CHAPTER 3 ENVIRONMENTAL IMPACT ASSESSMENT

3.1 Project Description

Outline of Vaza Barris Dam Project is as follows:

Vaza Barris Dam		
	Dam Type	Gravity Concrete
	Reservoir Area	9.5 km^2
	Total Storage Capacity	93,000,000 m^3
	Dam Height	48.2 m
Check Dam		
	Dam Type	Gravity Concrete
	Sediment Capacity	10,000,000 m^3
	Dam Height	20 m
Low Flow Bypass		
	Bypass Type	Concrete Box Culvert (Underground)
	Cross Section	1.05m W x 1.05m H
Pipeline		
	Material	Ductile Cast Iron
	Location	System 1: Vaza Barris Dam – Jenipapo – Brasilia – Acuvelho – Urubutinga – Lagarto
		System 2: Vaza Barris Dam – Ribeira – Cajaiba – Carrilho – Itabaiana
	Length	System 1: 25.4km System 2: 24.0km

3.2 Environmental Impacts

3.2.1 Social Environment

Resettlement:
The reservoir formed by Vaza Barris dam will have a surface area of approximately 9.5 km^2 at normal water level. Because there are no villages in the inundated area, people requiring relocation is expected to be a small number. According to topographical maps (1:5,000 in 1985), there are 31 sheds and 13 houses within the inundated area of Vaza Barris dam and Check dam. Some of these houses likely are barns for grazing activity. Actual resettlement requirements, including three families identified by the field surveys, will be less than ten families. Some of them are employed by the farm owners and have no land. However, some of the families may obtain the relocation site in their own lands around the reservoir.

The pipelines will be laid along existing roads and extensive agricultural land. Resettlement will not be needed.

Economic activity:
The two dam sites and the reservoir area are in hilly areas where agriculture is the only economic activity, but not in a great scale. The land acquisition area is extensive pasture land or grassland including small cultivated-pasture lands and riverside forests. Therefore, the agricultural resources loss of the farmers will not be large. The inundated pasture lands will be about 600 hectares. Due to the reservoir's barrier effect, pasture land

disruptions will occur. Moreover, because the corridor from end of the reservoir to the check dam, about 9 km long, will dry up during dry season, bathing points for the livestock will be lost in this area.

Agricultural lands and products will be lost in the acquisition of land for pipeline right of way, but these losses will only be a little in the overall.

An increase of construction workers to the project area will put additional pressure on the social services and the medical facilities. On the other hand, dam construction works will bring additional income to the local residents in terms of the employment of workers, the local economy will be revitalized subsequently.

Infrastructure facilities and cultural property:
State road (SE-110) crosses Vaza Barris River at about 20 km above Vaza Barris dam site. The reservoir will reach the point at normal water level, but the bridge spans far over the water level. There are several farm roads in the reservoir area. The impact of inundation of the roads is considered to be minor, because these roads are hard for automobiles to across the river even during dry season; therefore the users have been limited. There are no other infrastructure facilities or cultural properties in the inundated area.

In and around the dam sites, there are only farm roads that are only possible by tractors and jeeps. New roads shall have to be prepared for the construction. Therefore, the impact of construction vehicles on the traffic around project area is considered to be minor.

The pipelines will be laid along existing roads and pass several towns. Temporary and localized disruptions to the local traffic will occur. This impact can be mitigated by traffic control at the construction site.

Public health condition:
The reservoir will lead to an increase in the potential of water borne disease and provide breeding areas for mosquitoes that tend to breed in stagnant water body and field edges. Therefore, the risk of water or mosquito borne disease such as schistosomiasis or dengue fever may increase. The breeding areas in the reservoir are unavoidable but adoption of pipeline as the bypass channel can reduce the areas to some extents. The local governments have conducted a campaign and eradication program against dengue fever. Moreover, there are no villages around the reservoir. Therefore these diseases will hardly break out.

Waste:
The volume of construction waste from the dam construction will be large. The waste includes excavated soils, rocks, cements and some bulky waste such as concrete piles. Excavation works for the pipelines will also generate surplus soils. These impacts can be mitigated by reuse plan and proper disposal plan. There are possibly three ways as the reuse plan: 1. Filling valleys with high permeability in the reservoir, 2. Refilling the quarry site, and 3. Providing them as construction materials to local companies and people.

The construction camp will generate large quantity of waste that cause water contamination and sanitary problem. This impact can be mitigated by the proper waste management.

3.2.2 Natural Environment

Hazard and Soil erosion:
The two dam sites, the reservoir area and the pipeline alignments are located in hilly areas. There are no serious or large soil erosion sites such as gully erosion in the area. Storage of water into the reservoir may reduce the slope stability of the bank. However, according to the result of geological and topographical survey, large-scale landslide will not occur.

During the construction period, due to cut slope, land clearing and soil stripping, the topsoil may be eroded more easily, but these soil erosions can be mitigated by proper design and construction plan. During the operation period, soil erosion from slope around the reservoir area may cause sedimentation of the bed and water siltation, but the erosion level is considered to be minor.

Groundwater:
In Sao Domingos town located near the reservoir, groundwater is the main source of water supply. Some local people living around Vaza Barris River use well water also. Storage of water into the reservoir may increase the recharge level. However, according to the result of hydrogeological survey, the impact on the present groundwater use will not occur.

Water quality:
The outlet of wastewater from Sao Domingos town is located 3 km away from the reservoir. Because the wastewater is a small quantity and purified by the stabilization pond and natural purification, the effect on water quality of the reservoir may be negligible. There are no other significant pollution sources in the upper catchment area.

Because the concentration of phosphorus in Vaza Barris River is low, it will be hard for eutrophication of the reservoir to occur. However, for the first few years, the nutrient level in the reservoir will be influenced by the decay of the vegetation left at the time of first filling. Some pockets of anoxic water will occur in the shallow hollows of the reservoir where vegetation was dense at the time of inundation. Although it is impossible to remove the vegetation completely, land-clearing works in the inundated area will improve water quality of the reservoir to some extent. Even if some vegetation remains, the effect on the water quality is considered to be minor. The reasons for this are as follows:

1) The reservoir will have a high proportion of water volume to the vegetative biomass.
2) A high rate of flushing will be expected during floods.
3) The sinking of the water level prior to the rainy season will flush out the nutrients released into the water by the decay of vegetation.

Consequently, the water quality of the reservoir will be essentially the same as that of the river under present condition except for the sediment load, and will be suitable for domestic use and irrigation.

Hydrological situation and Estuary:
After the dam is closed, hydrological situation of the downstream will alter. The down flow and sediment load will be reduced. These effects are inevitable with the project implementation. The hydrological alternation by the project is shown in Figure-3.1 and Figure-3.2. The filling of the reservoir will take about 30 percent of the average annual-discharge at the dam site. The down flow will decrease from 8.7 m^3/s to 6.0 m^3/s as the

average-annual flow at the dam site. This decrease volume is equivalent to about 20 percent of the average-annual flow at end of the river (river mouth). If the water used in Vaza Barris River basin returns to the river perfectly, but unlikely case, the decrease volume will be only 4 percent of the flow at end of the river throughout the year.

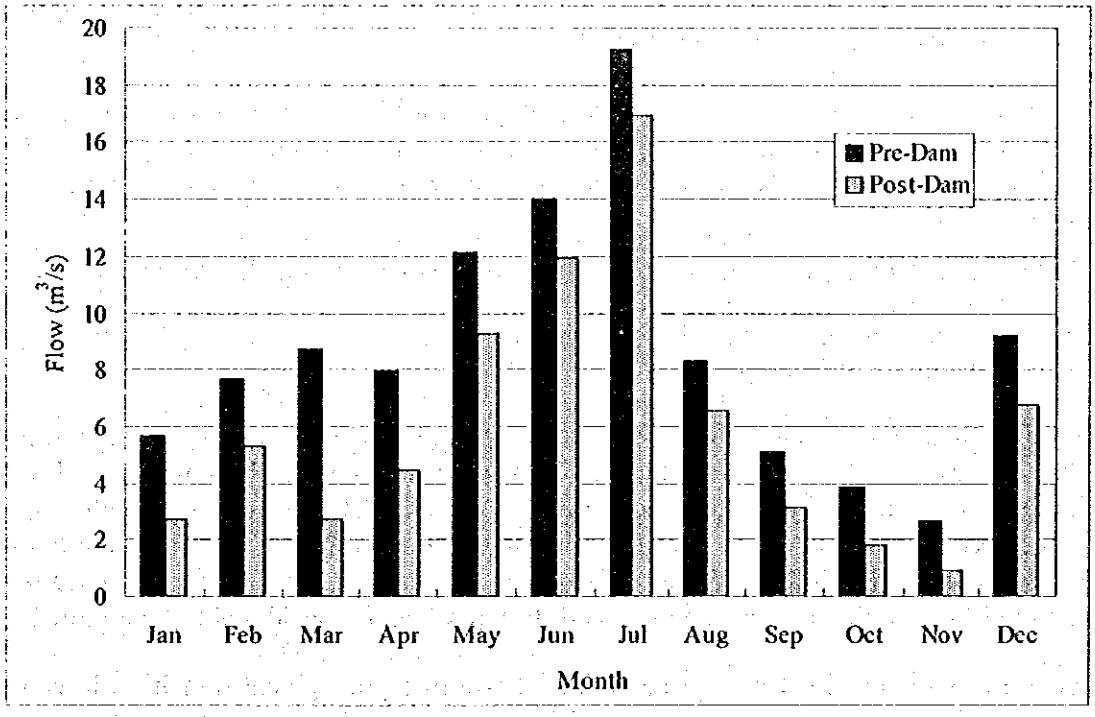

Figure-3.1 Effect on Average Monthly Discharge at the Dam Site (1986-1995: Average)

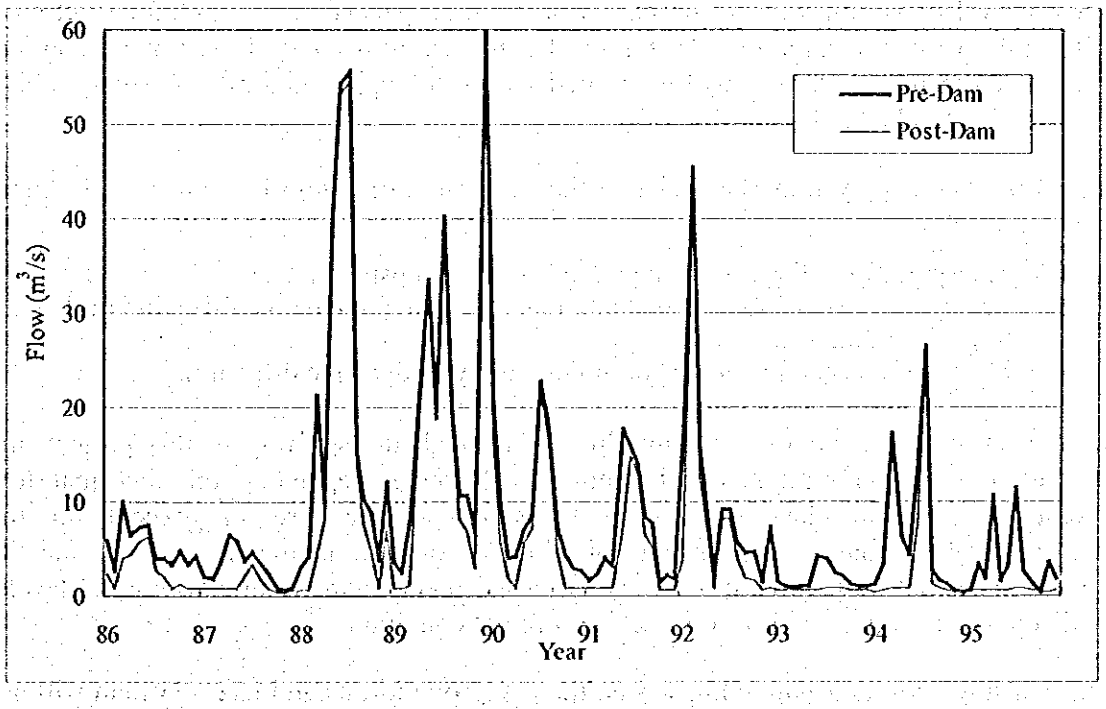

Figure-3.2 Effect on Average Monthly Discharge at the Dam Site (1986-1995)

Bed load sediments from the upstream will remain in the reservoir. Although the floods will normally flow directly through the spillway, most of the wash loads will also remain in the reservoir because of the long shape.

The environmental discharge adopted in this study is 0.44 m^3/s of the 10-year return period 7-day discharge (Q7,10). Because there are no domestic water use and irrigation systems in the downstream area, this value is considered to be suitable.

There is a mangrove forest zone with high value as wild life habitat in the estuary. The alteration of water quality and/or hydrological situation may damage the ecosystem and the fisheries in the estuary. The actual effects of the project on the mangrove zone are as follows:

1) Increase in concentration of salinity in the estuary water, due to decrease in the river flow.
2) Decrease in sediment load and nutrients.
3) Alterations of flood pattern.

According to the water quality analyses, the salinity in the mangrove forest zone is similar to that of seawater. In the estuary, the river flow contributes a very little to the total water volume of the estuary. Although there are no available data on the tidal condition, the average decrease volume of the river flow during one tide cycle will be equivalent to one-hundredth order of the inflow volume of seawater. Therefore, the impacts of the decrease in the river flow on the mangrove forests and its ecosystem is considered to be minor.

Decrease in sediment load may bring about long-term topographical transition in coastal area depending on the oceanographic condition. In general, this long-term transition is hard to estimate. About 70 percent of the mangrove forests in the estuary are formed on the coastal sand. The mangrove zone is an inlet area rather than a river area. Because the river sediments are concentrated mainly in the upper area of the estuary, the large-scale topographical transition will not occur. Moreover, suspended solids including nutrients will not decrease substantially. Therefore, the impacts of decrease in sediment load and nutrients on mangrove forests will be limited within the upper area of the estuary and is considered not to be large scale.

In general, floods play important roles in the ecosystem of mangrove zones. The main roles are as follows:

1) Transportation of sediments and nutrients from upstream area.
2) Supply of nutrients to surrounding area, due to hydrodynamic diffusion of detritus (organic sediment).
3) Supply of oxygen to anoxic bottom due to hydrodynamic diffusion.

Because most of the floods will flow directly through the spillway in this project, the alternations of flood pattern will be minor. However, depending on abnormal low precipitation, middle class floods will be stored in the reservoir except for the environmental discharge. Although this impact on the mangrove forests and its ecosystem can not be predict at this stage, after the precipitation returns to normal levels, the disturbed ecosystem will restore itself to original condition.

Consequently, serious negative impacts on the mangrove forests and its ecosystem will not occur. However, more detailed survey on the estuary and long-term monitoring program should be conducted.

Flora and Fauna:
Construction works such as land clearing, excavation, blast and hauling operations will change the physical environment drastically and damage the wildlife. Although the suitable construction plans can minimize the effects to some extent, this impact can not be avoided completely. Some wildlife in/around the dam site and the pipeline alignments will be lost.

Based on the limited available information from maps, satellite image and casual field observation, there are no extensive areas of undisturbed forest and wildlife habitat in the inundated area. Only scatted riverside forests remain along Vaza Barris River and the tributaries. These riverside forests have relatively high wildlife habitat value. Because rare or endangered species have not been identified in the project area, serious impacts on biodiversity would not occur. However, the riverside forests of about 90 hectares will be inundated. Although this biological loss is inevitable with the project implementation, the biological resources lost by the project can be restored by reforestation program to some extent.

After the dam is closed, migration of the fish will be obstructed. However, migratory fishes that swim up the river from the sea to spawn have not been identified in the project area. Adverse effect on the local fish can not be avoided, but the impact will be, to some extent, counteracted by the reservoir, as a newly created aquatic habitat. The fish will shift from species of rapid river type to species of pool or lake type.

As for newly created biological conditions around the reservoir, some qualitative change will occur in the vegetation along the edge of the reservoir over the next 20~30 years, due to the rise of groundwater level and humidity. Water level of the reservoir will change by about 15 m. In general, reservoirs with severe drawdown show the same characteristics. The drawdown zone will not be covered with vegetation. Submerged aquatic plant also can not grow under the condition. These water bodies will not get a chance to the complex food chains and species diversity. In areas where clearing is not performed, the bare skeletons of trees remain for many years, but eventually they will be destroyed by insects and bacteria.

Landscape:
There are no scenic spots around the dam sites, the reservoir and the pipeline alignments. However, construction works such as clearing and excavation will change the physical environment drastically and damage the landscape. After construction, two dams and reservoirs, which are artificial big objects, will be newly built. This impact can be mitigated by reforestation program of the dam sites and the buffer zone of the reservoir. The reforestation activities will create the harmonious scenery.

3.2.3 Environmental Pollution

Dam construction may increase the SS level of the river. This impact can be minimized by providing bypass for the river flow and settling ponds during the construction works.

Improper disposal of the waste and accidental spilling of harmful materials such as petroleum, oil and cement cause water and soil contamination but these impacts can be minimized by implementation of proper disposal plan and maintenance of the construction equipment. Heavy equipment operation will generate dust, noise and vibration, which are

harmful to the local residents and construction workers. Because the pipelines will pass several towns, temporary and localized disturbance to the residents will occur. These impacts can be mitigated by proper construction methods. With regard to the dam constructions, these impacts on the residents are negligible because the work sites are remote from the residential areas.

3.3 Environmental Mitigation Plan

3.3.1 Natural Environment Mitigation Plan

(1) Forest

Buffer areas around the reservoir and two dam sites should be created, where reforestation programs should be implemented to replace the lost vegetation cover such as riverside forests. Total 300 hectares, as about three times of the inundated forest area (approximately 90 ha), or 30,000 trees will be reforested in this project. The items of the reforestation sites are as follows:

150 hectares	Around Vaza Barris Dam site
50 hectares	Around the check dam site
100 hectares	Along the reservoir

The reforestation programs should consider for a harmonious landscape also. The choice of plants species must be considered adaptability to the environment. It is advisable ecologically to use local plants in the reservoir area. Therefore, most of the nursery trees should be gathered from existing riverside forests near the reforestation sites. In two dam sites, because it will be difficult to gather sufficient natural nursery trees, artificial nursery will be needed to cover the sites. It is impossible to reforest a circumference of the reservoir wholly. The priority sites are as follows:

1) Circumference of the existing forest
2) Side of the tributary
3) Flat area or side of the construction road (easy to work)
4) Conspicuous place such as the state road bridge

(2) Reservoir Water Quality

Because the nutrient level in the reservoir will be influenced by the decay of the vegetation left at the time of first filling for the first few years, vegetation in inundated area should be cut and removed in advance.

To protect the water quality of the reservoir, settlements around the reservoir should be limited except for the families relocated by this project. The water quality monitoring should be conducted periodically.

(3) Others

The designs of the two pipeline alignments should consider minimizing the changes to natural environment as well as the construction coast.

To minimize soil erosion, cut slope, land clearing and soil stripping works should be mainly implemented during the dry season.

To prevent noise, dust, water pollution, soil contamination and vibration, the contractors should maintain the heavy equipment in good condition and use suitable methods and equipment.

An environmental specialist should be enlisted as part of the site supervisor consultants to control soil erosion, dust, water pollution and inadequate tree cutting, and to monitor and the environmental aspects and the mitigation measures such as reforestation programs.

Environmental monitoring should be conducted to recognize the transition of environmental aspects such as water, fauna and vegetation in both periods during construction and operation. Especially, the long-term transitions of ecosystem and topography in the estuary should be monitored according to the prior plan from before the construction begins. The monitoring data should be open to the public and utilized by scientists, consultants, teachers and fisher persons.

3.3.2 Social Environment Mitigation Plan

(1) Land Acquisition and Resettlement

The information disclosure should be conducted at an early stage to obtain the agreement of affected population such as the landowners of the reservoir area and people required to relocate. The compensation and relocation plan must be well planned and satisfy these population.

(2) Division of Local Community

The compensation for negative impact on economic activity must be well planned and sufficient. Landowners of pasture land divided by the reservoir should be especially considered. Because the corridor from the end of the reservoir to the check dam, about 9km long, will dry up during dry season, bathing points for the livestock will be lost in the corridor. Constructions of wells or small pools for the livestock should be considered depend on claims from the farmers.

With regard to construction of the pipelines, temporary pathways should be provided to across the open trenches for the residents and livestock.

(3) Fishery in the Estuary

To obtain the agreement of fisher persons in the estuary, information disclosure should be conducted at an early stage. Furthermore, not only affected people around the reservoir area but the fisher persons should be made to participate in the public hearing.

Annual monitoring on fishery activities should be conducted to recognize the impacts of the projects on the fishing industry. This monitoring should be conducted according to the prior plan from before the construction began. The monitoring data should be open to the public and utilized by scientists, consultants, teachers and fisher persons.

In generally, it is impossible to estimate the exact impacts of a dam project on the ecosystem of a downstream area at the present time. If the serious impacts on the fishery are identified in the future, some compensation will be needed for the fisher persons. Not only economical compensation but also introduction of new fishery technique such as artificial incubation and farming should be considered as part of the compensation.

CHAPTER 4 SUGGESTION

4.1 Environmental Study Conducted by Sergipe Side

To supplement this report, following surveys should be conducted in Brazilian environmental impact assessment stage.

1) Fauna and Flora Survey at the Dam Site and the Reservoir Area
   The main purpose is to identify existence of rare or endangered species and migratory fish swimming up to spawn.
2) Land Use Survey in the Reservoir Area
   The main purposes are to estimate size by the land use type and estimate the inundated biomass.
3) Hydrological Situation (tide, current, seawater intrusion) Survey in the Estuary
   The main purpose is to collect baseline data for assessment of impact on the estuary.
4) Ecological Survey in the Estuary
   The main purpose is to collect baseline data for assessment of impact on the estuary.
5) Bed Load Sediment and Wash Load Survey at the Dam Site and the River Mouth
   The main purpose is to collect baseline data for impact assessment of the loads altered by the dam.
6) Water Quality Analysis of Vaza Barris River, Tributaries and Cajaiba Dam Reservoir.
   The main purpose is to collect baseline data for a forecast of water quality of the reservoir.
7) Economic Activity Survey in and around Reservoir Area
   The main purpose is to collect baseline data for assessment of the social impact and the mitigation plan.

4.2 Environmental Monitoring in Vaza Barris River Estuary

Preliminary Ecological Evaluation of Vaza Barris River Estuary was conducted by Federal University of Sergipe in this study. The monitoring plan should refer to these evaluation results. The sampling, measuring and analysis methods should follow the methods adopted in this evaluation as a rule to identify the long tram transition.

CHAPTER 5 CONCLUSION

Environmental impacts can be considered as falling in two categories. There are as follows:

< Unavoidable Adverse Impacts >

These are impacts such as the land loss to reservoir inundation, alteration of downstream situation and change of physical environment in the dam site and the pipeline right of way. These impacts are inevitable with project implementation and do not have avoidable actions without compromising the project.

< Manageable Effects >

These are direct or indirect, adverse or beneficial, effects. Some sort of action plans can lessen these effects and enhance the secondary benefits.

Vaza Barris Dam project has potentially adverse impacts on many environmental items. These environmental impacts will occur at operation stage as well as construction stage. However, the manageable adverse effects can be avoided by suitable mitigation plans. Considering no other useful water resources, the conclusion of this Environmental Impact Assessment is that the Vaza Barris Dam project is environmentally feasible.

JAPAN INTERNATIONAL COOPERATION AGENCY

STATE SECRETARIAT OF PLANNING, SCIENCE AND TECHNOLOGY
THE STATE OF SERGIPE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE STUDY
ON
WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT
SUPPORTING
(VOLUME II)
FEASIBILITY STUDY

[L] ECONOMIC, FINANCIAL AND SOCIAL EVALUATION

MARCH 2000

YACHIYO ENGINEERING CO., LTD. (YEC)

THE STUDY ON WATER RESOURCES DEVELOPMENT
IN THE STATE OF SERGIPE
IN THE FEDERATIVE REPUBLIC OF BRAZIL

SUPPORTING REPORT (L)
ECONOMIC, FINANCIAL AND SOCIAL EVALUATION

Table of Contents

List of Tables

CHAPTER 1 ECONOMIC EVALUATION

1.1 Assumptions

In estimating the economic cost and benefit, the following conditions and assumptions are applied.

1.1.1 Domestic and Industrial Water Supply Project

(1) Price Level

For economic evaluation, the basic price level (financial prices) for cost and benefit estimates were set at prices of September 1999. Foreign exchange rate was set at R$1.92 to US$1.00 based on the official exchange rate at the time.

(2) Opportunity Cost of Capital

Opportunity cost of capital represents the permissible economic rate of return for development projects. In Brazil, 10% or 12% of opportunity cost of capital is generally applied as a discount rate to assess the economic viability of projects. In this study, 10% of opportunity cost of capital is applied from the viewpoint of social purpose and needs for water resources development.

(3) Economic Value

In economic analysis, financial prices of all goods and services applied in the project are corrected with conversion factors to reflect real economic value.

Table-1.1 Conversion Factors

Item	Sector	Conversion Factor
Sector-specific Conversion Factor	Material	0.88
	Machinery and Equipment	0.80
	Skilled Labor	0.81
	Unskilled Labor	0.46
Standard Conversion Factor	—	0.96

Note: (1) Sector-specific conversion factors are calculated by Harvard University for the sanitation sector in Brazil
Source: Document of the World Bank, Report No: 17451-BR

Sector-specific conversion factors used for World Bank sanitation project in Brazil are principally applied in this analysis as shown in Table-1.1. Standard Conversion Factor (SCF) is applied for the other sectors. SCF is calculated as follows based on the statistical data of external trade of Brazil during three years from 1994 to 1996 as shown in Table-1.2:

– Standard Conversion Factor = (A + C) / (A + B + C – D) = 0.96

Table-1.2 External Trade of Brazil

	Import (CIF)	Import Tax	Export (FOB)	Export Tax	Exchange Rate
1994	35,512	2,822	43,545	-	0.639
1995	53,828	5,314	46,506	19	0.918
1996	56,749	4,163	47,746	2	1.005
Total	(A) 146,089	(B) 12,299	(C) 137,797	(D) 21	

Source: Anuario Estatistico do Brasil, 1996 and 1997, IBGE and Conjuntura Economica
Note: Exchange rate (R$/US$) is annual average and used to convert import and export tax in Real to in US Dollars.

(4) Economic Life

Various components with different specifics are used for construction in the project. The economic life of each component is hard to define correctly because it varies depending on the conditions such as maintenance, weather and so forth. In this analysis, the economic life of the structure such as dam is estimated at 80 years. Structures are assumed to be 40 years. Mechanical facilities and equipment are considered as 15 years. However, cast-iron pipeline is considered as 50 years. The components, if its economic life is less than economic evaluation period, would be replaced periodically during the period.

The economic evaluation period is set at 50 years in this analysis.

(5) Economic Cost

Financial construction costs of the project are described in Section I. The financial costs are corrected to reflect economic cost by applying conversion factors mentioned above. The total of financial project costs of Domestic and Industrial Supply Project are R$179million after cost allocation of Multi-purpose Dam and are given in detail by component and by year in Appendix-1.

(6) Economic Benefit

(a) Residential Water

The Study Team conducted the water use survey in August 1998, which showed that willingness to pay of rural inhabitants was 3% of the household income that is applied in this analysis. The urban area is also assumed to be 3% of the household income in this analysis.

However, there is no statistical information regarding the household income of the project area. In this analysis, the household income surveyed in August 1998 by the Study Team (R$270 in rural area and R$650 in urban area) was applied after being corrected with minimum wage increase, which is effective since May 1999, to reflect the latest level of income. Minimum wage was set up at R$130 in 1998 and at R$136 in 1999. That shows an increase of 4.6% compared to the prior year. Minimum wage is set up by Federal Government in every year that generally hikes the workers' income in the nationwide labor market. Thus, the household income of rural area and urban area is set respectively at R$280 and R$680 in this analysis.

The family size of the project area was 4.1 persons according to the 1991 census as shown in Table-1.3.

Table-1.3 Family Size of the Project Area

Unit: persons

Area	No. of Families	Residents	Family Size
Project Area	58,139	240,233	4.1
Areia Blanca	2,287	10,438	4.6
Campo de Brito	3,383	13,419	4.0
Itabaiana	16,065	64,827	4.0
Macambira	1,238	4,945	4.0
Sao Domingos	1,790	7,750	4.3
Poco Verde	3,963	17,657	4.5
Simao Dias	7,957	32,123	4.0
Lagarto	17,620	72,082	4.1
Riachao do Dantas	3,836	16,992	4.4

Source:Censo Demografico 1991, Familias e Domicilios, No.16 Sergipe, IBGE

Accordingly, economic benefit of rural area and urban area is assumed respectively as R$2.1/capita and R$5.0/capita.

Incremental beneficiaries in project area are set up on the basis of implementation schedule of the project. The summary is shown in Table-1.4.

Table-1.4 Incremental Beneficiaries in Project Area

Unit: 1000 persons

Area/Year	2007	2010	2015	2020
Urban Area	7.1	27.8	80.6	143.6
Rural Area	1.3	5.4	18.1	31.4

(b) Commercial and Public Water

The economic benefit of commercial and public sector is estimated at actual water charge based on the actual water tariff and consumption data of DESO in 1997.

Table-1.5 Water Tariff Table of DESO

Unit: R$

Item	Minimum Tariff		Tariff over the Minimum	
Residential	up to 10 m^3	5.50 (0.55/m^3)	11 m^3 ~	1.23/m^3
Commercial	up to 10 m^3	12.70 (1.27/m^3)	11 m^3 ~	2.24/m^3
Public	up to 10 m^3	24.20 (2.42/m^3)	11 m^3 ~	3.70/m^3
Industrial	up to 30 m^3	53.70 (1.79/m^3)	31 m^3 ~	2.81/m^3

Note: The table is effective since June 1999.

Table-1.6 Actual Consumption Data of Commercial and Public Water (Annual Average)

Area	Commercial			Public			Population in 1997
	Contracts	Consumption	R$/ contract	Contracts	Consumption	R$/ contract	
Urban	4,869	16.3	26.81	2,248	46.2	158.1	546,000
Rural	959	13.9	21.21	381	55.6	258.8	483,000

Source: Supply Records of DESO, 1997

Note: (1) Aracaju is excluded from Urban. (2) Consumption is m^3/month/contract.

Projected population in 1997 is 546,000 in urban area excluding Aracaju and 483,000 in rural area. Consequently, the economic benefits of commercial and public water are set as shown in Table-1.7.

Table-1.7 Economic Benefits of Commercial and Public Water

Unit: R$/capita

Area	Commercial	Public	Total
Urban	0.23	0.62	0.85
Rural	0.05	0.20	0.25

Note: The figures in the table are corrected with standard conversion factor of 0.96.

(c) Industrial Water

There is no statistical information regarding industries in the state such as input-output table of intermediate product of manufacturing sector to assess the economic benefit. So the averaged actual charge based on the data of DESO in 1997 is assumed also to be the economic benefit in this analysis, which is R$2.6/$m^3$ after correction with standard conversion factor of 0.96.

Table-1.8 Actual Consumption Data of Industrial Water (Annual Average)

Area	Contracts	Consumption (m^3/month/contract)	R$/Contract
Sergipe	1,267	244.7	657.0

Source: Supply Records of DESO, 1997

Incremental consumption volume is set up on the basis of implementation schedule of the project and is shown in Table-1.9.

Table-1.9 Incremental Consumption Volume

Unit: 1000m^3/day

Year	2007	2010	2015	2020
Industrial Water	0.3	1.4	12.7	30.7

1.1.2 Irrigation Water Supply Project

Since the irrigation was out of scope of the JICA Feasibility Study, SEPLANTEC conducted the pre-feasibility study on irrigation through the contract with a local consultant. The result of the pre-feasibility study is compiled in "Pre-Feasibility Study of Vaza Barris Irrigation Project / Sergipe, Volume I – III, 1999, SEPLANTEC" (herein after pre-feasibility study), which is summarized in Main Report Part II, Chapter-3.

The assumptions applied in the pre-feasibility study are summarized as shown in Table-1.10.

Table-1.10 Assumptions applied in Pre-feasibility Study for Irrigation Project

Item	Assumptions			
Opportunity Cost of Capital	10 %			
Conversion Factor	0.85			
Economic Life	10 to 50 years			
Benefit	Incremental Net Cash Flow under with/without Project			
Prices of Crops with Irrigation	Vegetables		Fruits	
	Item	Price (R$/kg)	Item	Price (R$/kg)
	Tomato	0.25	Orange	0.12
	Pimento	0.25	Lemon	0.20
	Cabbage	0.12	Passion Fruit	0.25
	Carrot	0.25	Acerola	0.30
	Watermelon	0.12	Pineapple	0.50
	Melon	0.20	Tangerine	0.30
	Bean	0.60	Papaya	0.20

The total of financial project costs of Irrigation Water Supply Project are R$86million after cost allocation of Multi-purpose and are given in detail by component and by year in Appendix-1.

1.2 Cost Allocation of Multi-purpose Dam

Regarding a method of cost allocation of multi-purpose facilities, "Separable Cost remaining Benefit Method" is applied for the proposed project as discussed in the Supporting Report, Volume 1-I, Chapter 2.

According to the method, allocation of total financial cost of multi-purpose dam is calculated as shown in Table-1.11. Calculation in more detail is given in Appendix-2. Accordingly, Domestic and Industrial Water Supply Project are allocated at R$39.5million for capital expenditure and R$0.04 million per annum for O&M expenditure, or 47.9% of total cost. And Irrigation Water Supply Project are allocated at R$42.8 million for capital expenditure and R$0.04 million for O&M expenditure, or 52.1% of total cost.

Table-1.11 Summary of Cost Allocation of Multi-purpose Dam

Unit: R$ million

Item	Dom. & Ind. Water	Irrigation Water	Total
1. Costs to be Allocated			83.1
a. Construction Cost			82.3
b. Operation, Maintenance & Replacement Costs (Capitalized)			0.9
2. Justifiable Expenditure (Capitalized Benefit)	87.0	116.3	203.3
3. Alternative Costs	70.4	73.7	-
4. Justifiable Expenditure	70.4	73.7	144.1
5. Separable Costs	8.6	12.0	20.6
a. Construction Cost	8.5	11.9	20.4
b. Operation, Maintenance & Replacement Costs (Capitalized)	0.1	0.1	0.2
6. Remaining Justifiable Expenditure	61.8	61.7	123.5
7. Per Cent Distribution	50.0	50.0	100.0
8. Remaining Joint Costs	31.3	31.2	62.5
a. Construction Cost	30.9	30.9	61.9
b. Operation, Maintenance & Replacement Costs	0.3	0.3	0.6
9. Total Allocated Cost	39.9	43.2	83.1
a. Construction Cost	39.5	42.8	82.3
b. Operation, Maintenance & Replacement Costs	0.4	0.4	0.9
10. Annual Operation, Maintenance and Replacement Costs	0.04	0.04	0.09

1.3 Results of Economic Evaluation

1.3.1 Analysis on PROVABASE Project

The summary of economic analysis is shown in Table-1.12.

The EIRR of PROVABASE project (entire project) resulted in 14.9%, which exceeds opportunity cost of 10%. Accordingly, the project is assessed to be in economic efficiency.

Table-1.12 Summary of Economic Analysis

Project	EIRR (%)	NPV at 10% (R$ million)	B/C
PROVABASE	14.9	75.4	1.59
PROVABASE Phase-1	16.0	72.6	1.74
PROVABASE Phase-2	10.7	2.8	1.09
Domestic & Industrial Water Supply	10.8	8.1	1.10
Irrigation Water Supply	20.4	67.3	2.37

According to the proposed schedule of the Feasibility Study, the implementation of the project is planned separately in two phases:

1) Phase-1; Dam, Dom. & Ind. Water Supply Project (Phase-1) and Irrigation Water Supply Project from year 2002 to 2006
2) Phase -2; Dom. & Ind. Water Supply Project (Phase-2) from year 2013 to 2016

The EIRR of each Phase was also conducted, which respectively resulted in 16.0% and 10.7% that exceeds opportunity cost of 10%. In the analysis, the construction cost of dam allocated to the Domestic and Industrial Water Supply Project as discussed above was evenly divided to the Phase-1 and Phase-2.

The EIRR of Domestic and Industrial Water Supply Project, and Irrigation Water Supply Project respectively resulted in 10.8% and 20.4%, which also exceeds opportunity cost of 10%.

The results of economic analysis of each project in detail are given in Appendix-3.

1.3.2 Analysis on Each Project of PROVABASE

(1) Domestic and Industrial Water Supply Project

The EIRR of 10.8% of the Project shows economic efficiency. However, it was a slight lower than 12.1% in the Master plan, mainly due to the construction cost hikes of the low flow bypass construction in dam site and of the pipeline system as a result of precise cost estimation study in Feasibility Study.

The results of economic analysis of each Phase are given in Table-1.13, which shows economic viability respectively.

Table-1.13 Economic Analysis of Domestic and Industrial Water Supply Project

Dom. & Ind. Water Supply Project	EIRR (%)	NPV at 10% (R$ million)	B/C
Project Total	10.8	8.1	1.10
Phase-1	10.9	5.3	1.11
Phase-2	10.7	2.8	1.09

(2) Irrigation Water Supply Project

Economic analysis was conducted on the basis of data and information of the pre-feasibility study by SEPLANTEC. The EIRR of 20.4% shows sufficiently economic

viability. It was higher than 15.0% in the Master Plan. The reason was derived particularly from the great difference of incremental benefits under the with/without project between in pre-feasibility study and in Master Plan, in spite of project economic cost hike by 70% in the pre-feasibly study.

1.3.3 Sensitivity Analysis

The sensitivity analysis is to examine the sensitivity of EIRR with respect to the major variables that may affect economic benefits and costs applied in the economic evaluation of the project. In this analysis, the sensitivity of the EIRR is ascertained by the price values considered as the major variables as shown below. Considering the inflation rate of 11.3% in 1996, 7.2% in 1997, 1.7% in 1998 and 8.5% in 1999/June, the price change is set at 10% as a foreseeable maximum level in the nation.

Case 1: Construction costs increase by 10%.
Case 2: Market prices of agriculture products decrease by 10%.

Table-1.14 shows the results of sensitivity analysis performed under the above variations. Almost all are still in economic efficiency in both cases, though the EIRR of the PROVABASE Phase-2 in Case 1 results in 9.7%, slight lower than the opportunity cost of 10%.

Table-1.14 Sensitivity Analysis of the Projects

Project/Case	EIRR (%)		NPV at 10% (R$ million)	
	Case 1	Case 2	Case 1	Case 2
PROVABASE	13.8	13.6	63.5	55.1
(Base Case)	(14.9)	(14.9)	(75.4)	(75.4)
PROVABASE Phase-1	15.0	14.4	64.8	52.3
(Base Case)	(16.0)	(16.0)	(72.6)	(72.6)
PROVABASE Phase-2	9.7	10.7	-1.3	2.8
(Base Case)	(10.7)	(10.7)	(2.8)	(2.8)
Dom. & Ind. Water	10.0	10.8	0.3	8.1
(Base Case)	(10.8)	(10.8)	(8.1)	(8.1)
Phase-1	10.3	10.9	1.6	5.3
(Base Case)	(10.9)	(10.9)	(5.3)	(5.3)
Phase-2	9.7	10.7	-1.3	2.8
(Base Case)	(10.7)	(10.7)	(2.8)	(2.8)
Irrigation Water	19.1	17.6	63.2	47.0
(Base Case)	(20.4)	(20.4)	(67.3)	(67.3)

Note: PROVABASE Phase-1; Dom. & Ind. Water Phase-1 and Irrigation Water
PROVABASE Phase-2; Dom. & Ind. Water Phase-2

CHAPTER 2 FINANCIAL EVALUATION

2.1 Financial Condition of the State Government

2.1.1 Basis for Financial Evaluation

The following financial schemes is confirmed through discussion with the State Government and applied to financial analysis of the Feasibility Study.

1) The construction of Dam, Domestic & Industrial Water Supply System and Irrigation Water Supply System will be conducted by UGP. Accordingly, the State Government shall be entirely responsible for raising funds for the projects.
2) The source of funds
   The State Government will apply for Foreign Soft Loan (the Soft Loan, herein after). Accordingly, source of funds for project costs will be composed as follows:
   - The Soft Loan; 50% of the project cost in Phase-1 and 60% in Phase-2
   - Transfer from the Federal Government; 50% of the project cost in Phase-1 and 40% in Phase-2

   The Soft Loan in Phase-1 is set at 50% of the project cost, considering the debt limited by Legislation as discussed in this Chapter 2.1.4 and other project progress.
3) After constructed by UGP, the Dam and the Domestic & Industrial Water Supply System will be transferred to DESO by the State Government as an increase of capital of the company. Also, the Irrigation Water Supply System will be transferred to COHIDRO as an increase of capital of the company after constructed by UGP.

2.1.2 Project Costs and Disbursement of the Funds

Total investment amount of the Project is R$370.5million, of which R$174.6million will be disbursed by the Federal Government as a transfer of the General Budget and R$195.9million from the Soft Loan.

The amount of the Soft Loan in Phase-1 and Phase-2 will be respectively R$132.0million and R$63.9million.

The project costs and disbursement of funds respectively from the Federal Government and the Soft Loan are shown in Table-2.1.

Table-2.1 Project Costs and Source of Funds

Unit: R$ million

Project	2002	2003	2004	2005	2006	Phase 1
Dam	2.8	4.0	43.2	49.6	2.2	101.8
Dom. & Ind. Water Supply	1.9	1.9	2.0	48.2	52.8	106.8
Irrigation Water Supply	0.6	0.6	0.6	26.3	27.3	55.4
PROVABASE	5.3	6.5	45.8	124.1	82.3	264.0
Disbursement						
Federal Government (50%)	2.7	3.2	22.9	62.1	41.1	132.0
Soft Loan (50%)	2.6	3.3	22.9	62.0	41.2	132.0
Project	2013	2014	2015	1016	Phase 2	Total
Dam	-	-	-	-	-	101.8
Dom. & Ind. Water Supply	2.4	47.9	2.7	53.5	106.5	213.3
Irrigation Water Supply	-	-	-	-	-	55.4
PROVABASE	2.4	47.9	2.7	53.5	106.5	370.5
Disbursement						
Federal Government (40%)	1.0	19.1	1.1	21.4	42.6	174.6
Soft Loan (60%)	1.4	28.8	1.6	32.1	63.9	195.9

2.1.3 Interest Payment and Repayment Scheme of the Loan

In this analysis, the guideline of a foreign soft loan was applied for the term and conditions of the Soft Loan as follows:

- Loan Period: 25 years (7 years of grace period and 18 years of repayment)
- Interest Rate: 2.5 % per annum payable semi-annually

The interests payable will be an amount of R$65.2million in the aggregate. The interest payment and repayment scheme subject to the above guideline is given in Appendix-4.

2.1.4 Debt Capacity of the State Government

(1) Indebtedness Limitation

The State Government owed loans equivalent to one year's net current revenue of the budget in 1998. However, the Debt Service Coverage Ratio was kept in lower level as discussed in Supporting Report Volume 1-A, Chapter 1. It means that the state government financial condition is healthy in terms of the ratio.

However, the state's indebtedness capacity is limited by Brazilian legislation. To establish the limit, the estimate was made in compliance with current legislation.

The Federal Law No.9496 of September 11,1997 prohibits the states owing outstanding debt amount superior to the real net revenue (Receita Liquida Real) from further credit operations. The internal and external outstanding debt amount of the State Government is R$ 920 million as of July/1999, which exceeds the real net revenue of R $ 760 million, calculated based on the amount announced by the Central Bank. Accordingly, further credit operations are not allowed for the State Government at the moment. Nevertheless, the external loans subject to projects are considered as exceptional cases.

To qualify for any credit operation, the state must meet the following two conditions established by Federal Senate Resolution No.78 of 1998:

1) The overall value of credit transactions may not exceed debt charges and amortization payment already due and payable in the year or, alternatively, 18% of real net revenue, this being the revenue received in the twelve months prior to the Central Bank's analysis.
2) In addition, the maximum annual expenditure for amortization, interest and other charges for all credit operations already contracted and to be contracted may not exceed 13% of real net revenue.

Thus, the State's total indebtedness capacity was estimated by applying these criteria on an annual basis with the following results:

- Current capacity to assume an additional credit operation of up to R$ 140 million and annual debt-service capacity of up to R$ 100 million.

Table-2.2 Estimates of State Debt Capacity

Unit: R$ million

A. Real Net Revenue	*770
B. Overall Debt Capacity (A x 0.18)	140
C. Debt Service Capacity (A x 0.13)	100

Note (*): Real net revenue of the state of July/1999 announced by Central Bank was multiplied by 12 months.

(2) Indebtedness Situation with the Soft Loan

The Soft Loan amount of R$132.0million in Phase-1 and R$63.9million in Phase-2 is respectively within the limited amount of R$140million.

According to the current debt service (total amount of repayment and interests) schedule prepared by the Secretary of Finance of the State, the debt service is R$ 77.0 million in 1999, R$ 70.5 million in 2010 and will decrease sharply to R$ 30.4 million in 2015. According to the projected schedules, the Loan period of Phase-1 will commence in 2002 and terminate in 2026. The period of Phase-2 will commence in 2013 and terminate in 2037. In spite of debt service increases with the Soft Loan, the total debt services will not exceed the annual limit of R$100million as shown in Table 1.16.

In addition, the State Government could maintain a healthy level of the debt service coverage ratio as shown in Table-2.3. The ratio is estimated at a peak of 10.4% in 2002. It means that the State Government could afford the overall debt services.

Table-2.3 Debt Service Ratio of the State Government

Unit: R$ million

Year	1999	2002	2005	2010	2015	2020	2030	2037
Current Debt Services	77.0	91.5	84.8	70.5	30.4	26.2	0.0	0.0
Debt Services Increases with Soft Loan	-	0.0	1.5	10.5	10.3	13.8	4.3	3.6
Total Debt Services	77.0	91.5	86.3	81.0	40.7	40.0	4.3	3.6
Debt Service Coverage Ratio (%)	8.7	10.4	9.8	9.2	4.6	4.5	0.5	0.4

Source of current debt services data: the Secretariat of Finance of Sergipe State
Note: Net Current Revenue of the State Budget Balance of 1998 (R$881.6million) was applied as a base revenue.

The debt service coverage ratio in detail is given in Appendix-5.

2.1.5 Project Cash Flow of the State Government

Project cash flow of the State Government during 36years from 2002 till loan termination year of 2037 is conducted as shown in Table-2.4. The price of September/1999 is used as basis in this analysis without consideration of price escalation. The cash flow in detail is given in Appendix-6.

Table-2.4 Project Cash Flow of the State Government

Unit: R$ million

Item/Year	2002 to 2019	2020 to 2037	Total
Cash Flow from Investing Activities	-265.4	0.0	-265.4
Cash Flow from Financial Activities	189.3	291.6	480.9
Transfer from Federal Gov.	127.0	0.0	127.0
The Soft Loan	138.4	0.0	138.4
Repayment of Loan	-63.7	-74.7	-138.4
Interest Payment	-33.4	-11.9	-45.3
Dividends Received	21.0	378.2	399.2
Cash increase/decrease	-76.1	291.6	215.5

Note: The Soft Loan – R$104.3million in Phase-1 and R$34.1 in Phase-2

The aggregate net cash flow during the period of 2002/2019 will be a negative amount of R$76.1 as shown in Table-2.4, which should be made up by the State Government.

However, the yearly net cash flow will turn positive in 2020 due to estimated dividends which will be paid by the Domestic and Industrial Water Supply Company from 2017. The accumulated cash surplus during the period of 2020/2037 will be an amount of R$291.6million

Accordingly, the Project generates accumulated cash surplus of R$215.5million till 2037 when the Loan terminates. Total project cost of R$265.4 could be entirely recovered by the year of 2040.

2.2 Financial Evaluation of the Public Companies concerned

In this analysis, financial evaluation is conducted independently on three companies to distinct each financial conditions: 1) Domestic and Industrial Water Supply Company, 2) Irrigation Water Supply Company and 3) Multi-purpose Dam Company. The price of September/1999 is used also as basis in this analysis.

2.2.1 Domestic and Industrial Water Supply Company

(1) Basis for Financial Evaluation

Water charges per m^3 of domestic water are set up on the basis of the actual water tariff as shown in Table-1.5 and projected unit consumption rates. And the charges of industrial water are set up at the actual consumption basis. Thus, the water charges are set up respectively as shown in Table-2.5.

Incremental consumption volume in project area is set up on the basis of implementation schedule of the project that is also shown in Table-2.5.

Table-2.5 Water Charges and Incremental Consumption Volume

Item		Water Charge (R/m^3$)	Incremental Consumption ($1000m^3$/day)			
			2007	2010	2015	2020
Domestic	Urban	1.15	1.1	4.4	12.9	23.0
	Rural	1.05	0.2	0.6	2.2	3.8
Industrial		2.70	0.3	1.4	12.7	30.7
Total		---	1.6	6.4	27.8	57.5

(2) Financial Analysis

The Company will start its operation in 2007. However, net income will continue negative till 2011. So the short-term bank loan should be raised during the period to run the company. Loan amount is estimated at R$1.0million in 2007, R$1.2million in 2008, R$0.6million 2009 and R$0.6milion in 2010. In this analysis, short-term interest rates are set up at 20% per annum.

The net income will turn positive from 2012. And retained earnings (accumulated net income) will turn to surplus from 2014. As a result, the Company could continue to pay

dividends to the shareholders from 2017, judging from the Profit/Loss Statement and the Cash Flow Table.

The paid-in capital of the Company is R$140.0million. Dividend rate (dividend per share/face value of share) is estimated at 5% till 2019 and at 20% afterwards. Thus the accumulated dividends paid till 2037 are estimated at R$399.2million. The State Government is a big shareholder of the Company and will receive almost all the dividends paid.

Profit and Loss, Balance Sheet and Cash Flow of the Company in detail are given in Appendix-7.

Table-2.6 Profit and Loss Statement in Summary

Unit: R$ million

Item/Year	2007	2008	2009	2010	2011	2012/16	2017/37
Operating Revenue	0.9	1.7	2.5	3.5	6.4	78.1	840.7
Operating Expenses	5.3	5.3	5.3	5.9	7.0	42.1	274.1
Non-operating Expenses	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Income before Tax	-4.5	-3.7	-2.9	-2.5	-0.6	36.0	566.6
Net Income	-4.5	-3.7	-2.9	-2.5	-0.6	31.0	425.0
Dividends	0.0	0.0	0.0	0.0	0.0	0.0	399.2

Table-2.7 Cash Flow Table in Summary

Unit: R$ million

Item/Year	2007	2008	2009	2010	2011	2012/16	2017/37
CF from Operating Activities	-0.8	0.0	0.8	1.2	3.0	51.6	534.9
CF from Investing Activities	-79.4	0.0	0.0	0.0	0.0	-26.7	-49.8
CF from Financing Activities	80.3	0.0	-0.6	0.6	0.0	26.7	-371.6
Cash increase/decrease	0.1	0.0	0.2	0.6	3.0	51.6	113.5
Cash at end	0.1	0.1	0.3	0.9	3.9	55.5	169.0

According to the above financial data, replacement costs of the water supply system and recurrent costs of the Company incurred during the period could be recovered entirely with water charges. And the cash surplus in 2037 is estimated at R$169.0million, which should be retained as a reserve for forthcoming replacement of the pipelines and re-construction of the system.

2.2.2 Irrigation Water Supply Company

The annual operating expenses of the Company are R$3.5million as shown in Table-2.8. The tariff for irrigation water is set by COHIDRO that is currently R$0.025/m^3. However, the current tariff is too low to recover either the operating expenses or O&M/training expenses of the Company.

Table-2.8 Annual Operating Expenses

Unit: R$ 1000

Operating Expenses	O&M/Training	Water Right Charge	Depreciation
3,517	1,623	280	1,615

The tariff should be set at a level to recover the entire operating expenses of the Company, including depreciation that will be retained as a cash reserve for forthcoming replacement costs of equipment. All recurrent and replacement costs should be recovered by beneficiaries.

The projected irrigation water supply volume is set at 1.507 m^3/sec on average. As a result, the tariff should be R$0.074/$m^3$.

Thus, the Company could continue its operation without financial assistance from the State Government, though the Company could not generate enough profits to pay dividends.

The project site consists of 6 models as discussed in Main Report Part II, Chapter 3.2. The financial evaluation of the each model in case of proposed tariff of R$0.074/$m^3$ is conducted and the FIRR of each model is shown in Table-2.9.

Table-2.9 FIRR of each Model

Model	A	B1	B2	C	D	E
Lot Area (ha)	3	5	5	10	20	50
FIRR (%)	20.8	29.6	21.5	57.2	37.2	33.1

All models resulted in high level of FIRR over 20% that shows financially feasible. Judging from it, the proposed tariff could be acceptable. However, when considering the long-term financial cost that is estimated at more than 15% in Brazil, the FIRR of 20.8% of the model A and 21.5% of the model B will be the bottom line. The FIRR of each model in detail is given in Appendix-7.

2.2.3 Multi-purpose Dam Company

The project costs should covered by users. However, the Irrigation Water Supply Company could not afford as discussed above. The costs will be covered indirectly with dividends paid to the State Government by the Domestic and Industrial Water Supply Company. Accordingly, the forthcoming re-construction expenditures could be covered with the cash reserve of the State Government as mentioned above.

The annual O&M expenses of R$95 thousand will be covered by Water Supply Company and Irrigation Water Supply Company.

CHAPTER 3 SOCIAL EVALUATION

PROVABASE project will induce several effects to the project area as well as to the state. The project will increase a supply of safe and sufficient volume of domestic, industrial and agriculture water to beneficiaries. It is also important to note that the project will induce social benefits and social environment impacts to the project area.

3.1 Social Benefits

(1) Increase of Employment and Activation of Regional Economy

Construction works of dam, pipelines for domestic/industrial water supply and irrigation water supply would offer a new labor opportunity to the people unemployed and underemployed of the region in construction sector itself and the related sectors. In general, unskilled worker living in or near the project area would be employed.

According to the project cost of dam and domestic/industrial water supply system conducted by the Study Team, the wages payable to unskilled workers will be an amount of R$18million during the construction period. The annual amount will be R$3.6million, which is equivalent to 0.7% of 1998 GRDP of the project area. The effect would be far greater if considering the skilled workers' wages and similar wages of irrigation water supply system construction.

In addition, basic material for concrete such as cement and aggregate for dam construction could be procured at the project area, an amount of which is estimated at R$30million during the two years of construction. Annual amount of R$15million is worth 3% of 1998 GRDP of the project area.

Generally, the workers spend their earnings for living such as food, clothes and miscellaneous goods there. Their consumption behavior will stimulate the business activities of the related manufacturers and retail stores in the region. Thus, this increased income of both workers and manufacturers of the construction material will induce a multiplied economic effect to the region, which activate the regional economy as a whole.

(2) Improvement of Safe Water Coverage and Public Hygiene

Upon completion of the project in 2020, all incremental urban population and 60% of rural population will be provided with safe and sufficient potable water by the project.

Moreover, the project is designed on the basis of 10-year return period that will make it possible to supply water safely even during the dry season.

According to the water use survey conducted by the Study Team on August 1998, almost rural inhabitants without residential water supply systems in dwellings desired an implementation of the projects for private tap system in the area. The most remarkable reason was a hygienic reason in Agreste Sergipano meso-region. The expansion of potable water supply by the project could decrease water-borne diseases and mortality rate in the region.

(3) Mitigation of Economic Disparity and Alleviation of Centralization in the State Capital

The industrial water supply rate currently assumed at less than 1% of the demand in the project area. The municipality has established several incentives to attract manufacturing companies to set up the plants inside the municipality but has not accomplished good results so far. One of the reasons is a scarcity of industrial water. The project will lift it to 50% of the demand by the target year of 2020 of the project. Itabaiana and Lagarto are expected as a core industrial region in the project area.

The proposed site of the irrigation project is located on the right bank of Vaza Barris river in Lagarto Municipality with total irrigation area of 4,519ha. Irrigated agriculture project could produce many benefits as follows: 1) higher productivity, 2) extension of cultivating season and possible multi-cropping, and 3) safe cropping particularly during droughts and so on. According to pre-feasibility study of the irrigation water conducted by SEPLANTEC, the benefits of the with-project will increase almost by six times of the without-project within 5 years since the start of irrigation.

Thus the project will alleviate the impact of water scarcity in the project area of the state that will attract the manufacturers to build its plant in the region and also give agricultural producers an incentive to cultivate harder. That will stimulate intensively regional economic activities and bring the inhabitants more sufficient living conditions there. As a result, it could lead the mitigation of economic disparity compared with the nation level and the alleviation of economic and demographic centralization to metropolitan area like Aracaju.

3.2 Social Environment Impacts

On the other hands, the project could induce several social problems among societies and residents in the project area during the construction and operation period. The negative social impacts derived from the problems must be mitigated for implementation of the project.

The careful planning of these measures will be necessary and effective to mitigate the social negative impacts, but should be disclosed and explained publicly, and discussed with the society and the residents. All of these entire implementations could minimize effectively the social environmental impacts.

The mitigating measures for these negative social impacts and Environment Impact Assessment (EIA) are conducted specifically in Supporting Report Volume II, K.

APPENDIX-1

Distribution of Project Cost by Component and by Year

Appendix-1 (1) Distribution of Project Cost by Component and by Year (Base Case)

Unit: R$ 000

Projects	Items	Grand Total (Phase 1 & Phase 2)			Total			2002			2003			Phase 1												Phase 2								
														2004			2005			2006			Total			2013			2014			2015			2016		
		Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign
Dam	Administration	815	815	0	815	815	0	163	163	0	163	163	0	163	163	0	163	163	0	163	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Consulting	7,405	3,702	3,702	7,405	3,702	3,702	1,481	740	740	1,481	740	740	1,481	740	740	1,481	740	740	1,481	740	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Material	13,596	13,596	0	13,596	13,596	0	0	0	0	0	0	0	5,389	5,389	0	8,207	8,207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Equipment: -Pipeline	11,720	11,720	0	11,720	11,720	0	0	0	0	0	0	0	5,860	5,860	0	5,860	5,860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Others	19,851	19,851	0	19,851	19,851	0	0	0	0	0	0	0	9,926	9,926	0	9,926	9,926	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Skilled Labor	12,233	12,233	0	12,233	12,233	0	0	0	0	0	0	0	5,624	5,624	0	6,609	6,609	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Unskilled Labor	13,243	13,243	0	13,243	13,243	0	0	0	0	0	0	0	6,286	6,286	0	6,957	6,957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Reforestation	755	755	0	755	755	0	0	0	0	0	0	0	755	755	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Compensation	1,596	1,596	0	1,596	1,596	0	532	532	0	1,064	1,064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	1,053	1,053	0	1,053	1,053	0	351	351	0	702	702	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	82,267	78,565	3,702	82,267	78,565	3,702	2,527	1,786	740	3,410	2,669	740	35,484	34,744	740	39,202	38,462	740	1,644	903	740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Urban Water Supply Facilities	Administration	1,387	1,387	0	824	824	0	165	165	0	165	165	0	165	165	0	165	165	0	165	165	0	563	563	0	139	139	0	139	139	0	143	143	0	143	143	0
	Consulting	12,609	6,304	6,304	7,489	3,744	3,744	1,498	749	749	1,498	749	749	1,498	749	749	1,498	749	749	1,498	749	749	5,120	2,560	2,560	1,260	630	630	1,260	630	630	1,300	650	650	1,300	650	650
	Material	2,005	2,005	0	1,191	1,191	0	0	0	0	0	0	0	0	0	0	680	680	0	510	510	0	814	814	0	0	0	0	410	410	0	0	0	0	404	404	0
	Equipment: -Pipeline	94,505	94,505	0	56,127	56,127	0	0	0	0	0	0	0	0	0	0	32,072	32,072	0	24,054	24,054	0	38,379	38,379	0	0	0	0	18,993	18,993	0	0	0	0	19,385	19,385	0
	-Others	21,723	20,392	1,330	12,903	12,113	790	0	0	0	0	0	0	0	0	0	1,699	1,383	316	11,205	10,731	474	8,819	8,279	540	0	0	0	4,225	3,946	279	0	0	0	4,594	4,333	261
	Skilled Labor	2,892	2,892	0	1,718	1,718	0	0	0	0	0	0	0	0	0	0	615	615	0	1,103	1,103	0	1,174	1,174	0	0	0	0	571	571	0	0	0	0	604	604	0
	Unskilled Labor	4,947	4,947	0	2,938	2,938	0	0	0	0	0	0	0	0	0	0	1,348	1,348	0	1,590	1,590	0	2,009	2,009	0	0	0	0	992	992	0	0	0	0	1,017	1,017	0
	Compensation	12	12	0	12	12	0	4	4	0	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	2	2	0	2	2	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	140,082	132,448	7,635	83,203	78,669	4,534	1,667	918	749	1,672	923	749	1,662	914	749	38,077	37,012	1,065	40,124	38,902	1,223	56,879	53,779	3,101	1,398	768	630	26,590	25,681	909	1,443	793	650	27,448	26,536	911
(Agreste)	Administration	677	677	0	400	400	0	80	80	0	80	80	0	80	80	0	80	80	0	80	80	0	277	277	0	139	139	0	139	139	0	0	0	0	0	0	0
	Consulting	6,152	3,076	3,076	3,633	1,816	1,816	727	363	363	727	363	363	727	363	363	727	363	363	727	363	363	2,519	1,260	1,260	1,260	630	630	1,260	630	630	0	0	0	0	0	0
	Material	1,002	1,002	0	592	592	0	0	0	0	0	0	0	0	0	0	338	338	0	254	254	0	410	410	0	0	0	0	410	410	0	0	0	0	0	0	0
	Equipment: -Pipeline	46,380	46,380	0	27,387	27,387	0	0	0	0	0	0	0	0	0	0	15,650	15,650	0	11,737	11,737	0	18,993	18,993	0	0	0	0	18,993	18,993	0	0	0	0	0	0	0
	-Others	10,318	9,636	682	6,093	5,690	403	0	0	0	0	0	0	0	0	0	839	678	161	5,254	5,012	242	4,225	3,946	279	0	0	0	4,225	3,946	279	0	0	0	0	0	0
	Skilled Labor	1,394	1,394	0	823	823	0	0	0	0	0	0	0	0	0	0	303	303	0	520	520	0	571	571	0	0	0	0	571	571	0	0	0	0	0	0	0
	Unskilled Labor	2,422	2,422	0	1,430	1,430	0	0	0	0	0	0	0	0	0	0	665	665	0	766	766	0	992	992	0	0	0	0	992	992	0	0	0	0	0	0	0
	Compensation	4	4	0	4	4	0	1	1	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	68,351	64,593	3,758	40,363	38,144	2,219	808	445	363	810	447	363	806	443	363	18,601	18,077	524	19,337	18,732	605	27,988	26,449	1,539	1,398	768	630	26,590	25,681	909	0	0	0	0	0	0
(Piaui/unga)	Administration	710	710	0	424	424	0	85	85	0	85	85	0	85	85	0	85	85	0	85	85	0	286	286	0	0	0	0	0	0	0	143	143	0	143	143	0
	Consulting	6,456	3,228	3,228	3,856	1,928	1,928	771	386	386	771	386	386	771	386	386	771	386	386	771	386	386	2,601	1,300	1,300	0	0	0	0	0	0	1,300	650	650	1,300	650	650
	Material	1,003	1,003	0	599	599	0	0	0	0	0	0	0	0	0	0	342	342	0	257	257	0	404	404	0	0	0	0	0	0	0	0	0	0	404	404	0
	Equipment: -Pipeline	48,125	48,125	0	28,740	28,740	0	0	0	0	0	0	0	0	0	0	16,423	16,423	0	12,317	12,317	0	19,385	19,385	0	0	0	0	0	0	0	0	0	0	19,385	19,385	0
	-Others	11,405	10,756	648	6,811	6,424	387	0	0	0	0	0	0	0	0	0	860	705	155	5,951	5,719	232	4,594	4,333	261	0	0	0	0	0	0	0	0	0	4,594	4,333	261
	Skilled Labor	1,498	1,498	0	895	895	0	0	0	0	0	0	0	0	0	0	312	312	0	583	583	0	604	604	0	0	0	0	0	0	0	0	0	0	604	604	0
	Unskilled Labor	2,525	2,525	0	1,508	1,508	0	0	0	0	0	0	0	0	0	0	683	683	0	825	825	0	1,017	1,017	0	0	0	0	0	0	0	0	0	0	1,017	1,017	0
	Compensation	8	8	0	8	8	0	3	3	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	71,732	67,855	3,877	42,841	40,525	2,315	859	473	386	862	476	386	856	470	386	19,476	18,936	540	20,788	20,170	618	28,891	27,330	1,562	0	0	0	0	0	0	1,443	793	650	27,448	26,536	911
Irrigation Water Supply Facilities	Administration	1,281	1,281	0	1,281	1,281	0	256	256	0	256	256	0	256	256	0	256	256	0	256	256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Engineering	1,281	1,281	0	1,281	1,281	0	256	256	0	256	256	0	256	256	0	256	256	0	256	256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Supply Facilities	40,532	40,532	0	40,532	40,532	0	0	0	0	0	0	0	0	0	0	20,266	20,266	0	20,266	20,266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	43,094	43,094	0	43,094	43,094	0	512	512	0	512	512	0	512	512	0	20,778	20,778	0	20,778	20,778	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total of Project Cost		265,444	254,106	11,337	208,564	200,328	8,237	4,706	3,217	1,489	5,594	4,105	1,489	37,659	36,170	1,489	98,058	96,253	1,805	62,547	60,583	1,963	56,879	53,779	3,101	1,398	768	630	26,590	25,681	909	1,443	793	650	27,448	26,536	911

Appendix-1 (2) Distribution of Project Cost by Component and by Year (corrected with estimated annual price escalation by 4%)

Unit: R$ 000

Projects	Items	Grand Total (Phase 1 & Phase 2)			Phase 1 Total			2002			2003			2004			2005			2006			Phase 2 Total			2013			2014			2015			2016		
		Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign
Dam	Administration	993	993	0	993	993	0	183	183	0	191	191	0	198	198	0	206	206	0	214	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Consulting	9,023	4,511	4,511	9,023	4,511	4,511	1,666	833	833	1,733	866	866	1,802	901	901	1,874	937	937	1,949	974	974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Material	16,941	16,941	0	16,941	16,941	0	0	0	0	0	0	0	6,556	6,556	0	10,384	10,384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Equipment: -Pipeline	14,545	14,545	0	14,545	14,545	0	0	0	0	0	0	0	7,130	7,130	0	7,415	7,415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Others	24,635	24,635	0	24,635	24,635	0	0	0	0	0	0	0	12,076	12,076	0	12,559	12,559	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Skilled Labor	15,205	15,205	0	15,205	15,205	0	0	0	0	0	0	0	6,843	6,843	0	8,362	8,362	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Unskilled Labor	16,451	16,451	0	16,451	16,451	0	0	0	0	0	0	0	7,648	7,648	0	8,803	8,803	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Reforestation	919	919	0	919	919	0	0	0	0	0	0	0	919	919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Compensation	1,843	1,843	0	1,843	1,843	0	598	598	0	1,245	1,245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	1,216	1,216	0	1,216	1,216	0	395	395	0	821	821	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	101,770	97,259	4,511	101,770	97,259	4,511	2,842	2,009	833	3,989	3,123	866	43,172	42,271	901	49,603	48,666	937	2,163	1,189	974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Urban Water Supply Facilities	Administration	2,040	2,040	0	1,004	1,004	0	185	185	0	193	193	0	200	200	0	208	208	0	217	217	0	1,036	1,036	0	240	240	0	250	250	0	268	268	0	279	279	0
	Consulting	18,544	9,272	9,272	9,125	4,562	4,562	1,685	842	842	1,752	876	876	1,822	911	911	1,895	948	948	1,971	985	985	9,419	4,709	4,709	2,181	1,091	1,091	2,269	1,134	1,134	2,436	1,218	1,218	2,533	1,267	1,267
	Material	3,059	3,059	0	1,533	1,533	0	0	0	0	0	0	0	0	0	0	861	861	0	672	672	0	1,526	1,526	0	0	0	0	739	739	0	0	0	0	787	787	0
	Equipment: -Pipeline	144,202	144,202	0	72,235	72,235	0	0	0	0	0	0	0	0	0	0	40,582	40,582	0	31,654	31,654	0	71,967	71,967	0	0	0	0	34,206	34,206	0	0	0	0	37,761	37,761	0
	-Others	33,452	31,417	2,035	16,894	15,871	1,024	0	0	0	0	0	0	0	0	0	2,149	1,750	400	14,745	14,121	624	16,558	15,546	1,012	0	0	0	7,610	7,107	503	0	0	0	8,949	8,440	509
	Skilled Labor	4,433	4,433	0	2,229	2,229	0	0	0	0	0	0	0	0	0	0	779	779	0	1,451	1,451	0	2,204	2,204	0	0	0	0	1,028	1,028	0	0	0	0	1,176	1,176	0
	Unskilled Labor	7,566	7,566	0	3,798	3,798	0	0	0	0	0	0	0	0	0	0	1,706	1,706	0	2,092	2,092	0	3,768	3,768	0	0	0	0	1,786	1,786	0	0	0	0	1,981	1,981	0
	Compensation	14	14	0	14	14	0	5	5	0	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	2	2	0	2	2	0	1	1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	213,312	202,005	11,307	106,835	101,249	5,586	1,875	1,033	842	1,956	1,080	876	2,023	1,112	911	48,180	46,833	1,347	52,801	51,192	1,609	106,477	100,756	5,721	2,421	1,331	1,091	47,887	46,250	1,637	2,704	1,486	1,218	53,465	51,690	1,775
(Agreste)	Administration	976	976	0	487	487	0	90	90	0	93	93	0	97	97	0	101	101	0	105	105	0	490	490	0	240	240	0	250	250	0	0	0	0	0	0	0
	Consulting	8,877	4,438	4,438	4,427	2,213	2,213	817	409	409	850	425	425	884	442	442	919	460	460	956	478	478	4,450	2,225	2,225	2,181	1,091	1,091	2,269	1,134	1,134	0	0	0	0	0	0
	Material	1,501	1,501	0	762	762	0	0	0	0	0	0	0	0	0	0	428	428	0	334	334	0	739	739	0	0	0	0	739	739	0	0	0	0	0	0	0
	Equipment: -Pipeline	69,453	69,453	0	35,247	35,247	0	0	0	0	0	0	0	0	0	0	19,802	19,802	0	15,445	15,445	0	34,206	34,206	0	0	0	0	34,206	34,206	0	0	0	0	0	0	0
	-Others	15,585	14,560	1,025	7,975	7,453	522	0	0	0	0	0	0	0	0	0	1,062	858	204	6,913	6,595	318	7,610	7,107	503	0	0	0	7,610	7,107	503	0	0	0	0	0	0
	Skilled Labor	2,096	2,096	0	1,068	1,068	0	0	0	0	0	0	0	0	0	0	383	383	0	684	684	0	1,028	1,028	0	0	0	0	1,028	1,028	0	0	0	0	0	0	0
	Unskilled Labor	3,635	3,635	0	1,848	1,848	0	0	0	0	0	0	0	0	0	0	841	841	0	1,007	1,007	0	1,786	1,786	0	0	0	0	1,786	1,786	0	0	0	0	0	0	0
	Compensation	5	5	0	5	5	0	2	2	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	102,128	96,665	5,463	51,820	49,085	2,735	909	501	409	948	523	425	981	539	442	23,536	22,873	663	25,446	24,650	796	50,308	47,580	2,728	2,421	1,331	1,091	47,887	46,250	1,637	0	0	0	0	0	0
(Piauitinga)	Administration	1,063	1,063	0	517	517	0	95	95	0	99	99	0	103	103	0	107	107	0	112	112	0	547	547	0	0	0	0	0	0	0	268	268	0	279	279	0
	Consulting	9,667	4,833	4,833	4,698	2,349	2,349	867	434	434	902	451	451	938	469	469	976	488	488	1,015	507	507	4,969	2,484	2,484	0	0	0	0	0	0	2,436	1,218	1,218	2,533	1,267	1,267
	Material	1,558	1,558	0	771	771	0	0	0	0	0	0	0	0	0	0	433	433	0	338	338	0	787	787	0	0	0	0	0	0	0	0	0	0	787	787	0
	Equipment: -Pipeline	74,749	74,749	0	36,988	36,988	0	0	0	0	0	0	0	0	0	0	20,780	20,780	0	16,208	16,208	0	37,761	37,761	0	0	0	0	0	0	0	0	0	0	37,761	37,761	0
	-Others	17,868	16,857	1,010	8,919	8,417	502	0	0	0	0	0	0	0	0	0	1,088	892	196	7,831	7,526	306	8,949	8,440	509	0	0	0	0	0	0	0	0	0	8,949	8,440	509
	Skilled Labor	2,337	2,337	0	1,162	1,162	0	0	0	0	0	0	0	0	0	0	395	395	0	767	767	0	1,176	1,176	0	0	0	0	0	0	0	0	0	0	1,176	1,176	0
	Unskilled Labor	3,931	3,931	0	1,950	1,950	0	0	0	0	0	0	0	0	0	0	865	865	0	1,085	1,085	0	1,981	1,981	0	0	0	0	0	0	0	0	0	0	1,981	1,981	0
	Compensation	9	9	0	9	9	0	3	3	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land Acquisition	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	111,183	105,340	5,844	55,015	52,164	2,851	966	532	434	1,008	557	451	1,041	572	469	24,644	23,960	684	27,355	26,542	813	56,169	53,176	2,993	0	0	0	0	0	0	2,704	1,486	1,218	53,465	51,690	1,775
Irrigation Water Supply Facilities	Administration	1,561	1,561	0	1,561	1,561	0	288	288	0	300	300	0	312	312	0	324	324	0	337	337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Engineering	1,561	1,561	0	1,561	1,561	0	288	288	0	300	300	0	312	312	0	324	324	0	337	337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Supply Facilities	52,312	52,312	0	52,312	52,312	0	0	0	0	0	0	0	0	0	0	25,643	25,643	0	26,669	26,669	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	55,433	55,433	0	55,433	55,433	0	576	576	0	599	599	0	623	623	0	26,291	26,291	0	27,343	27,343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total of Project Cost		370,515	354,697	15,819	264,038	253,941	10,097	5,294	3,619	1,675	6,544	4,802	1,742	45,818	44,006	1,812	124,075	121,790	2,284	82,307	79,724	2,584	106,477	100,756	5,721	2,421	1,331	1,091	47,887	46,250	1,637	2,704	1,486	1,218	53,465	51,690	1,775

APPENDIX-2

Cost Allocation
by Separable Costs - Remaining Benefits Method

Appendix-2 Cost Allocation by Separable Costs - Remaining Benefits Method

Unit: R$ million

	Item	Dom. & Ind. Water	Irrigation	Total
1.	Costs to be Allocated			83.1
	a. Construction Cost			82.3
	b. Operation, Maintenance & Replacement Costs (Capitalized)			0.9
2.	Justifiable Expenditure (Capitalized Benefit)	87.0	116.3	203.3
3.	Alternative Costs	70.4	73.7	-
4.	Justifiable Expenditure	70.4	73.7	144.1
5.	Separable Costs	8.6	12.0	20.6
	a. Construction Cost	8.5	11.9	20.4
	b. Operation, Maintenance & Replacement Costs (Capitalized)	0.1	0.1	0.2
6.	Remaining Justifiable Expenditure	61.8	61.7	123.5
7.	Per Cent Distribution	50.0	50.0	100.0
8.	Remaining Joint Costs	31.3	31.2	62.5
	a. Construction Cost	30.9	30.9	61.9
	b. Operation, Maintenance & Replacement Costs	0.3	0.3	0.6
9.	Total Allocated Cost	39.9	43.2	83.1
	a. Construction Cost	39.5	42.8	82.3
	b. Operation, Maintenance & Replacement Costs	0.4	0.4	0.9
10.	Annual Operation, Maintenance and Replacement Costs	0.04	0.04	0.09

Source: Manual of Standards and Criteria for Planning Water Resource Projects, Water Resources Series No.25, United Nations

Note: Line 1. Shows total cost to be allocated composed of: (a) total construction costs and (b) total annual costs, capitalized at 10%
Line 2. Shows the benefits given in Table 2 capitalized at 10%
Line 3. Shows the cost of single purpose alternatives given in Table 5.
Line 4. Justifiable expenditure is the lesser of line 2 and 3.
Line 5. The separable costs given in Table 4 composed of: (a) separable construction costs and (b) separable annual operation, maintenance and replacement cost capitalized at 10%
Line 6. Remaining justifiable expenditure is the remainder after subtracting line 5 from line 4.
Line 7. The percentage distribution of line 6 (column 8) into its component parts (column 2 to 7).
Line 8. Remaining joint costs distributed according to percentages shown in line 7.
The total joint cost shown in column 8 is the difference between the total separable cost (line 5 column 8) and the total cost to be allocated (line 1 column 8)
Line 9. Total allocated cost is the sum of the separable costs (line 5) and the allocated joint costs (line 8)
Line 10. Average annual operation and maintenance cost

Remark 1: Alternative Cost

	Project	R$ million
1.	Total Dam Construction	82.3
	a. Multi-Dam	37.5
	b. Catch Dam and By Pass	44.8
2.	Alternative Cost of Domestic and Industrial Water	70.4
	a. Multi-Dam	25.6
	b. Catch Dam and By Pass	44.8
3.	Alternative Cost of Irrigation Water	73.7
	a. Multi-Dam	28.9
	b. Catch Dam and By Pass	44.8

Note: Concrete Volume of Multi-Dam Body (m^3) 219,000
a. Domestic and Industrial Water 162,000
b. Irrigation Water 183,000

Remark 2: Separable Cost

Unit: R$ million

	Cost Item	Dom. & Ind. Scheme	Irrigation Scheme
1.	Construction		
	Entire Project	82.3	82.3
	Cost with Purpose Excluded	73.7	70.4
	Separable Cost of Purpose	8.5	11.9
2.	Annual Cost		
	Entire Project	0.10	0.10
	Cost with Purpose Excluded	0.09	0.08
	Separable Cost of Purpose	0.01	0.01

APPENDIX-3

Economic Evaluation of Projects

Appendix-3 (1) Economic Evaluation of PROVABASE

(Dom. & Ind. Water Supply Project
and Irrigation Water Supply Project)

Project Cost	223,957	(R$ 000)

EIRR	14.9	(%)
NPV	75,385	(R$ 000)
B/C	1.59	

Year	Cost				Benefit			Net
	Investment	Replacement	O&M	Total	D&I Water	Irrigation	Total	Cash Flow
2002	3,667	0	0	3,667	0	0	0	-3,667
2003	3,667	0	0	3,667	0	0	0	-3,667
2004	29,209	0	0	29,209	0	0	0	-29,209
2005	84,114	0	0	84,114	0	0	0	-84,114
2006	57,289	0	0	57,289	0	0	0	-57,289
2007	0	0	2,767	2,767	861	839	1,700	-1,067
2008	0	0	2,767	2,767	1,685	10,456	12,141	9,374
2009	0	0	2,767	2,767	2,527	21,661	24,188	21,421
2010	0	0	3,271	3,271	3,477	28,333	31,810	28,538
2011	0	0	4,296	4,296	6,336	30,489	36,824	32,529
2012	0	0	4,296	4,296	9,257	30,911	40,168	35,873
2013	1,366	0	4,296	5,662	12,240	30,444	42,684	37,022
2014	21,277	0	4,925	26,202	15,285	30,505	45,791	19,588
2015	1,411	1,326	6,029	8,766	18,393	30,505	48,898	40,132
2016	21,959	1,326	6,029	29,314	21,517	30,505	52,022	22,708
2017	0	0	7,037	7,037	26,955	30,505	57,460	50,423
2018	0	0	7,730	7,730	31,363	30,505	61,868	54,138
2019	0	0	8,359	8,359	35,855	30,505	66,360	58,000
2020	0	367	8,359	8,726	40,431	30,505	70,936	62,210
2021	0	7,222	8,359	15,582	40,431	30,505	70,936	55,355
2022	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2023	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2024	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2025	0	1,326	8,359	9,685	40,431	30,505	70,936	61,251
2026	0	1,326	8,359	9,685	40,431	30,505	70,936	61,251
2027	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2028	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2029	0	2,484	8,359	10,843	40,431	30,505	70,936	60,093
2030	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2031	0	2,703	8,359	11,062	40,431	30,505	70,936	59,874
2032	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2033	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2034	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2035	0	6,901	8,359	15,261	40,431	30,505	70,936	55,675
2036	0	13,757	8,359	22,116	40,431	30,505	70,936	48,820
2037	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2038	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2039	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2040	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2041	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2042	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2043	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2044	0	2,484	8,359	10,843	40,431	30,505	70,936	60,093
2045	0	10,042	8,359	18,402	40,431	30,505	70,936	52,534
2046	0	12,745	8,359	21,105	40,431	30,505	70,936	49,832
2047	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2048	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2049	0	0	8,359	8,359	40,431	30,505	70,936	62,577
2050	0	367	8,359	8,726	40,431	30,505	70,936	62,210
2051	-14,102	-19,784	8,359	-25,526	40,431	30,505	70,936	96,463

Appendix-3 (2) Economic Evaluation of PROVABASE (Phase 1)

Project Cost	152,460	(R$ 000)

(Dom. & Ind. Water Supply Project - Phase 1 and Irrigation Water Supply Project)

EIRR	16.0	(%)
NPV	72,559	(R$ 000)
B/C	1.74	

Year	Cost				Benefit			Net Cash Flow
	Investment	Replacement	O&M	Total	D&I Water	Irrigation	Total	
2002	3,282	0	0	3,282	0	0	0	-3,282
2003	3,282	0	0	3,282	0	0	0	-3,282
2004	22,707	0	0	22,707	0	0	0	-22,707
2005	71,606	0	0	71,606	0	0	0	-71,606
2006	51,583	0	0	51,583	0	0	0	-51,583
2007	0	0	2,744	2,744	861	839	1,700	-1,044
2008	0	0	2,744	2,744	1,685	10,456	12,141	9,397
2009	0	0	2,744	2,744	2,527	21,661	24,188	21,444
2010	0	0	3,249	3,249	3,477	28,333	31,810	28,561
2011	0	0	4,273	4,273	6,336	30,489	36,824	32,551
2012	0	0	4,273	4,273	9,257	30,911	40,168	35,895
2013	0	0	4,273	4,273	12,240	30,444	42,684	38,411
2014	0	0	4,273	4,273	15,285	30,505	45,791	41,518
2015	0	1,326	4,273	5,599	17,179	30,505	47,684	42,085
2016	0	1,326	4,273	5,599	19,290	30,505	49,795	44,196
2017	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2018	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2019	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2020	0	367	4,273	4,640	19,290	30,505	49,795	45,156
2021	0	7,222	4,273	11,495	19,290	30,505	49,795	38,300
2022	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2023	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2024	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2025	0	1,326	4,273	5,599	19,290	30,505	49,795	44,196
2026	0	1,326	4,273	5,599	19,290	30,505	49,795	44,196
2027	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2028	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2029	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2030	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2031	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2032	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2033	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2034	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2035	0	6,901	4,273	11,174	19,290	30,505	49,795	38,621
2036	0	13,757	4,273	18,030	19,290	30,505	49,795	31,765
2037	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2038	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2039	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2040	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2041	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2042	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2043	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2044	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2045	0	10,042	4,273	14,315	19,290	30,505	49,795	35,480
2046	0	10,042	4,273	14,315	19,290	30,505	49,795	35,480
2047	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2048	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2049	0	0	4,273	4,273	19,290	30,505	49,795	45,522
2050	0	367	4,273	4,640	19,290	30,505	49,795	45,156
2051	-7,051	-17,003	4,273	-19,781	19,290	30,505	49,795	69,576

Appendix-3 (3) Economic Evaluation of Domestic and Industrial Water Supply Project (Phase 1 and Phase 2)

Project Cost	142,996	(R$ 000)

EIRR	10.8	(%)
NPV	8,086	(R$ 000)
B/C	1.10	

Year	Cost				Benefit			Net
	Investment	Replacement	O&M	Total	Domestic	Industrial	Total	Cash Flow
2002	2,394	0	0	2,394	0	0	0	-2,394
2003	2,394	0	0	2,394	0	0	0	-2,394
2004	14,629	0	0	14,629	0	0	0	-14,629
2005	44,797	0	0	44,797	0	0	0	-44,797
2006	32,770	0	0	32,770	0	0	0	-32,770
2007	0	0	1,383	1,383	550	312	861	-521
2008	0	0	1,383	1,383	1,063	622	1,685	302
2009	0	0	1,383	1,383	1,588	938	2,527	1,144
2010	0	0	1,887	1,887	2,161	1,316	3,477	1,590
2011	0	0	2,911	2,911	2,964	3,372	6,336	3,425
2012	0	0	2,911	2,911	3,784	5,473	9,257	6,346
2013	1,366	0	2,911	4,278	4,622	7,618	12,240	7,963
2014	21,277	0	3,541	24,818	5,476	9,809	15,285	-9,532
2015	1,411	0	4,645	6,055	6,348	12,045	18,393	12,338
2016	21,959	0	4,645	26,603	7,215	14,302	21,517	-5,086
2017	0	0	5,653	5,653	8,266	18,689	26,955	21,302
2018	0	0	6,345	6,345	9,252	22,111	31,363	25,017
2019	0	0	6,975	6,975	10,257	25,598	35,855	28,880
2020	0	367	6,975	7,342	11,280	29,151	40,431	33,089
2021	0	7,222	6,975	14,197	11,280	29,151	40,431	26,234
2022	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2023	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2024	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2025	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2026	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2027	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2028	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2029	0	2,484	6,975	9,459	11,280	29,151	40,431	30,972
2030	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2031	0	2,703	6,975	9,678	11,280	29,151	40,431	30,753
2032	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2033	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2034	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2035	0	367	6,975	7,342	11,280	29,151	40,431	33,089
2036	0	7,222	6,975	14,197	11,280	29,151	40,431	26,234
2037	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2038	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2039	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2040	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2041	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2042	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2043	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2044	0	2,484	6,975	9,459	11,280	29,151	40,431	30,972
2045	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2046	0	2,703	6,975	9,678	11,280	29,151	40,431	30,753
2047	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2048	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2049	0	0	6,975	6,975	11,280	29,151	40,431	33,456
2050	0	367	6,975	7,342	11,280	29,151	40,431	33,089
2051	-14,102	-2,617	6,975	-9,744	11,280	29,151	40,431	50,175

Appendix-3 (4) Economic Evaluation of Domestic and Industrial Water Supply Project (Phase 1)

Project Cost	71,498	(R$ 000)

EIRR	10.9	(%)
NPV	5,260	(R$ 000)
B/C	1.11	

Year	Cost				Benefit			Net Cash Flow
	Investment	Replacement	O&M	Total	Domestic	Industrial	Total	
2002	2,009	0	0	2,009	0	0	0	-2,009
2003	2,009	0	0	2,009	0	0	0	-2,009
2004	8,127	0	0	8,127	0	0	0	-8,127
2005	32,289	0	0	32,289	0	0	0	-32,289
2006	27,064	0	0	27,064	0	0	0	-27,064
2007	0	0	1,360	1,360	550	312	861	-499
2008	0	0	1,360	1,360	1,063	622	1,685	325
2009	0	0	1,360	1,360	1,588	938	2,527	1,167
2010	0	0	1,864	1,864	2,161	1,316	3,477	1,612
2011	0	0	2,889	2,889	2,964	3,372	6,336	3,447
2012	0	0	2,889	2,889	3,784	5,473	9,257	6,368
2013	0	0	2,889	2,889	4,622	7,618	12,240	9,352
2014	0	0	2,889	2,889	5,476	9,809	15,285	12,397
2015	0	0	2,889	2,889	5,750	11,429	17,179	14,290
2016	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2017	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2018	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2019	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2020	0	367	2,889	3,255	5,969	13,321	19,290	16,035
2021	0	7,222	2,889	10,111	5,969	13,321	19,290	9,179
2022	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2023	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2024	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2025	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2026	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2027	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2028	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2029	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2030	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2031	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2032	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2033	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2034	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2035	0	367	2,889	3,255	5,969	13,321	19,290	16,035
2036	0	7,222	2,889	10,111	5,969	13,321	19,290	9,179
2037	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2038	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2039	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2040	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2041	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2042	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2043	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2044	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2045	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2046	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2047	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2048	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2049	0	0	2,889	2,889	5,969	13,321	19,290	16,402
2050	0	367	2,889	3,255	5,969	13,321	19,290	16,035
2051	-7,051	164	2,889	-3,999	5,969	13,321	19,290	23,289

Appendix-3 (5) Economic Evaluation of Domestic and Industrial Water Supply Project (Phase 2)

Project Cost	71,498	(R$ 000)

EIRR	10.7	(%)
NPV	2,826	(R$ 000)
B/C	1.09	

Year	Cost				Benefit			Net
	Investment	Replacement	O&M	Total	Domestic	Industrial	Total	Cash Flow
2002	385	0	0	385	0	0	0	-385
2003	385	0	0	385	0	0	0	-385
2004	6,502	0	0	6,502	0	0	0	-6,502
2005	12,508	0	0	12,508	0	0	0	-12,508
2006	5,706	0	0	5,706	0	0	0	-5,706
2007	0	0	23	23	0	0	0	-23
2008	0	0	23	23	0	0	0	-23
2009	0	0	23	23	0	0	0	-23
2010	0	0	23	23	0	0	0	-23
2011	0	0	23	23	0	0	0	-23
2012	0	0	23	23	0	0	0	-23
2013	1,366	0	23	1,389	0	0	0	-1,389
2014	21,277	0	652	21,929	0	0	0	-21,929
2015	1,411	0	1,756	3,167	599	616	1,214	-1,952
2016	21,959	0	1,756	23,715	1,246	981	2,227	-21,488
2017	0	0	2,764	2,764	2,297	5,368	7,665	4,901
2018	0	0	3,457	3,457	3,283	8,790	12,073	8,616
2019	0	0	4,086	4,086	4,288	12,277	16,565	12,478
2020	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2021	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2022	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2023	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2024	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2025	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2026	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2027	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2028	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2029	0	2,484	4,086	6,570	5,311	15,830	21,141	14,570
2030	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2031	0	2,703	4,086	6,789	5,311	15,830	21,141	14,352
2032	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2033	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2034	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2035	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2036	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2037	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2038	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2039	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2040	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2041	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2042	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2043	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2044	0	2,484	4,086	6,570	5,311	15,830	21,141	14,570
2045	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2046	0	2,703	4,086	6,789	5,311	15,830	21,141	14,352
2047	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2048	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2049	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2050	0	0	4,086	4,086	5,311	15,830	21,141	17,054
2051	-7,051	-2,781	4,086	-5,745	5,311	15,830	21,141	26,886

Appendix-3 (6) Economic Evaluation of Irrigation Water Supply Project

Project Cost	80,962	(R$ 000)

EIRR	20.4	(%)
NPV	67,299	(R$ 000)
B/C	2.37	

Year	Cost				Benefit			Net
	Investment	Replacement	O&M	Total	(Without Proj.)	(With Project)	Incremental Benef.	Cash Flow
2002	1,272	0	0	1,272	0	0	0	-1,272
2003	1,272	0	0	1,272	0	0	0	-1,272
2004	14,580	0	0	14,580	0	0	0	-14,580
2005	39,318	0	0	39,318	0	0	0	-39,318
2006	24,519	0	0	24,519	0	0	0	-24,519
2007	0	0	1,384	1,384	6,007	6,846	839	-545
2008	0	0	1,384	1,384	6,007	16,463	10,456	9,072
2009	0	0	1,384	1,384	6,007	27,668	21,661	20,277
2010	0	0	1,384	1,384	6,007	34,340	28,333	26,949
2011	0	0	1,384	1,384	6,007	36,496	30,489	29,104
2012	0	0	1,384	1,384	6,007	36,918	30,911	29,527
2013	0	0	1,384	1,384	6,007	36,451	30,444	29,059
2014	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2015	0	1,326	1,384	2,710	6,007	36,512	30,505	27,795
2016	0	1,326	1,384	2,710	6,007	36,512	30,505	27,795
2017	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2018	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2019	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2020	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2021	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2022	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2023	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2024	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2025	0	1,326	1,384	2,710	6,007	36,512	30,505	27,795
2026	0	1,326	1,384	2,710	6,007	36,512	30,505	27,795
2027	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2028	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2029	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2030	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2031	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2032	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2033	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2034	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2035	0	6,535	1,384	7,919	6,007	36,512	30,505	22,586
2036	0	6,535	1,384	7,919	6,007	36,512	30,505	22,586
2037	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2038	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2039	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2040	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2041	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2042	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2043	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2044	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2045	0	10,042	1,384	11,427	6,007	36,512	30,505	19,078
2046	0	10,042	1,384	11,427	6,007	36,512	30,505	19,078
2047	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2048	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2049	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2050	0	0	1,384	1,384	6,007	36,512	30,505	29,121
2051	0	-17,167	1,384	-15,783	6,007	36,512	30,505	46,288

APPENDIX-4

Foreign Soft Loan :
Disbursement and Repayment Schedule

Appendix-4 Foreign Soft Loan : Disbursement and Repayment Schedule

Unit: R$ 000

Item		Loan Amount	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Phase-1	Disbursement of Loan	132,019	2,647	3,272	22,909	62,037	41,154	0	0	0	0	0	0	0	0	0	0	0	0	0
	Repayment		0	0	0	0	0	0	0	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334
	Exposure		2,647	5,919	28,828	90,865	132,019	132,019	132,019	124,685	117,350	110,016	102,682	95,347	88,013	80,678	73,344	66,010	58,675	51,341
	Interest Payment		33	107	434	1,496	2,786	3,300	3,300	3,300	3,117	2,934	2,750	2,567	2,384	2,200	2,017	1,834	1,650	1,467
	Debt Service		33	107	434	1,496	2,786	3,300	3,300	10,635	10,452	10,268	10,085	9,901	9,718	9,535	9,351	9,168	8,985	8,801
Phase-2	Disbursement of Loan	63,886	0	0	0	0	0	0	0	0	0	0	0	1,453	28,732	1,622	32,079	0	0	0
	Repayment		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Exposure		0	0	0	0	0	0	0	0	0	0	0	1,453	30,185	31,807	63,886	63,886	63,886	63,886
	Interest Payment		0	0	0	0	0	0	0	0	0	0	0	18	395	775	1,196	1,597	1,597	1,597
	Debt Service		0	0	0	0	0	0	0	0	0	0	0	18	395	775	1,196	1,597	1,597	1,597
Total	Disbursement of Loan	195,905	2,647	3,272	22,909	62,037	41,154	0	0	0	0	0	0	1,453	28,732	1,622	32,079	0	0	0
	Repayment		0	0	0	0	0	0	0	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334	7,334
	Exposure		2,647	5,919	28,828	90,865	132,019	132,019	132,019	124,685	117,350	110,016	102,682	96,800	118,198	112,485	137,230	129,896	122,561	115,227
	Interest Payment		33	107	434	1,496	2,786	3,300	3,300	3,300	3,117	2,934	2,750	2,585	2,779	2,975	3,213	3,431	3,247	3,064
	Debt Service		33	107	434	1,496	2,786	3,300	3,300	10,635	10,452	10,268	10,085	9,920	10,114	10,310	10,548	10,765	10,582	10,398

Item		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	Total
Phase-1	Disbursement of Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	132,019
	Repayment	7,334	7,334	7,334	7,334	7,334	7,334	7,334	0	0	0	0	0	0	0	0	0	0	0	132,019
	Exposure	44,006	36,672	29,338	22,003	14,669	7,334	0	0	0	0	0	0	0	0	0	0	0	0	-
	Interest Payment	1,284	1,100	917	733	550	367	183	0	0	0	0	0	0	0	0	0	0	0	42,812
	Debt Service	8,618	8,435	8,251	8,068	7,884	7,701	7,518	0	0	0	0	0	0	0	0	0	0	0	174,831
Phase-2	Disbursement of Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63,886
	Repayment	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	63,886
	Exposure	60,337	56,788	53,239	49,689	46,140	42,591	39,042	35,492	31,943	28,394	24,845	21,295	17,746	14,197	10,648	7,098	3,549	0	-
	Interest Payment	1,597	1,508	1,420	1,331	1,242	1,154	1,065	976	887	799	710	621	532	444	355	266	177	89	22,349
	Debt Service	5,146	5,058	4,969	4,880	4,791	4,703	4,614	4,525	4,437	4,348	4,259	4,170	4,082	3,993	3,904	3,815	3,727	3,638	86,235
Total	Disbursement of Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	195,905
	Repayment	10,884	10,884	10,884	10,884	10,884	10,884	10,884	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	195,905
	Exposure	104,343	93,460	82,576	71,692	60,809	49,925	39,042	35,492	31,943	28,394	24,845	21,295	17,746	14,197	10,648	7,098	3,549	0	-
	Interest Payment	2,881	2,609	2,336	2,064	1,792	1,520	1,248	976	887	799	710	621	532	444	355	266	177	89	65,161
	Debt Service	13,764	13,492	13,220	12,948	12,676	12,404	12,132	4,525	4,437	4,348	4,259	4,170	4,082	3,993	3,904	3,815	3,727	3,638	261,067

APPENDIX-5

Debt Service Coverage Ratio of the State Government

Appendix-5 Debt Service Coverage Ratio of the State Government

Unit: R$ million

Items	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Current Debt Services	91.5	89.4	87.6	84.8	82.8	80.7	78.0	75.5	70.5	65.1	60.6	60.1
Increased Debt Services by the Soft Loan	0.0	0.1	0.4	1.5	2.8	3.3	3.3	10.6	10.5	10.3	10.1	9.9
Total of Debt Services	91.5	89.5	88.0	86.3	85.6	84.0	81.3	86.1	81.0	75.4	70.7	70.0
Debt Service Coverage Ratio (%)	10.4	10.2	10.0	9.8	9.7	9.5	9.2	9.8	9.2	8.5	8.0	7.9

Items	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Current Debt Services	38.1	30.4	29.8	29.1	28.4	28.2	26.2	26.2	26.2	26.2	30.8	25.9
Increased Debt Services by the Soft Loan	10.1	10.3	10.5	10.8	10.6	10.4	13.8	13.5	13.2	12.9	12.7	12.4
Total of Debt Services	48.2	40.7	40.3	39.9	39.0	38.6	40.0	39.7	39.4	39.1	43.5	38.3
Debt Service Coverage Ratio (%)	5.5	4.6	4.6	4.5	4.4	4.4	4.5	4.5	4.5	4.4	4.9	4.3

Items	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Current Debt Services	25.8	23.6	0	0	0	0	0	0	0	0	0	0
Increased Debt Services by the Soft Loan	12.1	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6
Total of Debt Services	37.9	28.1	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6
Debt Service Coverage Ratio (%)	4.3	3.2	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4

Source of current debt services data: the Secretary of Finance of Sergipe State.

Note: Debt Service Coverage Ratio = (Total of Debt Services)/(Net Current Revenue of the State Budget Balance of 1998; 881.6)
Net Current Revenue of the State Budget Balance of 1998=(Current Revenue; 979.4)-(Transfer to Municipalities; 97.9)