Costa Rica

Urban Potable Water Supply Project

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Field Survey: January 2006

1. Project Overview and Japan's ODA Loan

Map of project locations

Liberia water tank

1.1 Background

During the last half of the 1980s the installation of water service facilities in Costa Rica reached the high level of nearly 100% in urban areas and 85% in rural areas, but there were many points that required improvement to provide stable service. Deterioration or insufficient maintenance and management of existing facilities in rural cities resulted in such issues as chronic water supply problems due to leaks in water tanks and aqueducts, and insufficient water storage capacity. In addition, the disrepair and malfunction of water meters made it impossible to assess the amount of water lost or stolen, which lead to great financial loss. This made repair and improvement of the water service facilities an urgent matter for the nation's water service and sewage system sector.

1.2 Objective

1.2.1 Objective

To comprehensively maintain and improve water supply services by installing and repairing the water supply facilities in six cities[1] where the water service facilities had become superannuated, and thereby contribute to improving sanitation and the lives of

[1] The six cities are Cañas, Liberia, Esparza, Puntarenas, Guapiles and Guasimo, and El Pacito (See the city location map on the next page). The estimated total number of beneficiaries is 230,000 people, which is comparable to the 226,000 population of Sumida Ward in Tokyo.

local residents.

1.2.2 Project Scope

This project employed a small-scale cooperative financing scheme between the Inter-American Development Bank (IDB) and JBIC.

Based on this scheme, JBIC utilized IDB's product design and appraisal. The project consists of the following activities implemented for six of the 17 cities selected in (1) using yen loan-based financing.

(1) Repair and improvement of the water service and sewage systems of 17 rural cities

Repair and improvement of aqueducts, water purification plants, water tanks, water distribution facilities, regional administrative offices, and other facilities. The administration of water service facilities in these 17 cities is divided between the Instituto Costarricense de Acueductos y Alcantarillados (AyA, "Costa Rican Institute of Aqueducts and Sewers") and local governments[2], and part of the portion provided through yen loan-based financing is administered by AyA.

(2) Limon Province water service and sewage system repair

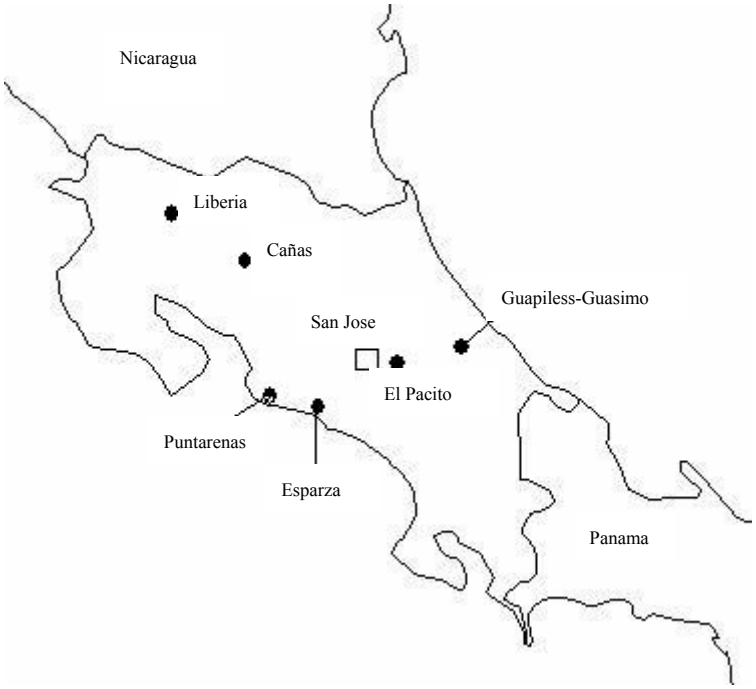
Repair water purification plants, drill wells, and repair and otherwise improve sewage processing plants in the City of Limon and in 16 towns and villages within the Limon Province.

(3) Organizational Strengthening

Purchase inspection equipment, establish control ledgers, and take other measures to strengthen the organization of AyA.

[2] There are three types of administration of water service and sewage system services in Costa Rica: Cities under the direct administration of AyA, systems operated by local governments, and those operated by regional private enterprises.

Fig. 1 Project Site Distribution Map



1.3 Borrower/Executing Agency

Borrowing entity	Republic of Costa Rica
Executing agency	Instituto Costarricense de Acueductos y Alcantarillados (AyA)

1.4 Outline of Loan Agreement

Loan Amount/ Disbursed Amount	1,656 million yen/1,593 million yen
Exchange of Notes Loan Agreement	December 1992 March 1993
Terms and Conditions - Interest Rate - Repayment Period (Grace Period) - Procurement	 3.0% 25 years 7 years General untied
Final Disbursement Date	June 2001
Main Agreement	Fernandes Vaglio Constructora S.A. and other local companies
Consulting Agreement	-
Feasibility study (F/S), etc.	1991 by IDB

2. Evaluation Result

2.1 Relevance

2.1.1 Relevance at the Time of Appraisal

At the time of this project appraisal, Costa Rica's "National Development Plan" (1990 - 1994) gave "providing potable water of sufficient quality and quantity to all citizens" as one of the targets of the health and welfare sector. Under this plan, "Maintaining water supply services in cities and supplying water to remote locations and rural communities by rehabilitating and optimizing the potable water system" was established as a water sector program. This project was given the highest priority as a means for specifying policies and measures for improving and expanding superannuated water supply facilities in regional cities.

2.1.2 Relevance at Time of Evaluation

In the current National Development Plan (2002 - 2006), "Strengthening public services to improve the health and living environment of citizens" and "Protecting water and river resources" are positioned as important areas in both the health and welfare sector and the environmental protection sector. In the sector program implemented under this plan, policies for strengthening and expanding the waterworks and sewage systems are being worked out under the priority policies of "protecting water resources" and "providing high-quality water and sewage services." In addition, the populations of those cities covered by the project in which tourism is developing, especially Liberia, are increasing rapidly, so the demand for the supply of potable water is increasing rapidly also. In view of this increase in demand, the project continues to be of great necessity for maintaining stable water supply services.

2.2 Efficiency

2.2.1 Outputs

This product consists of providing water intakes, aqueducts, water distribution pipes, water administration buildings, and other facilities for the six target cities. The output plan and results for the project are given below. The results for key output, such as aqueducts and water tanks, generally equaled or exceeded the plan.

Project Item	Plan	Actual Performance
(1) Cañas	1) Installation of water intakes 2) Installation of aqueducts 1,352m 3) Installation of water tanks 1,990m^3 4) Protective meter covers 1,672 units 5) Installation of water pipes 15,730m 6) Construction of administration building	1), 2), 3), 6) Nearly according to plan 4) Protective meter covers 173 units (▼90%) 5) Installation of water pipes 17,411m (Δ11%)
(2) Liberia	1) Installation of water intakes 2) Installation of aqueducts 587m 3) Installation of water tanks 2,600m^3 4) Installation of pump stations 5) Installation of water purification facilities 85 l/s (expansion/research facilities) 6) Installation of water pipes 9,900m 7) Protective meter covers 1,509 units 8) Construction of administration building	1), 3), 4), 5), 7), 8) Nearly according to plan 2) Installation of aqueducts 764.5M (Δ30%) 6) Installation of water pipes 11,692.39m (Δ18%) 7) Protective meter covers 902 units (▼47%)
(3) Esparza	1) Installation of water intakes 2) Installation of aqueducts N.A. 3) Water purification facilities 4) Installation of water pipes 5,580m 5) Protective meter covers 900 units 6) Construction of administration building	1), 2), 3), 6) Nearly according to plan 4) Installation of water pipes 11,038.65m (Δ98%) 5) Protective meter covers 1,079 units (Δ20%)
(4) Puntarenas	1) Water tanks 5,000m^3 2) Installation of pump station Expanded to 350 l/s 3) Purification facilities Expanded to 350 l/s 4) Construction of administration building	Nearly according to plan
(5) Guapiles and Guasimo	1) Installation of water intake 1 location 2) Installation of aqueducts 9,482m 3) Installation of water tanks 3,150m^3 4) Installation of chlorification treatment room 2 locations	4), 6) Nearly according to plan 1) Installation of water intake location Additional construction completed. 2) Installation of aqueducts 13,912M (Δ47%)

	5) Installation of water pipes 33,545m 6) Construction of administration building	3) Installation of water tanks 5,750m^3 (Δ83%) 5) Installation of water pipes 39,613m (Δ18%)
(6) El Pacito	1) Installation of water intakes 2) Installation of aqueducts 1,404m 3) Installation of water tanks 4,700m^3 (4 locations) 4) Protective meter covers 2,440 units 5) Installation of water pipes 56,580m 6) Construction of administration building	2), 6) Nearly according to plan 1) Installation of water intake Cancelled 3) Installation of water tanks 5,300m^3 (4 locations) (Δ13%) 4) Protective meter covers 70 units (▼93%) 5) Installation of water pipes 65,945m (Δ17%)

In some of the cities the output exceeded that of the initial plan, such as the total length of the aqueducts or expansion of the water tank capacity. As is described hereafter in 2.2.3 Project Costs, installation of additional facilities was made possible due to prices lower than the tendering price, currency depreciation, and other factors. This additional construction was used to help meet the increasing demand for potable water accompanying the population increase in the cities and allowed the project to be more effective than planned. Some of the effect was greatly reduced, however, by such occurrences as the cancellation of the water intake installation in El Pacito and the installation by AyA at its own expense of protective meter covers in regional cities such as Cañas and Liberia prior to the start of the project.

2.2.2 Project Period

The overall construction period at appraisal was 75 months from October 1993 to December 1999. The actual construction period was 85 months from October 1993 to October 2000, and although the loan disbursement period was extended once (December 1999), there were no major delays from the schedule at appraisal (113% of plan period)[3]. Factors that affected the construction period were (1) interruption of construction due to the effects of hurricanes that occurred between October and November 1998, (2) delay to the start of construction due to procedural delays during the tendering process, and (3) measures taken to change the design and perform additional construction accompanying the increase in demand for potable water. The project included additional construction to extend aqueducts and water pipes, so the fact that it was completed in just 10 months beyond the planned schedule attests to the

[3] Except for the aboveground facilities of El Pacito and Guapiles and Guasimo, nearly all construction was completed during 1999.

efficiency with which the project was conducted. The factors that allowed the executing agency to efficiently implement the project were (1) the water service facilities of the cities targeted by the project were under the direct administration of AyA[4], which made for efficient on-site correlation with the implementing organization, and (2) the employees of AyA and of contractors had much experience doing similar work, so there were no problems during the construction process.

2.2.3 Project Costs

This project was conducted through small-scale cooperative financing with the Inter-American Development Bank (IBD), and of the total development cost of 9,660 million yen; 7,038 million yen was provided by the IDB, 1,656 million yen was provided through yen loans (for the six target cities), and the remaining 966 million yen was provided through self-financing by the government of the Republic of Costa Rica. In the end, the total project cost was 8,083 million yen with approximately 20%, or 1,593 million yen, provided through yen loans. The yen loan-based portion of the project costs was less than that specified in the plan (96% of planned amount) despite achieving greater output than anticipated by the initial plan due to (1) lower bid amounts achieved through competitive tendering and (2) keeping down of project costs as a result of currency depreciation (strong yen)[5].

Although the above comprehensive evaluation showed that the project results exceeded those outlined in the initial plan, the project period and project costs were more or less as set forth in the plan, which is evidence of the high efficiency of this project.

Fig. 2 Puntarenas water purification facility

Fig. 3 Guapiles and Guasimo water intake

[4] In the Project Completion Report (2004) by IDB, one of the factors that had a negative impact on the delay and outcome of the overall cooperative financing project was the level of technical and operational capability of the local governments.

[5] The yen/dollar exchange rate at the time of appraisal was 1$=138 yen. The actual exchange rate was an average of 1$=123 yen (1996 - 2000).

2.3 Effectiveness

2.3.1 Improved Potable Water Supply Service

The main indicators for potable water service for the cities before and after the project are shown below. The water consumer population and water supply quantity are increasing for all the cities, with a striking upward trend seen in El Pacito and Liberia in particular, where the water consumer population has increased by 30% to 50% since the time the water population was appraised, and the supply water quantity has also nearly doubled since the appraisal. The 24-hour water supply quantity was met for all six cities, which means there is enough water at all times to provide a stable supply, and there were no problems in maintaining basic services.

Table 1. State of Potable Water Service in the Cities

City	Indicator	Before	After Project				
		1995	2001	2002	2003	2004	2005[*1]
Cañas Population 26,750	Water consumer population	-	19,938	20,314	20,584	20,864	-
	Water supply (1,000 m^3)/year	1,613	2,017	2,157	2,257	2,346	2,370
	Water supply (m^3)/day	4,419	5,526	5,910	6,184	6,427	6,493
Liberia Population 52,754	Water consumer population	33,327	41,688	42,385	43,189	44,008	-
	Water supply (1,000 m^3)/year	3,560	4,750	5,160	5,574	6,388	6,543
	Water supply (m^3)/day	9,753	13,014	14,137	15,271	17,501	17,926
Esparza Population 26,279	Water consumer population	12,884	16,656	16,902	17,152	17,536	-
	Water supply (1,000 m^3)/year	-	2805	3011	2922	-	-
	Water supply (m^3)/day	-	7,685	8,249	8,006	-	-
Puntarenas Population 10,786	Water consumer population	-	10,267	10,406	10,544	10,703	-
	Water supply	-	11,170	11,423	-	-	-

	(1,000 m^3)/year						
	Water supply (m^3)/day	-	30,603	31,296	-	-	-
Guapiles-Guasimo Population 46,779	Water consumer population	-	43,921	44,732	45,500	46,427	-
	Water supply (1,000 m^3)/year	-	19,518	22,791	18,949	21,706	20,445
	Water supply (m^3)/day	-	53,474	62,441	51,915	59,469	56,014
El Pacito Population 245,875*2	Water consumer population	46,211	59,528	62,377	65,391	68,359	69,507
	Water supply (1,000 m^3)/year	5,809	9,621	9,080	9,852	10,373	8,437
	Water supply (m^3)/day	15,915	26,359	24,877	26,992	28,419	23,115

Source: AyA

*1 Indicators for 2005 are provisional values calculated as of November.

*2 Data could not be collected for El Pacito, so the figures for the city of Alajuela, which contains El Pacito, were used for reference.

The following table compares the estimated water consumption per household for each city (AyA estimate) with the actual water quantity supplied. Even considering that the water supply quantity includes unaccounted-for water, it can be seen that a sufficient quantity of water is being supplied.

Table 2. Comparison of Estimated Water Consumption per Household and Water Supply Quantity

	Consumed Water Quantity/Household/Month (Estimate)	Water Supply Quantity/Household/Month (Result)
Name of City	2002 - 2003	2002 - 2003
Cañas	26.37m^3	40.00m^3
Liberia	24.45m^3	41.80m^3
Esparza	-	-
Puntarenas	27.62m^3	48.83m^3
Guapiles and	21.73m^3	88.67m^3

Guasimo		
El Pacito	-	-

Source: AyA *For Guapiles and Guasimo, only data for Guapiles is provided. The fiscal year for the data is 2002 for Cañas and Liberia, and 2003 for all other cities

AyA is proceeding with work to more accurately measure water quantity by installing a micro meter system[6], and this project purchased protective meter covers for some cities to support this activity. The following table gives the micro meter installation rate as of the end of 2004. The focus on this activity by AyA has brought the micro meter installation rate to nearly 100% in most cities. Installation of micro meters was not part of this project, but the installation rate in Guapiles and Guasimo was low at 70%. This was due mainly by opposition from the residents.[7]The executing agency views the installation of micro meters as being effective for accurately assessing the water usage quantity and increasing the fees collection rate, as well as for improving finances by reducing the unaccounted-for water rate, so this activity is expected to provide improved results in the future.

Table 3. Micro meter installation rate (December 2004)

Nationwide	96.3%
Cañas	100%
Liberia	99.8%
Esparza	98.7%
Puntarenas	99.2%
Guapiles-Guasimo	71.7%
El Pacito	100%

Source: AyA

*The data for the City of Alajuela, which includes El Pacito, was used.

Fig. 4 Protective meter cover inventory

2.3.2 Water Quality Improvement

[6] AyA uses two types of meters to measure production and consumption quantities. One is the micro meter, which is installed on the supply side (water tanks, water purification plants, etc.) to measure the production quantity, and the other is the macro meter, which is installed on the demand side (installed for each household and service) to measure the usage quantity.

[7] The reason for the opposition is a strong antipathy in the region toward the government and the misunderstanding that installing meters will increase fees. AyA aims to increase the installation rate by informing residents and other means and so plans to raise the installation rate to 90%during 2006.

The project was also seen to be effective in improving and maintaining water quality. Based on the national standard, which complies with the World Health Organization (WHO) drinking water quality standard, AyA set several inspection items and evaluated the water quality of all cities. The following table gives the water quality at the time of appraisal and currently. The water quality had already reached a certain standard at the time of appraisal, so there were no marked changes in water quality, but currently most indicators satisfy the standard and a water quality level where nearly 100% of the water can be used as drinking water is being maintained.

Table 4. Satisfaction of the Water Quality Standards of the Six Target Cities

City	Water Quality Standard	1995	Up to 2004
Liberia	**Water quality evaluation**[8]	-	**100%**
	Coli group[9]	95%	100%
	Residual chlorine concentration standard[10]	99%	100%
	pH value (hydrogen ion concentration)[11]	-	6.62
Cañas	**Water quality evaluation**	-	**100%**
	Coli group	92%	100%
	Residual chlorine concentration standard	93%	100%
	pH value (hydrogen ion concentration)	-	6.56
Guapiles-Guasimo *pH values are for (left) Guapiles and (right) Guasimo	**Water quality evaluation**	-	**100%**
	Coli group	91%*	95-100%
	Residual chlorine concentration standard	96%*	-
	pH value (hydrogen ion concentration)	6.96/6.62	6.74/6.85
Esparza	**Water quality evaluation**	-	**97.4%**
	Coli group	87%	100%

[8] The attainment rate of a water quality that can be used for drinking water.
[9] This indicator measures the existance of organisms that cause respiratory ailments and the standard is "None detected in 96% of samples collected during the year."
[10] The residual chlorine concentration standard is at least 0.1 mg/l at the outlet of the water supply tap, etc.
[11] This indicator measures the fundamental qualities of water, and in Japan the standard is 5.8 to 8.6, and about 7.5 is considered suitable water quality.

	Residual chlorine concentration standard	81%	96%
	pH value (hydrogen ion concentration)	-	-
Puntarenas	**Water quality evaluation**	**-**	**99.6%**
	Coli group	99%	96.0%
	Residual chlorine concentration standard	97%	100%
	pH value (hydrogen ion concentration)		
Puntarenas	**Water quality evaluation**	**-**	**100%**
	Coli group	92%	-
	Residual chlorine concentration standard	87%	-
	pH value (hydrogen ion concentration)	6.52	6.89

Source: AyA *The 1995 figures for Guapiles and Guasimo are for Guapiles only.

Since the purpose of this project is to maintain the potable water service of Costa Rica, major changes from the time of appraisal are not readily apparent. This project can be highly evaluated, however, for maintaining the basic level of service, improving water quality and providing a constant, stable supply of water through the renovation and expansion of superannuated waterworks facilities while at the same time meeting the increasing demands for water.

2.3.3 Improvement of Unaccounted-for water rate

The unaccounted-for water rates for the target cities are as follows. Although there is variation among cities, most cities continue to be at a near 50% level,[12] and no major improvements from the time of the appraisal were seen. A variety of factors, including leaks from water pipes and water tanks, are responsible for the unaccounted-for water rate, so a combination of measures are required to improve it. The executing agency views physical loss, such as water leaks, emergency usage of water, and non-functioning meters, as a major cause of unaccounted-for water, so it is focusing on the installation of micro meters (See 3.2.1) to counter metering problems due to a lack of installed meters or damaged meters[13] as one means to improve the unaccounted-for water rate. Looking at the unaccounted-for water rate city by city shows that the rates in

[12] The level in advanced counties is 15 to 20% (under 10% in Japan). In Central and South America the average is 40 to 60%.

[13] The installation rate for micro meters in Guapiles and Guasimo is a low 71.7%, and the unaccounted-for water rate is also 70%, which is a markedly high level compared to the other cities.

Liberia and Cañas are under 30% and 40%, respectively, which is much lower than for other areas. Interviews conducted during a local survey showed that this is the result of activities on the local level taken by the local administrative offices, such as (1) the widespread installation of micro meters, (2) adjustment of the supply amount based on suitable demand forecasts, and (3) more efficient use of water during maintenance[14]. It is important to duplicate these successes in other areas to improve the unaccounted-for water rate in those areas.

Table 5. **Unaccounted-for water rates** of the Target Cities

National average (1990)	46.4%
National average (2004)	46.9%
Cañas	39.0%
Liberia	28.6%
Esparza	56.0%
Puntarenas	44.4%
Guapiles and Guasimo	69.4%
Alajela (El Pacito)	55.7%

Source: AyA

2.3.4 Improvement of Customer Services

Customer services improved after the start of the project, and in particular after the construction of facilities, including administrative offices, and measures, such as training, to strengthen the abilities of AyA employees (See 2.3.5 Effect of Cooperative Financing) in AyA's financial department. The interviews conducted by the implementing organization showed that the establishment of administrative offices had reduced the wait time to pay bills and that customer services, such as starting service and resolving problems that occur, had improved.

[14] This is the water consumed when cleaning water tanks, treatment facilities, etc.

Even the project evaluation report prepared by IDB stated that the construction of the administrative offices had improved customer support and the image of AyA. Further, the local resident questionnaire survey discussed hereafter supported these results by finding that the project had improved customer service. (See 2.4.2 Local Resident Questionnaire Survey)

Fig. 5 AyA Regional Administrative Office

2.3.5 Financial Internal Rate of Return (FIRR) Calculation

This study calculated the financial internal rate of return (FIRR) to be 6.6% based on a project life of 20 years, income from water service facilities as the benefit, and project costs and maintenance and administrative costs[15] as the expenses. Because the FIRR was not calculated at the time of appraisal, a comparison with the time at appraisal cannot be made, but similar yen loan-based projects implemented in the past had a rate of return of 7.1%[16]. In any case, the unaccounted-for water rate is close to 50%, which is believed to be the factor that is suppressing the rate of return.

2.3.6 Effect of IBD Financing

This project was conducted through cooperative financing with IDB. The effects of the non-yen-loan-based portion of the project are as follows. According to the IDB project evaluation report, although there was a problem with a delay in the construction period, etc., during the implementation stage, the facilities installed by the project are operating suitably, and the expected effects have been realized, so overall a satisfactory effect has been obtained.

[15] The benefits were calculated as the number of services x quantity of water consumed by the water consumer population of each city x water fees, and the water consumer population was calculated using the forecast population for each city based on the average growth rate for each city from 2000 - 2004.

[16] Source: Ujung Pandang Water Supply Development Project (Indonesia 2004 Post-Project Evaluation Report)

Table 6. Main Effects of the IDB Cooperative Financing Portion

	Project	Output	Effect
1	(10) Repair and improvement of the water service and sewage systems of rural cities (10 cities)	Nearly according to plan	1) The water population increased from 488,000 (1991) to 800,000 (2002). 2) The water quality was improved. 3) The water supply time increased over the pre-project period (1991). In 2 cities, it increased from 16 hr/day to 18 hr/day. In 6 cities, it increased from 18 hr/day to 24 hr/per day. In 2 cities, it increased from 10 hr/day to 21
2	Limon Province water service and sewage system repair	Nearly according to plan	11) The water consumer population increased from 57,000 (1991) to approximately 74,000 (1998). (The water supply capacity increase was approx. 150,000 people.) 2) 24-hour water supply service was achieved (from 18 hr/day in 1991). 3) Installation of sewage systems reduced flood damage, sewage overflows, etc. 4) The water treatment plant was completed in 2004, and improved the water quality.
3	Organizational strengthening	Nearly according to plan	There is no detailed information. In a questionnaire survey of customers in 2001, 85% of respondents said they were satisfied with AyA's level of service.

Source: IDB Project Completion Report (2004)

2.4 Impact

2.4.1 Improvement of the Health of Residents and the State of Sanitation

The following shows the change in the occurrence rate of diarrhea before and after the project. Improvement was seen in Esparza and Guasimo, but overall there was not a large change from before the product was conducted, so the project cannot be said to have had a clear improvement effect. This trend is the same nationwide. Reasons given for this include (1) the water service coverage rate has been high and the water quality had consistently achieved a certain level since the time of the appraisal and (2) there are

a variety of factors that influence diarrheic disorders, which make it difficult to verify the direct effect of the water supply.

Table 7. Change in the Number of Diarrhea Patients

(Unit: Occurrences per 1,000 people)

	Before Project			After Project			
	1995	1996	1997	2001	2002	2003	2004
National Average	31.9	29.0	28.8	38.1	29.0	28.4	-
Puntarenas	311.0	260.4	223.3	519.9	627.7	-	137.0
Esparza	39.5	58.7	51.2	19.2	28.2	-	12.2
Liberia	58.8	48.6	59.3	43.3	58.9	-	52.7
Cañas	48.6	70.0	54.5	58.8	57.7	-	84.1
Guapiles-Guasimo*	216.2	193.4	160.7	27.1	46.8	-	-
El Pacito	-	-	-	-	-	-	-

Source: AyA, Costa Rica Department of Health and Welfare, Costa Rica Bureau of Statistics (INEC)

*Detailed data could not be collected for Guapiles, so only data for Guasimo was used.

A survey of those who benefited from the project[17] found that people thought the project improved the level of service. The results from this survey are summarized below.

Table 8. Summary of Results of Beneficiary Survey

Survey Item	Guapiles and Guasimo	Cañas
Degree of satisfaction in current waterworks service	・ 35% of respondents said they were satisfied. ・ The main reasons for dissatisfaction were the fees (35%) and customer service (28%).	・ 55% of respondents said they were satisfied. ・ The main reasons for dissatisfaction were water quality (chlorine smell, etc.) and water outages, both 25%. ・ Other reasons given were customer service and fees.

[17]To assess the project results a questionnaire survey was conducted of 400 people living in the three target cities (two areas) of Guapiles, Guasimo, and Cañas.

Project before/after change	・ 50% responded improved water pressure and quantity. ・ Other responses were improved water quality (29%), improved customer service (10%), and fewer water outages (11%), etc.	・ Approx. 56% responded improved water pressure and quantity. ・ Other responses were improved water quality (12%), fewer water outages (11%), and improved customer service (21%)

There was disparity in the degree of satisfaction in waterworks service, with this being 35% in Guapiles and Guasimo and 55% in Cañas. There were many in both cities that responded they were dissatisfied, but looking at the detailed reasons for this revealed that many people were dissatisfied with the water quality (chlorine smell, etc.) and the fees, and that there was little dissatisfaction with the level of basic services. With regard to the effect of the project on the other hand, there were many that thought there was an improvement effect, such as increased water quantity, which showed the residents think there was an improvement effect from the project. Of the respondents that were dissatisfied, the reason for many of them is thought to be due to the fact that safe and stable potable water supply services are already regularly provided in these cities, so the residents want a high level of service, such as being able to drink good-tasting water at low cost. The reason the figures for Guapiles and Guasimo are low is deemed by the executing agency to be the effect of the intrinsic temperament of people of the region.[18]

2.5 Sustainability

2.5.1 Executing Agency

2.5.1.1. Technical Capability

Detailed maintenance manuals and laws have been created for each facility, and technical training is being conducted in accordance with these. Veteran technicians with at least 10 years of experience are assigned to the regional offices, and no serious problems were found with the technical level.

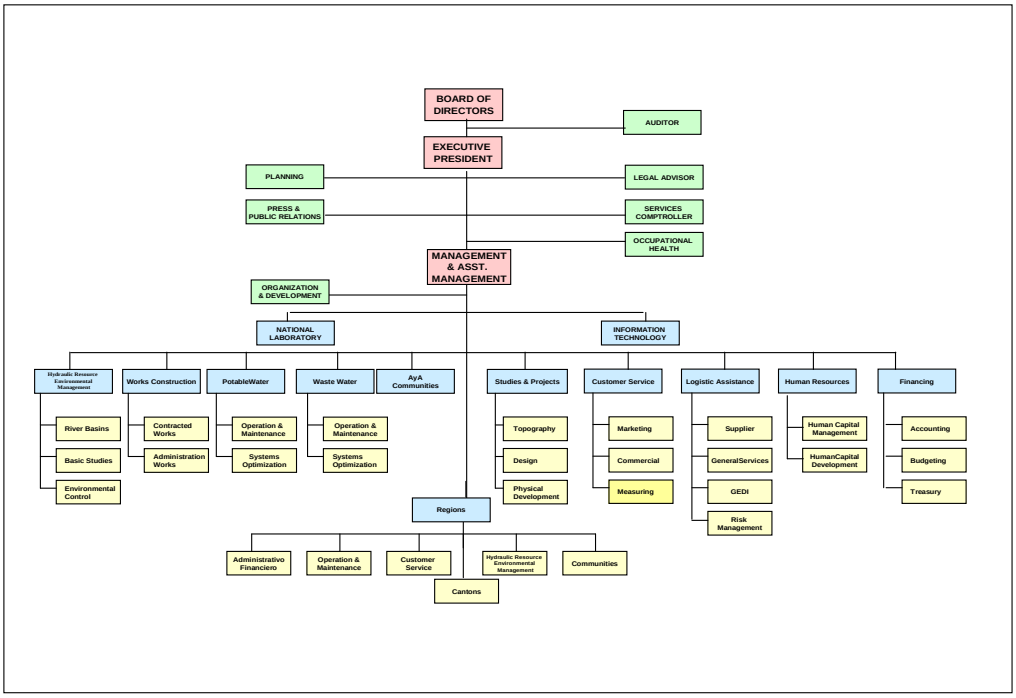
2.5.1.2 Structure

The total number of AyA employees is 2,500, and in the reorganization that has taken place in recent years, the ideas of increasing operational efficiency by separating the

[18] These are areas in which traditional antipathy toward the government and government agencies is strong (See 2.3.1 Footnote 5).

water and sewer operations departments and introducing private activity (BOT, concession agreements) have been considered. Behind this is the increase in demand accompanying the recent rapid development of tourism, so the expansion of capital investment, including that for the sewage system infrastructure which has lagged behind, is an urgent matter.

Fig. 6 Organizational Chart of the Costa Rican Institute of Aqueducts and Sewers



Source: AyA

2.5.1.3 Financial status

The billing collection rate of AyA (Accounted water = Billing collection rate per unit of unit amount of metered water) is at a high level averaging around 90% nationwide and the agency now has a positive operating income. There continues to be a current-account deficit for 2002-2003 due to an increase in loan interest payments and other factors, but simplification and revision (rate increase) of the rate system in 2004 greatly increased revenues. According to the balance sheet for 2005, the self-capitalization rate of AyA was 72%, a high level, and a level of close to 70% is maintained annually.

In view of the above, there are considered to be no problems with the financial sustainability of the project.

Table 9. Income Statement

(Unit: 1 million colones)

	2003	2004	2005
Operating income	30,635	28,873	34,197
Water	27,260	25,805	30,751
Sewerage	3,050	2,826	3,257
Other income	324	242	190
Operating expenses	27,293	22,658	26,716
Operating profit	3,342	6,216	7,481
Non-operating profit	-4,765	-2,588	-3,177
Ordinary income	-1,423	3,628	4,305

Source: AyA

Table 10. Water Fees Table

(Unit: colon)

Water Fees (Residential)[19]	Old System	New System (Starting 2005)
Metered rate	Costa Rica colon	
Basic rate (up to 15 m^3)	1,611	2,322
Additional (for each additional 15 m^3)	122	238
Fixed rate	2,576	3,714

Source: AyA

2.5.2 Operation and Maintenance Status

Operation and maintenance for each city is supervised by the administrative office engineers[20] assigned to each city. Although there is a difference in the number of engineers assigned to a particular city depending on the size of the city, interviews conducted as part of the local survey found no major problems with the current number of staff. Facilities, such as water intakes and water pipes, are being periodically inspected and repaired in accordance with the annual maintenance plan, and regular maintenance control work for such measures as water leakage countermeasures is being

[19] A fixed rate is where the fee paid does not change according to the usage amount. A metered rate is the fee applied varies according to the amount of water used. It includes the base rate up to 15m^3 and a set fee per set usage amount for additional usage after the basic rate usage amount. The metered rate base rate is 2,322 colon, which is approximately 491 yen (1US$ = Approx. 532 colon = 112.5 yen (2006).

[20] Staff members beneath the director and technical manager levels are formed into teams containing several people, such as pipe technicians.

conducted. According to the 2005 Inspection Report, the following trouble regarding the facilities and equipment constructed and installed by the project was reported, but the facilities and equipment are basically being kept in good condition and no major problems have occurred in the operation of the facilities.[21]

Table 11. Number of Maintenance Staff by City

Name of City	Staff	Major Trouble that Occurred
Liberia	22	Corroded pipes in the settlement tank of a water purification plant
Cañas	8	Leakage from the water intake pump facility
Esparza	16	None
Puntarenas	35	Deteriorated valve, broken plant, etc., of the settlement tank of the water purification plant
Guapiles and Guasimo	23	Leakage from a water tank due to cracks in the concrete wall
El Pacito	45	None

3. Feedback

3.1 Lessons Learned

One factor that contributed to the success of this project was the capability of the executing agency and contractors, and the excellent level of correlation. It is believed that if this experience and technical capability could have been transferred to the regional cities not under the jurisdiction of AyA, where the project was delayed, then it would have been possible to more effectively implement the cooperative financing scheme.

3.2 Recommendations

1. The unaccounted-for water rate still remains high, and improvement is required. Currently there is no detailed analysis of the main causes of the high rate of unaccounted-for water, so a detailed study and analysis of the causes should be conducted.

[21] These troubles were already repaired by the time of the local survey or were scheduled to be resolved during FY 2006.

2. Some cities, such as Liberia, have been successful in lowering the rate of unaccounted-for water, and the main reasons for this seem to be the production adjustments on the supply side and the large effects of efficient maintenance. Efforts should be made to lower the unaccounted-for water rate nationwide by extending these measures and successful examples to the system overall.

Comparison of Original and Actual Scope

Item	Plan	Results
(1) Project Scope 1) Cañas	① Installation of water intake ② Installation of aqueducts 1,352m ③ Installation of water tanks 1,990m^3 ④ Protective meter covers 1,672 units ⑤ Installation of water pipes 15,730m ⑥ Construction of administration building	①②③⑥ Nearly according to plan ④Protective meter covers 173 units (▼90%) ⑤Installation of water pipes 17,411m (△ 11%)
2) Liberia	① Installation of water intake ② Installation of aqueducts 587m ③ Installation of water tanks 2,600 m^3 ④ Installation of pump stations N.A ⑤ Installation of water purification facility 85l/s (expansion, research facilities) ⑥ Installation of water pipes 9,900m ⑦ Protective meter covers 1,509 units ⑧ Construction of administration building	①③④⑤⑦⑧ Nearly according to plan ②Installation of aqueducts 764.5m (△ 30%) ⑥Installation of water pipes 11,692.39m (△ 18%) ⑦Protective meter covers 902 units (▼47%)
3) Esparza	① Installation of water intake N.A ② Installation of aqueducts N.A ③ Installation of water purification facility N.A ④ Installation of water pipes 5,580m ⑤ Protective meter covers 900 units ⑥ Construction of administration building	①②③⑤ Nearly according to plan ④Installation of water pipes 11,038.65m (△ 98%) ⑤Protective meter covers 1,079 units (△ 20%)
4) Puntarenas	① Installation of water tanks 5,000m^3 ② Installation of pump stations Expanded to 350 l/s ③ Installation of water purification facility Expanded to 350 l/s ④ Construction of administration building	Nearly according to plan
5) Guapiles and Guasimo	① Installation of water intake 1 location ② Installation of aqueducts 9,482m ③ Installation of water tanks 3,150m^3 ④ Installation of chlorification treatment room 2 locations ⑤ Installation of water pipes 33,545m ⑥ Construction of administration building	④⑥ Nearly according to plan ① Installation of water intake Additional construction performed ②Installation of aqueducts 13,912m (△ 47%) ③Installation of water tanks 5,750m^3 (△ 83%) ⑤Installation of water pipes 39,613m (△ 18%)

6) El Pacito	① Installation of water intake ② Installation of aqueducts 1,404m ③ Installation of water tanks 4,700 m^3 (4 locations) ④ Protective meter covers 2,440 units ⑤ Installation of water pipes 56,580m ⑥ Construction of administration building	②⑥ Nearly according to plan ①Installation of water intake Cancelled ③Installation of water tanks 5,300 m^3 (4 locations)（△13%） ④Protective meter covers 70 units（▼93%） ⑤Installation of water pipes 65,945m（△17%）
(2) Construction period 1) Cañas 2) Liberia 3) Esparza 4) Puntarenas 5) Guapiles-Guasimo 6) El Pacito	Oct. 1993 to Dec. 1999 (75 months) 1) Oct. 1995 to Mar. 1997 2) Oct. 1995 to Aug. 1997 3) Jul. 1996 to Sept. 1998 4) Sept. 1996 to May 1998 5) June 1997 to Dec. 1999 6) Feb. 1997 to Sept. 1999	Oct. 1993 to Oct. 2000 (85 months) 1) Aug. 1996 to Aug. 1997 2) Oct. 1995 to Feb. 1998 3) Nov. 1996 to Jul. 1998 4) Sept. 1996 to Sept. 1998 5) Apr. 1998 to Oct. 2000 6) May 1998 to Sept. 1999
(3) Project cots Foreign currency Domestic currency Total ODA Loan Portion Exchange rate	 8,694 million yen 966 million yen (Local currency: Dollar) 9,660 million yen 1,656 million yen 1US$=138 yen	 7,596 million yen 487 million yen (Local currency: Dollar) 8,083 million yen 1,593 million yen 1US$＝123 yen (Average for 1996 - 2000)