Supplemental Volume

After Hurricane Mitch: Shelter and Municipal Infrastructure Reconstruction in Nicaragua

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The present document is a supplemental volume to a report prepared earlier by the United States Government (USG) Shelter and Municipal Infrastructure Task Force in Nicaragua, *After Hurricane Mitch Shelter and Municipal Infrastructure Reconstruction in Nicaragua Proposed Action Plan* (March 1999) Members of the USG Task Force and their respective agencies are listed on the title page

This Task Force visited Nicaragua in January 1999 to update an assessment of damage caused by Hurricane Mitch and to develop an interagency program design for reconstruction in the shelter and municipal infrastructure sectors The report named above synthesized the findings and recommendations of the Task Force The present, supplemental volume provides the interim working documents that served as inputs into the final, synthesized Task Force report Individual Task Force members prepared most of these (unedited) reports, while one was prepared jointly by several Army Corps of Engineers and Geological Survey representatives, see the Table of Contents for authors and agencies Most of the enclosed documents were prepared in January and February 1999

Damage Assessments of Community Infrastructure and Resettlement Camps

Damage assessments of community infrastructure and resettlement camps were conducted at the following locations in the northwest portion of Nicaragua León, Chinandega, Chichigalpa, Posoltega, Somotillo, and Telica At León, the second largest town in Nicaragua, we were shown two bridges that were severely damaged, one was rendered impassable At the rural bridge, the municipality had plans to replace all of the fill in the left approach that had been breached and eventually replace the guardrails Immediately upstream and downstream of this bridge were agricultural dams that were destroyed The urban bridge was a four-box culvert with the upstream portion of the center walls severely damaged The guardrails had also been removed by the flood waters There was evidence of some dwellings immediately upstream having been totally destroyed In one case, the resident had already reconstructed a dwelling We were not shown any other damaged property The mayor also proudly recounted the number of pieces of heavy equipment that they had The list was short and included 2 tracked hoes, 14 dump trucks, 1 crane, 2 or 3 front-end loaders, 1 bulldozer, and 1 grader

As was the case in all the other towns, the mayors had great difficulty differentiating between riverine flooding and flooding due to rainwater The vast majority of the "flooding" damage was due to inadequate drainage systems, which were overwhelmed by the enormous amounts of rainfall The rainfall event from Hurricane Mitch has been estimated at up to a 500-year event, which is obviously extremely rare Urban drainage systems are typically designed to accommodate relatively frequent events, on the order of 10-year events It appeared that this was the case in the urban areas we inspected To keep these systems viable, debris removal is a priority task that need to be accomplished before the next rainy season

Generally, the rivers did not overtop their banks for any great distances The houses that were located immediately adjacent to the channel were completely washed away Typically, it was difficult to determine how many structures had previously been located alongside the channel In a couple of instances, the residents had already reoccupied the site and reconstructed a dwelling The stream channels appeared to be both wider and deeper The banks were also devoid of any large vegetation and appeared to be relatively clean and, thus, more efficient However, this situation is precarious since the banks are in many cases vertical and thus unstable Bank sloughing and head cutting are likely future events that will reduce the efficiency of the channels and create land loss for the property owners immediately adjacent to the channels Bank stabilization, particularly around bridges, and debris removal need to be performed prior to the next rainy season This debris would be moved to bridge openings and could conceivably cause the collapse of recently repaired bridges

At Chinandega, the road and bridge problems were discussed, but again we were not escorted to any of damaged residential areas or to any of the bridges The stream crossings within the town were, however, of great concern The mayor was concerned about the possibility of losing one or both of the crossings in the next rainy season, and the loss that severing the town into two halves would have on the local economy He was desirous of upgrading the existing crossings and adding two new crossings These channels also appeared to be wider and deeper

and the channel bottoms were clean Bank stabilization above and below the bridges is a priority and appears to be well warranted

Perhaps the single greatest obstacle to resettlement is the overriding, compounding problem of land ownership The municipalities generally have few alternatives for siting refugee camps or more permanent resettlement areas While none of the sites visited are in geologically or hydrologically risky areas, many of them are in undesirable locations, such as a camp in Chinandega for 270 families located among a solid waste dump, a cemetery, and the town's sewage lagoons Prior to Hurricane Mitch, this area was to have been used for the relocation of the solid waste dump, which is adjacent to a river An indeterminable amount of the dump was washed downstream by flood flows

The mayor also reported that many of the rural bridges required annual maintenance, which indicates the probability that the openings are undersized for even "normal" rainfall amounts This conclusion is strengthened by the mayor's request for technical assistance in the design of the bridge openings The lack of adequate openings for "normal" rainfall also suggests a relatively expensive solution, i e , removal of the existing structure, construction of a temporary crossing, and replacement with a new structure Because of lack of financial resources, the municipality appears to be stuck in the vicious annual cycle of patchwork repairs just to keep what they have in service

The Somotillo township is surrounded by four rivers, two on the north side, Rio Guasaule and Rio Tecomapa, and two on the south side, Rio Gallo and Rio Negro The main portion of the town is between the two innermost streams, Rio Tecomapa and Rio Gallo, with subdivisions located between the outermost streams, Rio Guasaule and Rio Tecomapa, and the innermost streams, Rio Gallo and Rio Negro To the southwest of town the Rio Negro joins the Rio Gallo Approximately 2 kilometers downstream of this junction the Rio Tecomapa joins, and the Rio Guasaule joins approximately 8 kilometers further downstream

The mayor reported that nearly two-thirds of the central portion of the city was flooded, as were all of both subdivisions Since the central portion of the town and the southern subdivision are on high ground, the reported extensive flooding was due to inadequate drainage to handle the enormous rainfall We did not visit the northern subdivision or the northern bridges The debris lines along both banks of the Rio Gallo and the Rio Negro were only a matter of five to six feet above the elevation of the banks The dwellings immediately adjacent to the channel were washed away, with one exception A large building capable of housing five or six families withstood the flood waters, but was not currently inhabited

At the confluence of the Rio Negro and Rio Gallo on the left descending bank, a school was washed off its foundation The area surrounding the school house was littered with large piles of floating debris Almost all the small trees in the area remained standing It appeared that the water over the banks at this location was fairly shallow, no more than 3 feet The mayor reported that the school could not be rebuilt at this location, however, since the flooding was shallow and of a very rare frequency, it did appear that reconstruction at this location would not

be particularly risky The foundation for the school was left intact The electric power in the area was also intact

The channel is perched for a considerable distance upstream before it encounters a substantial rocky outcrop forcing a 90-degree bend in the Rio Negro to the right before joining the Rio Gallo The Rio Negro and Rio Gallo are flowing parallel to each other for a distance of a couple miles just prior to the confluence No doubt the flood flows merged to form a single flow over this stretch The distance between the channels appeared to be about 500 yards A small 3-foot levee along the upper bench of the Rio Negro for about 2,500 feet from the outcrop upstream to high ground would probably be sufficient to almost completely protect the site

About a half a mile from the confluence of the Rio Negro and Rio Galla is a temporary refugee camp for approximately 50 families Power is supplied to the area by the unauthorized tapping into the power lines The line was stretched across the road, separated, and nailed to a tree using fencing u-shaped nails From there, lamp cord and anything else that could be acquired was used to run power to the huts The lines were kept off the ground by notched poles, none of which was fixed in the ground While there is no refrigeration or other electrical appliances in evidence, the refugees do have access to television This could be used as a means of communicating the resettlement and reconstruction plans as well as other needed information to the refugees The solution to the sanitary waste problem is a latrine cover All of the latrines are too shallow, and they are being dug in soils that will not percolate, but little investment will be made by the refugees themselves or by the municipalities until ownership of the land has been resolved This was true for all of the other camps

In other rural areas of the Somotillo municipality, several water crossings had serious washouts Approximately one-fourth to one-third of the roadways were lost to erosion on the downstream side These crossings consisted of culverts underneath several feet of fill In some cases, the drainage alongside the roadway also exhibited substantial erosion This situation may also be similar in nature to the rural water crossing problems reported by the Chinandega municipality

In all of the visited municipalities, we received reports that the majority of families that received "flood" damage had sought shelter with relatives Some relief for the displaced persons was being made available There was also some efforts being made to "certify" that the aid was being given only to the displaced persons

Perhaps the greatest economic problem being faced by the displaced families, whether those in refugee camps or those residing with relatives, is the lack of economic activity If they were subsistence farmers, they no longer have land to farm If they were urban dwellers, they are now further from their places of employment Few of the municipalities have any plans for addressing the longer-term problems of unemployment Reportedly, among the criteria for selecting permanent resettlement areas is that they be no more than 5 kilometers from former places of employment A notable exception is Telica, where the mayor believes that the farmers can remain in the relocated settlements and return to cultivate their farms In addition, the subsistence farmers could be allowed to keep pigs and chickens at the new settlement

While we did not witness any of the streams for any distance removed from the bridges, it is probable that the agricultural water supply structures are also heavily damaged These structures will also need to be re-engineered because of the widening of the channels and rebuilt Without them, it may not be possible to irrigate the next crop, leading to large losses in crop yield and subsequent losses in this sector's contribution to GNP

Damage assessment of private housing units and municipal and rural infrastructure was conducted at the following locations in central Nicaragua Tiptop, Dare, a farming community near Dare, Matagalpa, Jinentaga, and Estelí Most single- and multi-family houses were previously constructed of locally made brick and mortar walls with a tin or tile roof The typical size of these units was approximately 36 square meters Houses were frequently located along one of the many rivers throughout the country, the water from these rivers provided, among other things, a convenient place to wash clothes, a food supply, and a water supply for crops These houses suffered various amounts of destruction from the hurricane

Housing construction efforts for those families who have totally lost their previous dwelling or have received extensive damages to previous housing located in flood plains vary with the funding and land availability within each community or municipality The levels of reconstruction of housing units vary from plastic sheeting walls with a tin roof to brick walls with tin roofs Many complaints were heard from residents concerning the inferior quality (plastic sheeting) method of construction due to the heat generated from the black plastic In some communities, we were told that the plastic would be replaced by brick if funds became available

Overall, we could not identify any major mission in housing needs that were not being met (although at inferior levels) by local municipalities or FISE Unit construction materials need to be improved, but housing site selection was a safe distance from potential floods or land slides Problems will occur due to these units being located further from places of employment or farm land

In conjunction with housing damages, various damage to municipality infrastructure was also observed in the inspections throughout the country Bridge damage within the boundaries of various municipalities usually are the responsibility of local government to rebuild or repair as required Lack of funds and lack of heavy equipment appear to be the limiting factors in reconstruction activities along these lines Bridge approach repairs can sometimes be easily performed if municipalities owned or had access to track hoes, dump trucks, bulldozers, and front-end loaders to move large rocks, debris, and earthen materials

Other urban damages that were seen involved the partial or total destruction of water and sewer lines adjacent to bridge sites Usually easy-to-fix repairs have been attempted, but the more-difficult repairs need equipment to aid in trench excavation and armor protection using gabion baskets to prevent future scour damage These repairs must be performed during the dry season for construction access The urgency of providing assistance along these lines cannot be stressed enough, since water-borne disease problems will probably increase with daily higher concentrations of human waste in the low-flow channels

Other urban damages that were seen in multiple locations involve the total removal of natural armoring of river banks Several bank failures adjacent to cemeteries were observed The more financially sound municipalities had reconstructed damaged flood walls adjacent to cemeteries and urban streets U S -designed bank stabilization practices using local stone materials and/or gabions should be taught to urban leaders to aid in these reconstruction activities in areas where bank failures and scour failures will occur during future annual event runoffs

The two inspection teams also inspected multiple farm community roads, stream crossings, small water supply reservoirs, vegetable production irrigation systems, water wells, and farm field alterations as a result of silt deposit or mud flows Little reconstruction efforts have been made to these systems The larger communities have reconstructed very small water supply dams Some improvements involving silt removal in concrete-lined water supply channels and unlined irrigation channels have been performed, but mechanized equipment or hand shovels and wheelbarrows are not readily available to perform these much-needed tasks in rural areas Dirt or natural stone roadways are in various conditions Some grading has been performed, but much effort is needed in establishing river crossing approaches (usually sandy material) since most rivers (whether large or small) are generally now deeper and wider than before Hurricane Mitch Again, lack of dump trucks, etc and funds to move locally available armor materials limits these reconstruction activities

The repair of silted-in open-pit water wells has generally not been performed due to the lack of powered pumps to stir up silt deposits on the bottom of the wells prior to pumping the possibly contaminated waters out of the well Chlorinating the well waters needs to be performed after silt removal operations to provide safe drinking waters for rural communities

Farm field alterations have occurred in many rural agriculturally based communities Silt deposits adjacent to flooded streams and rock/debris deposits adjacent to land and/or mud slides have drastically altered the slope of previously irrigated crop lands The re-establishment of slopes to these lands will be required prior to crop plantings that require surface water irrigation The removal of rocks and debris will be required either by hand or heavy machinery to re-establish cultivation practices Where land slides have occurred, grass seeding and mulching should be performed prior to annual heavy rains to reduce further scouring of these areas Many of the areas could benefit from the use of heavy earth-moving equipment to stabilize the slopes prior to seeding, but the cost of such equipment expenditures probably cannot be justified

Since the majority of bridges within Nicaragua were either totally destroyed or severely damaged, the stream-gaging devices (usually located near bridge sites) have been essentially destroyed Since the two teams are confident that watershed alterations have occurred due to scouring of new channels between low-lying adjacent rivers, the pre-Hurricane Mitch data sets of river elevation versus rainfall amount may not be applicable for future designs of bridges, flood walls, or other water resources-related structures This data collection system needs to be re-established as soon as possible to try and correlate hydrologic changes with rainfall data These systems will realistically not be in place prior to the reconstruction of a few bridges, but can reasonably be re-established prior to the reconstruction of most bridges Efforts should

definitely be concentrated on the watershed above the destroyed Santa Barbara dam in order to properly design a new dam and spillway

To design a cost-efficient bridge replacement program or irrigation dam/diversion replacement program, much help is needed in the training of engineers/scientists at INETER, the central government's only hydraulic engineering system for municipalities Based on extensive discussions with this agency, training is required in the fields of surface water computer modeling During the revolutionary years, it appears that chemicals such as DDT were used extensively (There is a warehouse full of DDT waiting to be transported to Finland for disposal) These long-lasting pesticides (including arsenic and organic chlorine) as well as seven heavy metals have been detected in many water wells As the rural wells are returned to service, the waters should be tested for chemical residues If residues are found, groundwater modeling should be performed to reduce risk for future drinking water sources INETER is in charge of this process, but needs training from U S sources to ensure proper application of various models available from the Corps of Engineers and other sources

Training needs also exist in the field of laboratory analysis of drinking water to ensure a safe water supply system INETER expressed a need for support in performing a water quality model for Lago Managua, where surface waters from contaminated sites (chromium plants and refineries, etc) were washed into the lake as a result of Hurricane Mitch

Another point that was almost overlooked in our inspections was the storm's impact on the port channels located on both the Caribbean and Pacific coasts Severe shoaling of these channels has occurred, but funds are not available to assess the true impact on commercial shipping as a result of the hurricane Assistance is needed in conducting hydrographic surveys of these four channels This relatively low-cost mission could identify local areas where minor dredging operations could eliminate shoals, which, if not removed, may severely affect Nicaragua's international shipping system As INETER engineers are trained in computer modeling, their future modeling studies could be used to determine the amounts of annual dredging requirements

Hydrologic Assessment of the Central Highlands of Nicaragua
January 21-24, 1999

During the period January 22-24, 1999, I helped assess post-Hurricane Mitch hydrologic conditions at several sites in the Central Highlands of Nicaragua This assessment included 1) general watershed conditions, 2) impacts of flooding and mud/landslides on population centers and other developed areas, 3) fluvial erosion and sedimentation, 4) observed stability of river reaches, and 5) hydrologic suitability of resettlement sites for refugees

A variety of hydrologic environments exist in Nicaragua, and the impacts of Hurricane Mitch were varied throughout the affected regions This assessment is based on a limited number of sites in the Central Highlands, including the municipalities of Dario and Matagalpa (Matagalpa Department), Jinotega (Jinotega Department), and Estelí (Estelí Department), a visit was also made to the site of the dam failure at the Santa Barbara hydroelectric facility (Esteli Department) The region is predominantly rural, and land use is agriculture (including coffee plantations) While the most extensive damage and loss of life occurred in the Pacific Lowlands to the west, the Central Highlands also incurred intense rains, record or near-record flood peaks (as indicated by high-water marks, destruction and damage to houses, roads, and bridges, and accounts from local residents), and numerous mudslides

Overview of Hurricane Mitch Rainfall

It is clear that rain, not wind, was the most devastating component of Hurricane Mitch in Nicaragua The report "Las Lluvias del Siglo en Nicaragua" (INETER, December 1998) provides a detailed overview of the storm and associated rainfall totals throughout the country According to INETER, the recurrence interval (or return period) for rainfall totals of October 1998 was greater than 100 years (less than 1 percent chance of occurrence in a given year) in the area of Chinandega, about 200 years (0 5 percent chance of occurrence in a given year) in the area of Jinotega, and greater than 500 years (less than 0 2 percent chance of occurrence in a given year) in the dry regions of San Isidro and Condega These figures emphasize the extreme magnitude of the storm in Nicaragua

The following information, including rainfall totals for the period October 21-31, 1998 and the percent of normal for the same 10-day period — that is, the percent difference from long-term average rainfall for the same 10-day period (based on the period 1966–98) — are taken from the INETER report

Region	Location	Elevation (m)	10-Day Rainfall Total (mm)	Percent of Normal
II	Chinandega	60	1,611 6	1,513 2
	Corinto	5	839 0	750 0
	Leon	60	1,113 4	1,052 6
VI	Jinotega	1,032	773 1	1,364 2
	San Isidro B (Matagalpa)	480	784 8	2,796 1
	Muy Muy (Mata)	320	392 0	630 0
III	Managua	56	544 9	811 2
I	Ocotal (Nueva Seg)	612	564 6	1,405 7
	Condega (Esteli	560	445 7	1,342 4
IV	Masatepe (Masaya)	450	662 7	774 3
	Nandaime (Granada)	95	391 0	331 1
	Rivas (Rivas)	70	494 9	603 0
V	Juigalpa (Chontales)	90	382 6	640 0

During the course of the storm, INETER lost 67 of its 346 meteorologic stations, and 27 of its 54 streamflow-gaging stations throughout the country The replacement and enhancement of this system should be considered a high priority for the recovery effort, in preparation for the coming rainy season

General Watershed Conditions

Dario and Matagalpa are situated along the Rio Grande de Matagalpa, which is formed at the confluence of two tributary streams near Matagalpa The river follows a circuitous route west and south out of the Central Highlands, then turns east and flows to the Atlantic Ocean The drainage basin is the third largest in the country (drainage area 18,445 square kilometers, INETER) and receives mean annual precipitation of 2,095 mm Based on the limited number of sites we visited, the Rio Grande de Matagalpa in Matagalpa Department has a fairly well-incised main channel and a well-defined floodplain In the area of Dario, the river system appeared to have conveyed the flood waters fairly efficiently and without substantial loss of capacity In the area of Matagalpa (near the headwaters of the drainage) there was some (localized) lateral migration of the channel, there also was some aggradation (1-2 meters) of the channel bed through the city

Jinotega is situated along the upper Rio Viejo (near the headwaters) in Jinotega Department Rio Viejo flows into Lake Managua (Lago Xolotlan) and ultimately is a tributary to Rio San Juan Rio San Juan has a drainage area of 29,824 square kilometers and receives mean annual precipitation of 1,694 mm (INETER) The flood caused substantial scour and fill of the channel bed, as well as widening and bank erosion The river has a fairly steep gradient in Jinotega and generally maintained its pre-existing channel alignment through town

The city of Esteli is situated along the upper Rio Estelí in Esteli Department Rio Esteli is tributary to Rio Coco, which forms much of the border with Honduras Rio Coco has a drainage area of 19,969 square kilometers and receives mean annual precipitation of 1,937 mm (INETER) In the vicinity of Estelí, Rio Estelí appeared quite unstable and probably received an oversupply of sediment (ranging in size from sand to boulders) from upland erosion during the flood It is unclear whether this condition of sediment influx was present before the Hurricane Mitch flooding occurred

We saw very little of the lower Rio Viejo system, which drains to Lake Managua, but this is a region of concern A hydroelectric dam (Santa Barbara Hydroelectric Emergency Spillway) on the river was destroyed during the flood, resulting in the loss of the reservoir pool and the rapid drainage of its contents downstream to Lake Managua Prior to the flood, the reservoir supplied flow to a 50 mega-watt power plant

Rio Viejo and Rio Grande de Matagalpa flow in close proximity to each other upstream from the Santa Barbara dam, near the town of Sebaco Based on accounts from INETER and from various local officials, flood waters from Rio Grande de Matagalpa broke through the drainage divide near Sebaco and contributed additional flood waters to the Rio Viejo system We were unable to visit this area during our trip, nor have INETER hydrologists had the chance to evaluate the changes that occurred there Such an evaluation will be important for design considerations during reconstruction of the spillway

Impacts of Flooding and Mud/Landslides

Extreme river flooding was clearly evident throughout the region, damage to roads and bridges was substantial Fatalities and housing losses generally were limited to developed areas adjacent to the rivers and to barrios built on steep hillsides surrounding the urban centers The lack of more-widespread urban destruction probably can be attributed to the sparse population density of the region and to the relatively efficient transport (at least in the areas we visited) of the flood waters by the river systems Mudslides (mostly small-scale, rotational-slip failures) were numerous throughout the region, but large-scale mass wasting was not evident The kind of large-scale mudslide damage that occurred in Honduras did not appear to be a major factor in this region (however, such damage might have become more prevalent in areas to the northwest, closer to the Honduras border, we did not visit those areas)

Dario

The town of Dario is situated along the left bank of the Rio Grande de Matagalapa in the hilly transition zone between the lowland plains and the steeper, more mountainous terrain near Matagalpa Just off the Pan-American Highway (CA-1), Dario has a population of about 9,300, and the entire municipality includes a regional population of about 40,000 Record or near-record flooding occurred in this reach of Rio Grande de Matagalpa (evidenced by high-water marks, damage to houses, roads, and bridges, and accounts from local residents) One of our stops along the secondary paved road adjacent to the river showed good evidence of the flood magnitude High-water marks (debris in trees) were 4-5 meters above the road level, and perhaps (my estimate) 15-25 meters above the low-water channel, the total width during the

flood appeared to be at least 100-150 meters, while the low-water channel (during our visit) was perhaps 15-20 meters wide

The majority of the flood damage in the Dario area occurred in the river's natural floodplain Houses flooded in Dario were situated in the low-lying areas adjacent to the river, where flood waters overtopped even the utility poles (perhaps 5-7 meters above the street), the river was said to have been near its peak for 3 days

We also visited the small farming village of Las Delicias, about 5 kilometers downstream from Dario This village was situated in the floodplain, on the left bank of Rio Grande de Matagalpa, and was destroyed by Hurricane Mitch flooding Observations of the flooded area showed that sediment (primarily sand and silt) had accumulated to a depth of 1-2 meters in houses and buildings, the well was also buried The residents were able to escape to higher ground and have relocated the village on the left bank of the river

Mudslide activity related to the intense rain was evident on the surrounding hillsides Slides were numerous, but localized, and did not appear to contribute substantially to observed damage If mudslides contributed substantial sediment loads to the river system during the flood, it was not evident The river channel and floodplain showed no evidence of capacity loss or aggradation of the bed The mudslide hazard relative to the population centers in this area appears small

Matagalpa

The flood-related damage to Matagalpa (population about 100,000) likewise was concentrated along the floodplain areas adjacent to the river Houses in the low-lying areas along the river were destroyed or damaged, there also was damage to roads and bridges adjacent to the river Mudslide damage occurred to housing in the barrios built on the steep hillsides on the outskirts of the city City officials provided us with a map of damages both along the river and in outlying barrios They were in the process of making repairs and seemed to have these problems generally under control Some displaced families in the outlying barrios were being housed temporarily in a camp not entirely free from mudslide hazards

Mudslides were more evident here than in the Dario area, and clearly had more impact on housing and roadways The mountainous terrain surrounding Matagalpa is densely vegetated with tropical forest Where mudslides had occurred, the exposed soil was reddish and appeared to have a substantial clay content Many potentially unstable material masses were observed on surrounding hillsides, and could be subject to release due to gravity or additional rainfall Though mudslides did not significantly affect the city itself, some risk to outlying barrios and to the road system still exist

Jinotega

Jinotega lies to the northwest of Matagalpa, near the headwaters of Rio Viejo, which drains to Lake Managua and is part of the Rio San Juan drainage basin The road from Matagalpa to Jinotega winds through mountainous terrain and was heavily damaged by flood waters and mudslides cascading from steep gullies on either side of the road The road is now open (with

detours around washed-out sections of road), but is subject to further damage from unstable masses of material that remain perched on the hillsides

Jinotega experienced damage similar to, though more extensive than, that in Matagalpa Being near the headwaters of Rio Viejo, the town normally does not experience large floods and so housing and other development encroached well into the floodplain The flood destroyed much of the zone adjacent to the river, as well as three bridge crossings, reconstruction efforts on these bridges were in progress during our visit Substantial damage from mud- and rockslides occurred in the barrios built up on the steep slopes above the valley, barrios on both sides of the valley were affected Residents were still living in the affected areas (many had repaired their damaged houses), because suitable land for relocation was not available

Estelí

Flood damages in the vicinity of Esteli were substantial Because the town is situated in a fairly open valley, mud- or rockslides did not significantly affect the town itself Extensive damage to bridges and roads was caused by channel widening and shifting of the channel in several reaches through the town Large parts of the population live on both sides of the river, and all major bridges in town were damaged or destroyed (though low-water crossings were in use) The most downstream bridge, built in 1938, was still intact but the channel had shifted some 100 meters to the north At another site, the bridge had been destroyed and a sewer siphon crossing the river severed, raw sewage was draining into the river (repairs are in progress)

The flood damage at Estelí was the most extensive of any urban area we visited

Channel Erosion and Sedimentation

All of the rivers that we visited are alluvial systems and are subject to erosion and sedimentation processes during floods Because of the magnitude of flooding from Hurricane Mitch, river channels were subject to widening (bank failures and erosion) and to scour or deposition of the bed These are normal processes that occur from one reach of river to another I did not observe any large-scale channel destabilization (excessive erosion or sediment influx) at the sites we visited on Rio Grande de Matagalpa or Rio Viejo The deposition of sediment in the floodplain bars (in the area of Las Delicias, for example) probably is normal The channel through Matagalpa showed some shifting of the low-water channel, as well as localized bed aggradation (that was being dredged by the city), but I did not see large-scale channel instabilities Channel capacities might have been improved overall — this seemed to be true in the reach near Dario, perhaps not in the reach through Matagalpa — though we did not make actual measurements Local instabilities do exist, and periodic dredging or channel-maintenance operations probably will be needed for some time

Rio Estelí, on the other hand, seemed to be destabilized by an excess supply of sediment from upland erosion during the flood The channel had widened substantially, appeared to have aggraded, and had changed its course in several reaches through town This instability might be expected to continue for some time into the future as this excess sediment is remobilized and moved during future flood events An assessment of river at and upstream from Esteli is needed

(aerial photographs and on-site surveys) to evaluate the channel and determine the best stabilization measures

Stability of River Reaches

It is impossible to broadly characterize the present stability of river systems throughout Nicaragua on the basis of our limited observations Rio Grande de Matagalpa in the area of Dario and parts of Rio Viejo did not seem to be significantly destabilized by the flooding Channel capacity may have been improved in some parts of these rivers However, local channel changes and instabilities can be expected to occur, particularly near Matagalpa and Jinotega, where the effects of erosion and sedimentation (including contribution of sediment from mudslides and other upland sediment input) are magnified in these smaller drainages

Rio Estelí seemed the most likely system to experience major channel changes in the future The area of the overflow from Rio Grande de Matagalpa to Rio Viejo also may have been significantly destabilized There may be other river systems (or river reaches) in Nicaragua that are now unstable and are subject to more channel changes (aggradation, lateral migration) in the future

Debris (including trees and large boulders) left by the flood will also affect the stability of these rivers We observed many large trees and tree stumps in many river reaches (especially in drainages around Esteli, to a lesser extent near Matagalpa) Such debris can be expected to affect channel stability in the future and might also threaten road and bridge stability when this material impinges on these structures during future floods

A reasonable evaluation of channel changes and river stability could be made with aerial photography of post-flood conditions (and comparison with pre-flood photography where available) This approach would be the best way to evaluate river stability in the short term (next rainy season) and probably the medium term (next 2-3 years) On-site surveys could be used for more-detailed analyses of specific areas of concern

River systems that were significantly destabilized by the flood can be expected to undergo changes for the next several years

Hydrologic Suitability of Resettlement Sites for Refugees

Resettlement sites that we visited generally were free from future flood or mud/landslide hazards, the exceptions were temporary housing sites in Matagalpa and Jinotega, where officials, aware of the ongoing hazards, were still trying to arrange suitable sites for relocation

Dario and Las Delicias

Many of the flood refugees within Dario have been housed temporarily at the local Instituto Ruben Dario (a privately funded institute established in honor of author/poet Ruben Dario, who was born here) Land for new housing (within the existing town limits) was donated by the church and is well outside of any flood-prone areas There is no landslide hazard The site has

adequate drainage and water supply is accessible The site is entirely suitable relative to natural hazards concerns

The relocation site for Las Delicias is on the opposite (right bank) side of the Rio Grande de Matagalpa, just downstream from the old town site The site is flat and is outside the high-water limits of the Hurricane Mitch flood Though situated near the base of some low hills, the danger of destructive mud/landslides appears small

Matagalpa

City officials recognized the mudslide hazard for families living in barrios on the hillsides The only resettlement site we saw looked to be free from flood or mudslide hazards Fifteen families were still living in a temporary camp until the permanent site was complete The temporary site was subject to mudslides, so these families should be moved as soon as possible

Jinotega

Here, too, officials were aware that families affected by mud/landslides were still being housed in potentially dangerous areas (they had returned to their old homes) The problem here is the cost of land There is suitable land in the municipality, but the land is privately owned and the municipalities cannot afford to buy it They are continuing their efforts

Estelí

The new housing site in Esteli is situated on the east side of Rio Estelí, near the existing developed areas The site is on a broad, flat plain that is well outside the floodplain and is not subject to any mud/landslide hazards There is access to water supply, and drainage trenches have been dug to carry waste from latrines All (or most) of the latrines were in place during our visit

Tipitapa/Tierra Prometida

We visited a refugee camp called Tierra Prometida near Managua on January 21 This site presently houses 1,500 people who were displaced from the flooded shores of Lake Managua There is no flood or mudslide hazard at this site However, the ground is covered with a thick layer of fine volcanic dust that likely will cause drainage and access problems when it rains The residents were walking some 2 kilometers for water during our visit, a water tank had been delivered to the site, but was not yet operational

Recommendations ***(Terms short=6 months, medium=2 years, long=>2 years)***

Enhance the information transfer between INETER and the municipalities INETER has a great deal of data and expertise that could be used and applied by the municipalities during reconstruction This information transfer seems to be lacking (or at least is very limited) at this time *(Short and medium term)*

Provide assistance and technical training to INETER in the areas of hydrologic data collection, mapping, and modeling (in particular, rainfall-runoff models) Such assistance could be provided by the USGS and the Corps of Engineers *(Medium and long term)*

The hydrologic and meteorologic monitoring networks operated by INETER were substantially damaged by the flood I recommend funding to provide equipment and technical support to INETER for repair/replacement of these gages *(Short and medium term)*

Using aerial photographs and on-site surveys, assess watershed changes that occurred in the area of overflow from the Rio Grande de Matagalpa drainage into the Rio Viejo drainage Such an analysis will be important to properly design and rebuild the hydroelectric dam at Santa Barbara *(Short term)*

Using aerial photographs (and possibly ground surveys), assess channel changes and upland sediment sources that have destabilized Rio Estelí in the vicinity of Estelí This assessment will be important to ensure the proper reconstruction and maintenance of the roads and bridges in Esteli *(Short term)*

Use aerial photography (pre- and post-flood) to assess river systems where stability concerns are critical Such areas might include cities and towns greatly affected by significant channel changes, as well as channel changes that have occurred along the Rio Negra and the Rio Coco (which form much of the border between Nicaragua and Honduras) *(Short and medium term)*

INETER Contacts (meeting of January 28, 1999)

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Volcanic Landslides, Debris Avalanches, and Debris Flows in Nicaragua Resulting from Hurricane Mitch, October-November 1998: Recommendations for Mitigation

Introduction

USGS staff (Mark Smith, WRD, Richard Smith, NMC, and myself) accompanied a USAID mission to evaluate housing issues and resettlement needs in Nicaragua The mitigation strategy I outline in the final section of this trip report is critical to this effort

My summary is based on the 10-day mission to Managua, including a 4-day field trip by the "West Team" consisting of Robert Kehew (PADCO), Fernando Cruz (consultant for USAID), Eric Nelson (Corps of Engineers), and myself Our field destination was the coastal zone of active volcanoes northwest of Managua This zone, including Managua and extending southeast to Lake Nicaragua, suffered approximately 80-90 percent of the 1998 fatalities and a similar proportion of economic loss It contains more than 80 percent of Nicaragua's population

The coastal zone contrasts sharply with the highlands of north-central Nicaragua My observations only in the southwesternmost highlands indicate that damage there was a less-intense version of that in much of Honduras I believe that the general recommendations by Ed Harp (USGS) for Honduras will apply to the Nicaraguan highlands as well The report from our colleagues visiting the highlands indicates specific study areas like those identified in Honduras I made a specific recommendation to the mayor of Somotillo, in the southern highlands, regarding significant risk to a village from an active landslide at Cerro El Coyote I also put him touch with geologists at INETER for further advice

The main disaster, and a major element of future risk in this coastal zone, was the hurricane-induced collapse (volcanic landslide) at Casita Volcano A 200,000 m^3 landslide (estimate from Sheridan and others, 1998) transformed to a debris avalanche and then to a debris flow (lahar, or volcanic "mudflow") that extended over 7 km and obliterated two towns in the municipality of Posoltega That flow branched and evolved into more dilute lahar-runout flows that inundated areas from 7-15 km downstream (inundating ~5-8 km^2) The mayor of Posoltega counts total fatalities at 2,513 This total is higher than that cited in the press, possibly because those accounts included only the dead specifically in the two towns

Scope of Observations and Sources of Information

The West Team met with mayors and their staffs at Leon, Chinandega, Chichigalpa, Posoltega, Somotillo, and Telica We were escorted to sites of flood damage in each municipality At Posoltega we visited the main area of lahar inundation from Casita Volcano with the mayor We talked with survivors in refugee camps, including a woman who had outrun the lahar and made valuable observations of its behavior In addition to the many agencies and staff with which we met as a group, I met individually with the following personnel of the USGS-analog agency, INETER

- Dr Wilfried Strauch (senior research scientist and a seismologist)
- MSc Fabio Segura (Director of Geophysics)
- Ing Martha Navarro (Director of Volcanology)

The Disaster at Casita Volcano

The catastrophe at Casita Volcano is described in detail because of its implications for future risk and as the basis for the mitigation strategy proposed in the final section Some of the following information is from the account of Sheridan and others (1998), but all statistics were verified in the field or are my direct field observations

Precipitation of 484 mm on October 30, 1998 (INETER, 1998) triggered a volcanic collapse of the dimensions noted above at approximately 11 00am Most of the failed mass transformed directly to a debris avalanche on the flank of the edifice and much of it then transformed directly to a debris flow (lahar) at the base of the volcano En route down the volcano flank, the flow front engulfed and destabilized much saturated material that was both entrained in the flow and formed the dilute tail of the flow wave Almost certainly, no damming of flow or delay in transformation was involved (to be verified by detailed field study) Flow velocity to the base of the volcano is estimated to have been $>>$ 25 m/s, based on runup heights seen on photos and the velocities of similar flows elsewhere (data from Pierson, 1998) Velocity of the flow front then decreased to the range of 20-25 m/s over the next 5 km, whereupon flow inundated the towns of El Porvenir (pop ~650, previous name on all maps is Augusto Cesár Sandino) and Rolando Rodriguez (pop ~1,250) Terrain at the town sites was gently sloping (the towns were separated by a small channel), and flow widened to as much as 1 5 km Depth of the catastrophic flow at that point was highly variable, being as much as 10 m Average flow depth was in the range of 3-4 m Virtually all traces of both communities have disappeared, and the sites are buried under 0 5- 1 5 m of muddy gravel and scattered boulders that will prevent future cultivation

Survivors described the noise of the flow as like a squadron of helicopters (much Sandinista-Contra fighting occurred near here) Some then looked up and saw it coming (before it arrived, the flow was visible from the towns in spite of heavy rain and mist) Actual time between sensing the flow (ground tremor also occurred) was estimated at 2-5 minutes in most accounts I read in newspaper articles from La Prensa of Managua One survivor with whom I talked and who ran for her life reported, however, that "it could have been seconds, minutes, or centuries " This is the first example I have recorded of a catastrophic debris flow (seismogenic and eruption- or precipitation-induced) in which most of a large populace could not have survived had they recognized the significance of the initial rumble and tremor and immediately sought high ground This is due primarily to the large width of the flow at Casita, and this is in turn due to the largely undissected alluvial fan ("ring plain" in New Zealand) that surrounds that volcano and many other Nicaraguan volcanoes

The flow volume increased markedly by bulking (sediment entrainment by erosion) on the flanks of the edifice, possibly to as much as 2 0 X the volume of initial failure from the summit Flow attenuated rapidly between 7 and 12 km from the volcano, and the runout flows were largely confined to previous drainage courses (similar to incised arroyos or washes on alluvial fans) at the crossing of the main highway Conveyance of all downstream channels was enlarged 1 5 to 2 X by erosion and clearance of vegetation by the runout flows

The following general and specific characteristics of the disaster are the basis for the proposed mitigation strategy My proposals for mitigation differ from those made by Carreño (1998) I emphasize that the potential for Casita-type disasters does not reduce the vital importance of seismic monitoring for volcanic activity as supported by the continuing OFDA program with the Volcanic Disaster Assistance Program (VDAP) of the USGS

1 Landslides from volcanoes are common and have taken many thousands of lives throughout the Western Hemisphere See the monograph by Scott and others (in press) and the training manual on hydrologic hazards at volcanoes by Pierson and others (in press) These landslides are extremely dangerous because the failed material is commonly clay-rich, the result of alteration by hot, acid-rich water, and because volcanic edifices contain abundant groundwater Consequently, a large volcanic landslide commonly transforms to a highly mobile lahar, a slurry of mud, rock, and water that may travel many tens of kilometers Lahars look and behave like flowing concrete

2 Many such lahars are triggered by destabilization accompanying magmatic activity or are directly associated with an eruption Seismic monitoring generally provides pre-event warnings Other lahars of landslide origin are triggered by rainfall, tectonic earthquakes, steam explosions, or simple gravitational collapse These, like the flow from Casita, lack pre-event warnings The following Nicaraguan examples in this second category were noted by Wilfried Strauch of INETER, and the El Chonco case history was brought to my attention by the mayor of Chinandega

Year	Volcano	Trigger	Fatalities
Possibly historic	Casita (same flank as 1998)	?	?
1670 (?)	Mobacho	Tectonic earthquake*	~400
1950 (?)	Cosiguina	Tectonic earthquake*	1,000
1960	El Chonco	Storm precipitation	60
1996	Maderas	Storm precipitation	7
1998	Casita	Storm precipitation	2,513

* Triggering earthquake was tectonic in origin per seismologist W Strauch

Note that this disaster, like nearly all such catastrophes, occurred at the site of a previous analogous flow That flow originated from the rim of Casita just clockwise from the origin of the 1998 flow It may have occurred in historic time (here, post-1524) Incidentally, while doing ad hoc volcanic stratigraphy at the site of Nicaragua's first capital, León, destroyed in 1609-10 by earthquake and eruption of V Momotombo, I noted that a Mitch-initiated

gully had just incised a series of pre-eruption burials near the cathedral ruins We reported the site to the park guide

3 Renewed failure from the zone of 1998 failure is probable at an unknown but possibly large scale Reforestation of the precipitous failure site is impractical No repopulation of the sites of the previous communities must be permitted Avoidance of this and other high-risk zones is the key to mitigation

4 The lahar-inundated area will be suitable for grazing Lahar deposits are commonly fertile because of the content of fine sediment The 1998 deposits at Casita also contain a significant proportion of eroded soil The area cannot be readily cultivated with large-scale equipment because of the abundance of coarse sediment

5 The area is proposed for a possible national park However, revegetation will occur so rapidly that, within several years, the evidence of the flow will no longer be visible, thus reducing the appeal to tourists Any permanent park should be based on other attributes of the landscape, which, frankly, are not obvious

6 Post-lahar sedimentation in downstream areas of the municipality will be significant in coming wet seasons before revegetation is complete Revegetation after wildfires in similar terrain and vegetative cover takes approximately 4 5 years If the equipment is available from the U S military or at modest cost, helicopter seeding of the downstream lahar deposits would be cost-effective However, revegetation is occurring rapidly, we observed banana trees 0 7 m in height on the fresh deposits

7 A significant component of the risk analysis is the potential for failure as related to the degree of alteration of the edifices Casita and El Chonco are both old, altered satellitic structures, both of which have failed, on the flanks of active San Cristobal, which has not failed in historic time Some volcanoes will present markedly less risk of hydrologic debris flows than others Nevertheless, GIS modeling involving extrapolation of a range of possible failure volumes can be a very useful additional approach (Iverson and others, 1998)

8 A significant component of the risk analysis is the frequency of prehistoric flows Efforts toward dating and mapping older flows, within the time necessary for short-term mitigation, should be maximized Areas of high risk of collapse are revealed in this manner

9 The areas of 1998 sedimentation, both downstream from Casita and elsewhere, can be readily and quickly mapped on the Landsat images These areas can be analyzed statistically to define causes of high sediment yields rapidly and interpreted to define the risk to resettlement sites Randy Updike (USGS, GD), in his preliminary inspection of the post-Mitch photos and imagery, has noted higher landslide frequencies in areas mantled by tephra (volcanic ash deposited downwind from an erupting volcano)

Proposal for Response to Hurricane Mitch in Nicaragua Risk Assessment for Relocating Survivors

The following is a first-approximation, detailed version of the "Volcanoes" component of the USGS Proposal for Response to Hurricane Mitch (see p 11 of that document)

The short-term need to relocate survivors to permanent sites requires rapidly compiled risk-analysis maps *Note (1) This is the view of virtually all municipal officials with whom we talked (2) It is, with reconstruction of the hydrologic/meteorologic network, the first item of priority of INETER Director Claudio Gutierrez (3) Survivors expressed widespread scepticism about the safety of the areas to which they had heard they were to be moved I agree with them — several such areas are clearly at high risk*

I propose a short-term, 1-year, joint USGS/INETER program to prepare the maps that will identify areas unsafe from both volcanic debris flow hazards, whether rainfall or seismically triggered (both triggers lack pre-event warnings), and to integrate this analysis with all existing volcanic hazard assessments in Nicaragua

Specific Short-Term Products

Risk-assessment maps of drainages of 10-12 volcanic centers (number estimated by INETER staff) This will include most of the populated areas in the coastal zone and approximately 80-90 percent of the Nicaraguan population

Specific Long-Term Strategic Goal

Strengthen INETER and increase its capability to respond to the needs of municipalities on issues of geologic and hydrologic hazards

Specific Line Items (approximate, with no overhead)

A	1 25 person-years senior USGS staff (a full-time PI will be assigned) based at the Cascades Volcano Observatory The PI will be in Nicaragua about 25 percent of the time and should have interdivisional expertise (i e , geologic, water resources, and national mapping divisions of the USGS)	110 K
B	Travel/PD, USGS	25 K
C	INETER staff 4 full-time, temporary positions, including 1 or 2 cartographic illustrators (to expedite existing INETER staffing plans)	130 K
D	In-country travel/PD and vehicle costs, INETER	35 K
E	Training and out-of-country travel for INETER staff	20 K
F	Computer hardware/software for INETER and training in GIS techniques, preparation of digital elevation models of the 10-12 study volcanoes	60 K

G	Preparation and distribution costs of CD-ROM and map products (provided without cost to municipalities)	40 K
H	Stereo-coverage with latest aerial photography per Open-Skies treaty, 400 images @ ~$10/image	4 K
I	Landsat Imagery, 5 @ $4,800	24 K
J	Acquisition of other satellite imagery, such as AVIRIS	40 K
K	Radiocarbon AMS dating, 40 @ $375	15 K
L	Helicopter seeding of lahar-inundation areas upstream from Posoltega (if equipment available)	5 K

Other

M	Possible installation of Acoustic Flow Monitors (AFM) (in case very high risk is identified upstream from significant populations) AFMs are small, solar-powered seismometers that detect the specific frequency of a moving debris flow	Future Supplementary Request
	Approximate Total	508 K

Note by KMS All above are subject to further refinement and agency review

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Sheridan, M F , Siebe, C , Bonnard, D , Strauch, W , Navarro, M , Cruz, J , and Buitrago, N , 1998, Informe sobre la avalancha y el flujo de agua con sedimentos, en el Volcan Casita, Nicaragua, disparados por el Huracán Mitch Anexo I of INETER, 1998, pps 141-143

Fact Sheet Catastrophic Landslide and Lahar at Casita Volcano, near Posoltega, Nicaragua, October 30, 1998

What happened?

A landslide was triggered near the volcano summit by intense rainfall from Hurricane Mitch at 11 00am on October 30 The landslide became a lahar (volcanic mudflow) and flowed 4 miles to overrun the towns of El Porvenir and Rolando Rodriguez in the municipality of Posoltega Both towns were "new" communities planned and settled during the 1980s Posoltega mayor Felicita Zeledon reports that as many as 2,513 people died Other estimates are in the range of 1,600-1,800

Why did it happen?

Volcanoes have plumbing systems of hot, acid water that gradually changes hard rock to soft clay When this material fails, it commonly forms a lahar — an Indonesian word used for the mudflows around the Pacific "Rim of Fire" that have taken many tens of thousands of lives

Why were so many killed by the lahar at Casita?

It occurred without warning and flowed at a speed of nearly 40 miles per hour from the volcano Near the towns the flow was 10 feet deep and nearly a mile wide Moving lahars look and behave like flowing concrete, and they can destroy almost any man-made structure No trace of El Porvenir or Rolando Rodriguez remains

Why did a few survive by running uphill to safety?

They heard the flow (a roar "like helicopters") or they sensed the ground vibrations of boulders crashing in the flow

Is this type of catastrophe common?

Yes, many lahars are caused by magmatic activity (intrusion of molten rock) or by volcanic eruptions Others are triggered without warning by rainstorms and earthquakes USGS scientists know of four pre-1998 catastrophic lahars of this second type in Nicaragua alone

Can the U S Geological Survey help Nicaragua avoid these tragedies?

YES, by working quickly with our sister agency, INETER (Nicaraguan Institute of Territorial Affairs), to make maps of high-risk areas around 10-12 volcanoes where resettlement must not be allowed and where future development and other new towns must be not be located Longer term, this cooperative project will strengthen INETER to respond to natural hazards in the nation's municipalities

We can identify places where a device invented by USGS scientists — the Acoustic Flow Monitor (AFM) — may be justified This small solar-powered device can detect moving lahars AFMs are installed at, among other dangerous volcanoes, Mount Rainier

Analogy with lahar risks at Mount Rainier in Washington State

The risk of lahars of collapse origin at volcanoes in Nicaragua is vary comparable to that risk at Mount Rainier At Mount Rainier, critical facilities are restricted in potential lahar pathways as far as 100 miles from the volcano Ten AFMs are installed in the two major river systems leading to the main industrial corridors of Seattle and Tacoma

ASSESSMENT OF GEOGRAPHIC INFORMATION NEEDS FOR HURRICANE MITCH: RECONSTRUCTION RESPONSE IN NICARAGUA

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Assessment of Geographic Information Needs for Hurricane Mitch: Reconstruction Response in Nicaragua

1 Scope of Report

Assessment of base geographic data needs for reconstruction and hazards mapping projects to be completed in a six-month to two-year time frame

2 Methodology

AID sponsored informational meetings detailing impact of Hurricane Mitch on components of Nicaraguan housing and infrastructure One field trip to gather on-site assessment of municipal level capabilities as potential sources for hazards and other geographic data pertinent to reconstruction and mitigation projects

2 1 Field Trip Portion

Four municipalities in the central highlands of Nicaragua were visited by the author of this report Ciudad Dario, Jinotega, Matagalpa, and Esteli They represent an adequate sampling of the type of settlements and civil infrastructure common throughout the country Typically, the mayor, a housing representative, and a civil engineer were present and available to answer questions posed by the team members in their fields of expertise A Field Report, specific to geographic data systems in these municipalities, follows at the end of this report

2 2 Meetings

Meetings with USGS team members and their central government counterparts within the Nicaraguan mapping authority (INETER) took place on 26 January at the level of the Director of INETER and, at the invitation of the director, on 28 January 1999 at the working level Comments and any recommendations stemming from those meetings will be included in the final report of the USGS team

3 General Comments, Recommendations, and Costs

3 1 General Comments

The recommendations contained in the mission summery require two levels of geographic data collection and organization, in effect small- and large-scale database development

- Level 1 — small-scale The proposed reconstruction of the national hydrographic monitoring network, to enable longer-term hydrologic modeling, and the proposed geologic hazards mapping would each require common layers of geographic information For example, topography, to derive slope and aspect, and soils, including measures of porosity, organic content, and depth, are two common layers There would also be project-specific data and information requirements Geologic sampling for the purpose of geologic material dating and drainage topology for hydrologic modeling are just two examples
- Level 2 — large-scale Engineering tasks would require site-specific information, typically at higher orders of accuracy In a few cases — Estelí, for example — some may be readily accessible For each task a project-specific assessment would be made by the design and

construction engineers Some of this data (core samples, flow measures) could provide valuable ground truth or source data for work performed at Level 1

3 2 Recommendations

Given the need for common layers of data and information for both hydrologic modeling and hazards mapping, I recommend that a data assessment phase be engaged, in order to establish the minimum level of accuracy required to satisfy both reconstruction and mitigation endeavors

3 3 Cost Estimates

Costs will be driven by multiple factors, including

- minimum accuracy requirements of common data layers,
- spatial extent of study or mitigation area,
- source data format and availability,
- equipment (hardware/software), and
- project staffing

4 Field Report

4 1 Municipal Assessments

4 1 1 Ciudad Dario, Jinotega, Matagalpa

In each of these municipalities a lack of a modern system of maintaining geographic information was apparent In Ciudad Dario the civil engineer carried and referenced a 1 50k topographic map when discussions related to relocation of housing with respect to natural hazards In Jinotega a system of producing appropriate municipal-level maps and planning graphics exists and is in use When asked about the system for maintaining this information, the planning representative confirmed that a paper-based archive served that purpose Matagalpa had essentially the same capabilities as Jinotega

4 1 2 Estelí

Esteli demonstrates how well a municipal-level office can succeed at what is officially a central government function (cadastral survey) The Estelí Public Works office has a Microstation mapping system containing cadastral-level data There exists a program for collecting this data in the Estelí province as well INETER has within its domain a cadastral-level mandate and confirmed in later discussions that there exists a program of coordination with Esteli in the collection and distribution of such information

4 2 Site-Specific Recommendations

4 2 1 Dario

At the very least training in collection and maintenance of data pertaining to municipal planning At a later date the introduction of a hardware/software package enabling the display and production of graphics should be considered

4 2 2 Matagalpa

See comments regarding Jinotega (next)

4 2 3 Jinotega

Here there is potential for conversion of existing paper archives and modernization of their information and mapping system There is evident skill in mapping Coordination with INETER to ensure system compatibility and exchange of data should begin in the short term with a longer-term aim of supporting an equipment modernization program

4 2 4 Estelí

There is little to offer in terms of training, the quality of their products and capabilities of the staff was evident I would recommend a move toward a relational database model for their data storage, enabling a more flexible use of their system

Richard F Moore
The U S Geological Survey

USAID NICARAGUA MISSION
HUD DRAFT REPORT

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1 Empowering and Building the Capacity of Municipalities

1 1 Ensuring Successful Integration of Population in Urban Areas

The municipalities of Nicaragua are weak and lack resources, they depend on sale and property taxes for revenues and receive no money from the central government They have created an organization, AMUNIC (Association of Municipalities of Nicaragua) to help each other toward common goals and objectives There are a number of strategies municipalities can use to plan for successful integration of affected populations in established areas **HUD would assist in exploring strategies for municipalities to use in successfully integrating the displaced population**

1 2 Managing Urban Growth and "Sprawl"

Urban growth is creating new issues for municipalities The rate of migration to urban centers will likely increase as a result of Hurricane Mitch **HUD would promote the exchange of information on strategies and approaches to managing growth by bringing together U S officials, Nicaraguan municipal officials, and AMUNIC**

1 3 Collecting and Using Data and Statistics for Urban Planning and Management

Data and statistics will be critical tools for managing the allocation of resources to various classes of victims Such information will be critical to manage development and financial resources and mechanisms for housing **HUD can assist in the collection, analysis, and use of data and information on income, housing stock, ownership, and the composition of communities** Assisting with the enhancement of such capacity locally would have enormous benefits related to reconstruction efforts and long-term development

1 4 Clarifying the Municipal Role in Disaster Management

Municipalities do not have the authority to relocate people and purchase land Sharing authority and responsibility between municipalities and the central government in Nicaragua is a challenge **HUD would focus on catalyzing interest of U S municipalities in working with Nicaraguan municipalities, AMUNIC, and central government authorities to explore how different levels of government collaborate when there is a disaster**

2 Financing Mechanisms

2 1 Fostering Mainstream Lender Entry into the Market for Low-Income Borrowers

Although there is a very low income sector of the population that will not be able to afford to borrow for housing (especially with interest rates as high as 38 percent), there is a sector of low- to medium-income families that would be in a position to do so Critical to the large-scale availability of financing for this population is the involvement of mainstream lenders **HUD would bring together mortgage bankers and others to work with Nicaraguan banks and institutions in developing strategies for lending to this sector of the population**

2 2 Sharing Models for Community Banking

HUD would focus on examining (and helping adapt) models for community and cooperative banking that have been used in poor communities and urban areas in the U S The focus would be on working with NGOs and other local community groups to develop self-help banking strategies

3 Enhancing Building and Construction

3 1 Assisting NGOs and the Private Sector in Enhancing the Design of New Housing

As designs are developed for different housing solutions, small low- and no-cost design modifications could improve the safety and durability of buildings **HUD and its partners (the National Association of Home Builders [NAHB] and others) would provide technical assistance to NGOs, groups designing housing for displaced persons, and others HUD would further promulgate and disseminate beset practices through these channels in the future**

3 2 Promulgating and Disseminating Best Practices for Construction

Improving the quality of construction will help reduce future risks By working with universities, the Nicaraguan Contractors Institute (CNC), the Nicaraguan Institute of Engineers and Architects (INIA), and other sectors of the housing and construction industry, **HUD and industry partners will help foster the exchange of information and technology cooperation to improve building technology**

3 3 Assisting with the Development of Locally Appropriate Building and Construction Codes and Standards

Building codes and standards will enable standardization and will ensure improved safety **HUD would work with partners, such as the National Conference of States on Building Codes and Standards (NCSBCS), and with local Nicaraguan organizations, such as CNC, INIA, and AMUNIC, to promote the development of codes and standards**

3 4 Assisting in the Promulgation and Dissemination of Sound Land Planning and Development Practices

Working with the American Planning Association (APA) and others, **HUD will help develop sound land planning practices and land acquisition and titling strategies on low-cost natural hazard mitigation designs**

3 5 Involving the Private Sector to Promote Revitalization and Technology Cooperation

there is an enormous interest in U S industry in helping support reconstruction and promote investment and trade with all the countries of Central America, this would foster economic revitalization by providing foreign exchange and employment **HUD would focus on helping stimulate joint ventures in housing and construction that would promote local production while supplying needed goods and materials locally and to the U S In partnerships with the**

NAHB and others, HUD would focus on bringing together potential Central American and U S partners

3 6 Designing and Procuring Basic Housing Solutions for Displaced Families

In the short term, moving refugees from shelters (such as schools, churches, and public buildings) to temporary housing solutions first and later to permanent and safe dwellings will be critical to staving off migration and successfully reintegrating displaced families into society HUD offers the greatest access to technological know-how and to U S private sector entities interested in assisting reconstruction through donations and at-cost contributions of skill labor and materials **HUD would design and procure basic housing solutions for distribution/sale to new land owners Materials could be procured locally, when appropriate, and designs tested HUD's procurement of basic materials "kits" could flow into a distribution and financing mechanism jointly developed with USAID and others, and implemented by USAID and its local partners**

WORKFORCE DEVELOPMENT IN POST-DISASTER RECONSTRUCTION: A ROLE FOR NONGOVERNMENTAL ORGANIZATIONS WORKING IN NICARAGUA

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1 Introduction

1 1 Response

Immediately after Hurricane Mitch ran its devastating course over a large area of Central America from October 27 to November 1, 1998, nongovernmental organizations (NGOs) in Nicaragua mobilized their resources to assist survivors, by clearing damaged home and roadways and delivering emergency medical and food supplies The network of local NGOs and international NGO affiliates facilitated a quick response to the immediate needs of hundreds of affected families and dozens of communities

The scope of the assessment conducted on site by the United States Government Inter-Agency Task Force between January 19 and January 30, 1999 focused on damage caused by Hurricane Mitch to shelter and municipal infrastructure in Regions I, II, and VI comprising the Departments of Nueva Segovia, Madriz, Estelí, Leon, Chinandega, Jinotega, and Matagalpa Approximately 371,000 persons were directly affected by evacuation from their places of residence, resulting ultimately in 65,000 persons needing temporary shelter The direct and indirect cost of the damage estimated immediately following the hurricane by the World Bank is US$900 million, this is based on a depreciated value of built structures By comparison, the Nicaragua 1998 economy produced a bit over US$2 billion GDP The human toll was 2,863 dead, 968 missing, and 25,000 homes damaged or destroyed [1]

Three months after the event, flooded areas began to sprout new signs of life, denial of loss was slowly being replaced by acceptance of the circumstances Nicaraguans are resilient, having been tempered by fate and history Expectations of immediate solutions have given way to practical considerations and long-term planning The lands that were severely damaged will not likely be inhabited for years to come, if at all Relocation was imminent particularly for the survivors of the communities of El Porvenir and Rolando Rodriguez sited at the base of Las Casitas volcano that were buried by the lahar — a debris *cum* mudflow triggered by the collapse of a hyper-saturated volcanic wall Throughout the regions, poorly designed bridges have to be rebuilt, roads and houses repaired Planting the next harvest crops (primera) before the spring rains figured as a priority, with or without outside help One binding hope is reliance on the local community and the civil society associations that proved valuable during the war years With differing degrees of success, the NGOs represent a viable, though limited, resource for reconstruction support after natural disasters

There are more than 100 registered NGOs operating in Nicaragua today In each of the 9 regions and corresponding 16 *departamentos* and 147 *municipios*, there is at least one affiliate of a national-level NGO and one local chapter of an international NGO, such as the Red Cross In addition, local-level NGOs composed of associations, foundations, and cooperatives provide a variety of services, some with high quality others with a bit less Included in the Nicaraguan NGO category are faith-based radio stations, social service agencies, and private foundations with no specific purpose

[1] Data provided by the Secretaria de Accion Social

This paper is a companion piece to the main report produced by the Inter-Agency Task Force [2] Readers are referred to the main report for technical descriptions of the atmospheric phenomenon The field work timeline did not allow for a thorough assessment of the NGO community and its response in the aftermath of Hurricane Mitch Therefore, the discussion developed is based on anecdotal information gathered through several interviews with NGO representatives in Nicaragua and by telephone from Washington, DC, as well as printed information available at the time of writing Recommendations center on the opportunity the disaster opens for expanding employment options among the displaced workforce

1 2 Purpose

The purpose of this paper is twofold (1) to present a summary of the response activities carried out by key NGOs in the affected regions of Nicaragua and (2) to propose a concept that can offer hope for better employment options for those displaced by the flooding The recommendations are the result of introspection about innovative roles that selected NGOs can have in support of long-term reconstruction activities With regard to point (1), there is really little new to report that has not been tried in other disaster rehabilitation/reconstruction work worldwide, and it is too early to know how effective the current efforts will be With respect to (2), a different twist may be to consider the results of displacement among workers and households and envision what the people most affected need as the economy enters the next millennium The focus is on *workforce development*

1 3 Consistency with USAID Objectives

Another challenge is to make a simple recommendation that meets present resource constraints In this manner, scarce resources can more effectively reach families and individuals whose income-generation possibilities were curtailed by the flooding The proposed initiative is consistent with USAID/Nicaragua strategic objectives Workforce development fits in with Program Component No 3, "improved resettlement solutions," proposed by the Task Force members, and supports Mission Strategic Objectives (SO1 and SO2) [3]

2 Background

In the regions most affected by Hurricane Mitch, there are approximately 76 NGOs offering a variety of services to the community Of these, there are about 10 U S -based NGOs[4] with their local affiliates, plus the Government of Nicaragua (GON) agencies, such as INIFOM, INETER,

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[2] U S Government Inter Agency Task Force AG International/PADCO Inc et al After Hurricane Mitch Shelter and Municipal Infrastructure Reconstruction in Nicaragua Proposed Action Plan March 1999

[3] USAID/Nicaragua strategic objective (SO1) calls for 'more political participation, transparency and compromise, particularly better governance at the municipal levels SO2 sustainable growth of small producers' income and employment covers agricultural small farm programs as well as micro-enterprise development and expansion A special objective that responds to the post hurricane reconstruction activities to be implemented over a two year time frame is in the process of adoption

[4] USAID refers to Private Voluntary Organizations as PVOs

the Ministry of Health, and the Ministry of Education, as well as the municipalities themselves, which are poised to extend social services in their particular domain

2 1 Characteristics of Civil Associations in Nicaragua

The preponderance of NGOs in Nicaraguan is locally based, and reflects a society that is firmly based on family ties Any local civic organization becomes an extension of a social group, thereby placing "organizational structure" at a point below that of personal influence in distributional matters Local NGOs reflect in general the participation of extended family members It is not surprising to discover that a foundation or association is created to protect a family interest Recognition of this structure helps explain the alliances that have been formed over the years, resulting in amazing contradictions to outside observers

Consider for example the communities of the Atlantic coast and imagine what kind of organizations might be more-effective vehicles for channeling donor assistance there as compared to Chinandega In the Atlantic North and South regions, the core language spoken is English based, the people are of African descent mixed with Miskito Indian (Mosquito Coast dwellers), the economy is oriented toward Caribbean markets, and the infrastructure is inadequate to sustain regional growth Even the folk music is different than that enjoyed in Managua The civil society organizations on the Atlantic coast reflect these particularities, which are dramatically different from conditions in the western departments and in Managua Therefore, the political dynamics of this region in relationship to Managua, for example, result in vastly different political postures During the Sandinista years, the Atlantic coast cities of Bluefields and Puerto Cabezas were ignored by progressive politics that affected more dramatically the communities west of the Cordillera Isabela and Dariense Boaco and Matagalpa in the central highlands became the "liberated" departments

Throughout Nicaragua, family-owned farms and businesses held together during the Sandinista years despite the attempt to redistribute their holdings One of the more contentious issues facing Nicaraguan society today is the repatriation of lands that were taken away from titled owners during the Sandinista revolution During the hardest times, it was the cohesive structure of family ties that bound the country together, and those ties also continue to bind local civic organizations

Thus, there are few NGOs in Nicaragua that truly embrace a larger audience When international donors looked for a neutral partner in distributing relief to Hurricane Mitch survivors, the church was the chosen agent

2 2 Efficacy of NGO Community

International relief agencies, such as the Adventist Development and Relief Agency (ADRA), CARE, Catholic Relief Services (CRS), Save the Children, and the Red Cross, have developed an in-depth knowledge of the local setting, the people, and the institutions When partnered with local affiliates or community-based NGOs, the combined efficacy is tremendous This power came into play immediately after the hurricane struck when relief efforts got under way Without the network of community organizations, many more would have died or suffered major injuries

A measure of the efficacy is how ADRA distributed 420 tons of corn and soy blend cereal, 98 tons of vegetable oil, and enough food rations to feed 57,000 people for one month ADRA's warehouse in Ocotal received and transported 1,112 tons of USAID food from Managua's airport In cooperation with Project Concern International and Save the Children, food containers were transported by truck to refugee centers as far away as Nueva Segovia The Nicaraguan military also collaborated in delivering 3,000 bags of cereal (25 kilos each bag) and 3,000 4-liter cans of vegetable oil to the departments in the north of the country During March, ADRA plans to build 300-500 two-room homes in the affected regions The homes are designed with cement floors, block walls, corrugated steel roof, and individual latrines — a far cry from the temporary shelters that consist of plastic sheeting, a tin roof, and a dirt floor Medical volunteers comprise the cadre of technicians that ADRA deployed in Nicaragua In one press release dated January 25, 1999, ADRA boasts that " a medical team of seven from Miami holds the ADRA record for treating the most victims in one day 420 victims who had everything from the flu to leg fungus to dehydration "

Another strength of the NGO community is its ability to reach out to those most in need, the poor, and the isolated The international NGOs have a committed staff placed in key locations throughout the country During normal times, these workers are fomenting relationships that bring vital intelligence when disaster strikes

CARE has been in Nicaragua for 30 years, working primarily in the departments hardest hit by Mitch Water wells, irrigation systems, and agriculture projects are typical of the portfolio USAID has funded CARE-administered water and health projects in Estelí and is planning new watershed management projects in the Rio Coca Funding is also provided by Canadian and British development agencies, as well as private fund raising The staff is international in background and brings a wide range of experience Working agreements with ENACAL, the national water company, enable CARE to complement potable water projects in many municipalities CARE staff was on site and able to provide emergency relief as displaced families sought refuge in communal areas of Leon, Chinandega, Matagalpa, and Estelí Emergency shelters were also provided to refugees during the first month after Hurricane Mitch

Local NGOs also have the capacity to link with the World Food Program (PMA) and serve as distributors of basic food supplies, hand tools, and other emergency supplies CRS and the local CARITAS teamed to distribute both PMA food supplies and donations of clothing and medicines from abroad

Pro-Mujer, a credit NGO based in New York City, has two projects, one in Chinandega and another in León USAID is funding Pro-Mujer activities, which focus primarily on women borrowers ACCION International is a long-term partner in micro-credit with more than 20 years of experience in the region FINCA International operates a village bank model of micro-credit and is also a recipient of USAID funding

2 3 Micro-Credit Activities

No assessment of hurricane damage can slip pass the glaring need to extend credit for reconstruction activities As noted in the main report, the housing finance system is in great disrepair BAVINIC has suffered enormous loan losses over the years and is now in the process of liquidation [5] Commercial banks do not have windows for uncollateralized credit and the micro-finance system is barely organized Displaced persons have little or no savings that can be used for expansion of their entrepreneurial activities or repair of damaged homes

Micro-finance organizations (MFOs)[6] are quite limited in servicing post-disaster relief In Nicaragua, several NGOs have taken on the role of MFOs providing grants or credit to members Prior to the hurricane, a few NGO-MFOs operated limited credit programs For example, Fundacion Nicaraguense de Desarrollo (FUNDE) operated cooperatives, offered technical assistance, reached out to rural households, built low-cost housing, and assisted artesanal fishing cooperatives FUNDE, which has been in operation since 1969, has over the years received financing from USAID and the private sector Its loan portfolio also suffered losses as a result of Mitch, the organization has designed a financial intermediation proposal to address the credit needs of its members FUNDE is an example of a "family"-driven organization The executive director, who has been at the helm since its conception 30 years ago, is distinguished by ideological opposition to the Sandinista precepts, much in line with the current government

Timely intervention is essential during the reconstruction phase if success is desired Reaching those in need at the opportune time simply contributes to effectiveness Ongoing loan programs must use the period immediately after the disaster to reschedule debt, if necessary, or to permit savings to be withdrawn New indebtedness comes at a later time when conditions have stabilized For this reason, the period following a disaster is not the best time to start a micro-credit program [7]

Fortunately, the second USAID/Nicaragua strategic objective involves micro-credit, and the project is in place with a termination date of mid-1999 The participating U S NGOs currently working in the micro-credit sector in Nicaragua with USAID grant contracts in the amounts shown are [8]

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[5] See AG Intl/PADCO Report p 19

[6] The term micro finance institution (MFI) is used in USAID publications

[7] For a full discussion on micro-finance and natural disasters see Nagarajan, Geetha "Microfinance in the Wake of Natural Disasters Challenges and Opportunities draft March 1998 USAID DAI/MBP Project PCE-0406-C-00-6004-00 p 10ff

[8] Source USAID/Nicaragua Micro-Enterprise Development Program documents (Jan 1999)

ACCION International (Nicaragua)	$1,500,000	+	ACCION Funds	$1,591,313
Catholic Relief Services	998,453	+	CRS	335,026
FINCA International	1,500,000	+	FINCA	784,000
Opportunity International	1,507,328	+	OI	751,351
Pro-Mujer	1,498,844	+	Pro Mujer	509,000

Local NGOs participating in the USAID/Nicaragua project are ASODENIC, Fundacion Nieborowski, Fundación León 2000, and FUNDENUSE

2 4 Displacement of Workers

Field observations by the Task Force members confirmed that more than half of the adult persons displaced from their homes were rural agricultural workers Many lost the opportunity to harvest the crops damaged by flooding, resulting in decreased income Perhaps more financially significant to families was the damage to the small plots of agricultural land that signify income sources

Farmers have not, of course, lost their farming skills and knowledge Small farmers have the knowledge of how best to grow the crop varieties they plant The skill is adequate for the level of agricultural production demanded by local markets Larger farms use machinery and irrigation, apply technology to increase output, and sell to large agro-business intermediaries Of concern to planners is the diversification of semi-skilled farm labor as the changes in crop production take place Cotton was once king in Chinandega-Leon After world prices for cotton fell in the late '80s at about the time cooperatives expropriated private warehouses, machinery, and lands, the small farmer took a beating Soy bean and sesame seeds, the current large-scale crops, simply do not generate the level of income cotton once did, all things being equal

There is no simple solution to the dilemma currently facing the small-scale agricultural laborer and small farmer Domestic demand for traditional crops will remain the same, increasing as population grows, but insufficient to absorb excess labor The flight to the urban centers, especially Managua, will only increase over the middle term The labor demand for skilled workers in technical fields is particularly troubling, since the supply is so low A disaster condition serves to accelerate the flight in search of a better future, typically among the younger workers who were displaced One international manifestation of this flight is the increase in the months of January to March of immigrants from Nicaragua and Honduras detained at border crossings along the Rio Grande in Texas Reports of an increase of Nicaraguans seeking work in Costa Rica following Hurricane Mitch has prompted the immigration authorities there to deport undocumented workers and to withhold social services to those Nicaraguans already in Costa Rica This action has caused enormous tension among the displaced refugees currently in camps Many depend on the remittances of funds from a member of the family working in Costa Rica

3 Assessment

Reconstruction of Nicaragua's hurricane-damaged communities represents a challenge to the ingenuity of development practitioners As important as reconstruction of shelter and infrastructure is in re-establishing life as it was, the future demand for improved work lifestyles is enormous The displacement of farm workers in the affected regions swelled the ranks of the unemployed With lands lost to flooding, as many as 20,000 families were forced into alternative, temporary occupations If the past disaster rehabilitation is any indication of the present, the displaced will somehow get blended into some job, even if it is not the best one possible Lack of meaningful work will superficially fade from view by the time the rains fall again

An appropriate response would be a strategy that can begin to develop the displaced workforce into a more marketable one This requires specialized, perhaps even new skill-based training that can best be offered through nontraditional vehicles To depend on the state-run educational system, the schools, and vocational training centers means the challenge will not likely be met Most of the displaced persons are older workers, beyond the age or reach of formal K-12 education programs The curriculum offered by the formal system is not likely to meet the needs of a developing market-based economy Failure to adapt to these changing needs will forever cast the displaced worker at a disadvantage Something must be offered to "second-chance" population groups

Macroeconomic data show that of the economically active population (est 1 7 million in 1998) 11 percent are unemployed and 12 percent subemployed [9] Regional unemployment may be as high as 20 percent in rural areas

3 1 Workforce Development

The term "workforce development" describes both an educational system and the ways to improve that system [10] In a passive sense, the educational system of Nicaragua embodies all schools K-12, private and public corporate training, courses offered by trade unions, NGOs, and private schools that prepare individuals to enter the workplace The public school system has received much investment in the past decades by international donors, private foundations, and NGOs The investment has mostly been on improvements to curricula, teacher training, and classroom construction However, in the active sense, workforce development has not been fully understood, particularly as it pertains to post-disaster reconstruction The concept refers to the process of improving the formal educational system so that workers are fully prepared with the tools and knowledge that makes them competitive in the current as well as future labor markets Improvements or changes to a formal educational system can take a long time to accept and even

[9] Banco Central de Nicaragua Gerencia de Estudios Economicos, 'Indicadores Economicos " Precios Empleo y Salarios June 1998

[10] Maryland Department of Business and Economic Development, 'Economic Pulse,' October 1998 This monogram argues for effective employee preparation for global competition The central thesis is applicable, according to the author to the Nicaraguan 2000 labor strategy herein proposed

longer to implement Faced with an exigent condition, nonformal educational approaches managed by NGOs can more readily serve the purpose

Several questions arise with respect to the need for workforce development Can workers displaced by the flood make a transition into new jobs or, in some cases, jobs that have not yet been created? More to the point of this paper, what is the role of an NGO in addressing this labor issue? Isn't reconstruction more about blocks and mortar, paving and digging?

Two alternatives can be considered One would have the displaced workers return to their pre-Mitch labor condition This implies accessible land, affordable enough for the poorest to make a living from its production, inputs, such as seeds and fertilizer, and markets and prices that remain relatively constant There would be no change in living standards or quality of life — status quo across the board

The second alternative, and the one that more clearly reflects the changed situation in the economy, would accommodate the displaced worker who chooses to leave the farm or small town and seek a better-paying job The better job will require a new set of skills The trick is in obtaining the skills quickly enough to compete in an expanded labor market From the observations made during the field trips, it became clear that workers, particularly younger ones, would rather move into higher-paying jobs, if they become available, than remain in a stagnant condition Pablito or Juanita simply cannot be expected to remain in the countryside, scrape out a living on the remains of the flooded land, and reasonably sustain a family Without new skills and training, diversification in agriculture production, and integration of economic activities linking urban-rural labor, Nicaragua will stagnate in comparison to El Salvador and Costa Rica

Can NGOs play a role in preparing displaced workers to compete in a shifting market place? Perhaps not fully, but certainly aided by design As a part of NGO reconstruction activities, new skills and knowledge can be introduced CARE could easily incorporate the workforce development concept in four of the current projects La Esperanza (NIC080) that operates in Dario and Matagalpa — family orchards and crop diversification training are but one step away from exportable seasonal winter crops, PALESA (NIC 066) deals with potable water, latrines, and health education in Leon and Chinandega, PAS (NIC 037) is a sustainable water project for 18,000 impoverished households in León, Chinandega, and Matagalpa — three areas affected by the hurricane — involving community organization, improved agricultural practices, and technical assistance, and WATOTO (NIC 068) — water today and tomorrow — is a unique community water management approach that reaches 4,900 rural dwellers This project enables participants to build their own water and sanitation system CARE has received USAID financing and is an NGO with wide experience in micro-credit, low-income housing, and relief distribution in Nicaragua

Managua 2000 is an urban-based visionary investment proposal by the municipality that when implemented will change the face of the city forever New building technology is part of the plan The urban development contemplated is already a magnet attracting workers in search of better wages and lifestyles One cannot be but struck at the formidable (for Managua) new hotel construction taking place in the capital Workers of all skills are needed to fill the job vacancies

this growth is generating Some examples are technicians with specialized expertise in computer hardware and software, installation of electronic equipment in new buildings, repair of same, construction technologies using prefabricated modular components, and installation and maintenance of state-of-the-art telecommunication systems This opportunity is knocking at the doors of future workforce development centers NGOs poised to take on the challenge will have a sustainable future role training the new workforce

3 2 Need for a New Workforce

Managua has an economically active population of approximately 1 7 million, spanning all sectors and skills, ages, and gender Thirty-four percent of the population age 15 and older is illiterate, the poverty rate as a percentage of the population below the poverty line is 50 percent The structure of the economy shows that agriculture represents 33 8 percent of GDP and the trend appears to be shifting toward services that measured 44 6 percent of GDP in 1997 This does not indicate that the labor force is proportionately represented in agriculture or services, however

Unemployment figures are not exact The range is from 11 percent in national averages to 20 percent in rural areas, depending on who counts The labor force is growing at 4 percent annually compared to population growth of 3 percent This factors out to 190,000 workers seeking employment this year

The primary short-term concern is for the workers displaced by Hurricane Mitch and how these can be absorbed into a new workforce There are five options available to deal with labor mismatches and shortages in new fields

- do nothing,
- allow businesses to expand or locate in other countries of Central America,
- import qualified workers, as is the case with hotel managers and plant supervisors, drywall installers, and computer technicians,
- upgrade the skills of the local workforce, or
- develop a pipeline of trained workers

As suggested in Section 3 1 above, the preferred alternative is to upgrade skills of the local workforce to meet the needs of the economy through direct interventions and thus begin to create a pipeline of trained workers This is where hope comes in for those whose options in the workplace has up to now been limited

4 Recommendations

4 1 General Recommendations

Which NGO type can USAID best team up with to reconstruct or repair shelter? Which one is posed to handle reconstruction of infrastructure repair? Which one is best able to handle water and sanitation or repair roads?

Fortunately, the answer is direct and already operating Shelter is not a concern at this point given the ongoing dialogue with the GON on shelter policy formulation Temporary shelters have by now been distributed and resettlement of refugees is not a pressing issue Repairs are already near completion and handled by local NGOs

Municipalities are waiting for funding to begin construction of newly designed bridges, approaches, and road repairs of a more permanent nature Unfortunately, at the time of writing the supplemental appropriation that will make funds available for the recommended infrastructure works is tied up in the U S Congress with no immediate approval expected until the summer of 1999

CARE is already working on water and sanitation projects Additional funding will help accelerate the completion of well-supplied water systems ADRA has plans for constructing two-room housing using its own resources

There is no need to start a new NGO specific to the reconstruction activity

USAID can support established NGOs identified in previous sections that have ongoing grant agreements with the Mission All Hurricane Mitch-related projects, either new or amended, must have sunset limitation on funding and specific results within a prescribed timeframe

Experience has dictated that it is not practical or necessary to start up a new NGO to respond to disaster relief If it isn't in place, it won't be in place when needed Established NGOs are better poised to react to emergency situations, as was the demonstrated during Mitch in Central America

Grant funding of post-relief operations or activities is recommended This is already under way, either through USAID sources or other donors and foundations

With respect to micro-credit programs, no relief of prior financial obligations using emergency funding destined for reconstruction activities should be used The focus must be on sustainable approaches as part of reconstruction efforts

Obvious to some but not others, NGOs must continually prepare for future emergencies and disasters by planning and training staff Donors can fund research for the creation of disaster response credit mechanisms A long-term objective is to begin advocating for national insurance to mitigate financial loss to economic activities owned by poor

4 2 Specific Recommendations

The case for focusing on the workforce displaced by Hurricane Mitch may not resonate among USAID managers given the overwhelming tasks already expected of them This paper highlights this topic because of the anecdotal information gathered during the field visits and the evident physical growth in the capital, Managua Other secondary cities of Nicaragua are also experi-

encing investment-led growth, as are the urban centers in neighboring Costa Rica, El Salvador, Honduras, and Guatemala This growth means that workforce demand is up

The role that some NGOs can play in preparing the workforce through their existing programs is not a far stretch Post-disaster reconstruction projects in shelter and infrastructure can serve as pilots for the introduction of advanced technology Hurricane-resistant construction technology is a contribution offered by the HUD member on the Task Force, this should be adopted and NGOs, such as CARE, CRS, ADRA, and Save the Children, should be invited to participate in the workshops along with local NGO affiliates or counterparts The USAID/Dominican Republic recently held such workshops [11]

[11] Refer to Nelson Carbonell Housing and Urban Development PDR Office, Hurricane Construction Techniques Workshop (March 1999)

La Situación Habitacional de Nicaragua antes y después de Mitch

Situación Existente antes de Mitch, Stock de Vivienda y Estimaciones de Déficit

Segun la Constitucion Politica de Nicaragua, la población nicaraguense tiene derecho a una vivienda digna, comoda y segura que garantice la privacidad familiar El Estado promoverá la realizacion de este derecho (Articulo 64 de la Constitución Politica de la República de Nicaragua) Esto es interpretado por muchos como que una de las obligaciones del Estado es proveer de vivienda a todos los ciudadanos que la necesiten, meta poco realista para cualquier país y mas difícil aun para Nicaragua dada su situación económica, la alta tasa de crecimiento poblacional, el deficit acumulado, y las periodicas perdidas en el stock de viviendas ocasionadas por huracanes, maremotos y terremotos

Estudios realizados por el entonces Ministerio de Acción Social (MAS) en 1994 indican que en 1991, a nivel nacional, el 60% de las viviendas urbanas se encontraban en situación de hacinamiento, para el año 2000 estima el mismo estudio que el 66% de todas las viviendas se encontraran en ese estado[1]

Este mismo estudio indica que el total de viviendas existentes en 1994 era de alrededor de 630,000 unidades ocupadas en promedio por 6 5 habitantes

Los cálculos del déficit habitacional varian grandemente según el origen de los datos, las estimaciones de dicho déficit oscilan grandemente entre 240,000 unidades y más de 500,000 unidades Tal vez el mejor calculo realizado a la fecha fue el llevado a cabo por el Banco Centroamericano de Integración Económica BCIE en 1992 como parte de su estudio del sector vivienda con miras a la reactivacion del sistema de financiamiento de viviendas en Nicaragua[2] En dicho estudio se calculaba el déficit habitacional a nivel nacional en 509,976 unidades de las cuales 332,212 (65%) eran urbanas y el resto (35%) rural Este déficit se incrementaría a razon de 20,436 unidades solamente como consecuencia del crecimiento vegetativo de la poblacion Tambien existía una necesidad de remplazar 35,130 unidades ubicadas en zonas de riesgo

Mientras tanto, como resultado de una redefinición de estandares mínimos, se redujo oficialmente el déficit habitacional a entre 160,453 y 241,154 unidades Recientemente se ha manejado la cifra de 242,000 unidades como el deficit habitacional en 1994, el cual aumentado de 20,000 unidades anuales en 5 años nos lleva a una estimación del deficit habitacional actual de Nicaragua en alrededor 350,000 unidades

El deficit habitacional no esta uniformemente repartido en los diferentes departamentos del pais El 33 1% del deficit esta concentrado en la Región III Ciudad de Managua La dos zonas de afectación primaria de Mitch, la Region II Occidente y Región VI Norte, participan en 15 8%

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[1] MAS (Ministerio de Accion Social) (1994) *Poblacion y Desarrollo - Diagnostico* Managua

[2] BCIE (Banco Centroamericano de Integracion Economica) (1994) *Propuesta Institucional para un Sistema Nacional de Vivienda* Managua

y 6 1% del déficit respectivamente Habia según los mismos cálculos un deficit de 52,348 unidades en Occidente y de 20,233 unidades en el Norte

Durante los 15 años comprendidos entre 1980 y 1995, las agencias de servicios nicaraguenses hicieron poco por mantener sus redes de infraestructura y casi nada por extenderlas Las necesidades en ese sentido son enormes, tanto en el campo como en la ciudad 40% de la poblacion no recibe agua potable, ni domiciliaria, ni de puesto público y debe de recurrir a pozos profundos, sujetos a contaminación, el 30% de la población no tiene electricidad, 55% de las unidades habitacionales solamente tienen acceso a una letrina, un tercio de las casas en los asentamientos espontáneos existentes en las principales ciudades, no tiene siquiera acceso a una letrina

De acuerdo al informe de la Comisión Nacional de Vivienda, CONAVIAH, durante el quinquenio 1990-1995 solamente se construyeron 17,677 viviendas en todo el pais, distribuidas asi

Viviendas construidas por el MCT (hoy MTI) 3,159
Viviendas construidas por el BAVINIC 215
Viviendas construidas por ONGs y otras instituciones 8,303[3]

Efectos de Mitch

De acuerdo a las estimaciones de la Defensa Civil, Mitch destruyó 23,854 viviendas y dañó parcialmente otras 17,566 para un total de 41,420 viviendas afectadas Este total es sorprendentemente aproximado al estimado de 35,130 viviendas en zona de riesgo hecho años antes por las estimaciones de deficit habitacional del BCIE

Como era de esperarse la mayor concentración de daños de viviendas fue en la Región II Occidente y en la Región VI Norte Del total de viviendas destruidas, 7,675 (32 2%) estaban ubicadas en la Región II y 4,527 (19%) en la Region VI De las viviendas dañadas, 4,003 (22 8%) estaban ubicadas en la Región II y 3,204 (18 2%) en la Region VI

Segun datos suministrados por BAVINIC, el 70% de las viviendas destruidas y dañadas estaban ubicadas en el area rural y que los programas de reubicacion y reconstruccion contemplan la creación de asentamientos que no excedan de 500 viviendas

Si consideramos como válida la cifra de 6 5 habitantes por unidad familiar, tenemos que las 19,409 viviendas destruidas total o parcialmente en las Regiones II y VI generaron 126,158 personas damnificadas o desplazadas de sus lugares de habitacion normal que tuvieron que buscar refugio en albergues temporales

[3] CONAVIAH (Comision Nacional de Vivienda y Asentamientos Humanos (1996) *Plan de Accion Nacional de Vivienda y Asentamientos Humanos 1996-2000* Managua Documento llevado a Habitat II Estambul 1996

Es difícil cuantificar el monto de las pérdidas monetarias en vivienda ya que en la mayoria de los casos se trata de vivienda inadecuada cuyas dimensiones y costos se desconocian Es más facil proyectar un valor de reposicion para las 19,409 viviendas afectadas en las dos regiones de afectación primaria de Mitch

Para facilitar dicha tarea dividamos las viviendas afectadas de la manera siguiente

Región II Occidente 7,675 viviendas totalmente destruidas que deben de ser reemplazadas totalmente, 4,003 viviendas dañadas que debido a su ubicación seguramente tendran que ser abandonadas y reemplazadas por vivienda nueva en otro terreno Total 11,678 viviendas a ser remplazadas

Región VI Norte 4,527 viviendas totalmente destruidas que deben de ser reemplazadas totalmente, 3,204 viviendas dañadas que debido a su ubicación seguramente tendran que ser abandonadas y reemplazadas por vivienda nueva en otro terreno Total 7,731 viviendas a ser remplazadas

Alternativas de Remplazo

En el Estudio de Factibilidad para el Programa de Vivienda de Interés Social que elaboro la firma SUM CONSULT de Wiesbaden, Alemania para la KFW y el Banco de la Vivienda de Nicaragua, BAVINIC, que mas tarde no fue ejecutado se establecieron las siguientes alternativas de soluciones habitacionales posibles para ejecutarse

- Vivienda nueva de 36 metros cuadrados con paredes de mampostería confinada, techo de zinc, piso ladrillo corriente, sin instalaciones, a un costo de US$2,818 00 por unidad
- Vivienda nueva de 36 metros cuadrados con paredes de mamposteria confinada y techo de zinc, piso embaldosado, sin instalaciones, a un costo de US$2,436 00 por unidad
- Plan Techo consistente en fundacion, estructura soporte y techo de zinc, sin divisiones ni instalaciones sanitarias, a un costo de US$898 00 por unidad
- Plan Techo consistente en fundación, estructura soporte y techo de teja de microconcreto, sin divisiones ni instalaciones sanitarias, a un costo de US$860 00 por unidad
- Vivienda de un cuarto, consistente en una habitacion de 9 metros cuadrados (3 metros por 3 metros), a un costo de US$609 00 por unidad

Además

- Una instalación sanitaria asumiendo red de agua existente que incluya servicio sanitario, lavadero doble y espera para lavatrastos, no incluye conexión domiciliar, a un costo de US$533 00 por unidad
- Una letrina sencilla, a un costo de US$172 00 por unidad
- Una instalacion eléctrica, sistema sencillo con canalizacion en pvc para toma, apagador y luz en pared, no incluye conexion domiciliar, a un costo de US$143 00 por unidad

Estos datos nos lleva a las siguientes alternativas

Como puede verse en los datos arriba apuntados las inversiones necesarias para remplazar las viviendas destruidas por vivienda adecuada, fuera de la zona de riesgo, es considerable, aun sin incluir el costo del terreno La construcción de una vivienda nueva de 36 metros cuadrado, utilizando la alternativa 2, piso embaldosado, con su servicio electrico y una letrina sencilla requeriria la siguiente inversión

19,409 viviendas a US$2,436 00 c/u	US$47 3 MM
19,409 servicios electricos a US$143 00 c/u	2 8 MM
19,409 letrinas sencillas a US$172 00 c/u	3 4 MM
Total 19,409 soluciones habitacionales	US$53 5 MM

Posibles Actores en el Sector Vivienda

Una variedad de instituciones gubernamentales, de distinto nivel, se han involucrado recientemente en la produccion de vivienda con diferentes grados de responsabilidad en su planificacion, promocion, regulacion y control, financiamiento, ejecución y seguimiento Son tambien actores

- El sector privado, que participa en la construcción, la produccion y distribución de materiales de construcción y presta servicios profesionales de toda indole
- Las Organizaciones no-gubernamentales, ONGs, a través de la ejecucion directa de programas, la obtención y canalizacion de recursos internos o externos, la realizacion de experiencias alternativas e investigaciones
- Organismos multi y bilaterales que prestan asistencia técnica y financiera a Nicaragua y que han acelerado sus esfuerzos después de la destrucción causada por Mitch

La carencia de una política sectorial claramente establecida, la debilidad de las instituciones y el accionar imperfecto de las fuerzas de mercado resultan en una falta de coordinación general entre estos actores

Las instituciones gubernamentales más importantes con incidencia, directa o indirectamente, en el sector vivienda son las siguientes

El Ministerio de Transporte e Infraestructura, MTI

Es por Ley responsable de la planificacion del sector y ejecutor de las acciones concretas Sin embargo, estas funciones son solo nominales y en la práctica el Ministerio no las ejerce, de acuerdo a la ultima reestructuracion institucional, el MTI guarda las siguientes responsabilidades en relación a la vivienda

- Redaccion de normas tecnicas y supervision de su aplicación,
- Contralor del cumplimiento de normas referentes a la producción de materiales de construcción y la calidad de la construcción de viviendas,
- Coordinacion de la investigacion sobre materiales de construcción y tecnicas constructivas,

- Apoyo en la formulación y ejecución de proyectos de vivienda de emergencia

Las normas técnicas del MTI tendrían incidencia en un programa de reconstrucción ya que estas han sido diseñadas para tiempos normales y no siempre se adaptan a situaciones de emergencia donde la rapidez y la economía son esenciales Por otra parte, el MTI publica listas de fabricantes de materiales que cumplen con las normas de calidad y realiza investigaciones tecnologicas que podrían ayudar al programa de reconstrucción

Secretaría de Acción Social (SAS)

Esta Secretaría es la sucesora del Ministerio de Acción Social, MAS, que había sido fundado en 1993 con el objeto de coordinar la politica social del gobierno El Ministerio venía funcionando como ejecutor de programas y proyectos de vivienda dirigidos al sector mas indigente de la población La nueva Secretaría continuará como coordinador de la politica social del gobierno pero no ejecutará programas, interviniendo en el sector vivienda unicamente en caso de emergencia o para soluciones puntuales de indigencia

Banco de la Vivienda de Nicaragua, BAVINIC

El BAVINIC fue en su época el mas importante actor y ejecutor de la politica habitacional de Nicaragua Sin embargo, una serie de descapitalizaciones de la institucion debido al cambiante regimen legal de la propiedad que se operó en la década de los 80, la institución ha quedado relegada al papel de Administrador de Cartera de los proyectos de vivienda que en años anteriores ejecutó y comercializó

Recientemente el Gobierno de Nicaragua planea la liquidación del BAVINIC y su transformación en Instituto de Vivienda y Urbana y Rural (INVUR) Sin embargo, no se ha aclarado todavía que pasara con la actual cartera del BAVINIC, ni si la nueva institución contará con recursos financieros para realizar sus funciones

El periodo de transición entre Banco e Instituto ha sido de paralisis para la institución La tragedia de Mitch ocurrió en momentos en que el BAVINIC tenía poca capacidad de ejecución y su participación en la emergencia fue marginal

A pesar de esta situación, el BAVINIC cuenta con ejecutar una serie de acciones ligadas a la reconstrucción y a la movilización de recursos externos de ayuda para el sector vivienda

El BAVINIC señala que servira de coordinador de los siguientes proyectos habitacionales

- Arquitectos sin Fronteras 600 viviendas,
- PNUD 1000 viviendas,
- Donación de España 300 viviendas,
- Cruz Roja de Francia 1,700 viviendas,
- GTZ 400 viviendas por autoconstruccion en los departamentos de Matagalpa, Chinandega y Estelí,

- Venezuela 300 viviendas,
- Club Rotario Internacional 200 viviendas, y
- 100 viviendas que construye el BAVINIC en Posoltega

Total proyectado por BAVINIC 4,600 viviendas

El BAVINIC no dio detalles sobre el papel que desempeñara en cada uno de estos proyectos, sin embargo, señaló que el Gobierno se ha comprometido a facilitar los terrenos donde se realizaran estas construcciones y que ha asignado una partida de C$100 00 millones de córdobas para la adquisicion de los mismos

El Presidente de BAVINIC anunció que de la privatización de ENITEL, la compañia de telefonos, se asignará una partida de $ 10 a $ 15 millones de dolares para proveer capital semilla a las entidades financiadoras de vivienda

Instituto Nicaraguense de Fomento Municipal, INIFOM

El objeto principal de INIFOM es

- Fortalecimiento de la Administración Municipal y la promocion del desarrollo de los municipios, y
- Contribuir a formular estrategias y plan de acción para la descentralizacion del Gobierno Central hacia el Municipal

El INIFOM juega un papel importante en la coordinacion entre el Gobierno Central y los gobiernos locales En el pasado, INIFOM ejecutó con fondos de cooperación externa y la colaboracion de varias alcaldias y ONGs programas de vivienda y mejoramiento urbano Colaboro con el BAVINIC en la obtencion de terrenos municipales para el programas de viviendas, Soluciones Habitacionales de Interes Social, SHIS, que ejecuto BAVINIC en diferentes municipalidades con financiamiento de Mexico y del Fondo de Inversiones de Venezuela, FIV El INIFOM recibe asistencia técnica y financiera de GTZ, DANIDA y el Banco Mundial, Proyecto PROTIERRA

Durante el periodo de emergencia de Mitch, el INIFOM movilizó $ 17 0 millones de dólares para la rehabilitacion de caminos, agua potable y alcantarillado sanitario

Los objetivos de PROTIERRA son alivio a la pobreza rural y proteccion del medio ambiente y recursos naturales Además, impulsa la creacion del Instituto Forestal PROTIERRA también participa en el proyecto del Corredor Centroamericano de Bio-diversidad

PROTIERRA apoya actualmente a 32 municipalidades en el Oeste y Sur Este de Nicaragua Despues de Mitch el programa se amplio a 48 municipios adicionales

INIFOM visualiza su papel en la reconstruccion post-Mitch de la siguiente manera

- INIFOM y las alcaldías deben de ser los actores principales de la reconstrucción,

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- INIFOM debe de ser el coordinador de las otras asociaciones municipales como AMUNIC,
- INIFOM apoyara preferentemente a las alcaldías mas pequeñas o financieramente debiles, y
- INIFOM ayudara a la recuperacion de la base de ingresos de las municipalidades

Instituto Nicaraguense de Estudios Territoriales

El INETER fue establecido en 1981 a traves de la fusión de tres instituciones que existían desde la década de los 50 el Instituto Geografico Nacional, el Instituto de Investigaciones Sismicas y el Servicio Meteorologico Nacional Su objetivo es el de profundizar el conocimiento acerca del territorio nacional en cuanto a los recursos naturales como base para planificar el desarrollo integral de las actividades económicas A traves de sus direcciones de planificación fisica y geográfica realiza estudios y propuestas para el ordenamiento territorial a nivel nacional, regional y urbano

Recientemente, despues de la destruccion de Mitch, el INETER a surgido como una institucion clave en la prevencion de desastres y en la mitigación de los efectos causados por fenómenos naturales

El INETER es una pieza clave en el programa de reconstrucción de viviendas a través de la información que brinda a las alcaldías y el asesoramiento directo que podría brindarles en cuanto a la localización de areas habitacionales

El INETER reciba ayuda de diferentes entidades para el fortalecimiento de su capacidad técnica y científica

Fondo de Inversión Social de Emergencia, FISE

El FISE es un organismo autónomo del Gobierno creado en Noviembre de 1990 para gestionar y administrar recursos locales y externos destinados al financiamiento de proyectos sociales de emergencia Inicialmente se había previsto una existencia limitada a 5 años, sin embargo se prolongó su plazo hasta 1997 y luego hasta 2003

El FISE sirve de intermediario entre las fuentes financieras y los solicitantes, pudiendo ser estos ultimos entes nacionales, gobiernos locales, ONGs o inclusive organizaciones comunitarias y de beneficencia , siempre que tengan personería juridica

El FISE ha movilizado recursos de muchos organismo financieros internacionales siendo sus principales donantes el Banco Interamericano de Desarrollo, la KFW de Alemania y el Banco Mundial

Los recursos se asignan a los municipios que se encuentran en las peores situaciones de pobreza Se utilizan segun prioridades establecidas localmente, en base a un menu de posibles proyectos que entre otros han incluido construcción y equipamiento de escuelas, puestos de salud, letrinas, mejoramiento de infraestructura urbana (redes de agua, drenaje, pavimentación de calles etc)

Dado su carácter de programa asistencial de emergencia y de red de seguridad en contra de la pobreza, el FISE no recupera sus costos

Aunque el FISE manifiesta que no participa en proyectos de desarrollo habitacional, sus acciones podrian coordinarse con los programas de reconstrucción habitacional para complementar con infraestructuras sociales o urbanas los asentamientos habitacionales que se produzcan Algunas de las experiencias desarrolladas por el FISE como el uso de contratistas informales podrian ser utilizados en un eventual programa de reconstrucción

Alcaldías/Municipios

Las alcaldías deben de jugar un papel importante en la formalización y ejecución de proyectos de vivienda y de otra indole relacionados con la reconstruccion En su Articulo 10 la Ley de Municipios establece

> *Los municipios pueden realizar actividades complementarias de las atribuidas a otras instituciones, y entre las relativas a la educacion, sanidad, aguas, viviendas, alumbrado publico, cultura y deportes* [4]

Muchas alcaldías se han involucrado en estas actividades, aun antes de la emergencia de Mitch Algunas promueven la realizacion de proyectos de vivienda en sus municipios, para los que ponen tierras a disposición, identifican beneficiarios y realizan otras tareas tecnicas o de apoyo logistico En otros casos realizan programas directamente o en cooperación con ONGs, para los cuales generalmente gestionan financiamiento externo Las investigaciones realizadas pusieron de manifiesto que existe a nivel de las alcaldías, especialmente de las mas grandes, un potencial de gestion y de ejecución que debe de ser utilizado en el esfuerzo de reconstruccion

[4] Ley No 40 de Municipios LA GACETA No 155 del 17 08 1988