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RURAL EQUITABLE ECONOMIC GROWTH ACTIVITY (CRECER)

SAN SALVADOR, EL SALVADOR

EVALUATION OF EL SALVADOR'S FOUR MAJOR IRRIGATION DISTRICTS

- ATIOCOYO NORTE, ATIOCOYO SUR, LEMPA-ACAHUAPA, and ZAPOTITAN -

ADMINISTRATION AS WATER USER ASSOCIATIONS

FINAL REPORT - July 31, 1998

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ACRONYMS AND ABBREVIATIONS

AID	U S Agency for International Development Agencia para el Desarrollo International de los Estados Unidos
DGRNR	Direccion General de Recursos Natuales Renovables
FAO	Food and Agriculture Organization of the United Nations Organizacion de las Naciones Unidas para la Agricultura y la Alimentacion
GOES	Government of El Salvador
ID	Irrigation District
I&D	Irrigation and Drainage
MAG	Ministerio de Agricultura y Ganaderia
O&M	Operations & Maintenance
USAID	U S Agency for International Development Agencia para el Desarrollo International de los Estados Unidos
TA	Technical Assistance
WU	Water User
WUA	Water Users Association
WU-G	Water User - Group

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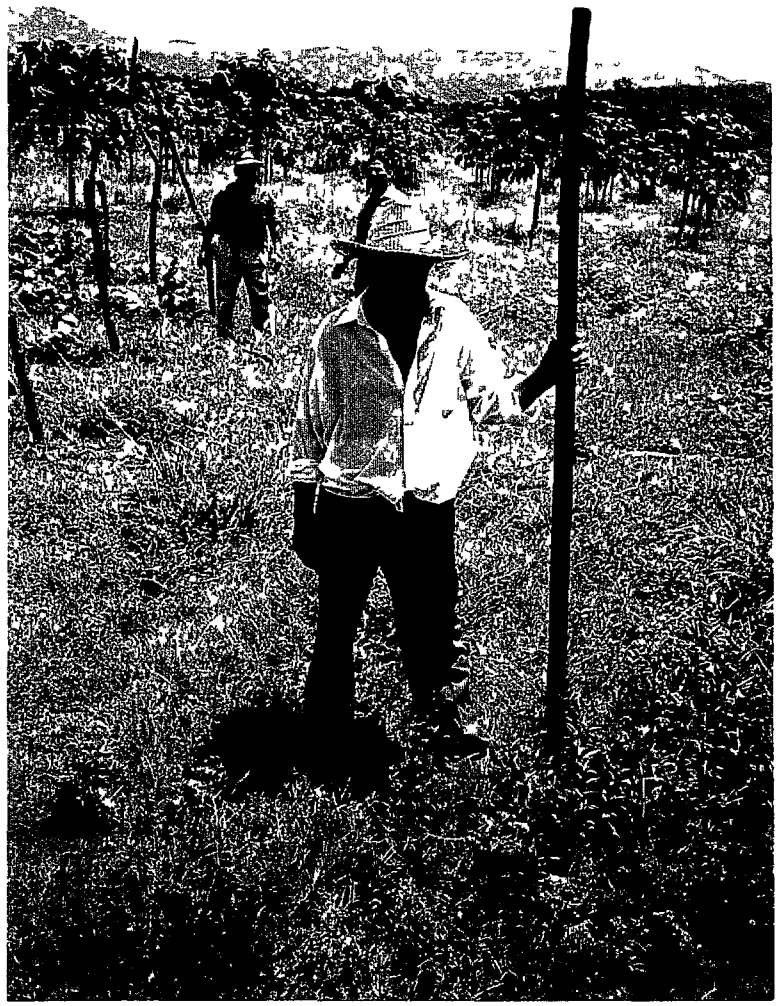

LEMPE ACAHUAPA - FARMER WITH SIPHON TUBE FOR ON-FARM SERVICE - JULY 3, 1998

EXECUTIVE SUMMARY

PRESENT STATUS

At present a Transfer Committee" composed of both Government of El Salvador (GOES)/Ministry of Agriculture (MAG) and Water Users Associations s (WUA) personnel meet almost weekly in order to facilitate the preparation of a legal agreement to transfer the administration of Irrigation and Drainage Districts (I&Ds) from GOES/MAG to the WUAs Various points have been discussed and some documented points agreed to in principal Other activities have been completed and/or are underway

A draft legal document has been prepared and needs to be finalized This would allow transfer of ID administrative responsibility to the WUAs for a fifty year concession period The initial four IDs to be transferred are Atiocoyo Norte, Atiocoyo Sur, Lempa-Acahuapa, and Zapotitan The three older irrigation districts are to have their main systems (canals, drains and roadways, etc) rehabilitated by the GOES to the extent that donor assistance funding is available

New legislation now being drafted would form a Federation of WUAs and would include the four major Irrigation Districts, Atiocoyo Norte, Atiocoyo Sur, Lempa-Acahuapa, and Zapotitan The Federation would assist farmers through the WUAs in the purchase of inputs (seeds, fertilizers etc) and commercialization (marketing/finance, etc) activities

One of the main results of this technical assistance activity (Output) will be to support the Minister and associations in finalizing the district transferring negotiations, and to strengthen other type of rural enterprises

FINANCIAL AND ECONOMIC EVALUATION

At present the four IDs/WUAs are assessing and collecting an "out-of-pocket' amount as water charges These vary from district to district The present financial and economic conditions are difficult, as the I&D-WUAs have no legal means to enforce collect of payments until the administrative right is transferred

An official decision on condonation of the investment debts (or at least a set percentage), and the outstanding O&M debts and power bills (and/or a set percentage of energy costs over a set time period) greatly affects any proposed tariff structures, as well as affects the evaluation of the economic implications and impacts on the sustain ability of the producers in the irrigation districts An analysis is to be made (as soon as data is available) of the amount of funds due to MAG as unpaid O&M and the investment cost recovery tariffs **The length of the transfer period has to be determined as well as the annual subsidy percentage amounts over time**

THE I&D DISTRICTS ADMINISTRATIVE TRANSFER STATUS

There is no question about the desirability and the need to transfer the administration of the four

I&D Districts from the GOES to the WUAs This administrative transfer would be advantageous to the GOES who would be relieved of the responsible for the cost of the administration of the four I&D Districts and the Water Users who would benefit from the lower administrative costs of the private sector salaries and benefits

Leaving the social/economic and political issues aside and looking at the administrative cost issue in simple terms the main administrative savings is in the difference in administrative personnel costs of GOES compared to WUAs By transferring the administration of the four I&D Districts the GOES would realize an annual savings of 900 000 x 4 (districts) or 3 600 000 Colones The total estimated WUs cost savings for the four I&Ds per year would be 1,200 000 Colones an **average of 134 60 Colones per Ha**

However, all of these cost issues are over shadowed by the ability of the land owners to pay This is especially true of the smaller land owners (1-3 Ha) who are usually at only a bare subsistence level

EVALUATION OF INVESTMENT (CAPITAL) COSTS REPAYMENTS

The following is the information presently available on investment (capital) costs for each of the four Irrigation and Drainage Districts to be transferred by GOES to the WUAs

Zapotitan original construction 1969/71 at 13 0 million Colones (GOES funds)
partial rehabilitation 1996/98 at $12 0 million (Donor-Japan)
(main canal, 15 wells, 3 pumping stations, etc)
irrigated area = 3,500 Ha
original cost = 3 714 28 Colones per Ha
rehabilitation cost = 29,828 57
total cost = 33,542 85 Colones per Ha

Atiocoyo Norte original cost 1975-78/79 IDB - $8 0 million & GOES - $7 9 million
irrigated area = 1,200 Ha - Norte (both Norte & Sur together)
= 1,704 Ha - Sur
total area = 2,904 Ha
cost = IDB = 23,966 94 Colones per Ha
+ GOES = 23,667 36
total cost = 47,634 30 Colones per Ha

Atiocoyo Sur original cost 1975-78/79 IDB - $8 0 million & GOES - $7 9 million
irrigated area = 1,200 Ha - Norte (both Norte & Sur together)
= 1,704 Ha - Sur
total area = 2,904 Ha
cost = IDB = 23,966 94 Colones per Ha
+ GOES = 23,667 36
total cost = 47,634 30 Colones per Ha

Lempa Acahuapa designed 1985/86 major construction started 1991/93 estimated at 70% completed in July 1998

- IDB loan = $10 9 million + $6 1 million GOES = $17 0 million

irrigated area = 2,511 Ha

- IDB = 37,765 83 Colones per Ha
- GOES = 21,135 00 (GOES) Colones per Ha

total cost = 58,900 83 Colones per Ha

Notes (1) This includes an average cost of 2 500 Colones per Ha for land leveling
(2) The IDB loan is for 40 years @ 1 percent for the first ten years and 2 percent for the 30 year balance

PHYSICAL ASSETS OF WUAs

The original decrees forming the I&D districts define the physical assets, irrigation system, drainage system, and roadways by nomenclature A, B, C, & 1, 2, 3, etc , and by lengths (Kms), widths (mts), and area (Ha), in addition to buildings, pumps, and wells, etc related to the original design layout Over the years the systems have been changed Therefore, an accurate system inventory for each separate I&D District needs to be made and verified by GOES and WUAs

It is advisable to transfer the administration of the original I&D District decrees, as to lengths, widths, and areas but require the WUAs to operate and maintain only the present actual useable lengths, widths and areas Buildings, Structures and Stationary Equipment should be transferred in a similar format as that of the physical assets

MOBILE EQUIPMENT

An accurate up-to-date inventory should be made that includes the make, model, year (age), and present condition These inventories can then be compared to needs and costs for further discussions At the minimum, all non-usable equipment should be returned to the GOES for disposal and/or salvage A transfer memorandum can be developed based on transfer methodology needs and an understanding of cost responsibility, etc

In order to properly evaluate the equipment, under the present conditions, the following actions need to be taken

- Prepare equipment inventory lists per format already developed (Section 2 2 2)
- Secure original equipment costs and/or present replacement costs
- Add the information concerning 'average number of workdays used per year' to the equipment list
- Compare and evaluate the need for the construction equipment presently available for transfer to O&M uses, to that of the actual equipment needed
- Check on possible equipment exchanges with the Ministry of Public Works

WATER DISTRICT SYSTEMS

Information data sheets were developed for each project and data was collected from each of the four irrigation districts The information and data secured from this survey are given in Sections 4 through 8 of this report

The following issues and or constraints related to the transfer of the four I&D Districts in the preliminary evaluation have been identified

Water Rights
In order to assure the capability to supply the designed flows, the administrative use of the diversionary water rights also needs to be transferred

Water Measurements
The rapid appraisal of each district s ability to equitably distribute water indicates that El Salvador s laws and legal responsibilities clearly imply, from the volumetric division point (water right) that initial measurement is mandated by the I&D designed water service (liters per second per hectare) Further measurement structures should be constructed within the distribution system and each individual on-farm outlet so as to assure equitable water distribution

The Value of Irrigation Water
Usually there is a value put on water 1) at the point of diversion (water right value) or 2) a cost so as to protect the water diversion volume and quality The water cost value of 2) could be equal to the GOES cost for I&D district systems monitoring which is presently estimated to be 100 to 200 Colones per Ha Overall, the high cost differential between present charges and sustainable levels of the I&D Districts indicates that a cost phasing system over a initial five year period is more realistic The standard percentages per year are usually set at 15%, 25% 25% and 25% with an allowance of 10% for slippages over time to be picked up in the last year

High Electric Energy Costs
Recently the El Salvador electrical energy sector was privatized This resulting in the formation of five electrical distribution service companies with set service areas CLESA is the electrical service company for service to Zapotitan I&D and DEL SUR is the service company for Atiocovo Norte I&D Electrical distribution companies buy power from various suppliers and then distribute/transmit energy to their areas electrical consumers/users Distribution companies add their transmission and administrative costs plus a 10% profit to the initial supply cost
The charge for Medium Demand Energy of more that 10 kw and less than 50 kw is
a) 9 68 Colones per month for commercialization and 64 63 Colones per kw/month for distribution with hourly energy rates per kwh of 0 847 Colones for High
b) 0 196 Colones per kwh for Low and
c) 0 658 Colones per kwh for Remaining Hours

Irrigation Water Tariff Structures

The normal development procedure for irrigation tariff structures would be to develop the costs of annual operations and maintenance and other long term (20 year period) costs for investment cost recovery, additional new construction, rehabilitation, major equipment repairs and replacements, training, additional technical assistance and other special items These cost would then be prorated over the 20 year period as annual expenses

To facilitate planning and budgeting for irrigation water charges, the Detailed Planning Expenses Budget format and a Summary Major Line-Item Budget format (Section 2 5 4) have been developed Once the initial detailed planning expense budget is developed, the estimated expenditures have to be balanced against income Most of the income would be in the form of water service charges However, all true I&D District income must be shown, e g , rental of equipment, and production profits off of District lands, etc All non I&D income and expenditures(land preparation and harvesting etc) must be separated

Further balancing between income and expenditures is required related to at least two other major factors (1) the true ability of the Water Users/Farmers to pay any increase, and (2) the present water rate charge Normally, any increase of over 15% will not be accepted without 70 to 85% of the WUs knowing and agreeing to any higher amount

Rapid Appraisal of WUA's Leaders Training Needs

At present there appears to be an immediate need for at least the following

- Planning and awareness of laws and other legal requirements
- Budgeting, accounting, and monitoring and evaluation procedures and practices
- Improved communications and public relations

One of the first initial TA activities needed is to develop a standard set of Rules and Regulations (R&Rs) for the I&D Districts

GENERAL SUMMARY AND RECOMMENDATIONS

All known major issues and constrains have been identified The present situation/status has been evaluated against the desired or required level for sustain ability The resulting recommendations are based on findings, observations and discussions, and take into consideration the different aspects of economic, social and political situations effecting each issue and/or constraint

With the basic initial differences in the positions of the Water Users and the GOES, it was apparent that the **NO-ACTION (status quo) scenario** would have to be evaluated The preliminary evaluation of this scenario reflects a minimum loss over a 15 to 20 year period to both parties **GOES loss of $25.0 +/- million dollars and Water Users in the range of $9 0 to $18 0 +/- million dollars** Most of this loss is in land values and reduced production due to the farmers returning to rain-fed agriculture

Negotiations on the transfer of the I&D Districts must be continued in order to resolve all related issues and constrains Detailed recommendations are listed in Section 3 of this report The following are specific recommended actions that should be taken within the next 60 to 90 days

1 Agree on a legal transfer agreement/document

2 A letter of agreement in principal covering the following points must be developed and signed

- all items mutually agreeable at this time
- define the GOES s already agreed to minimum points as the starting points for further negotiations
- agree on a time period to conclude further negotiations (September 15) and agree to either appoint an acceptable arbitrator, or arbitrators who s decisions (by 01 November) would be binding on both parties and/or ask for legal rulings that would be binding on both parties

3 During this 60-90 day period develop detailed cost estimates for each subsidy activity as to cost sharing during transfer period so that GOES can secure approval and necessary funding in order to make payments to WUAs prior to actual need This would allow WUAs to develop detailed water charge tariff structures during the transfer period

4 Each I&D District should prepare the following within 30 days for review and evaluation if necessary

a) detail physical inventories
b) detailed equipment list with following information -
Make - Model/Year - Condition - Original or Replacement Costs
c) draft planning I&D budget for July/August 1998 thru December 1999
(per forms in this report) and propose budgets for the next 4 / 5 years
d) draft separate planning budgets for all other activities per c) above

5 Items #4-a) and b) should then be attached to the transfer agreement for each separate I&D District

6 Each I&D district should adopt a set of I&D District Rules and Regulations

7 A Federation of Water Users Association should be legally formed and should undertake an information and public relations program related to present electrical energy tariff and other activities

8 Undertake the start of as many of the other recommendations as listed in Section 3

ZAPOTITAN - RESERVOIR SITE - JUNE 26, 1998

1 PRESENT STATUS

At present a 'Transfer Committee' composed of both GOES/MAG and WUA's personnel meet almost weekly in order to facilitate the preparation of a legal agreement to transfer the administration of Irrigation Districts (IDs) from GOES/MAG to the Water Users Associations (WUAs) Various points have been discussed and some documented points agreed to in principal Other activities have been completed and/or are underway

A draft legal document has been prepared and needs to be finalized This would allow transfer of administrative responsibility to the WUAs for a fifty year concession period The initial four IDs to be transferred are Atiocoyo Norte, Atiocoyo Sur, Lempa-Acahuapa, and Zapotitan At least one of these districts needs to be transferred by 31 July 1998 In general, the three older irrigation districts are to have their main systems (canals, drains and roadways, etc) rehabilitated by the GOES to the extent that donor assistance funding is available

The WUA's have been informally operating the four IDs (with MAG concurrence and in accordance with the General Irrigation and Drainage Law for forming WUAs) for approximately three plus years They have collected an Operations and Maintenance (O&M) charge (tariff) to cover only out-of-pocket operating costs However, these charges are not sufficient to cover electrical pumping costs in at least two of the Irrigation Districts with pumping stations and/or wells

Under the old tariff system the Government of El Salvador (GOES), through the Ministerio de Agricultura y Ganaderia (MAG) under the General Water Law, sets a water tariff for water service based on a prorated volume, but without actual measurements on a per hectare (ha) per year basis for each irrigation district

Recently the GOES privatized the electrical energy service sector and the new electrical rate for irrigation has more than doubled A three level tariff structure was set for energy per Kwh for the daily time periods of low, peak, and regular demand

New legislation now being drafted would form Federation of Water User Associations (WUA's) and would include the four major IDs, Atiocoyo Norte, Atiocoyo Sur, Lempa-Acahuapa, and Zapotitan The Federation would assist farmers through the WUAs in the purchase of inputs (seeds, fertilizers, etc) and commercialization (marketing and finance, etc) activities

One of the main results of this technical assistance activity (Output) will be to support the Minister and associations in finalizing the district transferring negations, and to strengthen other type of rural enterprises

2 ACTIVITIES

2 1 Financial and Economic Evaluation of WUA's Administration

General Background

At present the four I&D Districts-WUAs are assessing and collecting an out-of-pocket amount as water charges These vary from district to district The I&D Districts-WUAs are also assessing in some form or another additional costs above the available money The present financial and economic conditions are unsatisfactory, as the I&D Districts-WUAs have no legal means to enforce the collection of payments until the administrative right is transferred

Each district I&D District-WUA has a number of common problems and issues that can be addressed in general (e g an high amount of deferred maintenance) However each has some problems and issues that are common only to one other district (e g , Zapotitan and Atiocoyo Norte with high energy bills and costs due to pumping stations) Additionally each WUA has individual problems peculiar to their own district that need to be addressed, (e g , rehabilitation and/or lack of rehabilitation)

ISSUES AND CONSTRAINTS

- GOES - Law on Cost Recovery Tariff indicates the GOES should pay a minimum of 40% of investment costs However the WUA s/farmers would prefer that the GOES pay 100% of the Irrigation Districts investment costs

- An official decision on condonation of the investment debts (or at least a set percentage) and the outstanding O&M debts and power bills (and/or a set percentage of energy costs over a set time period) greatly effects any proposed tariff structures as well as effects the evaluation of the economic implications and impacts on the sustain ability of the producers involved in the irrigation districts An analysis is to be made of the amount of funds due to MAG as unpaid O&M and the investment cost recovery tariffs

- The four WUA s are presently assessing an out-of -pocket tariff rate varying from 140+ to 500+ Colones per ha /year This does not include investment costs and electrical energy costs

- If the electrical energy/pumping costs were to be added to the tariff rate it is estimated by some that it would increase the present water tariff rate to between 600 to 3,500 or more Colones per ha /yr The lower rate is for total gravity systems and the higher rate is for those systems that have pumping stations and/or wells Preliminary discussions related to present billing and tariff, have been started with the two energy distribution suppliers - CLESA for Zapotitan and DEL SUR for Atiocoyo Norte

- An estimation of savings to the GOES/MAG derived from the WUAs records after the administration take-over of the four I & D Districts, is under way However it is difficult to secure the records and the status of payments from GOES and WUA, as the present administration and record keeping by the WUAs is not at an acceptable level or pare Once the administration data is made available, an economic comparison of costs covered by the WUAs tariff, versus the expenses saved to MAG, can be completed

2 1 1 The Irrigation and Drainage Districts Administrative Transfer Status

There is no question about the desirability and the need to transfer the administration of the four I&D districts from the GOES to the WUAs This administrative transfer would be advantageous in the following ways

- The GOES would benefit by being relieved of the responsible for the cost of the administration of the four I&D districts

- The WUs would benefit from lower administrative costs resulting from the administrative cost differential of GOES versus the private sector salaries and benefits

- The WUs, who are the WUA members, would also benefit by having more direct contact with the I&D districts' administration

It is a documented fact that where I&D Districts are operated by the WUs, the operation usually goes smoothly and the level of maintenance is higher However, in this case, the sense of ownership is not complete as only the administration rights (50 year period) are being transferred This legal situation allows for issues to be raised related to who is responsible for various high cost items such as high electrical energy costs for pumping stations and wells, major repairs and replacements, as well as the status of the various I&D district systems at the time of the turn-over, etc

These outstanding cost issues have been under discussion, and in some cases debated, as to who should pay for what

All of these cost issues are over shadowed by the ability of the land owners to pay This is especially true of the smaller land owners (1-3 Ha) who are usually at only a bare subsistence level

Leaving the social/economic and political issues aside and looking at the administrative cost issue in simple terms, the main administrative savings is in the difference in administrative personnel costs of GOES compared to that of the WUAs

The following chart for estimating I&D Districts-WUAs personnel requirements and costs is based upon the evaluation of present staffing in addition to future staffing requirements New clerks will be needed to update accounts books for the new proposed tariff structure as well as record the new volumetric flow measurements systems within the irrigation system and at each on-farm delivery point

There will also be increased levels of O&M equipment usage and maintenance in addition to much needed critical maintenance The increase in personnel can be satisfied as each activity is started and/or put into operation by phased scheduling over a period of 1 to 5 years

ESTIMATED I&D DISTRICT/WUA PERSONNEL REQUIREMENTS * AND COSTS

Position/ title	**Number/ 1st 2000Ha**	**Number/each Added -500 Ha**	**Est Monthly Salary Colones**
Manager	1	0	4 500
Treasure/Sec to Board	1	0	3 500
Office Secretary	1	1	3 000
Accountant	1	1	2 500
Clerk	1	1	2,000
Office Maint	1	1	1 500
Night Watchman	1	0	1 000
Operations Foreman	1	0	2 500
Canal Operator	1	1	2 000
Asst Canal Operator	1	1	1,500
Maintenance Foreman	1	0	2 500
Equipment Operators (6 for every 5 units)			2 000
Equipment Mechanic (1 for every 5 units)			2 500
Maintenance Worker	3	2	1 500

Note * This draft is based upon the evaluation of present staffing in addition to future staffing requirements

This chart would indicate administrative personnel costs of 500 000 to 700 000 Colones per I&D district If adjusted at plus 50% for estimated GOES personnel costs, the amount would be between 750 000 to 1 050 000 Colones **By transferring the administration of the four I&D districts, the GOES would realize an average annual savings of 900,000 x 4 (districts), or 3,600,000 Colones**

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The annual savings to the Water Users would be the difference between GOES personnel costs of 3,600,000 Colones and WUAs personnel costs of 600,000 x 4 (districts) or 2 400,000 Colones **Total cost estimated savings by Water Users for the four I&Ds per year would be 1,200,000 Colones**

To calculate the average administration cost savings per Ha, the total irrigated area of the four I&D districts of (3500 + 1200 + 1704 + 2511 =) 8,915 Ha is divided into the 1,200,000 Colones savings and would **average 134 60 Colones per Ha**

Therefore, when the above numbers are taken over a 20 and 50 year period, the total amount would be

20 years	**50 years**
Savings by the GOES	
- 3,600,000 x 20 = 72,000,000 Colones	3,600,000 x 50 = **180,000,000 Colones**
Savings by the Water Users	
- 1,200,000 x 20 = 24,000,000 Colones	1,200,00 x 50 = **60,000,000 Colones**

This is a significant amount of money.

These costs will be adjusted as more detailed costs data becomes available However, the saving are initially defined by estimations (based on general numbers and information supplied as of this date), so as to allow for their use in negotiation discussions related to the administrative transfer of the four I&D Districts

It is known that the WUAs have been administratively operating various I&D District for some time Also, in the earlier years of GOES operation, the Districts were used as a source of employment and during these times the number of GOES personnel were quite high However, at this time we have no numbers and time periods available so as to make evaluations

2 1 2 Evaluation of Investment (Capital) Costs Repayments

The following is the information presently available on investment (capital) costs for each of the four Irrigation and Drainage Districts to be transferred by GOES to the WUAs

Zapotitan original construction 1969/71 at 13 0 million Colones (GOES funds)
partial rehabilitation 1996/98 at $12 0 million (Donor-Japan)
(main canal 15 wells 3 pumping stations etc)
irrigated area = 3,500 Ha
original cost = 371 43 Colones per Ha
rehabilitation cost = 28,828 57
total cost = 29,200 00 Colones per Ha

Atiocovo Norte original cost 1975-78/79 IDB - $8 0 million & GOES - $7 9 million
(both Norte & Sur together)
irrigated area = 1,200 Ha - Norte
= 1,704 Ha - Sur
total area = 2,904 Ha
cost = Norte- IDB = 23,961 94 Colones per Ha
+ GOES = 23,667 36 (1,704 Ha - Sur)
total cost = 47,629 30 Colones per Ha

Atiocovo Sur original cost 1975-78/79 IDB - $8 0 million & GOES - $7 9 million
(both Norte & Sur together)
irrigated area = 1,200 Ha - Norte
= 1,704 Ha - Sur
total area = 2,904 Ha
cost = Norte- IDB = 23,961 94 Colones per Ha
+ GOES = 23,667 36 (1,704 Ha - Sur)
total cost = 47,629.30 Colones per Ha

Limpa Acahuapa designed 1985/86, major construction started 1991/93 estimated at 70% completed in July 1998
- IDB loan = $10 9 million + $6 1 million GOES = $17 0 million
irrigated area = 2,511 Ha
- IDB = 37,765 83 Colones per Ha
- GOES = 21,135 83 (GOES) Colones per Ha
total cost = 58,900 83 Colones per Ha

Notes (1) This includes an average cost of 2 500 Colones per Ha for land leveling

(2) The IDB loan is for 40 years @ 1 percent for the first ten years and 2 percent for the 30 year balance

(3) The Lempa Acahuapa Decree calls for a repayment of the loan @ 12% interest for 20 years with a grace period of 5 years and the following subsidies

Category		Subsidy- %	Payment - %
I	- 3 Ha or less, Cooperatives & Associations of Cooperatives	100	0
II	- 3 to 10 Ha	80	20
III	- 10 to 20 Ha	60	40
IV	- 20 to 30 Ha	40	60
V	- 30 to 50 Ha	20	80
VI	> 50 Ha	0	100

Landholding (1997)

Ha	No of Owners
1 to 3	1026
3 1 to 25	441
> 25	724
total no	**2,196**

The general law states that the GOES pays a minimum of 40 % of investment costs However, the WUAs would like the GOES to pay 100 % of investment costs

The Lempa Acahuapa I&D Decree sets an acceptable precedent to continue with further discussion to resolve this issue

Atiocoyo Norte and Atiocoyo Sur systems should be put on an equal pare with Zapotitan related to rehabilitation of works and the GOES is making an effort to secure donor funding for these two rehabilitation needs

2 2 Physical Assets of WUAs

The original decrees forming the I&D districts define the physical assets, irrigation system, drainage system, and roadways by nomenclature A, B, C, & 1, 2, 3, etc , and by lengths (Kms), widths (mts), and area (Ha), in addition to buildings, pumps, and wells, etc related to the original design layout Over the years the systems have been changed Therefore, an accurate system inventory for each separate I&D District needs to be made and verified by GOES and WUAs

Additionally, the original widths of the systems and roadways have been encroached upon by landowners, e g (1) The fence-lines have been moved on to the canal banks and trees now grow on the banks and right-a-ways (2) Landowner fence-lines have decreased the actual parallel roadways widths from 7 0 (mts) to 4 0 (mts) or less

The growth within the canal banks and right-of-ways especially the now large trees cause an increase in evapotranspiration of water and higher than normal water loss from the systems

In the original decrees the drainage systems defined were natural depressions and or lower valleys through which the water drained eventually flowing into rivers These more-or-less natural drainage systems were never maintained and as a result they have also been encroached upon

The administration of the original I&D District decrees as to lengths widths and areas should be transferred but the WUAs should be required to operate and maintain only the present actual useable lengths widths and areas If desired an over-time program to recover the full right-of-ways can be developed

2 2 1 Buildings, Structures and Stationary Equipment

These assets should be transferred in a similar format to that of the physical assets It should be noted however that the difference between the original decrees and the present inventory lists should be an individual district amendment

2 2 2 Mobile Equipment

An accurate up-to-date inventory should be made and should include the make, model year (age) and present condition These inventories can then be compared to needs and costs for further discussions At the minimum all non-usable equipment should be returned to the GOES for disposal and/or salvage A transfer memorandum can be developed based on transfer methodology needs and an understanding of cost responsibility, etc

To facilitate this transfer a present inventory list needs to be developed to include the following

Make	Model/Year	Present Condition		
		Operational	Needs Repairs	Non-usable (Non-usable equipment should be returned to GOES)

As the transfer agreement will only transfer the administrative responsibilities from GOES/MAG to the WUAs and the assets will still legally remain with the GOES there will always have to be a GOES assets monitoring presence

A Evaluating and Costing of Mobile Heavy Equipment

Procedures

The basic procedures for evaluating mobile heavy equipment related to the cost of purchasing, operating & maintaining, are as follows

- Each piece of equipment should have a projected life use of a minimum of five years or more
- When calculating depreciation and replacement costs, the minimum number of workdays used per year should be between 150 to 200 days This figure is based upon an average of 260 working days per year 200 workdays per year would be approximately 1,500 machine hours per year

When the equipment is used to this extent, the employment of an equipment operator and/or an operator with other part-time duties is necessary For each equipment operating group of three to five units, an additional operator is required This will allow all equipment within the unit to be used when not all operators are available Most experienced heavy equipment operators can operate more than one model or type of unit (e g , motor graders, dozers, tractors, backhoes, loaders, etc) as each piece of equipment requires similar operating skills

Cost Example

A Caterpillar model 70 motor grader with an estimated original cost of 1,500,000 Colones and a estimated life of between 12 to 15 years (based on 1500 hours per year of machine usage) has the following machine hour overhaul requirements

Machine Hours	Maintenance	Cost
first 5,000 machine hours or 3 to 4 years	minor overhaul	est at 20% of original cost or 300,000 Colones
first 10,000 machine hours or 6 to 8 years	major overhaul	est at 40% of original cost or 600,000 Colones
each additional 3,000 machine hours above the first 10,000 or every two years	minor overhaul	est at 20% of original cost or 300,000 Colones
20,000 to 25,000 machine hours or between 12 to 15 years	rehabilitation	est at a minimum of 60% of original cost
	salvage	est at a maximum of 30% of original cost
	replacement	est at double the original cost plus 7% inflation rate

Annual O&M costs average 15% of the cost of the original machine Over a minimum of 5 years and up to 15 years the O&M cost would be 225 000 Colones per year without inflation To this annual O&M cost a one year prorated portion of the average cost is added in order to arrive at an annual O&M budget

For example

a) 3 minor overhauls at 300 000 Colones per equals 900 000 Colones

b) 1 major overhaul at 600 000 Colones

and adding either of the following

c) rehabilitation for 900 000 Colones equals a 20 year total cost of 2 400,000 Colones
Prorating the total of **a)**, plus **b)** plus **c)**, or 2 400 000 Colones over 20 years gives a total annual amount of 120 000 Colones to be added to the annual O&M cost of 225 000 for a total yearly O&M budget of 345 000 Colones

or

d) replacement for double the original cost of 3 000 000 less 30% of original for salvage for a total replacement cost of 2,500 000 Colones
Prorating the total of **a)**, plus **b)** plus **d)** or 4,050 000 Colones over 20 years gives an annual amount of 202,500 Colones to be added to the annual O&M cost of 225,000 for a total yearly O&M budget of 427 500 Colones

These evaluation and cost procedures usually give an average amount of 150% to 170% of the annual O&M cost of 225 000 Colones (without inflation) for a range of 338 000 to 383,000 Colones

If the deviation from the 1 500 machine hours of estimated annual machine usage is within + or - 15% the cost could then be prorated However if the estimated annual machine usage is above or below 15%, then the estimated useful life and cost factors would have to be recalculated Much of the recalculating process would then depend in part upon an evaluation of the effects of actual preventative maintenance levels, corrosion etc

For example, if the motor grader was used only in the range of 700 to 1,000 machine hours per year then a recalculation of the annual O&M costs would reflect a figure too low to justify purchasing, operating and maintaining the unit

B Application of the Above Procedures to the Issues of Transfer of Equipment and the Related Costs

The application of the evaluation and cost procedures in evaluating Irrigation & Drainage District mobile equipment needs, as well as the O&M and replacement costs, gives unacceptable high costs related to the WUAs ability to maintain and replace mobile heavy equipment

In order to properly evaluate the equipment, under the present conditions, the following actions need to be taken

- Prepare equipment inventory lists per format already developed
- Secure original equipment costs and/or present replacement costs
- Add the information concerning 'average number of workdays used per year to the equipment list
- Compare and evaluate the need for the construction equipment presently available for transfer to O&M uses, to that of the actual equipment needed Usually, there is little need for tract-type tractor equipment for I&D maintenance However, consideration should be given to other uses for this type of equipment such as land leveling, etc

Estimated I&D District -O&M Equipment Needs	**2,000/Ha**	**3,500/Ha**
Pick-up (4-w/d -1-single cab & 2 double cab)	3	3
Motor cycles (2-canal Opts & 1/2 maint)	3	4
Motor grader (caterpillar #110)	1	1
Loader/ Backhoe (extended) -1/2 yd	1	2
Dump Trucks (5-ton)	2	3
Truck (1-1/2 to 2 ton)	1	1
Portable concrete mixers (½ yd)	1	2
Portable Welder -w/ cutting torch	1	1

These high costs should be subsided by GOES during the lst period of the 5 year transitional period at percentages - similar to electrical costs

Minor and major repairs, replacements and rehabilitations, as well as the responsibility for payment should be defined These definitions need to be accepted by GOES and WUAs Additionally, related to the transfer agreement, there is the need to define what is considered major and minor repairs related to civil works, mechanical and electrical

The following draft for discussion and acceptance is the proposed methodologies for defining the terms 'minor' and 'major' as they would apply to the various assets

'MINOR' - Minor is defined as all annual O&M (the costs of O&M for all facilities based on their estimated useful life
For example

a) civil works = 20 yrs
b) mechanical works = 5 10 15 yrs
c) electrical = 3, 5, 7 (and related number of electrical starts) and
d) mobile equipment = 2 3, 5 yrs

All these are equated back to an overall annual cost number plus costs for critical maintenance These are defined as *the maintenance that is required to keep the I&D district at a normal operational level from year to year* (For present estimation calculations we are using one percent of total investment/capital costs)

'MAJOR' - Major is defined as those repairs and replacements costs above the defined MINOR costs (annual O&M plus critical costs) above and that meet the additional criteria of

a) > 15% of the budgeted line-item cost
b) > 10% of the budgeted total over-all contingence
c) and are not due to negligence
d) For pumps and wells, and mechanical equipment and/or mobile equipment a basic cash value number could be used (e g > 200 000 Colones)

2 3 Rapid Appraisal of Water Districts Distribution and Metering Systems

In order to assist in the identification of the above activities, information/data sheets were developed for each project and data was collected from each of the four irrigation districts The information and data secured from this survey form are given in this report, sections 4, 5, 6, and 7

The following issues and/or constraints related to the transfer of the four I&D districts in the preliminary evaluation have been identified

2 3 1 Water Rights

In order to assure the capability to supply the designed flows the administrative use of the diversionary water rights also needs to be transferred However, the GOES needs to take every effort to protect the volume and quality of water for the benefit of all concerned This is an important aspect now and in the future, as there will be an ever increasing demand for this natural resource Flows have already diminished due to deforestation and increased water divisions, and noticeable degradation in water quality has occurred

2 3 2 Water Measurements

The rapid appraisal of each district's ability to equitably distribute water indicates that El Salvador's laws and legal responsibilities clearly imply, from the volumetric division point (water right) that initial measurement is mandated by the I&D designed water service (liters per second per hectare) Further measurement should be carried out within the distribution system and to each individual on-farm outlet so as to assure equitable water distribution

The original I&D designs were based upon an acceptable cropping pattern (water demand), estimated system losses and/or efficiency (%) and an on-farm irrigation efficiency (%) Therefore, system diversion/measurement structures and on-farm outlet/measurement structures were constructed

However, over time, due to various factors, the use for the most part of measurements within the distribution system and at the on-farm outlets has been abandoned Most of the irrigation systems are now being operated on an visual estimation of flows based on experience and needs, etc

Therefore, the immediate need to re-instate volumetric measurements at all irrigation levels is mandated Tariff structures that are based on volumetric measurement are more flexible and easier to manage

At present the lack of water measurement devices and structures within the irrigation and drainage systems has led to operational practices that generally deliver twice as much water is actually needed

This is due to various factors to include

a) the loss of the original design criteria related to water measurements,
b) lack of system flow management procedures,
c) high system losses,
d) low on-farm irrigation efficiencies, and
e) interruption of system usages, etc

As a result, the water user has a limited understanding of the value of irrigation water

The common practice of using visual estimation of water flows usually provide 50 to 100 percent more water to the farmer than originally designed

For example

- In Atiocoyo Norte district, the farmers are only second cropping rice on ½ of the irrigated area

- In Atiocovo Sur during periods of high river flows the system is being operated above the canal s original designed water surface level This is done by using the cross-sectional area of the freeboard (area above the designed water surface level and the top of the lining) and in some canal sections over the top of the lining In other canal areas the top of the lining has been raised by adding a coping (an additional top layer) to the canal linings to help prevent water from over-toping
- In Zapotitan parts of the system show the same operational situations as in Atiocovo Sur with certain minor modifications
- As only parts of Lempa Acahuapa are now receiving water service there is a surplus of water for delivery to the areas presently being irrigated

Irrigation plots receiving excessive amounts of water is now a common and accepted practice Therefore, there is little interest or concern over the need and advantage of volumetric water measurements This lack of interest and understanding of the value of irrigation water and the value of water measurements predicate the development of the re-instatement of water measurement at all irrigation levels

2 3 3 The Value of Irrigation Water

Establishment of a Value for Irrigation Water

1 There are 10 000 sq m in one hectare and if, during the irrigation season (Nov 15 to March 30 - 165/170 days), there were 10 irrigation sessions of 10 cm each equaling 1 0 meter, the volume of water passing through the on-farm delivery point would be 10 000 m3

a) - @ 350 Colones per Ha charge the value of water per m3 = 0 035 Colones
b) - @ 500 Colones per Ha charge, the value of water per m3 = 0 50 Colones
c) - @ 2,100 Clones per Ha charge, the value of water per m3 = 0 21 Colones
*[**a) b)** and **c)** are derived by dividing costs by 10 000 m3]*

2 The 2 100 charge is an estimated average charge for additional electric energy cost for the first three years This is assuming that GOES pays 80% - 1st year, 60% - 2nd year 40% - 3rd year, 20% - 4th year and 0% - 5th year, and after the 3rd year the Electrical Distribution Companies revise their tariff structure (allowed by the contract) to subsides agricultural pumping, plus an increase in on-farm irrigation efficiency should be developed by that time

3 The excessive irrigation water either runs off at the end of the field (tail water) and/or is lost due to inefficient irrigation (deep water percolation though the soil below the needed depth) The cost of this water is estimated at either 0 035 (gravity) or 0 21 (pumped) Colones per m3

4 Measurement is a means of monitoring and controlling water losses and therefore, is needed on all irrigation systems However, due to the cost factor, the first priority must be given to the areas with high pumping (energy) costs

5 Usually there is a value put on water at the point of diversion (water right value) or there is a cost so as to protect the water diversion volume and quality However, the cost value of (2) could be equal to the GOES costs for I&D district systems monitoring, presently estimated to be 100 to 200 Colones per Ha

The present and ever increasing value of water used for irrigation, mandates system wide and on-farm volumetric measurement policies The initial costs of introducing measurement structures - construction, operations and maintenance, in addition to record keeping, can be distributed over a five year transition period

Overall, the high cost differential between present charges and sustainable levels of the I&D districts indicates that a cost phasing over a initial five year period is more realistic The standard percentages per year are usually set at 15%, 25%, 25%, and 25%, with an allowance of 10% for slippages over time to be picked up in the last year

2 4 High Electric Energy Costs

Recently the El Salvador electrical energy sector was privatized This resulted in the formation of five electrical distribution service companies with set service areas CLESA is the electrical service company for service to Zapotitan I&D, and DEL SUR is the service company for Atiocoyo Norte I&D The electrical distribution companies buy power from various suppliers and then distribute/transmit the energy to their areas electrical consumers/users The distribution companies add their transmission and administrative costs plus a 10% profit to the initial supply cost

The present electrical tariff structure is based on a simple three demand levels

a) *Low* = 10 kw or lower,
b) *Medium* = more than 10 kw & less than 50 kw,
c) *Large* = more than 50 kw with charges for commercialization, energy and distribution

Within these demand levels are three separate energy rates according to usage within a set daily time (hours) periods

a) High hours = 18 00 to 22 59,
b) Low hours = 23 00 to 04 59, and
c) Remaining hours = 05 00 to 17 59

The charge for medium demand is

a) 9 68 Colones per month for commercialization and 64 63 Colones per kw month for distribution with hourly energy rates per kwh of 0 847 Colones for High
b) 0 196 Colones per kwh for Low and
c) 0 658 Colones per kwh for Remaining Hours

All electrical distribution companies are to operate under the same tariff structure and procedures This tariff structure was based on a study done for CEL prior to privatization However before the negotiations were finalized, an additional requirement was added to the distribution contracts It required an off-setting credit for time periods of non-supply of electrical service - (3 hours credit for 1 hour of outage)

Most of the newer larger electrical meters have the capability to record the total usage within the time periods but not the length of time nor during which usage time period the outages occur Therefore the distribution companies are estimating this amount, if any for consumer/user credit

Continued discussions with electric companies are necessary and developing a memorandum based on an initial transfer time period (5 years ?) with proration of energy costs should be considered This would allow time to develop a long term solution

2 5 Irrigation Water Tariff Structures

2.5 1 Basic Irrigation Water Tariff Structures

RATE - BASES	ROTATION PERIOD	FLOW PERIOD
1 **Flat Rate/Ha** (based on design)	- set rotation periods	- flow period related to area

Present practice at Zapotitan Atiocoyo Norte and Atiocoyo Sur (However Atiocoyo Norte has a modification related to 2nd cropping of rice)

2 **Crop Modified Flat Rate** (based on crop within designed limits)	- rotation periods set per crop	- flow period related to crop and area

Present practice at Lempa Acahuapa with 56 measuring structures to the Unit level (53 Units within the 2511 Ha) however the system was designed for gravity service base on 18 hours per day six days per week

3 **Basic Set Volumetric Rate** (based on design) - set rotation periods - flow period related to area

This was the basic original design concept for all four irrigation districts however the measurement concept on the three older districts has been lost over time etc

4 **Gravity Modified Basic Set Volumetric rate** - set rotation periods - flow periods related to area

(Within designed limits, during periods of high river flows and low water service demands, flow rate is increased by increased head and/or area of opening)

- No increase in water costs

Presently being done to some extent by using visual flow estimation procedures in the three older districts which provides more water to the farmers than original design

5 **Pumped Modified Basic Set Volumetric Rate** - set rotation periods - flow periods related to crop and area

(Within designed limits and if rotational scheduling permits, irrigation can continue into night and/or during peak energy periods, but penalty charges for excessive water above set period volume at approximately double the regular pumped rate)

Due to the high cost of electrical energy for pumping some form of additional energy charges is mandated for immediate implementation

There are various other combinations and/or modifications to the above tariff structures that can be used However, as in all cases the charges have to be in direct proportion to costs of water services or have to be used as a penalty to promote efficient use of irrigation water

2 5 2 Volumetric Rates

Lempa Acahuapa's present procedure for scheduling Water Service based in part on crop water requirements/needs per Mz

Maize, Cana, & Pasture	@ 1,000 m3 once per week per Mz
Rice	@ 1,000 m3 twice per week per Mz
Vegetables	@ 500 m3 twice per week per Mz

Note 1 000 m3 spread over 7 000 sq m would be equal to a depth of 14 3 cm approximately 15 cm equals 6 inches which is a common irrigation application rate

Based on the above procedure

Rice with a 120 day growing season, and two applications per week for an average of 34 irrigation applications per growing season (1,000 m3 x 34) = 34,000 m3/Mz, with 7,000 sq m /Mz, equates to a season total application rate of approximately **4 9 meters of water**

Maize/corn and vegetables with a 90 day growing season and weekly application rates of (1 000 m3 x 12) = 12 000 m3/Mz with 7 000 sq m/Mz equates to a season total application rate of approximately **1 7 meters of water** Three seasons per year would equal about 5 1 meters of water

If all land owners water users are to receive equal volumes of water area year then a water user farmer could decide if he is better off with one season of rice or perhaps three seasons of corn vegetables per year as each would take the same approximate volume of water for the same basic flat rate charge for equal volumetric water service

Therefore if **35,000 cu m** were the set volume per Mz and it cost **0 02** Colones per m3 to distribute gravity water then the gravity water tariff rate per Mz would equal 700 Colones /Mz or (700 x 1 43) = **1,001 00 Colones per Ha** If gravity costs were 0 04 /m3 then it would cost **2,002 00 Colones per Ha**

If electrical pumping costs raised the water distribution costs to 0 20 Colones per m3 it would cost **10,010 Colones per Ha** In the first year if the GOES were to contribute 80% of electrical energy cost ('0 000 minus 1 000 = 9 000 @ 80% = 7 200 Colones the payment rate would then be 10,000 minus 7,200 = **2,800 00 Colones per Ha**

If electrical pumping costs raised the water distribution costs to 0 50 Colones per m3 it would cost would be **25,025 Colones per Ha**

An evaluation of the above cost factors for electrical energy on pumping service dictates that considerations must be given to lowing the base volumetric amount of 35,000 m3 to **25,000 m3 per Mz** @ 0 20/m3 = 5,000 Colones /Mz or 5 000 x 1 43 = 7,150 Colones /Ha Then by applying a first year GOES - 80% electrical energy contribution (7 150 - 1 000 = 6 150 @ 80% = 4 920 Colones, the payment rate would be 7 150 - 4, 920 = **2,230 00 Colones per Ha** The **difference** between 35,000 m3 and 25,000 m3 is 2,800 - 2 230 = **570** Colones per Ha

However if the set volumetric rate per area (Mz or Ha) in an irrigation district (Zapotitan) is reduced in the pumping areas then in order to be equitable shouldn t there also be a reduction in the gravity area? **There are pros and cons related to this 'equitable issue' within the same district**

2 5 3 Development Procedures for Irrigation Tariff Structures

Planning and Budgeting

Normal development procedure for irrigation tariff structures would be to develop the costs of annual O&M and other long term (20 year period) costs for investment cost recovery additional new construction, rehabilitation, major equipment repairs and

replacements training, additional technical assistance and other special items These cost would then be prorated over the 20 year period as annual expenses

To facilitate planning and budgeting for irrigation water charges, the attached Detailed Planning Expenses Budget format and a Summary Major Line-Item Budget format have been developed

In all costs evaluations, benefits and projections, the effect of annual inflation has not considered It is believed inflation is more accurately handled by annual adjustments during the annual budget planning This methodology is used in all cases except the replacement of large, costly items (mobile equipment) at the end of normal useful life

Therefore, during the annual planning and budgeting period, annual adjustments for inflation must be included in setting annual tariff rates

Once the initial detailed planning expense budget is developed, the estimated expenditures have to be balanced against income Most of the income would be in the form of water service charges However, all I&D district income must be shown, e g , rental of equipment, land preparation charges /fees, and production profits off of district lands, etc

As indicated in the section on mobile equipment costing, if the districts use of each unit is below the minimum usage level of 150 to 200 working days per year, then income could be derived from renting this equipment either at an hourly rate or for agricultural uses at an area-rate charge These service practices are already being used to some extent However, these practices should be balanced against district needs and then policies can be developed, controlled and monitored so as to prevent abuse

Normally, the first draft of expenses exceeds the present income Therefore, as the water charges are the major source of income, the water rates have to be adjusted

At the I&D Districts 23 July Transfer Workshop, a good way to lower cash water rates was discussed This was to have a high input of contributed manual labor by the WUs for maintenance of the system The rate value difference between providing 1 day of contributed labor versus 15 days of water at 35 Colones per day is, 35 Colones x 14 days per WU x 200 WU, equals 98,000 Colones

Further balancing between income and expenditures is required related to at least two other major factors, (1) the true ability of the WUs/farmers to pay any increase, and (2) the present water rate charge Normally, any increase of over 15% will not be accepted without 70 to 85% of the WUs knowing and agreeing to any higher amount

Therefore certain needed and/or desired activities must be accomplished over a set period of time under a planned program For example WUAs staff increases to the needed levels can be accomplished over the transfer period as GOES personnel are removed under an agreed set schedule However staffing numbers and training needs must also have a planned coordinated program

Another method of initially balancing the farmers ability to pay is to have tariff structures that subsidizes the small farmer in relation to size of land holding

Examples of three different general types of irrigation tariff structures are reflected below using an I&D district with total irrigatable area of 2 500 Ha and an average irrigated area of 1 800 Ha

Tariff Structure # 1		**Colones**
Assessment on the total irrigatable area of 2 500 Ha @ 100 00/Ha (All lands that qualify to request water service)	=	250,000
Basic Allocation Block of 4 0 meters = 40 000 m3 @ 750 00/Ha 1 800 Ha x 750 00	=	1,350 000
Total Income	=	1,600,000
or		
Alternatively 1 800 Ha @ 889 00 +/- (Only lands irrigated)	=	1 600,000

Tariff Structure # 2		**Colones**
Assessment on the total irrigatable area of 2,500 Ha @ 100 00/Ha (All lands that qualify to request water service)	=	250,000

Rates related to size of landholdings

Ha	No of Land Owners	Rate/Ha		
1 - 3	800	350	=	280 000
3 - 9	300	500	=	150,000
10- 24	200	650	=	130,000
25- 50	150	800	=	120,000
> 50	50	1,000	=	50 000
	Total Income		=	980,000

Tariff Structure # 3		**Colones**
Assessment on the total irrigatable area of 2,500 Ha @ 100 00/Ha (All lands that qualify to request water service)	=	250,000
Allocation 1st Block of 2 0 meters = 20,000 m3 @ 500 00/Ha 1,800 Ha x 500 00	=	900,000
Allocation 2nd Block of 1 0 meters = 10,000 m3 @ 300 00/Ha 1,000 Ha x 300 00	=	300,000
Allocation 3rd Block of 1 0 meters = 10,000 m3 @ 300 00/Ha 500 Ha x 400 00	=	200,000
Total Income	=	1,650,000

or

Alternative Block of 5 0 meters = 50,000 m3 @ 1,000 /Ha 1,800 Ha x 1,000 (Only lands irrigated)	=	1,800,000

The most equitable tariff system is Tariff # 3, especially in an I&D district with high electrical energy pumping costs that must be added to the expenditure side of a balanced water tariff charge structure

Attached is a 2 page notice of 1998 Water Rates and Allocation for the Central California Irrigation District, Los Banos, California as a reference It reflects conditions starting to occur in El Salvador,
(1) competition for water (water rights),
(2) the need for WUs to beneficially use water and to conserve, not waste water, and
(3) the rate structure provides economic incentives to the water user for using water beneficially

Note An acre foot (a f) Is a volume of water one foot(12" or 30 cm) high over one square acre at $10 00 a f = $0 01/m3 or 0 09 Colones/m3, @$40 00 = 0 36 Colones m3

2 5 4 Proposed New WUA's Tariff Structure

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ANNUAL BUDGET - LINE ITEMS

1998/99 (year)

Income		Estimated Amount
Water Charges		
Total Irrigatable Area	@	_____
Area Irrigated	@	_____
Equipment Rental		_____
Services provided		_____
Land Profit/income		_____
Other Income		_____
Total Income		_____

Expenditures

	Items	Cash Cost	Contributed Labor
1 0	Administration	_____	_____
2 0	Annual O &M	_____	_____
2 1	Operations	_____	_____
2 2	Maintenance	_____	_____
2 2 1	Irrigation system	_____	_____
2 2 2	Drainage system	_____	_____
2 2 3	Roadway system	_____	_____
2 2 4	Mobile Equipment	_____	_____

	Items	Cash Cost	Contributed Labor
3 0	New Construction	_____	_____
3 1	Measuring Structures	_____	_____
3 1 1	distribution system	_____	_____
3 1 2	on-farm	_____	_____
4 0	Investment Recovery &/or Replacements	_____	_____
4 1	Civil Works	_____	_____
4 2	Mechanical / Electrical Works	_____	_____
4 3	Mobile Equipment	_____	_____
5 0	Transitional Costs (5 year period)	_____	_____

5 1	Training WUA -staff and Board of Directors	_____	_____
5 2	Additional Technical Assistance	_____	_____
Sub-total (1 - 5)		_____	_____
Contingencies (15% of sub-total)		_____	_____
Total Expenditures		_____	

Total Numbers of Irrigatable Ha _____

Average Cost per HA _____

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PROPOSED NEW WUA's DETAILED TARIFF STRUCTURE EXPENDITURES

Items		Cash Cost	Contributed Labor
1 0	**Administration**		
1 0 1	- personnel	_____	_____
1 0 2	- material & supplies	_____	_____
1 0 3	- utilities		
	1 0 3 1 - electric	_____	_____
	1 0 3 2 - gas	_____	_____
	1 0 3 3 - telephone/fax	_____	_____
	1 0 3 4 - radio	_____	_____
	1 0 3 5 - other	_____	_____
1 0 4	- office equipment		
	1 0 4 1 - typewriter	_____	_____
	1 0 4 2 - copy machine	_____	_____
	1 0 4 3 - computer/printer	_____	_____
1 0 5	- transportation	_____	_____
1 0 6	- miscellaneous	_____	_____
2 0	**Annual O &M**		
2 1	**Operations**		
2 1 1	- personnel	_____	_____
2 1 2	- material & supplies	_____	_____
2 1 3	- electrical costs/pumping	_____	_____
2 1 4	- equipment		
	2 1 4 1 - consumables	_____	_____
	2 1 4 2 - maintenance	_____	_____
	2 1 4 3 - replacement	_____	_____
2 1 5	- transportation	_____	_____
2 1 6	- miscellaneous	_____	_____

	Items	Cash Cost	Contributed Labor
2.2	**Irrigation Maintenance**		
	2 2 1 - personnel		
	2 2 2 - material & supplies		
	2 2 3 - electrical costs		
	2 2 4 - equipment		
	2 2 4 1 - consumables		
	2 2 4 2 - maintenance		
	2 2 4 3 - replacement		
	2 2 5 - transportation		
	2 2 6 - miscellaneous		
	2 3 Drainage Maintenance		
	2 3 1 - personnel		
	2 3 2 - material & supplies		
	2 3 3 - electrical costs		
	2 3 2 4 - equipment		
	2 3 2 4 - consumables		
	2 3 2 4 - maintenance		
	2 3 2 4 - replacement		
	2 3 2 5 - transportation		
	2 3 2 6 - miscellaneous		
	2 4 Roadway Maintenance		
	2 4 1 - personnel		
	2 4 2 - material & supplies		
	2 4 3 - electrical costs		
	2 4 4 - equipment		
	2 4 2 4 - equipment		
	2 4 2 4 - consumables		
	2 4 2 4 - maintenance		
	2 4 2 4 - replacement		
	2 4 2 5 - transportation		
	2 4 2 6 - miscellaneous		
2 5	**Mobile Equipment**		
	2 5 1 - personnel		
	2 5 2 - material & supplies		
	2 5 3 - electrical costs		

	Items	Cash Cost	Contributed Labor
	2 5 4 - equipment		
	2 5 4 1 - consumables	_____	_____
	2 5 4 2 - maintenance	_____	_____
	2 5 5 - transportation	_____	_____
	2 5 6 - miscellaneous	_____	_____
3 0	**New Construction**	_____	_____
3 1	**Measuring Structures**		
	3 1 1 Distribution System		
	3 1 1 1 - labor	_____	_____
	3 1 1 2 - material & supplies	_____	_____
	3 1 1 2 - transportation	_____	_____
	3 1 1 3 - quality control/ management supervision	_____	_____
	3 1 2 On-farm		
	3 1 2 1 - labor	_____	_____
	3 1 2 2 - material & supplies	_____	_____
	3 1 2 2 - transportation	_____	_____
	3 1 2 3 - quality control/ management supervision	_____	_____
4 0	**Investment Recovery &/or Replacements**	_____	_____
4.1	**Civil Works**	_____	_____
4.2	**Mechanical / Electrical Works**	_____	_____
4 3	**Mobile Equipment**	_____	_____
5 0	**Transitional Costs (5 year period)**		
5 1	**Training WUA - Staff and Board of Directors**		
	5 1 1 - planning, budgeting, accounting	_____	_____
	5 1 2 - water measuring & accounting	_____	_____

Items	Cash Cost	Contributed Labor
5 2 Additional Technical Assistance		
5 2 1 - TechnoServe (above present level & time)	________	________
5 2 2 - Others	________	________
Sub-total (1 - 5)	________	________
Contingencies (15% of sub-total)	________	________
Total Expenditures	________	________

Irrigated Area Ha ________________

Average Cost per Ha ________________

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2 6 Rapid Appraisal of WUA's Leaders and Staff Training Needs

WUAs Leaders

At present there appears to be an immediate need for training in at least the following areas

- Planning and awareness of laws and other legal requirements
- Budgeting accounting, and monitoring and evaluation procedures and practices
- Improved communications and public relations

As reflected at the 23rd of July Workshop, the "voice" of the Federation of Water Users Association is 5 to 10 times greater than the voice of a single WUA This is especially true related to requesting changes in the present electrical energy tariff charges for pumping

The new Federation of Water Users Association should be quickly and legally formed and immediately start information and public relations activities

WUAs Staffs

The four I&D District s staff are at different levels and using different practices However, all WUAs staff need training in basic office procedures as well as other standard programs

Managers Accounts and other key personnel should meet and establish common uniform practices and procedures Then, training should start in the following fields planning, budgeting, accounting and record keeping, computers and software programs, e /g Word Perfect & Excel/ Quart Pro, and water measurement practices

Training methodology

a) Short Courses 5 - 10 day Workshops
b) On-the-job
c) Self-paced programs

2 7 Rapid Appraisal of WUA's Future Technical Assistance (TA) Needs

2 7 1 Initial Transfer Activity TA Needs

I&D Districts Rules & Regulations

One of the first initial TA activities needed is to develop a standard set of Rules and Regulations (R&Rs) for the I&D Districts Related to this, TechnoServe (TNS) has developed a draft set of R&Rs in Spanish for review and adaptation To aid in this activity, an English copy of the R&Rs for the Central California Irrigation District, Los Banos, California, has been provided to TNS and is included as an attachment to this report

It is recommended that TNS review these English R&Rs and if necessary and/or desirable make changes in their draft Spanish R&Rs Each I&D district should have the ability to add special clauses that would apply to only their individual district These revised R&Rs should be reviewed by local attorneys familiar with GOES and I&D laws before the R&Rs are formally adapted by each District

2 7 2 Transfer Period Activities TA Needs

Improving On-farm Irrigation Efficiencies

It is a well known fact that in addition to installing measuring structures, one of the next activities to increase On-farm irrigation efficiencies would be to improve land leveling This was recognized by the Lempa Acahuapa District as it was included it's construction activities The present land leveling methods used at the Lempa Acahuapa District are older practices However, it is understood that TNS is planning to bring more modern

practices to El Salvador These practices will include computerized leveling programs and laser technology leveling equipment Technical assistance from TNS should be requested and if necessary donor funding to implement new land leveling practices within the four I&D Districts

2 7.3 Long Term Activities TA Needs

As it will not be possible to achieve full completion of all of the activities started during the transfer period the above mentioned activities should continue as phased activities during the Long Term Period

3 0 GENERAL SUMMARY AND RECOMMENDATIONS

All known major issues and constrains have been identified The present situation status has been evaluated against the desired or required level for sustain ability The resulting recommendations are based on findings observations and discussions and take into consideration the different aspects of economic social and political situations effecting each issue and or constraint

With the basic initial differences in the positions of the Water Users and the GOES it was apparent that the **NO-ACTION (status quo) scenario** would have to evaluated The preliminary evaluation of this scenario reflects a minimum loss over a 15 to 20 year period to both parties **GOES loss of $25 0 +/- million dollars and Water Users in the range of $9 0 to $18 0 +/- million dollars** Most of this loss is in land values and reduced production due to the farmers returning to rain-fed agriculture

Negotiations on the transfer of the I&D Districts must be continued in order to resolve all related issues and constrains

3 1 Investment (Capital) Cost Recovery Payments

The investment information for each of the four I&D districts reflected in Section 2 1 2 confirms that an acceptable solution to the situation must be negotiated

All older investment costs must be considered as sunk costs with no repayment Repayment should only be required for recent loans and should include subsidies for land owners per Lempa Acahuapa Decree These are acceptable starting points if further negotiations are needed

However the TechnoServe report Evaluacion Critica del Proyecto de Desarrollo Agricola Lempa-Acahuapa El Salvador Diciembre 15 1997 reflects that 92% of the Users would pay for 48% of the loan while 8% (larger landholders) of the Users would have to pay 52% of the loan This coupled with the difference in interest rates (IDB loan at 1 & 2% and Decree repayment at 12% interest) requires further evaluation and perhaps further negotiations

3 2 Outstanding Water Charges

The possibility of GOES forgiving all outstanding charges should be discussed If this is not possible, negotiations on repayments based on size of landholdings per Lempa Acahuapa Decree or other prorations should be considered

3 3 Personnel Costs

Transferring the Four I&D Districts to WUAs will generate the following savings

a) **GOES** estimated savings over the 50 year period = **180,000,000 Colones**
b) **Water Users** estimated savings over the 50 year period = **60,000,000 Colones**

Note Prior WUAs operational savings to GOES are unknown at this time due to lack of available data

These cost values should be used as trade-off value for GOES subsidies granted

3 4 Heavy Mobile Equipment Major Repairs and Replacement Costs

In order to properly evaluate the equipment, under the present conditions, the following actions need to be taken
a) Prepare equipment inventory lists per format already developed
b) Secure original equipment costs and/or present replacement costs
c) Add the information concerning 'average number of workdays used per year' to the equipment list
d) Compare and evaluate the need for the construction equipment presently available for transfer to O&M uses, to that of the actual equipment needed Usually, there is little need for tract-type tractor equipment for I&D maintenance However, consideration should be given to other uses for this type of equipment such as land leveling, etc
e) Define minor and major repairs, replacements and rehabilitations, as well as the responsibility for payment These definitions need to be accepted by GOES and WUAs

The high costs of major repair and replacement of equipment need to be subsidized by GOES during the 1st period of the 5 year transitional period at percentages similar to that of electrical costs

3.5 Water Measurements

Phased construction program and training of both WUAs staff and Water Users in measurement practices must be implemented Investment costs and added O&M costs must be established These costs will be off-set by the value of volumetric water measurement benefits, e g tariff structures based on water volumes, increased on-farm irrigation efficiencies, etc

3 6 Water Tariff Structure

When all the costs that make up an irrigation water tariff structure that has the ability to maintain a sufficient level of sustain ability are included the cost differential between the present tariff and what should be required are much higher than the present water users ability-to-pay It is recommended that a **three phase approach** is used to resolve this problem (1) Initial Phase (2) Transitional Phase of five years and (3) a 15 year Betterment program in order to bring the districts up to an acceptable level for sustain ability

(1) Initial Phase (Period between now and September /October 1998 or no later than January 1999)
Activities

- Conclude and sign legal transfer agreement
- Make and complete Addendums for each separate I&D District
- Agree on all GOES subsidy amounts
- Start WUAs staff training
- Increase Technical Assistance levels
- Formally start Federation of WUAs
  (With emphasis on marketing)

(2) Transitional Phase (Five years - 1999 to 2004)
Activities

- Operate with the financial assistance of GOES subsidies
- Negotiate new electrical energy tariff for irrigation pumping
  (before the tariffs are due for adjustments in three years)
- Install measuring structures phasing from diversion point to on-farm, with emphasis on areas with high electrical energy costs
- Improve on-farm irrigation efficiency
- Provide assistance in crop planning budgeting and marketing
- Develop "Betterment" Program based on experience

(3) "Betterment" Phase (15 years - 2005 - 2020)
Activities

- Add additional measurement structures/devices
- Pick-up portions of deferred maintenance
- Continue to improve status of roads and drains (upper levels)
- Continue to improve on-farm irrigation efficiency
- Improve costs controls on water service charges

3 7 Training of WUAs Leaders and Staff

Training of WUAs leaders in communications, management, budgeting and public relations should be started as soon as possible WUA staff training should also start in the following fields planning budgeting, accounting and record keeping, computers and software programs, e g Word Perfect & Excel/ Quart Pro, and water measurement practices

3 8 Additional Technical Assistance (TA)

Phased TA programs with allocated resource (WUAs, GOES-CENTA & TNS), in activities related to crop planning, budgeting and marketing need to be developed as soon as possible Additional funding sources should be found, if required to complete the necessary programs

3 9 Ability-to-Pay

As reflected in the TNS (TechnoServe) report on the Lempa-Acahuapa project, detailed studies on economic, social and political aspects as to the water users/farmer's ability-to-pay, need to be immediately implemented as these reports are required as soon as possible

3 10 Federation of Water Users Association

As reflected at the 23rd of July Workshop, the Federation of Water Users Association needs to be formally and legally organized It will then have a "voice" that is 5 to 10 times greater than a single WUA This voice is especially needed related to the problems of the present high electric energy tariff

The new Federation of Water Users Association then needs to start public information programs related to the present high electric energy tariff imposed on the WUAs

3 11 Marketing/Commercialization of Agricultural Products

One of the weak links in the WUs/farmer's "ability-to-pay" is the present marketing situation in El Salvador Farm products are only purchased on volume and price, with no regulations, standards practices nor policies as to size and/or quality Local and international linkages are at best weak, and result in the importation of farm products from neighboring countries

The mere development on paper, of a cropping pattern that should yield high cash returns does not put money into the pockets of the WUs/farmers without adequate crop marketing
Further detailed marketing studies and analysis of reasonable and acceptable expansion of higher value crops need to be made as soon as possible The building on existing information and studies already available, needs to be coordinated into the water users/farmer's ability-to-pay studies (Section 3 9 above)

3 12 Planning and Budgeting During Transfer Period

GOES operates on a calender year budget and the irrigation season is a split year (November to April) budget Therefore initial transfer planning and budgeting should be for an 18 months period July 1998 to December 1999 and an understanding related to what GOES budget year (1998 or 1999 ?) is number one as this makes a great difference in cost subsidies and therefore annual WUAs water charges This issue needs to be immediately resolve and/or an acceptable solution be negotiated

It is recommended that GOES pay all (100%) of 1998 costs 1999 @ 80% 2000 @ 60% 2001 @ 40%, 2002 @ 20% and 2003 @ 0%

3 13 Recommended Actions - Should be taken in the next 60 to 90 days

1 Agree on a legal transfer agreement/document

2 A ' letter of agreement in principal covering the following points must be developed and signed

- all items mutually acceptable,
- define the GOES s already agreed-to minimum points as the starting points for further negotiations,
- agree on a time period to conclude further negotiations (September 15), and agree to either appoint an acceptable arbitrator, or arbitrators who s decisions (by 01 November) would be binding on both parties and/or ask for legal rulings that would be binding on both parties

3 During this 60-90 day period, develop detailed cost estimates for each subsidy activity as to cost sharing during transfer period so that GOES can secure approval and necessary funding in order to make payments to WUAs prior to actual need This would allow WUAs to develop detailed water charge tariff structures during the transfer period

4 Each I&D District should prepare the following within 30 days for review and evaluation if necessary

a) detail physical inventories

b) detailed equipment list with following information -
Make - Model Year - Condition - Original or Replacement Costs

c) draft planning I&D budget for July/August 1998 thru December 1999
(per forms in this report) and propose budgets for the next 4/5 years

d) draft separate planning budgets for all other activities per c) above

5 Each I&D District should adopt I&D District Rules and Regulations

6 Items #4-a) and b) should then be attached to the transfer agreement for each separate I&D District

7 Legally form a Federation of Water Users Association and undertake information and public relations program related to present electrical energy tariff and other activities

8 Undertake the start of as many of the other recommendations as possible

4 ZAPOTITAN IRRIGATION AND DRAINAGE SYSTEM EVALUATION

This evaluation is based on discussions with GOES/MAG and WUA personnel, farmers and other related groups such as Techno Serve, etc , field trip observations and photographs, as well as the attached Irrigation Project Information Sheets

4 1 Design and Construction

The original system was designed in 1969/70 by TAHAL Consulting Engineers Ltd, Tel Aviv, Israel in accordance with acceptable International Standards for design flows, structure drawing and construction methodologies for irrigation and drainage systems Initial construction was started in 1969/71 and cost 13 0 million Colones However, the construction materials, quality control and level of O&M since construction, lead to the need for system rehabilitation 1996/98 at a cost of US $12 0 million

Original hydraulics numbers and calculations are available so as to check the system's originally designed flows and delivery assumptions

4 2 Rehabilitation

The I&D system was partially rehabilitated in 1996 98 by the GOES/MAG with Donor (Japanese) funding of $12 0 million US dollars The activities undertaken were construction and replacement of equipment of 15 wells rehabilitation of 12 6 kms of main canal construction of 2 bridges and 3 weirs replacement of pumping equipment in three pumping stations and the construction of a central warehouse As part of the loan 13 pieces of mobile equipment and one computer all 1997 models were also left in-country

As the rehabilitation was to the original design with only minor modifications the present Operation and Maintenance (O&M) status of the system can be evaluated

The sections/parts of the system not rehabilitated were 54 65 kms of secondary canals and 6 6 kms of laterals 4 non-functional wells 2 pumping stations 9 4 + 35 5 kms of roads and 38 5 kms of drains etc All these sections reflect a level of O&M below normal for continued system sustain ability This has resulted in either a backlog of deferred O&M and/or additional rehabilitation needs

4 3 Operations

4 3 1 Diversions - Water Rights and Water Quality

There are 10 river diversion points and the water volumetric diversion rights need to be clarified and protected as well as the water quality checked at each diversion point This lack of clarification and checking has lead to some confusion in the reporting of flows divisions system losses and on-farm delivery amounts, e g 1 6 l/s /ha - Designed System Flows, 1 8 m3/sec diverted except in Sector # 5 = 0 55m3/sec with 18 hours per day pumping On-farm Delivery Amounts = 25 - 30 l/s for 4 - 7 hours/Mz Crops Rice corn green pepper, cucumber

4 3 2 Measurement Structures and Practices

In the original design of the system and according to the diversionary water rights there is a mandate to have volumetric measurements throughout the entire irrigation system

The following is extracted from the General Report section
I I Salvador s laws and legal responsibilities clearly imply from the volumetric division point (water right) that initial measurement is mandated by the I& D designed water service (liters per second per hectare) and that further measurement should be carried out within the distribution system and to each individual on-farm outlet to assure equitable water distribution

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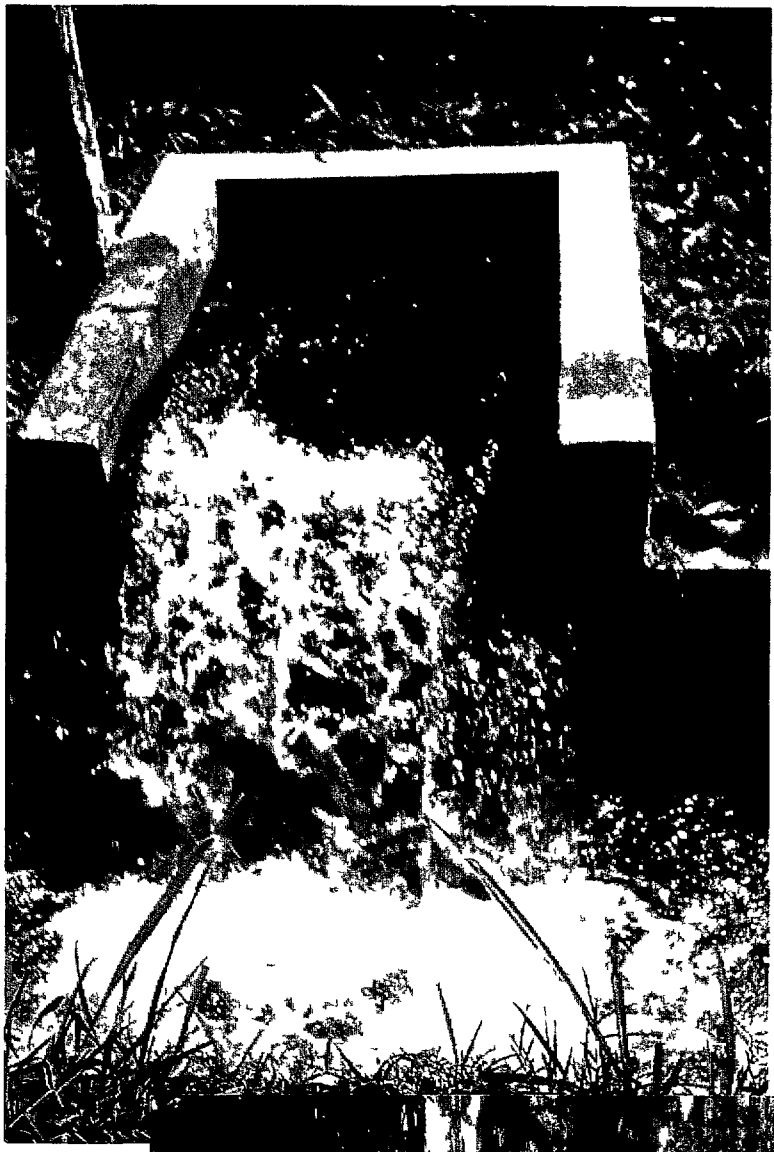
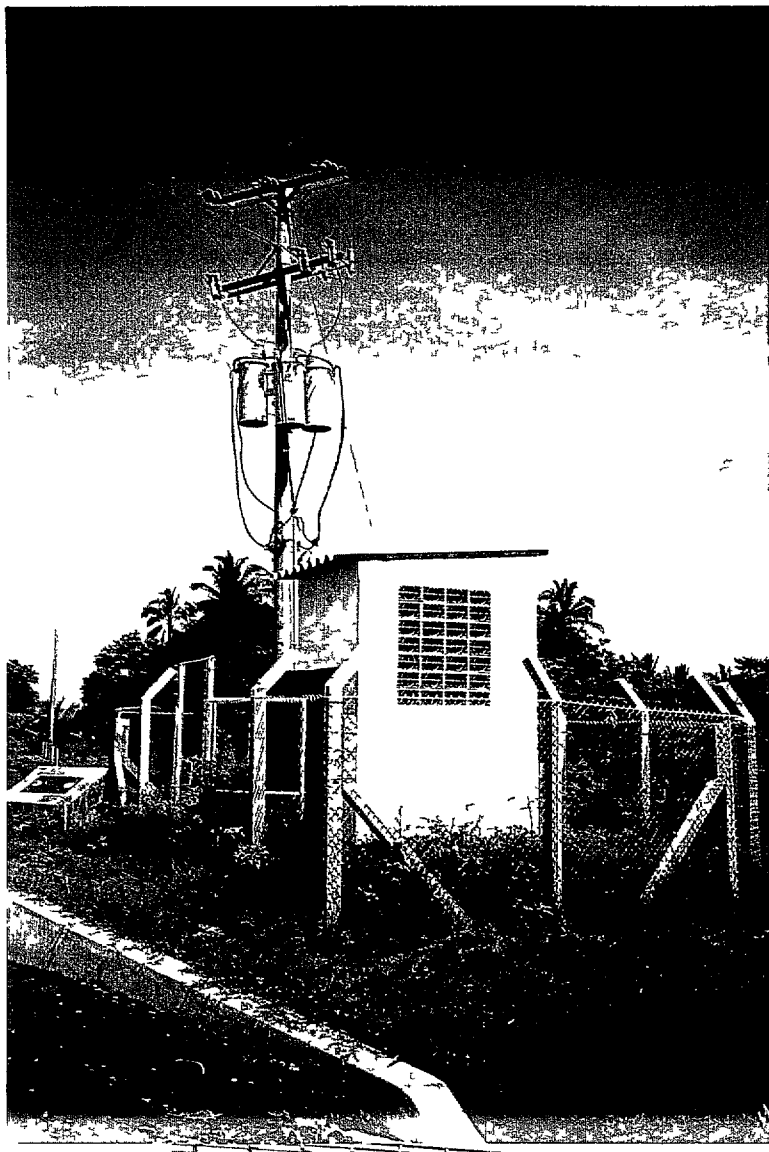
ZAPOTITAN
MAIN CANAL AND
HEADQUARTERS
JUNE 26, 1998

ZAPOTITAN
MAIN CANAL AND
TURN OUT
JUNE 26, 1998



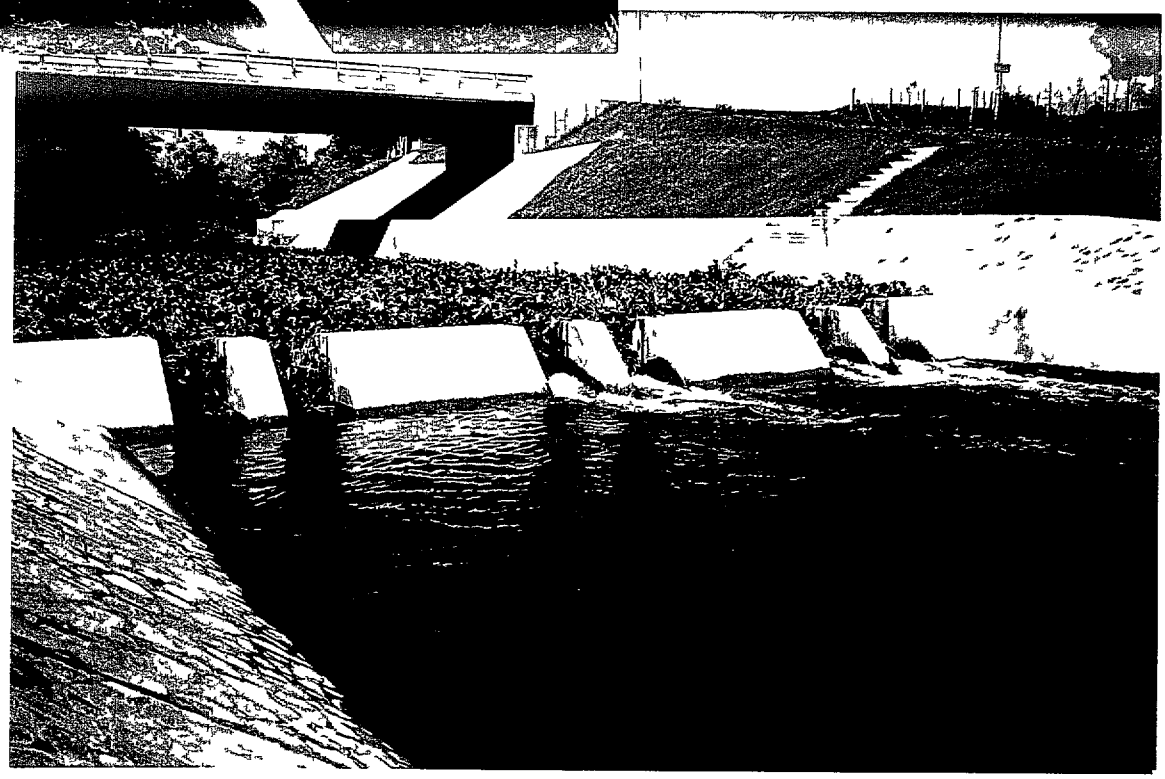
ZAPOTITAN
WELL #3 AT
HEADQUARTERS
PUMPING STATION
JUNE 26, 1998

ZAPOTITAN
WELL #3 AT
HEADQUARTERS
JUNE 26, 1998



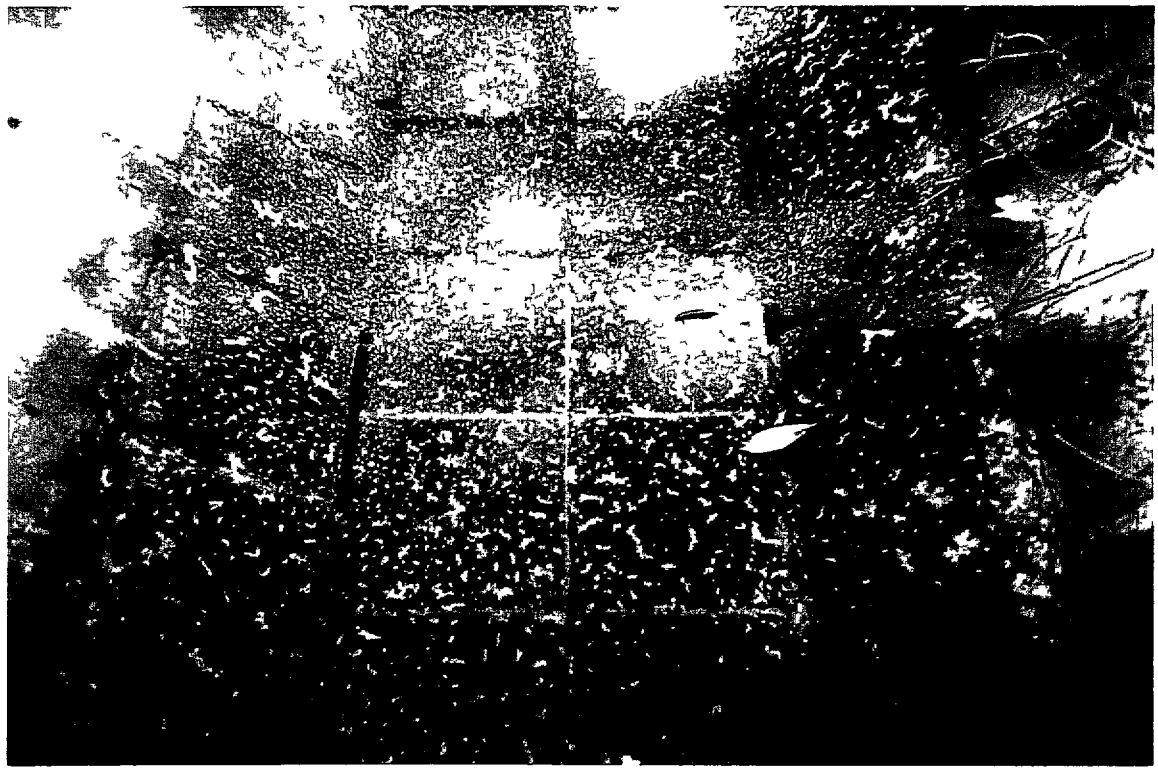
ZAPOTITAN
DIVERSION AT RIVER
ELECTRIC TRANSFORMER
AND CONTROLS
JUNE 26, 1998

ZAPOTITAN
DIVERSION AT RIVER
JUNE 26, 1998



ZAPOTITAN
SECOND CANAL
WASHING POINT
JUNE 26, 1998

ZAPOTITAN
SECOND CANAL
BROKEN LINING
JUNE 26, 1998



ZAPOTITAN - CANAL LINING - JUNE 26, 1998

The original I&D designs were based upon an acceptable cropping pattern (water demand) estimated system losses & or efficiency(%) and an on-farm irrigation efficiency (%) Therefore system diversion measurement structures and on-farm outlet measurement structures were constructed

However over time and due to various factors, the use for the most part of measurements within the distribution system and at the on-farm outlets has been abandoned Most of the irrigation systems are now being operated on an visual estimation of flows which are based on experience and needs, etc

Therefore the immediate need to re-instate volumetric measurements at all irrigation levels is mandated Tariff structures that are based on volumetric measurement are more flexible and easier to manage

The re-instalment, at all irrigation levels, of measurement structures/devices based on volumetric measurement, is mandated The costs for additional measurement structures and on-farm delivery outlet measurements devices, in addition to training and record keeping, must be added to the proposed new tariff structure

4 3 3 Operational High Electric Energy Costs

Operational electric costs discussions were held with the Electric Distribution Company CLESA and the electric tariff is as discussed in Section 2 4 of this report Until the tariff is adjudicated related to the ability-to-pay, pumping operational procedures can be modified to start operations during the low hours (23 00 to 04 59) and finish before the high hours start at 18 00 hours resulting in cost savings up to 10%

4 4 Maintenance

4 4.1 I&D - System Maintenance

In the above section **4 2 Rehabilitation**, it was noted that the sections/parts of the system that were not rehabilitated were - 54 65 kms of secondary canals and 6 6 kms of laterals plus 4 non-functional wells, 2 pumping stations, 9 4 + 35 5 kms of roads and 38 5 kms of drains, etc These system sections reflect a below normal level of O&M and this has resulted in either a backlog of deferred O&M and/or additional rehabilitation needs

From the backlog of deferred maintenance, the critical maintenance needs will have to be estimated and added to the revised annual maintenance costs Fifteen kms of secondary and lateral canals, 10 kms of roadways, and 10 kms of upper elevation drains and/or drainage crossings will be used for initial estimation purposes A calculation for replacement and/or rehabilitation cost will be added

4 4 2 Maintenance of Electrical Pumps/Wells and Motors

Annual maintenance will be calculated on the rehabilitated units from the inventory lists
Estimated critical maintenance will be calculated on the balance of equipment

Calculations for replacement and/or rehabilitation costs must be added to the budget

4 4 3 Maintenance of Mobile Equipment

Annual maintenance will be calculated on the rehabilitated units from the inventory lists
Estimated critical maintenance will be calculated on the balance of equipment
Calculations for replacement and/or rehabilitation cost must be added to the budget

4 5 Planning and Budgeting and Development of New Tariff Structures

Section 2 5 3 Development Procedures for Irrigation Tariff Structures must be followed and the 2 5 4 Proposed New WUA s Tariff Structure forms and formats must be completed Once the desired level of expenditures is calculated then comparisons of District's income and WUs ability to pay can be made and evaluations of acceptable tariff structure and rates can be made

4 6 Recommendations

Sector #5 and perhaps the balance of the gravity service areas should be at a gravity tariff rate (set volumetric block amount perhaps related to perhaps size of landholdings)

The pumped areas and the well service areas should be at rates to cover electrical energy costs If and when exact areas and energy cost can be determined, it may then be desirable to set elevation service areas A simplified form of estimated volumetric block flow is recommended until measurement structures are sufficiently in place to provide accurate volumetric measurements

All general report recommendations should be implemented over-time to the extent economically feasible

5 ATIOCOYO NORTE IRRIGATION AND DRAINAGE SYSTEM EVALUATION

This evaluation is based on discussions with GOES/MAG and WUA personnel, farmers and other related groups such as Techno Serve etc field trip observations and photographs as well as the attached Irrigation Project Information Forms

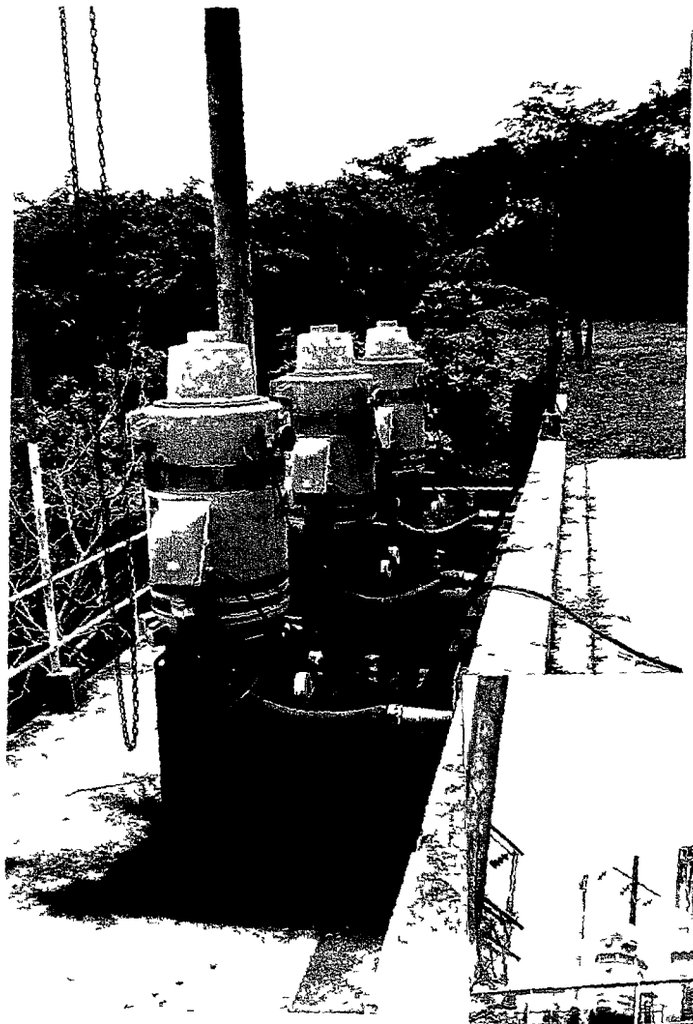
ATIOCOYO NORTE - TREES GROWING ON CANAL BANK
JULY 18, 1998

ATIOCOYO NORTE - CANAL OVER FLOW - JULY 18, 1998

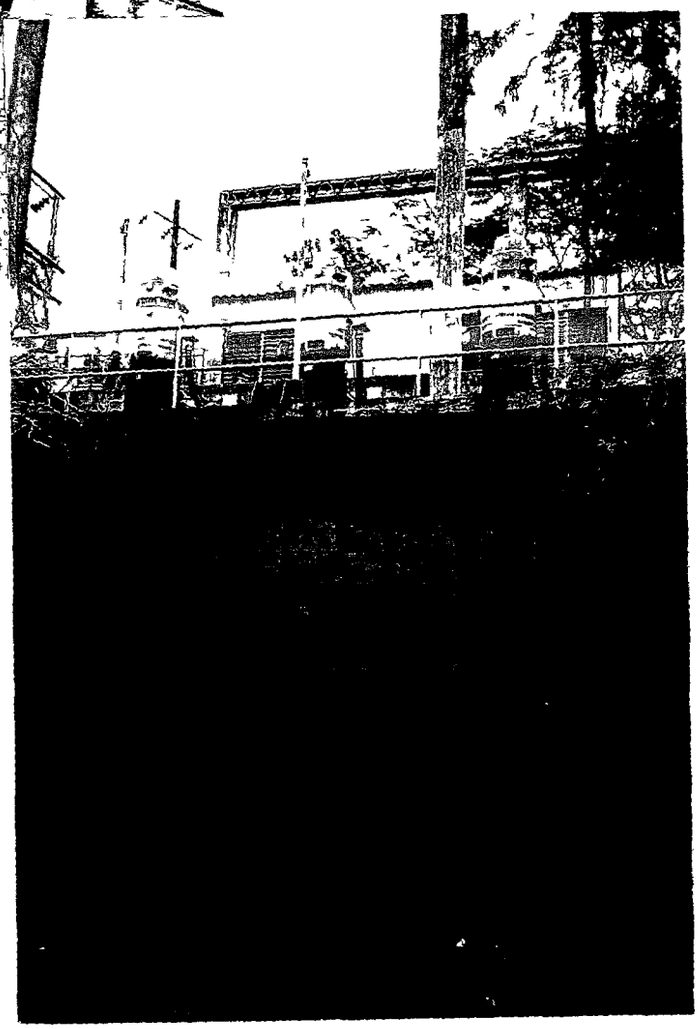
ATIOCOYO NORTE - CANAL OVER FLOW - JULY 18, 1998

ATIOCOYO NORTE
SIPHON
JULY 18, 1998

ATIOCOYO NORTE
CANAL OVER FLOW
JULY 18, 1998



ATIOCOYO NORTE
PUMPING STATION
JULY 8, 1998



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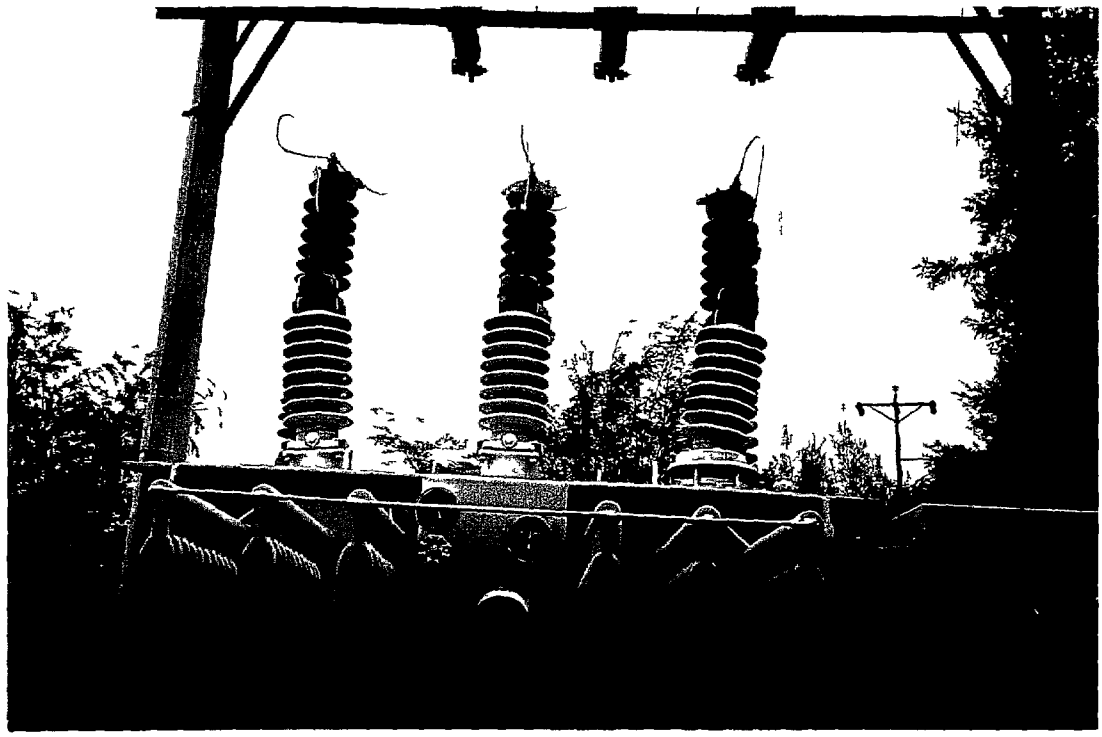
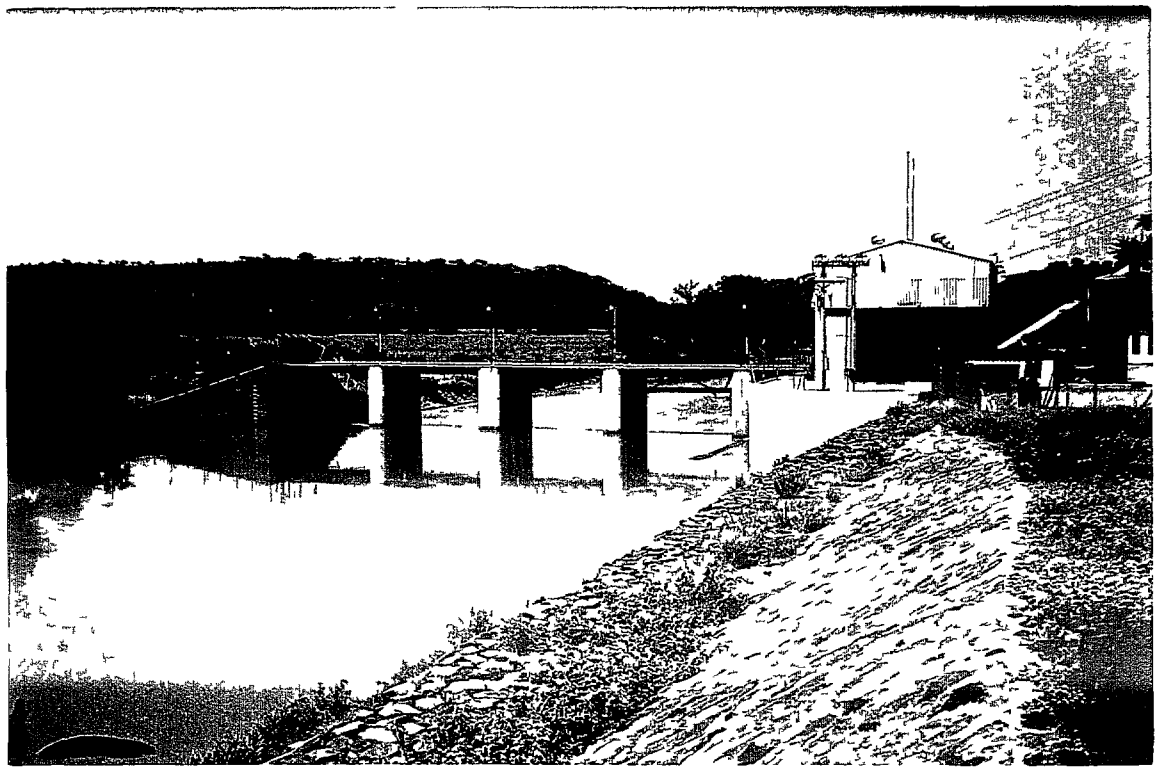
PUMPING STATION
JULY 8, 1998



ATIOCOYO NORTE - PUMPING STATION TRANSFORMERS
JULY 8, 1998



ATIOCOYO NORTE - DOMESTIC WATER FACILITY
JULY 18, 1998

5 1 Design and Construction

The original system was designed in 1973 by ICATEC, SA in accordance with acceptable International Standards for design flows, structure drawing and construction methodologies for irrigation and drainage systems However, the construction materials, quality control and level of O&M since initial construction have led to the present need for some rehabilitation The system was built in 1975 - 1979 with IDB funding for $8 0 million USD and $7 9 million USD funding from GOES

In the initial Atiocoyo design, the two areas of Atiocoyo North and South were consider to be one project with the Limpa River running through the middle of the district However, during construction the north and south sections were divided into two separate systems by eliminating a large siphon under the river and the installation of a new pumping station for the northern area

During the period from 1983 to 1993 there was technical assistance provide through German funding At present, rehabilitation of the system - at least the main canal and it's pumping station - is needed A rough estimate puts the costs are between ½ to 2 million USD for a minimum effort

Original hydraulics numbers and calculations are available in order to check the systems original designed flows and delivery assumptions The O&M status of the system can also be evaluated

5.2 Rehabilitation

The entire system reflects a level of O&M below normal for continued system sustain ability, resulting in either a backlog of deferred O&M and/or the need for additional rehabilitation The pumping station has three 300 hp pumps - the original design was for a two pump operation with the third pump on standby status At present, with all three pumps operating, capacity is still below the original designed capacity of just two operating pumps This low pumping efficiency is reflected in the high electric energy bills, and is especially costly now that the electrical energy costs have more than doubled with the new energy tariff structure

Note The original decree no 285 shows one single system However in initial construction a large siphon and part of the connecting canal were not constructed A separate pumping station was installed to service northern area Therefore a detailed accurate inventory must be made for both north and south system areas

5 3 Operations

The service area is divided into 14 sections However, #12 & #13 are not irrigated
Since 1990/91, the 12 remaining sections are divided into two service areas (1, 2, 3, 10, 11, 14) and (4, 5, 6, 7, 8, 9)

Rice is cropped in 90% of the area and most all farmers grow a rainy season crop of rice However the ½ of the area not growing a second crop of rice receives a preference for supplement irrigation water prior to the start of the rainy season and during the dry period The ½ of the area growing a second crop of rice during irrigation season receives water on a delivery schedule of every eight days irrigating 24 hours per day with an estimated water delivery of sufficient water to irrigate 1 manzan (Mz) in 6 hours

However to secure the high flows for rice the system is operated above the canals designed water surface levels and in some sections over the top of the canal lining (see attached photographs)

All water-users pay 225 Colones per Mz or 321 75 Colones per Ha and those receiving water for a second rice crop pay an additional 200 Colones per Mz or 286 00 Colones per Ha This results in an average yearly water cost of about 325 Colones per Mz

The remaining 10% of the area is in pastures and/or sugar cane The WUA also rents equipment, including a rice harvester

On-farm Irrigation Efficiencies

There is a serious problem related to the lack of efficient on-farm irrigation practices One of the contributing factors in Atiocovo is the lack of properly leveled irrigation fields This coupled with the lack of accurate volumetric water measurement, has led to delivery of high volume of water which in turn leads to higher volumes of waste or run-off waters, which in turn leads to noticeable soil erosion

Rice has a noted high crop water requirement and all soils (light and medium textured) are not suitable for rice production

5 3 1 Diversions -Water Rights and Water Quality

With the changes in original design and construction, the river diversion point, the water volumetric diversion rights, as well as the water quality need to be clarified and protected

The revised original system design called for a pumped diversion of 1 8 m3/sec In 1997 the flow was estimated at 1 57 m3/sec However the present (July 1998) amount is estimated at less than 50% of original design or about 1 35 m3/sec

The proposed El Cimarron Hydroelectric project on the upper Lempa River may pose problems related to the ability of Atiocovo Norte to divert the above flow Refer to attached CESTA paper related to same

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5 3 2 Measurement Structures and Practices

In the original design of the system and per the diversionary water rights, it was mandated to have volumetric measurements throughout the entire irrigation system

It is recommended that a system measurement be constructed at the diversion point, within the distribution system, and at the on-farm delivery points

5 3 3 Operational High Electric Energy Costs

The electric energy costs are quite high This is due to the status of the 16 year old pumps and motors at the Main Pumping Station at Atiocoyo Norte

On 24 July the Electric Distribution Company DEL SUR, at the request of GOES, came out to disconnect the electrical service to the pumping station The WUs have a rice crop of an estimated 14 million Colones value, and they provided DEL SUR with a written statement that they would not allow DEL SUR to disconnect the service The service was then left on, however, this does not fully resolve the problem

5 4 Maintenance

5 4 1 I&D System Maintenance

There is a backlog of deferred system maintenance throughout the entire system in addition to the previously rehabilitation needs stated above

The drainage system is basically the natural basin terrain and the drainage water flows into seasonal streams and natural rivers As such, the maintenance is definitely 'low-cost' However, when the I&D system was originally installed, it had to be constructed across this naturally contoured drainage systems As a result, all along the irrigation and roadway systems there are parallel drains and natural drainage crossings that must be maintained in order to protect the systems

An additional problem is the lack of control of irrigation water and in some cases rainfall, as it enters into the upper portions of the drainage system There is noticeably high soil erosion in this area, due to lack of adequate soil conservation practices

5 4.2 Maintenance of Electric Pumps & Motors

The electric energy costs are quite high This is due to the status of the 16 year old pumps and motors at the Main Pumping Station at Atiocoyo Norte, and is reflected in 5 2 and 5 3 1 above

Atiocoyo Norte does not have the abilitv to fund the rehabilitation nor the replacement of the pumps and motors which are in need of immediate action

5 4 3 Maintenance of Mobile Equipment

A detailed inventory list of mobile equipment is being compiled in order to evaluate the present status versus actual need

5 5 Planning and Budgeting and Development of New Tariff Structures

Section 2 5 3 Development Procedures for Irrigation Tariff Structures must be followed and the 2 5 4 Proposed New WUA s Tariff Structure forms and formats must be completed Once the desired level of expenditures is calculated then comparisons of District s income and WUs abilitv to pay can be made and evaluations of acceptable tariff structure and rates can be made

5 6 Recommendations

Rehabilitation

The main canal irrigation system needs to be rehabilitated, as does the pumping station and three electric pumps (3-300 hp) The GOES/MAG is aware of this problem and is trying to secure funding It is understood that perhaps 4 5 million Colones may be available this vear (1998) for Atiocovo Sur, and a total of 9 0 million Colones (4 5 for Sur and $ 5 for Norte) may be available in 1999

It is recommended that GOES/MAG consider re-allocating part of the 1998 Sur funds for immediate repair and/or replacement of the three Norte pumps in sequence (worst-one-first) this year

This would help lower the electric costs and improve flow volume Our discussions with WUA staff indicate that this would be accomplished as the present operating practice during the irrigation season is to charge (fill) the system by using all three pumps They then operate with one pump for a month, start the second pump during the second month and finally start the third pump at about three months

Alternate Gravity Water Supply

It is further recommend that a ' Desk-top study" (pre-feasibilitv type that collects existing information and studies) be made in order to look at the alternative of developing a gravity supply to eliminate the high present cost of pumping If the yearlv cost of electric is 2 500 000 Colones then (2,500 000 x 50 (years) = 125,000,000 Colones, this would be the cut-off cost for considering alternative gravitv supplv costs

Consideration may be given to constructing the original designed siphon from Sur to Norte However, it is understood that sufficient water supply may not be available at that point

Due to the present situation of proposed inter-river transfers, etc , referred to above in Section 5 3 1, this study should be an immediate action

Electric Energy Payments

The present situation related to electrical energy concerning 'who pays and what amounts' was previously discussed in the main section of this report As reflected in Section 5 3 4 above, this problem needs to be immediately clarified

It is recommended clarifications be sought from GOES related to this matter

6 0 ATIOCOYO - SUR IRRIGATION AND DRAINAGE SYSTEM EVALUATION

This evaluation is based on discussions with GOES/MAG and WUA personnel, farmers and other related groups such as Techno Serve, etc , field trip observations and photographs, as well as the attached Irrigation Project Information Forms

6 1 Design and Construction

The original system was designed in 1973 by ICATEC, SA in accordance with acceptable International Standards for design flows, structure drawing and construction methodologies for irrigation and drainage systems Initial construction started in 1975 - 1979 with IDB funding for $8 0 million USD and $7 9 million USD funding from GOES However, the construction materials, quality control and level of O&M were not up to standard
In the initial design, the two areas of Atiocoyo North and South, separated by the Limpa River, were consider to be one project However, during construction they were divided into two systems This was done by eliminating a large siphon under the river and installing a new pumping station for the northern area

The original hydraulics numbers and calculations are available so as to check the systems original designed flows and delivery assumptions

6 2 Rehabilitation

The entire system reflects a level of O&M below the normal level for continued system sustainability, resulting in either a backlog of deferred O&M and/or additional rehabilitation needs The need for rehabilitation is recognized by all concerned and GOES/MAG is presently investigating and working toward securing a Donor loan

In the initial design the two areas of Atiocovo North and South separated by the Limpa River were consider to be one project However during construction they were divided into two systems This was done by eliminating a large siphon under the river and installing a new pumping station for the northern area

The original hydraulics numbers and calculations are available so as to check the systems original designed flows and delivery assumptions

6 2 Rehabilitation

The entire system reflects a below normal level of O&M for continued system sustainability resulting in either a backlog of deferred O&M and/or additional rehabilitation needs The need for rehabilitation is recognized by all concerned and GOES/MAG is presently investigating and working toward securing a Donor loan

Note The original decree no 285 shows one single system However in initial construction a large siphon and part of the connecting canal were not constructed A separate pumping station was installed to service northern area Therefore a detailed accurate inventory must be made for both north and south system areas

6.3 OPERATIONS

The irrigated area in Sur is 1704 Ha with about 1560 Ha presently being irrigated About 2/3 of the area is in pastures 1/3 of the area is in rice, about 75 Ha is in corn and 10 Ha is in watermelon The average landholding is 3 60 Ha in Atiocoyo Sur

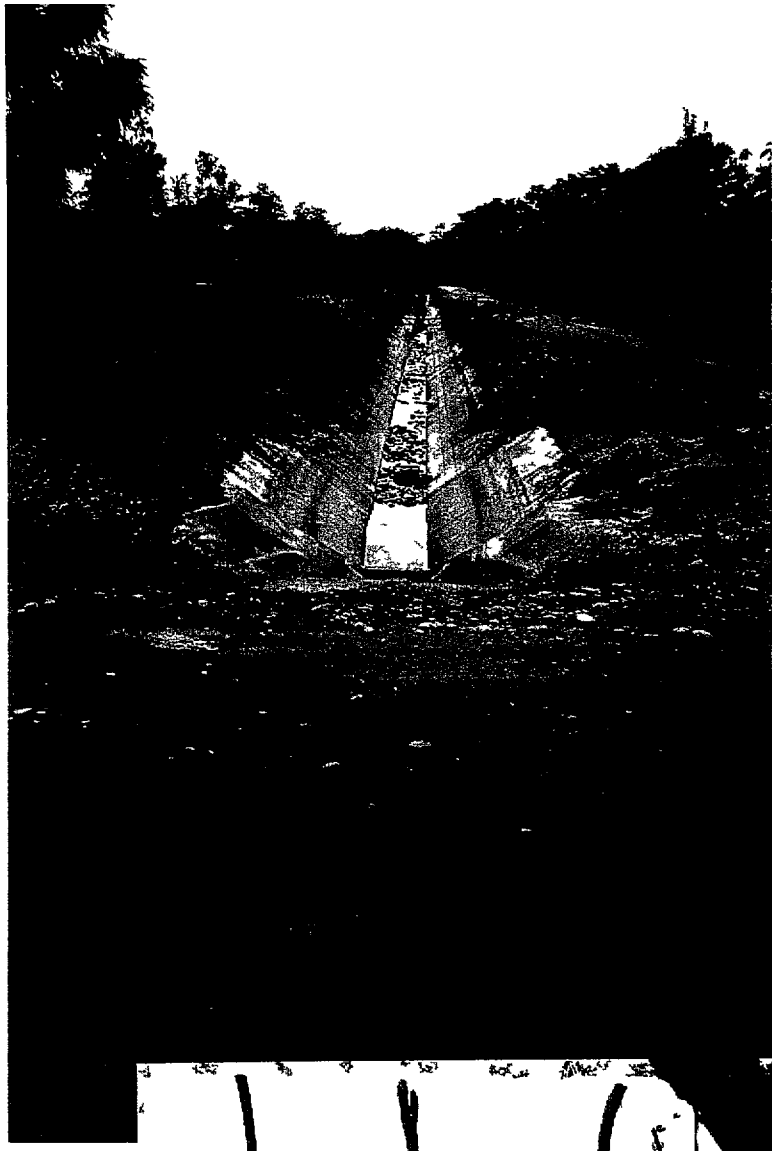
The service area is divided into sections Water Users during irrigation season receive water on a delivery schedule every eight days irrigating 24 hours per day with an estimated water delivery of sufficient water (est 25 l/s) to irrigate 1 manzans in 4 hours All water-users pay 140 Colones per Ha (see comment in 6 4 1 below)

Low On-farm Irrigation Efficiencies

There is a serious problem related to the lack of efficient on-farm irrigation practices One of the contributing factors in Atiocoyo is the lack of properly leveled irrigation fields This coupled with the lack of accurate volumetric water measurement, has led to delivery of a high volume of water which in turn leads to higher volumes of waste or run-off waters which in turn leads to noticeable soil erosion

Rice has a noted high crop water requirement, and not all soils (light and medium textured) are suitable for rice production

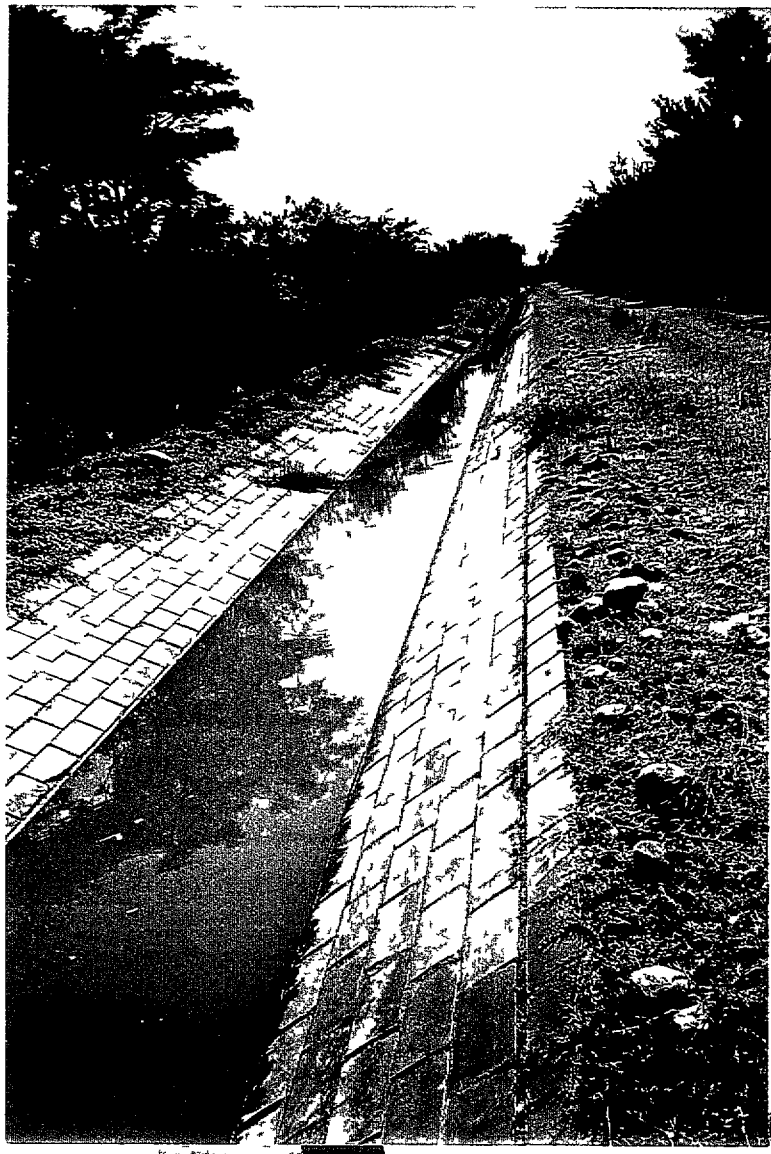
6"



ATIOCOYO SUR
SECOND CANAL
JULY 8, 1998

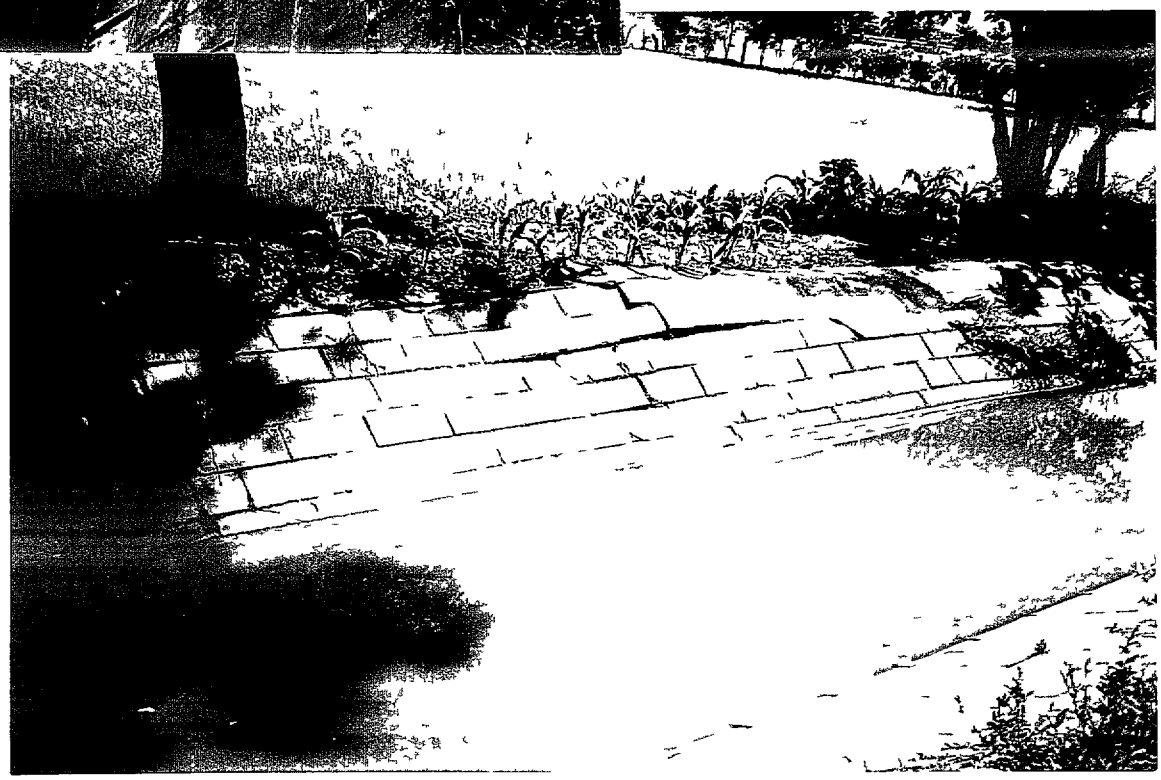
ANTIOCOYO SUR
MAIN CANAL AND
SECOND CANAL
JULY8, 1998

ATIOCOYO SUR - MAIZE ON CANAL BANK - JULY 18, 1998



ATIOCOYO SUR
CANAL
JULY 18, 1998

ATIOCOYO SUR
TREE ROOTS IN
CANAL LINING
JULY 18, 1998



ATIOCOYO SUR - CHANGE IN CANAL LINING MATERIAL
JULY 4, 1998

ATIOCOYO SUR - BANANA TREES GROWING NEXT TO CANAL
JULY 18, 1998

6 3 1 Diversions -Water Rights and Water Quality

With the changes in original design and construction, the river diversion point, the water volumetric diversion rights, as well as the water quality, need to be clarified and protected

6 3 2 Measurement Structures and Practices

The original system design called for a gravity diversion of 1 5 l/s However, at the present time, water is being diverted during high river flow periods to between 2 2 to 2 5 l/s (3800) and almost all of the designed freeboard is being used In certain sections, they are operating over the top of the concrete lining

In the original design of the system and per the diversionary water rights, it is mandated to have volumetric measurements throughout the entire irrigation system

A system measurement device is recommended at the diversion point, within the distribution system, as well as at the on-farm delivery points

6 3 3 Operational Electric Energy Costs

As Atiocoyo Sur is a gravity division system, high operational electric energy costs for pumping are not present However, use of any electrical energy should be controlled and monitored

One of the best contributing factors that help keep the system operating is the dedication and practical experience of the Water Users Association staff

6.4 Maintenance

6 4 1 I & D System Maintenance

There is a backlog of deferred system maintenance throughout the entire system, in addition to the rehabilitation needs previously stated

This District has very good WU contact with it's 482 Users and has developed a high rate of contributed labor (about 15 days per Water User) That has a cash value of 317 Colones per Ha which helps to keep the cash water charge at the low level of 140 Colones per Ha

The drainage system is basically the natural basin terrain and the drainage water flows into seasonal streams and natural rivers As such the maintenance is definitely low-cost However when the I&D system was originally installed it had to be constructed across this naturally contoured drainage systems As a result all along the irrigation and roadway systems there are parallel drains and natural drainage crossings that must be maintained in order to protect the systems

An additional problem is the lack of control of irrigation water and in some cases rainfall as it enters into the upper portions of the drainage system High soil erosion in this area is noticeable due to lack of adequate soil conservation practices

6 4 2 Maintenance of Electrical Pumps and Motors

As indicated in Section 6 3 3 the operational costs in Atiocoyo Sur are not high This is because this system is a gravity diversion system and therefore has no major maintenance costs associated with large pumps and motors

6 4 3 Maintenance of Mobile Equipment

A detailed inventory list of mobile equipment is being compiled in order to evaluate the present status versus actual need

6 5 Planning and Budgeting and Development of New Tariff Structures

Section 2 5 3 Development Procedures for Irrigation Tariff Structures must be followed and the Section 2 5 4 Proposed New WUA s Tariff Structure forms and formats must be completed Once the desired level of expenditures is calculated, then comparisons of District's income and Water Users ability to pay can be made and evaluations of acceptable tariff structure and rates can be made

6 6 Recommendations

This District has rehabilitation needs as discussed earlier however the timing of construction should occur during the non-irrigation season Refer to recommendations made for Atiocoyo Norte in Section 5 6 above

This District may be the best one to select as the first I&D District to be transferred

7 LEMPA ACAHUAPA IRRIGATION AND DRAINAGE SYSTEM EVALUATION

This evaluation is based on discussions with GOES/MAG and WUA personnel, farmers and other related groups such as Techno Serve, etc , field trip observations and photographs as well as the attached Irrigation Project Information Forms

7 1 Design and Construction

The original system was designed in 1985/86 by Salzguiter (German), CLASS (Peru) and CONSULTA (El Salvador) Construction was started in 1991/93 and as of July 1998, the system is estimated to be 70% completed The total cost is $17 0 million, with an IDB loan for $10 9 million, a GOES at $6 1 million, and the IDB loan for 40 years with 1% interest for the 1st 10 years and 2% interest for the loan balance of 30 years

Therefore, the original hydraulics numbers and calculations are available to check systems original designed flows and delivery assumptions

7 2 Rehabilitation

During the long construction period, the system reflects a below normal level of O&M for continued system sustainability This has resulted in a backlog of deferred O&M during the construction period

The designed irrigated area is for 2511 Ha In 1997/98 about 1,000 Ha were cropped, 600 Ha being irrigated and 400 Ha in sugar cane (no water service)

The average landholding is 5 4 Ha with 4 Cooperatives The distribution is

- **a)** 1 to 3 0 Ha = 1026 Ha,
- **b)** 3 1 to 25 Ha = 441 Ha, and
- **c)** more than 25 Ha = 721 Ha

The service area is divided into 53 Units for control and record keeping, with 20 units in Sector #1, 13 units in Sector #2 and 20 units in Sector #3

7 3 Operations

The service area is divided into 53 units Water Users, during the irrigation season, receive water on a delivery schedule of 18 hours per day, Monday through Saturday and only irrigate during daylight hours

Water-users pay **500 Colones per Ha/Yr + 13% tax** In addition, they pay **a one time subscription fee of 100 Colones per User and a social activities fee of 50 colones per User per year**

The I&D District is providing land leveling services estimated at average of 200 m3/Ha or 2 500 Colones per Ha average cost It also provides land preparation services at

a) plowing @ 300 per mz
b) disking @ 130 per mz and
c) sowing @ 120 per mz

plus 13% tax

Water charges and land preparation charges all go into a special Lempa Acahupa District fund

7 3 1 Diversions -Water Rights and Water Quality

The original system design called for a gravity diversion of 5 0 m3/sec with 2 1 m3/sec for the Right Canal and 2 9 m3/sec for the Left Canal The irrigation system was designed for a distribution efficiency of 63% and an on-farm irrigation efficiency of 40%

7 3 2 Measurement Structures and Practices

In the original design of the system and per the diversionary water rights it is mandated to have volumetric measurements throughout the entire irrigation system

There are 26 of 56 measuring structures within the distribution system at this time The present design calls for a partial flume measuring device down to the start of each unit (which averages about 50 Ha) System measurement devices are recommended to be installed to a average of at least 20 Ha and preferably to 10 Ha

7 3 3 Operational Electric Energy Costs

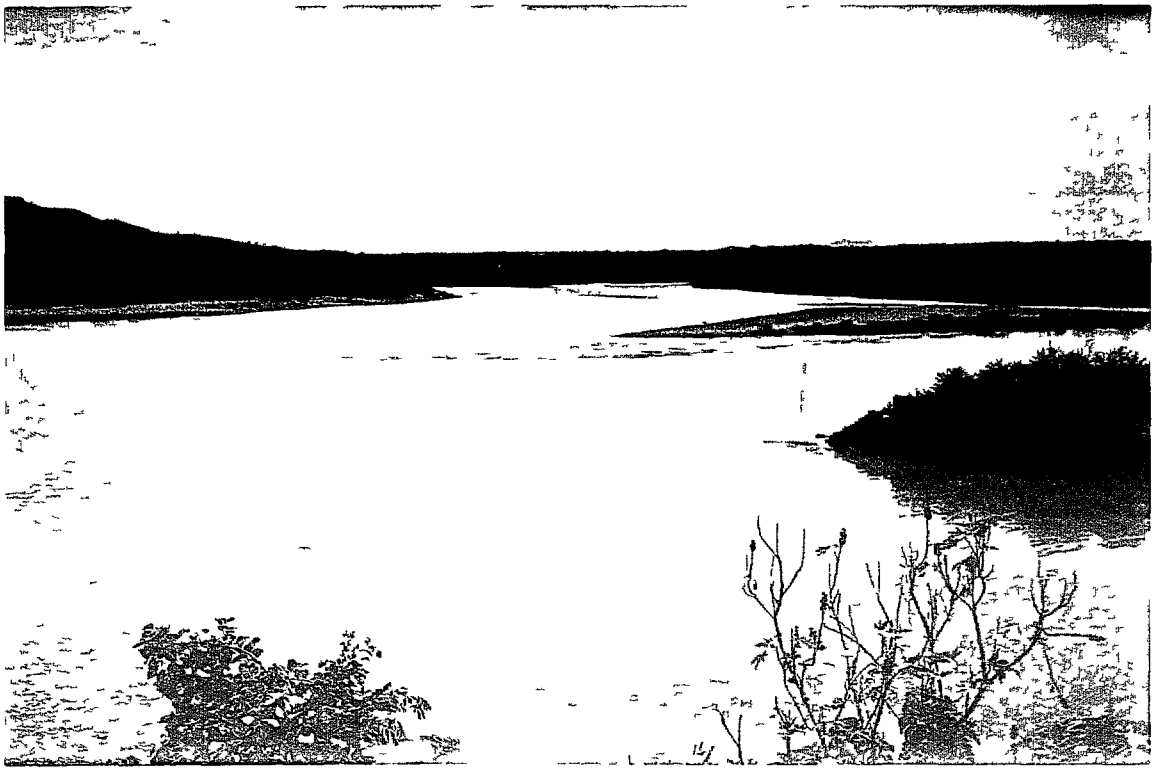
As Lempa Acahuapa is a gravity division system, high operational electric energy costs for pumping are not present However, use of any electrical energy should be controlled and monitored

7 4 Maintenance

7 4 1 I & D System Maintenance

There is the backlog of deferred system maintenance throughout the entire system especially that part of the irrigation system that is built on **elevated levies - 7 34 kms/ 20 9 Ha**

LEMPE ACAHUAPA - SIPHON CROSSING - JULY 18, 1998



LEMPE ACAHUAPA - RIVER AT SIPHON CROSSING
JULY 18, 1998

LEMPE ACAHUAPA - VEGETATION AT ELEVATED SECTION
JULY 18, 1998

LEMPE ACAHUAPA
PARTIAL FLUME
(MEASURING
STRUCTURE)
JULY 18, 1998

LEMPE ACAHUAPA
OVER GROWTH AT
ELEVATED SECTION
JULY 18, 1998

LEMPE ACAHUAPA
DIVERSION FROM
MAIN CANAL
JULY 3, 1998

LEMPE ACAHUAPA
MAIN CANAL (LEFT)
JULY 3, 1998

LEMPE ACAHUAPA
MAIN CANAL
ON FARM TURN OUT
JULY 3, 1998

LEMPE ACAHUAPA
CANAL AND ON FARM
TURN OUT -
MEASUREMENT
STRUCTURE
JULY 3, 1998

LEMPE ACAHUAPA
CUT SECTION FOR
WASHING
JULY 18, 1998

LEMPE ACAHUAPA
WATER OVER FLOW
JULY 18, 1998

The drainage system is basically the natural basin terrain and the drainage water flows into seasonal streams and natural rivers As such, the maintenance is definitely 'low-cost' However, when the I&D system was originally installed, it had to be constructed across this naturally contoured drainage systems As a result, all along the irrigation and roadway systems there are parallel drains and natural drainage crossings that must be maintained in order to protect the systems

An additional problem is the lack of control of irrigation water and in some cases rainfall, as it enters into the upper portions of the drainage system High soil erosion in this area is noticeable, due to lack of adequate soil conservation practices

7 4 2 Maintenance of Electrical Pumps and Motors

As indicated in Section 6 3 3, the operational costs in Lempa Acahuapa are not high This is because this system is a gravity diversion system and therefore, has no major maintenance costs associated with large pumps and motors

7 4 3 Maintenance of Mobile Equipment

A detailed inventory list of mobile equipment is being compiled in order to evaluate the present status versus actual need

7 5 Planning and Budgeting and Development of New Tariff Structures

Section 2 5 3 Development Procedures for Irrigation Tariff Structures must be followed and the Section 2 5 4 Proposed New WUA's Tariff Structure forms and formats must be completed Once the desired level of expenditures is calculated, then comparisons of District's income and Water Users ability to pay can be made and evaluations of acceptable tariff structure and rates can be made

7.6 Recommendations

It is recommended that the backlog of deferred maintenance during construction be picked up by a set program for same Rules & Regulations should be adopted so as to prevent encroachment and breaking of canal linings for washing cloths, etc

If the designed on-farm irrigation efficiency of 40% is achieved and the lack of On-farm volumetric water measurement is corrected by installing measuring devices below the present unit level (average of 50 Ha) to 20 Ha average, this would be quite an acceptable starting point

8 0 Irrigation and Drainage District Profiles

8 0 Irrigation and Drainage District Profiles

8 1 Zapotitan I&D District Profile

ZAPOTITAN IRRIGATION PROJECT INFORMATION PROFILE

Datos de Proyecto de Riego

Project name **ZAPOTITAN (Original Decree No 214)**
Nombre de Provecto

Total Project Area (Ha) **4580**
Area total de proyecto (ha)

Area Irrigated (Ha) **3500 - 3200**
Superficie regable (ha)

Additional irrigatable area (Ha) **NONE**
Area adicional regable (ha)

Number of Landowners **1,200**
Numero de duesños de tierra

Number of Farmers **1,200**
Numero de Agricultores

Size of farms <10Ha **90 %** < 100 Ha **10 %** 100-1 000 Ha __ >1,000 Ha __
Tamaño de las fincas

Average landholding (Ha) **3 0**
Promedio area

Attach District Maps/drawings
Adjuntar mapas de distritos, diseños

Designed System Flows (l/s per Ha) **1 6 (1 8 m3/sec - pumping 18 hrs/day)**
Caudales diseñados en sistema **Designed by TAHAL Consulting Engineers Ltd Tel Aviv - 1970**

Actual present system flows (l/s per Ha)
Caudales reales actuales

Source(s) of water supply **8** River(s) **17** Wells **4/5 pumping stations** Other
Fuentes de captacion Rio(s) Pozos Otros

Type(s) of ID systems **X** Gravity **X** Gravity + Pumping, **X** Wells
Tipo de sistemas de distribucion

Date project constructed **1969 - 1971** Rehabilitated **1996 - 1998**
Fecha de construccion del proyecto Japan

Capital Costs GOES **1969-71 13 0 Mil Colones, and 1996-98 $ 12 0 Mil - Donor -Japan**
Costo de capital de inversion (Donacion, GOES)

Notes Japanese Loan
- construction of 15 wells & replacement of equipment
- rehabilitation of 12 6 kms of main canals
- construction of 2 bridges

- **construction of 3 weirs**
- **replacement of pumping equipment in 3 stations**
- **construction of a central warehouse**

Irrigation System Layout
Distribucion del sistema de riego

River Diversions No **10** Location(s) **Rivers** - **Sta Teresa**
Derivaciones de rios localizaciones - **Paso Hundo**
- **Las Canas - 1** - **Las Canas - 2**
- **Las Naranjos** - **Talnique - 1**
- **Chuchocato - 1** - **Chuchocato - 2**
- **Belen** - **Colon**

Type(s) - **1 concrete w/ stop-logs & 5 structures & 3 wooden & 1 earthen**
Tipos
Main Canals No **1**, & Kms **12 7**, **(Total Irrig. Sys Area (Ha) · 59 7)**
Canales principales ***(One Siphon)***
Secondary Canals No **20**, & Km **54 65+**,
Canales secundarios
Laterals No **7**, & Km **6 6**,
Canales terciarios o canaletas
Number of Pump Stations **4/5 - pumping stations (3 with new equipment)**
Numero de estaciones de bombeo
Number of Well Pumps **17 (15 new & 2-2 yrs old - 4 non-functional wells)**
Pumping Capacity **500 l/s**
Numero de bombas pozo Capacidad de bombeo
Average Pumping Efficiency Est **80-85 % (new) & 70 - 75% (old)**
Promedio de eficiencia de bombeo

Note Original decree shows 30 wells, 2-diversions, 2 pumping stations & 1 siphon

Number of Main Roads **1**, No of Kms **9 4**, Total Area (Ha) **33 7**
No de calles primarias
Number of Secondary Roads **11** No of Kms **35 5**
No calles secundarias

Designed On-Farm Delivery Amount (l/s per Ha) **25-30 l/s (4-7 hrs) per Mz**
Caudal diseñado de distribucion a parcelas
Number of Measuring Structures 1 Sizes
Numero de estructuras de medicion Tamaños
Type(s) of Measuring Structures **parshall**
Tipos de estructuras de medicion

95

Number of Measuring Devices **NONE** Sizes
Numero de aparatos de medicion Tamaños
Types of Measuring Devices **originally yes, but NONE now**
Tipos de aparatos de medicion
Number of On-Farm Outlets **Estimated @ 1200 +** Sizes **50 x 50 cm (average)**
Numero de compuertas de distribucion en parcelas Tamanos
Number of On-Farm Measuring Devices **NONE** Sizes **X**
Numero de aparatos de medicion en parcelas Tamaños
Types of On-Farm Measuring Devices **NONE**
Tipos de aparatos de medicion en parcelas
Estimated System Losses **60 0%__** Efficiency % **40 0%__**
Perdidas estimadas del sistema Eficiencia
Estimated On-Farm Losses **55 0%__**, Efficiency % **45 0%__**
Perdidas estimadas en parcelas Eficiencia
Estimated Overall Irrigation System Reliability (%) **70-80% __**
Confiabilidad estimada del sistema de riego

Drainage System Layout **Total Drainage Area (Ha) =106 0**
Distribucion del sistema de drenaje
River &/or Natural Outlets No **11** Location(s) **various**
Desagues de rios y/o naturales Localizacion
Type(s) **X** - Natural Rivers & valleies Total length = **38 5 Kms**
Tipos(0) Total Area = **87 7 Ha**
Main Drains No **19** & Kms **27 5**
Drenaje principal
Secondary Drains No & Km **(included in main drainage no 's) - Total Area = 18 3**
Drenaje secundario
Laterals No & Km
Drenajes terciarios o asequias
Number of Drainage Pump Stations **NONE**
Numero de estaciones de bombeo de drenaje
Number of Drainage Pumps **NONE** Pumping Capacity
Numero de bomba de drenaje Capacidad de bombeo

Mobile equipment being transferred - Yes **X** - No
El equipo automotriz esta siendo transferido
Attach List of Equipment -
Adjunte la lista de equipo

Donor Japon	**Make** **Marco**	**Model** **Modelo**	**Year** **Ano**	**Condition** **Condicion**
1 - tractor (dozer)	**Komatzu**	**P58**	**1997**	**Good - (Bueno)**

1 - front-end loader	Caterpillar	910	1997	Good
1 - motor-grader	Mitsubishi	330	1997	Good (under repair)
1 - backhoe	Komtsu	P100	1997	Good
2 - dump-trucks	Hino	275	1997	Good
1 - pick-up (4x4) - (double-cab)	Toyoto	HyLux	1997	Good
2 - pick-ups (4x4) - (regular cab)	Toyoto	HyLux	1997	Good
4 - motor-cycles	Honda	1255	1997	Good
1 - computer	_____	____	____	_____
GOES/MAG				
1 - motor-grader	Caterpillar	70	1970	Fair (Regular)
1- tractor	Caterpillar	D4	1965	Fair
1-tractor	Caterpillar	D6	1965	Fair

Attach Annual Rainfall Distribution (Monthly/Weekly)
Adjunte la distribucion de lluvia en el año (mensual/semanal)

Crops Produced Cultivos producidos	Area (Ha). Area	Season (dates) Estacion del año	Yield per Ha Rendimiento/Ha	Value/Ton Valor/Ton
Rice - Arroz	2000	Winter(Invieino) April - August	140qq	1800
Corn - * Maiz	3000	All Year Todo el ano	50.Dedes/Mz	80.-/net(red)
Cane - Cana	850	All Year	100 tons/ha	163 -/ton
Pasture Pastos	250	All Year	_____	_____
Vegetables * Hortalizas	1000	All Year	Chile - 600 sacks/Mz Pepino -220 sacos/Mz	400 -/sack 60 -/saco

(* = 2 to 3 crops per year, * = 2-3 cosechas al ano)

Notes The WUA service area is divided into five sections with 22 Water User Groups
#1 - 80% gravity and 29% wells
#2 - 15% pumping station and 85% wells
#3 - 15% gravity, 75% pumping station and 15% wells
#4 - 15% gravity, 75% pumping station and 15% wells
#5 - 100% gravity -

87

This section # 5 is about 660 ha with 660 farmers (families) with an average land holding of 1 0 ha or less At present they have separated into a Farmer's Association, separate from the WUA, and are collecting 175 Colones per ha

They are responsible for laterals (12 6 kms concrete plus earth) and 40 0+ kms of roadways within the area, which is divided into four sub-sectors with a separate canal operator each They have made repairs to the main canal and two diversion structures, and recently installed two small bridges

Past Cost of GOES - Water Service per Ha

Charge to Water Users 46 00 Colones & 21 00 Colones with-out water service

Present Cost of WUA - Water Service per Ha

Collection of "Out-of-Pocket" - Annual O&M fee (250 Colones /per Ha /Year)

- **Administration**
- **O&M - Main Canal**
- **Maintenance of part of the Principal Roads (along main canals)l**
- **Maintenance & Preventive Maintenance of Wells & Pumping Stations**
- **Cost of Construction & Removing of Four River Diversion Structures ?**
- **General Overhead Costs**

Note ***The Water User Groups (22) pay each Canal Operators @ 1,000 to 1,500 Colones per month***

8 2 Atiocoyo North (Norte) I&D District Profile

ATIOCOYO NORTH (Norte) IRRIGATION PROJECT INFORMATION PROFILE

Detalles de Provectos Riego

Project name **ATIOCOYO - NORTH (Original Decree No 286- refer Note - below)**
Nombre de Proyecto **(refer to Note below)**
Total Project Area (Ha) **2706**
Completo areas de proyecto (ha)
Area Irrigated (Ha) **1,200-North (Presently irrigating 1500 Mz-Separated by Lempa River)**
Superficie regable (ha)
Additional irrigatable area (Ha) **included in above**
Extension zona (ha)
Number of Landowners **180 (w/20 awaiting title transfer)**
Numero de patrons

Number of Farmers **180**
Numero de Granjeros
Size of farms <10Ha , < 100 Ha **5 -50**, 100-1,000 Ha , >1,000 Ha
Clasifico de pais
Average landholding Ha **4 0 (80%) = 5 14 (now reported as 2 80**
Promedio area
Attach District Maps/drawings
Apegar mapas / empates
Designed System Flows (l/s per Ha) **1 8 m3 principal & RI1 = 1 2 m3**
Designio projecto fluidos

Actual present system flows (l/s per Ha) **1.57 m3**
Real projecto fluidos
Source(s) of water supply **X (Rio Lempa)** River(s), Wells, Other,
Fuente de agua
Type(s) of ID systems Gravity, **X (Norte)** Gravity + Pumping Wells,
Date project constructed **1975 - 1978 original , & German Asst. Proj 1983-93**
flcha de construir **(Designed by ICATEC, SA Julio 1973)**
Capital Costs **(Donors & GOES)** **IDB - $8 0 Mil & GOES - $ 7 9 Mil**
Costo de capital **(Both Atiocoyo North & South)**

Irrigation System Layout
Sistema de planificar
River Diversions No 1 Location(s)
Type(s) **I - Pumping Station for North**

Note The original decree no 285 shows one single system. However, in initial construction a large siphon and part of the connecting canal were not constructed. A separate pumping station was installed to service northern area. Therefore, a detailed accurate inventory must be made for both north and south system areas - (separated by the Limpa River)

Irrigation System
Main Canals No **1** & Kms **10 11**
Canal principal
Secondary Canals No **14** & Km **21 15**
Canal secundario
Laterals No **. 9** & Km
Canales terciatios o canaletas
Number of Pump Stations **1**
Numero de estaciones de bombeo

Number of Pumps **3** Pumping Capacity **3-300 hp pumps**
Numero de bomba **(Originally 1,800 l/s)**
Average Pumping Efficiency **< 50%**
Bomba Promedio Eficiente

Number of Main Roads **4** No of Kms

Number of Secondary Roads **8** No of Kms

Designed On-Farm Delivery Amount (l/s per Ha)

Number of Measuring Structures **10** Sizes

Type(s) of Measuring Structures **Parshall (Now estimated flow -based on experience)**
Number of Measuring Devices Sizes

Types of Measuring Devices **(Flows estimated by canal Operator)**

Number of On-Farm Outlets **102** Sizes
(Delivery points)

Number of On-Farm Measuring Devices Sizes

Types of On-Farm Measuring Devices

Estimated System Losses Efficiency %

Estimated On-Farm Losses Efficiency %

Estimated Overall Irrigation System Reliability (%) **35 %**

Water Users Association Operations

Notes (1) The service area is divided into 14 sections However, #12 & #13 are not irrigated.
(2) Since 1990/9, the 12 sections are divided into two service areas (1, 2, 3, 10, 11, 14) and (4, 5, 6, 7, 8, 9)
(3) 90% of the area is cropped in rice, all grow a rainy season crop of rice However, the ½ of the area not growing a second crop of rice gets a preference for supplement irrigation water prior to the start of the rainy season and during the dry period.
(4) The ½ of the area growing a second crop of rice during irrigation season receives water on a delivery schedule every eight days, irrigating 24 hours per day with an estimated water delivery of sufficient water to irrigate 4 manzans in 24 hours

(5) All water-users pay 225 Colones per Mz. and those receiving water for a second crop pay an additional 200 Colones per Mz.
(6) The WUA also rents equipment, including a rice harvester

Drainage System Layout
Sistema de planificar

River & /or Natural Outlets No Location(s)
Type(s)
Main Drains No **4** & Kms
Drenajel principal
Secondary Drains No & Km
Drenajel secundario
Laterals No & Km
3rd
Number of Drainage Pump Stations

Number of Drainage Pumps Pumping Capacity
Numero de bomba

Mobile Equipment being transferred - Yes **X** No

Attach List of Equipment

Attach Annual Rainfall Distribution (Monthly/Weekly)

Crops Produced	Area (Ha)	Season (dates)	Yield per Ha	Value per Ton
Rice	**90%**			
Corn				
Pasture/cana	**10-05%**			
Other				

Past Cost of GOES - Water Service per Ha

Charge to Water Users

Present Cost of WUA - Water Service per **Mz** **All pay 225 & ½ pay +200 Colones**

Collection of "Out-of-Pocket" - Annual O&M fee (Colones /per Ha /Year)
- **Administration**
- **O&M - Main Canal**
- **Maintenance of part of the Principal Roads (a long main canals)**
- **Maintenance & Preventive Maintenance of pumps & Pumping Stations**
- **Other Costs**
- **General Overhead Costs**

Atiocoyo Norte pays for manual labor at 237,300 to 474,600 Colones for maintenance of the system

Note ***Personnel 2- technical & 1- watchman MAG 8- WL 4 1- TNS plus 3- temp canal operators , 1- temp tractor opt. and 1- temp mechanic***

Water delivery estimate at 25 l/s for 4 hrs Mz Rice is irrigated 18 times plus 3 4 times per irrigation for weed control equals 22 times per year

8 3 Atiocoyo South (Sur) I&D District Profile

ATIOCOYO SOUTH (Sur) IRRIGATION PROJECT INFORMATIONAL PROFILE
Datos de Proyectos Riego

Project name _____**ATIOCOYO SOUTH**___**(Part of the original decree no 285**
Nombre de Provecto **see notes in Atiocoyo North -App.#2)**
Total Project Area (Ha)_____**3064 0**_____
Completo areas de proyecto (ha)
Area Irrigated (Ha) _____**1704 0 - with irrigation = 1549** _____
Superficie regable (ha)
Additional irrigatable area (Ha) _ **155 0 included in above**
Extension zona (ha)
Number of Landowners _____**482**_____
Numero de patrons
Number of Farmers _____**482**_____
Numero de Granjeros
Size of farms <10Ha ___ < 100 Ha _**5 -50**___ 100-1 000 Ha _____ >1 000 Ha ____
Clasifico de pais
Average landholding Ha _____**3 60** _____
Promedio area

Attach District Maps/drawings _____
Apegar mapas / empates
Designed System Flows (l/s per Ha) ___ **1 5** _____
Designio projecto fluidos
Actual present system flows (l/s per Ha) **_2 45____(divert 3800 - 3200 l/s)** _____
Real projecto fluidos
Source(s) of water supply **____X____**River(s),_____Wells,_____ Other,
Fuente de agua _____
Type(s) of ID systems **__X** __ Gravity, __ Gravity + Pumping, ____ Wells,
Date project constructed **_____1975 - 1981** _____
ficha de construir **(Designed by ICATEC, SA Julio 1973)**
Capital Costs (Donors & GOES) **IDB - $8 0 Mil & GOES - $ 7 9 Mil** _____
Costo de capital **(Both Atiocoyo North & South)**
Irrigation System Layout
Sistema de planificar
River Diversions No **___1_____** Location(s) _Suceo river_____
Type(s) _____**Gravity**_____

Note The original decree no 285 shows one single system, however in initial construction a large siphon and part of the connecting canal were not constructed, as a separate pumping station was installed to service the northern area Therefore, a detail accurate inventory must be made for both the north and south system areas that are separated by the Limpa River

Irrigation System
Main Canals No **____1_____** & Kms **___16 0_____**
Canal principal
Secondary Canals No **_____9_____** & Km **_____30 7_____**
Canal secundario
Laterals No **_____3____** & Km, **_____3.60_____**
3rd

Number of Main Roads **_____1____** No of Kms **_____16 0_____**
No calles primarias
Number of Secondary Roads **____32_____** No of Kms **____54 10_____**
No de calles secundarias

Designed On-Farm Delivery Amount (l/s per Ha) **_____1.5_____**
Caudal disenado de distribucion a parcelas
Number of Measuring Structures **_____6_____**Sizes **_3-Parshal (61cms)**
Numero de estructuras de medicion **2-Ventui (40 cms) & 1-RBC (80cms)**
Type(s) of Measuring Structures _____
Tipos de estructuras de medicion

Number of Measuring Devices _____1_____ Sizes _**AOTT -Correnfometio**__
Numero de aparatos de medicion
Types of Measuring Devices _____
Tipos de aparatos de medicion
Number of On-Farm Outlets _____**32**_____ Sizes __**20 cms** _____
No de compuertas de distribucion en parcelas
Types of On-Farm Measuring Devices _____Venturi_____
Tipos de aparatos de medicion

Estimated System Losses _____ Efficiency % _____
Perdidas estimadas del sistema Eficiencia

Estimated On-Farm Losses _____ Efficiency % _____
Oerdidas estimadas en parcelas Eficiencia

Estimated Overall Irrigation System Reliability (%) _____
Confiabilidad estimada del sistema de riego

Drainage System Lavout
Sistema de planificar
River & /or Natural Outlets No _____ Location(s)_____
Type(s) _____
Main Drains No _____ & Kms _____
Drenajel principal
Secondary Drains No _____ & Km _____
Drenajel secundario
Laterals No _____ & Km _____
Drenajes terciarios o/ asequias
Number of Drainage Pump Stations _____
No de estaciones de bombeo de drenaje
Number of Drainage Pumps _____ Pumping Capacity _____
Numero de bomba

Mobile Equipment being transferred - Yes ___**X**_____ No _____
El equipo automotriz esta siendo transferido
Attach List of Equipment _____-
Adjunte la lista de equipo

Attach Annual Rainfall Distribution (Monthly/Weekly) _____
Adjunte de distribucion de lluvia en el ano (mensual/semanal)

Crops Produced Cultivos producidos	Area (Ha) Area	Season (dates) Estacion del ano	Yield per Ha Rendimiento/Ha	Value per Ton Valor/Ton
Rice **Arroz**	**552 45**	**Nov - Jun**	**135 85 gg/ha**	**C/ 103 -/gg**
Corn **Maiz**	**68 53**	**Nov - May**	**85 8 gg/ha**	**C/ 105 -/gg**
Sweet-Corn **Maiz Dulce**	**3 5**	**Oct - Jun**	**6860 0- tray/ha** **Bandeja/ha**	**4 50/tray** **Bandeja**
Water- Melon **Sandea**	**8 39**	**Nov - Ene**	**12,870 - v/ha**	**C/ 3 0 /v**
Yuca	**2 44**	**May - Apr**	**500. gg/ha**	**C/ 40 0/gg**
Pastures **Pastos**	**917 48**	**Oct - Sept**	**8164 bot/ha**	**C/ 2 0 /bot**

Past Cost of GOES - Water Service per Ha _____

Present Cost of WUA - Water Service per Ha __ **140.00 Colones** _____

Collection of "Out-of-Pocket" - Annual O&M fee (___ Colones /per Ha /Year)

- Administration
- O&M - Main Canal
- Maintenance of part of the Principal Roads (a long main canals)
- Maintenance & Preventive Maintenance of pumps & Pumping Stations
- Other Costs
- General Overhead Costs

Note. Water Users contribute about 15 days per Ha or 317 Colones in manual labor for a value of 457 Colones per Ha for water service. This is an excellent method of keeping water charges at a lower cash rate

8 4 Lempa-Acahuapa I&D District Profile

LEMPA-ACAHUAPA - IRRIGATION PROJECT INFORMATIONAL PROFILE
Datos de Proyectos Riego

Project name _____**LEMPA-ACAHUAPA**___**(Original decree no 396)**
Nombre de Proyecto
Total Project Area (Ha) _____**4,325**_____**1997=1635 2**_____
Completo areas de proyecto (ha)
Area Irrigated (Ha)__ **(Original 2,726_)**___**2511 design** ____**1997 = 98 1**_____
Superficie regable (ha)
Additional irrigatable area (Ha) _____
Extension zona (ha)
Number of Landowners _____**2,196**_____
Numero de patrons
Number of Farmers _____**2,196**_____**(1997 = 116 w/water service)**_____
Numero de Granjeros
Size of farms <10Ha _____, < 100 Ha __**X**__ 100-1 000 Ha _____, >1 000 Ha ____
Clasifico de pais
Average landholding Ha _____**5 7 (w/ 4-Coop's)**__**1997=10 (R) & 17 6 (L)**_____
Promedio area **(1-3 Ha = 1026, 3 1-25 Ha = 441, >25 Ha = 724 & total = 2,196)**
Attach District Maps/drawings _____
Apegar mapas / empates
Designed System Flows (l/s per Ha) __**1 8+** ____Main Canal = **5 0m3/s**____
Designio projecto fluidos **-(Original design for 18 hrs./per day -Monday to Saturday)**
(Designed by Salzguiter, German CLASS, Peru & CONSULTA, El Salvador)
Actual present system flows (l/s per Ha) _____
Real projecto fluidos **(Area divided into 53 units)**
(Sector #1 = 20 , Sector #2 - 13 , Sector#3 = 20 units)
Source(s) of water supply _____**X**____River(s) _____Wells _____ Other
Fuente de agua
Type(s) of ID systems ___**X**___ Gravity _____ Gravity + Pumping _____ Wells
(Irrigate only during daylight hours)
Date project constructed __**(designed 1985/86)**_____**estimated 70% completed -6/98**
ficha de construir **(major construction started in 1991/93)**
Capital Costs (Donors & GOES)___**$ 17 0 mil W/$10.9 - IDB & $6 1 - GOES**
Costo de capital **(40 yr Loan w/ 1st 10 yrs @ 01% and balance 30 yr @ 02%)**

Irrigation System Layout **(The area is divided into 53 Units for records/ reports)**
Sistema de planificar
River Diversions No ____**1**_____ Location(s) _____

Type(s) _____**Gravity**_____

Main Canals No _**1**_**(5 0 m3)** & Km __**4 646**__ Total Area = **16.256 Ha**
Canal principal
Secondary Canals No _**2**_ & Km _**R = 13 3 (2 1 m3) & L = 10 7**_**(2 9 m3)**__
Canal secundario
Laterals No _____**6**_____ & Km,_**14 8**_____
3rd
Number of System Dams __**4**__ Total Area = **20 855 Ha**
(Distribution designed Efficiency = 63%)

Note Part of the irrigation system 7 34 kms / 20 9 Ha is built on elevated levies

Number of Main Roads ____**1**_____ No of Kms ___**1 166**_____
No de calles primarias **Total Area = 15 572 Ha**
Number of Secondary Roads ___**2**_____ No of Kms _**R = 0 4**_**& L =**__**10 7**___
No de calles secundaries
Number of Lateral Roads ____**20**_____ No of Kms ___**25 6** _____
No de calles de terciatios

Designed On-Farm Delivery Amount (l/s per Ha) _____**1.25 +**_____
Caudal disenado de destribucion a parcelas **(On-farm designed Efficiency = 40%)**
Number of Measuring Structures _____**26 constructed out of 56**___Sizes _____
No de estructuras de medicion **(1 - MC, 9 - LC, & 16 -RC)**
Type(s) of Measuring Structures _____**Parshall Flumes** _____
Tipos de estructuras de medicion
Number of Measuring Devices _____Sizes _____
No de estructuras de medicion Tamanos
Types of Measuring Devices _____
Tipos de estructuras de medicion

Number of On-Farm Outlets _____Sizes _____
(Delivery points) Tamanos
Number of On-Farm Measuring Devices _____Sizes _____
No de compuertas de distribucio en parcelas Tamanos
Types of On-Farm Measuring Devices _____
No de compuertas de distribucio en parcelas
Estimated System Losses _____ Efficiency % = **63% designed**_____
Perdidas estimadas del systema Eficiencia
Estimated On-Farm Losses _____ Efficiency % = **40% designed**_____
Perdidas estimadas en parcelas Eficiencia
Estimated Overall Irrigation System Reliability (%) _____
Confiabilidad estimada del sistema de riego

Drainage System Layout
Sistema de planificar

River & /or Natural Outlets No __X_____ Location(s) __various_____
Type(s) __natural___
Main Drains No __X____ & Kms __X___ **Total Area = 29 839 Ha**
Drenajel principal
Secondary Drains No _____ & Km _____
Drenajel secundario **Total length = 19 2 Kms**
Laterals No _____ & Km _____
3rd

Moblie Equipment being transferred - **Yes** _____ No _____
El equipo automotriz esta siendo transferido
Attach List of Equipment _____
Adjunte le lista de equipo

Notes (1) I&D District is providing land leveling services estimated at average of 200 m3/Ha or 2,500 Colones /Ha. average cost. (2) providing land preparation services - plowing @ 300 per mz, disking @ 130 per mz, & sowing @ 120 per mz plus 13% tax
(3) Water charges and land preparation charges all go into a special Lempa Acahupa District fund.

Attach Annual Rainfall Distribution (Monthly/Weekly) _____
Adjunte la distribucion de lluvia en el ano (mensual/semanal)

Crops Produced	Area (Ha)	Season (dates)	Yield per Ha	Value per Ton
Cultivos peoducidos	Area	Estacion del ano	Rendimiento/Ha	Valor/Ton

1997/98 - 1000 Ha in crops w/ 600 Ha using water & 400 Ha in cana (no water service)

Rice	_____	_____	_____	_____
Pasture	_____	_____	_____	_____
Sugar Cane	_____	_____	_____	_____

Past Cost of GOES - Water Service per Ha _____
Costos de passado de agua - GOES

Charge to Water Users _____

Present Cost of WUA - Water Service per Ha __**500 Colones per Ha/Yr_+13% tax**
Costos de presentar de agua - WUA

Note Plus (1) A one time subscription fee of 100 Colones per WUs and (2) a social activities ? fee of 50 colones per WUs per year

- **Administration**
- **O&M - Main Canal**
- **Maintenance of part of the Principal Roads (a long main canals)**
- **Maintenance & Preventive Maintenance of pumps & Pumping Stations**
- **Other Costs**
- **General Overhead Costs**

APPENDIX· A

CONSULTANTS TERMS OF REFERENCE / SCOPE of WORK

APPENDIXES

A Consultant's TOR/SOW

Date September 25 1997

CRECER PROJECT
Rural Equitable Economic Growth Project
San Salvador, El Salvador

TERMS OF REFERENCE

I Assigned Number

Short term consultant for the evaluation of and decision about tariffs for the operation and maintenance of the irrigation districts currently under the administration of producers organized into water user associations

II Proposed Candidate

An agricultural economist with international experience in advising about private management of irrigation districts and institution building of self governing water user associations Experience in Latin American countries is preferable

III. Background

There are four major irrigation districts in El Salvador, Atiocoyo Norte, Atiocoyo Sur, Lempa-Acahuapa, and Zapotitan The Lempa-Acahuapa, despite its financing by the Inter-American Development Bank, has not been finished but is operating in the extent possible The other districts are completed and functioning A grant form the Japanese government of about US$6 million will finance the complete rehabilitation of the Zapotitan district The rehabilitation project for Atiocoyo Norte has been approved by the government but funds are yet to be allocated The Atiocoyo Sur is operating without major difficulties, although it needs also some rehabilitation works

Up to about 1990-1991, the districts were entirely managed by the Irrigation Division of the General Directorate of Natural Resources, a branch within the Ministry of Agriculture, which meant personnel, logistics, and minor repair expenses covered by public funds From this date on and motivated by a change in the government policy, MAG gradually reduced its support to the operation and maintenance of the districts leaving the payment of the required expenses to the water user associations organized for this purpose, and tacitly

transferring the administration of the districts to the private sector Currently the personnel assigned to the districts is minimum and government financing has reduced to payments of the energy used to pump water from the derivations and some wells inside the districts This latter payment refers specifically to the Atiocoyo Norte and Zapotitan districts

During the time MAG was covering the majority of the operating and maintenance expenses (O&M) the tariff determined for this purpose and the tariff to cover the amortization of investment were in arrears and the debt accumulated to some million colones The actual figure in yet undetermined since 1) the unit in charge of collecting the tariffs lost control of the records 2) ownership of the land and parcels has changed hands a number of times and 3) in some cases, there was not a tariff set for O&M and investments recovery In any case the amount mentioned by the Irrigation Division is at least questioned by the actual land tenants and members of the water user associations Since the time the associations have undertaken the responsibility to manage the use of the irrigation districts, the O&M expenses have been paid by the users, except for the energy costs in the Atiocovo Norte and Zapotitan cases

The current Minister of Agriculture has decided to officially transfer the administration (i e the O&M) of the districts to their associations including the channel road and installation systems buildings and other permanent facilities The machinery assigned to each district will be evaluated either to discard the unusable pieces or to publicly auction them granting some privileges to the associations in the process (The law restricts the government from donating its goods to the private sector)

Among the points of the transfer negotiation an important issue is the payment of the overdue tariffs as well as a gradual reduction of the energy payment by MAG The proposal of the associations is for MAG to condone entirely the debt, upon the argument that, even without an official transfer the associations have covered the O&M expenses and have saved resources to the government MAG s position is one of expectation the Minister would like to have an evaluation of the amounts involved before taking a decision on this issue

Given the financial problems the associations have faced and will face in the near future especially if they have to cover all O&M expenses including energy, and eventually some investment costs they have requested technical assistance to evaluate the expenses already covered vis a vis the debt due to unpaid tariffs and to determine the appropriate tariff to easily cover the O&M and other contingent expenses

IV Objective

The main objective of these terms of reference is to precisely evaluate the value of the O&M expenses covered by the associations vis a vis the amount MAG claims as overdue tariffs plus interests, and to assist the associations to set the right tariffs for O&M and, eventually, for
covering a proportion of the investment cost which is another point of negotiation A parallel objective is to train the leaders of the water user associations in the elemental techniques of

VII Estimated Dates and Location

Since the negotiations conducive to an agreement on the transferring of the districts to their water user associations are expected to be completed before 31 July, 1998, it is recommended to initiate the work described in these terms of reference by mid June, 1998 The consultant will be located in San Salvador and arrangements will be made to take him/her to the district sites as often as needed

VIII Technical Coordinator

The technical coordinator will be Hugo H Ramos, the Agricultural Policy Advisor of Crecer

IX Expected Outputs

These are the concrete products expected from the consultant

1 A financial and economic evaluation of the expenses financed by the associations in operating and maintaining the irrigation systems along with an estimation of the amount saved by the government by tacitly allowing the associations to administer them

2 A recommendation memorandum on the appropriate tariffs to cover O&M and other minor contingent expenses, for each of the major irrigation districts

3 A rapid appraisal statement on the water metering and distribution system currently used by the associations, including recommendations to improve it

4 In service training of the association leaders on the main aspects of the scope of work, especially on setting the tariffs and keeping record of the water use and payments

5 A memorandum identifying future technical assistance needs for the associations

One of the main results of this technical assistance will be to support the Minister and associations in finalizing the district transferring negotiations, and to strengthen these other type of rural enterprises

setting tariffs and implementing a simple but efficient recovery and record keeping system Still another side objective is to appraise the current water metering system used by the associations and present recommendations on how to improve it

V Scope of Work and Activities

The following are the main activities to be developed by the consultant

1 Prepare a financial and economic assessment of the costs covered by the associations in terms of O&M expenses adding to this figure the savings generated to MAG by the undertaking of the administration of the four major irrigation districts Atiocoyo Norte, Atiocoyo Sur, Lempa-Acahuapa, and Zapotitan

2 Prepare an economic comparison between these costs covered and expenses saved to MAG and the amount MAG is claiming as unpaid O&M plus investment cost recovery tariffs

3 Evaluate the economic implications and impacts on the sustainability of the producers involved in the irrigation districts of any official decision on the issue of condonation of the debt

4 Recommend the appropriate tariffs to cover O&M and other contingent expenses and eventually, a proportion of the amortization of the investments, for each of the major irrigation districts

5 Assist the association leaders to design a simple system to monitor the recovery of tariffs and keep record of the water use

6 Conduct a rapid appraisal of the water metering and distribution system of each irrigation district and make recommendations for improvement

7 Identify future assistance needs in the engineering financial, economic and institutional areas where the associations require some strengthening interventions and help

VI Time Required

It is estimated a minimum of 6 person-weeks of work to complete the suggested activities and to reach the objectives of these terms of reference

APPENDIX: B

CONSULTANTS ACTIVITY SCHEDULE

APPENDIX B ACTIVITY SCHEDULE

Proposed 6/22/98 **ACTIVITY SCHEDULE**

	June				July															
	22	24	26	29	30	01	03	06	08	10	13	15	17	20	22	24	27	29	31
Activity/Task																				
Info /Data Collection																				
- Review existing data	X	-------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
- Identify data needed		X	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
- Collect data needed			X	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
- Review data collected				X	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Hold Meetings/discussions																				
- CRECER	X		X			X			X			X			X			X		X
- TechnoServe																				
- USAID																				
- MAG																				
Report Reviews																				
- Rough Outline	X																			
- Preliminary Outline			X																	
- First Draft Report							X													
- Second Draft Report													X							
- Final Draft Report																			X	

APPENDIX: C

LIST OF MEETINGS &

CONTACT PERSONNEL

APPENDIX C - LIST OF MEETINGS and CONTACT PERSONNEL

6/19/98 Travel to El Salvador - Jack Earl Farmer (JEF)

6/20/98

09 30 - 11 30 - Meet with Hugo Ramos CRECER Coordinator @ hotel

6/21/98 - Sunday - day-off

6/22/98

08 00 - 09 00 - CRECER Hugo Ramos (HR), Coordinator and Richard Clark, COP
Re introduction and discussion of SOW

10 00 Meet with Ing Edwin M Arayon, MEE / MAG @ MAG , w/ HR
Re Introduction and discussion of SOW

10 30 With Hugo Ramos in his MAG office

11 30 Meet with Attorney Myrian Esther Sorto (MES), @ CRECER, w/ HR
Re Legal transfer of Irrigation Districts from GOES/MAG to WUAs document

15 45 Meet with Ing Alirio Edmundo Mendoza (AEM) Coordinator Irrigation Projects TechnoServe (TNS) @ TNS w/ HR & MES

16 05 Joined by Ing Alejandro Flores Bonila (AFB), Chief of I&D-MAG
Re Introduction and discussion of SOW

6/23/98

08 30 - 14 00 Meeting @ TNS w/ AEM and staff Rutilio Mena (RM), Agr Eng , Gonzalo Menudes (GM), Agr Eng , w/ HR
Re Discussion of SOW and Work Activities

6/24/98

08 00 - 12 00 Meeting @ TNS w/ AEM and staff Rutilio Mena (RM), Agr Eng , Gonzalo Menudes (GM), Agr Eng , w/ Lissette Funetes (LF), CRECER
Re Discussion of SOW and Work Activities - draft of temporary work schedule

15 00 Reviewed Activities Schedule with Richard Clark COP - CRECER

6/25/98

09 00 - 11 30 Attended Transfer Committee meeting @ MAG w/ HR LF
Re Zapotitan ID -discussions

12 00 -15 30 Meeting @ TNS with Zapotitan WUA, and TNS staff w/LF
Re Further discussions on issues and constrains to transfer

6/26/98

07 00 - 14 30 Field Trip to Zapotitan, meet with WUA Manager and farmers, w/ LF & Cesar Adan Menendez (CAM), MAG

6/27/98

07 00 - 16 30 Field Trip to Atiocoyo Sur, meet with WUA staff, Manager , and Canal Operator, and farmers, w/ LF & CAM

6/28/98 - Sunday - day-off

6/29/98

09 00 - 11 30 Meeting at MAG with Joaquin Flores, Manager for Lempa Acahupa ID in San Salvado office w/ LF & CAM
Re Information and data collection on system

14 00 - 17 00 Meeting at CRECER office with Attorney Myrian Esther Sorto (MES), @ CRECER, w/ HR
Re Legal transfer of Irrigation Districts from GOES/MAG to WUAs document - issues and constrains

6/30/98

09 00 -12 00 Meeting with CLESA @ CLESA office with Ing Alejandro Flores Bonila (AFB), Chief of I&D-MAG and , Manager, WUA- Zapotitan ID, and LR & CAM
Re Zapotitan Id's - Electrical billing and tariff charges

14 00 - 18 00 Attended Zapotitan WUA - Board of Director's meeting at Zapotitan W/ LF & CAM
Re Legal transfer of Irrigation Districts from GOES/MAG to WUAs document - issues and constrains

7/01/98

06 30 - 16 00 Attended Atiocoyo Norte WUA - Board of Director's meeting and field visits with WUA staff, w/ LF & CAM
Re Transfer Agreement and issues and constrains

7/2/98

09 00 -12 30 Attended Transfer Committee meeting @ MAG w/ HR, LF, CAM
Re Presentation by Attorney Myrian Esther Sorto (MES), CRECER, on transfer document preparation - then discussions of issues

7/3/98

06 30 -1600 Attended at 09 00 Lempa Acahuapa WUA - Board of Directors meeting, followed by field visits with WUA staff and farmers, w/ LF & CAM
Re Present status of construction and operations of district

7/4/98

07 00 - 16 30 Attended at 09 30 Atiocoyo Sur - Board of Director s meeting, followed by field visits with WUA staff and farmers w/ LF & CAM
Re Legal transfer of Irrigation Districts from GOES/MAG to WUAs document - issues and constrains

7/5/98 - Sunday - day-off

7/6/98

14 00- 15 30 Meeting at DELSUR, company office with Ing Jaime Cordova, Commercial Analysist, and
w/ LF & CAM
Re Atiocovo Norte s electric service and billing

7/7/98

13 00 - Departure for Zapotitan w/ LF & CAM
14 00 - Meeting with Water Users in Section # 5 of Zapotitan ID
15 00 - Attended Zapotitan WUA - Board of Director s meeting at Zapotitan W/ LF &
Re Transfer - issues and constrains

7/8/98

07 00- 10 00 Departed for field visit to Atiocoyo Norte- met w/ LF & CAM
10 00- 12 30 met with Atiocoyo & WUA staff and farmers
15 00 - 17 00 @ CRECER w/HR

7/9/98

09 00 - 17 00 Transfer Committee meeting at FUSAL w/ HR LF & CAM
Presentations and discussions by Jack Farmer and CRECER Attorney
Related to Legal Agreement for Transfer

7/10/98

06 30 Departure for Lempa -Achuapa w/ LF &CAM
09 00 - 12 30 Discussions and field visits
12 30 - 15 00 Return travel
15 30 - 17 30 Discussions with CRECER Attorney HR, LF
Re Legal constrains related to Transfer Agreement

7/11/98

08 00 - 17 00 Worked in CRECER office

7/12/98 Sunday - Day-off

7/13/98
- 08 00 - 13 30 Worked in CRECER office
- 14 00 - 17 00 Meeting @ TNS office w/CAM
  Re Coordination and planning for July 23 rd Workshop

7/14/98
- 08 00 - 17 30 Worked in CRECER office

7/15/98
- 08 00 - 13 30 Worked in CRECER office
- 14 00 - 16 30 Meeting @ TNS office w/CAM & AEM
  Re Coordination and planning for July 23rd Workshop

7/16/98
- 08 00 - 17 30 Worked in CRECER office
- 09 00 Transfer Committee meeting @ MAG - HR, attended

7/17/98
- 06 30 - 15 00 Departed for field visit to Atiocoyo Norte - w/ LF & CAM
  Re Coordination and planning for July 23rd Workshop
- 15 30 - 18 30 Worked in CRECER office

7/18/98
- 07 00- 14 00 Departed for field visit to Atiocoyo Sur - w/ LF & CAM
  Re Coordination and planning for July 23rd Workshop
- 14 30 - 18 30 Worked in CRECER office

7/19/98
- Sunday - Day-off

7/20/98
- 07 00- 12 30 Departed for field visit to Zapotitan - w/ LF & CAM
  Re Coordination and planning for July 23rd Workshop
- 13 30 - 18 30 Worked in CRECER office

7/21/98
- 06 30 Departure for Lempa -Achuapa w/ LF &CAM
- 09 00 - 12 30 Re Coordination and planning for July 23rd Workshop
- 14 30 - 18 30 Worked in CRECER office

7/22/98
- 08 00 - 18 30 Worked in CRECER office
  Re Preparation for July 23rd Workshop

7/23/98
08 00 - 17 30 Attended Workshop on transfer of I&D Districts

7/24/98
08 00 - 17 30 Worked in CRECER office
Evaluating Workshop presentations

7/25/98
08 00 - 17 30 Worked in CRECER office
Evaluating Workshop presentations

7/26/98
Sunday - Day-off

7/27/98
08 00 - 13 30 Worked in CRECER office
11 00 - 14 00 Meeting at TNS with AEM & CAM
Re Report Recommendations
15 00 - 18 00 CRECER office

7/28/98
08 00 - 14 00 CRECER office
14 00 - 15 00 travel to Zapotitan with LF
15 00 - 17 30 meet with Manager and Board of Directors
17 30 - 18 30 travel back to CRECER office

7/29/98
06 30 - 13 00 Field trip to Atiocoyo Norte w/ LF for
Meeting with Manager, President of Board and TNS
Re Report Recommendations

7/30/98
08 00 - 09 00 CRECER office
09 30 - 10 30 Meeting with Minister of Agriculture @ MAG w/ HR
10 30 - 13 00 Attended Transfer Committee meeting @ MAG
and gave presentation on Findings & Recommendations

7/31/98
08 00 - 18 00 CRECER office- Revisions to final report

9/01/98
08 00 - 18 00 CRECER office- Revisions to final report

9/02/98
Sunday - Day-off

9/03/98
06 00 Departure for San Salvador Airport-
Travel to USA

APPENDIX: D

LIST OF REFERENCES

APPENDIX D - LIST OF REFERENCES

1) Water User Associations and Irrigated Agriculture within the Context of the Rural Sector - TECHNICAL REPORT - January 1995 by L Humberto Yap-Salinas Ph D - Department of Biological and Irrigation Engineering Utah State University for the Support for Policy Analysis and Agricultural Sector Investment with IICA (AID Project 519-0349)
- Refers on page xi to article in La Prensa Grafica press Dec 2 1994 that illegal aliens in California cost the state just over $1,382 00 per year
- Generally confirmed the need for WUA s and expanded agriculture within El Salvador

2) Proposed World Bank paper on El Salvador - Public Sector Modernization Project, March 1996
- Proposed a El Salvador project for public sector modernization through technical assistance loan, with private sector participation
- Query if loan & project finalized

3) Marco De Referencia Para La Formalacion De una Politica Nacional De Recursos Hidricos En El Salvador - Informe Primero por Enrique Aguilar Amilpo Consultor Internacional - ORGANIZACION DE LAS Naciones unides para Agricultura y la Alimentacion (FAO) Roma - Mayo 1996, - programa de cooperacion Tecnica - TCP/RLA/4557
Query status of program

4) Irrigation System Management Transfer (ISMT) and Water Users Association in Aticocoyo (Sur) Irrigation District, El Salvador - TECHNICAL EVALUATION REPORT - September, 1996, by L Humberto Yap-Salinas, Ph D , Director International irrigation Center, - Department of Biological and Irrigation Engineering, Utah State University
- page 36 comment TechnoServe efforts should continue and be expanded to include
1) A detailed inventory, or profile of a) physical conditions and of b) farmers

2) promotion of land leveling
3) continue efforts to work with the government
4) page 38 -

5) Comision Ejecutive Hidroelectrica del Riom Lempa -CEL
- Propuestas para el Pago de Servicos de Energia Electrica y Manejo de Demanda en el Distrito de Riego del MAG Atiocoyo Norte
- Gerencia de Planificacion y Estudias - Febrero de 1998

6) Proyecto de Desarrollo Agricola del Valle de Zapotitan - Volumen IV -Plans
-TAHAL Consulting Engineers Ltd , Tel Aviv - Julio 1970

7) Distrito de Riego y Avenamiento No 2 ATIOCOYO
- Asesoria ICATEC, SA - Julio 19973 & Julio 1974

8) Evaluaion Critica del Proyecto de Desarrollo Agricola Lempa-Acahuapa El Salvador
- Boris E Bravo-Ureta y Alirio E Mendoza, TechnoServe - Diciemre 15, 1997

9) Propuesta de Transferencia de los Distritos de Riego
- Federacion de Asociaciones de Regantes de El Salvador - Agosto de 1996

10) El Salvador - proyecto de Riego Atiocoyo Pn 85 2298 9
Mision de Apoyo en Operacion y Mantenimiento - Agosto, 1992
- GFA-Gesellschaft Fur Agrarprojekte M B H
With separate Anexo (#1 through #50

11) Cooperacion Salvadorena - Alemana
Fomento de la Agricultura de Regado y de los Servicios en el Area de Atiocoyo
Estructuracion del Presuepuesto de la Asociacion de Regantes del Sector Sur del Distrito de Riego de Atiocoyo -GTZ- MAG-GFA - Abril 1993

12) Regamento Interno dela Asociacion de Regantes del Sector de Atiocoyo San Isidro
Distrito de Rirgo y Avenamiento No 2 - TechnoServe , -Julio de 1996

13) Rules and Regulations of Central California Irrigation District - 1990
With two page letter - 1998 Water Rates and Allocations, - March 4, 1998

14) Impacto Ambiental del Proyecto Hidroelectrico El Cimarron - CESTA
Centro Salvadoreno de Tecnologia Apropiada

15) Farm Irrigation by Jack Farmer - (Basic principals of farm irrigation - booklet)

16) Measuring Irrigation Water, University of California Davis -1981 (leaflet #2956)

17) Surface Irrigation, University of California, Davis -1995 (Handbook)

18) Water Policy and Water Markets, - 1992, World Bank Technical Paper No 249