PD-AAN-968

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete)
Amendment Number:
DOCUMENT CODE: 3

3. PROJECT NUMBER: 520-0274

4. PROJECT TITLE (maximum 40 characters): Highlands Agricultural Development

Guatemala

6. ESTIMATED DATE OF OBLIGATION

A. Initial FY 83 B. Quarter 3 C. Final FY 83

8. COSTS ($000 OR EQUIVALENT $1 =)

				LIFE OF PROJECT		
A. FUNDING SOURCE			D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total		200	1,500	1,300	200	1,500
		4,041	7,500	3,459	4,041	7,500
Host Country		5,782	5,782	-	5,782	5,782
TOTALS		10,023	14,782	4,759	10,023	14,782

9. SCHEDULE OF AID FUNDING ($000)

			E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
		-	1,500	7,500	1,500	7,500
TOTALS		-	1,500	7,500	1,500	7,500

11. SECONDARY PURPOSE CODE

14. PROJECT PURPOSE (maximum 480 characters)

To improve the productive resource base of the rural poor in Guatemala's highlands.

16. SOURCE/ORIGIN OF GOODS AND SERVICES

Final: 06 88

000 941 Local Other (Specify) CACM

(This is page 1 of a ____ page PP Amendment.)

Signature: Charles E. Costello

Title: Director, USAID/Guatemala

Date Signed: 06 / 1 / 83

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

HIGHLANDS AGRICULTURAL DEVELOPMENT
PROJECT PAPER

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2. RECOMMENDATIONS AND SUMMARY

A. Recommendations

Pursuant to the review and approval of the proposed Highlands Agricultural Development Project by the USAID/Guatemala Mission Review Committee, it is recommended that:

(1) The AA/LAC approve the Project described herein for a total cost to AID of $7,500,000 in loan funding and $1,500,000 in grant funding to be totally authorized in FY 1983.

B. Terms

25 years, 2 percent interest during a 10 year grace period, 3 percent interest thereafter.

C. Borrower/Grantee

The Borrower/Grantee will be the Government of the Republic of Guatemala acting through the Direccion General de Servicios Agricolas (DIGESA), the Banco Nacional de Desarrollo Agricola (BANDESA), the Instituto Nacional Forestal (INAFOR) and the Direccion General de Caminos (DCR).

D. PROJECT RATIONALE

Within the Guatemalan economy, agriculture is the dominant productive sector, accounting for 26% of all economic activity in 1978. The 1979 census indicates that the agricultural sector employs 55 percent of the nation's work force. Over half of all farms in Guatemala, containing 80% of the rural population, consist of plots of 1.4 hectares or less. This is generally considered too small to generate sufficient income for the basic needs of a rural family (5 or more people) without resorting to outside income. This problem is most visible in Guatemala's Highland region which contains 46% of the country's population but only 19% of soils capable of high to moderate yields. In spite of the relative poverty of soils and the mountainous terrain, this area produces about 35% of the country's foodstuffs.

Small farmers predominate in this region. A study prepared in 1982 by the Centro de Consultora, S.A. of Guatemala estimated that 91% of the people in the Western Highlands had per capita incomes of less than Q480 per year while for more than half of these, annual per capital incomes were less than Q250. Farming remains the primary occupation of most residents of the Highlands despite the fact that farms have been subdivided to the point that they are no longer capable of supporting families given the existing corn and bean technologies available to the area.

Incentives for these farmers to produce additional crops have eroded since mid-1970. The terms of trade for the Highlands small farmer -- the relationship between the prices he receives for his output and the prices he must pay for goods and services produced in the urban areas -- has declined 32% since 1975. If these terms continue to deteriorate, the resulting

declines in production will result in a growing dependence on imported foodstuffs placing an added burden on the balance of payments. Also in the absence of alternative crops, the small farmer's real income will continue to decline.

The Mission's Agricultural Strategy is to increse the size and quality of the existing resource base while improving the efficiency of utilization of these resources. Attention is directed toward the Highlands in order to impact on the greatest number of small commercial or potentially commercial farms. The present program actions to carry out this agricultural strategy include natural resource management (land terracing, on farm irrigation, reforestation, access road construction and maintenance), agricultural tecnification (agricultural research, extension, crop diversification), and agricultural marketing and processing.

A May 1983 evaluation of the terracing, small-scale irrigation and access roads activities carried out under the Small Farmer Development Project (520-0233) in the Highlands has demonstrated these activities to be successful. Terracing, irrigation, and resulting crop diversification have meant more productive hours in the fields for farmers. Where vegetables and fruits have been introduced, women prepare this produce for the market (cleaning, sorting, bunching) thereby providing additional sources of family income and employment. It is clear that the majority of farmers who participated in these soil conservation and irrigation activities have benefitted economically. Even those farmers continuing to sow traditional crops on newly-terraced or irrigated plots report a doubling of total annual output. Roads have contributed to increased agricultural activity by providing savings in time previously needed to transport produce to markets, resulting in 20% to 30% more produce arriving in the marketplace.

Apart from the immediate economic benefits to the small farmers, rural families have derived other benefits. Some participating farmers have experienced less need to migrate for employment since their additional cash needs have been met from the sale of production increases. Further, small farmer's recognition of the benefits of on-farm irrigation and terracing has been demonstrated by the spread effect which followed initial introducrion of this technology in the Highlands. Approximately one hectare of cooperative, self-financed terracing for each three hectares directly supported by the Direccion General de Servicios Agricolas (DIGESA) has been identified. A measure of peasant interest in small-scale irrigation is that they have donated their labor even when their margin of economic existence normally would force them to sell their labor elsewhere. Interviewed rural farmers have indicated that the access roads not only have facilitated the export of the agricultural produce out of the immediate area, but also have provided greater access to agricultural inputs and to numerous government services particularly those provided for health care.

E. Summary of Project

The project goal is to increase agricultural productivity. More specifically, the purpose is to improve the productive resource base of the rural poor in the Highlands. This will be achieved by financing a labor intensive access roads maintenance program to guarantee small farmers a constant access to markets, agricultural inputs and extension services. Project funds will finance technical assistance and social cost payments for farmers and communities undertaking soil conservation and improvement programs such as land terracing. Technical assistance and credit to individual small farmers or groups of small farmers who are interested in utilizing existing water resources to develop small-scale irrigation systems will be provided. With project financed outputs (access roads, terraces, reforestation and small-scale irrigation), the Highlands farmer will be in a better position to preserve the limited natural resources available, increase his farm production and transport it to market, thereby increasing his level of income. Given the current underemployment of the rural population, the project design emphasizes individuals and/or community/based labor intensive self-help to achieve project outputs. Summary descriptions of Project Components follow:

1. Natural Resources Management:

There are three elements proposed under this component, Small-Scale Irrigation, Soil Conservation Structures and Reforestation. The interventions planned will all be undertaken in the Guatemalan Highlands and will impact upon over 60,000 rural poor families. DIGESA technical teams will survey, design and assist in the construction of approximately 50 small irrigation systems which will provide irrigation water to some 750 hectares. The systems constructed will be primarily gravity fed which require no mechanical pumping devices. DIGESA extension agents will instruct interested farmers in the construction of approximately 2200 soil conservation structures, which will protect approximately 5000 hectares of land. The type of structure will vary according to land topography and other factors but the primary type of structures built will be land terraces. All structures will be brief, using locally obtained materials and labor intensive methods. Project loan funds will be used to pay for labor costs incurred by the farmers during construction. An estimated 120 hectares of land will be improved through the INAFOR reforestation efforts. Rapid growing fuelwood trees will be grown on publically owned lands and seedings sold at cost to area farmers for fuelwood purposes. The activities undertaken under this forestry sub-activity will be conducted on a pilot basis to determine relative strengths of the INAFOR implementing agency.

2. Access Roads Maintenance Component:

This Component is designed to assure that rural access roads constructed in the Highlands continue to provide access to markets, agricultural inputs and extension services. Roads previously constructed were not adequately maintained and benefits to users were eroded. It is known

that such roads in the Highlands deteriorate very rapidly without maintenance. Without such maintenance these roads must often be completely reconstructed after five years of use. Therefore, the Direccion de Caminos Rurales has requested AID financing to initiate a labor intensive access roads maintenance program. The program would include labor intensive road maintenance, maintenance of heavy equipment utilized for both road maintenance and construction, and access roads mapping, planning and promotion. By the end of the project 1300 roads will be under maintenance benefiting the 47,700 small farm families who live near the roads while providing $ 1,687,000 in wages to 6,750 rural workers. Additionally, a GOG labor intensive access road maintenance program will have been established and field tested.

TABLE I

SUMMARY OF PROJECT INPUTS
($ 000)

	USAID		GOG	TOTAL
	LOAN	GRANT		
NATURAL RESOURCE MANAGEMENT				
a. Soil and Water	3,000	----	1,117	4,867
b. Reforestation	300	200	158	658
ACCESS ROADS MANAGEMENT	3,655	870	3,757	8,282
BASELINE SURVEY	----	100	----	100
EVALUATIONS	----	10	----	100
AUDITS	----	50	----	50
CONTINGENCIES	545	180	----	725
TOTAL	7,500	1,500	5,782	14,782

F. PROJECT PREPARATION PARTICIPANTS

Project Development Committee:

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Technical Assistance:

Juan Casasco, Institutional Analysis
John Hawkins, Social Analysis
Candeloro Bonato, Engineering
Perez y Perez, Engineering Consulting
Gary Smith, USDA
Bert Embry, Technical Analysis of Mini-Irrigation and Terracing

Mission Review:

Charles Costello, Mission Director
Peter Kolar, Deputy Mission Director
Edward Baker, PDSO
Harry Wing, ORD
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3. PROJECT DESCRIPTION

A. NATURAL RESOURCE MANAGEMENT

1. Activity Overview

As described in various studies, most recently the 1982 Land and Labor in Guatemala: An Assessment, only six percent of all available lands in the Guatemalan Highlands is classified as first class land (lands suitable for intensive cultivation with little or no limitation). This compares to 20 percent first class land in all other Guatemalan departments excluding El Peten. This limited amount of prime agricultural land combined with high population growth rates has forced the small farmer in the Highlands to remove natural forest growth on hillsides and cultivate this steep land, often with dramatic soil losses.

Calculations have shown that in a small area of the Quiche Department, 34 metric tons of top soil are being lost per hectare annually due to sheet and rill erosion. More striking is the estimate that 534 surface hectares (6" in depth) of top soil are lost annually due to erosion from the 36,000 hectare Xaya-Pixcaya watershed near Guatemala City.1/ Similar problems are encountered throughout the Highlands. Although there is general recognition of the problem and corrective actions have been taken by some individuals and collectively by a few villages, there has been no effective program (until recently) to deal with these erosion problems. It is estimated that no more than 10% of Highland farms have improvements and practices which adequately cope with the problem of soil erosion and water mismanagement. In the Western and Central Highlands (the departments of Baja Verapaz, Chimaltenango, El Progreso, Guatemala, Huehuetenango, Sacatepequez, San Marcos, Solola, and Totonicapan) where this project will be concentrated (See Map II), water retention is so poor and runoff so rapid that crops start to suffer from lack of soil moisture shortly after heavy rains. Rapid runoff also carries away heavy loads of top soil and sediment as well as amounts of chemical fertilizers applied to the soil. This loss of soil and water results in decreased crop yields and, as a result, decreased farmer income.

While the use of improved seed, fertilizer and cultural practices has contributed to increased agricultural productivity, maximum benefit from these inputs in many areas of the Highlands cannot be realized unless measures are taken to increase water availability and retention and provide protection against soil erosion. These conservation measures will also insure the long-term productive capacity of the hillside plots in the Guatemalan Highlands.

The activities undertaken under the Land Resources Improvement Activity of the Small Farmer Development Project (520-0233) successfully initiated a small number of soil and water conservation measures. The success of these services in terms of increased agricultural production and increased farmer income has been noted in several reports and evaluations. 1/ As noted in the Smith report, when using terraces and without changing any other agricultural practice, corn yields increased 100%, bean yields increased 133% and wheat yields increased 80%. 3/ This report also indicates that there is a substantial potential for increasing small farmer incomes up to 100% by improving their ability to exploit soil and water resources, especially through permitting longer growing seasons for non-traditional, diversified crops (i.e. snow peas, broccoli, cauliflower, etc.).

In spite of the actions taken under Project 520-0233, the problems of soil erosion and water underutilization are still widespread and, as a result, the small farmer continues to suffer from low agricultural production. The Mission believes it vital to continue and expand these activities to other areas of the Highlands. Visual inspection shows that there are still vast areas of land which could benefit from small irrigation and soil conservation projects. It is estimated that over 1.9 million hectares of land in MAGA Regions I and V alone could benefit from these activities. These projects would generally protect farm units less than 5 hectares in size and would consist of simple, low-cost designs (gravity irrigation systems, earth and rock terraces, contouring, belt reforestation, etc.)

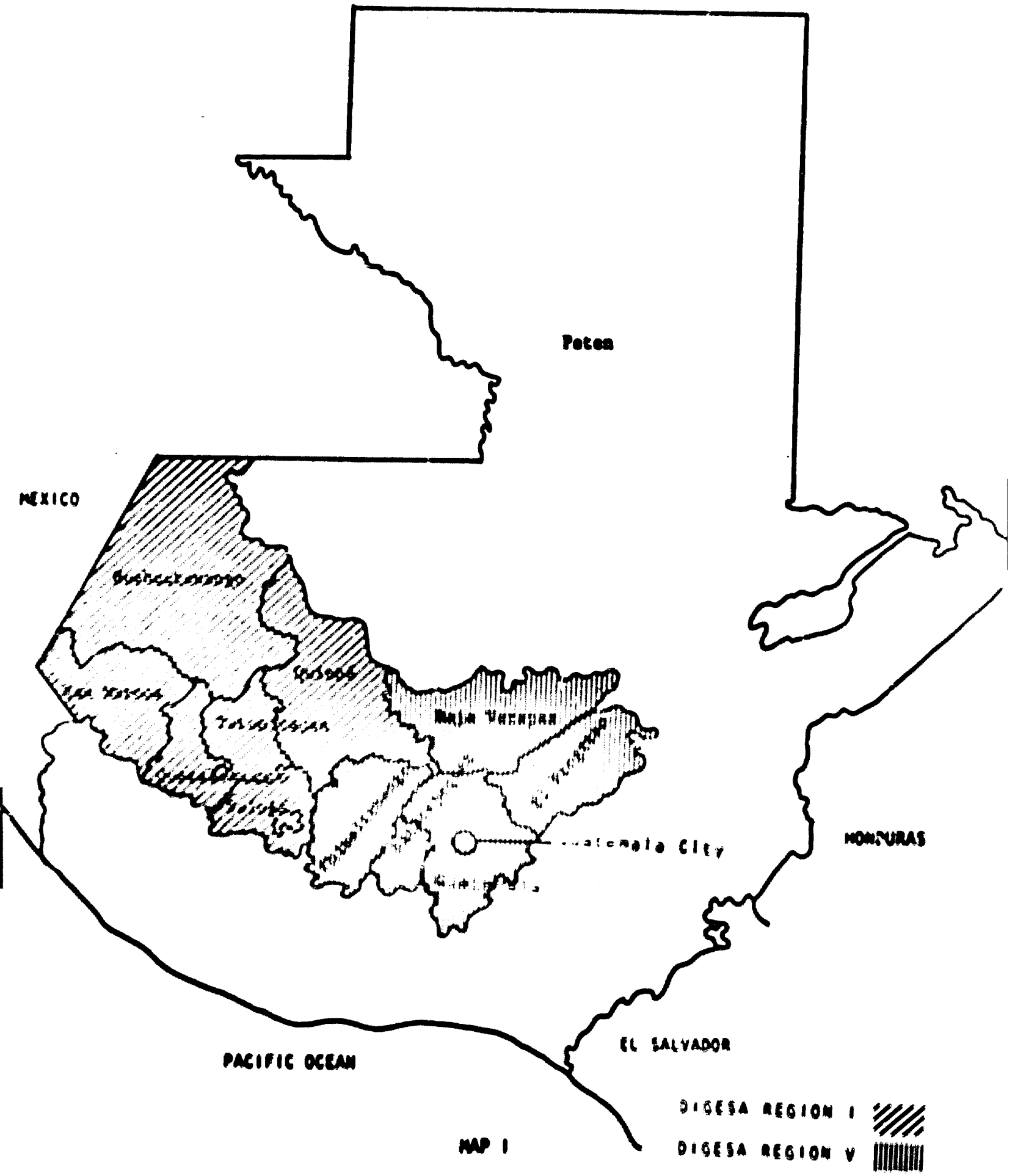
Agriculture in the Highlands is basically dependent on rainfall which has highly unpredictable patterns in Guatemala. Given wide variance in these rainfall patterns and the fact that subsistence farmers cannot afford a crop failure, it is clear that supplementary irrigation has a high potential for social and financial payoff. The benefits from supplemental water supplies derive principally from:

1/ Evaluacion de Recursos Naturales Para Determinar el Uso Potencial de la Tierra en Guatemala.

2/ Final Report, Jerome Arledge, June 1980.
Small-Scale Irrigation, Bertis Embry, March 1983.
Abbreviated Economic Analysis of the Small Farmer Development Project, Gary Smith, May 1983.

3/ Smith, Gary, op. cit., P.

AREA OF PROJECT 520-0274



MAP I

Enabling the introduction of multiple cropping in many areas;

Reducing risk of loss due to lack of water at critical periods during the growing season;

Increasing yield potentials through use of fertilizers and pesticides; and

Reducing planting time restrictions.

The major activities required to permit effective use of supplemental water in the Highlands are:

Construction of systems to introduce proven irrigation techniques;

Capture of runoff water to increase total supply through contouring and terracing, and

Conservation of soils by regulating runoff rates through proper cropping patterns.

The benefits from implementing soil conservation may be summarized as follows:

Prevention of hillside erosion, thus conserving the soil;

In conjunction with an assured water supply, an increase in flexibility regarding sowing and harvest times, thus enhancing the farmer's ability to take advantage of shifts in prices and other market conditions; and

Prevention of fertilizer and pesticide runoff with rain, thus contributing to higher yields.

During the last 30 years, the country's forested area has diminished from 65% to 33% due principally to the high rates of population growth of more than three percent annually. This has resulted in increased pressure to produce agricultural products, and subsequent clearing of forest land for agricultural purposes, as well as a greater absolute demand for fuelwood by this increased population. As deforestation occurs, rural families must spend more time and travel further distances to obtain fuelwood, which simultaneously drives up fuelwood prices for the 45% of wood-using families who must purchase it. 4/ With indiscriminate cutting the long-range effect will be increased soil depletion, disappearance of forest-supported wildlife, excessive water erosion, and stream and lake sedimentation.

4/ A Fuelwood Policy for Guatemala, United Nations Development Program Project GUA/74/014V. Susan Bogach, January 1981, p. 1-1.
5/ Ibid, p. 1-10.

Empirically while per capita consumption of fuelwood declines with increasing incomes and urbanization, demand for fuelwood increases proportionally with growth in population. Presently in Guatemala population growth is about three percent while average growth in the economy in real terms during the last three years has been about one percent Given these growth levels, the demand for fuelwood in the coming years is estimated to be: 1985 - 6.5 million cubic meters, 1990 - 7.6 million cubic meters, and 2000 - 10.2 million cubic meters. With this increasing level of demand for fuelwood and the decreasing availabilility of natural fuelwood forests it will be necessary for Guatemala to increase sharply its planting of fuelwoods of rapidly maturing varieties especially in the highly populated Highlands, in order to avoid the replacement of a domestic, renewable resource (fuelwood) by an imported, non-renewable fuel (petroleum). Failure to do so will have a negative impact on the Guatemalan balance of payments in general and on the Highlands rural population s standard of living in particular.

A second reason for the rapid disappearance of natural fuelwoods is the use by over 80% of rural households of open fires or inefficient traditional wood cookstoves, resulting in an energy loss of from 25-60%. If fuel-efficient stoves were used by this population, these families could reduce by 50% the amount of fuelwood they presently use, thereby reducing their financial outlay for fuelwood as well as permitting existing natural fuelwood supplies to last further into the future.

The replacement of a renewable, domestically available fuel by non-renewable, imported fuels is not an inevitable process. There are numerous ways of making fuelwood a viable source in the long-run for the majority of Guatemalan families, all of which imply a varying combination of human institutional and financial resources.

II. Detailed Activity Description

Three programs have been designed which will expand the conservation and proper management of soil, water and forestry resources. These programs will be carried out on approximately 5,800 hectares benefitting over 60,000 rural poor families. The activities carried out under this activity will promote soil conservation practices, small irrigation systems and promote reforestation activities in Guatemala.

a. Small-Scale Irrigation

These sub-projects include the construction of simple infrastructure works using local labor and materials to irrigate agriculture lands used primarily for rainy season cultivation. This addition of water introduces a potential for the doubling of incomes on the same land area through producing at least one additional harvest annually.

Based on the experience of an irrigation engineer from Utah State University[1/], working with GOG engineers and agronomists, it has been

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1/ Final Report Small Farmer Irrigation Project - Bertis L. Embry April 1981

shown that there are no overriding technical difficulties with this activity. A number of potential approaches are feasible for providing irrigation depending on the terrain and water source. These will be carried out in conjunction with soil conservation and drainage improvements. Examples of potential returns from different types of systems and costs are discussed in detail in Annex F with high internal rates of return shown.

On-Farm - Simple Diversion, Gravity Flow System: This example assumes that a farm is close to sufficient water, which means it is next to or running through the farm. Under these conditions, a simple diversion system with gravity ditching and complete open furrows will be constructed.

Community - Simple Diversion, Gravity Flow System: For this example a stream flow, adjacent to or flowing through the land to be irrigated, of two cubic feet/second is assumed along with 4" weekly irrigation water delivered to each individual plot. This system, consisting of a rock and earth diversion dam, gravity canals and open furrows, would be constructed. Due to the materials used and construction methods utilized, the cost of the above two systems will be minimal.

Community - Simple Diversion, Gravity Pipe System: This alternative assumes flow of two cubic feet/second from a stream that can be diverted from high up on a steep hill. The system is designed to provide sufficient pressure for sprinklers and would be constructed using an entrance box - settling basin structure, and appropriate pipelines. Using this system, it is estimated that it will cost $26 to irrigate one cuerda (.043 hectare) of land.

Lake and River Community - Pump Irrigation System: Under this assumption two cubic feet/second of water (900 gal/min) would be lifted from the water supply for gravity flow distribution. This more complex system would require a pump, motor, pipe system, sprinklers, installation and annual operating costs. Using a pump system, it will cost approximately $61 to irrigate one cuerda (.04) hectare) of land.

It is anticipated that, based on past experience, 80% of all irrigation systems constructed will be of the simple diversion gravity flow types. For the roughly 20% non-gravity flow systems, conventional electrical or diesel pumps may be used, as well as hydraulic rams, wheel pumps or wind mills if proper circumstances to operate these irrigation mechanisms exist.

The Direccion General de Servicios Agricolas (DIGESA) will be in charge of the design and construction of small irrigation systems and soil conservation devices. Four small-scale irrigation DIGESA technician teams consisting of a hydraulic engineer, agronomist, topographer and draftsman will work with the farmers to draw up plans and specifications, and a simple credit agreement. The plans and agreement will be reviewed by the regional chief of

DIGESA and presented to the proper agency for approval and disbursement. The teams will organize labor and supervise construction providing any needed technical assistance. DIGESA will strengthen its staff in Regions I and V (Sierra) with the hiring and training of sixty local farmers (guias agricolas). These guias agricolas will assist the 30 current DIGESA extension agents in visiting projects and facilitating the organization of informal water user associations (where desirable). In addition the DIGESA teams will monitor the operation and maintenance of the irrigation systems, assist with proper irrigation techniques and encourage crop diversification and on-farm improvements. The DIGESA teams have conducted similar activities in the past and are familiar with all methods and technologies required for the construction of irrigation systems.

Site identification, design, construction and on farm development will be carried on simultaneously. This procedure was chosen in order to take advantage of the strengths of the implementing agency to identify, study and execute small scale irrigation and soil conservation activities. A potential small scale irrigation site is identified by a farmers association or a DIGESA promoter. One of the DIGESA small scale irrigation teams will make several site visits to determine if an irrigation system is technically feasible and what type of structure best suits the conditions present. This team will also investigate water rights and land tenure, determine potential land use, calculate water quantity and availability and determine the social and economic feasibility of the irrigation system. The DIGESA team will draw appropriate plans and assist in the actual construction.

The resulting plan will include what is to be done technically and structurally (such as a simple diversion gravity flow pipe irrigation system with terraces), how it will be done (organization of labor/tools, materials), and who will accomplish given tasks (schedule man-days of work, local material procurement for small scale irrigation which will include cement, pipes, pump, materials, parts and fuel as required). The DIGESA team will also assist the participating farmers in the preparation of credit applications. These applications will then be submitted to the Regional Chief of DIGESA for presentation to the Banco Nacional de Desarrollo Agricola (BANDESA) for approval. BANDESA will participate as the financial agent for the fund established for sub-lending to the benefitting farmers for the purchase of needed materials. Credit procedures have been established in BANDESA and are currently functioning for administering medium-term programs of this nature. Individual or group loans are available. Actual construction of the irrigation system will be done by the system beneficiaries. Social cost payments will not be provided due to the high rates of return on investment and increased income potential when the irrigation systems are operational.

The time required for the completion of each phase and construction varies dramatically due to the topography, problems (if any) involving water rights, size and type of the irrigation system and the number of beneficiaries. However, an average irrigation project of 15 hectares requires approximately 670 person-days of labor for construction.

b. Soil Conservation

This activity will be carried out in close conjunction with small-scale irrigation activities, and where technically feasible, on the same farm lands. The structures may consist of any one of several designs. However, due to soil and water retention and soil slopes encountered, it is estimated that 70% of these devices constructed will be simple bench terraces. Other types of soil conservation structures constructed or practiced will be brush and rock dams, strip cropping or contour furrows. The type of soil conservation method used will be determined by the DIGESA extension agent and the local farmer.

Approximately 115 person-days of labor are required to construct one hectare of bench terrace while normal land preparation requires 25 person-days per hectare. It was demonstrated under Project 520-0233 that farmers, once they have observed and been convinced of the benefits, will construct soil conservation structures without social benefit payments. However, to maximize the demonstration impact of these works throughout the Highlands and the resultant spread effect, $1,500,000 in loan funds will be used by DIGESA, in Regions I and V for social benefit payments and logistical costs to compensate farmers for this extra labor and to make these practices more attractive. Using proposed project funds and under the guidance of DIGESA approximately 2,200 soil conservation structures will be built which will protect 5,000 hectares of land and will directly benefit over 20,000 families, or 120,000 rural poor. Assuming that each participating family will terrace six cuerdas (0.258 hectares) of land, the one-time social benefit payment to each family will be approximately $80. In order to increase the effectiveness of the DIGESA personnel, 60 selected individuals from the community (guias agricolas) will be utilized by DIGESA to promote and, if necessary, supervise the construction of the soil conservation devices. BANDESA will participate as the financial agent for the social cost payments which will be approved by the DIGESA extension agent and which will be paid after the construction process. Once completed, the soil conservation terraces will require little additional input from the GOG. The hand construction of these soil terraces requires only rudimentary equipment to survey and design the terrace and only minimal maintenance is required to keep the terraces in good repair. Incomes have been shown to increase when only terraces are constructed but not as dramatically as when irrigation systems are utilized (Annex F).

DIGESA extension agents, in conjunction with locally trained area farmers or guias agricolas (whose wages are paid by DIGESA), will be responsible for the site selection and construction of soil conservation structures (primarily bench terraces and contour rows). Thirty-six months of short and long-term loan funded technical assistance will be provided to improve the agricultural extension abilities of the DIGESA employees and guias agricolas. Using home-made leveling devices and hand tools, the interested farmer will work under the guidance of the extension agent to construct the soil conservation structure. The construction process will be as follows:

Site identification by the interested farmer and DIGESA personnel.

Examination of the topography and determination of appropriate structure.

Construction of soil conservation structure using hand tools and locally made equipment.

One cuerda of soil terraces requires approximately four days for construction. This time, however, will vary considerably due to soil topography, soil type and size of structure. After the construction of the bench terrace, the entire backwall will be planted in grasses (obtained from DIGESA) for animal fodder and to provide additional protection from soil erosion.

Social cost payments will be used only to introduce soil conservation practices in areas where they are not presently used. Interested farmers will be selected by DIGESA agents to receive payments and will be paid on a per unit of land improved basis, calculating approximately $3.20 per day for their labor. BANDESA will participate as the financial agent for the social cost payments which will be approved by the DIGESA extension agent and which will be paid after the construction process.

Project loan funds will purchase 12 four-wheel drive vehicles and 12 motorcycles for use by DIGESA soil conservation agents to make their efforts more effective. In addition, sixty locally manufactured bicycles will be purchased for use (by the guias agricolas), as appropriate, for Small-Scale Irrigation and Soil Conservation.

TABLE II
INPUTS - SMALL SCALE IRRIGATION, SOIL CONSERVATION AND REFORESTATION
($000)

ITEM	FOREIGN EXCHANGE	LOCAL CURRENCY	TOTAL
I. USAID			
A. Small Scale Irrigation			
1. Construction Materials		1,000	1,000
2. 4WD Vehicles X 8	80		80
3. Motorcycles X 6	10		10
4. Bicycles X 60		10	10
5. Educational and Training Materials		50	50
6. Office Supplies/Equipment	50	-	50
SUBTOTAL	140	1,060	1,200
B. Soil Conservation Structures			
1. 4WD Vehicles X 4	40		40
2. Motorcycles X 6	10		10
3. Office Supplies/Equipment	50		50
4. Educational and Training Materials		140	140
5. Technical Assistance	300		300
6. Social Payments	-	1,260	1,260
SUBTOTAL	400	1,400	1,800
C. Reforestation			
1. Labor Intensive Wages	-	248	248
2. Commodities (Total)	13	28	41
a. Polyethylene Bags	6	-	6
b. Fencing Wire	7	-	7
c. Pesticides, Insecticides and Fertilizers	-	2	2
d. Other	-	26	26
3. In Country Training	-	11	11
4. Technical Assistance	200	-	200
5. GOG Personnel Costs	-	-	-
6. Land (Municipalities)	-	-	-
SUBTOTAL	213	287	500
USAID TOTAL	753	2,747	3,500

II. GOVERNMENT OF GUATEMALA (GOG)

A. Small Scale Irrigation*			
1. Construction Materials		281	218
2. Admin. Overhead/Indirect Costs	=	460	460
SUBTOTAL		741	741
B. Soil Conservation Structures			
1. Social Payments		450	450
2. Admin. Overhead/ Indirect Costs	=	676	676
SUBTOTAL		1,126	1126
C. Reforestation			
1. Labor Intensive Wages		23	23
2. Commodities		1	1
a. Polyethylene Bags		+1/	1
b. Fencing Wire		+1/	1
c. Pesticides, Insecticides and Fertilizers		+1/	1
d. Other		1	1
3. In Country Training		-	-
4. Technical Assistance		-	-
5. GOG Personnel Costs		71	71
6. Land (Municipalities)	=	63	63
SUBTOTAL		158	158
GOG TOTAL		2,025	2,025
USAID AND GOG TOTAL	753	4,772	5,525

1/ Less than Q1,000

* The beneficiaries of a system will provide on the average, 670 person days of labor to construct an irrigation system.

c) Reforestation

1 Strategy

The purpose of this reforestation activity is to assure a long-run profitable supply of fuelwood for the Highland population at fair market prices which will not effect a reduction in their net incomes. The objectives of this activity are:

Minimize deforestation in the Altiplano as a result of fuelwood consumption.

Determine the feasibility of private reforestation activities.

Provide employment opportunities in the communities where reforestation is taking place.

According to the Technical Analysis (Annex 7), five possible interventions were considered, but because of funding limitations, project feasibility, and the need to test interventions, only two production interventions were selected to be included in this Project with a third more limited intervention:

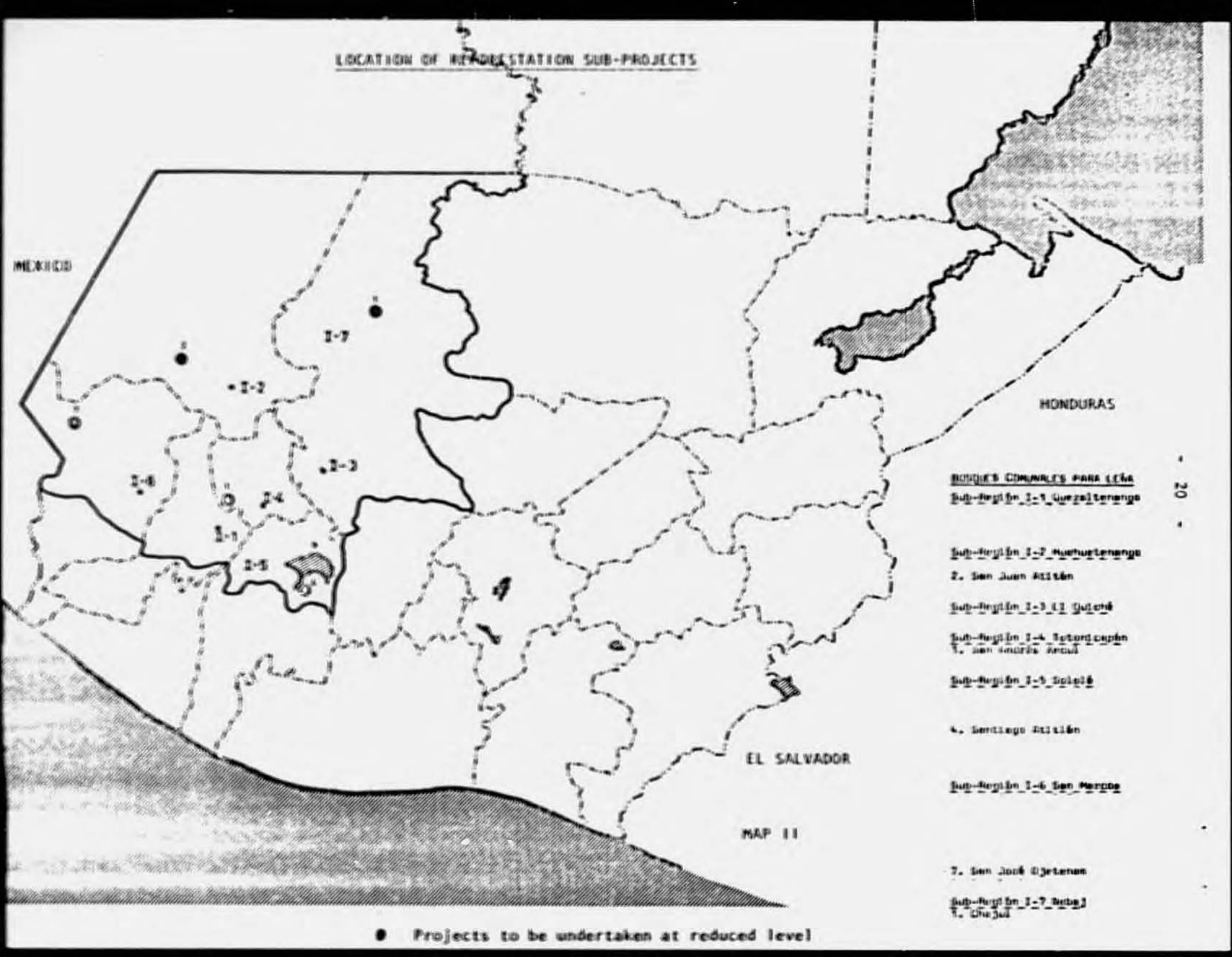
Fuelwood production from reforested public lands.

Fuelwood production from seedlings planted on small land holdings.

Development of an action plan for wider dissemination of fuel-efficient stoves.

2) Description of the Target Area

The National Forestry Institute (INAFOR) prepared 27 detailed reforestation sub-projects to be implemented with their own funding during the period 1983-86 (See Map II). These sub-projects are located in the INAFOR Region I, which includes the six departments of Quezaltenango, Huehuetenango, El Quiche, Totonicapan, Solola and San Marcos and the Sub-Region of Nebaj. However, because of severe budget reductions in the GOG public sector in 1983 and 1984, INAFOR has not been able to initiate these sub-projects. At AID's request INAFOR subsequently presented a subset of 19 projects, which still covered the original seven sub-regions indicated on the map. The final decision to undertake only five of these sub-projects in reforestation of municipal lands (explained in the Technical Analysis) means that five of the seven sub-regions will have pilot projects. According to the map these are the sub-projects of San Juan Atitlan (I-2), San Andres Xecul (I-4), Santiago Atitlan (I-5), San Jose Ojetenam (I-6), and Chajul (I-7). The total area to be reforested is 124.5 hectares.


LOCATION OF REFORESTATION SUB-PROJECTS
MEXICO
HONDURAS
EL SALVADOR
I-7
I-2
I-3
I-6
I-4
I-1
I-5
BOSQUES COMUNALES PARA LEÑA
Sub-Region I-1 Quezaltenango
Sub-Region I-2 Huehuetenango
2. San Juan Atitán
Sub-Region I-3 El Quiché
Sub-Region I-4 Totonicapán
Sub-Region I-5 Sololá
4. Santiago Atitlán
Sub-Region I-6 San Marcos
7. San José Ojetenan
Sub-Region I-7 Baja
1. Chajul
MAP II
• Projects to be undertaken at reduced level

The size of these sub-projects varies from 4 hectares in Solola to 45 hectares in Huehuetenango and Totonicapan. All are located on or near to existing roads which will facilitate transportation of inputs into and fuelwood out of the area. Other than some extensive holdings by municipalities -- the subject of the public lands reforestation -- and a few individual landowners, most of the agricultural land in these areas is held in small plots worked by Indian farmers with few technical inputs. It is this group that will be the target of the seedlings for small land holdings in these same five areas, with the expectation of reaching 40,000 farm families.

3. Implementation Plan

INAFOR, with assistance from municipal officials and the community and municipal reforestation committees, will carry out the five sub-projects selected for pilot activities in municipal land reforestation. Each of the five responsible INAFOR sub-project managers will be required to keep detailed records of all input and labor costs during the four-year period so that total and per hectare costs of production of fuelwood can be accurately determined as well as the level of labor employed. In this manner the most efficient combination of labor and capital resources and the expected profitability of reforestation can be determined. Also, recordkeeping in the pilot approach will enable INAFOR and AID analysts to determine geographical differences in availability and use of labor, wage rates and difficulty of access to the sub-project area. The predominant type of fast-growing fuelwood to be grown on municipal lands will be aliso, although fresno will also be grown in San Jose Ojetenam while cherry and eucalyptus will be grown in San Andres Xecul. The INAFOR sub-project managers will be responsible for obtaining the appropriate seed and inputs for establishing the seedbeds in each of the five areas and, with the community and municipal reforestation committees, identify the location of the nurseries. Local participation will be determined by the above mentioned committees.

INAFOR technicians will visit the communities surrounding each sub-project area prior to initiation of reforestation activities in order to plant some demonstration trees, explain the program and help organize the community reforestation committees. INAFOR will use audio-visual materials developed by CATIE in this task. After these committees are established, the sub-project managers will concentrate their efforts in the organization of the municipal reforestation committees. Having achieved this, the manager will then set up the nurseries. As mentioned earlier, once the nurseries are established, each sub-project manager will keep detailed records on operational costs of this activity.

The provision of seedlings to small farmers will be accomplished through collaboration between INAFOR and the municipality in which the seedlings will be produced in the same nursery used for reforestation activities on public lands. During year 1 all transplants will be made from nurseries to the land to be reforested, thus freeing up nursery land for additional activities. In years 2-5 these nurseries will be employed to produce seedlings for small farmers. It is expected that as local community employees are trained in tree

planting and maintenance, they will better understand the desirability and profitability of reforestation on their own lands. In year 2 INAFOR will have a fund to develop seedlings and provide the people who purchase these seedlings with wire cones to protect the individual trees planted on land boundaries. When community members purchase the seedlings at cost from the nurseries, the nursery fund will be replenished which will permit the growing of seedlings in each subsequent year. This fund will be managed by the respective municipal reforestation committee. INAFOR and DIGESA technicians will work closely in this activity since fruit trees (especially cherry) are the most likely species of tree for sale to surrounding communities. Not only do they produce fuelwood rapidly as well as provide fruit, but it appears to be the type of tree for which rural inhabitants would be willing to pay. DIGESA's collaboration is important also because of the possibility of planting these trees on terraces built under the AID-DIGESA terracing component.

4) Organizational Requirements

The implementing agency for this activity will be the National Forestry Institute (INAFOR) which has an established regional office in Quezaltenango, responsible for all forestry activities in Region I. All activities in this activity will be managed out of this regional office with INAFOR budgetary support being provided for salaries, travel and per diem, gasoline and materials over the four-year duration of the activities.

In order to assist INAFOR in the establishment and operation of reforestation on municipal lands, reforestation committees will be set up at the community and municipal levels. At the lowest level, the participants will be solely community inhabitants who will in turn elect their representatives to the municipal committees. All communities which surround the individual reforestation sub-projects will establish these local committees, the number varying from five to fifteen, depending on the number of communities in the area of influence. At the municipal level the participants will include the mayor, a representative of each of the community reforestation committees, a representative of INAFOR, and a representative of the Ministry of Agriculture Extension Service. This committee will be responsible for determining the level of participation (number of person days per year) to be provided by each local committee, the distribution of fuelwood when it is cut, the pricing policy for fuelwood sales, and general supervisory and inspection responsibilities concerning the implementation of each sub-project. When the work quotas are established for each local committee, this committee in turn will assign work responsibilities to the members of the community. Additionally, this municipal committee will be responsible for managing the nursery fund to provide seedlings for small farmers.

d. Summary of Activity Inputs

These irrigation and soil projects are designed with the objectives of providing the optimum number and level of inputs to complete up to 750 hectares of small scale irrigation projects and 5,000 hectares of soil

conservation/water retention improvements. These inputs will include construction materials and equipment, construction labor costs, staff and equipment for regional teams and technical assistance to DIGESA in project planning and execution. In addition to the construction supervision of the irrigation and soil conservation structures, the DIGESA agents will provide technical assistance to the farmers in water utilization as well as advice on crop diversification, optimal inputs and marketing advice which will maximize production and income. Table II below provides a breakdown of financial inputs for both the GOG and AID

In order to reforest 124.5 hectares of municipal lands on a pilot basis, distribute fuelwood seedlings to 40,000 farm families and develop a strategy for coordinated action in the building of fuel-efficient stoves, this activity must have $500,000 of AID funds ($300,000 of loan and $200,000 of grant) for the specific items indicated in Table IV.

Costs for the reforestation of municipal lands ($239,000 of AID funds) go principally for payment of wages to members of the surrounding communities to carry out the nursery transplant and maintenance activities over the four-year period. Likewise for production of seedlings for small farmer distribution, the principal part of total cost ($50,000 of AID funds) will become effective in year 2 and will be a rotating fund to be replenished by the purchase at cost of the seedlings produced in these nurseries.

In-country training for $11,000 of AID funds will be undertaken only at a regional and field level for four different groups: community groups (reforestation comittees), people hired from the communities to work in the nurseries and woodlots, foremen specialists in the management of nurseries and woodlots, and INAFOR and DIGESA technicians. The middle two groups will be trained in nursery management through one short course of 4 days as well as on-the-job training and field days. The community will be given training through two short courses of 3 days each for establishing and maintaining woodlots and individual plantings. Also 10 field days for community leaders will be organized as well as various conferences and informational meetings in communities using pamphlets, posters, slides and movies. Funds will also be provided from this activity for development of appropriate audio-visual materials.

Grant-funded technical assistance for $200,000 of AID funds will be provided for hiring a U.S.technician with experience in natural resource management, reforestation on small scale and fuel-efficient wood burning stoves. During the two years of his contract, he will do the following: assist INAFOR in the technical aspects of reforestation and nursery maintenance, help develop informational campaigns with DIGESA and INAFOR for on-farm planting of seedlings, analyze the information from records on municipal reforestation and make recommendations on most-efficient mixes of capital and labor as well as the profitability of reforestation activities, guide the municipal and community reforestation committees and, most importantly, develop a long-range strategy for an integrated campaign of building fuel-efficient wood stoves.

The GOG contribution of $158,000 will be in the form of wages, inputs, support personnel costs at both the sub-regional and municipal levels, and land.

B. Access Roads Component

1. Component Overview

The Departamento de Caminos Rurales (DCR) was established in 1978 within the Direccion General de Caminos to initiate an AID-financed labor intensive access roads construction program. By 1984 the DCR will have constructed or rehabilitated more than 450 kilometers of AID-financed roads and about 300 kilometers of GOG-financed access roads. However, once constructed these roads received little maintenance resulting in reduced road use benefits such as access to markets, agricultural inputs, and health and extension services. Access roads without maintenance generally have to be completely reconstructed after five years at approximately the same cost as building new roads. Therefore, the Direccion de Caminos Rurales has requested AID financing to initiate a labor intensive access roads maintenance program. This program will include all roads previously constructed by the DCR that do not now require rehabilitation 1/ as well as labor intensive access roads to be constructed by the DCR during the next five years. It is anticipated that by the end of the five year period of the project maintenance methods to be initiated will be sufficiently established to allow the DCR to continue both its labor intensive maintenance and construction program without further technical assistance.

The purpose of the component is to assure continuous road access to markets, agricultural inputs and health and extension services by rural Highlanders. Since these roads will be maintained utilizing labor intensive methods with the factor cost of labor reasonably priced, the cost per kilometer will be relatively low while at the same time providing part-time employment opportunities for a portion of Guatemala's rural underemployed population (405,000 work days of labor).

2. Maintenance of Rural Access Roads Program

Initially, 500 kilometers of access roads previously constructed by the DCR utilizing labor intensive methods will be brought into the new maintenance program. Each following year about 200 additional kilometers of new access roads constructed by the DCR will be introduced into the expanding maintenance program. At two of DCR's six regional headquarters maintenance offices will be established, each office covering three DCR regions. One regional office will be located in Region I and the other office in Region IV (see map III for DCR Regions). Each regional access road maintenance office will oversee the maintenance of approximately 250 kilometers the first year

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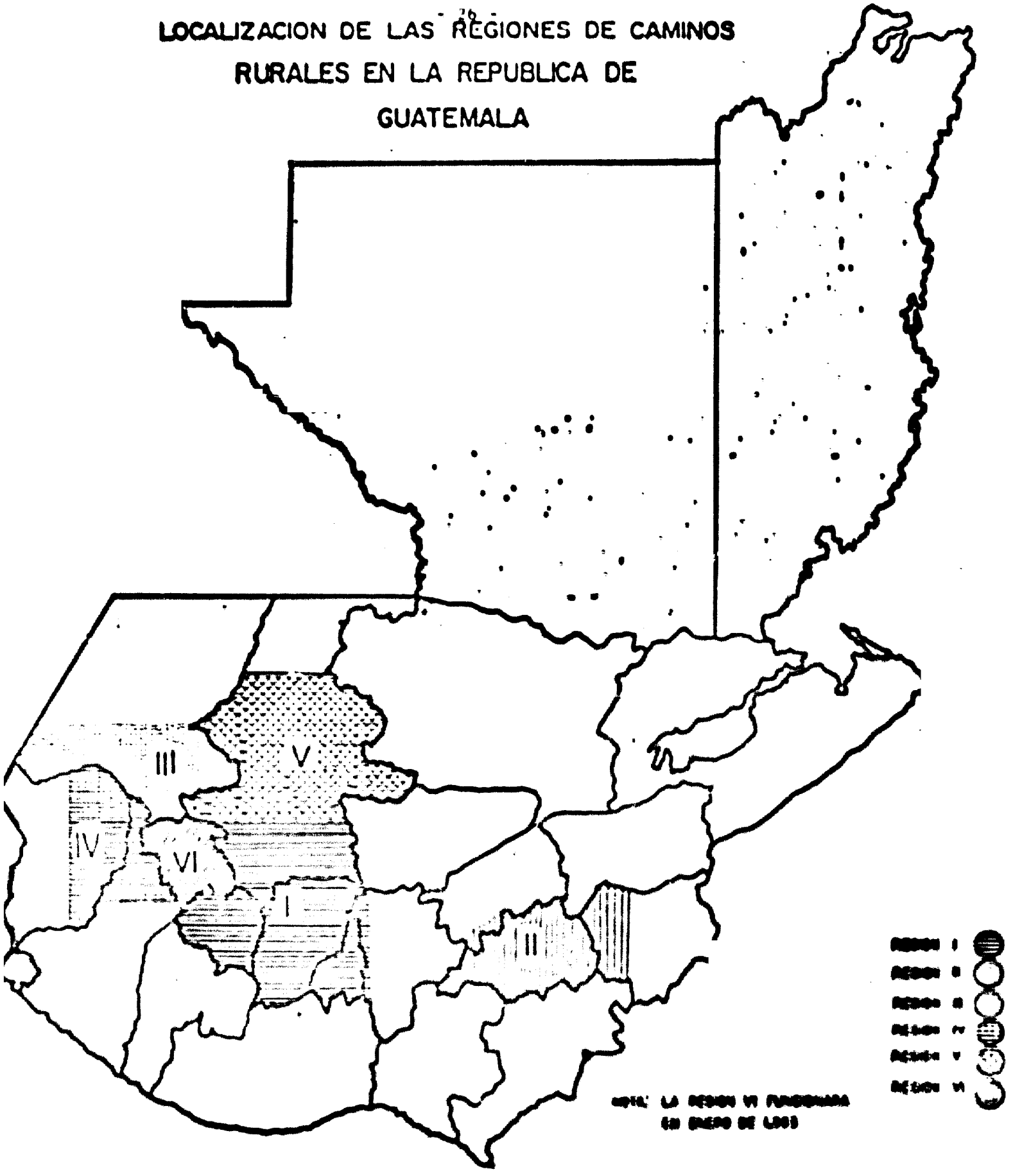
1/ DCR will rehabilitate roads not currently in condition to enter the maintenance program with funds provided by AID within the $3.0 million extension to the Small Farmer Development Project (520-T-026).

LOCALIZACION DE LAS REGIONES DE CAMINOS RURALES EN LA REPUBLICA DE GUATEMALA



MAP 111

increasing to 650 kilometers by the fifth year, the end of AID financing. Total roa being maintained at the end of the project will be 1300 kilometers. (See table IV below for yearly maintenance activities).

TABLE III

	Km. under maintenance program /Km. bajo programa de mantenimiento	Accum. Km. of roads maintenance /Km. accum. mant. caminos	Required work days annually/ dias anuales requer.	Work days accummulated/dias de trabajo acumulados
1 Year/1er. ano	500	500	45,000	45,000
2 Year/2do. ano	700	1200	63,000	108,000
3 Year/3er. ano	900	2100	81,000	189,000
4 Year/4to. ano	1100	3200	99,000	288,000
5 Year/5to. ano	1300	4500	117,000	405,000

The majority of the maintenance work required will be accomplished by labor intensive methods. The required labor will be provided by rural community construction and maintenance committees established during the DCR construction program. At the initiation of the program these committess will organize sufficient laborers to provide 45,000 work days of manual labor to be supervised by community foreman trained by DCR. As the number of roads under maintenance increases, work provided by these maintenance committees will increase. By the fifth year of the project it is anticipated that these community maintenance committees will supply 177,000 work days of labor annually to be paid on a piece rate bases at roughly Q 3.00 per day (see Annex F(8) for a description of required work.

a. Project Administration

Within the DCR's six regional headquarters two maintenance offices will be established, one in Chimaltenango Regio[illegible] and one in Quetzaltenango (Region IV). Each new maintenance office will administer the maintenance of roads constructed within three of the DCR's regions. The existing staff in the two regional headquarters will provide payroll and accounting support. The maintenance program will require the hiring of two new DCR employees (resident maintenance engineers) to coordinate and manage the program. Each engineer will have a staff of two assistants and one assistant warehouseman for a total administrative staff of eight new employees plus six drivers to support their activities. The programs within the two maintenance regions will also be monitored by the chief of maintenance of the DCR central office who will be assisted by one newly hired administrative assistant.

b. Project Operation

The DCR maintenance personnel will support this program by (1) providing initial technical assistance in identifying work requirements during monthly field visits to assess the physical state of each road segment; (2) providing supervision during major maintenance efforts; and (3) providing heavy equipment support when needed. Routine preventive maintenance consisting of cleaning drainage ditches and culverts, filling potholes, minor road reshaping and earthwork, and removal of excess vegetation will be undertaken on a continuous basis by the community with hand tools distributed by DCR and will require little DCR supervision, given the level of experience of the community committees. The four maintenance assistants will make routine inspection and certification visits before workers receive their periodic wages at each of the six regional offices located in the working area.

The major tasks of resurfacing road segments with replacement gravel and major reshaping will be required about once a year for portions of each road segment depending on traffic, topographic, and climatic conditions. For this effort each of the two maintenance regional headquarters will be equipped with a heavy equipment maintenance unit to assist the communities. Each unit will include one road grader, six dump trucks and one backhoe/front end loader. In addition, one lowboy truck will be purchased to facilitate the transportation of heavy equipment from one work area to another. In total, 17 pieces of heavy equipment will be purchased (see Table IV) for the major maintenance support effort and the DCR will hire an additional 13 drivers to drive the dump trucks and low boy, and 4 heavy equipment operators to operate the 2 graders and 2 backhoes. The road graders will only be used for major road reshaping requirements and major resurfacing efforts. At the current time, the DCR uses two road graders during the construction effort. The communities provide sufficient manual labor to spread and level surfacing materials as well as shape the roadway. Each road grader will be assisted where needed by three or four dump trucks which will be loaded by the backhoe/front end loader. The other dump trucks will be used on roads where the gravel pits are readily accessible and the volume of gravel to be transported to a segment for resurfacing is small. In these cases the community maintenance committees will load the trucks manually, a slower method, but one which eliminates the need to operate additional heavy equipment. The use of equipment in each region will be scheduled primarily in accordance with resurfacing needs.

The 17 pieces of heavy equipment will have the capacity to meet maintenance needs through the third year of the project. Beginning the fourth year an additional unit (eight pieces) will be required in order to provide sufficient heavy equipment coverage for the larger number of kilometers in the road system. At that time the DCR will contract six additional drivers for the new dump trucks and two heavy equipment operators for the grader and back hoe, plus three additional drivers to support two additional assistant engineers and one resident engineer.

Table IV/Cuadro IV
($000)

Inputs - Labor Intensive Access Roads Maintenance Program
Insumos - Programa de Mantenimiento de Caminos de Acceso con Uso Intensivo de Mano de Obra

		FX/ME	LC/ML	TOTAL
A.	USAID			
1.	Commodities/Mercaderias-(total)	1,476	45	1,521
a.	Dumptruck/ Camion de Volteo x 18	360	-	360
b.	Road Graders/ Motoniveladoras x 3	135	-	135
c.	Backhoes/ Excavadoras x 3	105	-	105
d.	Low Boy/ Trailer con Plataforma Baja x 1	90	-	90
e.	4 WD Vehicles/ Vehiculos con traccion en las Cuatro Ruedas x 9	90		
f.	Spare Parts/ Respuestos	108	-	108
g.	Tires/ Llantas	520	-	520
h.	Hand Tools/ Herramientas	68	45	113
2.	Other Costs (Total)/ Otros Costos (Total)	-	929	929
a.	Labor Wages/ Jornales	-	765	765
b.	Heavy Equipment Lubricants/ Lubricantes p/Equipo Pesado	-	164	164
	Sub Total	1,476	974	2,450
B.	DCR			
1.	Personnel (5 years) - 48 employees/ Personal (5 anos) - 48 empleados	-	844	844
a.	Assistant to Maintenance Coordinator/ Asistente de Mantenimiento Coordinador x 1	-	-	-

b.	Resident Engineer/ Ingeniero Residente x 3	-	-	-
c.	Assistant to Resident Engineer/ Asistente del Ingeniero Residente x 6	-	-	-
d.	Warehouseman/ Bodeguero x 2	-	-	-
e.	Payroll Clerk/ Planillero x 2	-	-	-
f.	Drivers/ Pilotos x 28	-	-	-
g.	Heavy Equipment Operators/ Operadores de Equipo pesado x 6	-	-	-
2.	Labor Wages/ Jornales	-	922	922
3.	Operating Costs/ Costos de Operacion	-	1,426	1,426
	Sub Total	-	3,192	3,192
	TOTAL	1,476	4,166	5,642

By the end of the five year program over approximately 50,000 farm families will have received benefits associated with well maintained roads. In addition, Q1,687,000 in productive labor costs will have been paid to the target group paying for more than 405,000 work days of manual labor. In total, 1,300 kilometers of access roads will be included in the labor intensive access roads program, being maintained at an average annual cost of Q 1,149 per kilometer, or 5.7% of the original cost to construct or upgrade a path to an all weather access road using labor intensive methods.

3. Heavy Equipment Maintenance:

In order to insure that the above mentioned objectives are achieved, the heavy equipment purchased to support the road maintenance program must itself be maintained and operating at top efficiency. In addition, existing DCR equipment used to construct roads must be maintained in order to assure continued construction of new rural access roads

A recent survey of the $2.0 million investment in AID financed heavy equipment purchased for the initiation of the labor intensive access roads construction program under a previous AID loan project (520-0233) has shown that the current DCR corrective and routine heavy equipment maintenance program is not sufficient to keep the existing heavy equipment in top condition. In order to remedy this situation as well as guarantee the efficient utilization of the heavy equipment to be purchased for road maintenance, an equipment maintenance element will be included within this component.

The DCR currently has a small mechanic's shop at each one of the six regional headquarters. Each shop is staffed with a diesel engine mechanic, a gasoline engine mechanic, an assistant and a welder. At two of the shops a mobile field maintenance truck with two assistant mechanics will provide required preventive maintenance at work sites. In order to bring each regional workshop up to an equal and adequate level of installed equipment maintenance capacity, four more mobile maintenance trucks will be purchased, along with 3 electric welding machines, 4 autogenous welding machines and one set of mechanical tools for each of the six maintenance shops. To operate this equipment, the DCR will contract four additional drivers, three welders and eight assistant mechanics to provide mobile preventive maintenance. (See Table V for required inputs).

In the central office of the DCR one heavy equipment maintenance coordinator will be hired to initiate an improved heavy equipment maintenance program at each regional office. He will be responsible for developing standards and procedures for preventive equipment maintenance as well as assisting regional office chiefs to obtain the best utilization of equipment used in the field. He will also coordinate and schedule required corrective maintenance with the DGC district maintenance shops. This coordinator will be assisted by a newly appointed heavy equipment specialist who will perform the following tasks: inspect all equipment in the field, verify if preventive or

TABLE V/CUADRO V
Inputs - Heavy Equipment Maintenance
Insumos - Mantenimiento de Equipo Pesado
($000)

	FC/ME	LC/MN	TOTAL
A. USAID (Loan Only)/(Prestamo)			
1. Commodities/Mercaderias	1,100	-	1,100
a. Lubricant Trucks/Lubricantes para Camiones x 4	88	-	88
b. Electric Welders/Soldadores Electricos x 3	15	-	15
c. Autogenous Welders/Soldadores Autogenos x 4	4	-	4
d. 4 WD Pick Ups x 2	10	-	10
e. Mechanical Shop Tool Sets/ Juego de Herramientas Mecanicas x 6	180	-	180
f. Spare Parts for Construction (15%) Equipment/Repuestos para Equipo de Construccion (15%)	303	-	303
g. Tires for Construction and above Maintenance Equipment/ Llantas para Equipo de Construccion y Mantenimiento	500	-	500
2. Training/Adiestramiento			
a. Materials/Materiales	-	30	30
. Sub Total	1,100	30	1,130
B. DCR			
1. Personnel (5 Years) - 20 Employees			
Personal (5 anos) - 20 empleados	-	400	400
a. Equipment Maintenance Coordinator/ Coordinador de Equipo de Mantenimiento	-	120	120
b. Heavy Equipment Specialist/ Especialista de Equipo Pesado	-	90	90
c. Purchasing Expeditor/Agente de Compras	-	60	60
d. Drivers/Pilotos x 6	-	44	44
e. Welders/Soldadores x 3	-	38	38
f. Greasers/Engrasadores x 8	-	48	48

2.	Operating & Maintenance Costs for Maintenance Equipment/ Costos de Operación y Mantenimiento para Equipo de Mantenimiento	=	94	94
3.	Training/Adiestramiento			
a.	Per diem and Transportation/ Viáticos y Transporte Costs/Costos	=	26	26
	Sub Total	=	320	320
	TOTAL	1,100	550	1,650

corrective maintenance was completed; assist in the training of on-board mechanics; and advise the equipment maintenance central office of any excessive downtime or the need to obtain corrective maintenance at DGC district maintenance shops. These two employees will be supported with two 4 wheel drive vehicles and 2 drivers.

In addition, in order to insure that spare parts needed for routine maintenance are ordered and received when required, the DCR will contract a purchasing expeditor to coordinate all purchase requests at the central office. He will also check with regional office warehouse personnel to anticipate future requests and will advise local suppliers of possible future needs.

Approximately 3 person years of a heavy equipment maintenance program expert will be required to coordinate and technically support the activities described above. Specifically, the expert will provide DCR guidance in the efficient use of heavy equipment within a labor intensive maintenance program, in maintenance requirements of heavy equipment, in required spare parts and inventory procedures, and in on the job training for shop mechanics.

4. Mapping, Planning and Promotion of Rural Access Roads

a. Mapping

In order to assist in establishing priorities and scheduling road maintenance and rehabilitation, this activity will finance the development of a computerized access roads inventory. Socio-economic baseline data for each existing access road as well as road sections that are possible candidates for upgrading into all-weather access roads will be gathered. In addition to data regarding the number of people living along these roads and the economic value of their agricultural produce, physical data such as road length, width, conditions, drainage requirements, and topographic constraints will also be collected. This computerized data will indicate by DCR regions socio-economic data, physical, and environmental information for (1) possible new road sections; (2) road sections under construction, (3) road sections requiring rehabilitation, and (4) road sections under maintenance.

The gathering of the initial base-line data will be financed by grant funds. A mini computer will be purchased with loan funds and the DCR will contract one keypunch operator/programmer to enter new data and to recall analytical information for DCR management purposes. The updating of the original data base will be undertaken by GOG personnel at all six regional offices who will gather and revise access road statistics during their field trips. This information will be sent to the DCR central office where the keypunch operator will enter the new data into the computer.

Road sections will be divided at the boundary lines of each regional office so that each field unit will have its own roads identified (name or number of route, kilometer numbers, dimensions and characteristics of the surface type). Roads will be inventoried in the field by engineers.

experienced maintenance supervisors and social workers. They will be annually updated to provide feedback for evaluation of the access road program thus establishing a realistic basis for future planning and estimates of construction, rehabilitation and maintenance programs. Field evaluations, which will include information on population, schools, community organization and agricultural production, will be performed by the Access Roads Construction Department.

This data will not only serve the DCR in its selection and management of road construction, rehabilitation and maintenance activities, but it will also serve as a basis for inter-agency planning and decision making since it will assist in determining the viability of projects planned by other GOG agencies. For example, this information on rural accessibility will be a critical input into other agencies' future planning decisions regarding where to best construct projects such as rural schools, health posts, grain storage facilities, and rural markets.

Approximately 6 person months of a consultant in computerized access roads inventory programs will be required to support the above activities. The expert will possess experience in computer programming, data gathering, coding and report presentation.

b. Promotion

Presently, the general public is not adequately aware of the social and economic benefits accruing from timely and adequate maintenance of rural roads. This limited awareness, in turn, precludes popular pressure for improved performance in rural road maintenance. Consequently, the project will support a promotion campaign to educate the general public and key decision makers as to the need for the government to invest more of its resources in upgrading rural road maintenance programs.

The promotion campaign will convey two basic messages: (1) that it is cheaper to maintain rather than to reconstruct roads, and (2) that economic and social benefits of roads are greatly reduced when roads become impassable due to lack of maintenance. As to content, it will consist of three activities: seminars, radio spots, and videotaped documentaries. A local advertising firm or firms will implement the program in coordination with the GOG Chief of the Rural Roads Department.

Four seminars will be conducted annually beginning in year two. Each seminar will last 3-4 days, and will be scheduled to be held in April-May before the beginning of the GOG budget cycle. The seminars will discuss achievements/problems of the project to date, and new work methods or technologies which can improve rural road maintenance. Each event will involve approximately 30 participants from Caminos Rurales, and communities involved in road maintenance, high-level GOG officials, and representatives from agencies such as the Ministry of Finance and the National Economic Planning Council. In addition guest speakers from other countries and the local press will attend the sessions. Seminars will be held at locations in

the Highlands near access roads so that site visits may be made during these training events. AID will finance travel and per diem for seminar participants and speakers, as well as materials and supplies. The GOG will provide vehicles and gasoline for field trips to road maintenance sites.

Approximately 15 minutes per week of radio spots will be broadcast over local stations in the project area beginning in year two. Messages will urge communities to support and participate in local maintenance road programs, and will rely heavily on testimonials from laborers, bus/truck drivers, and other community members who work in or benefit from the maintenance program. A Guatemalan advertising firm will devote at least two months per year in developing or updating these radio spots. Production costs, which will be financed by AID grant funds, will fund taping and editing of radio messages. In addition, both AID grant and GOG counterpart funds will finance the purchase from private radio stations of approximately 500 1-3 minute spots. Commercial spots will be supplemented by 100 1-3 minute spots made available by national government radio stations in the project area. Spots will probably be broadcast early in the morning to maximize the listening audience.

The third and final element in the promotion campaign will be videotaped documentaries which will focus on the social and economic benefits produced by the maintenance road program. The documentaries will address two audiences: middle and upper class opinion leaders through television broadcasts, and a broader audience reached through local movie theaters in the project area. Addressing the television audience will help build greater public support for the program, whereas movie theater spots will encourage communities to continue with their involvement in the program when they see local road workers or users shown or interviewed in the documentaries.

A local advertising firm will devote approximately two months per year toward producing or updating four videotapes to be shown annually beginning in year two of the project. AID grant funds will cover all production costs and a portion of the funds required to purchase sufficient television air time to broadcast the documentaries two or three times a year during the life of the project, as well as rental of time in local movie theaters in order to show the documentaries during the same period.

c. Programming and Planning

In order to meet project goals, DCR must coordinate the execution of road maintenance, heavy equipment maintenance, promotion and mapping activities. Procurement of equipment and materials, hiring of counterpart staff and other project inputs must all be provided in a timely manner. Consequently, the project will fund four person years of technical assistance in labor intensive access roads programming and planning. This expert will possess expertise in computer planning, personnel needs, heavy equipment requirements, and budgetary planning and resources necessary to support expanded construction and maintenance of rural access roads using labor intensive methods. Tables VI and VII provide a summary of required inputs for this element.

TABLE VI/CUADRO VI
Inputs - Mapping, Planning and Promotion
Insumos - Mapeo, Planificacion y Promocion
($000)

	FX/ME	LC/MN	TOTAL
USAID			
1. Commodities/Mercaderias (total)	25	-	25
a. Small Computer/ Computadora Pequena	10	-	10
b. Computer Software/ Programas de Computadora	5	-	5
c. Audio-Visual Materials/ Materiales Audio-Visualles	10	-	10
2. Other Costs (Total)/ Otros Costos (total)	-	50	50
a. Programming/ Programacion - 3 mm	-	5	5
b. Production of Audio-Visual Materials/ Production de Materiales Audio-Visuales	-	30	30
c. Radio/TV/Newspaper Commercials/ Comerciales en Radio/TV/Periodicos	-	15	15
Sub Total	25	50	75
GOG			
1. Personnel/ Personal			
a. Keypunch Operator/Program Analyst/ Operador de Perforadora-Analista de Programas	-	30	30
2. Seminar Costs/ Costos de Seminarios	-	15	15
Sub Total	-	45	45
TOTAL	25	95	120

TABLE VII/CUADRO VII
Inputs - Technical Assistance
Insumos - Asistencia Tecnica
($000)

	FX	LC	TOTAL
USAID (Grant)/(Donacion)			
1. Chief of Party/Jefe de Equipo - 4 person yrs.	400	-	400
2. Heavy Equipment Expert/ - 3 person years 2. Experto en Equipo Pesado - 3 anos persona	300	-	300
3. Computer Road Inventory Expert - 6 months/ Experto en Computadoras para Inventario de Caminos - 6 meses	60	-	60
4. Mass Media Campaign Expert - 6 months/ Experto en Campanas en Medios de Comunicacion - 6 meses	60	-	60
5. Baseline Data (Roads Component Only)/ Datos Basicos (Componente de Caminos Unicamente)	-	50	50
TOTAL	820	50	870

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4. COST ESTIMATE AND FINANCIAL PLAN

Table VIII-Cuadro VIII

Summary Financial Plan By Component
(Resumen del Plan Financiero por Componente)

		USAID				
		Foreign Exchange (FX)($)	Local Currency (LC)(Q)	Total	GOG	Total
I.	Loan (Prestamo)					
	Soil and Water Management (Administracion de Suelos y Agua)	550	2,450	3,000	1,867	4,867
	Forestry (Reforestacion)	13	287	300	158	458
	Access Roads (Caminos de Acceso)	2,601	1,054	3,655	3,757	7,412
	Contingencies (Imprevistos)	295	250	545	-	545
	- Subtotal	3,459	4,041	7,500	5,782	13,282
II.	Grant (Donacion)					
	Access Roads Technical Assistance (Caminos de Acceso Asistencia Tecnica)	820	-	820	-	820
	Natural Resources Management Technical Assistance(Administracion de Recursos Naturales-Asistencia Tecnica)	200	-	200	-	200
	Baseline Survey (Encuesta Basal)	50	100	150	-	150
	Evaluation (Evaluacion)	50	50	100	-	100
	Audits (Auditorias)	-	50	50	-	50
	Contingencies (Imprevistos)	180	-	180	-	180
	- Subtotal	1,300	200	1,500	-	1,500
	- TOTAL	4,759	4,241	9,000	5,782	14,782

TABLE IX CUADRO IX

SUMMARY FINANCIAL PLAN - BY INPUTS
(Resumen del Plan Financiero - Por Insumos)

Component Inputs (Insumos por Componente)	Access Roads (Caminos de Acceso)	Soil and Water (Agua y Suelos)	Reforestation (Reforestacion	Support Grant (Donacion de Apoyo)	Total
1. Technical Assistance (Asistencia Tecnica)	-	300	-	1,020	1,320
2. Commodities (Articulos)	2,646	440	41	-	3,127
3. Training (Adiestramiento)	30	-	11	-	41
4. Social Benefits Costs & Wages (Costos y Salarios por Beneficios Sociales)	765	1,260	248	-	2,273
5. Credit (Credito)	-	1,000	-	-	1,000
6. Other (Studies, Evaluations, Audits (Otros = Estudios, Evaluaciones, Auditorias)	314	-	-	200	514
7. Contingencies	181	182	182	180	725
SUB TOTAL	3,836	3,182	482	1,500	9,000

Table 8 (Cuadro 8)
Annual Projection of Expenditures
(Proyección Anual de Gastos)
($000)

ACTIVITY (Actividad)	Year 1(ano 1) FX($)	LC($)	Year 2(ano 2) FX($)	LC($)	Year 3(ano 3) FX($)	LC($)	Year 4(ano 4) FX($)	LC($)	Year 5(ano 5) FX($)	LC($)	Total FX($)	Total LC($)	Total
1. USAID													
a. Natural Resources Management (Administración de Recursos Naturales)													
1. Soil & Water Sub-Component (Sub-Componente de Agua y Tierra)													
a. Social Payments (Pagos por bonificación sociales)	-	362	-	362	-	267	-	282	-	117		1,260	1,260
b. Commodities (artículos)	250	295	-	296	-	296		282	-	125	250	1,190	1,440
c. Technical Assistance (Asistencia Técnica)	300	-	300	-	300	-	-	-	-	-	300	-	300
- Subtotal	550	657	300	658	300	563	-	574	-	242	550	2,450	3,000
2. Forestry Sub-Component (Sub-Componente Forestal)													
a. Community Labor (Pago de Obra Comunal)	-	62	-	62	-	62	-	62	-	-	-	248	248
b. Commodities (artículos)	13	28	-	-	-	-	-		-	-	13	28	41
c. Training (adiestramiento)	-	6	-	6	-	3	-	-	-	-	-	11	11
- Subtotal	13	96	-	68	-	63	-	62	-	-	13	287	300

B. Access Roads Component
(Composante de Gestion de Accès)

1.	Labor Intensive Opns (Selection par Voies de Gros Intensité)	-	331	-	169	-	178	-	194	-	141	-	765	765	
2.	Commodities (utilisation)	2803	11	91	5	101	5	423	11	185	13	2601	45	2646	
3.	Other Costs (autres coûts)	-	60	-	27	-	30	-	66	-	51	-	234	234	+
4.	Training (utilisation/collecte)	-	20	-	10	-	-	-	-	-	-	-	30	30	+ 30
	- Subtotal	2803	192	91	291	101	213	423	253	185	205	2601	1054	3655	+
C.	Contingencies (Imprévisions)	91	30	30	30	30	30	30	30	30	30	295	250	545	
	- Subtotal IDA/B (Loan)														
	- (Sub-total de IDA/B/Prestamo)	2239	973	241	941	251	887	473	729	235	497	3459	4041	7500	
D.	Grant (Donación)														
1.	Natural Resource Manager (Gestión de Recursos Naturales)	30	-	200	-	30	-	-	-	-	-	200	-	200	
2.	Baseline Survey (Encuesta de Base)	30	100	-	-	-	-	-	-	-	-	50	100	150	
3.	Evaluations (Evaluaciones)	-	-	-	-	25	25	-	-	25	25	50	50	100	
4.	Audits (Auditorías)	-	10	-	10	-	10	-	10	-	10	-	50	50	
5.	Technical Assistance-Access Roads (Asistencia Técnica - Caminos de acceso)	320	-	200	-	200	---	100	-	-	-	820	-	820	
6.	Contingencies (Imprévisions)	180	-	-	-	-	-	-	-	-	-	180	-	180	
	- Subtotal (Grant/Donación)	600	110	300	10	275	35	100	10	25	35	1300	200	1500	
	- Total IDA/B (Loan/Grant)														
	- (Total IDA/B (Prestamo/Donación)	2839	1083	541	955	526	922	573	749	260	532	4759	4241	9000	

II Government of Guatemala
(Gobierno de Guatemala)

A. [illegible]

1.	Social Payments (Pagos por beneficios sociales)	-	-	-	-	-	75	-	150	-	225	-	450	450
2.	Commodities (artículos)	-	-	-	-	-	-	-	112	-	169	-	281	281
3.	Administrative/Indirect Costs (Costos Administrativos/Indirectos)	-	203	-	217	-	228	-	238	-	250	-	1,136	1,136
	- Subtotal	-	203		217	-	303	-	500	-	644	-	1,867	1,867

B. [illegible] and Municipalities
([illegible] y Municipalidades)

1.	Land (tierra)	-	15	-	16	-	16	-	16	-	-	-	63	63
2.	Commodities (artículos)	-	1	-	-	-	-	-	-	-	-	-	1	1
3.	Administrative Costs (Costos Administrativos)	-	17	-	18	-	18	-	18	-	-	-	71	71
4.	Wages (salarios)	-	5	-	6		6	-	6	-	-	-	23	23
	- Subtotal	-	38	-	40	-	40	-	40	-	-	-	158	158

C. Dirección General de Caminos

1.	Labor Intensive Wages (Salarios por mano de obra intensiva)	-	34	-	80	-	145	-	239	-	424	-	922	922
2.	Personnel (personal)	-	232	-	232	-	232	-	289	-	289	-	1274	1274
3.	Operating Costs (Costos de Operación)	-	213	-	232	-	254	-	399	-	437	-	1535	1535
4.	Training (Adiestramiento)	-	17	-	9	-	-	-	-	-	-	-	26	26
	- Subtotal	-	496	-	553	-	631	-	927	-	1150	-	3757	3757
	- Total [illegible]	0	737	-	81-	-	974	-	1467	-	1794	0	5782	5782
	- Project Grand Total - (Gran Total del Proyecto)	3059	1820	541	1765	526	1896	573	2216	260	2326	4759	10023	14782

[illegible]

5. ILLUSTRATIVE IMPLEMENTATION PLAN[1/]

ACTIVITY	DATE
1. AID/GOG to signing of Loan/Grant Agreement	08/31/83
2. GOG ratifies Agreement	10/31/83
3. Ministry of Finance meets initial C.P.s.	11/05/83
4. Ministry of Agriculture meets secondary C.P.s	11/15/83
5. Grant Funded baseline survey completed	09/15/84
6. Selection of initial small irrigation system	01/20/84
7. Identification of participating families for reforestation	01/20/84
8. Design and construction of initial soil and conservation structure	02/01/84
9. Selection of short term extension technical assistance	02/01/84
10. Purchase of forestry component commodities	04/15/84
11. Local procurement of materials and construction of first small irrigation system	04/15/84
12. Cultivation of seedlings	06/30/84
13. Procurement of vehicles and bycicles	02/28/84
14. Hiring of additional "Guias Agricolas"	03/30/84
15. Project interim evaluation	03/15/86
16. Activities completed	06/30/88
17. Final evaluation	09/30/88

1/ Complete implementation plans will be developed by each implementing organization as part of conditions precedent to disbursement for each component.

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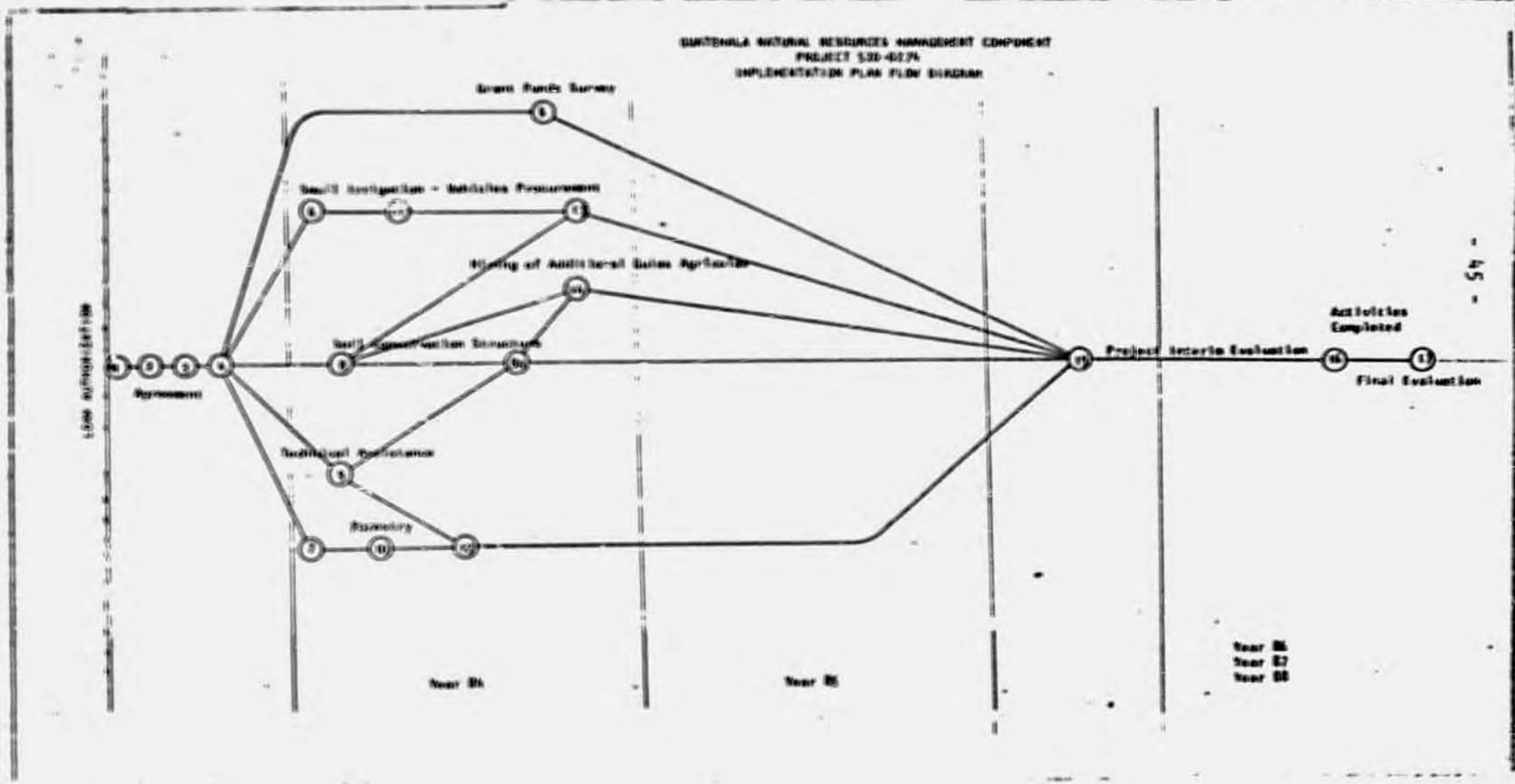
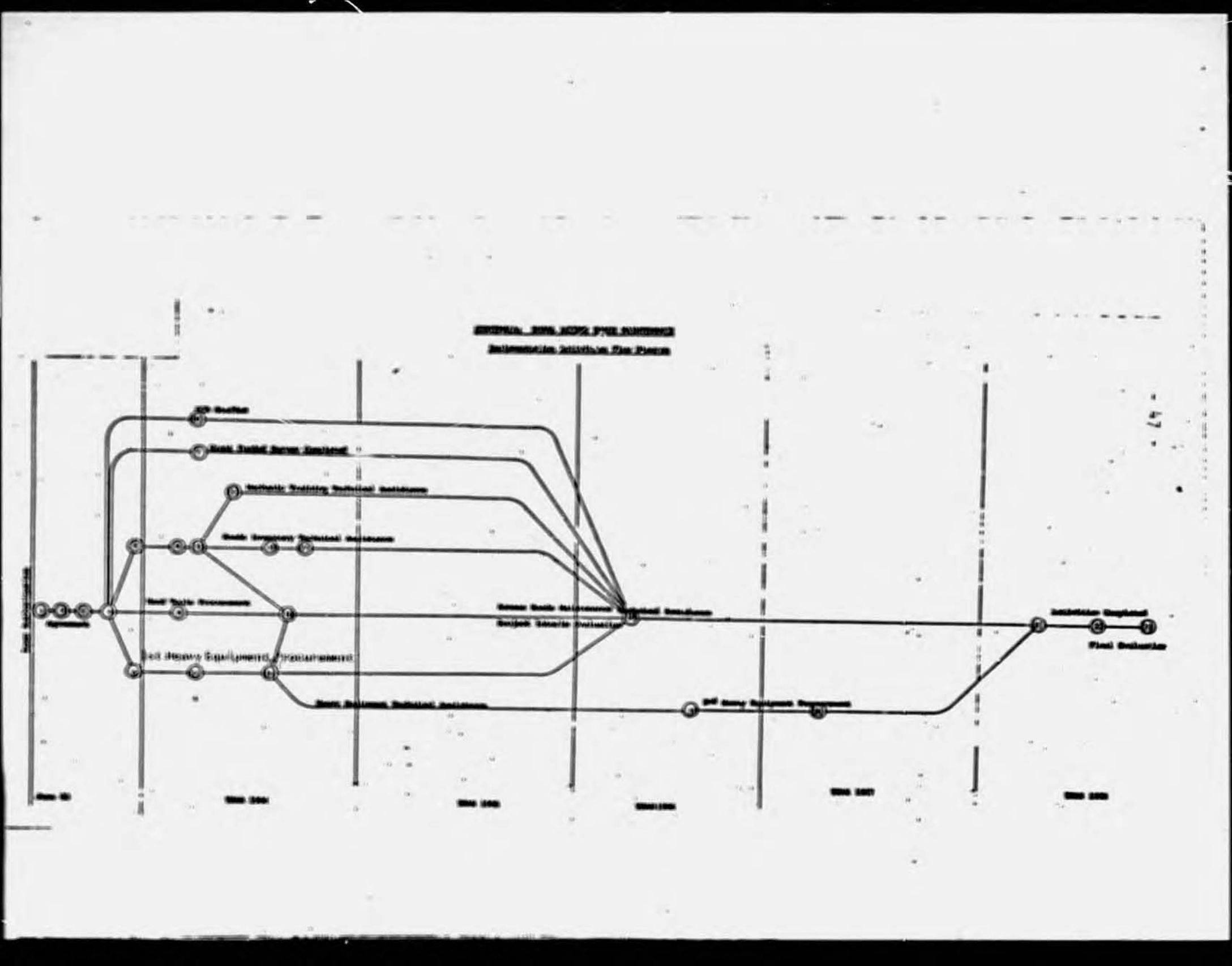

GUATEMALA NATURAL RESOURCES MANAGEMENT COMPONENT
PROJECT 520-0274
IMPLEMENTATION PLAN FLOW DIAGRAM
Grant Funds Survey
Project Interim Evaluation
Activities Completed
Final Evaluation
Year 86
Year 87
Year 88

5. IMPLEMENTATION PLAN[1/] ACCESS ROAD COMPONENT

ACTIVITY	DATE
1. AID/GOG signing of Loan/Grant Agreement	08/31/83
2. GOG ratifies Agreement	10/31/83
3. Ministry of Finance meets initial C.P.s	11/05/83
4. Ministry of Public Work meets secondary C.P.s	11/15/83
5. Issuance of RFP for access roads and heavy equipment technical assistance	12/15/83
6. Issuance of IFB for access roads heavy equipment	12/15/83
7. Grant funded baseline survey initiated	03/15/84
8. Procurement of access roads handtools	02/15/84
9. Access Roads technical assistance selected and contracted	02/15/84
10. DCR new positions staffed	03/15/84
11. Access roads technical assistance team on board	03/15/84
12. Access roads bids opened and contracts awarded	03/15/84
13. First mechanics training course held	05/15/84
14. Access roads heavy equipment arrives at field sites	07/15/84
15. Road inventory technical assistance Arrives in Guatemala	07/15/84
16. Initiation of first road maintenance projects	08/15/84
17. Access roads inventory completed	10/15/84
18. Project interim evaluation	03/15/86
19. Heavy equipment second procurement completed	08/15/86
20. Completion of heavy equipment technical assistance	03/15/87
21. Completion of road maintenance technical assistance	03/15/88
22. Activities completed	06/30/88
23. Final evaluation	09/30/88

1/ Complete implementation plans will be developed by each implementing organization as part of conditions precedent to disbursement for each component.



6. MONITORING PLAN

The proposed project as described in Section 3 of the paper is to be implemented by four GOG entities. The Natural Resources Management Component is to be directed by DIGESA Region I Office in the Highlands in coordination with BANDESA's rural credit offices. The forestry element will be implemented by the Director of Instituto Nacional de Forestacion (INAFOR), a semi-autonomous organization within the Ministry of Agriculture. The labor intensive access road maintenance activity will be executed by the Chief of the Departamento de Caminos Rurales (DCR), Direccion General de Caminos, within the Ministry of Communications and Public Works.

The Office of Rural Development (ORD) within USAID/Guatemala will be responsible for the monitoring of project activities. ORD will be assisted by the Mission's Project Development and Support Office (PDSO) on matters relating to general project monitoring and implementation as well as engineering monitoring and certification of construction activities, energy use and conservation, environmental issues, and proper documentation of project agreement requirements. The Office of the Controller and the Administrative Office will also assist ORD in the monitoring of the project.

ORD will use a combination of three methods to closely oversee the completion of project activities. Quarterly progress reports prepared by all four implementing agencies with assistance from project funded technical assistance will help the ORD in obtaining data on the status of project activities. Secondly, routine field trips and visits to executing agency offices and project sites will help verify and confirm the validity of quarterly reports. Thirdly, grant financed audits and evaluations will assist the project officer. A mid-term evaluation is scheduled to aid the Mission to assess the progress toward achieving project objectives and the development of inter-institutional relationships. The results and recommendations of this evaluation will aid the Mission in adjusting project activities, if needed. Annual audits of each institution will be required and will assist in identifying any potential problems.

7. SUMMARY OF ANALYSIS:

Below is given a brief summary of eight analytical annexes listed under item F Project Analysis.

A. Social Soundness Analysis (Annex F-1)

With the exception of forestry, the Mission has had experience in the implementation of activities financed under the project. Of these, small irrigation and soil conservation structures brought the most striking economic benefits to small Highland farm owners. From these economic benefits came social benefits such as a reduction of seasonal migration for employment. Increased production meant market contacts with nearby communities. These contacts are expected to assist in reducing barriers between Highland Indians

and Guatemalans who follow Hispanic traditions. For example, market contacts should increase incentives by Indian producers to learn Spanish so as to better market their produce. The lack of Spanish language in Indian areas has been a major constraint to their integration into the economic, political and social mainstream of Guatemala.

Implementing agencies responsible for project activities have demonstrated their ability to effectively work with Highlanders in both natural resource and access road projects. Important to this success was the high degree of participation in both decisions and work by project recipients. For example, access roads were selected for construction only after requests for roads were made by communities. These same communities then elected committee members to organize the provision of labor and foremen for road construction.

Further, technology selected was simple. For example, for terracing only two tools were required; the hoe, available in most households, and a simple leveling device made of local materials. As a result nearby non-participating farmers were able to adopt this technology without technical assistance. Past experience has shown that this adoption amounted to thirty percent of total hectares terraced under the project.

No significant sociological constraints were identified in the Natural Resources Component. However in the Road Maintenance Component it was discovered that Highlanders would not provide voluntary labor for long term maintenance of access roads. They did however participate for wages in the construction phase of the program. Therefore, under the project access road maintenance workers will be paid for the work they perform.

B. Financial Analysis (F2)

Analysis of the project budget and expenditure plan indicates that the $.9.0 million in AID funds will be spent at slowly decreasing rates during project implementation. Due to large purchases of commodities in the first year, about 44% of the AID funds will be expended in year one, with 17%, 16%, 14% and 9% respectively being expended in years 2 through 5. At the same time the GOG planned expenditure rate gradually increases with project life from an initial 13% to 31% by the fifth year. This steady increase in GOG activity coupled with a decreasing AID participation demonstrates that as the project progresses the GOG will become more responsive to reoccuring cost needs.

Reoccuring costs analysis for each innovation was also undertaken, a summary by each type of activity is given below:

1) Terracing

Recurrent costs within the Natural Resource Management Component will be minimal. Terracing activities will require labor input for maintenance, but it is expected that individual farmers will maintain their terraces once they are built. Hence, although there are some recurrent cost (labor input), there is no need for additional GOG funds under this element.

2) Small Scale Irrigation:

The gravity flow mini-irrigation systems to be built with project funds will also require minimal maintenance such as cleaning out catchment boxes, sluiceways and pipes, with minor purchase of new pipes or valves over the long run. The labor required to maintain these systems will be supplied by the individual farmers on a voluntary basis. Approximately 20% of the mini-irrigation systems to be built will require pumped water. Recurrent costs associated with these systems are higher due to the cost of fuel (electricity or diesel) for the pumps as well as routine maintenance and repair. However, past experience with eleven pump driven systems indicates that this group of farmers generates sufficient profits to more than cover the recurrent costs of keeping the systems operational.

3) Reforestation:

This element should encounter no problem with recurrent costs. The reforestation sub-component will become self-substaining by project's end. The ability of the Instituto Nacional Forestal (INAFOR) to recuperate its investment and establish a rotating fund for additional reforestation by charging the buyers of seedlings a price equal to cost of production insures the original AID-GOG investment will create a self-financing mechanism.

4) Access Roads Maintenance:

The design of the Access Road Maintenance Program allows for a gradual increase in GOG funding until the final year of the project; at that time the GOG funds cover all costs which are of a recurrent or on-going nature. It should be pointed out that prior to 1983 the DGC did not have a budget line item for rural roads maintenance. An integral part of the recently approved $3.0 million add-on to the AID Loan 520-T-026 project is the creation of two rural roads construction units within the Direccion General de Caminos (DGC). Budgeted expenditures for these two units total approximately $4.0 million for 1983.

The only critical point with regard to recurrent costs of this component would be the time at which major equipment purchases would have to be made to replace equipment which had reached the end of its useful life. The DGC makes provision for equipment depreciation through per kilometer road maintenance charges. Given this depreciation system equipment purchases can be funded from the normal DGC budget. The DGC has a very sophisticated, computerized accounting system which will enable them to assign adequate depreciation factors to fund replacement equipment.

It can then be concluded that the Government of Guatemala will be able to continue funding project activities after the initial five year period of AID funding.

C) Economic Analysis (F3)

The Natural Resource Management Component will affect some 60,000 families through the adoption of soil conservation small scale irrigation systems and reforestation practices. However, due to the gradual process of technology adoption, about 10,000 families will have the new system in place over the entire project life. As the calculations in Annex F (3) show, if this group achieves a 8-9% real income gain annually as a result of multicropping and improved yields due to the new technology, the component will be economically viable at a B/C ratio of 2:0 even with significant cost overruns. With the fragmentary evidence that is available these income gains are judged to be feasible.

The Access Road Maintenance Component of the project will affect some 165,000 families but only 28,000 will experience the potential benefits from serviceable roads throughout the project life. In the absence of such maintenance this group would suffer reduced incomes as commercial activities of farmers were gradually cut off from access to distant markets due to deteriorating roads. If the present discounted value (PDV) of this hypothetical income loss exceeds the PDV of maintenance costs, the component is economically viable. As has been shown, if the present incomes of the target group were to degrade just 18% due to the lack of usable roads, the project would achieve a B/C ratio of 2:0. This calculation does not include any future increases in income that would be foregone due to the lack of serviceable roads.

D. Administrative Analysis (F4)

This annex includes an analysis of the three implementing agencies identified to execute the project, they include: 1) Direccion General de Servicios Agricolas (DIGESA), 2) Banco Nacional de Desarrollo Agricola (BANDESA); and 3) the Direccion General de Caminos (DGC). Based on past experience with both DIGESA and BANDESA under the Small Farmer Development Project, the analysis found both institutions to be capable of administering an expanded terracing and small scale irrigation activity with some additional on the job training and slight increases in staff levels. AID funds would be assisting both institutions continue ongoing programs, and it is anticipated that the two institutions will be able to effectively implement the proposed activities.

The analysis of the Direccion General de Caminos indicated that the fast growing Departamento de Caminos Rurales, (DCR) with its current staff of over 500 technicians, can easily increase its staff by 70 employees in 1984 since almost all those additional positions required to implement a road/heavy equipment maintenance program are similar to those positions already filled. During 1983 alone, the DCR increased its staff by over 200 employees without negatively impacting on the efficiency of their road construction program. It is therefore felt that the DCR has the capability to undertake the improved maintenance program described in Section 3 of this project paper.

E. Environmental Analysis (F5)

During the development of the PID for the project an Initial Environmental Evaluation (IEE) was prepared. Based on this IEE the Mission recommended that a negative determination be granted. Annex F5 provides AID/W's concurrence with the Mission's recommendations. Therefore, no additional environmental analysis is required.

F. Energy Analysis (F6):

The vast majority of work to be undertaken in the road maintenance program, soil conservation and small irrigation program, and reforestation program will consist of manual labor. Little impact will be therefore felt on Guatemala's currently limited energy resources.

As the project's objectives are achieved and rural farmers increase their productive base, more energy will be required to transport increased amounts of farm produce to market. This increased use of gasoline and diesel fuel will not significantly alter the current trend towards increased importation of petroleum products into Guatemala. In addition, the reforestation activity will generate an additional fuel wood in the long run, thereby reducing on a limited scale the need to deplete Guatemala's forest resources.

G. Technical Analysis Natural Resources Management (F7)

The technologies required to implement soil conservation activities and to construct small irrigation systems were tested and proven under the Small Farm Development Project. The same construction methods and procedures will be utilized under this project. To implement this soil and water conservation effort, $ 1,281,000 will be utilized for construction materials, $ 1,710,000 will be used for social cost payments. In addition $ 300,000 in project funds will be used for technical assistance and $ 440,000 for vehicles, educational materials and supplies. INAFOR has submitted to the Mission a six volume set of reforestation projects complete with location, costs and benefits. The interventions detailed in these six volumes are similar to on going INAFOR projects but may not be implemented due to a lack of funding. AID has selected two of these interventions to implement on a pilot scale. To implement the reforestation subcomponent, $650,000 in project funds will be utilized for labor intensive wages, commodities, training, technical assistance and personnel costs.

H. Technical Analysis - Access Roads Program (F8)

This analysis justifies a design to maintain access roads in the Guatemalan Highlands using labor intensive methods. Two organizations will work together to maintain roads; the rural communities who benefit from well maintained roads and the DCR who helped these same communities construct the

roads. The maintenance program will be initiated on 500 kilometers of access roads the first year, and will increase by 200 kilometers a year until the fifth year of the project. When AID financing terminates 1300 kilometers of roads will be maintained annually under the program.

The rural communities living along side of these roads will provide 117,000 work days of work on an annual basis to maintain these 1300 kilometers by the end of the fifth year of the project life. The communities will also provide maintenance foreman to organize and supervise all labor intensive activities. Besides providing for a source of extra off farm income the access roads maintenance program will insure that the target group has year-round access to markets and services.

In order to undertake the program the DCR will initially hire 32 employees to manage and operate the program from two of the DCRs six regional offices. As project activity grows an additional 16 employees will be hired by the fourth year. The communities will provide roughly 6,750 man years of paid labor during the five-year life of the project. The communities will also provide about 950 previously trained foremen to supervise the labor crews.

To support the effort over $113,000 in hand tools will be bought and issued to the road crews. In addition $888,000 in heavy equipment will be purchased to provide needed support to the hand labor. In the first year $612,000 in heavy equipment will be required consisting of two maintenance units (1 roadgrader, 6 dump trucks, 1 backhoe each) plus one low-boy to transport equipment between work sites. As more roads enter into the maintenance program a third unit will be purchased for the fourth year of activities.

In total the project will cost $ 5,642,000 over five years to bring 1,300 kilometers into an annual labor intensive maintenance program, costing $1,149 per kilometer of access road maintained annually, 30% of which is for manual labor. During the five year life $1,687,000 in labor costs will have been paid for over 405,000 work days of labor.

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8. EVALUATION ARRANGEMENTS:

During the initial period of the project, prior to initiation of project activities at the field level, grant funds will be used to undertake a complete project specific and socioeconomic baseline study of areas to be included within the project. Also data will be gathered in a few selected sites outside the project area to provide control group information. The contracted team will obtain baseline data against which project targets and progress indicators can be measured at later dates.

During the third year of project activities an evaluation will be undertaken by the Mission and the GOG with assistance from a grant-financed evaluation team. This evaluation team will measure the progress achieved to date against implementation plans for outputs prepared by host country agencies and approved by the Mission as part of the required conditions precedent to disbursement. This evaluation will indicate the status of project implementation, what corrective action is required (if any), and analyze institutional effectiveness of the agencies carrying out the project activities.

During the last year of project activities a grant financed impact evaluation will be undertaken to verify if the project purpose was achieved, and when the attainment of goals is possible. Also analysis of discrete project activities will be undertaken to ascertain whether the interventions in fact contributed to the target group's productivity.

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9. DRAFT PROJECT AUTHORIZATION

Name of Country: Guatemala
Name of Project: Highlands Agricultural Development
Number of Project: 520-0274
Number of Loan: 520-T-037

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Highlands Agricultural Development Project for Guatemala (the "Cooperating Country") involving planned obligations of not to exceed Seven Million Five Hundred Thousand United States Dollars ($7,500,00) in loan funds and One Million Five Hundred Thousand United States Dollars ($1,500,000) in grant funds over a one year period from the date of authorization subject to the availability of funds in accordance with the A.I.D. OYB allotment process, to help in financing foreign exchange and local currency cost for the project. The planned life of the project is five years from the date of the initial obligation.

2. The project consists of assistance to improve agricultural development in the Altiplano region through:

a) a labor intensive access roads maintenance program,

b) a soil conservation program (including terracing and small irrigation systems and reforestation program).

3. The Project Agreements which may be negotiated and executed by the officers to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. Dollars within Twenty-five (25) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services (Loan)

Goods and services, except for ocean shipping financed by A.I.D. under the Loan shall have their source and origin in countries included in A.I.D. Geographic Code 941 or in countries that are members of the Central American Common Market, except as A.I.D. may otherwise agree in writing.

Ocean shipping financed by A.I.D. under the Loan shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States or of countries that are members of the Central American Common Market.

e. Source and Origin of Goods and Services (Grant)

Goods and services, except for ocean shipping, financed by A.I.D. under the Grant shall have their source and origin in the United States or in countries that are members of the Central American Common Market, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

d. Conditions Precedent to First Disbursement (Loan only)

Prior to any disbursement, or the issuance of any commitment documents under the Project Loan Agreement, the Cooperating Country shall furnish to A.I.D., in form and substance satisfactory to A.I.D.:

(1)An opinion of counsel advising that the Agreement has been duly authorized or ratified by and executed on behalf of the Borrower and constitutes a valid and legally binding obligations in accordance with all its terms.

(e) Other Conditions Precedents to Disbursements (Loan Only)

1. Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities under the access roads activity, with the exception of technical assistance, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D. a) a financial plan detailing the Direccion General de Caminos annual counterpart contribution to the project and b) a detailed time-phased plan setting forth all activities to be completed during the life of the Project.

2. Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities under the soil conservation activity with the exception of technical assistance, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D. 1) a financial plan detailing DIGESA's and BANDESA's annual counterpart contribution to the project and 2) a detailed time-phased plan setting forth all activities to be completed during the life of the project.

3. Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities under the reforestation activity with the exception of technical assistance, the Cooperating Country shall furnish in form and substance satisfactory to AID a detailed time phased plan setting forth all activities to be completed during the life of the Project.

f. Waiver (Loan)

Motorcycles financed by AID under the Project in an amount not to exceed $50,000 may have their source and origin in countries included in AID Geographic Code 899. Exclusion of such procurement from Free World countries other than the cooperating country and countries included in Code 941 would seriously impede attainment of U.S. foreign policy objectives and objectives in the foreign assistance program.

Otto J. Reich
Assistant Administrator
Bureau of Latin America and
the Caribbean

ANNEX A

VZCZCGTC371
PP HUEHOT
DE AULHC #4422/01 3270755
ZNR UUUUU ZZH
P 2705342 JAN 83
FM SECSTATE WASHDC
TO AMEMBASSY GUATEMALA PRIORITY 2078
BT
UNCLAS STATE 024422

AIDAC

27 JAN 83
TOR: 1544
CN: [illegible]
CHRG: AID
INFO ECON

ACTION: PROGRAM
INFO: RURAL DEV
PSDO
CONTROLLER
ADM

E.O. 12356: N/A
TAGS:
SUBJECT: ALTIPLANO AGRICULTURAL DEVELOPMENT PID

1. THE DAEC REVIEWED AND APPROVED SUBJECT PID ON JANUARY 7, 1983. THE FOLLOWING COMMENTS AND GUIDANCE ARE PROVIDED TO ASSIST THE MISSION IN PROJECT DEVELOPMENT AND PREPARATION OF THE PROJECT PAPER (PP). WE STRONGLY ENCOURAGE THE MISSION TO ADHERE TO PP DEVELOPMENT SCHEDULE BY SUBMITTING THE PP TO AID/W IN EARLY MAY IN ORDER TO ALLOW A JUNE OBLIGATION.

2. RATIONALE - IT SHOULD BE CLEAR IN THE PP THAT AGRICULTURAL DEVELOPMENT, RATHER THAN EMPLOYMENT GENERATION, IS THE PRIMARY RATIONALE FOR THE PROJECT. THE DISCUSSION SHOULD REVIEW WHAT ALTERNATIVE ACTIVITIES ARE CONSIDERED AND WHY THE MIX OF ACTIVITIES PROPOSED WILL BEST ADDRESS THE PROBLEMS IN THE ALTIPLANO. IN ADDITION, THE RELATIONSHIP OF THE PROPOSED PROJECT TO OTHER ONGOING ACTIVITIES SHOULD BE [illegible]. THE RATIONALE SHOULD ALSO INCLUDE A DISCUSSION SHOWING HOW PROJECT ACTIVITIES RELATE TO THE PERCEIVED NEEDS OF THE PEOPLE IN THE ALTIPLANO. IN THIS REGARD, IF DATA IS NOT AVAILABLE FROM THE

INTEGRATED AREA DEVELOPMENT STUDIES, A SURVEY TO OBTAIN VIEWS OF TARGET POPULATION SHOULD BE CARRIED OUT.

3. MAINTENANCE. A. THE DESIGN AND IMPLEMENTATION PLAN FOR THE MAINTENANCE SYSTEM SHOULD BE DETAILED IN THE PP. THIS WILL REQUIRE THAT ANY TECHNICAL ASSISTANCE FOR THE DESIGN OF THE MAINTENANCE PROGRAM WHICH WAS PROPOSED UNDER THE SMALL FARMER DEVELOPMENT (520-T-026) PP AMENDMENT BE PROVIDED BEFORE THE PP IS FINALIZED, SO THAT THE RESULTS CAN BE INCORPORATED IN THE PP. THIS MIGHT MEAN THAT THE ASSISTANCE PROPOSED FOR MAINTENANCE UNDER THE 026 AMENDMENT BE DELETED AND THAT SUCH ASSISTANCE BE INCORPORATED INTO THE PP DEVELOPMENT PROCESS. FYI, R. MACDONALD, LAC/DR/ENG, HAS THE NAME OF SEVERAL CANDIDATES TO PROVIDE TECHNICAL ASSISTANCE IN ROAD/EQUIPMENT MAINTENANCE. THE DAEC RECOMMENDED THAT DURING PP DEVELOPMENT REPRESENTATIVES FROM THE MISSION, THE GOG AND THE GOH SHOULD VISIT HAITI AND PERHAPS THE DOMINICAN REPUBLIC TO REVIEW THEIR ROAD MAINTENANCE AND CONSTRUCTION PROJECTS.

CONCERN WAS EXPRESSED BY THE DAEC, THAT GIVEN THE ECONOMIC DIFFICULTIES, IT IS NOT EVIDENT THAT THE GOC CAN AFFORD TO UNDERTAKE AND SUSTAIN ROAD CONSTRUCTION AND MAINTENANCE PROGRAMS ON THE SCALE ENVISIONED IN THE PID. THEREFORE, THE COMMITMENT OF THE GOC TO A MAINTENANCE PROGRAM SHOULD BE WELL DEMONSTRATED IN THE PP. THE DAEC RECOMMENDED THAT THE GOC CONTRIBUTE AT LEAST 25 PERCENT OF THE LABOR COSTS FOR THE MAINTENANCE PROGRAM RATHER THAN AID FINANCING 100 PERCENT OF THESE COSTS IN YEAR 1 OF THE PROJECT IN ORDER TO ENSURE GOC COMMITMENT EARLY ON. THE PHASE-OUT OF AID FINANCING LABOR COSTS MIGHT THEN BE MORE GRADUAL THAN PROPOSED.

C. SPECIFIC CONCERNS IN REGARD TO THE MAINTENANCE COMPONENT WHICH SHOULD BE ADDRESSED IN THE PP ARE AS FOLLOWS:

1) THE ORGANIZATIONAL STRUCTURE OF MAINTENANCE SYSTEMS IN THE PAST AS WELL AS THE SYSTEM BEING PROPOSED SHOULD BE DESCRIBED.

2) THE SAME SYSTEM AND FACILITIES SHOULD BE USED FOR EQUIPMENT MAINTENANCE AS FOR ROAD CONSTRUCTION.

3) QUESTIONS REGARDING EQUIPMENT MAINTENANCE SUCH AS STANDARDIZATION OF EQUIPMENT, SOLE SOURCE PROCUREMENT, IF JUSTIFIED, WAREHOUSING AND SPARE PARTS SHOULD BE ADDRESSED.

ROADS INVENTORY IN THE PROJECT WHEN IT APPEARS THAT SUCH INFORMATION WOULD BE NECESSARY TO DESIGN A MAINTENANCE SYSTEM. THEREFORE, THE PP SHOULD BE CLEAR AS TO WHAT INFORMATION PRESENTLY EXISTS IN REGARD TO THE EXISTING ROADS AND MAINTENANCE REQUIREMENT NEEDS, AND WHAT INFORMATION WILL BE NECESSARY TO ACCUMULATE AND UPDATE ON AN ONGOING BASIS FOR THE MAINTENANCE SYSTEM.

4. SOIL AND WATER MANAGEMENT COMPONENT. A. IN REGARD TO THE FOUR SUBCOMPONENTS UNDER THE SOIL AND WATER MANAGEMENT COMPONENT (MINI-IRRIGATION, PASTURE DEVELOPMENT, TERRACING AND AGROFORESTRY) THE LEVEL OF INPUTS, ESPECIALLY TRAINING AND TECHNICAL ASSISTANCE, AND THE STRATEGY FOR SELECTING SITES OF ACTIVITIES SHOULD BE DISCUSSED IN DETAIL IN THE PP. PROJECT DESCRIPTION SHOULD ALSO INCLUDE A DISCUSSION OF MAINTENANCE CONSIDERATIONS OF THE FOUR SUBCOMPONENT ACTIVITIES.

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A. IT SHOULD BE CLEAR IN THE PP THAT THE TRAINING PROPOSED AT ISAFOR FOR AGROFORESTRY ACTIVITIES IS SHORT-TERM ONLY AND NOT A LONG-TERM INSTITUTIONAL-DEVELOPMENT EFFORT. IN ADDITION, MEASURES TO PROTECT AGROFORESTRY OR PASTURE PLANTINGS ON COMMUNALLY-HELD LANDS SHOULD BE DISCUSSED. THE DATC RECOMMENDED THAT PROJECT PREPARATION TEAM, PER PARA. 3.A. VISIT HAITI TO SEE AND DISCUSS RELEVANT ACTIVITIES UNDER THE HAITI AGROFORESTRY PROJECT (521-0122).

C. GIVEN THE FACT THAT THE DEMONSTRATION PHASE UNDER THIS PROJECT MUST AWAIT ADAPTIVE RESEARCH ON GRASSES, THE TIMING AND THE PHASING OF RELEVANT RESEARCH UNDER THE SMALL FARMER DIVERSIFICATION PROJECT (521-T-034) AS IT RELATES TO PASTURE DEVELOPMENT ACTIVITIES IN THE PROPOSED PROJECT SHOULD BE DESCRIBED IN THE PP. THE EXPERIENCE OF SIMILAR ACTIVITIES IN OTHER COUNTRIES (E.G. BOLIVIA) SHOULD BE TAKEN INTO ACCOUNT.

D. THE PP SHOULD DISTINGUISH BETWEEN THE DEMONSTRATION PHASE AND THE SPREAD EFFECT PHASE OF THE TERRACING SUBCOMPONENT IN ORDER TO ILLUSTRATE THE RATIONALE FOR INCENTIVE PAYMENTS TO MAXIMIZE THE EXTENSION IMPACT. INPUT REQUIREMENTS, AMOUNT OF SUBSIDY PAYMENTS, SIZE OF DEMONSTRATION EFFORTS AND RATE OF RETURN OF TERRACING ACTIVITIES SHOULD BE INCLUDED IN THE PP. IN ADDITION, AN EVALUATION OF TERRACING ACTIVITIES UNDER PAST PROJECTS SHOULD BE INCLUDED IN COMPONENT DESCRIPTION.

E. IN THE DISCUSSION OF THE MINI-RIEGO SYSTEMS, THE PP SHOULD INCLUDE HOW TO ACCESS THE MARKETING CONSTRAINTS WHICH HAVE NEGATIVELY AFFECTED THE BENEFITS DERIVED FROM THE INSTALLMENT OF THESE SYSTEMS. IT IS REALIZED THAT THIS IS A DEMONSTRATION NOT A PRODUCTION PROJECT. NEVERTHELESS, MARKET DATA FOR CROPS TO BE IRRIGATED SUCH AS WHAT IS CONSUMED DOMESTICALLY AND WHAT IS EXPORTED, AT WHAT VOLUME AND PRICE, SHOULD BE INCLUDED IN THE DISCUSSION TO PROVIDE AN IDEA OF THE DIMENSION OF THE PROBLEM. FURTHER, THE MISSION SHOULD CONSIDER INCLUDING FUNDS FOR A FEASIBILITY STUDY OF THE PRODUCTION AND MARKETING POTENTIAL FOR VARIOUS CROP MIXES. IF MORE SCALE ARE NEEDED TO ALLEVIATE MARKETING CONSTRAINTS, MISSION SHOULD CONSIDER ROAD CONSTRUCTION AS A POSSIBLE COMPONENT.

D. PROJECT COORDINATION/MANAGEMENT - THE PP SHOULD ADDRESS IMPLEMENTING AGENCIES' MANAGEMENT AND COORDINATION REQUIREMENTS AS WELL AS MISSION MANAGEMENT REQUIREMENTS FOR THE VARIOUS ACTIVITIES PROPOSED. THE PP SHOULD BE CLEAR ON THE TIMING AND METHOD OF CONTRACTING ALL ASSISTANCE, INCLUDING THE PROPOSED PROJECT COORDINATOR. THE PROVISION OF ENGINEERING SUPPORT FOR MONITORING, SUPERVISION AND INSPECTION SHOULD ALSO BE DISCUSSED.

G. BUDGET - THE COSTS AND AMOUNTS OF TECHNICAL ASSISTANCE AND TRAINING SHOULD BE SET FORTH IN THE

NANCIAL ANALYSIS. THE DAEC RECOMMENDS THAT MISSION
EVIEW THE BASIS FOR THE SPLIT IN LOAN AND GRANT
UNDING AND, IF POSSIBLE, SUBSTITUTE MORE LOAN
INANCING FOR GRANT FUNDING. THE RATIONALE FOR THE
OAN/GRANT SPLIT SHOULD BE CLEAR IN THE PP. SHULTZ

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ANNEX B

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 83 to FY 88
Total U.S. Funding $ 8 million
Date Prepared: 4/21/83

Project Title & Number: HIGHLANDS AGRICULTURAL DEVELOPMENT PROJECT 520-0274

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To increase agricultural productivity.	**Measures of Goal Achievement:** Average income of target beneficiaries increases more rapidly than non beneficiaries.	1. Impact evaluation.	**Assumptions for achieving goal targets:** Farmers will adopt new production technologies.
Project Purpose: Improve the productive resource base of the rural poor in the Highlands.	**Conditions that will indicate purpose has been achieved: End of project status.** 1. 30% increase in agricultural production.	1. Impact evaluation.	**Assumptions for achieving purpose:** Improved management of scarce natural resources available to the rural poor will result in expanded cultivation of farm produce and that the additional produce can be marketed.
Outputs: 1. Terraces - Increased production of foods and grains. 2. Mini-Irrigation - Increased production of diversified crops. 3. Forest Conservation - Improved fuel wood availability. 4. Maintained access roads - constant access to markets. 5. Increased on and off-farm employment.	**Magnitude of Outputs:** - 5000 hectares of terraces. - 750 hectares of irrigation. - 525 hectares of new forests. - 1300 km. of access roads maintained on an annual basis by year 5. - Over 450,000 man-days of paid labor during the life of the project.	CDC status reports. CDC status reports. CDC status reports. CDC status reports.	**Assumptions for achieving outputs:** Soil conservation and watershed management provide expansion of natural resource base. CDC implementing units can be upgraded to provide required service. Rural poor will accept innovations and are willing to implement them.
Inputs: Technical assistance $ 1,320 m. Commodities 3,427 Training 43 Social benefits costs 2,275 Credit 1,000 Other Costs 534 Contingencies 725 Total $ 9,000 m.	**Implementation Target (Type and Quantity)** - PIO of technical assistance, heavy equipment, and vehicles. - Training sessions. - Farm families involved in labor intensive activities.	- Contracts - PIO/Cs - Records - Community Maintenance Committee records	**Assumptions for providing inputs:** - Commodities are available on a timely basis. - The communities are interested in providing laborers for road maintenance. - Participating agencies will provide resources on a timely basis.

5 C (2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A includes criteria applicable to all projects. Part B applies to projects funded from specific sources only. B.1 applies to all projects funded with Development Assistance Funds, B.2 applies to projects funded with Development Assistance loans, and B.3 applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?	
A. GENERAL CRITERIA FOR PROJECT	
1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634 A; Sec. 653 (b).	
(a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project;	This project was presented in the Mission's FY-84 Congressional Presentation under the title of Integrated Rural Development
(b) Is assistance within (operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)?	Yes.
2. FAA Sec. 611 (a) (1). Prior to obligation in	Yes.

	excess of $100,000, will there be:	
	(a) engineering, financial or other plans necessary to carry out the assistance and	
	(b) A reasonably firm estimate of the cost to the U.S. of the assistance?	
3.	FAA Sec. 611 (a) (2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	Not applicable.
4.	FAA Sec. 611 (b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? (See AID Handbook 3 for new guidelines.)	Yes.
5.	FAA Sec. 611 (e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into	Yes.

	consideration the country's capability effectively to maintain and utilize the project?	
6.	FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral projects? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
7.	FAA Sec. 601 (a). Information and conclusions whether project will encourage efforts of the country to:	The maintenance of rural access roads, coupled with the development of land terraces and mini-irrigation projects will increase farm output and thereby increase international commodity trade, as well as fostering private farming and marketing initiatives. The development of mini-irrigation systems will encourage the formation of farming cooperatives. By providing small farmers with improved farming infrastrure, monopolistic tendencies are reduced, efficiency is increased and the concept of free labor is strengthened.
	(a) Increase the flow of international trade;	
	(b) Foster private initiative and competition; and	
	(c) Encourage development and use of cooperatives, and credit unions, and savings and loan associations;	
	(d) Discourage monopolistic practices;	
	(e) Improve technical efficiency of industry, agriculture and commerce; and	
	(f) Strengthen free labor unions.	
8.	FAA Sec. 601 (b). Information and conclusions on	The increased produce available for marketing will encourage

	how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the service of U.S. private enterprise).	private trading companies from abroad to invest in Guatemala's export trade for farm commodities.
9.	FAA Sec. 612 (b), 636 (h); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The Government of Guatemala has consistently supported all A.I.D. financed developmental projects with counterpart necessary to achieve project objectives.
10.	FAA Sec. 612 (d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11.	FAA Sec. 601 (e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12.	FY 1982 Appropriation Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance	The majority of the increased crop productin resulting from improved conservation practices and access will meet internal demands. Only those few items which are produced in excess and have markets in other central american countries or the western hemisphere may be exported. However, the amount of exportation may be of insignifi-

likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

cant magnitude.

13. FAA 118 (c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests?

Yes. Project activities will not be implemented in tropical low lands.

14. FAA 121 (d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?

Not applicable.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102 (b), 111, 113, 281 (a). Extent to which activity will (1) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small

(1) The soil and water conservation, acces roads maintenance and the forestry components will provide direct payment to laborers for labor intensive work utilising local appropriate technologies; (2) both access roads maintenance committees and mini irrigation groups will be established to assist the rural poor help themselves; (3) rural Guatemalans will build their own land terraces, mini-irrigation systems, as well as maintain their own access roads, all with the resistance of GOG extension agents technical

	towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries?	assistance and supervision; (3) rural women will participate in the planting and harvesting of diversified crops on new terraces irrigated fields and will participate in the marketing of the produce utilizing community maintained access roads; (5) the anticipated increased farm production caused from improved soil and water conservation and access roads may encourage more active regional trade and cooperation within the Central American Common Market (CACM).
b.	FAA Sec. 103, 103 A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	Yes.
c.	FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using	Yes.

	technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	
d.	FAA Sec. 110 (a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?	Yes.
e.	FAA Sec. 110 (b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alternation of a physical falcility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial	Grant funds will not finance capital assistance.

and training services, and not undertaken as part of a project of a predominantly technical assistance character".

f. FAA Sec. 122 (b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

Yes.

g. FAA Sec. 281 (b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in government processes essential to self-government.

By providing the rural poor with means of increasing their income through increased and diversified crops, and improved access to market it is anticipated that the rural poor will not be as economically nor physically isolated from those resources as described in Section 281 (b). In addition, rural committees and cooperatives established to maintain roads and develop mini-irrigation systems will provide a foundation for rural farmer participation in self government.

3. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122 (b). Information and conclusion of capacity of the country to repay the loan, at a

Guatemala has demonstrated its capacity to repay on a timely basis all A.I.D. loans.

reasonable rate of interest.

b. FAA Sec. 620 (d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan? — Not applicable.

c. ISDCA of 1981, Sec. 724 (c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624 (g)? — Not applicable.

3. Economic Support Fund Project Criteria

a. FAA Sec. 531 (a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of FAA Section 102? — N.A.

b. FAA Sec. 531 (e). Will assistance under this chapter be used for military, or paramilitary activities? — N.A.

c.	FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives?	Not applicable.
d.	FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	Not applicable.

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MINISTERIO DE
FINANZAS PUBLICAS
GUATEMALA, C. A.

ANNEX D

La Nueva Guatemala,
6 de junio de 1983.

Señor Ministro:

Me es grato dirigirme a usted, para hacer referencia a su Nota No. 502-01408 de fecha 23 de mayo de 1983, por medio de la cual nos informa sobre la necesidad de que la Dirección General de Caminos -DGC-, emprenda un Programa especifico de mantenimiento de las obras ya construidas dentro del Plan de Construcción de Caminos Rurales con Mano de Obra Intensiva, cuyo componente podría ser incorporado al Proyecto "Desarrollo Agrícola del Altiplano".

Sobre el particular, informo a usted que con fecha 25 de mayo de 1983 se recibió del Ministerio de Agricultura, Ganadería y Alimentación, un documento que contiene los lineamientos generales del Proyecto "Desarrollo Agrícola del Altiplano". Dicho documento ha sido trasladado a la Secretaría General del Consejo Nacional de Planificación Económica -SEGEPLAN- para su análisis y dictamen.

Este Ministerio comparte su interés en que el Proyecto sea financiado con fondos blandos de la Agencia para el Desarrollo Internacional -AID-, tan pronto se reciba el estudio de factibilidad del mismo y se obtenga la opinión de la SEGEPLAN, procederá a presentar la respectiva solicitud de Préstamo ante la Agencia mencionada.

Sin otro particular, me suscribo de usted con muestras de mi alta consideración y deferencia.

Atentamente,

Ministro de Finanzas

Señor Ministro de Comunicaciones,
Transporte y Obras Públicas
Coel. e Ing. Edgar Leonel Ortega Rivas
SU DESPACHO.

c.c.: SEGEPLAN,
Sr. Director de AID.

HGF/MC/alim.

Action Copy ORD
Info. Copy PDSU
Necessary Action Info
Due Date
Date Routed 6/16/83 By

ANNEX E

CERTIFICATION PURSUANT TO
SECTION 611 (e) OF THE
FOREIGN ASSISTANCE ACT OF 1981
AS AMENDED

I, Charles E. Costello, the principal officer of the Agency for International Development in Guatemala, certify that to the best of my knowledge and belief Guatemala possesses both the financial capability and human resources to effectively maintain and utilize the mini irrigation system and soil conservation structures to be built the Highlands Agricultural Development Project. The construction of this infrastructure will stimulate the growth and expansion of on-farm activities in the Guatemalan Highlands.

This judgment is based in part on the fact that, similar irrigation and soil conservation structures being built under two currently active AID loan projects have been maintained in working condition through efforts of the farmers themselves with assistance from Guatemalan Ministry of Agriculture Extension Agents.

(Signed) _____
Charles E. Costello
Director
USAID Guatemala

(Date) 11 June 1983

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ANNEX F (1)

SOCIAL SOUNDNESS ANALYSIS

The analysis given in this annex is taken from a larger, more encompassing report prepared for AID entitled "REGIONAL DEVELOPMENT MISSION REPORT" dated December 9, 1982 which, addressed the social impact and constraints of four developmental innovations including land terracing, small scale irrigation, labor intensive access roads, and forestry projects. A summary of the analysis of these four activities is given below.

Background

Guatemala's western Highlands is a region of rugged, mountainous terrain. In this region live a predominantly rural, agricultural population of mostly Indians and rural Ladinos[1/]. The already high population density*/ is further pressured by a population increase in an excess of three percent per year. This has resulted in a pattern of heavily exploited mountainside agriculture. With the good valley lands long taken, farm families have been forced to farm higher and higher on the forested mountain slopes. They work this new land three to five years, or sometimes more, but the fields are eventually impoverished due to the erosion of the steep mountain slopes by the heavy rains. As the land becomes increasingly less productive, the farmer abandons the site and clears a new patch of the hillside and the cycle begins again; destruction of the hillside cover leading to eventual erosion and depletion of the topsoil. Those most immediately affected by the process effects are the rural poor of Guatemala's Highlands, for they are utterly dependent on successful agricultural exploitation, or they are forced into the slums of Guatemala's major cities.

1/ An Indian is one who speaks some non-Hispanic mother tongue, speaks Spanish generally with phonological and syntatic interference from the indigenous language, wears clothing which is distinctive (specially the woman), and adheres to numerous group-specific domestic, social and religious patterns. A Ladino, in contrast, speaks accent-free Spanish as sole (or dominant) language, wears western style clothing, and adheres to the generalized Hispanic domestic, social and religious institutions relevant throughout Latin America.

*/ Project area population is 91 persons per square kilometer, or 353 persons per square mile.

To address these urgent and difficult conditions, Guatemalan agricultural extension agents, with technical and financial assistance from AID, have begun a system of labor intensive technically appropriate interventions involving rural people, that effectively improve natural resource management and increase the value and productivity of the small farmer's land.

1. Soil Conservation:

The technology to accomplish the project is simple and can be applied by the farmers who use only two tools: the hoe, which they generally have in every household, and a simple leveling device consisting of three sticks or other native materials tied together firmly in the shape of a capital "A" from whose apex hangs a plumb bob of string and a rock. Starting at the top of his field, the farmer uses the level to determine the width and length of an area to be terraced. Then he removes and stores the topsoil from a small patch. After the patch has been excavated to a level condition, the topsoil is replaced by taking it from the next patch to be excavated. The process is repeated until a single terrace is completed. The farmer then lays out a new area just below the completed terrace, and repeats the procedure until his land is completely terraced. The terrace walls are sodded with grass pluge, and the terrace surface is planted either with traditional subsistence crops (corn and beans) or cash crops.

Terracing is highly labor intensive. For these farmers, a standard days labor consists in hand hoeing a single "cuerda" (approximately 430 $m.^2$). Terracing the same size patch by contrast, requires seven or eight days labor. For many rural farmers, whose margin of economic existence is extremely precarious, the difference between one day of labor and eight on a single piece of land is considerable, for the farmers would ordinarily sell their labor and with the wages, buy corn and beans to feed their families. To meet this need, AID funds will be used to compensate the farmers for the extra labor time so that the poor do not suffer hunger in the one time process of converting his fields from raw slopes into stable terraces. DIGESA administers the monetary assistance and varies payments according to the difficulty of the task determined by the steepness of the slope soil type, and the degree of peasant's poverty. The average terracing cost is estimated at Q15 and Q20 per "cuerda" or Q350 to Q460 per hectare. Payments are made on the completion of the measured units of terracing. This cost is a one time only expense for each unit of land. Payments will be used to encourage farmers to adopt soil conservation measures in areas where such practices do not presently exist. Past experience has shown that when this practice is used, the total area of land using conservation practices will be expanded without the use of payments by 35 percent.

a. Socio-economic Impact

All evidence indicates that terracing substantially increases agricultural production. Based on reports from agricultural technicians working on the project, the increased corn production on terraced land is approximately 141% over unterraced land, for wheat 81%, for potatoes 98%, and

for beans 95%1/. The small rural farmers who have terraced their land are clearly aware of the production increases, though in less exact terms. A spin-off benefit of terracing is the highly nutritious grass that is grown on the terrace walls to stabilise them and protect them from erosion. The grass provides feed for a farmer's livestock. There are indeed more cattle among farmers with terraces than among farmers not incorporating this practice. Alternatively, the grass is cut as a cash crop. The farmers secure one cutting of grass every two or three months, worth approximately Q5-Q8 per cuerda per cutting. Harvesting requires no more than one to two hours of labor. This is a considerable sum in a region where two dollars per day is the common farm wage. The increased agricultural production is due to the ability of the terraces to retain moisture. The terraces slope back to the hill slightly so that rainwater that falls on a given terrace is retained until it seeps into the terrace soil. This clearly results in more retained ground moisture, and as a result, in more vigorous and productive crops. Evidence indicates that even without supplementary irrigation, farmers can grow potatoes and other vegetables, and that they can get more than one crop of these per year.

Not only does the terracing increase agricultural production, but it also decreases direct agricultural production costs. Commercial fertilizers applied to the field do not quickly leach out of the soil. Thus, farmers report a reduction in the need for purchasing commercial fertilizer. In addition, the grass harvested from the terrace wall is usually fed to cows or other animals. This, in turn, produces a greater quantity of organic fertilizer which is then returned to the terraces by the farmer, resulting in richer soil and a further reduction in the need for chemical fertilizers. Finally, since the terracing stabilizes the land and makes it more productive, the farmer is much less likely to shift to new fields. Thus he saves the cost of opening new land on the hillsides.

This entire process of increased production and reduced cost decidedly increases the value of the land to the farmers. They are very much aware of the labor they have invested in terracing and the production increases. A given mountain slope that in the past might have been depleted in four to ten years is now recognized as a non-depreciating asset. Furthermore, the increase in production reduces farmer's the need to migrate for temporary wage labor. This migration has traditionally been to the plantation agricultural areas of Guatemala's Pacific Coast. There the migrants work in the coffee, sugar cane and cotton fields and are exposed to poor living conditions, inadequate health facilities and tropical diseases.

Apart from the immediate benefits to the rural farmer, the entire process of terracing stabilizes and conserves natural resources that are crucial for the livelihood of the rural population in the project region and for and the country in general. Soil loss in the terraced areas is greatly reduced, preserving this precious and extremely limited resource of

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1/ "Informe Final" Conservacion de Suelos - DIGESA 1982

the farmer. With reduced water run-off from the hillsides, there is less likelyhood of flooding. Thus, water retention on the terrace results in improved watershed management that directly affects communities down the mountain, providing a greater volume of more usable water throughout the year. Finally, the terracing system reduces the destruction of forest and natural hill cover by minimizing the need to open new fields as a result of erosion and depletion of the old fields. An important factor is that there is a considerable spread effect. So far, DIGESA officials have located approximately one hectare of cooperative self-financed terracing for each three hectares directly stimulated by DIGESA/AID. This reduces the cost of terracing from Q350-Q460 per hectare to Q280-Q350 per hectare. Moreover, this figure only reflects those fields that have been casually found by DIGESA in the process of their serving assisted farmers. Other fields have probably been terraced using the simple technology, in locations where DIGESA officials have not seen.

Apart from the immediate economic benefits to the small farmer, and the long term conservation effect, past and future terracing will have significant social effects, by reducing the need for migration. Both Ladino and Indian rural farmers receive social benefits, though they differ because of the migration patterns. In Ladino families, the man tends to migrate alone. Past research by anthropologists suggests that such migration often results in family disruption, as the men may take up new social and sexual relationships in the region where they work. Thus, for Ladinos, terracing may well result in a somewhat lessened rate of family disruption and thereby reduce somewhat the stresses this problem placed on women and children. Among the Indians, the tendency is of whole families to migrate. Family migration, however, considerably disrupts the education of children and has contributed to the low level of Indian literacy. Consequently, terracing contributes somewhat to improved Indian education.

Notably, farmers involved with DIGESA officials have gained a considerable respect for the GOG and for the services it provides. Indians have traditionally isolated themselves and have been fearful of government and other official contacts. Their new appreciation of the GOG will have considerable significance in the development of a politically stable rural area. Finally, the system of terracing and the extension education that goes with it involves the entire family in the improvement of important production resources and develops a sense of conservation pride.

b. Beneficiaries:

The primary beneficiaries will be over 18,000 rural families, for it is the family land that is improved in the process. Clearly, the economic benefits go to the family as a whole. Moreover, the social benefits, especially of contact with DIGESA officials, also goes to the family as a whole, for husband, wife, and children together are often involved in the layout and construction of the terraces. DIGESA tries to stimulate about 5 cuerdas of terracing per family. Thus, approximately four families, or 25-28 people are affected per hectare at a cost of Q75-100 per family, or Q3 per

person. Indirectly, the entire nation benefits from reduced incursion on the forest, improved watershed, and retention of the soil resources necessary for continued food production within the country.

c. Participants:

The primary participants consist of whole families from both Ladino and Indian ethnic background, plus DIGESA extension agents.

d. Socio-cultural Constraints and Solutions:

Because the social unit involved in the terracing project is the individual family, DIGESA officials secure relatively easy participation and acceptance. Moreover, DIGESA officials are successfully using radio broadcasts and other forms of public communications to pass their message more widely. These broadcasts are often done in the local Indian language by the agricultural assistants (guias agricolas) hired to work with the extension agents as rural village counterparts. It is estimated that the terracing program may be more acceptable and successful in Indian rural areas rather than in Ladino rural hamlets. This is because the extremely heavy hand labor input goes against the Ladino cultural preference for more skilled, less manual activities.

No adverse effects were detectable in the terracing project. Given the small landholdings the corn and beans deficit of most of the families and of the country as a whole, there is no possibility of oversupplying the corn and beans market.

2. Small Scale Irrigation

a. Background

Within the Highlands of western Guatemala the sharp division between rainy season (May-October) and dry season (Nov-April) severely constrains agricultural production by limiting the farmers to one crop a year. This problem is exacerbated by the relatively short moisture retention period of the soil and fast runoff due to planting on steep hillsides.

b. Technical Evaluation

A mini irrigation system consists of a group formed of between 10 to 40 small farmers. These farmers contribute all labor, and use GOG Ministry of Agriculture personnel only for technical and design assistance. A typical mini irrigation system uses a perennial stream as a water source. The water is diverted into a catch basin of about 1 cubic meter capacity and conducted by gravity through PVC pipe to the areas to be irrigated. Lateral PVC tubing of smaller size is employed to direct the water to the lands of those farmers participating in the system. Final irrigation is done through the use of portable sprinklers or in some cases, merely by garden hose. The GOG provides financial assistance to the target group at favorable rates for

the purchase of materials needed for the construction of the water delivery system as well as their irrigation hoses and sprinklers.

c. Social and Economic Impact

In general, the impact of the mini irrigation has been highly successful in both increased agricultural production, reduction of risk, and in social acceptance. The introduction of a dependable irrigation system enables the served farmers to extract at least two, often three, and sometimes four harvests annually from the irrigated land. Formerly, they were limited to only one harvest. This more intensive cropping requires more human labor per unit of land, which provides added employment and encourages the small farmer to remain in the area. His extra labor is rewarded by providing him with the opportunity to diversify and plant other types of crops, rather than the traditional corn and beans. This situation constrasts sharply with the condition of most farmers in the project area who have insufficient land to adequately feed and support the cash needs of their families. Such farmers have traditionally been forced to migrate to the unhealthy lowland areas in search of seasonal wage labor. Under irrigation, moreover, some farmers have experienced less need of extensive wage migration since their additional cash needs are derived from the sale of second and third crops. Moreover, the change to vegetable farming contributes to a more diversified diet both within the farmer's family and throughout the community.

Indirect benefits include year-round vegetable availability in the local market region, resulting in diet enrichment. Moreover, during project design, construction, and follow-up, farmers received additional valuable information from the agricultural extention agents. For example, farmers have agreed to construct terraces and employ other soil conservation techniques as a condition of participation in the irrigation projects. Thus, valuable terracing has been extended at minimal cost. Finally, women in these households are generally positively affected as they commonly receive cash profits directly and reinvest them in foodstuffs and other required goods. Thus, both female labor on the vegetable crops, and female generated market profits contribute to an elevated status in a male centered society.

There appear to be no identifiable adversely affected groups. The water used would have been wasted in unused streams, and is not a source of contention. Mini irrigation projects probably introduce price and sales competition with the vegetable producers of the towns of Zuni and Almelonga, two Indian towns that have long been specialists in vegetable production by ditch irrigation methods.

d. Beneficiaries

The farm families brought under irrigation are the most direct beneficiaries. On average, a rural farm family consists of 7 persons, which usually include the parents and their children and may often include a surviving elderly parent of the head couple, a daughter-in-law, and a

grandchild or two. It is estimated that 53 small irrigation systems will be constructed which will benefit over 2,000 farm families.

e. Participants

Participants will be farmers who construct and maintain the water delivery systems. There have been no significant difficulties in securing water rights and water easements to date. Farmers and agricultural officials have cooperated well. It should be emphasized that DIGESA and DIGESEPE (Guatemalan Agricultural Crop Extension Service) regional officials have a high degree of technical skill and have delivered these skills to the rural farmers with exemplary dedication.

f. Socio Cultural Constraints and Solutions:

Based on past experience, it is expected that this project will encounter no social or cultural impediments among either the Ladino or the Indian ethnic populations. Perhaps one measure of the peasant interest in past similar activities is that they have been willing to donate their labor in the construction of small irrigation systems and to expand soil conservation measures without social cost payments. The margin of economic existence of these individuals should in fact force most to sell their labor elsewhere. They have also been willing to suffer temporary food shortages. In one case, members of a cooperative formed a food pool to tide over the poorest participants during the construction phase of a small irrigation project.

A number of the participating farmers report that in areas with several nearby mini irrigation projects the local markets have become saturated with vegetable produce. As a result, in some cases prices have dropped to the point that farmers are, quite rationally, returning to the traditional crops of corn and beans. This, though, increases the difficulty with which the loans can be repaid, and it partially defeats the purpose for which the systems were installed to -- diversify crops and increase the proportion of cash crops.

Given the evidence of occasional local market saturation in the areas where several past irrigation projects have been financed, future project financing should be linked to an assessment of the market situation. Without an assured outlet for his new crops at a fair price, the farmer will return his lands to the traditional crops of corn and beans. Until such time as GOG directly addresses the marketing problem, and either educates the rural farmers on marketing possibilities, or stimulates a successful marketing infrastructure, new irrigation projects should be carefully distributed. Since the corn and beans diet is relatively healthy, and since Guatemala must import these products to satisfy food needs within the country, mini irrigation projects should not be generalized throughout the Highlands unless it can be shown that the irrigation projects sufficiently increase the production of corn and beans (above that provided by the cheaper and simpler means of terracing alone), so that the loans can be economically repaid on the

basis of corn and beans production alone. AID financed irrigation projects should be quite widely dispersed within the project area. For the present, given the heavy vegetable production of Almolonga and Zunil, it would probably not be advisable to establish any irrigation projects in the Quezaltenango valley area. Given the evidence of market saturation in the department of San Marcos, new installations should be planned there with caution. On the other hand, so as not to lose the momentum of mini irrigation technical teams, appropriately distributed projects in Huehuetenango and El Quiche are encouraged.

Part of the marketing problem will be resolved by addressing the issue of transportation costs. At present it is expensive for the farmer to move a small quantity of produce to a distant market. This renders his product non-competitive, and limits him to a local marketplace. However, some mini irrigation groups concentrate their shipments into a full truckload and then hire a local truck to move their produce to market.

Finally, if improved seeds are developed or are available, or if other farming techniques are introduced that permit two crops of corn per year, then mini irrigation should be stimulated without concern for marketing issues.

3. Reforestation

For both Ladinos and Indians, firewood (leña) is the principal fuel for cooking. For the most part, houses are totally unheated, the kitchen fires being located often in a separate building to avoid fire hazard to the main structure and smoke irritation to the inhabitants. Households depending on firewood commonly burn the cookfires on the ground, supporting the cooking pots over the fire by resting them on three volleyball sized stones. Alternatively, they raise the three rocks up onto a sand covered wood table or clay platform. Some families, most often in towns, have placed a metal plate over a raised firepit.

For the inhabitants, the essential matter is that these cooking sites are cheap to build. Placing the boulders on the floor costs nothing; raising the fire onto a table costs somewhat more but is quite modest in any event. Thus the initial cost makes this form of cooking attractive , while firewood cost is programmed into the weekly budget. The alternative of a kerosene or a LP gas stove entails an outlay equal to two weeks to one month of salary for a rural farmer.

In addition, gas purchases exceed wood costs generally. Hence, firewood cooking is certain to remain dominant. At present, 88% of all Guatemalan households (96% in the project region) use firewood for fuel, while 83% of all firewood used in Guatemala is for cooking compared to 17% of wood burned for industrial production[1]. Finally, of all wood used in Guatemala for any purpose, 90% is burned[2]. Multiplying these figures together, 75.7% of all wood used in Guatemala for any purpose is burned in domestic cook fires.

b. Socio-economic Impact

The evaluation team anticipated that a reforestation project would impact upon the regions population in the following ways:

1) Belt reforesting on municipal lands, for subsequent firewood use would have a favorable social and economic impact on household economies and on the stabilizaton of municipal resources.

2) Fuelwood cultivation on the boundaries of farmer's land should conserve costs as well as resources, provided it does not cause a shading problem on the farmer's crop lands.

3) Firewood available on the farm would relieve many women and children of the time consuming task of gathering brushfall firewood or transporting from the hillsides firewood cut by husbands. In addition, this would assist women by reducing a frequent drain from their limited cooking purse, out of which they are obligated to cook for and feed the family.

c. Beneficiaries

Approximately 200,000 individuals will be benefited from these forestry activities. Clearly, with 96% of the project region's households dependent on fuelwood, and well over 60% of the regions households rural, the country as a whole will benefit through the preservation of forest resources, and the conservation of soil and water supplies.

d. Participants

1) For individual land fuelwood plantings along boundaries, rural families throughout the Highlands would participate, individually, with technical assistance from DIGESA or INAFOR.

2) For municipal level efforts to develop belt reforestation and fuelwood supplies, INAFOR would deal with entire communities through their elected municipal leadership. Selected communities throughout the Highlands would join in the project.

3) It is etimated that over 40,000 rural families will benefit from the activities undertaken under this sub-component.

1/ Fuelwood and Alternative Energy Sources, ROCAP Project Papers, August 16, 1979, P. 20-21).

2/ Environmental Profile of Guatemala, May 1981, P. 40.

e. Socio-Cultural Constraints and Solutions:

The purpose of the reforestation activity is to assure a long run, profitable supply of fuelwood for the Highlands population at prices which will not effect a reduction in their net incomes. The objectives of this activity are to:

- Minimize deforestation in the Highlands as a result of fuelwood assumption.
- Determine the feasibility of private reforestation activities.
- Provide employment opportunities in the communities where reforestation is taking place.

In order to implement the project activities as described in the body of the Project Paper, it will be necessary to work at the community and individual levels. The following should be taken into consideration at these distinct levels:

1) Community Level

In Indian hamlets, INAFOR should visit the hamlet principales individually in their homes, and explain the program. This will give them time to think the issue through and gain public support. At the hamlet council INAFOR should make an audiovisual presentation to hamlet councils. In Ladino hamlets, the audiovisual materials should be presented in the hamlet mayor's home first, to secure his authority as backing, then to the Ladino hamlet council. Let the people discuss the issue after the INAFOR presentation of pictures and results from other communities that have the firewood problem and now have a growing stand of trees and after they have seen the economic figures on the wood costs to be saved.

2) Individual Level Farm Reforestation

Individuals should be taught to plant and care for trees on their own property. Use the above procedures to secure public viewing of individual reforestation techniques, so that mass teaching can be accomplished.

Train INAFOR extension agents and use AID money to supply them with audiovisual materials, (audiovisuals are very attractive to the people), so that they can demonstrate the need for both community reforestation and individual tree planting. Demonstrate that 6 trees planted means one tree per year harvested with one new planting per year indefinitely. Given a six year growth to firewood maturity, (for the alien species), and a three week firewood supply from each tree, 100 trees will supply the farmer's needs without need of future deforestation, provided replacement plantings are made at each cutting. If tree ownership could be effectively marked, then good quality firewood trees could be planted on land

boundaries (except for corner markers). Presumably owners would alternate owned trees or possess all the trees on one side of the centerpont of each boundary. Such boundary trees would also provide valuable windbreak, for the shallow rooted native corn is prone to wind damage, and the trees would also provide additional erosion control. (Care must be taken to ascertain if boundary firewood trees would cause shade problems for adjoining milpa plots, or soil changes).

4. Rural Access Roads

a. Socio-Economic Impacts

Rural farmers interviewed during the development of the Regional Development Mission Report indicated that rural access roads facilitated the export of their agricultural produce and reduced the transportation cost of their product to market. The presence of the roads allowed them the opportunity of producing crops of greater cash value and facilitated the delivery of needed goods from market centers.

Rural farmers also emphasize their greater access to numerous government services. Foremost among these are health benefits. The farmers recognize that the roads allow emergency medical transportation and permit government health agents to bring to the villages regular innoculations and medical extension education. Other agencies of the GOG such as agricultural extension agents and forestry officials, are were able to deliver additional services and supervise projects with greater facility. In short, rural access roads is perhaps one of the most important first steps in the development process, for they bring with them many collateral services and open significant new opportunities.

Of a more immediate nature, the process of road maintenance injects funds directly into the rural communities since the roads are maintained with an emphasis on the use of paid local labor. This will have a significant impact on those employed under the program. During the project $1,687,000 will be paid for 405,000 man days of labor. As in the construction phase of the Access Roads Program, work will be distributed throughout communities. Crews work for two week periods after which a different crew is selected. In addition to more widely distributing wage benefits agricultural activities are not significantly interrupted.

b. Beneficiaries

The beneficiaries will be those people living within the area of influence of each access road. During the first year of the access roads maintenance program when 500 kilometers will be maintained about 92,000 beneficiaries will enjoy well maintained roads. This will increase to 240,000 rural inhabitants by the fifth year of the project when 1,300 kilometers will be under annual maintenance.

c. Participants

There will be two types of participants within the proposed maintenance program. Active participants will supply labor and receive payment for their work efforts. During the life of the project 405,000 man days of labor will be required at a total payment of $1,687,000. Inactive participants are those individuals living within the area of influence of the roads who will reap socio-economic benefits from the well maintained roads, but will not participate directly in the road maintenance plan.

d. Social-cultural Constraints and Solutions

The beneficiaries of the Access Roads Component are small farm owners, mainly Indians, who live in the Highlands where access roads have been previously constructed or will be constructed during the proposed project. In Guatemala these Highland Indians occupy the lowest socio-economic strata. One of the main contributors to this situation is that because of the difficulty of travel in the mountainous Highland terrain, Indian groups isolated from each other have, over time, developed 23 different dialects. Separated from the lowlands, they have not learned Spanish. This isolation, the numerous dialects and the lack of knowledge of the Spanish language have reduced educational opportunities for Indians further preventing their economic, social and political participation outside of the Highlands. Because of this and other cultural differences, it has often been difficult for generally non-Indian government workers to introduce new technology in the Highlands.

This is not expected to be a significant problem for the proposed project since the DGC has effectively implemented similar projects in the past utilizing extension agents and promoters trained in community development techniques. The proposed project will utilize the same field tested extension technology while benefitting from the experience of many of the same field trained extension personnel.

Current experience has demonstrated that projects such as the Rural Access Roads Program have improved Indian perceptions of government extension workers. These projects are thought to have been effective because they involved the Indian communities in decisions concerning the planned interventions. Access roads, for example, are initiated only after request for such roads from interested communities. Promoters then visit the communities to discuss the roads, and community committees are formed to help in the organization of community participation. These committees, elected by the communities, select both local work crews and local foremen for the construction. This system has worked well enough to produce 630 kilometers roads over the past six years. The same committees will participate in the organization of community participation for road maintenance. They will select local road maintenance crews and local foremen as well as provide for control of maintenance hand tools. As in the construction phase of the program, the local foremen will not only supervise maintenance crews but will provide an accounting of work performed to the DGC for worker payroll.

One problem that was not forseen under the Rural Access Road Program was that after construction, roads were not well maintained. The assumption was that communities would maintain roads without payment for their labor because of perceived benefits of the road to the community. However, community members would not accept individual responsibility to work on the roads since many people who used the roads had no responsibility to maintain them. Further, the workers believed that road maintenance is a proper responsibility of government. Taking this into account, the proposed project will provide wages for work performed. It is believed that this will assure community participation as it did under the construction phases of the program.

Maintained access roads allow continuous contact with nearby communities by both Indian men and women as goods are transported for sale at markets and agricultural inputs purchased. In time, this increased contact should provide the incentive and the opportunity for Indians to learn Spanish. This in turn will assist Indian participation in the economic, social and political mainstream of Guatemala.

It is important to point out that these roads can only provide socio-economic benefits if they are not allowed to deteriorate. Current DCR estimates are, that on the average, unmaintained roads deteriorate to the point where they must be completely reconstructed after five years. Thus, each year of deterioration reduces road utilization and reduces benefits accordingly. Extension and health service must generally be carried out over time to effectively reinforce the transfer of technology. The opportunity for this reinforcement is greatly reduced by deteriorating roads which cannot handle motorized traffic.

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Annex F (2)
FINANCIAL ANALYSIS

A. Project Budget and Disbursement Plan

The proposed total cost of the project is $14.782 million. AID's contribution will comprise 60.9% of the total project budget and will consist of $1.5 million in grant funds and $7.5 million in loan funds for a total input of $9.0 million. The remaining 39.1% of the budget or $5.782 million will be contributed by the Government of Guatemala.

The project life is estimated to start August 1, 1983, and end on September 30, 1988, for a total of 5 years. It is projected that 100% of the loan and grant funds contributed by AID will be obligated early in the 4th quarter of FY 1983.

The Access Roads Maintenance Component will require $7.612 million. Of this amount 50.6% will be AID funded using $3.655 million of loan funds and the balance of $200,000 from grant funds. The remaining 49.3% ($3.575 million) will be a counterpart contribution of the GOG.

The Natural Resources Component requires $6.145 million. AID will fund 67% of this component; 53.7% will be loan funded and 13.3% will be grant funded.

The remaining 6.9% of project costs relate to contingencies, audits, evaluation, and baseline survey. These costs, totaling $845,000, will be 100% AID funded with all items except the $545,000 contingency item being grant funded.

Table II, Summary Financial Plan by Component, gives a breakout of all costs by component, source of funding and foreign exchange/local currency portions.

TABLE I
PROJECTION OF EXPENDITURES BY FISCAL YEAR

PROJECT YEAR	AID FUNDS GRANT	AID FUNDS LOAN	GOG FUNDS	TOTAL
1	710	3,232	737	4,679
2	310	1,186	810	2,306
3	310	1,138	974	2,422
4	110	1,212	1,467	2,789
5	60	732	1,796	2,586
TOTAL	1,500	7,500	5,782	14,782

Table II/Cuadro II
Summary Financial Plan By Component
(Resumen del Plan Financiero por Componente)

	USAID				
	Foreign Exchange (FX)($)	Local Currency (LC)(Q)	Total	GOG	Total
I. Loan (Prestamo)					
Soil and Water Management (Administracion de Suelos y Agua)	550	2,450	3,000	1,867	4,867
Forestry (Reforestacion)	13	287	300	158	458
Access Roads (Caminos de Acceso)	2,601	1,054	3,655	3,757	7,412
Contingencies (Imprevistos)	295	250	545	-	545
- Subtotal	3,459	4,041	7,500	5,782	13,782
II. Grant (Donacion)					
Access Roads Technical Assistance (Caminos de Acceso Asistencia Tecnica)	820	-	820	-	820
Natural Resources Management Technical Assistance(Administracion de Recursos Naturales-Asistencia Tecnica)	200	-	200	-	200
Baseline Survey (Encuesta Basal)	50	100	150	-	150
Evaluation (Evaluacion)	50	50	100	-	100
Audits (Auditorias)	-	50	50	-	50
Contingencies (Imprevistos)	180	-	180	-	180
= Subtotal	1,300	200	1,500	-	1,500
= TOTAL	4,759	4,241	9,000	5,782	14,782

TABLE III/CUADRO III

SUMMARY FINANCIAL PLAN - BY INPUTS
(Resumen del Plan Financiero - Por Insumos)

Component Inputs (Insumos por Componente)	Access Roads (Caminos de Acceso)	Soil and Water (Agua y Suelos)	Reforestation (Reforestacion	Support Grant (Donacion de Apoyo)	Tota
1. Technical Assistance (Asistencia Tecnica)	-	300	-	1 020	1,320
2. Commodities (Articulos)	2,646	440	41	-	3,127
3. Training (Adiestramiento)	30	-	11	-	41
4. Social Benefits Costs & Wages (Costos y Salarios por Beneficios Sociales)	765	1,260	248	-	2,273
5. Credit (Credito)	-	1,000	-	-	1,000
6. Other (Studies, Evaluations, Audits (Otros - Estudios, Evaluaciones, Auditorias)	214	-	-	300	514
7. Contingencies	181	182	182	180	725
SUB TOTAL	3,836	3,182	482	1,500	9,000

The above Table I gives a breakdown of project expenditures by year for both AID and GOG. On a percentage basis 43.8% of AID funds will be expended in year one with 16.6%, 16.1%, 14.7%, and 8.8% respectively, being expended in year 2 through 5. This rate of expenditure appears reasonable given the fact that during the first year of the project all project commodities will be purchased, representing a large flow of funds, and that during the life of the project AID financing of wages and other recurrent costs will gradually be reduced. One would anticipate lower expenditure rates as the project matures. At the same time, because AID funding is required through the project life, the design of the project cannot be criticized for "front ending" AID funds.

On the GOG side during the first year of project activities, expenditures will be 12.7% of the planned GOG life of project budget and expenditures in year 2 through 5 will equal 14.0%, 16.8%, 25.4%, and 31.0%, respectively.

In summary, the project, as presently designed, does not appear to anticipate overly ambitious, sporadic expenditure rates but rather after the first year, a gradual decrease in AID funding coupled with a gradual increase in GOG funding. This approach therefore coincides with sound financial management. Table IV graphically displays AID-GOG funds flow.

B. Financial Viability and Recurrent Costs Analysis

The Natural Resource Component should encounter no problems with recurrent costs. The Reforestation sub-component will become self-sustaining by project's end. The ability of the Instituto Nacional Forestal (INAFOR) to recuperate its investment and establish a rotating fund for additional reforestation by charging the buyers of seedlings a price equal to its cost of production insures the original AID-GOG investment will create a self-financing mechanism. Our institutional analysis of INAFOR indicates that the accounting structure exists so that the appropriate price to be charged can be accurately calculated.

Recurrent costs within the Natural Resource Management Component will be minimal. Terracing activities will require labor input for maintenance, but it is expected that individual farmers will maintain their terraces once they are built. Hence, although there are some recurrent costs (labor input), there is no need for GOG to input additional funds under this element.

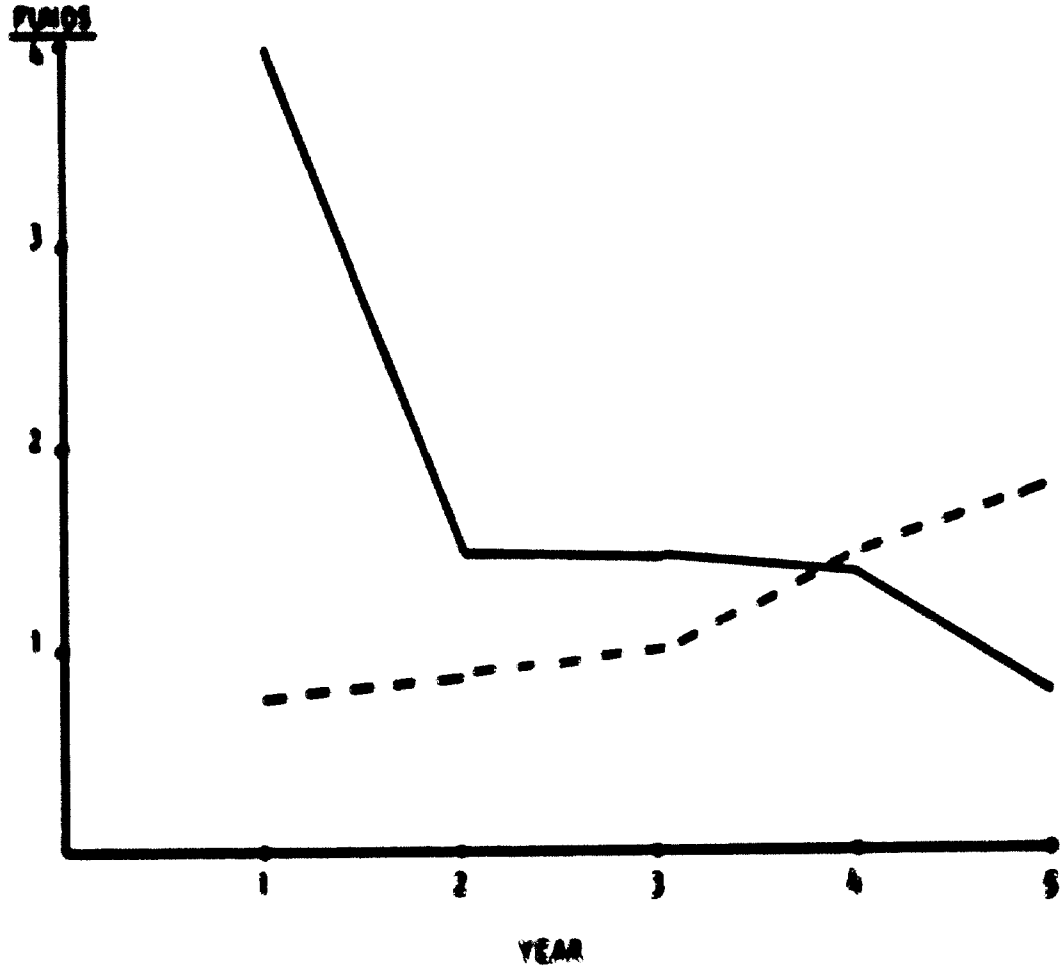
The gravity flow mini-irrigation systems to be built with project funds will also require minimal maintenance such as cleaning out catchment boxes, sluiceways and pipes, with minor purchase of new pipes or valves over the long run. The labor required to maintain these systems will be supplied by the individual farmers on a voluntary basis.

Approximately 20% of the mini-irrigation systems to be built will require pumped water. Recurrent costs associated with these systems are higher due to the cost of fuel (electricity or diesel) for the pumps as well

TABLE IV

AID - OOC FUNDS FLOW

($ 000)



as routine maintenance and repair. However, past experience with eleven pump driven systems indicates that this group of farmers generates sufficient profits to more than cover the recurrent costs of keeping the systems operational.

The design of the Access Road Maintenance Program allows for a gradual increase in GOG funding until in the final year of the project; at that time the GOG funds cover all costs which are of a recurrent or on-going nature. It should be pointed out that prior to 1983 the DGC did not have a budget line item for rural roads maintenance. An integral part of the recently approved $3.0 million add-on to the AID Loan 520-T-026 project is the creation of two rural roads construction units within the Direccion General de Caminos (DGC). Budgeted expenditures for these two units total $3.825 million for 1983.

The only critical point in regards to recurrent costs of this component would be the time at which major equipment purchases would have to be made to replace equipment bought from project funds which had reached the end of its useful life. The DGC makes provision for equipment replacement through a depreciation process which amortizes equipment costs through per kilometer road maintenance charges. Given this depreciation system equipment purchases can be funded from the normal DGC budget. As was pointed out in the institutional analysis the DGC has a very sophisticated, computerized accounting system which will enable them to assign adequate depreciation factors to fund replacement equipment.

From the following analysis it can be concluded that the Government of Guatemala will be able to continue funding project activities after the initial five year period which includes AID funding. The conclusion can also be drawn that recurrent costs can be met.

According to recent economic analysis Guatemala Central Government net expenditures (debt servicing excluded) are expected to rise in real terms (inflation deleted) by 3% per year through 1986. Beginning in 1987 the real term growth is expected to be 4% to 5%. Table V gives a comparison of the projected Central Government budget with expected project expenditures.

TABLE V

Project Budgetary Requirements Compared to
Projected Central Government Budgets
(In $000)

Year	Projected Central Government Budget 1/	GOG Inputs	Project Inputs as % of Budget
1984	1,419,000	737	.052
1985	1,463,000	810	.055
1986	1,518,000	974	.064
1987	1,584,000	1,467	.093
1988	1,650,000	1,794	.108

1/ Contains a 10% inflation factor which equals the inflation factor computed in the project budget.

Funding for this project initially requires GOG outlays which are equal to 1/2 of 1% of the total GOG central budget. Project funding while increasing every year and constantly becoming a larger percentage of the central budget, nevertheless only reaches 1% of the central budget in the fifth year of the project. This is hardly an unmanageable financial burden for the Government of Guatemala.

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ANNEX F(3)

ECONOMIC ANALYSIS

The goal of this project is to increase the economic welfare of the small farmer in the Highlands region of Guatemala. Rural road maintenance will allow continued access to markets and the introduction of terracing and small scale irrigation systems will permit multi-cropping and crop diversification. Both will serve to increase the cash income of the small Highlands farmer. One element of the Natural Resource Management component, forestation, is only a pilot project and since it will not yield a meaningful stream of economic benefits over the life of the project, it will not be considered in this analysis.

Because of limited baseline data, a modification to the benefit-cost calculus will be utilized. Rather than relate the present discounted value (PDV) of project costs and benefits in the form of a benefit-cost ratio the argument will be reversed. Project benefits will become the unknown in the equation and will be solved with a given benefit-cost ratio. The reasoning of the analysis will be as follows: given the present discounted value of project costs, what must the present value of project benefits be in order to achieve a given benefit-cost ratio? The analysis must then focus on the feasibility of such a level of project benefits given what is generally known about the target area and the type of economic activities found there. The discussion will consider several discount rates and benefit cost ratios as well as cost overruns thus introducing some sensitivity analysis into the calculus.

RURAL ROADS MAINTENANCE

This component of the project will focus on maintaining an existing net work of rural access roads. There are two economic benefits: (a) the present level of economic activity along the roads will be preserved and, (b) the present volume of economic activity will be able to grow at some rate over the five year life of the project. In the absence of road maintenance, we must assume that not only would economic growth not take place along the roads, but that the present level of economic activity would degrade at some rate over the next five years.

Roads maintenance will affect almost 193 thousand families in the Highlands, but not all of these will experience benefits from the project for the entire five-year project life. As this component progresses, more and more kilometers of rural roads will be added to the maintenance schedule, but those added towards the end of the project will mean only limited benefits to those families. On a weighted average basis, therefore, only about 28 of the 193 thousand families will receive economic benefits from road maintenance over the entire five years.

TABLE 1

USAID/GUATEMALA AID: RURAL ROADS MAINTENANCE ECONOMIC COSTS
Q(000)

	(1) Wages[1/]	(2) Goods	(3) Other	(4) Total Domestic Costs (1-3)	(5) Goods	(6) Technical Assistance	(7) Total Foreign Exchange Costs (5+6)	(8) Domestic Value of Foreign Exchange[2/]	(9) Total Economic Costs (4+8)	(10) PDV At Year 0 (12%)	(11) PDV At Year 0 (15%)
Year 1	604.0	48.1	110.0	162.1	1976.9	320.0	2296.9	2985.9	3548.0	3167.9	3085.2
Year 2	480.0	48.9	27.0	555.9	279.1	200.0	479.1	622.8	1178.7	939.7	891.3
Year 3	555.0	30.0	53.3	638.3	305.7	200.0	506.7	658.7	1297.0	923.2	852.8
Year 4	720.0	85.3	48.0	855.3	747.7	100.0	847.7	1102.0	1957.3	1243.9	1119.1
Year 5	854.0	93.9	51.0	998.9	541.1	-	541.1	703.4	1702.3	965.9	846.3
TOTAL	3017.0	306.2	287.3	3610.5	3851.5	820.0	4671.5	6072.8	9683.3	7240.6	6794.7

1/Paid at the minimum wage which is assumed to reflect the opportunity cost for labor. Includes also training and other overhead costs.
2/A shadow price of 1.30 was used to convert foreign exchange to domestic costs.

TABLE 2

RURAL ROADS MAINTENANCE: MATRIX OF BENEFIT VALUES
Q(000)

	12%	15%
1.0	7,240.6	6,794.7
(*)	(9,051.1)	(8,493.9)
1.5	10,860.9	10,192.1
(*)	(13,576.7)	(12,740.9)
2.0	14,481.2	13,589.4
(*)	(18,102.2)	(16,987.8)

*With a 25% annual cost overrun.

The question that this analysis must address is whether such losses would take place. With no real growth, the PDV of the income stream of the 28,000 families in the target group over the next five years (at a 12% discount rate) would be Q100.9 million (see Table 3). The highest value in Table 2, Q18.1 million, is 18% of this figure. In other words, to achieve a benefit-cost ratio of 2.0 with an annual cost overrun of 25% it must be assumed that in present value terms 18% of the income of the target group would be lost over the next five years in the absence of road maintenance. At a benefit-cost ratio of 1.5, with no cost overrun (with a discount rate of 12%), the loss would have to be 10.8%.

These numbers are not large and without road maintenance it is reasonable to expect losses of this magnitude. We know generally that much of the income of the target group is linked to distant markets. The evaluation of the Small

TABLE 3

USAID/GUATEMALA AAD: PDV OF THE FIVE YEAR INCOME STREAM OF THE TARGET GROUPS UNDER DIFFERENT RATES OF REAL GROWTH
(Q Millions)

	0%			5%			10%			15%		
		12% DR	15% DR		12% DR	15% DR		12% DR	15% DR		12% DR	15% DR
Road Maintenance												
Year 1	28.0[1/]	25.0	24.35	29.4	26.35	25.57	30.8	27.50	26.78	32.2	28.75	28.00
Year 2	28.0	22.32	21.17	30.9	24.63	23.36	33.9	27.02	25.63	37.0	29.50	28.00
Year 3	28.0	19.93	18.41	32.4	23.06	21.30	37.3	26.55	24.53	42.6	30.32	28.00
Year 4	28.0	17.79	16.01	34.0	21.61	19.44	41.0	26.06	23.44	49.0	31.14	28.00
Year 5	28.0	15.89	13.92	35.7	20.26	17.75	45.1	25.59	22.42	56.3	31.95	28.00
PDV at Year 0	-	100.93	93.86	-	115.81	107.42	-	132.72	122.80	-	151.66	140.00
Natural Resource Management												
Year 1	10.0[2/]	8.93	8.70	10.5	9.38	9.13	11.0	9.82	9.57	11.5	9.96	10.00
Year 2	10.0	7.97	7.56	11.0	8.79	8.32	12.1	9.65	9.15	13.2	10.55	10.00
Year 3	10.0	7.12	6.58	11.6	8.24	7.63	13.3	9.47	8.74	15.2	10.83	10.00
Year 4	10.0	6.36	5.72	12.2	7.73	6.98	14.6	9.30	8.35	17.5	11.12	10.00
Year 5	10.0	5.67	4.97	12.8	7.24	6.36	16.1	9.14	8.00	20.1	11.41	10.00
PDV at Year 0	-	36.05	33.53	-	41.38	38.42	-	47.38	43.84	-	53.87	50.00

1/28,000 families in the adjusted target group at Q1,000 annual income per family.
2/10,000 families in the adjusted target group at Q1,000 annual income per family.

Farmer Development Project pointed out that in those areas where soils were poor and agricultural technologies were primitive permitting little agricultural surplus for market, the roads accelerated commercial activities such as new trucking and busing firms, movement of local handicrafts and various roadside businesses. In other regions where conditions permitted a marketable surplus, the roads resulted in significant savings in transport. One community of 200 families saved 150 workdays of foot or horseback transport by a 3 kilometer stretch of road.

And it must be emphasized that this analysis has only addressed what would be lost of the present level of economic activity, not what future growth would be foregone. The values in Table 5 indicate that a 5% real annual increase in incomes among the 28 thousand families in the adjusted target group amounts to an additional Q15 million in present value terms for that group. If this or only a part were to be lost due to the absence of serviceable rural roads, it could be argued that the benefit stream from this project component is much larger than has been considered.

TERRACING AND IRRIGATION SYSTEMS

The objective of this project component is to raise the incomes of the 20,000 families in the target group by increasing the value of their farm production. Terracing combined with small scale irrigation systems will make possible multi-cropping and a production mix less weighted towards subsistance crops and more heavily weighted to cash crops such as vegetables.

Not all of the 20,000 farm families in the target group will adopt irrigation and terracing during the first year of the project. The absorption of new technologies is a gradual process and even if a 100% adoption rate is achieved, it would only come towards the end of the five year period. It is safe to assume that whereas most of the target group will have availed themselves of the new farm technology by the end of the project, only half, 10,000 families, will have made use of the new systems for most of the five years.[1/]

Tables 4 and 5 follow the format of the tables in the preceding section. The PDV of component costs and of project benefits under three benefit-cost

1/ This assumption is based on a linear rate of adoption, 5,000 families per year with 20,000 reached in the fourth year of the project. The weighted average of this progression, i.e., the number of families with the technology in place for all five years, is 11.33 thousand which we rounded off to 10 thousand. Some may argue that this is optimistic, but since little is known of the sociological and anthropological dynamics of technology absorption in the Highlands, this assumption is as defensible as any.

TABLE 4

USAID/GUATEMALA AAD: NATURAL RESOURCES MANAGEMENT
(TERRACING AND SMALL SCALE IRRIGATION SYSTEMS)
(Q(000)

	(1) Wages[1/]	(2) Goods	(3) Total Domestic Costs	(4) Goods Foreign Exchange	(5) Technical Assistance Foreign Exchange	(6) Total Foreign Exchange Costs	(7) Domestic Value of Foreign Exchange[2/]	(8) Total Economic Costs (5+7)	(9) PDV At Year 0 (12%)	(10) PDV At Year 0 (15%)
Year 1	545.0	148.0	693.0	398.0	100.0	498.0	647.0	1,340.0	1,196.4	1,165.2
Year 2	559.0	147.0	706.0	147.0	100.0	247.0	321.0	1,027.0	818.7	776.6
Year 3	570.0	147.0	717.0	147.0	100.0	247.0	321.0	1,038.0	738.8	682.5
Year 4	580.0	147.0	727.0	147.0	-	147.0	191.0	918.0	583.4	524.9
Year 5	592.0	147.0	739.0	147.0	-	147.0	191.0	930.0	527.7	462.4
TOTAL	2,846.0	736.0	3,582.0	986.0	300.0	1,286.0	1,671.0	5,253.0	3,865.0	3,611.6

1/Paid at the minimum wage which is assumed to reflect the opportunity cost for labor. Also includes administrative overhead.
2/A shadow price of 1.30 was used to convert foreign exchange to domestic costs.

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ratios have been calculated. The highest value in the matrix in Table 5 is Q9.7 million and represents the PDV of project benefits that is required in order to justify this component at a benefit-cost ratio of 2.0 and with an annual cost overrun of 25%. Again the question is asked: Which of these are reasonable estimates of project outputs?

A judgement can be made by comparing the values in the matrix to the income stream of the 10,000 families in the adjusted target group. If the adjusted target group were to collectively increase its real income from the base of Q1,000 by 10% annually, the PDV (at 12% discount rate) of that five-year income stream would be Q47.4 million or Q11.3 million more than under no real growth and greater than the highest value in Table 5 (see Table 3). The values in Table 5 imply that, under the most demanding conditions -- 2.0 B/C ratio with 25% annual cost overruns -- the adjusted target group would have to increase its annual income by 8-9% for five years in order to justify the project economically. Under less demanding conditions, for example, a 1.5 B/C with no cost overruns, each of the 10,000 farm families would have to realize about a 6% real annual increase in income to justify the project. Again it is asked: can it be expected that the target group, through the use of new technologies, would achieve such increases in annual incomes over what they would have achieved ir the absence of this project?

TABLE 5

NATURAL RESOURCE MANAGEMENT: MATRIX OF BENEFIT VALUES
Q(000)

	12%	15%
1.0	3865.0	3611.6
(*)	(4831.3)	(4514.4)
1.5	5797.5	5417.4
(*)	(7246.95)	(6771.6)
2.0	7730.0	7223.2
(*)	(9662.6)	(9028.8)

*With a 25% annual cost overrun.

Based on the fragmentary evidence that is available, these numbers seem to be reasonable. According to the economic evaluation of the Small Farmer Development Project in the Highlands, the use of terracing alone without irrigation permitted an increase in the yield of traditional crops of 75% and of vegetables of 35%. The use of irrigation in these cases permitted an increase in farm incomes net of cost by about 20%. The author emphasized that these estimates were on the low side.

If the two project components were to reinforce one another, the total stream of project benefits would be higher. Rural road maintenance will make possible low cost marketing of the output stemming from the new farm technologies. If terracing and small scale irrigation systems are adopted by farm families along the maintained roads, both project components will be able to claim higher levels of project benefits.

ANNEX F (4)

ADMINISTRATIVE ANALYSIS

The project proposed in Section 3 of the Project Paper includes activities to be implemented by four distinct Guatemalan governmental agencies. They include: the Direccion General de Servicios Agricolas (DIGESA), the Banco Nacional de Desarrollo Agricola (BANDESA), the Instituto Nacional Forestal (INAFOR), all under the auspices of the Ministry of Agriculture and the Rural Roads Division of the Direccion General de Caminos (DCR) of the Ministry of Communications and Public Works. An administrative analysis of DIGESA, BANDESA, and the DCR is given below. Since pilot activities will be undertaken with INAFOR, a brief description of this agency is given in the project paper.

A. DIGESA

1. Role and Organization

DIGESA, formally established in 1970, is a direct line agency of the Ministry of Agriculture charged with a wide range of activities from seed certification to aquaculture. These activities are conducted through three technical directorates: Agricultural Development (Extension), Renewable Natural Resources, and Agriculture Education and Training. The Ministry of Agriculture operates at the level of eight regions. The DIGESA extension directorate in the Ministry of Agriculture Regions I and V (see Map I) is principally responsible for improving the economic conditions of small and medium size farmers by upgrading their agricultural practices. In the project area, DIGESA operates two regional offices staffed with agricultural technicians who provide educational extension and support services to the various strata of the rural population. Their function includes programs of technical assistance related to small farm production, credit, marketing, and community organization and development.

As crop production research findings become available, DIGESA is responsible for technological transfer by training small and medium farmers in the appropriate technology as these are adapted to local conditions. Moreover, DIGESA encourages the conservation of agricultural resources, primarily by training farmers in soil and water management practices.

To accomplish this training and promotion of soil and water management, DIGESA has thirty extensionists and technical personnel

working in Regions I and V. To complement these individuals, 50 guias agricolas have been hired and trained. These guias are bilingual, area farmers who are selected and hired by DIGESA to promote and assist in the establishment and proper use of soil conservation works and small irrigation structures.

The bulk of the institution's technical staff is located in the regional offices (Quezaltenango for Region I, Guatemala City for Region V), while headquarters in Guatemala City provides administrative and support services to the regional offices.

2. Problems observed and addressed

a) Personnel

Four irrigation teams exist in Regions I and V which are each composed of a civil engineer, an agronomist, a topographer and a draftsman. These teams survey, design and assist in the construction of small scale irrigation projects. Fourteen extensionists are involved in the design and construction of soil conservation structures. Through trial and error under past projects, field technicians have become skillful at their respective tasks. Since the termination of related funds under project 520-0233 these teams have surveyed and designed over 54 small irrigation projects with an estimated value of $1,400,000. In addition, these teams have identified and designed soil conservation structures for over 500 hectares of land.

Because of funding limitations these sub-projects have not been initiated. As DIGESA has soil and water projects designed representing over 51% of project funds available for these components, the Mission believes additional DIGESA professional staff for soil conservation and small scale irrigation is not needed. However, for effective follow up work to insure proper water usage and to encourage crop diversification, sixty additional guias agricolas are required. Under project 520-0233, 50 guias promoted and assisted in the construction of soil and/or irrigation structures and provided follow up work on 940 hectares of land. The soil and irrigation components of project 520-0233 each had an effective life of three years. During the effective life of Project 520-0233 one guia was able to promote, assist in the construction of and provide follow up work for the improvement of 3 hectares of land. Promotional work was a major task in terms of time expended under this period. Since little time will be required for project initiation and minimal promotional work will be required, the Mission believes that sixty additional guias can provide the services required to each support 5 hectares of improved land and can be effectively supervised by existing DIGESA staff. The newly hired guias will, where appropriate, be provided with bicycles for more efficient transportation. These bicycles are of local manufacture and have an estimated life of five years.

a) Training

Literacy levels and lack of initial knowledge about irrigation methods are major constraints in the training of small and medium size farmers. 22% of the farmers are semi-literate while 78% are functionally illiterate. In addition, Region I has many different local indigenous idioms and cultural values which tend to make difficult the task of the extension service professionals who are unfamiliar with the local social environment.

Raising the level of literacy of the beneficiaries is a long-term educational objective. However, while the process takes place and its effects are perceived, some short term strategies have been devised and will be implemented to advance this project e.g., utilization of effective communication methods such as the audio-visual and "comic book" approaches tailored to the different cultural groups of the project region. These communication methods, including radio programs aimed at the small scale farmer, were developed under project 520-0233. Their impact was considered by DIGESA to be great and generally accepted by agriculturalists of all age groups. Project loan funds will be used to support and continue these communication methods. Training under the above approach will be implemented through the extensionists as well as the guias agricolas who possess local technical knowledge and can effectively communicate with the local target groups.

In addition, $300,000 in loan funds are provided in this project for 2 years of long term and twelve months of short-term technical assistance. This technical assistance will concentrate on improving extension methods, especially in the areas of crop diversification, and will enhance and increase the effectiveness of DIGESA extensionists and the guias agricolas in Regions I and IV. Officials from the education and training division of DIGESA (DECA) will be involved in this training and will benefit from the technical assistance.

c) Project Site Selection

Under project 520-0233, small irrigation projects were sometimes constructed too close together geographically and the problems of local market saturation and resulting low product prices have been identified.

To address these problems, future small irrigation projects will be approved for construction by DIGESA and AID based on the following criteria: location of other similar activities, proximity to access roads, the relative vecinity of BANDESA lending facilities, the marketability of proposed crops and possible problems of market saturation. Marketing assistance will be geared toward linking farmers with larger markets beyond their local ones.

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B. BANDESA

The National Agricultural Development Bank (BANDESA) will be responsible for the administration of the soil and water conservation fund, i.e., provision of credit and social cost payments to finance investments in soil conservation structures and small scale irrigation systems.

BANDESA is a semi-autonomous division of the Ministry of Agriculture which was established in 1971 as the principal credit agency for the agricultural public sector. According to its charter, BANDESA is the financial institution responsible for the promotion and administration of credit for the country's agricultural activities oriented fundamentally to small and medium sized farmers. The current organization has its central offices in Guatemala City and serves national needs through seven regional districts. Thirty-six sub-regional agencies (six in DIGESA Region I and seven in DIGESA Region V) have been established to serve agricultural credit needs. Each sub-regional office is able to develop and approve (up to established limits) loans made to farmers.

Thirteen rural offices exist in the project area which are each staffed by a credit agent and secretary. The duties of the credit agents include promoting new and monitoring current loans. Indicative of BANDESA's decentralized organization is that only ten percent of its roughly seven hundred staff reside in the capital city. There are 141 BANDESA positions (excluding those in the Central Offices) in Regions I and V. In addition, BANDESA operates seventeen warehouses (five in DIGESA Region I and four in DIGESA Region V) for storage and distribution of farm inputs (primarily fertilizer) which it purchases in large quantities for use by credit program clients.

In line with the basic objective of BANDESA to contribute to rural development by providing timely credit on favorable terms to the small and medium farmer, BANDESA's programs do provide incentives to investmesnt through favorable interest rates and repayment schedules which fit the production/marketing cycle. These interest rates are presently 8% (compared to regular commercial rates of 11% for agricultural lending) and the loan terms are for seven years with an initial grace period of two years.

1. Problems Observed and Addressed

a) Personnel

Under project 520-0233 problems were encountered in the administrative procedures required for loans for small irrigation systems and to make social cost payments. These problems were because all loans and social cost payments had to be approved in Guatemala City. Further

complicating the procedures was the relatively great distance between the borrower/social payment recipient and the BANDESA office. To address these problems BANDESA will open twenty additional rural offices in the project area by January 1984. Existing BANDESA employees will be transferred to operate these offices. In addition, the managers of these rural offices will be allowed to authorize fund disbursements up to $2,000. It is estimated that with this new authorization, the time required to process loan applications or social cost payments will be decreased to five days. BANDESA already has the capacity to channel about 8,000 small loans (under $2,000) each in Regions I and V per semester.[1/] The average loan for small irrigation systems per family is $540. In 1980 BANDESA processed 10,900 loans in Region I alone. Approximately 1800 loans or social payments would be processed per region per year under this project. The expansion of BANDESA's operations for the project would be small relative to its present and projected operational levels.

The DIGESA small irrigation and soil conservation program prepares farmers for supervised credit administered by BANDESA and provides follow-up DIGESA technical assistance. Once the credit plan has been written by the DIGESA promotor in collaboration with the BANDESA credit agent and has been aproved by BANDESA, the financial aspects are monitored and supervised by BANDESA.

The past BANDESA relationship with DIGESA gave the DIGESA extension agents the added responsibility of the development of credit plans. It was recognized by both institutions that this arrangement detracted from the DIGESA role of providing technical assistance particularly in regard to farm activities not related to credit. To free the DIGESA extension agents of this responsibility, BANDESA has more clearly defined the roles of their own extension personnel to include the development of credit plans. The 40 BANDESA extension agents who will staff the additional 20 rural offices will reduce the work load of existing personnel and provide for more comprehensive work completion.

C) DCR

In 1978 the Departamento de Caminos Rurales (DCR) was established within the Direccion General de Caminos (see Organizational Chart attached) to construct and maintain AID-financed labor intensive access roads. The volume of activities undertaken by the DCR has steadily increased during its five years of existence and its staff has increased from seven in

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1/ Small Farmer Diversification Project for the Highlands of Guatemala, Gustavo Gomez, May 1981.

1978 to 512 in 1983. In 1983 alone 200 new employees were added to the DCR staff.

The AID Mission to Guatemala, convinced of the DCR's ability and capacity to utilize funds, has secured an additional $3.0 million in AID funds during 1983 through an amendment to the Small Farmer Development Project to complement the 1983 GOG financing of $7.2 million. This brings the total to more than $10.0 million in labor intensive road construction and upgrading in 1983 alone.

The current project under consideration would provide an additional $3.655 million over a five year time frame to round out the DCR's active program. The majority of this funding would be used to assist the DCR improve its road maintenance and equipment maintenance capabilities. To complement the new AID funds, the DCR will need to increase its staff. The proposed program calls for an addition of 69 DCR positions most of which are similar to positions currently being filled. New positions would include:

YEAR 1

1.	Assistant to Maintenance Coordinator/Central Office x 1	1
2.	Resident Maintenance Engineer x 2	2
3.	Assistant to Resident Engineer x 4	4
4.	Assistant warehouseman x 2	2
5.	Drivers x 25	25
6.	Heavy Equipment Maintenance Coordinator x 1	1
7.	Heavy Equipment Specialist x 1	1
8.	Welders x 3	3
9.	Assistant mechanics x 8	8
10.	Purchasing expeditor x 1	1
11.	Heavy equipment operators x 4	4
12.	Key punch machine operator x 1	1

YEAR 4

1.	Resident Maintenance Engineer x 1	1
2.	Assistant to Resident Engineer x 2	2
3.	Payroll clerks x 2	2
4.	Drivers x 9	9
5.	Heavy equipment operators x 2	2
		53
	TOTAL	69

SYSTEM OF WORK EXECUTION

A. Access Roads Maintenance Program

In order to implement the proposed program five levels of work execution are required (see attached organizational chart).

At the highest level the DCR central office will coordinate and administer the program. The DCR central office will establish identical work standards for the two Maintenance Regional Centers and will supervise the Resident Engineers in the performance of those standards. The coordinator of the program will elaborate the manuals and will use them to train the engineers, assistants and foremen.

The manuals will identify:

a) The job of the most effective crew for each activity
b) The equipment and tools to be provided for each activity
c) The necessary materials for each activity
d) The procedures and methods of work.
e) Estimation of the efficiency grade required to meet standards.

At the regional level the Resident Engineer will perform the following activities:

a) Evaluation of Requirements: The Engineer will establish the necessary work in fiscal terms. This will require an inventory summary of the roads' system in his area, effectuate regular inspections of each road, knowledge of the nature and the quantity of vehicles that use the road and knowledge of the land, soil and climate of the region.

b) Assignment of resources: Calculate the personnel, materials and equipment required for the different jobs determining priorities and assigning resources to assure the effective cost results.

c) Supervision: Verify that the work performed produces the desired results and that the tools and equipment are being used in adequate form in accordance with the DCR established standards.

The Resident Engineer will be assisted by two assistants. Each assistant will:

a) Assist the Resident Engineer in the constant supervision of the work and provide technical assistance to the foremen during his visits and maintenance.

b) Collaborate with the Resident Engineer in the evaluation of requirements and assignation of resources.

In addition the administrative staff at the regional office will provide program support with the financial arrangements. The payrolls and payment cards for the workers will be done in each DCR regional construction office localized in the departments. The payment cards will be given personally to each worker.

In the field, community supplied DCR trained foremen will supervise community labor crews. These foremen will report directly to the assistants of resident engineers.

B. Heavy Equipment Maintenance Program

Within this program the majority of the employees are currently on board and working at regional offices maintaining heavy equipment. Three new positions at the central office will strengthen this system:

1. Heavy Equipment Maintenance Coordinator

The DCR heavy equipment maintenance coordinator will be responsible for developing standards and procedures for controlling the preventive and corrective heavy equipment maintenance. The heavy equipment coordinator will also establish the spare parts control procedures, in the regional and central warehouse shops.

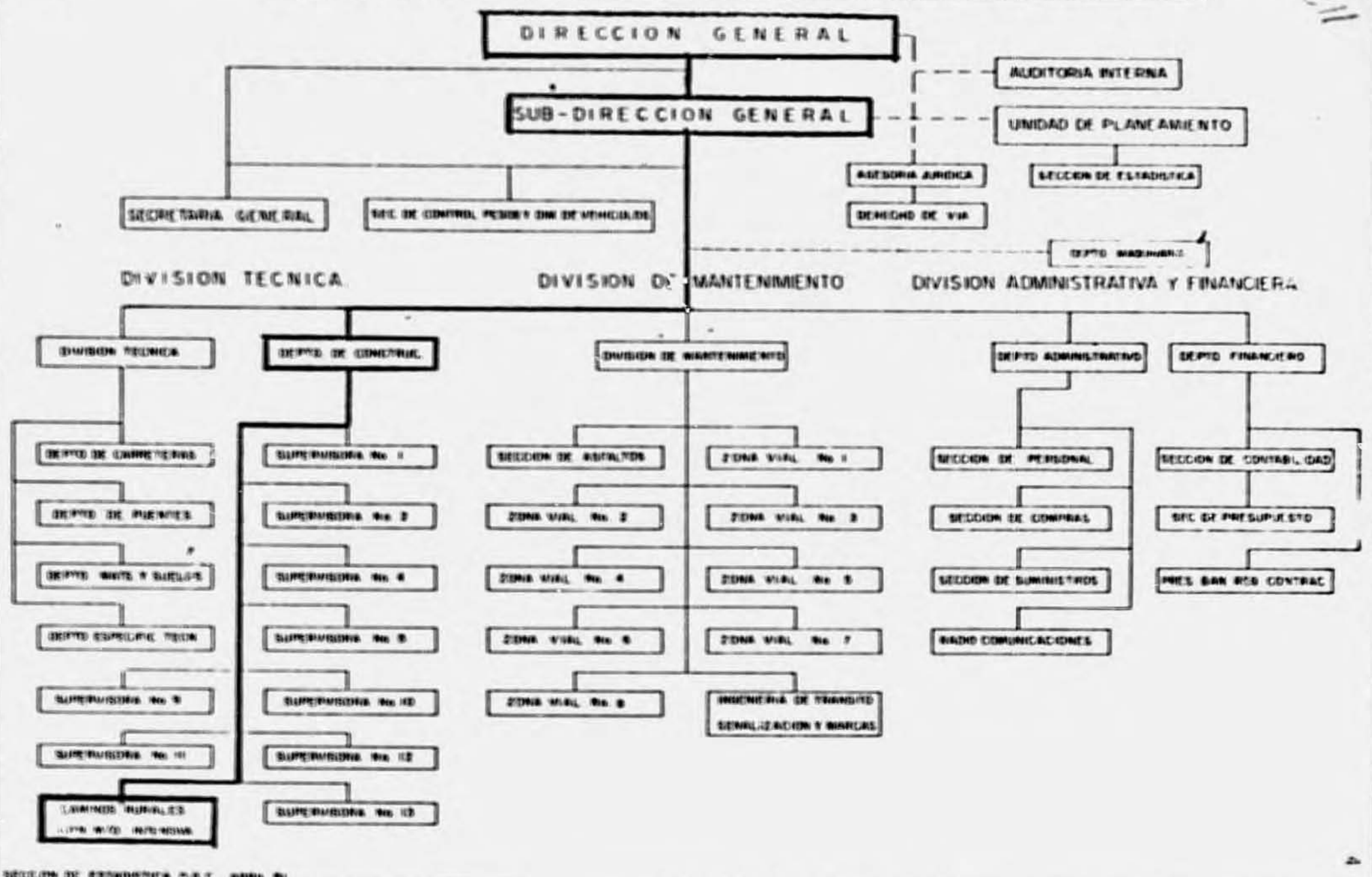
2. Heavy Equipment Specialist

The heavy equipment coordinator will be assisted by a mechanical specialist responsible for: (a) inspection of all the heavy equipment in the field, (b) assisting in the training of on-board mechanics, (c) advising the heavy equipment coordinator of any situation of excessive down-time or the need for major corrective maintenance.

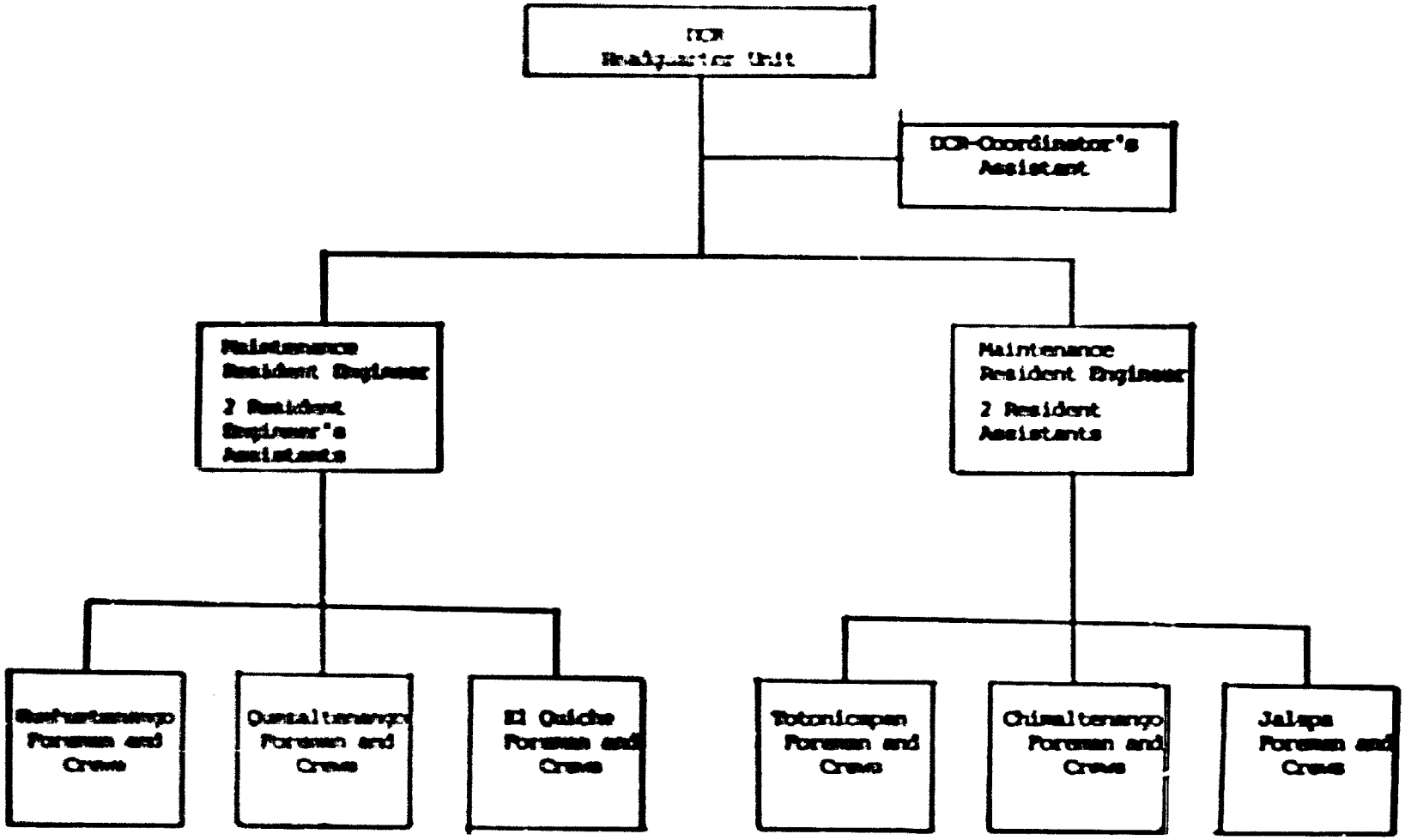
3. Procurement Expeditor

This individual will process all field requests for the purchase of heavy equipment spare parts and insuring that purchased items are sent to the regional offices on a timely basis.

ORGANIGRAMA DE LA DIRECCION GENERAL DE CAMINOS



ACCESS ROADS MAINTENANCE PROJECT ORGANIZATIONAL STRUCTURE



ANNEX F (5)

LAC/DR-IEE-83-19

ENVIRONMENTAL THRESHOLD DECISION

Project Location	:	Guatemala
Project Title and Number	:	Altiplano Regional Development 520-0274
Funding	:	$2.1 million - Grant $5.0 million - Loan
Life of Project	:	Five years
IEE Prepared by	:	Lawrence Odle Mission Environmental Officer
Recommended Threshold Decision	:	Negative Determination
Bureau Threshold Decision	:	Concurrence with recommendation
Action	:	Copy to Charles Costello Director, USAID/Guatemala City
	:	Copy to Lawrence Odle
	:	Copy to Susan Schaeffer
	:	Copy to IEE file

James G. Hester Date 13 January 1983

James G. Hester
Environmental Officer
Bureau for Latin America
and the Caribbean

ANNEX F. 6.
ENERGY ANALYSIS

A. Background:

Given the mountainous geography and rainy climate Guatemala is rich in hydroelectric generation potential. Although at the present time much of Guatemala's electricity is diesel generated, when power generated from Guatemala's new Chixoy Hydroelectric facility comes on stream during the summer of 1983 diesel generated electricity will no longer be required except in unusual circumstances to satisfy the internal needs of Guatemala. Guatemala anticipates that when a second large hydroelectric power plant is completed in few years, it will be able to provide both for a growing internal demand for electrical consumption as well as provide electrical power to other countries connected to the Central American energy grid.

In addition to its large hydroelectric potential, Guatemala is the only Central American country with significant petroleum resources. At the present time Guatemalan wells pump about 8,000 barrels of crude oil per day, most of which is exported for refining. A small portion of Guatemala's crude is sent directly to the larger diesel powered electrical generating power plant where it is mixed or burned as is, perhaps unefficiently, to generate Guatemala's electricity. In spite of the existence of petroleum resources Guatemala imports all its petroleum needs with the exception of that mentioned above. At the present time Guatemala uses about 25,000 barrels of imported gasoline and diesel per day, the largest uses being the industrial and transportation sectors. Unless Guatemala discovers and develops additional petroleum resources, an initiates its own petroleum refining infrastructure, it is anticipated that Guatemala will continue to be dependent on externally supplied petroleum derivatives.

Presently, the greatest demand for energy is internally grown firewood. It is estimated that more than 70% of all the energy consumed in Guatemala is through the burning of Guatemala's large yet finite forestry resources. With a rapidly growing rural population, Guatemalan energy planners anticipate an increasing demand for fuelwood in the foreseeable future.

B. Proposed Project's Energy Demands:

The project as described in Section 3 of the Project Paper is designed to use labor intensive methods to complete project activities wherever feasible. The road maintenance program will use almost exclusively manual labor with only minor support from 18 small dump trucks, 3 road graders and 3 backhoes. The complementary heavy equipment maintenance program will insure that existing heavy equipment remains finely tuned to guarantee the use of limited fuels as efficiently as possible. The soil conservation and mini irrigation element will be implemented by the rural farmers themselves, supplying all the required manual labor, with only minimal support of bicycle driven or motorized Guatemalan governmental extension agents. In the forestry element,

manual labor will be exclusively used to implement reforestation activities. In short, the proposed Highlands Agricultural Development Project is designed to rely heavily on manual labor to achieve project objectives.

In order to further reduce the demands on Guatemala's scarce refined petroleum resources, all vehicles purchased with project funds will be required to be the most energy efficient vehicles currently available in the U. S. In addition to the few cases where (due to physical constraints) gravity fed mini irrigation systems are not feasible and pump systems are required, the most appropriate energy efficient system will be recommended. In situations where large volumes of water exist, hydraulic ram pumps will be installed. Where electricity is available electric pumps would be recommended. Only in very rare situations would diesel water pumps be installed to pump irrigation water to the fields.

C. The Proposed Project's Long Term Impacts on Energy Use

The labor intensive access roads maintenance program will guarantee the continual access of Guatemala's rural farmlands to the larger internal Guatemalan and external market. This in turn will encourage increased transportation of farm related inputs and outputs which will put more demands on Guatemala's limited petroleum resources. It is anticipated that the increased farming activities and diversification of crops due to innovations will encourage increased exportation of Guatemalan farm produce to Central American markets and the U.S. as well as provide for import substitution. The increased cost of petroleum imports can be partially offset by the increased revenues generated by exports as well as the savings in food imports.

In the future as communal wood lots mature, the forestry element of the proposed project will help reduce the need to destroy natural forest areas by providing a more efficient, controlled form of obtaining wood for rural household consumption. Also the generation of additional fuelwood will offset the need for the rural farmer to turn to other forms of energy such as a bottled gas, kerosene, diesel or gasoline for his household consumption needs .

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ANNEX F (7)

Technical Analysis - Natural Resource

The following analysis is taken in part from a larger document "Abbreviated Economic Analysis of the Rural Roads, Soil Conservation and Small Irrigation Components of the Small Farmer Development Project (520-0233)" by Dr. Gary Smith. This report may be found in its entirety in the Office of Rural Development, USAID/Guatemala.

Soil Conservation

The term "soil conservation" broadly refers to activities designed to protect the qualities (mechanical, nutritive) of a given area of land from degradation due to environmental conditions and cultivation practices. Under the A.I.D. Project 520-T-0233, the focus was upon reducing water erosion and increasing agricultural yields through promotion of contour cropping on gentle slopes and bench terracing on steep slopes (more than 10%). Since most slopes in the central and western Highlands of Guatemala are more than 10%, and since most project sites contain cultivated areas with slopes much steeper (up to 80%), bench terracing has been and continues to be the primary focus of soil conservation practices in DIGESA Region I and Region V.

A bench terrace, constructed along level contours of a hillside and characterized by a small "backslope" which encourages water to run away from the edge of the terrace back towards the hill, accomplishes the following:

-- Prevention of hillside erosion, thus "conserving" the soil.
-- Prevention of fertilizer and pesticide runoff caused by rain, thus contributing to higher yields with the same levels of inputs.

-- Increase in the effective cropping area of the original hillside plot due to double cropping, thus increasing the farm s land resources.

-- Increase in the planting density and in the variety of crops which can be planted on a given plot, thereby increasing production and marketable surplus.

-- In conjunction with an assured water supply, an increase in flexibility of sowing and harvest dates, thus enhancing the farmers' ability to take advantage of shifts in prices and other market conditions.

Where soil is easily worked--as was the case in many conservation sites under Project 520-T-0233--terraces can be constructed using the farmers' "digging hoe" and a simple "A" frame levelling device. To anchor the terraces, rye grass, elephant grass, and other hardy varieties of grasses can be planted on the facing edges. In addition to protecting the terraces, this grass can be used as forage for cattle which, in turn, can provide fertilizer for growing crops.

Besides providing direct technical assistance to farmers in constructing terraces, DIGESA soil conservation extension workers trained more than 50 local farmers ("guias agricolas") to promote terracing among their neighbors in communities participating in the project.

To compensate farmers for the time needed to terrace their hillside fields, the project included "social payments" for those willing to act as "pioneers" in their communities. The payments served to reduce the perceived risks of undertaking a significant investment in time and labor, as well as compensate the farmer for lost employment opportunities. In the longer run, it is expected that such payments would diminish as farmers' incomes improve and as they see advantages in further terracing on their own.

Short-Term Costs and Benefits

According to Smith, the only completed and available set of data from DIGESA concerning soil conservation was a report titled Breve Informe Proyecto Conservacion de Suelos de 1978 a Marzo de 1983 which covered all actions completed or pending in DIGESA Region I as of his evaluation. Assuming the data aggregated by department are reasonably correct, this summary report permits a rough estimate of the results of social payments in terms of areas terraced and farm families benefitted.

Table 1 indicates by department the number of projects, total social payments, hectarage and number of families benefitted with and without social payments. Table 2 converts the data from Table 1 into percentages and average values per project and per family.

It should be noted that Project 520-T-0233 was intended to consist of a number of pilot projects of which soil conservation was one. It was not expected that all farms in a given area would necessarily be terraced by the end of the project. Thus, the global average of 9 families per site (Table 2, column 5) is not as trivial as it might seem to someone unacquainted with the levels of poverty found among these farmers. DIGESA extension workers told Smith that approximately 10% to 15% of all farmers in any one project area have terraced to some extent, and new terraces are being constructed with the aid of guias independently of the project. It should be noted, too, that approximately 22% of all farmers terracing have done so without any social payment at all (Table 2, column 10).

TABLE I/Cuadro I

AMOUNT OF SOCIAL PAYMENT, AREA AND FAMILIES BENEFITED BY DEPARTMENT APRIL 1978 TO 1982
MONTO DEL PAGO SOCIAL, SUPERFICIE CONSERVADA Y FAMILIAS BENEFICIADAS POR DEPARTAMENTO. DE 1978 A ABRIL DE 1982

DEPARTAMENT/ DEPARTAMENTO	NO. OF PROJECTS No. DE PROYECTOS	SOCIAL PAYMENT (SP) PAGO SOCIAL (PS) EN QUETZALES	HAS. CONSERVED/ HAS. CONSERVADAS WITH SP CON PS	WITHOUT SP SIN PS	TOTAL	FAMILIES BENEFITED FAMILIAS ATENDIDAS WITH SP CON PS	WITHOUT SP SIN PS	TOTAL
Huehuetenango	28	34,906.82	86.23	51.52	137.75	440	97	537
Quetzaltenango	72	43,371.43	154.48	28.50	183.34	310	104	414
Quiche	13	7,744.00	23.51	12.97	36.48	185	49	234
Solola	34	14,486.47	60.52	26.16	86.72	219	102	321
Totonicapan	65	12,362.69	39.46	14.17	56.62	313	81	394
San Marcos	29	31,306.33	59.57	17.01	76.58	280	67	347
TOTAL	241	144,177.74	424.07	152.39	577.49	1,747	500	2,247

SOURCE/FUENTE: Evaluation and Statistics, DIGESA./Evaluacion y Estadistica.

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TABLE 11/Cuadro 11
Soil conservation, Region I - Additional Data/
Conservacion de Suelos, Region I - Datos Adicionales

(1) DEPARTMENT / DEPARTAMENTOS	(2) NO. OF PROJECTS / NO. DE PROYECTOS	(3) HECTARES/ PROJECT / HECTAREAS POR PROYECTO	(4) CUERDAS/ PROJECT / CUERDAS PROYECTO (25 V2)*	(5) FAMILIES/ PROJECT / FAMILIAS PROYECTO	(6) CUERDAS/ FAMILY / CUERDAS POR FAMILIA	(7) SOCIAL COST/FAM. / COSTO SOCIAL FAMILIA**	(8) SOCIAL COST PROJECT / COSTO S. PROYECTO	(9) SOCIAL COST CUERDA / COSTO S. CUERDA	(10) % FAMILIES PAID/ % FAMILIAS PAGADAS
Huehuetenango	28	4.9	112.7	19	5.9	Q 79	Q1,247	Q11.00	82
Quetzaltenango	72	2.5	57.5	6	10.0	140	602	10.30	75
El Quiche	13	2.8	64.4	18	3.6	42	596	9.30	79
Solola	34	2.6	59.8	9	6.2	66	426	7.30	68
Totonicapan	65	2.6	20.7	6	3.3	39	190	9.50	79
San Marcos	29	2.4	59.8	12	5.0	112	1,080	17.70	81
ALL REGION I	241	2.4	55.2	9	5.6	83	598	10.90	78

SOURCE/FUENTE: Derived from Breve Informe: Proyecto Conservacion de Suelos de 1978 a Marzo de 1983. Ministerio de Agricultura, Ganaderia y Alimentacion, DIGESA, Region I, Quetzaltenango (n.d.)

* One hectare = 23 cuerdas of 25 x 25 varas./Una hectarea = 23 cuerdas de 25 x 25 varas.

** These data include only those families actually having received social payments, some families did not (see column 10)./Estos datos unicamente incluyen aquellas familias que realmente recibieron los pagos sociales; algunas familias no recibieron (ver la Columna 10).

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A total social payment cost of Q144,000 for DIGESA Region I over a span of 5 years (1977-1983) does not seem excessive, especially when that figure is expressed in terms of payments per cuerda (Q10.84) or per family (Q82.53). If a low figure of three members per family is assumed, the payments per capita come to Q27.51. This payment is made on a one-time basis. Once constructed, the terraces are to be maintained by the farmers without further input from the government. Presumably, the terracing will improve output enough to more than offset such maintenance costs as purchasing seed for the grass to be planted on the facing of the terraces and repair of occasional cave-ins and erosion channels.

Social payments represent roughly the opportunity cost, as perceived by the farmers, of working on the terraces rather than on more traditional tasks. This could include an allowance for risk, at least at the beginning of the project. Once farmers see how terracing improves their yields, the risk element should diminish and the necessary social payments with it. This has, in fact, happened. Smith observed farmers in the Patzun-Lake Atitlan area voluntarily extending terracing for areas initially terraced under Project 520-0253.

Thus, social payments in the short run are offsets to alternative sources of income as the farmers see them. At the margin there would be no net benefit. In the longer term, of course, there is a net benefit, if the terraced land proves to be more profitable than before it was terraced From the government's standpoint, social payments (and salaries of extensionists payments for vehicles and gas, etc.) are short-run costs which represent an investment which should yield a longer term social benefit to the country. As in the case of rural roads, any innovation which raises rural incomes will contribute to the rural sector's ability to accumulate capital and to the overall decline in the costs of feeding the population, including the urban/industrial sector. Viewed in this perspective, the government's expenditure to date in DIGESA Region I does seem reasonable.

Unfortunately, Smith was unable to obtain detailed information on soil conservation activities in DIGESA Region V. However, the terracing activities observed in DIGESA Region V (near Patzun, San Juan Ostuncalco, and El Progreso) were similar to those in DIGESA Region I. If anything, the social costs in DIGESA Region V should be even smaller since the land in the Western Highlands, especially in San Marcos, Huehuetenango, and Quezaltenango (DIGESA Region I) can be difficult to manage, due to its steeper slopes and greater erosion.

Longer Term Costs and Benefits

Unfortunately, no base-line studies of pre-project farming, marketing, and household consumption activities were made. To assess changes brought about by soil conservation in a short time requires faith in the memories and veracity of both farmers and DIGESA extensionists.1/ Table 3 summarizes information given Smith by farmers in both DIGESA Region I and DIGESA Region V concerning pre- and post terracing yields.

These data, sparse as they are, seem roughly of the same magnitude. Many of the farmers interviewed by Smith have continued to raise the traditional corn, beans, and wheat on their terraces, and there seems to be an overall consensus that yields of these crops have about doubled . Other farmers, especially in DIGESA Region V who already were growing non-traditional vegetable and root crops for cash prior to terracing, reported increases in yields varying from about 30% to nearly 100%. Additional non-traditional crops for which a scattering of farmers encountered "on the road" estimated increases from 45% to 100% were radishes, strawberries, chinese pea pods, lettuce, beets and squash

For the most part, farmers continuing to raise traditional crops on their terraces reported that, prior to terracing, their families had consumed most of their own output and often had to purchase additional corn and beans prior to the next harvest. Some of those living in the Patzun area (DIGESA Region V) earned the necessary cash by seasonal migration to the coastal sugar and cotton plantations. With the increased output on their terraces, these farmers still seem to be consuming rather than selling corn and beans, but they are purchasing considerably less. A few indicated that they no longer migrate seasonally.2/

Most of the conservation sites visited by Smith during the evaluation had no supplementary irrigation.Since the greatest increases in yields, incomes, and crop varieties appear in the irrigation sites, there is a strong likelihood that a combination of irrigation projects and terracing projects would make the farmers observed even better off than they were before.

1/ One hypothesis that appears frequently is that innovation in the Highlands will raise the cost of labor in the lowlands because of the disapperance of seasonal migrants. If profitable, labor-intensive crops continue to proliferate in the Highlands, this would seem to be a persuasive argument. It's certainly one meriting empirical investigation.

2/ If time and resources permit, Smith recommends a more detailed survey of (1) farmers having participated in the project and (2) a set of closely-matched farmers who have not.

TABLE III

Reported Increases in Yields of Certain Crops
Following Terracing under Project 520-T-016
DIGESA Region I and DIGESA Region V, Guatemala, 1983.
(Data in quintales or bunches per cuerda*)

CROP	DATA REPORTED BY FARMERS PRE-PROJECT	DATA REPORTED BY FARMERS POST-PROJECT	PERCENTAGE CHANGE SMITH DATA	PERCENTAGE CHANGE DIGESA DATA	PERCENTAGE CHANGE ARLEDGEE REPORT
CORN	2-3 qq	5-6 qq	100-133	50	141
BEANS	1.3 qq	3qq	131	-	95
WHEAT	2.0 qq	3-1/2-5 qq	75-250	70	81
POTATOES	5-6 qq	9-11 qq	80-120	110	98
BROAD BEANS	1-1/2 qq	2 qq	33	-	-
ONIONS	5 qq	7 qq	40	-	-
GARLIC	4-1/2 qq	6 qq	38	-	-
CABBAGE	35 bunches	47 bunches	34	-	-
CARROTS	38 bunches	55 bunches	45	-	-

* 1 cuerda = 25 x 25 varas = 0.04 hectare

SOURCE: Smith interviews, Breve Informe: Proyecto Conservacion de Suelos, de 1978 a marzo de 1983, and Jerry Arledge's Informe Final

In summary, using the lowest reported figures, terracing alone--without irrigation, additional access roads or crop diversification--permits a sustained increase in yields of traditional crops (corn, beans, wheat, potatoes) of about 75% and of vegetables of about 35%. In the case of traditional crops, this additional output seems mainly to be consumed by the family, thereby releasing resources which otherwise would have been used to obtain additional food, including, perhaps, seasonal migration. Since most vegetable crops seem to be raised mainly for cash, the addition represents an increase in gross cash income, assuming no significant change in prices.

Most farmers were not queried concerning the instances where their cash incomes rose as a result of both soil conservation and irrigation projects. The main interest was in identifying changes in food consumption habits. Surprisingly, very few farmers reported any changes in the pattern of their diets. Where the production of traditional corn and beans rose as a result of terracing, families ate about the same daily diet as before but did not have to purchase as much. Farmers with cash crops tended to use the cash for specific purposes such as further improvements to their land and/or their houses (i.e., investment) or hiring an extra hand thereby permitting their older children go to school. Virtually no one said they bought more food, although a more detailed survey might determine that some of them did (e.g., snacks at the local tienda, extra liquor). This suggests a version of the "permanent-income" hypothesis: farmers are not sure that their recent gains in earnings are sufficiently permanent to justify significant intrafamily changes in habits, including diets. Instead, the money is used to finance deferred "one-shot" expenditures such as home repair, another year of school for the children, additional seed and fertilizer. This kind of information is very important from a development perspective, and the "tracking" of changes in household behavior with technological change is a major justification for baseline and followup studies.

With respect to changes in cost, the most important of these in conservation sites seems to be increased labor. Aside from the labor needed to construct the terraces originally, the increased density of planting permitted by terracing requires more work at planting and harvest time and more attention to interim weeding. When Smith questioned farmers about additional labor requirements, responses ranged from 15% to 25% more than pre-project levels where traditional crops were involved, and 50% or more where vegetable and root crops (intrinsically more labor intensive) were grown. In a few instances, farmers growing the latter crops reported increases in expenditure for fertilizer and pesticides, although still others reported reduction in these costs due to the reduced levels of water runoff from the new terraces.

Small-Scale Irrigation

The purpose of the irrigation component of 520-T-0233 was to increase small farm incomes by insuring a reliable supply of water throughout the calendar year via relatively inexpensive, simple technologies which exploit existing supplies of ground water and/or nearby river water.

In DIGESA Region I, virtually all irrigation activities funded under this project used a gravity/sprinkler system whereby water from nearby springs was concentrated in a catchment basin and led to simple sprinkler systems via low-cost plastic piping. Aside from simplicity, this system has the virtue of very low maintenance costs, involving mainly the care of valves and the sprinkler mechanisms. The mountainous terrain in DIGESA Region I contains many springs with adequate water flow throughout the year.

In DIGESA Region V, however, 10 of the original 20 projects involved pumping water from nearby rivers, often requiring electric pumps from 25 to 50 HP, in some cases two connected in series, to lift water as much as 200 meters to the level of the fields. Three DIGESA Region V projects (El Tempisque, San Jose Pacul, and La Vega I) did not use sprinklers, the water being turned directly into furrows from small canals. Projects involving pumping also involved significant maintenance and electricity costs.

Short Term Benefits and Costs

Table 4 summarizes salient features of irrigation projects in DIGESA Region I and DIGESA Region V. Region I data at Smith's disposal was broken down by departments, the scale of operation there was larger than in Region V. Hence Smith lumped the 20 Region V projects together. Since this lumping tends to mask some of the higher costs of pumped-irrigation projects in this Region, he broke out the latter and listed them in Table 5.

A comparison of the average materials cost per irrigated cuerda in DIGESA Region I Q26.30 (Table 4, column 6) with that of electric pump projects in Region V of Q61.39 (Table 5, column 5) gives some idea of the differences between pump and gravity irrigation. The figures for average cost per family are even more striking (Q259 for gravity vs. Q1,164 for pump). Comparable figures for soil conservation social payments from Table 3 are Q11 per terraced cuerda and Q83 per participating family.

Costs of installation of pipes, catchments, pumps, sprinklers and other materials are financed by the individual families participating in the projects, either individually or collectively with loans from BANDESA. In all projects participating families contribute labor to the construction of the system, e.g., laying pipe, aiding in the installation of pumps, etc. Participants also contribute to maintenance of the systems, with the assistance of DIGESA extensionists and guias agricolas.

TABLE V

Electric Pump Irrigation Projects in DIGESA Region V

Financed under 520-T-026

(1) PROJECT	(2) COST OF MATERIALS (Q)	(3) AREA IRRIGATED (CUERDAS)*	(4) NO. OF FAMILIES FAMILIES	(5) COST PER CUERDA (Q)	(6) COST PER FAMILY (Q)
El Tempisque I	2,383	92	4	25.90	595.75
El Tempisque II	3,750	35	1	107.14	3,750.00
San Jose Pacul	3,876	58	7	66.83	553.71
Rincon Grande	30,500	460	46	66.30	663.04
Santa Maria Cauque	25,000	472	50	52.97	500.00
San Francisco	2,900	28	2	103.57	1,450.00
San Jose	4,100	58	2	70.69	2,050.00
Paso Ancho	2,400	46	2	52.17	1,200.00
Tempisque III	2,400	46	2	52.17	1,200.00
Santiago Sacatepequez	30,000	460	40	65.22	750.00
Tulio Garcia	1,000	81	11	12.35	90.91
AVERAGES	9,846	167	15	61.39	1,163.95

* 1 cuerda = 25 x 25 varas = 0.04 hectare

SOURCE: DIGESA Report to USAID/Guatemala, October 1982, Tables on pages 3 and 4, Smith's calculations.

Unlike the soil conservation projects, there are no "social payments" for irrigation projects. BANDESA loans carry the immediate burden of the farmers' expenses, and most of the farmers interviewed by Smith did not seem to regard the work they did installing the systems as excessive. In the longer term, the loans are repaid out of the realized increases in earnings.

Longer-Term Costs and Benefits

Of the many impacts identified for miniriego projects, three are especially important:

1. A reliable, year-round water supply permits significant diversification into a variety of crops, including fruits, vegetables, and tubers.

2. For any given crop, two or more harvests per calendar year are possible; some vegetables can be harvested four times per year.

3. The farmer can, through diversification of his "expanded portfolio of crops" vary sowing and harvesting of certain crops to take advantage of price fluctuations; in the longer term, all farmers acting in this way should contribute to damping of traditional wide swings in commodity prices over any given calendar year.

In short, farm incomes are expected to rise and become more secure. Prices for agricultural produce seem to be stabilizing for the time being and farmers experimenting with new crops and different sowing/harvesting times. In addition, Smith noted that some farmers are using their new earning to purchase additional cattle, both for milk and for reproduction purposes, which would provide an additional source of income. Finally, most of the farmers involved in irrigation projects are receiving extension assistance in constructing compost pits to augment the quality and quantity of fertilizer.

In Santiago Sacatepequez and Santa Maria Cauque, both regions of relatively flat land not far from Guatemala City, several of the crops presently irrigated were being sown prior to project 520-0233. Here the main impact has been the ability to plant an extra crop during the dry season: snow peas, radishes, lettuce, beets, carrots, guicoy, and acelga. The main cash crop, --snow peas-- now brings about Q150 per cuerda per year, an increase of about 50% since installation of irrigation. In general, about 50% earnings increase is realized in most crops, since the second harvest does not bring as high prices as the primary harvest. Farmers in both of the above areas are aware of the decline in prices due to increased supplies, but they are also aware that the decline has not been in proportion to the increase in marketed volume, i.e., total earnings are still significantly above pre-project levels.

Both areas, however, are irrigated with electric pumps, and this has resulted in additional monthly costs of production as follows:

Insecticides and fertilizers	Q56 per cuerda per crop
Soil Preparation	Q9 per cuerda per crop
Electricity	Q19 per cuerda per month

Labor requirements have increased by about 100%, due to additional time needed for second and third cropping, more attention given to field preparation and weeding, and occasional work on the irrigation system itself.

Smith was able to visit the following six irrigation sites where systems had been in operation for one year or more: Santa Rita, San Juan Ostuncalco, Santiago Sacatepequez, Santa Maria Cauque, Lo de Silva and Rincon Grande.

Each of these projects was different from the others, but collectively they gave a feeling for how irrigation affected yields, incomes, and participating farmers' outlooks.

Santa Rita according to Smith, is doubtless one of the more impressive projects. He explained this as partly due to the fact that this community of some 17 families lies along the main highway connecting the cities of Quezaltenango and San Marcos. Both cities are large vegetable and fruit market centers. Thus, this site is a good example of how a mix of more than one kind of project (e.g., marketing, diversification, and irrigation) can interact synergetically. The farmers in Santa Rita reported that, prior to project 520-0233, they were earning on the average about Q10 to Q15 per cuerda (.043 hectare) from sales of surplus corn and beans. Since the average holding is 5 to 6 cuerdas, this amounted to a yearly cash income of Q50 to Q90. Additional cash income had to be earned from off-farm sources (including seasonal migration) and sale of handicrafts. Following installation of gravity/sprinkler irrigation, most Santa Rita farmers began diversifying into such crops as cabbage, lettuce, carrots, onions, radishes, and garlic. The water permitted 2 to 3 crops per year and sales to Quezaltenango and San Marcos were uninterrupted during the first year. Average earnings on land under the new crops rose to Q80 to Q100 per cuerda (counting sales from multiple crops during the calendar year), and several farmers gave up planting corn and beans entirely, preferring to purchase these in the market rather than "waste" irrigated land on them. In the second year, prices declined and total earnings fell to an average of Q60 to Q80 per cuerda.

To illustrate the "worst-case" situation, a farmer with 10 cuerdas of snow peas had been earning the following before irrigation"

Gross income (10 cuerdas at Q100)		Q1,000
Less costs:		
Fertilizers and Insecticides (10 cuerdas x Q37)	370	
Soil preparation (10 cuerdas x Q7)	70	-440
		Q 560

With irrigation and an extra crop:

Gross income (10 cuerdas at Q150)		Q1,500
Less costs:		
Fertilizers and Insecticides (10 cuerdas x Q56)	Q560	
Soil Preparation (10 cuerdas x Q9)	90	
Electricity (10 cuerdas x Q19) (one month)	190	-840
		Q 660

In this scenario, net income has gone up by Q100 per year or by about 20%.

It should be emphasized that these figures do not take into account the opportunity cost of the farmers' extra labor time, nor extra earnings/costs associated with other crops.

Assuming the 20% figure to apply to all farmers in the Santiago Sacatepequez/Santa Maria Cauque areas, irrigation has not had as strong an impact on net earnings as in Santa Rita. Santa Rita, however, does not have electricity costs. If the Q190 of electricity costs were eliminated, the increase in net earnings would be Q290 or about 60%, a figure comparable to the farmers using a gravity system.

San Juan Ostuncalco and Lo de Silva are examples of how, unless a good road exists and/or diversification of cropping takes place along with irrigation, there may be relatively little impact. Although it was a gravity project, San Juan was relatively costly--Q22,000 total costs of installation and materials, or Q70 per cuerda and Q73 per family--due to the large area irrigated (316 cuerdas) and the large number of households connected to the system (300). This is the largest single project in the irrigation component of Project 520-0233. The system is still functioning well and the farmers seem to be content with it. However, many farms are still sowing traditional corn and beans, like other traditional farmers in the terraced areas near Patzun. The ability to plant two staple crops instead of one in a given year and to get measurably better yields (10% - 20%) mean that farmers have more staples to eat and fewer to purchase. It doesn't indicate, however, the impressive gains in cash incomes observed in other, diversified, irrigation areas. The problem is the cost of getting produce out of the area to vegetable consuming places like Quezaltenango or Guatemala City. Some farmers, however, are diversifying, in spite of transportation difficulties.

In the case of Lo de Silva (a community near Palencia, El Progreso) a number of circumstances, -- a very poor road, disputes over rights to use water from certain springs, plant diseases affecting the area's two main crops (guisquil and potatoes), and a price decline in the national market for these same crops -- have combined to overwhelm any advantages the gravity irrigation system may be contributing. It has also been noted that land values fall some 300% from plots near the town to similar plots near the end of the road. From discussions with local farmers it is clear that an improved road and help with crop diversification would be welcome.

Rincon Grande, near Zaragoza, Chimaltenango, with a reported gross income of Q130,000 per year for its 46 families from the sale of strawberries, vegetables, and flowers, is one of the more commercially active Indian enterprises participating in the 520-0233 irrigation activities. It also has been experiencing some of the highest monthly electricity costs--about Q5,000 per month, or some Q30,000 per year, assuming irrigation during the full 6-month dry season. The farmers Smith interviewed complained about this high cost, but felt that the project nevertheless had been moderately successful despite occasional problems with the electric pumps.

In summary, where farmers have access to good roads and have been able to introduce a variety of short-season crops, irrigation has had a major impact on net earnings. Where traditional crops continue to be grown, the result has been similar to that found on terraces planted to the same crops: approximately a doubling of total output over the calendar year due to at least one extra crop permitted by a reliable water supply. Only where a project has been severely handicapped by lack of complementary infrastructure and/or resources, such as Lo de Silva, are the merits of even a gravity system in doubt. Clearly, gravity flow systems are more economical than pumping systems, but it is not clear that pump unreliability and seemingly high power costs have necessarily offset the gains in output and incomes generated by the irrigation. At Rincon Grande, the prosperous appearance of the farmers and the excellent condition of their fields and buildings led Smith to believe that they still are doing very well indeed.

0051C

TECHNICAL ANALYSIS - REFORESTATION

a. Technical Evaluation

In order to achieve the objectives of the reforestation activity of the Project, various alternatives were considered.

- Reduced consumption through fuel-efficient stoves;
- Production of fuelwood from the Peten;
- Production from fuelwood plantations on public lands;
- Production from commercial woodlots on private lands; and
- Production from seedlings planted on small land holdings.

Reduced Consumption - Early results from recently initiated programs in Guatemala to encourage the use of Lorena stoves have indicated that there is a high degree of acceptance among rural families of this means of saving on fuelwood consumption, especially if there is a prior educational campaign and assistance in helping the families build the stoves. Assuming the installation of fuel-efficient stoves at a rate of 50,000 per year from 1984 to 2000 (which would reach 50% of families using fuelwood), forest withdrawls could be cut by 5 million cubic meters per year by the year 2000. Assuming that all family users would provide the materials and labor for construction of these stoves, the cost to the GOG for instructional materials, educational campaigns, and field technician's (para-professionals) salaries to provide instruction of the building of the stoves, would amount to Q1.2 million per year, or Q20.4 million for the entire 17-year period.

Production from the Peten - Although the Peten represents an enormous forest resource --75% of the total volume of forest presently existing in the entire country -- the distance from the southern Peten to the nearest markets in the eastern part of the country (not the Highlands), is 150 to 200 km., the economic limit for transport of fuelwood. This market by the year 2000 could absorb only 0.5 million cubic meters of fuelwood per year, which represents scarcely five percent of the demand for fuelwood. This would be considered a private, commercial operation.

Production from commercial woodlots on private lands - The idea of tree farms or fuelwood plantations on private lands in developing countries is becoming more prominent as alternative sources of energy continue to be very expensive. The advantage of this approach is that it would be self-financing and would not need injections of GOG or AID funds. Since 45% of domestic fuelwood in Guatemala is purchased, the current high wood prices and the use

of fast growing tree species would make such plantations economically feasible. If 15 private plantations of 1,500 hectares of good land each were established each year from 1984-1993, production from these woodlots would reach 4 million cubic meters annually by the year 2000. The total cost of producing fuelwood from these 225,000 hectares would amount to Q56.3 million.

Production from fuelwood plantations on public lands - This intervention has been tried previously by INAFOR and has been shown to be successful as a reforestation mechanism. Because of the limited amount of public lands in the Highlands, however, its impact may not be as widespread as reforestation on private lands. Nevertheless, it is an action that should be used to its fullest potential since the GOG can guarantee that the most needy in the rural areas will be hired to do the reforestation and will have an accessible source of firewood. Establishing 2,000 hectares annually of fuelwood plantations on public lands over the five-year period 1984-88, the resulting 10,000 hectares would produce 0.2 million cubic meters of fuelwood annually by the year 2000 for the communities where they are established. The cost of this intervention over five years would be Q7.0 million, the higher cost due principally to high labor use, training and availability of relatively poor steep land.

Production from seedlings distributed to small landowners. The nurseries established to supply the seedlings for the public lands reforestation activity could also be used to supply seedlings on a cost-plus or government subsidized basis to individual landowners. These seedlings could be planted at field borders on eroded slopes and on presently non-productive land. The distribution of 15 million seedlings per year over the period 1984-2000 would increase fuelwood production by approximately 1 million cubic meters annually by the year 2000. At an estimated cost of Q 0.10 per seedling, the total annual cost of providing an average of 15 million free seedlings would be Q1.5 million per year, or a total of Q25.5 million.

Given these five interventions, the total demand for fuelwood of 10.2 million cubic meters in the year 2000 could be met at a cost to the GOG of Q52.9 million over 17 years[1/]. Although this annual amount does not seem to be excessively high, a five-year program of fuel-efficient stoves, public woodlots, and seedlings for small land holdings would amount to Q20.5 million, considerably more than the amount which the Mission presently has available

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1/ This calculation of cost to the GOG does not include Q56.3 million for private, commercial wood plantations, which would account for 40% of the expected production in the year 2000, since this should be considered solely private investment. It also assumes that seedlings would be distributed free to small farmers However, if the Mission position of selling seedlings at cost were followed, this cost would be lowewred even more.

for these purposes under this Project. Consequently, a determination was made as to priority interventions at available funding levels.

Because various government and voluntary institutions are presently undertaking programs, albeit very limited, for building Lorena stoves in Guatemala, the Project will not make a direct investment in the building of these stoves. However, because of its relative importance, a strategy for an integrated approach to dissemination of fuel-efficient stove construction will be developed by technical assistance under the Project. Other AID projects, including Community Based Health and Nutrition Systems (0251) and Non Formal Education (0281) offer possibilities for support and funding of an action program.

Since access to markets for Peten fuelwood production is so difficult and this activity should be undertaken by private, commercial enterprises, it will not be considered in this Project.

Fuelwood production by commercial enterprises on private lands offers great potential for alleviating Guatemala's future fuelwood deficit situation. Because this type of operation should be self-financing from private investment, direct COG investments should not be required in this type of activity. However, the COG should encourage private investment in fuelwood projects through special tax exemptions or write-offs for investments in and income from fuelwood projects; through studies of the growth rates of fast growing local species under different site conditions, and through the determination of optimum management techniques of forest plantations. In addition the profitability of this private reforestation action will be determined through the implementation and analysis of the pilot public woodlot sub-projects.

On the basis of an analysis (Table VI) of 19 sub-projects for reforestation of municipal lands presented by INAFOR to AID, it was determined that although this type of reforestation was important, there were considerable variations in the sub-project costs. For example, costs per hectare per sub-project ranged from Q850 to Q7,645 while labor cost as a percentage of total cost varied from 29.2 to 94.0. This raises the question as to the most appropriate and efficient combination of labor and capital resources in reforestation, as well as its profitability for commercial exploitation. Therefore, it was decided not to finance all 19 proposed sub-projects but only a few pilot sub-projects which, closely monitored and analyzed, could provide answers to the above question. Five sub-projects were chosen which represent a good geographical distribution as well as wide differences in per hectare costs and labor use. These sub-projects will also provide on-the-job training in reforestation for local people employed in public woodlot development and strengthen community collaboration and responsibility for natural resource conservation.

TABLE VI

DESCRIPTION OF PROJECTS

SUB-PROJECT AREA	NO. OF HECTARES	TOTAL COST	COST PER HECTARE	LABOR COST/ TOTAL COST(%)
(I-1) Quezaltenango Dept.				
Concepcion Chiquirichapa	45.0	64,156	1,426	81.1
Olintepeque	22.5	104,846	4,660	75.4
(I-2) Huehuetenango Dept.				
Malacantancito	67.5	59,400	880	23.0
San Juan Atitlan*	45.0	45,810	1,018	20.2
Chiantla	90.0	76,500	850	23.9
(I-3) El Quiche Dept.				
Sacapulas	67.5	144,821	2,145	92.0
(I-4) Totonicapan Dept.				
San Andres Xecul *	45.0	95,475	2,122	88.0
(I-5) Solola Dept.				
Panajachel	2.0	7,122	3,561	72.6
San Marcos La Laguna	4.0	10,449	2,612	62.2
Santiago Atitlan *	8.0	14,884	1,861	61.3
Santa Cruz La Laguna	14.0	22,671	1,619	83.0
Concepcion	5.0	13,441	2,688	79.8
(I-6) San Marcos Dept.				
San Cristobal Cucho	22.5	65,813	2,925	92.5
Concepcion Tutuapa	22.5	64,500	2,867	89.4
San Jose Ojetenam *	22.5	62,082	2,759	89.8
Esquipulas Palo Gordo	22.5	62,872	2,794	92.6
(I-7) Nebaj Sub-Region				
Nebaj	10.0	42,403	4,240	92.8
San Juan Cotzal	6.5	33,497	5,153	92.4
Chajul *	4.0	30,579	7,645	94.0
TOTAL	526.0	1,031,321	1,942 1/	90.1 2/

* Sub-projects selected for pilot activities.
1/Median cost per hectare is Q 2,688.
2/Median percentage labor cost of total cost is 83.0.

Seedlings distributed to small landowners by INAFOR has also been selected for inclusion in this Project because of the availability in Years 2-5 of the nurseries established originally in Year 1 for public woodlots; the multiplier effect of making seedlings available to those who have received training on the public woodlots or to a few big, private commercial operations; and the ability of INAFOR to recuperate its investment and establish a rotating fund for additional reforestation by charging the buyers of seedlings a price equal to its cost of production (Q0.10 per seedling). Thus, the original GOG investment would become a self-financing mechanism.

INAFOR, at both national and regional levels, stands ready to improve forestry resources. INAFOR is backed by extensive research done by the Tropical Agricultural Research and Training Center (CATIE), (ROCAP, Fuelwood and Alternative Energy Sources, Project Number 596-0089). Work by CATIE, in association with INAFOR, insures INAFOR's state-of-the-art technical preparedness. INAFOR's major difficulty lies in a shortage of personnel able to implement a large program. However, because of the pilot size of the activity, INAFOR appears able to handle these activities.

Research Support is already available. The above ROCAP project on Fuelwood and Alternative Energy Sources has conducted $7 million of research on both tree planting for farmer and community fuelwood sources and on preferred stove types for fuel efficiency and user convenience. Thus, personnel from this research project and printed data are available to guide a more extensive implementation by the GOG.

b. Socio-Economic Impact

The reforestation activities would impact upon the region's population in the following ways:

1) Belt reforesting on municipal lands, for subsequent firewood use would have a favorable social and economic impact on household economies and on the stabilization of municipal resources.

2) Fuelwood cultivation on the boundaries of farmer's land should conserve costs as well as resources, provided it does not cause a shading problem on the farmer's crop lands.

3) Firewood available on the farm would relieve many women and children of the time consuming task of gathering brushfall firewood or transporting from the hillsides firewood cut by husbands. In addition, this would assist women by reducing a frequent cash drain from their limited cooking purse, out of which they are obligated to cook for and feed the family.

c. Beneficiaries

Since 96% of the region's households depend on fuelwood, and well over 60% of the region's households are rural, a tremendous number of people

could be substantially benefited individually, while the country as a whole preserves forest resources, avoids land erosion, and improves water supplies. Municipal reforestation efforts in the five pilot sub-projects covering 124.5 hectares will provide 60 person-years of employment annually while seedlings for fuelwood cultivation on boundaries of small plots will be made available to 40,000 farm families in the project area.

d. Participants

For individual land fuelwood plantings along boundaries, rural families in the areas surrounding the five sub-projects will participate, individually with technical assistance from DIGESA and INAFOR.

For municipal level efforts to develop belt reforestation and fuelwood supplies, INAFOR will deal with entire communities through their elected municipal leadership.

e. Socio-Cultural Constraints and Solutions

INAFOR and DIGESA extension agents must observe suggested method of dealing with ethnic differences, especially in the preparation of audio-visual materials in the native Indian tongues.

A determination must be made on the types of tree seedlings which the small farmer will be willing to purchase and how much he would pay. Some cost must be charged to each family so that they value and protect the plantings. However, it must not be too high to discourage purchases.

If tree ownership could be effectively marked, then good quality firewood trees could be planted on land boundaries (except for corner markers). Presumably owners would alternate owned trees or possess all the trees on one side of the centerpoint of each boundary. Such boundary trees would also provide valuable windbreak, for the shallow rooted native corn in prone to wind damage, and the trees would also provide additional erosion control. However, care must be taken to ascertain that boundary firewood trees would not cause shade problems for adjoining milpa plots.

A determination must be made on the eventual distribution of the fuelwood grown on municipal lands. This would include establishing a pricing mechanism, wood cutting rights based on some calculation of community labor participation and quotas for cutting. Precautions must be taken to assure that those most in need of fuelwood are able to have equal access at fair market prices.

F(8) Technical Annex - Access Roads

1. Access Roads Maintenance Objectives and Terms

The purpose of this rural access roads maintenance program is to guarantee the continuance of access of rural highlanders to farm markets and to agricultural inputs and agricultural, health, and extension services.

The purpose of the design proposed within is to utilize community supplied labor to the maximum extent possible to maintain, not rehabilitate, all weather rural access roads. This maintenance program is to include both routine maintenance and periodic maintenance.

For purposes of the project the following definitions are employed:

A. All-Weather Rural Access Road is of minimum standard design, with a general road width of 6 meters including shoulders. The roads to be constructed will have a riding or wearing surface (4 meters in width) covered either with river gravel or other free draining select material. Side ditches and culverts provide sufficient drainage to insure year round use of the road. The facility should connect agricultural producing areas and communities to secondary and primary roads leading to marketing and processing centers.

B. Rehabilitation is a corrective type maintenance which restores a previously completed but substantially damaged road to its original design standard and might possibly include additional drainage structures. Road rehabilitation tasks include cleaning and restoring side ditches, culvert cleaning, reshaping the roadway and replacing the gravel surface.

C. Routine Maintenance is a type of preventive maintenance. Tasks include ditch cleaning, control of weeds, culvert cleaning, filling potholes, restoring limited areas of the riding surface and maintaining free flow around bridges. The work is performed throughout the year on a scheduled basis.

D. Periodic Maintenance is performed by the use of heavy equipment on an annual or semi-annual basis. Tasks include scarification by grader and reshaping of the road surface, replacing lost surface material and compacting and repair of bridges, culverts and other drainage structures.

2. Proposed Process for Maintaining Rural Access Roads using Labor Intensive Methods

In order to establish a successful labor intensive access roads maintenance program two organizations must work together. They include the rural community construction and maintenance committees and Departamento de Caminos Rurales (DCR).

A. Rural Community Construction and Maintenance Committees - These committees will supply the required labor for both routine and preventative

maintenance. These committees were established during the DCR's labor intensive access roads construction program and include at least one trained community committee foreman per committee and a large number of farmers who have had substantial training in labor intensive road construction (building mason culverts, building or improving drainage systems, shaping road sections, spreading and compacting gravel surface materials, and clearing road right of way of excess vegetation). These community committees have the demonstrated capacity to continue these activities, most of which are required for a labor intensive maintenance program. Therefore, no community level training is required to perform the required maintenance work except for occasional guidance or on the job training by DCR rural roads inspectors.

B. DCR - The DCR is to supply supervision and scheduling of maintenance works and hand tools required to assist community maintenance efforts. The DCR has for the past 6 years, managed a labor intensive access roads construction program where they provided the supervision and scheduling of community road construction work and supported it with heavy equipment and hand tools. The labor intensive access roads maintenance program as presented in this annex will use much of the same system already established within the DCR. However, since the current DCR staff is associated with construction activities within the DCR's six regional offices, additional personnel will be hired to coordinate the maintenance activities.

C. Volume of Work to be Undertaken

By the end of 1983 the DCR and rural community access roads construction and maintenance committees will have constructed about 650 kilometers of access roads in Guatemala's Highlands since the initiation of the program in 1978. About 150 kilometers of these roads segments have deteriorated and require rehabilitation prior to entering into a maintenance program. Hence in the initial year of the proposed program maintenance will be given to only 500 kilometers of rural access roads (roughly 100 individual road segments). It is anticipated that each succeeding year an additional 200 kilometers (or about 40 sections) will enter the program as the DCR/community construction committees complete construction of new roads. Therefore, for planning purposes, this maintenance program will maintain 500 kilometers in 1984, 700 kilometers in 1985, 900 kilometers in 1986, 1,100 kilometers in 1987 and 1,300 kilometers in 1988 the final year of the project life. Although by 1988 only 1,300 kilometers will be under annual maintenance, during the total five year life of the project 4,500 kilometers of access roads will have received annual labor intensive maintenance. A summary of all costs associated with this level of effort are found in Table I.

D. Level of Effort by the DCR

During the first year of the proposed maintenance program only 500 kilometers (or about 100 road segments) will require maintenance. These 500 kilometers are spread throughout the DCR's six regions, with between 75 to 100 kilometers within the jurisdiction of each regional office. Due to the

Table 1 /Cuadro 1

Summary of Expenditures for Access Roads Maintenance Program
Resumen de Gastos para el Programa de Cuidado de Acceso
10 = 1 US$

	YEAR 1 AND 1		YEAR 2 AND 2		YEAR 3 AND 3		YEAR 4 AND 4		YEAR 5 AND 5		TOTAL TOTAL		
	US$	Q	US$	Q	US$	Q	US$	Q	US$	Q	US $	Q	TOTAL
A. [illegible]													
1. Commodities (Total)/ Artículos	676	11	91	5	101	5	423	11	185	13	1476	45	1521
a. Heavy Equipment/ Equipo Pesado	612	-	-	-	-		276	-	-	-	888	-	888
b. Tires/ Llantas	47	-	84	-	93	-	131	-	165	-	520	-	520
c. Handtools/ Herramientas	17	11	7	5	8	5	16	11	20	13	68	45	113
2. Other Costs (Total)/ Otros Costos	-	123	-	173	-	205	-	239	-	189	-	929	929
a. Heavy Equipment Maintenance/ Mantenimiento de Equipo Pesado	-	22	-	24	-	27	-	43	-	48	-	164	164
b. Rural Labor/ Mano de Obra Rural	-	101	-	149	-	178	-	196	-	141	-	765	765
SUBTOTAL	612	134	91	178	101	210	423	250	185	202	1476	974	3450

limited amount of maintenance required, a separate maintenance unit within each of the six regional offices can not be economically justified. On the other hand, one maintenance unit based out of the DCR central office could not adequately cover the maintenance needs of the six regions due to the distances between the regions compounded by the mountainous topography which reduces accessibility and increases transportation time. Therefore the maintenance activities, though coordinated by the central office in Guatemala City, will be managed out of two of the six DCR regional offices. Because of their geographic location, the regional offices in Chimaltenango and Quetzaltenango were chosen. Each of these DCR offices will be responsible for the maintenance of about 250 kilometers the first year of the project. The program will be administered by one resident maintenance engineer at each of the two maintenance headquarters. Each engineer and two assistants will inspect all roads being maintained as well as those roads which will enter into the maintenance program shortly, identifying work to be undertaken, levels of community work force required, scheduling of both routine and periodic maintenance efforts and managing the most cost effective mix of heavy equipment required to support the maintenance effort. It is anticipated that each road will be visited at least once a week by either the resident engineer or one of the two assistants. During the first year of the project roughly 50 road segments (250 kilometers) need to be visited by one of these three individuals each week, or 17 roads (75 kilometers per week per person). Given the grouping of different road segments it will be feasible to visit these 17 roads within 2 or 3 days per week. The third year each individual will have to visit 30 roads segments per week reaching their capacity to visit project sites. The fourth year additional staff will be hired. 2 assistant warehousemen will be hired to process field requests for handtools, one at each regional center. To initiate the heavy equipment supported portion of the maintenance program, each regional maintenance office will have at their disposal one road grader, six dump trucks and one backhoe/front end loader (requiring eight heavy equipment operators/drivers) which will be used primarily for resurfacing gravel running surface materials. As the regional maintenance officer increases the level of maintenance activities, additional heavy equipment will be purchased (at the end of the third year) to complement the initial mix of equipment. Two additional engineering assistants and two payroll clerks, as well as one additional resident engineer would be hired at that time. Social workers currently located at all six regional offices will undertake community maintenance promotion campaigns to increase or continue public awareness of the value of maintenance in communities and municipalities where the maintenance program is to be initiated or continued.

The resident engineer or one of the two assistants will certify that road maintenance has been undertaken, so that the community road maintenance committee members can be paid.

The system for payment of community maintenance workers will be the same as that established under the rural access roads construction program. This system has been field tested over a six year period and has proven to be efficient and acceptable by both the DCR as well as the work crews. Work crew foremen selected by community road committees and who were trained under the

H1

access roads construction program will coordinate work crews as well as record worker attendance and work performed. This information will then be reported weekly to the Assistant for the resident engineer who requests the DCR payroll unit to process bi-weekly payment claims based on unitary price of work to work performed. These payment claims are then delivered to the workers by DCR on a bi-weekly basis and can then be cashed at Regional Offices of the Bank of Guatemala.

At the initiation of the project the DCR will require the hiring of 32 new employees: 1) one assistant to the road maintenance coordinator for the central office, 2) two resident maintenance engineers one at each of the regional maintenance headquarters, 3) four assistant maintenance personnel, 4) two assistant warehousemen 5) six drivers to drive the personnel in #2 and #3 above to work sites, 6) thirteen drivers for the 12 pump tanks and one low boy, 7) four heavy equipment operators to operate the 2 road graders and 2 back/hoes. In addition, payroll personnel and social workers currently on board at the six regional offices will be utilized. During the fourth year, the following additional DCR staff will be hired: 1) one resident engineer, 2) two assistant maintenance personnel, 3) two payroll clerks, 3) three drivers for #1 and #2 above, 4) six drivers for the 6 new dump trucks and 5) 2 heavy equipment operators for the new road grader and backhoe. Therefore, by the fifth year the DCR level of effort will include an additional 48 employees. (salary costs for these new employees is given in Table II).

Table II

A. Administrative Personnel - DCR Central Office/
A. Personal Administrativo - Oficinas Centrales de la DCR Administracion
1 Q = 1 US$

	Salary/Salario		Total 5 Years/
	Monthly/ Mensual	Annual Annual	Total Durante los 5 Anos
1 Assistant Engineer/ Ingeniero Asistente	Q505	Q6,440	Q32,200
		Q6,440	Q32,200

The Coordinator of the Department of Rural Roads will be responsible for road maintenance, assisted by his deputy who will represent a new position at the administrative management level./El coordinador del Departamento de Caminos Rurales sera responsable del mantenimiento de los caminos ayudado por su asistente que incrementa una posicion a nivel de direccion administrativa.

B. Administrative Personnel - Regional Office/
B. Personal Administrativo - Oficina Regional

Expenses for Two Regional Maintenance Centers
Gastos para Dos Centros Regionales de Mantenimiento
1 Q = 1 US$

Amount Cantidad	Title of Position. Titulo del Puesto	Salary/Salario Monthly Mensual	Salary/Salario Annual Anual	Christmas Bonus/ Aguinaldo	Total
2	Resident Engineers/Ingenieros Residentes	Q1,215	Q29,160	Q1,600	
2	Warehousemen helpers/ Ayudantes de Bodeguero	285	10,260	320	
4	Operators/Operadores	400	19,200	800	
19	Drivers/Conductores de Vehiculos	120	27,360	1,520	
4	Engineer's Assistant/ Auxiliar de Ingeniero	500	24,000	940	
			Q109,980	Q5,188	Q115,168
Total Technical Administrative and Operating Costs					Q145,828

Technical administrative personnel in the Regional Maintenance Centers which will be stationed in the two access roads regions./Personal tecnico administrativo de operacion en los centros regionales de mantenimiento que estaran localizados en dos de las regiones de caminos de acceso.

The cost of the technical administrative operations for 5 years will be Q145,828 x 5 = Q729,140 since there are not any salary increases anticipated during the life of project.

Beginning with the fourth year, to cover the needs of the new equipment and assist its administrative and technical staff, it will be necessary for the DCR to increase its staff from the fourth year as indicated below. This additional equipment and staff will be required because of the additional access roads constructed by the DCR during the first years of the project in addition to roads planned for construction after the fourth year.

E. Level of Community Effort

During the construction of 325 kilometers of access roads within the AID financed 520-0233 project approximately 60,000 people or about 12,000 families living in 236 communities along these access roads benefited from the improved access provided by these new roads as well as benefitting from village labor payments for their participation in the labor intensive construction effort. Assuming that the roads to be maintained are similar in characteristics to those already constructed then in the first year of the maintenance program about 474 community supplied foremen will supervise laborers who will provide 44,953 man days of labor from the 474 communities along the 500 kilometers to be maintained. With an increasing volume of roads to be maintained the number of these foremen will reach about 949 individuals by the fifth year when 1,300 kilometers are under annual maintenance. These

C. Additional Requirements (Fourth Year)
C. Necesidades Adiciodnales (Cuarto Ano)
1 Q = 1 US$

Amount Cantidad	Title of Position. Titulo del Puesto	Salary/Salario Monthly Mensual	Salary/Salario Annual Anual	Christmas Bonus/ Aguinaldo	Total
9	Drivers/Conductores de vehiculos	Q120	Q12,960	Q720	
2	Operators/Operadores	400	9,600	400	
1	Resident Engineer/ Ingeniero Residente	1,215	14,580	800	
1	Engineer's Assistant/ Auxiliar de Ingeniero	500	12,000	470	
2	Payrollmen/Planilleros	235	5,640	220	
			Q54,780	Q2,610	Q57,390

The cost of technical administrative operation for two years of additional staff = Q57,390 x 2 = Q114,780.

Whereas the DCR will have to increase the total cost of its budget for the 5 years of the life of project will be Q729,140 + Q114,780 = Q843,920.

foremen will provide their services year around (to be paid by the DCR) at roughly $3.00 per day depending on the type of work undertaken. Each foreman will supervise a number of community supplied laborers, the exact number depending on the work to be accomplished. In order to spread the opportunity for extra income more equally among all interested community maintenance committee members as well as to insure that members have sufficient time to attend to their fields, each laborer will work 20 days a month for 3 months a year. Therefore each laborer involved in the program can anticipate an outside annual income of approximately Q180 (3 months x 20 x Q3.00). Using the criteria that each laborer will supply only 60 man days of labor per year during the first year of the maintenance program 750 laborers will perform 44,955 man days of work required to maintain 500 kilometers of roads (see Table III for calculation of work requirements). By the fifth year 1950 laborers will be required. In total, during the five year project the communities will provide 6,750 man years of labor and will receive a total of Q1,687,000 in labor wages which will be distributed over the 949 rural communities (47,700 families, or about 238,500 individuals).

F. Project Equipment Needs

In order to maintain access roads using labor intensive methods the community labor will require handtools. However, for certain types of work, such as transporting fill or running surface materials or in spreading large volumes of gravel, heavy equipment is required. It is more cost effective to coordinate the level of output of the backhoe and dump trucks with road grader which can spread the material in the time it takes to deliver it to the work sites. Therefore, both handtools and heavy equipment will be needed to maintain the access roads within the program.

a. Handtools

Experience with labor intensive road maintenance under the previous AID Project No. 520-0233 indicates the need to divide maintenance activities among 5 man crews, each assigned to 3 Kilometer sections of road. In other words, the maintenance program for the first year will cover 167 sections (i.e. 500 ÷ 3 = 167). Each section, or crew, will require a mix of 6 handtools. Appropriate hand tools to carry out road maintenance tasks will include picks, shovels, hoes, wheelbarrows and machetes. The quantity and cost of hand tools per kilometer are described in Table VI.

Although handtools by law will always belong to the GOG, the community committees will be responsible to the DCR for the handtools. The handtools will be replaced by the DCR when no longer useable. Handtools will be kept within the same communities and village maintenance committees will be responsible for maintaining the borrowed tools in good order.

b. Heavy Equipment

It is estimated that about 400 m^2 of surfacing material is required per kilometer to provide an adequate running surface. In total, for

Table III/Cuadro III

Access Roads Maintenance Component, Estimation of Labor Costs

Componente de Mantenimiento de Caminos de Acceso, Estimación de Costo de la Mano de Obra

Maintenance Activity/ Actividad de Mantenimiento	Execution Criteria/ Criterio de Ejecución	Type Access Roads. Clase de Caminos Acceso	Work Unit/ Unidad de Trabajo	Efficiency Eficiencia	Total Annual Work/ Cantidad Trabajo Anual	Laborers Required/ Trabajadores Requeridos	Crew Days/ Días Cuadrilla	Man Day/ Hombre Día	Cost per Day/ Costo por Día	Labor Cost/ Costo Mano Obra	Sub Total
1. Smoothing/Nivelación con Mano de Obra	Frequency Frecuencia	2 Years 2 Años	Km.	1 Km/Day/Crew 1 Km/Día/Cuadrilla	250	5 2/	250	1,250	Q3.00 1/	Q3,750	
2. Shaping and Smoothing Nivelación y Perfilado con Maquina	Frequency Frecuencia	2 Years 2 Años	Km.	10 Km/Day 10 Km/Día	250	2	25	50		150	
3. Patching/Bacheo	m^3/Km/Year m^3/Km/Año	1 Year 1 Año	m^3 m^3	1.5m^3/Crew Day 1.5m^3/Cuadrilla Día	2,500	5	1,667	8,335		25,005	Q 28,905
4. Resurfacing/Recubrimiento	Frequency Frecuencia	4 years 4 Años	m^2 m^2	250m^2/Day 250m^2/Día	80,000	20	228	4,560		13,680	Q 13,680
5. Cleaning and Repair of Culverts/Limpieza y Reparación de Alcantarillas	Frequency Frecuencia	6 Months 6 Meses	Km. Culverts/Alcantarillas	4 un/s-week 4 un./h-semana	5,000	2	1,250	2,500		7,700	
6. Hand Cleaning Ditches/Limpieza y Perfilado Cunetas	Frequency Frecuencia	6 Months 6 Meses	metro metro	60mt./s/day 60mt./h/día	100,000	10	1,667	16,670		50,010	
7. Vegetation Control/Control de Vegetación	Day-s/km/year Día-s/km/año	1 year 1 año	m^2	40m^2/s/day 40m^2/h/día	750,000	5	1,875	9,385		29,125	
8. Earth Slides/Derrumbes	m^3/Km/Year m^3/Km/Año	1 year 1 año	m^3 m^3	3m^3/s/day 3m^3/h/día	1,500	5	441	2,205		6,615	Q 92,250
Unit Cost of Hand Labor per Kilometer/Costo Unitario de Mano de Obra por Kilometro =								44,955			Q 134,835 Q 134,835 500 = Q270.00

1/ Q3.00 is the average wage that a laborer will earn per day/Q3.00 es el salario promedio que un trabajador ganara por día.

2/ 5 men is the more effective quantity for a crew 5 hombres es el tamaño de la cuadrilla mas efectiva

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Tabla IV/Cuadro IV
Proyecciones del Costo de la Mano de Obra
Rural Labor Cost Projections
1Q = 1 US$

	HH	Cost./HH Costo/HH	Cost./Total Costo/Total	USAID %	USAID Amount/ Cantidad	CDC/GSaG %	CDC/GSaG Amount/ Cantidad
1st. Year/1er año	500	270	135,000	75	101,250	25	33,750
2nd. Year/2do año	700	327	228,900	65	148,785	35	80,115
3rd. Year/3er año	900	359	323,100	55	177,705	45	145,395
4th. Year/4to año	1100	395	434,500	45	195,525	55	238,975
5th. Year/5to año	1300	425	565,500	25	141,375	75	42,425
			Q 1,687,000		Q 764,640		Q 922,360

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Table V/Cuadro V

Labor Requirements/
Mano de Obra Necesaria

	Kilometers per Year/ Kilometros/por año	No. of Communities[1]/ No. de Comunidades	Man-Days-Year[2]/ Persona-Dias-Año	No. of Laborers No. de Trabajadores
First Year/Primer Año	500	474	45,000	750
Second Year/Segundo Año	700	511	63,000	1,050
Third Year/Tercer Año	900	657	81,000	1,350
Fourth Year/Cuarto Año	1,100	803	99,000	1,650
Fifth Year/Quinto Año	1,300	949	117,000	1,950

1/ = No/Year = (236 communities / 225 km.) No/Año = (236 Comunidades / 225 km.)

2/ = No/Year = (44,955 / 500 km.) No/Año = (44,955 / 500 km.)

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500 kilometers, this volume is about 200,000 m^2. Given Guatemalan climatic and topographical conditions the volume of resurfacing material required annually to replace lost or worn surfacing material is about 40 percent. Hence during the first year of the maintenance program about 80,000 m^3 of material will be replaced. This volume of work will be undertaken by heavy equipment, not by hand labor, because on the average the gravel borrow pits are located 10 to 15 kilometers from the work sites. Therefore it is more cost effective to use heavy equipment to transport the resurfacing materials than by land with wheelbarrows. One front end loader can load about 350 m^3 per day. Therefore 229 days (80,000 m^3/350 m^3/day) are required to complete the task. A heavy equipment unit at each of the two regional offices consisting of one backhoe, 6 dump trucks and one road grader can undertake half of the required work in 115 days. Compacting of resurfacing material will be undertaken by manual labor.

By the beginning of the fourth year 900 kilometers of roads will be included in the maintenance program with an additional 200 kilometers entering into the program. With 900 kilometers to be maintained, approximately 144,000 m^3 of resurfacing materials need to be transported to road sections (900 kilometers x 400 m^3 x .4 = 144,000). This will require 411 days (144,000 m^3/350 m^3/day). Each backhoe/front end loader will be utilized 205 days or near the limit of available work days per year. Hence, heavy equipment maintenance equipment package will be required to be purchased during the fourth year of the project. Table VII provides a listing of the heavy equipment to be purchased at two discreet intervals. Table VIII provides operating and maintenance costs for these vehicles on an annual basis.

Table VI/Cuadro VI

Handtools Requirements/
Herramienta Necesaria

Hand Tool/ Herramienta	Amount per Crew/ Cantidad/ Cuadrilla	Crews/ Cuadrillas	Amount/ Cantidad	Replacement per year/ Renovation per ano	First Year/ Primer ano	2nd. Year/ 2do. ano	3rd. Year/ 3er. ano	4th. Year/ 4to. ano	5th. Year/ 5to. ano	Total Amount/ Cantidad total	Unit Cost/ Costo Unitario	Total Cost/ Costo Total
Shovels/Palas	2	24.7	234	1.2	480	192	192	384	480	1,657	Q 5.0	Q 8,285
Picks/Picos	3	24.7	300	1.5	752	300	300	477	826	2,855	6.0	17,130
Hoes/Azadones	2	24.7	234	1.5	300	200	200	450	550	1,902	4.0	7,604
Machetes/ Cortadillos	2	24.7	234	1.2	480	192	192	384	488	1,657	40.0	66,280
Machete/Machete	2	24.7	234	1.2	480	192	192	384	488	1,657	6.0	9,942
Power Tools/ Herramientas de Alimento	-	-	28	1.5	30	-	50	15	25	80	50.0	4,000
												Q 113,241

Handtools cost per Ha/
Costo de la Herramienta por Ha =Q44

During the second and third years, hand tools will be purchased only for new roads maintained during those two years. During the fourth year the purchase will include hand tools for new roads during the fourth year plus 50% replacement of what has been purchased during the first year. By the fifth year the purchase will include 50% replacement of the first year plus new tools required for roads maintained for that year plus 50% replacement of the second year.

Durante el segundo y tercer ano solo se comprara las herramientas de mano necesarias para los nuevos caminos que reciben mantenimiento durante esos dos anos. Durante el cuarto ano la compra incluira herramientas de mano para los nuevos caminos durante el cuarto ano mas 50% de repuestos de lo que ha sido comprado durante el primer ano. Para el quinto ano la compra incluira 50% de repuestos del primer ano mas las nuevas herramienta requeridas para los caminos que reciben mantenimiento ese ano mas el 50% del segundo ano.

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Table VII/Cuadro VII

A. Heavy Maintenance Equipment for Two Centers
A. Equipo Pesado de Mantenimiento para Dos Centros
1Q = 1 US$

Item/Renglon	Amount/ Cantidad	Unit Price/ Precio Unitario	Total Price/ Precio Total
Road Graders/Motoniveladoras	2	Q45,000	Q90,000
Back Hoes/Retroexcavadoras	2	35,000	70,000
Dump Trucks/Camiones de Volteo	12	20,000	240,000
Pick-up Trucks/Camiones Pick-up	6	10,000	60,000
Low-Boy/Plataforma	1	90,000	90,000
Sub Total			Q550,000
Spare Parts/Repuestos			62,000
			Q612,000

B. Additional Heavy Maintenance Equipment After the Third Year
B. Equipo Pesado de Mantenimiento adicional despues del Tercer Ano
1Q = 1 US$

Item/Renglon	Amount/ Cantidad	Unit Price/ Precio Unitario	Total Price/ Precio Total
Road Graders/Motoniveladoras	1	Q45,000	Q45,000
Backhoes/Retroexcavadoras	1	35,000	35,000
Dump Trucks/Camiones de Volteo	6	20,000	120,000
Pick-up Trucks/Camiones Pick-up	3	10,000	30,000
Sub Total			230,000
Spare Parts/Repuestos			46,000
			Q276,000

Table VIII/Cuadro VIII

Operating Expenses - Maintenance and Tires
Gastos de Operacion - Mantenimiento y Llantas

Fuels and Lubricants
Combustibles y Lubricantes

Trucks/Camiones

12 Dump Trucks/camiones de volteo

Annual mileage per truck/Recorrido anual por camion: 60,000 kms.
Diesel Consumption/Consumo Diesel: 15 Km/Gal
Amount of gallons per truck/Cantidad de galones por camion: 4,000 Gal diesel
Assuming 10% percent for inflation/Tomando un % de inflacion del 10%

Price of Diesel/Precio del Diesel:

1Q = 1 US$

	Price per Gal.Diesel/ Precio por Gal.Diesel	Gallons Per Year/ Galones por Ano	Number of Trucks Numero de Camiones	Cost/Yr. 1 Procurement/ Costo/Ano 1 Compra	Number of Trucks/ Numero de Camiones	Cost/Yr. 2 Procurement/ Costo/Ano 2 Compra	Total Cost Year/ Costo Ano
1 Year/Ano	Q1.31	4,000	12	62,880			Q62,800
2 Year/Ano	1.44	4,000	12	69,120			69,120
3 Year/Ano	1.58	4,000	12	75,840			75,840
4 Year/Ano	1.73	4,000	12	83,040	6	41,520	124,560
5 Year/Ano	1.9e	4,000	12	91,200	6.	45,600	136,800
							Q469,200

Maintenance/Mantenimiento

It is estimated that each truck will receive maintenance service every 5,000 km. or 12 annual services.

Average Cost of Service = Q150.00

1Q = 1 US$

	Cost per Service/ Costo por Servicio	No. of Services/ No. de Servicios	First Procurement No. of Trucks/ No. de Camiones	First Procurement Cost Year/ Costo Ano	Second Procurement No. of Trucks/ No. de Camiones	Second Procurement Cost Year/ Costo Ano	Total Cost/ Costo
1 Year/Ano	150	12	12	21,600			21,600
2 Year/Ano	165	12	12	23,760			23,760
3 Year/Ano	180	12	12	25,920			25,920
4 Year/Ano	198	12	12	28,512	6	14,256	42,768
5 Year/Ano	218	12	12	31,392	6	15,696	47,088
							Q161,136

Tires/Llantas:

Replacement of tires every 25,000 kms. or 2.4 times during the year./Reposicion de llantas cada 25,000 km. o sea 2.4 veces al ano.

Value of Tires/Valor llantas = Q250

Number of tires per truck/Numero de llantas por camion = 6

Each dump truck will need three changes of tires per year except for the first year when one set of new tires comes with the new equipment, therefore the cost of tires per truck for the first year = 6 x Q250 x 2 = Q3,000.

	Cost of Tires/Yr. Costo de Llantas por ano	First Procurement No. of Trucks/ No. de Camiones	First Procurement Cost Year/ Costo Ano	Second Procurement No. of Trucks/ No. de Camiones	Second Procurement Cost Year/ Costo Ano	Total Cost Year/ Costo Total Ano
1 Year/Ano	3,000	12	36,000			36,000
2 Year/Ano	4,950	12	59,400			59,400
3 Year/Ano	5,445	12	65,340			65,340
4 Year/Ano	5,900	12	70,800	6	23,600	94,400
5 Year/Ano	6,570	12	78,840	6	39,420	118,260
						Q.373,400

Pick-Up:

Annual mileage/Recorrido anual: 50,000 km.
Consumption/Consumo: 17 km/Gal
Unitary price regular gas/Precio Unitario gasolina regular: Q1.94

Amount of Gallons per vehicle/Cantidad de galones por vehiculo = 2,940 gal.

	Price per Gal/ Precio por Gal.	Gals. Year/ Gals. Ano	First Procurement Number Pickups Numero Pickups	First Procurement Cost Year/ Costo Ano	Second Procurement Number Pickups/ Numero Pickups	Second Procurement Cost Year/ Costo Ano	Total Cost Year/ Costo Total Ano
1 Year/Ano	1.94	2,940	6	34,222			34,222
2 Year/Ano	2.13	2,940	6	37,573			37,573
3 Year/Ano	2.35	2,940	6	41,454			41,454
4 Year/Ano	2.58	2,940	6	45,511	3	22,756	68,267
5 Year/Ano	2.84	2,940	6	50,098	3	25,049	75,147
							Q.256,663

Maintenance/Mantenimiento

It is estimated that each pickup truck will receive 10 maintenance services per year per 5,000 km./Se estiman 10 servicios al ano por vehiculo, o sea cada 5,000 km.

Unit cost per service = Q100

1Q = 1 US$

	Cost Service/ Costo Servicio	Number Services/ Numero Servicios	First Procurement Number Pickups/ Numero Pickups	First Procurement Cost Year/ Costo Ano	Second Procurement Number Pickups/ Numero Pickups	Second Procurement Cost Year/ Costo Ano	Total Cost Year/Costo Total Ano
1 Year/Ano	Q100	10	6	Q6,000			Q6,000
2 Year/Ano	110	10	6	6,600			6,600
3 Year/Ano	121	10	6	7,260			7,260
4 Year/Ano	133	10	6	7,980	3	Q3,990	11,970
5 Year/Ano	146	10	6	8,760	3	4,380	13,140
							Q.44,970

Tires/Llantas:

Replacement of tires each 15,000 kms./Reposicion de llantas cada 15,000 kms.

Only two replacements of tires are estimated during the first year and three during the following years./Se consideran solo 2 reposiciones de llantas el primer ano y 3 para los siguientes anos.

Value of tire/Valor llanta: Q 150

Tires per vehicle/Llantas vehiculo: 4

Annual cost of tires for the first year./Costo anual de las llantas para el primer ano: = 150 x 4 _ 2 = Q1,200

Cost of tires for the 2nd. year = 150 x 4 x 3 x 1.1 = Q1,800

Cost of Pickup Truck Tires/Costo de Llantas para Pickups

	Annual Cost of Tires/ Costo Annual Llantas	First Procurement Number Pickups Numero Pickups	First Procurement Annual Cost/ Costo Annual	Second Procurement Number Pickups/ Numero Pickups	Second Procurement Annual Cost/ Costo Annual	Total Cost Year/ Costo Total Annual
1 Year/Ano	Q1,200	6	Q7,200			Q 7,200
2 Year/Ano	1,980	6	11,880			11,880
3 Year/Ano	2,178	6	13,068			13,068
4 Year/Ano	2,395	6	14,370	3	Q7,185	21,555
5 Year/Ano	2,635	6	15,810	3	7,905	23,715
						Q.77,418

Heavy Equipment/Equipo Pesado

1. Graders/Motoniveladores

Number/Cantidad: 2

Daily Output/Rendimiento Diario: 350 m^3

Volume/Volumen m^3: 80,000 m^3

Time/Tiempo = $\frac{80000\ m3}{350\ m^3\ day/dia}$ = 229 days/dias

The cleaning of ditches is considered separate from the surfacing work./Se considera el trabajo de limpiesa de cunetas separado del recubrimiento.

For geographical reasons two graders are required, one for each maintenance center./Se consideran 2 motoniveladores por razones de localizacion geografica una para cada Centro de Mantenimiento.

Annual work days/Dias de trabajo por ano: 229

Daily fuel consumption/Consumo diario de combustible: 32 gals.

For 2 graders/Para 2 motoniveladoras = 229 x 32 x 2 = 14,656 gal Diesel year/ gals Diesel al ano

Graders - Price of Diesel/Motoniveladoras - Precio de Diesel
1Q = 1 US$

	Price per Gallon/ Precio por Galon	Gallons Per Year/ Galones por Ano	First Procurement No. Graders/ Motonive-ladoras	First Procurement Annual Cost/ Costo Anual	Second Procurement No. Graders/ Motonive-ladoras	Second Procurement Annual Cost/ Costo Anual	Total Annual Cost/ Costo Anual
1 Year/Ano	Q1.31	14,656	2	Q38,399			Q38,399
2 Year/Ano	1.44	14,675	2	42,209			42,209
3 Year/Ano	1.59	14,675	2	46,606			46,606
4 Year/Ano	1.74	14,675	2	51,003	1	Q25,501	76,504
5 Year/Ano	1.92	14,675	2	56,279	1	28,139	84,418
							Q288,136

Backhoe with Front End Loader/Retroexcavadoras:

Same number of days working than graders/Igual numero de dias trabajando que las motoniveladoras

Daily diesel consumption/Consumo diario de diesel: 24 gals.

Annual diesel consumption/Consumo anual de diesel: 10,992 gals.

1Q = 1 US$

	Price per Gallon/ Precio por Galon	Gallons per Year/ Galones por Ano	First Procurement No. Back-hoes/ Motonive-ladoras	First Procurement Annual Cost/ Costo Anual	Second Procurement No. Back-hoes/ Motonive-ladoras	Second Procurement Annual Costo/ Costo Anual	Total Annual Cost/ Costo Anual
1 Year/Ano	Q1.31	10,992	2	Q28,799			Q28,799
2 Year/Ano	1.44	10,992	2	31,657			31,657
3 Year/Ano	1.59	10,992	2	34,955			34,955
4 Year/Ano	1.74	10,992	2	38,252	1	19,126	57,378
5 Year/Ano	1.92	10,992	2	56,279	1	21,103	61,314
					Total		Q210,103

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Maintenance of Heavy Equipment/Mantenimiento Equipo Pesado

Cost of Grader/Costo motoniveladora: Q45,000

Useful life/Vida util. 5 anos

Depreciation after 5 years/
Depreciacion a los 5 anos: 60%

Repairs and Maintenance/Mantenimiento
y Reparaciones: 75% of depreciation/ de la depreciacion

$\frac{45,000}{5}$ = 9,000 9,000 x .6 = $5,400 each year/al ano.

0.75 x 5,400 = Q4,050 the first year/al primer ano.

1Q = 1 US$

	Annual Maintenance Cost/Costo Anual Mantenimiento	First Procurement No. Graders/ Motoniveladoras	First Procurement Annual Cost/ Costo Anual	Second Procurement No. Graders/ Motoniveladoras	Second Procurement Annual Cost/ Costo Anual	Total Annual Cost/ Costo Anual
1 Year/Ano	Q4,050	2	Q8,100			Q8,100
2 Year/Ano	4,455	2	8,910			8,910
3 Year/Ano	4,900	2	9,800			9,800
4 Year/Ano	5,390	2	10,780	1	5,390	16,170
5 Year/Ano	5,930	2	11,860	1	5,390	17,790
				Total		Q60,770

Tires for graders and backhoes/Llantas para motoniveladoras y retroexcavadoras

Cost of tire/Costo llanta: $1,500

Amount of tires/numero de llantas 6 each/c.u.

Number of motor graders/Numero de motoniveladoras: 2

The first set of tires comes with the new equipment/El primer set the llantas viene con el nuevo equipo.

The tires will be replaced during the second year at a cost of/Las llantas seran renovadas a partir del 2o. ano con un costo de: 1,500 x 1.1 = 1,650 each/c.u.

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Tires for Graders/Llantas para Motoniveladoras
1Q = 1 US$

	Annual Cost of Tires/ Costo Anual de las Llantas	First Procurement No. Graders/ Motonive-ladoras	First Procurement Annual Cost/ Costo Anual	Second Procurement No. Graders/ Motonive-ladoras	Second Procurement Annual Cost/ Costo Anual	Total Annual Cost/ Costo Anual
2 Year/Ano	Q1,650	2	Q3,300			Q3,300
3 Year/Ano	1,815	2	3,630			3,630
4 Year/Ano	1,996	2	3,992			3,992
5 Year/Ano	2,196	2	4,392	1	Q2,196	6,588
				Total		Q17,510

It is estimated that during the first year of the project the graders will utilize the factory tires./Se considera que el primer ano del proyecto las motoniveladoras utilizaran el juego de llantas nuevas de fabrica.

Tires for 2 backhoes/Llantas para 2 retroexcavadoras

Cost of big tire/Costo llanta grande: $1000

Cost of small tire/costo llanta pequena: 150

Amount of big tires/Numero de llantas grandes = 2, $2,000

Amount of small tires/Numero de llantas pequenas = 2, 300

Total $2,300

Cost of Tires for the second year/Costo de las llantas para el segundo ano = 2,300 x 1.1 = Q2,530

10 = 1 US$

	Annual Cost of Tires/ Costo Anual de las Llantas	First Procurement No. Back-hoes/ Motonive-ladoras	First Procurement Annual Cost/ Costo Anual	Second Procurement No. Back-hoes/ Motonive-ladoras	Second Procurement Annual Cost/ Costo Anual	Total Annual Cost/ Costo Anual
2 Year/Ano	$2,530	2	$5,060			$5,060
3 Year/Ano	2,783	2	5,566			5,566
4 Year/Ano	3,061	2	6,122			6,122
5 Year/Ano	3,367	2	6,734	1	$3,367	10,101
				Total		$26,849

Backhoe maintenance/Mantenimiento de retroexcavadoras

Cost/Costo= 35,000
Useful life/Vida util= 5 anos
Depreciation/Depreciacion= 60% in five years/60% a los cinco anos.
Maintenance and repair/Mantenimiento y reparaciones= 75% de la depreciacion
$\frac{5000}{5}$= 7000, 7000X0.6= 4200 cada ano/each year
4200X.75= 3150 al primer ano/during the first year

10 = 1 US$

	Annual Maintenance Cost/Costo Anual Man-tenimiento	First Procurement No. of Backhoes. Motonive-ladoras	First Procurement Annual Cost/ Costo Anual	Second Procurement No. of Backhoes/ Motonive-ladoras	Second Procurement Annual Cost/ Costo Anual	Total Annual Cost/ Costo Anual
1Year/Ano	$3,150	2	$6,300			$6,300
2 Year/Ano	3,465	2	6,930			6,930
3 Year/Ano	3,812	2	7,624			7,624
4 Year/Ano	4,193	2	8,386	1	$4,193	12,579
5 Year/Ano	4,612	2	9, 224	1	4,612	13,836
				Total		$47,269

Low-Boy

It is considered that the low-boy will have the same use as that of one dump truck, the maintenance and gasoline costs were considered on this basis Se considera que el low-boy tendra un recorrido aproximado de un camion de volteo, los costos de mantenimiento y combustibles seran en base a esta consideracion.

Price of diesel/Precio del diesel
10 = 1 US$

	Price per Gallon/ precio por Galon	Gallons per year/Galones por ano	Annual fuel cost/ costo anual de combustible
1 Year/Ano	Q1.31	4,000	Q5,240
2 Year/ano	1.44	4,000	5,760
3 Year/ano	1.58	4,000	6,320
4 Year/ano	1.73	4,000	6,920
5 Year/ano	1.90	4,000	7,600
		Total	Q31,840

Tires for a low-boy/Llantas para un low-boy
Unit price of tires/Precio de las llantas por unidad = Q2.50 each/cada una.

	Cost offer tires/ precio de las llantas	Number of tires/ Numero de llantas	Annual tire cost/ costo anual de llantas
1 Year/Ano	Q250	16	Q4,000
2 Year/ano	275	16	4,400
3 Year/ano	302	16	4,832
4 Year/ano	333	16	5,328
5 Year/ano	366	16	5,856
		Total	Q24,416

Low-boy maintenance/Mantenimiento para low-boy.
Unit cost for service/Costo de unidad por servicio = Q200.
1Q = 1 US$

	Maintenance cost/ Costo de mantenimiento	Number of services/ Numero de servicios	Annual maintenance cost/ Costo anual por mantenimiento
1 Year/Ano	Q200	12	Q2,400
2 Year/ano	220	12	2,640
3 Year/ano	242	12	2,904
4 Year/ano	266	12	3,192
5 Year/ano	293	12	3,516
		Total	Q14,652

Summary/Resumen

	Fuel/ Combustibles	Maintenance/ Mantenimiento	Tires/ Llantas
1st. year/1er ano	169,340	44,400	47,200
2nd. year/2ndo. ano	186,319	48,840	84,040
3rd. year/3er. ano	205,175	53,508	92,436
4th. year/4to. ano	333,629	86,679	131,397
5th. year/5to. ano	367,279	95,370	164,520
TOTAL	1,261,942	328,797	519,593

Heavy equipment operational costs during the life of the project/El costo de operaciones del equipo pesado esta basado en la vida util del mismo.

Low-boy operational estimate has been considered to be the same as for a truck/El costo de operacion del low-boy ha sido considerado igual al de un camion.

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Table -IX- Summary of Expenditures for Heavy Equipment Maintenance
Table IX Descripción de Gastos para Mantenimiento de Equipo Pesado

(000)

1 Q. = 1 US $

	YEAR 1 AÑO 1		YEAR 2 AÑO 2		YEAR 3 AÑO 3		YEAR 4 AÑO 4		YEAR 5 AÑO 5		TOTAL TOTAL		
	US$	Q	US$	Q	US$	Q	US$	Q	US$	Q	US$	Q	TOTAL
A. USAID (LOAN)/USAID													
1. Commodities/Artículos													
a. Maintenance Vehicles and Equipment Mantenimiento de Vehículos y Equipo	297	-	-	-	-	-	-	-	-	-	297	-	297
b. Spare Parts/ Repuestos	303	-	-	-	-	-	-	-	-	-	303	-	303
c. Tires/ Llantas	500	-	-	-	-	-	-	-	-	-	500	-	500
2. Training/Entrenamiento	-	20	-	10	-	-	-	-	-	-	-	30	30
SUBTOTAL	1100	20	-	10	-	-	-	-	-	-	1100	30	1130
B. GOVERNMENT OF GUATEMALA/ GOBIERNO DE GUATEMALA													
1. Personnel/ Personal	-	80	-	80	-	80	-	80	-	80	-	400	400
2. Maintenance Equipment Operating Maintenance Cost/ Equipo de mantenimiento Costos de Operación de Mantenimiento	-	18	-	19	-	19	-	19	-	19	-	94	94
3. Training (Per Diem) Transportation/Entrenamiento (Viáticos y Transporte	-	17	-	9	-	-	-	-	-	-	-	26	26
SUBTOTAL	-	115	-	108	-	99	-	99	-	99	-	520	520
TOTAL	1100	135	-	118	-	99	-	99	-	99	1100	550	1650

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B. GOVERNMENT OF GUATEMALA/ GOBIERNO DE GUATEMALA														
1. Personnel// Personal	-	146	-	146	-	146	-	203	-	203-	-	844	844
2. Operating Costs (TOTAL)// Costos de Operacion	-	192	-	210	-	232	-	377	-	415	-	1426	1423
a. Heavy Equipment Fuel// Combustible Equipo Pesado	-	120	-	186	-	205	-	334	-	367	-	1262	1262
b. Heavy Equipment Maintenance// Mantenimiento de Equipo Pesado	-	122	-	24	-	27	-	43	-	48	-	164	164
3. Rural Labor// Mano de Obra Rural	-	34	-	80	-	145	-	239	-	424	-	922	922
SUBTOTAL	-	372	-	436	-	523	-	829	-	1042	-	3192	3192
TOTAL	612	506	91	614	101	723	423	1069	185	1244	1476	4166	5642

Basic

Table - 3/Cuadro - 3

Summary of Expenditures for Mapping, Planning and Promotion
Resumen de Gastos para Mapeo, Planificación y Promoción
1 Q = 1 US$ ($/Q 000)

	YEAR 1 AND 1		YEAR 2 AND 2		YEAR AND 3		YEAR 4 AND 4		YEAR 5 AND 5		TOTAL TOTAL		
	US $	Q	US $	Q	US $	Q	US $	Q	US $	Q	US$	Q	TOTAL
1. [illegible]													
A. [illegible]													
1. [illegible]	15	-	-	-	-	-	-	-	-	-	15	-	15
2. [illegible]	-	5	-	-	-	-	-	-	-	-	-	5	5
SUBTOTAL	15	5	-	-	-	-	-	-	-	-	15	5	20
B. [illegible]													
1. [illegible]	-	6	-	6	-	6	-	6	-	6	-	30	30
TOTAL	15	11	-	6	-	6	-	6	-	6	15	35	50
2. [illegible]													
A. [illegible]													
1. [illegible]	10	-	-	-	-	-	-	-	-	-	10	-	10
2. [illegible]	-	30	-	-	-	-	-	-	-	-	-	30	30
3. [illegible]	-	3	-	3	-	3	-	3	-	3	-	15	15
SUBTOTAL	10	33	-	3	-	3	-	3	-	3	10	45	55
B. [illegible]	-	3	-	3	-	3	-	3	-	3	-	15	15
TOTAL	10	36	-	6	-	6	-	6	-	6	10	60	70

Table XI -/Cuadro XI

Summary of Technical Assistance Expenditures/
Resumen de Gastos en Asistencia Tecnica

($/Q 000)

	YEAR 1 AÑO 1		YEAR AÑO 2		YEAR 3 AÑO 3		YEAR 4 AÑO 4		YEAR 5 AÑO 5		TOTAL TOTAL		
	US$	Q	US $	Q	US $	Q	US $	Q	US $	Q	US $	Q	TOTAL
GRANT/Grant Only/Solo Donación													
1. Chief of Party/Jefe del Grupo - 4 years/4 años	100	-	100	-	100	-	100	-	-	-	100	-	400
2. Heavy Equipment Expert/ Experto en Equipo Pesado - 3 years/3 años	100	-	100	-	100	-	-	-	-	-	300	-	300
3. B... Inventory-Computer Expert/Inventario de Caminos - Experto en Computación	60	-	-	-	-	-	-	-	-	-	60	-	60
4. Promotion Campaign Experts/ Expertos en Campana de Promocion - 6 months/ 6 meses	60	-	-	-	-	-	-	-	-	-	60	-	60
5. Baseline Survey/Encuesta de Lineamientos	-	50	-	-	-	-	-	-	-	-	-	50	50
Total	320	50	200	-	200	-	100	-	-	-	820	50	870

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Table XII /Cuadro XII

Summary of Expenditures for Study Component

Resumen de Costos para el Componente de Estudios

	YEAR 1 / AÑO 1		YEAR 2 / AÑO 2		YEAR 3 / AÑO 3		YEAR 4 / AÑO 4		YEAR 5 / AÑO 5		TOTAL / TOTAL		
	US $	Q	US $	Q	US $	Q	US $	Q	US $	Q	US $	Q	TOTAL
A. US$/Q (Loan/Préstamo)	FX	LC	FX	LC									
1. Commodities/Artículos	1,801	11	91	5	101	5	423	11	185	13	2,601	45	2,646
2. Labor Intensive Wages/ Salarios Mano de Obra Intensiva		101	-	149	-	178	-	196	-	141	-	765	765
3. Training/Adiestramiento	-	20	-	10	-	-	-	-	-	-	-	30	30
4. Other Costs	-	60	-	27	-	30	-	46	-	51	-	214	214
Subtotal	1,801	192	91	191	101	213	423	253	185	205	2,601	1,054	3,655
B. US$/Q (Grant/Donación)													
1. Technical Assistance/ Asistencia Técnica	320	-	200	-	200	-	100	-	-	-	820	-	820
2 Baseline Study/Estudio Sobre Línea Base	-	50	-	-	-	-	-	-	-	-	-	50	50
Subtotal	320	50	200	-	200	0	100	-	-	-	820	50	870
Total US$/Q	2,121	242	291	191	301	213	523	253	185	205	2,421	1,104	4,525
C. IDB													
1. Labor Intensive Wages/ Salarios Mano Obra Intensiva	-	34	-	80	-	145	-	229	-	424	-	922	922
2. Personnel/Personal	-	232	-	232	-	232	-	289	-	289	-	1,274	1,274
3. Operating Costs/Costos de Operación	-	213	-	232	-	254	-	299	-	437	-	1,535	1,535
4. Training	-	17	-	9	-	-	-	-	-	-	-	26	26
Subtotal	-	496	-	553	-	631	-	927	-	1,150	-	3,757	3,757
Total A(2)+C(3)/ Total A(2)+C(4)	2,121	738	291	744	301	844	523	1,180	185	1,355	2,421	4,861	8,282