



**National Emergency Management Organization
Damage Assessment and Needs Analysis**

Preliminary Report

**TROPICAL STORM ARTHUR
Flooding Events**

1st June, 2008

BELIZE

Acknowledgements

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The Ministry of Agriculture and Fisheries
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1.0 Introduction

Tropical Storm Alma made land fall along Nicaragua's Pacific Coast on Thursday 28 May 2008. The dissipating depression moved across the Central American Region dumping as much as 36 cm of rain in Honduras, Guatemala and Belize. The remains of Tropical Storm Alma drifted into the Gulf of Honduras and northwestern Belize where conditions were favorable for its reorganization into Tropical Storm Arthur.

Around 10:30 Saturday morning (31.5.08) a center of circulation was identified over extreme northwestern Belize with tropical storm force winds observed by a weather ocean buoy off the east coast of Cozumel, Mexico. Tropical storm force winds were also observed in the broad circulation well to the east of the center in the northwest Caribbean.

Picture 1: Tropical Storm Arthur



At midday Saturday, after consultation with the Hurricane Center, the Acting Chief Meteorologist was granted permission by the Cabinet Secretary to declare a Tropical Storm warning for the coast of Belize. The Mexican Government also declared a Tropical Storm watch for the Yucatan coast based on the premise that the storm was already moving across Belize, Yucatan and Guatemala.

Arthur moved across northwestern Belize at 7 miles per hour with maximum sustained winds of 40 miles per hour extending 230 miles from the center. Total rainfall measured up to 15 inches over a three-day period. It is anticipated that rains will continue for another twenty four (24) hours.

The areas affected include the Corozal, Orange Walk and Stann Creek Districts, with the rains causing life threatening floods and mud slides particularly in the Stann Creek District.

A total of twenty two (22) shelters were opened as part of the relief effort.

Search and rescue operations have been prioritized particularly for the Orange Walk and Stann Creek Districts. Preliminary reports confirm five deaths, inclusive of two minors, and one person missing. Significant losses have occurred in the agriculture, fisheries and tourism sectors, as well as severe infrastructural damage in the affected districts.

2.0 Humanitarian Consequences

Rains associated with dissipating Tropical Storms Alma and Arthur have significantly impacted 40 communities in northern, central and southern Belize. An estimated 34,624 persons (7,213 households) reside in the impact zone. Initial field assessments indicated that of this total, some 15% of individuals (5324 persons) suffered direct impacts related primarily to flooding of major water ways (*See Appendix 1 for details*).

Women and children account for approximately 73% of the impacted persons. Most of the affected populations were socio-economically vulnerable prior to the floods, as the majority was employed as seasonal labor within the tourism, agriculture and aquaculture industries.

Table 1A Demographic by Sex

% POPULATION AFFECTED			
TOTAL	Women	Men	Children
5324	1431	1444	2449

Source: UN Assessment Team

The National Emergency Management Organization confirms a total of some 650 individuals being initially displaced due to localized flooding. Of these some 569 individuals remain in national shelters. The Stann Creek District fared the worst displaying the greatest incidence of displacement and recording all reported fatalities.

The villages of the Orange Walk District have also reported flood related impacts.

Table 1B Displaced Individuals by District

DISTRICT	No. of PERSONS IN SHELTER
Orange Walk	102
Stann Creek	364
Corozal	23
Belize	80
Total	569

Source: UN Assessment Team

Communities hardest hit are those coastal communities of Southern Belize District and the Stann Creek District including Mullins River, Gales Point Manatee, Hope Creek, Sittee River and Hopkins. In the hours directly following the floods, these communities recorded as much as 95% communal lands and infrastructure impacted by the raging waters. Official reports suggest that water levels in the communities are subsiding. However this subsidence is slow and a large percentage of these communities remain inundated. Possibly complicating humanitarian responses is the fact that access to most impacted communities is limited, as roads and bridges have been damaged and/or washed away by the floodwaters. Consequently, affected people in several areas are cut off from accessing health and other social services, placing all displaced persons who are particularly vulnerable, at risk.

In the northern districts, various housing schemes associated with the Orange Walk Township have recorded significant incidence of flooding. The villages of San Lorenzo, San Antonio and Guinea Grass of western Orange Walk remain areas of concern as access roads to these villages are flooded. This situation is expected to persist for at least 5 days, effectively severing these communities from essential support services.

Additional impacts to community infrastructure include damage to schools, health centers and community centers, with some reports of destruction of school supplies. Formal classes have been suspended, and it is uncertain when normalcy will be restored as most school buildings in the country are also utilized as temporary shelters.

Water systems, while confirmed intact at the pump stations, suffered damages along delivery lines. Communities supplied by rudimentary systems are reporting shortages and contamination of surface and ground water systems remain of great concern to Health officials. The health sector also warns of possible increases of water/vector borne diseases if early mitigation strategies are not employed.

Assessment teams deployed to the field have reported a need for the counseling teams to support community members, particularly young children who survived this traumatic event.

Humanitarian stakeholders will focus on the following priority sectors:

- Health/ Environmental Health
- Sanitation and Hygiene
- Food and Water
- Shelter

3.0 Damages by Sector

The damages/losses to various sectors and sub-sectors are shown in this section of the damage assessment and needs analysis report. Data sources used include reports by DANA Field Team reports, Aerial Reconnaissance reports, data collected from the

National Emergency Operating Centre of the NEMO, and official sectoral reports submitted by government and non-governmental agencies.

3.1 Social Sectors

3.1.1 Housing

Aerial observations revealed that houses between Middlesex community on the Hummingbird Highway and Kendall Bridge on the Southern Highway have been severely affected by flash floods and strong water currents.

- At least 17 houses have been completely destroyed in this area.
- It is possible that some of the remaining buildings may have suffered structural damage, but this cannot be verified at this time.
- Settlements along the coast, like Sittee River, Hopkins, Mullins River and Gales Point, are primarily affected by rising water.

With respect to the northern districts, 9 houses were completely destroyed and an additional 400 have been affected by floods.

The damage to homes, in particular, will contribute significantly to the displacement of families and the need for temporary shelters or/and building materials and supplies for house repairs. Many of the families affected will doubtlessly require financial assistance to rebuild their homes. (*See Appendix 2*)

3.1.2 Education

Classes were suspended countrywide due to excessively wet conditions.

In Hope Creek Village, the ITVET complex experienced significant flooding on the lower flat, thereby sustaining damage to equipment and appliances. Loss/damage to equipment has been estimated at \$1.5 million. Restoration costs are estimated to be in the region of \$1.62 million.

It is anticipated that there will be flood damage to school equipment and supplies in other areas, but this cannot be quantified at this time.

3.1.3 Health

3.1.3.1 Health Facilities

The Health Center in Gales Point was reported to be leaking heavily and will be inaccessible until flood waters subside. The centers in Hopkins, Sittee River, and at HTA Bowman, Ltd. in Pomona were most likely not destroyed but are completely flooded and will require immediate repairs before their functions can be restored.

3.1.3.2 Morbidity and Mortality

At present, four fatalities have been confirmed, and one child has been reported missing. The expected morbidity will be skin lesions, respiratory infections and gastrointestinal disorders mostly associated with exposure to contaminated water. With the rudimentary water systems affected, the challenge now is to restore the water supply and immediately conduct quality testing.

Access to essential daily medications for diabetic and hypertensive patients and others must be re-established immediately despite the difficulties of infrastructure. It should be noted that in the 2007 survey on the prevalence of both diabetes and hypertension, the Stann Creek District had the highest rates in the country. With the present crisis, all supplies and medications are expected to have been lost or damaged.

Emergent conditions, especially complications of pregnancy but including trauma, will need to be evacuated by air ambulance. An emergency operating theatre has been established at Southern Regional Hospital, particularly for C-Sections. Control of breeding sites for vectors of other diseases will be a priority. Mental Health will have been impacted and the poor and vulnerable groups, especially children and the elderly will be most at risk. The situation is urgent as shelter conditions are particularly conducive to the spread of contagious diseases.

3.1.3.3 Emergency Supplies

The fact that the road is impassable at different points limits the transportation of medical and other supplies until the road and more than one destroyed bridge are repaired or replaced. Equipment and supplies at clinics and in individual homes in the affected areas must be assumed destroyed and will need to be replaced immediately.

3.1.3.4 Health Infrastructure

Electrical services are seriously affected and water supplies severely restricted or totally absent in the affected communities. Health centres are assumed to be essentially intact from the information currently available, though the 8 to 15-foot flood waters would indicate that all would require extensive renovations estimated at approximately \$20,000.00 for each of the five centres.

3.1.3.5 Environmental Health

This is a serious threat to the affected population in regards to the quality of drinking water, food safety, and the incidence of vector borne diseases.

Noting that entire villages have been flooded with water levels ranging from 2 to 15 feet conditions will be favorable for the extensive development of vector breeding sites, even after much of the water recedes.

The inundated areas will result in unsanitary conditions, e.g. fecal contamination of water due to inundated latrines.

3.1.3.6 Actions to be taken

- 1) deployment of multidisciplinary teams comprising physicians, nurses, health inspectors, health educators, and psychiatric nurse practitioners to the affected areas;
- 2) implementation of communicable disease surveillance at shelter and health facility level;
- 3) deployment of ground assessment/relief teams from Dangriga to affected villages in coordination and support of the local transport committee;
- 4) deployment of vector control teams equipped with anti-malaria drugs, blood testing supplies, etc.;
- 5) implementation of ULV spraying and larviciding within the next three days; and
- 6) the establishment of supply routes to southern communities.

Medical teams will be self-sustainable, presenting no burden to the local authorities, and should be prepared with first aid kits including ORS, antipyretics, tetanus toxoids, anti-inflammatory drugs and replacement medical supplies for chronic conditions. Public Health Inspectors must go equipped with chlorine tablets and must be prepared to assist with the immediate reactivation of rudimentary water systems. Health educators will need to be prepared to offer advice and information on a house-to-house basis, and Psychiatric Nurse Practitioners must be prepared to offer counseling services to those affected, particularly children.

3.2 Productive Sectors

3.2.1 Agriculture

Agriculture in the Southern District is dominated by the citrus, banana, mango and shrimp sub-sectors. Additionally, root crops and fruit tree production are important activities in this region. Livestock production involves small stock and cattle.

3.2.1.1 Citrus

It is estimated that approximately 75% of the 2007/2008 citrus crop has already been harvested. Sixty-five (65%) of the farms between North and South Stann Creek are inundated. This situation might be exacerbated with continued rainfall; however rapid runoff is anticipated for the Valley region.

About 70% (32,000 acres) of the country's total acreage (46,000 acres) reside within the Stann Creek District. Aerial reconnaissance of the affected area suggests 5% total destruction of the citrus acreage (1500 acres). Approximately 459,000 boxes were also lost in the fields. This translates to direct losses in the amount of \$8.2 million.

3.2.1.2 Rice

Destruction of this crop included some 914 acres at Blue Creek, and 460 acres at Big Falls Ranch in the Belize District, all of which were ready for harvesting. Estimated loss for this sector is \$1.7 million.

3.2.1.3 Sugar-cane

Losses to this sector include 1800 acres burnt and awaiting harvesting, as well as 1600 tons held on trucks en route to the BSI factory. Estimated losses are to the tune of \$1.6 million.

3.2.1.4. Other

Preliminary indications are that the banana sector was not severely affected.

In the Valley area, it is expected that root crops including cassava, coco-yam and sweet potatoes are totally destroyed.

Losses to fruit crops such as pineapples could not be determined.

Livestock losses could not be confirmed by aerial reconnaissance; however it was observed that about 40% of the pasture acreage was inundated. It is anticipated that there will be losses to the livestock sub-sector but this will be confirmed through field assessments.

With respect to Belize Rural South (Gales Point Manatee and Mullins River) crop production activity is concentrated on citrus, mango and other fruit trees. Approximately 60% – 65% of agricultural land in this area is inundated.

3.2.1.5 Economic Loss to the Agriculture Sector

Total economic loss to the agriculture sector resulting from Tropical Storm Arthur is estimated at around \$25 million. This includes direct loss to the farmer (damage assessment), which is estimated at around \$11.7 million, and other losses to the country of Belize.

In computing economic loss, deprived economic activity associated with the production process is considered. The process varies across sectors and includes the processing of paddy into milled rice, conversion of sugar-cane into sugar and molasses, producing concentrate, juice and oil from citrus fruits, as well as the various support activities related to the production process.

These deprived activities are important factors in the medium term since they represent economic losses for Belize such as loss of employment, fewer purchases of input materials, decreased demand for support services such as transport and distribution. Consequently, imports will increase and exports will decrease.

3.2.2 Fisheries

The lobster season in Belize commences on June 15 and lobster farmers have already lodged their traps in preparation. Production is usually highest at the start of the season and it is anticipated that approximately 25 % of the average annual lobster production will be lost due to damage to sea-grass beds and traps. This represents about 125,000 pounds of tails having an estimated value of \$5 million.

With regards to conch, there has only been one month of production and indications are that the production rate will be lower than expected. It is estimated that about 62,000 pounds of conch will be lost as a consequence of the tropical storm. These losses would result in direct financial losses of approximately \$428,000.

The estimated loss to the finfish fishery is presently indeterminable given the lack of information required to formulate estimates.

Preliminary estimates of loss to the sector, not including fishing gear and equipment, amount to \$5.4 million.

With regard to the aquaculture sub-sector, Paradise Shrimp Farm and Melinda Mariculture Ltd. suffered damages to the tune of \$2.4 million. In the case of the former, losses of \$0.4 million were sustained as a result of excessive flooding of production ponds. Melinda Mariculture did not suffer production losses, but sustained severe damage to farm machinery, buildings and equipment estimated at approximately \$2 million.

Fresh Catch Tilapia Farm located along the Coastal Road near the Sibun River was not affected. Similarly, the Cobia marine cage farming operation near the Robinson Point Cayes was not affected. In the medium-term, the changes in water quality might pose a significant risk to producers given that the water is contaminated and might result in an outbreak of disease.

Although the other shrimp farming operations further South of Belize did not suffer any significant damages due to the flooding, the main constraint to these producers would be the access by road to the Mexican market given that the Kendall Bridge is not functional. Belize's farmed shrimp can only access the Mexican market until the month of June. After this, the Mexican producers take over the market.

The preliminary economic losses to the aquaculture sub-sector in Belize have been estimated at \$7.8 million.

3.2.3 Tourism

In the Stann Creek District major tourism sites include Hopkins, Sittee River and Placencia. No visible damage was recorded for the Placencia area. In the villages of Hopkins and Sittee River aerial reconnaissance indicate flood damage to hotels and guest houses.

There is no available data on the value of such damages at this time, but Sittee River appears to be hardest hit. Most of the establishments in this area are small and suffered major losses. At the time of our survey, flood waters averaged three to four feet high and hindered proper damage assessment.

Five (5) boats have been reported destroyed in the Stann Creek District.

There were no major damages reported at the properties in the Orange Walk and Corozal districts, and all properties are operational at this time.

Preliminary indications are that damage to the tourism sector is in the order of \$600,000.00 BZ. This figure is expected to increase as more data becomes available from the Stann Creek district.

4.0 Environment

This information is based on an aerial survey conducted after the storm, in conjunction with on the ground assessments of impacted areas. A more comprehensive and detailed assessment of the various environmental impacts of Tropical Storm Arthur is currently being developed. The assessment in this section is more qualitative in nature and is not intended to give a quantitative assessment of the environmental-economic loss sustained, as a result of the impacts of Tropical Storm Arthur on Belize.

The aerial survey focused on the affected areas in the Stann Creek, Belize, Orange Walk and Corozal Districts, as well as the area between the coast and Ambergris Caye.

4.1 Environmental Impacts of Immediate Concern

The environmental impacts of immediate concern are those associated with the contamination of surface and ground water in the coastal and inland areas that have been subject to flooding. Chemical contamination of these water resources have been minimized due to rapid response in containing spilled chemicals, and by preemptive action taken by stakeholders, which ensured that chemicals in previously identified **High Risk Areas** were either secured or evacuated. The former is true for the Citrus Growers' Association which had two drums of Malathion which spilled on their compound.

Other chemical contamination of the surface waters would have resulted primarily from agricultural runoffs. However, it is believed that because of the tremendous volumes of water flowing through these areas, any chemical contained in the runoff may have been greatly diluted to levels that may be "undetectable" and which may pose little or no

significant risk to public health.

Contamination with fecal coliform is the parameter of greatest immediate concern to the environment and public health. This bacterial contamination is primarily as a result of the overflow of pit latrines and the inundation of septic tanks in the affected areas. The recreational and other domestic use of these waters should be avoided as much as possible and where the use of these waters for domestic purposes is unavoidable, it must be properly boiled or treated with household chlorine.

Solid waste disposal in flooded areas will need to be given priority consideration. Carcasses of dead animals must be burnt or buried immediately. Portable toilets should be provided to these affected areas to ensure the proper disposal of human waste, in particular for Clean-up and Emergency Response Crews, and for those left homeless or seeking refuge.

4.2 Coastal Erosion

Preliminary assessment indicates that the environmental impact associated with coastal erosion was not as severe as expected when one considers the intensity and duration of Tropical Storm Arthur. Reports however indicate that mainland coastal areas have experienced significant erosion. Mullins River, a coastal community, has had large areas of beach completely wiped away, and a small road running adjacent to the shoreline in front of homes also had some sections washed away as a result of flood water.

Significant erosion was also noted along the various rivers in the south as a result of flash flooding. Clearly evident in the aftermath of Tropical Storm Arthur were roads and river banks that had been scoured and eaten away by the tremendous volumes of flood water that passed through various rivers and streams.

4.3 Damage to Reef, Mangrove, and Sea-grass Bed Ecosystems

The waters within the Reef Lagoon were extremely turbid. Fortunately, this turbidity has not yet extended beyond the Belize Barrier Reef system. The turbid/murky waters were clearly evident in the inner lagoon west of Ambergris Caye. The effects of this tremendous amount of silt on sections of the Belize Barrier Reef will need to be assessed in order to determine its immediate, medium and long-term impacts. These sections of the Reef may suffer long-term irreversible damage from the smothering effect of this silt plume, since both soft and hard corals may have been severely damaged on the western fringe of the Reef along these areas. A more comprehensive report is being prepared.

Sea-grass beds within the Reef Lagoon in this area have also been impacted by the mechanical motion of the water due to Tropical Storm Arthur. Those beds that remain will continue to be affected by the smothering effects of the silt as it is deposited on the seafloor.

Generally, the island's mangrove stands were not affected; all were intact and appeared to suffer little or no damage.

4.4 Impacts to Wildlife

Perhaps the most visible impacts are those associated with the damage to vegetation in the impacted zone with these becoming more evident immediately along river banks and flood plains. Although areas adjacent to the Rio Hondo and New River were under varying depths of water, there was no obvious physical destruction of vegetation. It is expected that wildlife in these areas will be displaced temporarily until the flood waters recede. There were no signs of flash flooding, suggesting that the flood waters rose gradually affording wildlife time and opportunity to evacuate the area.

The southern rivers were markedly different and vegetation on river banks and in the path of the flash flooding was completely leveled. Local wildlife would have similarly been displaced. There were no obvious signs of dead wildlife.

4.5 Flood Impact

Most of the villages bordering the Rio Hondo, the New River, the Belize River, and their main tributaries, have been impacted by the flooding resulting from the rains of Tropical Storm Arthur.

Farmlands and pastures were also affected and displayed signs of minimal water logging, but with very few being completely submerged. Villages along the Belize River Valley also showed some signs flooding.

Pollution in the coastal areas resulted from increased sedimentation and agricultural run-off. This situation was exacerbated in areas along the rivers and streams where the vegetation had been cleared up to the edge of the water bodies and replaced with crops. The absence of this buffer prevented the filtration and absorption of some of these pollutants. Increased sediment loads were due to deposits of soil from denuded areas and cleared riverbanks. Another issue of concern was pollution of water resources from sewage due to inundated septic tanks and pit latrines in flooded areas.

4.6 Recommendations

1. Immediate concerns for the affected areas are those associated with water contamination and the need for appropriate disposal of human and solid waste (debris). Portable toilets must be provided to these communities to reduce the risk of further contamination of these waters with fecal coliform and other pathogens. Animal carcasses must be immediately burnt or properly buried.
2. Special attention should be given to reducing the risks of outbreaks of environmental diseases such as cholera, hepatitis and gastro-intestinal diseases. The Ministry of Health should increase its vector control programmes in the

- affected areas. Pools of stagnant water should be expected after the floods recede. Measures should be taken to ensure that the potential development of these as breeding grounds for vectors is minimized.
3. The Department of the Environment and the Public Health Bureau should continue to monitor the waters around these affected areas. Special emphasis must be placed on sources of drinking water and, in the case of the cayes, recreational waters used by tourists.
 4. The Environment Committee should be commissioned to assess the economic consequences of Tropical Storm Arthur on these resources, and should consider the following:
 1. The value of the resources lost or damaged;
 2. Loss of income resulting from #1;
 3. Cost of resource substitution;
 4. Cost of resource recovery; and
 5. Cost of protecting these resources from similar future events.

5.0 Infrastructure

Damage to infrastructure is estimated at some \$18 million.

Most of the damage to infrastructure was as a result of severe flooding in the Stann Creek, Cayo and Orange Walk Districts. Some wind damage was also reported in the Belize District.

There were damages to highways, feeder roads, culverts and bridges.

Damage to the road infrastructure has been severe between the points mentioned above.

- At least 3 culverts on the Hummingbird Highway have suffered from wash outs. Replacement costs are estimated at \$150,000.
- Kendall Bridge on the Southern Highway has been completely destroyed and will cost approximately \$10 million to replace.
- Mullins River Bridge on the Manatee Road has also been completely washed away. The cost of replacing this bridge is estimated at \$5 million.
- The Soldier Creek Bridge was also lost and will cost \$5.6 million to replace.
- The approach to the San Lazaro Bridge has been washed out, compromising the structural integrity of the bridge. It will cost approximately \$20,000.00 to remedy this situation.
- Road shoulders will need to be replenished.

- Damage to feeder roads, farm roads and village streets and drainage was also noted.
- Waterways will need clearing.

In the Orange Walk District two bridges have been reported damage in the Mameyal and Trinidad Area. Additionally, two culverts in August Pine Ridge and Santa Martha were reported damaged.

In the Corozal District, the road linking San Narciso and San Victor has been made impassable by a 12 ft washout.

In the Cayo District, the Iguana Creek Bridge and the temporary bypass bridge have been flooded but no damage has been reported.

In the Belize District flooding was reported at the Hector Creek Bridge and along certain portions of the Burrell Boom Road and Northern Highway. At this point damage is unknown.

Restoration works are estimated at roughly \$26 million. Table 5.1 provides details of these costs by district.

Table 5.1 Replacement/Restoration Costs

Activity	CZL	OWK	BZE	CYO	SCK	TOL	Totals
Highway Rehabilitation	\$10,000.00	\$10,000.00	\$70,000.00	\$10,000.00	\$300,000.00	\$10,000.00	\$410,000.00
Feeder Road Restoration	\$200,000.00	\$200,000.00	\$150,000.00	\$100,000.00	\$350,000.00	\$40,000.00	\$1,040,000.00
Farm Road Restoration	\$100,000.00	\$100,000.00	\$30,000.00	\$40,000.00	\$400,000.00	\$40,000.00	\$710,000.00
Culvert Repair / Replacement	\$40,000.00	\$40,000.00	\$80,000.00	\$50,000.00	\$400,000.00	\$40,000.00	\$650,000.00
Bridge Repair / Replacement	\$10,000.00	\$30,000.00	\$5,620,000.00	\$30,000.00	\$15,500,000.00	\$20,000.00	\$21,210,000.00
Village Street Restoration	\$50,000.00	\$50,000.00	\$80,000.00	\$50,000.00	\$350,000.00	\$40,000.00	\$620,000.00
Debris Clean-up	\$0.00	\$0.00	\$0.00	\$10,000.00	\$200,000.00	\$10,000.00	\$220,000.00
Water ways Clean up	\$0.00	\$0.00	\$60,000.00	\$0.00	\$150,000.00	\$0.00	\$210,000.00
Drainage	\$0.00	\$0.00	\$0.00	\$0.00	\$150,000.00	\$0.00	\$150,000.00
Totals:	\$410,000.00	\$430,000.00	\$6,090,000.00	\$290,000.00	\$17,800,000.00	\$200,000.00	\$25,220,000.00

Source: Ministry of Works

6.0 Utilities

Belize Water Services Limited (BWSL) has indicated that all of its systems are functional at the level of the pumping stations. However, Potable water supplies have been affected at the distribution level through breakage and damage of pipes and meters).

Most communities supplied by rudimentary water systems have experienced interruption in water supply. BWSL has indicated its willingness to supply chlorine tablets and to assist with the transportation and distribution of water to the affected areas.

Belize Electricity Limited reported turning off electricity supply in all affected areas in the interest of public safety. There was some damage to poles and transformers.

7.0 Summary of Damages and Needs

7.1 Damages

The housing, infrastructure and agriculture sectors suffered the most damage. Losses in the housing sector included structural damage/destruction to homes due to flooding (*See Appendix 2*).

Table 7.1 provides a preliminary assessment of the damage for the various sectors. It is anticipated that total value of damage will exceed \$60 million. The economic cost of the damage to infrastructure cannot be quantified at this point, but will be significant considering the disruption of public transportation and distribution of goods and services (petroleum, agrochemical products). Itinerant traders and the tourism sector will also be significantly affected.

Table 7.1

SECTOR AFFECTED	DIRECT COST	ECONOMIC LOSS	REMARKS
Infrastructure	18,915,000		
Housing	7,177,500.00	0.00	
Damage buildings	2,195,500.00		
Destroyed buildings	468,000.00		
Damage to Household Items	4,514,000.00		
Vehicles & Machinery	330,000.00		
Agriculture	14,223,493.00	25,457,073.00	
Banana	2,304,000.00	4,320,000.00	
Rice	1,700,000.00	3,388,840.00	1,374 acres - av, yield 4,000lb/0.3 per lb
Citrus:			
Crop	3,672,000.00	5,883,150.00	459,000 boxes/\$8 per box
Acreage	4,500,000.00	7,765,758.00	1,500 acre @ \$3,000 per acre
Sugar Cane			1,800 acres
Crop in field	1,530,000.00	2,845,440.00	1,800 acres burnt awaiting harvesting @ \$50/ton
Crop in Storage	80,000.00	149,760.00	1,600 tons @ \$50/ton
Other Crops	242,543.00	822,275.00	
Livestock and Pasture	131,950.00	218,850.00	
Processed Products	63,000.00	63,000.00	
Fisheries	9,428,000.00	0.00	
Production	5,428,000.00		Lobster, Shrimp, Conch
Fishing Equipment	4,000,000.00		Aquaculture Equipment only
Education	1,560,000.00	0.00	ITVET
Tourism	600,000.00		Ambergris Caye & Stann Creek
Environment			Info o/s
TOTAL	52,233,993.00	25,457,073.00	

Economic losses to the agriculture sector have been estimated at \$25.5 million. Further analysis is required in order to determine the total economic loss to the nation.

7.2 Needs

Immediate needs have been estimated to be in the order of \$46.0 million. This figure is expected to increase as additional data becomes available for the tourism and fisheries sectors. Table 7.2 provides details.

Table 7.2

SECTOR AFFECTED	QUANTITY	ESTIMATED COSTS	REMARKS
Infrastructure		25,220,000	
Housing		10,178,520.00	Households
Affected Homes	714	2,195,500.00	
Destroyed buildings	26	936,000.00	
Damage to Household Items	740	7,047,020.00	
Health		755,836.60	
Medical Equipment		355,043.00	
Furniture & Fixtures		100,000.00	Est of damage clinics in the South
Building Repairs		100,000.00	
Medicine		200,793.60	
Agriculture		1,485,000.00	
Fertilizer		735,000.00	
Planting Material		400,000.00	
Agrochemicals		350,000.00	
Education		1,612,000.00	Stann Creek ITVET only
Tourism		800,000.00	To be updated
Financial		5,000,000.00	
Credit		5,000,000.00	Productive & Housing Sector
Social/Humanitarian Needs		816,900.00	
Blankets	5,000	50,000.00	
Pillows	5,000	25,000.00	
Personal Hygiene Kits	10,000	150,000.00	
Water (7 days)	273000	81,900.00	3 gallons per day X 13,000 persons x 1 week
Temporary Water Storage Tanks		30,000.00	
Portable Toilet for Affected Areas	28	30,000.00	\$75/da w/ \$3/mi w/ 1 toilet/20 persons
Food		450,000.00	500 person x 60 day
TOTAL		45,868,256.60	

Humanitarian assistance will be necessary to facilitate households' return to normalcy. Initial estimates place this value at approximately \$1 million. Thus far, \$0.1 million have been expended on food and water as part of the relief effort in affected areas.

This Preliminary Report is submitted to NEMO for its consideration and further action.

8.0 References and Information Sources

DANA Aerial Reconnaissance Team

Five Field Teams made up of personnel from DANA and United Nations Agencies

Lands and Surveys Department, Environmental Statistics for Belize 2004

Central Statistical Office, Central Statistical Office Abstract of Statistics Report 2004

Ministry of Agriculture and Fisheries

The National Emergency Management Organization

Ministry of Works

Ministry of Health

Belize Tourism Board

Department of the Environment

Appendix 1

DISTRICT	POPULATION	AFFECTED AREAS	POPULATION IN IMPACTED AREAS	POPULATION SUFFERING DIRECT IMPACT
Stann Creek	32,200	Hopkins	1,193	1,193
		Kendall	114	-
		Hope Creek/Melinda	899	809
		Middlesex	362	-
		Mullins River	238	238
		Red Bank	788	-
		Sarawee	244	138
		Sittee River	374	374
		South Stann Creek	474	-
		Steadfast	458	-
		Valley Community	250	141
		Alta Vista	745	421
Orange Walk	47,100	August Pine Ridge	1,927	-
		Carmelita	946	40
		Douglas	640	125
		San Antonio/Rio Hondo	450	45
		San Estevan	1,775	106
		Guinea Grass	3,005	33
		San Lazaro	1,087	-
		Yo Creek	1,571	-
		OW Town	16,000	765
Belize Corozal	93,200	Gales Point Manatee	296	296
	36,300	San Roman	788	130
		Santa Clara	901	75
		San Victor	770	42
		Concepcion	1,072	25
		Louiseville	776	70
		Caledonia	1,516	126
		Buena Vista	478	43
		San Narciso	2,489	90
TOTAL			34,624	5,324

Appendix 2

Communities	Homes		
	Affected	Destroyed	Households Items
Stann Creek	227	17	244
Valley Community	4	2	6
Alta Vista	0	0	0
Sarawee	22	0	22
Mullins River	16	0	16
Hope Creek/Melinda	140	15	155
Middlesex	0	0	0
Steadfast	0	0	0
So Stann Creek	0	0	0
Red Bank	0	0	0
Hopkins	15	0	15
Sittee	30	0	30
Kendall	0	0	0
Belize	80	0	80
Galespoint	80	0	80
Orange Walk	293	9	302
San Luis	6	0	6
San Pablo	23	3	26
Douglas	25	1	26
Nuevo San Juan	0	0	0
San Jose	9	5	14
Trial Farm	28	0	28
San Lorenzo	60	0	60
San Estevan	18	0	18
Carmelita	8	0	8
Guinea Grass	7	0	7
San Roman	0	0	0
San Antonio	9	0	9
Santa Cruz	0	0	0
Louisana	48	0	48
Ocho Benque	9	0	9
Marcus Canul	36	0	36
Albert Burns/Ramada Area	7	0	7
Santa Martha	0	0	0
Yo Creek	0	0	0
Corozal	114	0	114
San Victor	7	0	7
Concepcion	5	0	5
Santa Clara	15	0	15
Caledonia	21	0	21
San Narciso	18	0	18
Buena Vista	10	0	10
Luisville	14	0	14
San Roman	24	0	24
Total	714	26	740
Damages	2,195,500	468,000	4,514,000.0
Total Replacement Cost	2,195,500	936,000	7,047,020
Stann Creek	1,021,500	612,000	2,610,800
Belize	360,000	-	856,000
Orange Walk	586,000	324,000	2,604,380
Corozal	228,000	0	975,840

Appendix 3: Pictures
Agricultural Sector- Sugar Cane



Agricultural Sector- Rice



Agricultural Sector- Banana



Agricultural Sector- Citrus



Infrastructure



Kendall Bridge Location

