required (US\$): 900,000

- Labour
(person/months)
- Domestic inputs:
- Imported inputs: _____

Financing (US\$) Under negotiation

- Local:
- Foreign:
- Donation: _____

Potential financing sources:

External credit: IDB, IBRD and CABEL.

Donor:

Special observations: This study sets forth investment options for US\$100 million over the medium term.

GUATEMALA**No. 9.2**

Engineering studies to rebuild destroyed bridges on main highways

Sector: TRANSPORT**Subsector: HIGHWAYS**

Background: Flooding destroyed 12 bridges on the country's main highways, deviating traffic and raising transport costs.

Project objectives: Prepare technical information for bids to rebuild destroyed bridges.

Tentative duration: 3 months
Estimated starting date: December
1998

National agency in charge: Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Conduct topographical, geological, hydrological and structural studies for the new bridges, placing emphasis on the need to reduce vulnerability to high waters and floods.

Expected results: Comprehensive, updated and efficient technical information to rehabilitate and improve the country's road system.

Total investment required (US\$): 200,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local: 40,000

- Foreign: 160,000

- Donation: _____

Potential financing sources:

External credit: IDB.

Donor:

Special observations:

GUATEMALA**No. 9.3****Engineering studies to rebuild destroyed bridges on secondary and tertiary roads****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: Flooding destroyed 25 bridges on secondary and tertiary roads, hindering access to highways leading to consumption centres. Traffic on available road sections has also been hindered.

Project objectives: Prepare technical information for bids to rebuild destroyed bridges.

Tentative duration: 3 months
Estimated starting date: December 1998

National agency in charge: Social Investment Fund (FIS) and National Fund for Peace (FONAPAZ).

Description of activities and tasks: Conduct topographical, geological, hydrological and structural studies for the new bridges, placing emphasis on the need to reduce vulnerability to high waters and floods.

Expected results: Comprehensive, updated and efficient technical information to rehabilitate and improve the country's road system.

Total investment required (US\$): 200,000

- Labour (person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local: 40,000

- Foreign: 160,000

- Donation: _____

Potential financing sources:

External credit: IDB.

Donor:

Special observations:

GUATEMALA**No. 9.4****Engineering studies to rehabilitate damaged main highways****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: The magnitude of the damage to the country's main highways makes it necessary to study the best alternatives for their repair.

Project objectives: Prepare the technical information needed to invite tenders to rebuild affected highway sections.

Tentative duration: 3 months
Estimated starting date: December 1998

National agency in charge: Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Conduct topographical studies, geometric design, structural road surfacing design, and design of drainage works to define reconstruction projects for damaged sections.

Expected results: Technical information to contract for reconstruction work.

Total investment required (US\$): 1,000,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local: 200,000

- Foreign: 800,000

- Donation: _____

Potential financing sources:

External credit: IDB.

Donor:

Special observations:

GUATEMALA**No. 9.5****Engineering studies to rehabilitate secondary and tertiary roads****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: The secondary and tertiary road network suffered severe damage, making it impossible for farm produce to reach consumption centres, and isolating various localities.

Project objectives: Prepare technical information to contract for reconstruction work, considering changes in routing where applicable, in order to prevent future damage.

Tentative duration: 3 months**Estimated starting date: December 1998****National agency in charge:** FIS and FONAPAZ.

Description of activities and tasks: Conduct topographical and hydrological studies to prepare alternative routing proposals and define new road characteristics.

Expected results: Technical information to invite tenders to rebuild secondary and tertiary roads, avoiding repetition of past errors.

Total investment required (US\$): 500,000

- Labour (person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local: 100,000

- Foreign: 400,000

- Donation: _____

Potential financing sources:

External credit: IDB and IBRD.

Donor:

Special observations:

GUATEMALA**No. 9.6****Reconstruction of secondary and tertiary roads****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: Around 300 secondary and tertiary roads were totally or partly destroyed, thus blocking or hampering transport to and from affected zones.

Project objectives: Re-establish some 718 kilometres of rural roads with appropriate designs and layouts.

Tentative duration: 18 months
Estimated starting date: January 1999

National agency in charge: General Directorate of Roads, FONAPAZ and FIS.

Description of activities and tasks: Restoration of road edges; earthworks, construction of drains and laying of gravel pavement, using intensive labour.

Expected results: Scheduled works will re-establish traffic, thus normalizing productive and social activities.

Total investment required (US\$):	10,000,000
• Labour (15,000 person/months)	3,000,000
• Domestic inputs:	2,500,000
• Imported inputs:	4,500,000
Financing (US\$)	
• Local:	2,000,000
• Foreign:	8,000,000
• Donation:	
Potential financing sources:	
External credit: IBRD, IDB and CABEL.	
Donor:	

Special observations: This project is complementary to the rebuilding and rehabilitation of bridges on damaged roads. The new routing under study will not necessarily coincide with former routes, to avoid possible risks. Works will be executed using intensive labour.

GUATEMALA**No. 9.7****Reconstruction of destroyed bridges on secondary and tertiary roads****Sector: TRANSPORT****Subsector: BRIDGES**

Background: The previous Project (9.6) shows that it is essential to complete the designs for rural roads by planning the necessary improvements to destroyed bridges.

Project objectives: Complement the reconstruction projects described in the previous profile.

Tentative duration: 12 months
Estimated starting date: March 1999

National agency in charge: General Directorate of Roads, FONAPAZ and FIS.

Description of activities and tasks: Rebuild some 625 metres of redesigned longer bridges to avoid future flood damage, including protective river walls.

Expected results: Normal use of secondary and tertiary roads.

Total investment required (US\$):	3,400,000
• Labour (6,800 person/months)	1,360,000
• Domestic inputs:	2,400,000
• Imported inputs:	1,000,000
Financing (US\$)	
• Local:	700,000
• Foreign:	2,700,000
• Donation:	
Potential financing sources:	
External credit: IDB, IBRD and CABEL.	
Donor:	

Special observations:

GUATEMALA**No. 9.8****Reconstruction of destroyed bridges on main highways****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: As indicated in previous road-project profiles, the hurricane destroyed 12 bridges on different main roads, cutting off or obstructing traffic.

Project objectives: Re-establish regular traffic with low operating costs.

Tentative duration: 18 months
Estimated starting date: March 1999

National agency in charge: Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Rebuild destroyed bridges following the designs resulting from engineering studies.

Expected results: Normal use of roads.

Total investment required (US\$):	3,300,000
• Labour (6,500 person/months)	1,300,000
• Domestic inputs:	1,000,000
• Imported inputs:	2,000,000
Financing (US\$)	
• Local:	660,000
• Foreign:	2,640,000
• Donation:	
Potential financing sources:	
External credit: IBRD, IDB and CABEL.	
Donor:	

Special observations:

GUATEMALA**No. 9.9****Reconstruction of footbridges****Sector: TRANSPORT****Subsector: HIGHWAYS****Background:** 57 footbridges were destroyed as a result of the hurricane and must therefore be replaced.**Project objectives:** Quick and effective pedestrian traffic.**Tentative duration: 6 months****Estimated starting date: January 1999****National agency in charge:** Social Investment Fund.**Description of activities and tasks:** Reconstruction of hanging, hammock and railing-type footbridges.**Expected results:** Necessary urban-sector support works.

Total investment required (US\$):	800,000
• Labour (1,600 person/months)	320,000
• Domestic inputs:	320,000
• Imported inputs: _____	160,000
Financing (US\$)	
• Local:	800,000
• Foreign:	
• Donation: _____	
Potential financing sources:	
External credit: IDB and IBRD.	
Donor:	

Special observations:

GUATEMALA**No. 9.10****Reconstruction of isolated sections of damaged highways****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: In some cases damage is localized in specific highway sections, hindering traffic. Repairs are only required at certain points; reconstruction of the entire highway is not necessary.

Project objectives: Untrammelled highways, normal traffic flows and lower operating costs.

Tentative duration: 12 months
Estimated starting date: March 1999

National agency in charge: Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Recover road platforms, repave deteriorated stretches and rebuild complementary works such as drainage and road safety structures.

Expected results: Rapid, safe highways.

Total investment required (US\$):	31,000,000
• Labour (23,000 person/months)	4,700,000
• Domestic inputs:	10,800,000
• Imported inputs:	15,500,000
Financing (US\$)	
• Local:	6,200,000
• Foreign:	24,800,000
• Donation:	
Potential financing sources:	
External credit: IBRD, IDB and CABEL.	
Donor:	

Special observations:

GUATEMALA**No. 9.11****Reconstruction of sections of the railway system****Sector: TRANSPORT****Subsector: RAILWAYS**

Background: Prior to the hurricane the government had granted a concession for the use and commercial operation of the Guatemala City-Puerto Barrios railroad. The contract specified that the railway system would be turned over in normal operating conditions, but the hurricane caused considerable damage to certain bridges and line sections. The railway is therefore inoperative and for the time being, the State is unable to fulfil its contractual obligations.

Project objectives: Rehabilitate the railroad to turn it over in good conditions to the licensee.

Tentative duration: 3 months
Estimated starting date: December 1998

National agency in charge: Railway Development Company (CODEFE, S.A.).

Description of activities and tasks: Remove landslide debris, carry out earthworks, rebuild destroyed line sections, and build protection works.

Expected results: Normal railway operations and compliance with the above-mentioned contract.

Total investment required (US\$):	6,000,000
• Labour (5,000 person/months)	1,000,000
• Domestic inputs:	2,500,000
• Imported inputs: _____	2,500,000
Financing (US\$)	
• Local:	6,000,000
• Foreign:	
• Donation: _____	
Potential financing sources:	
External credit:	
Donor:	

Special observations:

GUATEMALA**No. 9.12****Sustained rehabilitation of main and rural roads****Sector: TRANSPORT****Subsector: HIGHWAYS**

Background: The government, with the assistance of the World Bank and other donors, has been working on the process of continuously rehabilitating the country's road system, which must be significantly expanded after the hurricane.

Project objectives: Ongoing rehabilitation of a number of main and secondary roads in the region of Zonapaz, Department of San Marcos over a five-year period, while strengthening institutions in road management and maintenance.

Tentative duration: 60 months
Estimated starting date: January 1999

National agency in charge: Ministry of Communications, Transport, Public Works and Housing and Municipal Development Institute.

Description of activities and tasks: Design a national transport strategy; develop a pilot subproject to rehabilitate part of the national system and roads in San Marcos Department, and rehabilitate and improve 370 kilometres of main and secondary roads.

Expected results: Improved medium and long-term management of rural roads, access on feeder roads for low-income groups to health, education and other services, and a wider range of market options for Zonapaz farmers.

Total investment required (US\$): 136,500,000

- Labour
(person/months)
- Domestic inputs:
- Imported inputs: _____

Financing (US\$)

- Local: 20,000,000
- Foreign: 116,700,000
- Donation: _____

Potential financing sources:

External credit: IBRD: US\$66.7 million.
 OECF: US\$49.8 million.

Donor:

Special observations:

- 1) The project had already been approved and was under way; it was not deemed necessary reprogram it, in view of its objectives and the areas it covers.
- 2) The objectives are long-term, irrespective of the hurricane.
- 3) Some of the funds from this operation may be used to finance earlier projects, which would hardly affect overall reconstruction and rehabilitation works.
- 4) Part of the external funds may become donations.

GUATEMALA**No. 9.13****Planning and feasibility studies to expand the main highway system and feeder roads****Sector: TRANSPORT****Subsector: PRE-INVESTMENT**

Background: Main highways were obstructed as a result of the hurricane, making it difficult and costly to link places of origin with destinations.

The highway network is incomplete, i.e., there is a shortage of road links between cities, the capital and ports. Secondary and tertiary networks are also incomplete, and lack sufficient feeder roads to the highway system.

Project objectives: Study highway linkage alternatives between the country's main urban and productive centres and identify the best ways of completing the highway system and its feeder roads.

Tentative duration: 12 months**Estimated starting date: March 1999****National agency in charge:** Ministry of Communications, Transport, Public Works and Housing.

Description of activities and tasks: Develop an extensive highway planning study (traffic engineering, demand, projections, alternative routes, etc.) and conduct project feasibility studies.

Expected results: Technical and economic information for well-founded decision-making on the most cost-effective projects to be executed in the short and medium terms.

Total investment required (US\$): 600,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit: IDB, IBRD and CABEL.

Donor:

Special observations: These projects propose investments amounting to some US\$100-200 million.

GUATEMALA**No. 10.1****Relocation of human settlements****Sector: HOUSING****Subsector: PRE-INVESTMENT**

Background: In addition to causing considerable damage to low-income housing, the hurricane highlighted the vulnerability of certain areas, due to irregular settlements.

Some 200,000 families live in high-risk locations in urban and rural areas. The government has a subsidy programme for the purchase of low-cost housing. The government should establish guidelines on the most suitable areas for housing projects for private companies building such housing.

Project objectives: Make housing infrastructure less vulnerable to natural disasters and assist the government in drawing up or improving master plans governing human settlements.

Tentative duration: 24 months**Estimated starting date: First quarter of 1999****National agency in charge: FONAPAZ and FOGUAVI.**

Description of activities and tasks: Conduct a nationwide survey of suitable areas for human settlements.

Expected results: Plans governing human settlements for each department and the capital; background information for policies to encourage building companies to adopt the established norms.

Total investment required (US\$): 100,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____ 100,000

Potential financing sources:

External credit:

Donor: HABITAT.

Special observations: The project involves intensive fieldwork in consultation with national and municipal authorities.

GUATEMALA**No. 10.2****Basic studies for the construction of low-cost housing****Sector: HOUSING****Subsector: PRE-INVESTMENT**

Background: The extensive destruction of housing was mainly due to unsuitable location of human settlements in urban and rural areas.

According to FOGUAVI, more than 200,000 dwellings are located in vulnerable areas, a structural problem highlighted by the hurricane.

Project objectives: Determine less vulnerable sites for housing.

Tentative duration: 12 months

Estimated starting date: March 1999

National agency in charge: Ministry of Communications, Transport, Public Works and Housing, FIS and FONAPAZ.

Description of activities and tasks: Assess the vulnerability of current human settlements; identify suitable sites for new housing; take institutional and legal steps to be able to use the selected sites; conduct engineering and architectural studies to define housing design, ensuring the use of domestic inputs and labour as far as possible, and encourage the private sector to take part in building low-cost housing.

Expected results: Architectural and site information for construction companies and the government to make building plans for low-cost housing units.

Total investment required (US\$):

500,000

- Labour
(person/months)

- Domestic inputs:

- Imported inputs: _____

Financing (US\$)

- Local:

- Foreign:

- Donation: _____

Potential financing sources:

External credit:

Donor: Under study.

Special observations:

GUATEMALA**No. 10.3**

Construction of 6,000 destroyed dwellings and repair of 20,000 damaged houses

Sector: HOUSING**Subsector: HUMAN SETTLEMENTS**

Background: The hurricane destroyed an estimated 6,000 housing units and damaged a further 20,000, all located on particularly vulnerable sites.

Under the agreements adopted during the peace process, the government pledged to earmark not less than 1.5 per cent of the tax-revenue budget to housing development, placing priority on low-cost housing solutions.

Project objectives: Rebuild housing using locally made, more disaster-resistant building materials, based on intensive use of unemployed labour.

Tentative duration: 12 months

Estimated starting date: March 1999

National agency in charge: Ministry of Communications, Transport, Public Works and Housing, Social Investment Fund, National Fund for Peace, FOGUAVI and Guatemalan Chamber of the Construction Industry.

Description of activities and tasks: Promote private-sector participation in construction of houses whose cost per m² does not exceed US\$100 –excluding urbanization costs– and develop affordable financing formulas for low-income groups; make maximum use of the country's prefabricated housing capacity and build the housing units.

Expected results: 6,000 new housing units and 20,000 dwellings repaired.

Total investment required (US\$): 30,000,000

- Labour (60,000 person/months) 12,000,000
- Domestic inputs: 12,000,000
- Imported inputs: 6,000,000

Financing (US\$)

- Local: 10,000,000
- Foreign: 20,000,000
- Donation: _____

Potential financing sources:

External credit: IBRD, IDB, bilateral financing and national private banks.

Donor: _____

Special observations: