

Ex-post Monitoring for Completed ODA Loan Projects  
El Salvador “Water Supply and Sewerage Improvement Project

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Field survey: May 2008

1. Project Profile



Location of the project



Chinameca Water Storage tank (May 2008)

1.1 Purpose

The project aims for rehabilitating and improving water supply systems and wastewater treatment systems in 41 cities that have a population of less than 30,000 in the four eastern prefectures of El Salvador. This project will enhance the quality of water supply service and sewerage service together with the project carried out by the Inter-American Development Bank (IDB) for institution-building through improving the operation and maintenance system of the Administración Nacional de Acueductos y Alcantarillados (ANIDA, El Salvador’s national water company). Thus, these two projects together will contribute to improvements in environmental hygiene and prevention of environmental pollution in the target cities.

## 1.2 Outline of the project (Summary of loan agreement, etc.)

Loan Amount	¥1,210,000,000
Loan Disbursed Amount	¥1,191,000,000
Loan Agreement	March 1993
Date of (Disbursement)Completion	December 2000
Ex-post evaluation	FY2002 <sup>1</sup>
Executing agency	ANDA
Main Contractors	There are no corporations with which a contract has been concluded for an amount of one billion yen or more.
Consultant Services	None

In El Salvador the sector of water supply and sewerage lagged behind in its improvement due to the civil war extending over a period of ten years. Therefore, it was necessary to develop the sector as quickly as possible. This project was implemented as a co-financing project in partnership with IDB. The ODA loan project targeted comparatively small 41 cities (the total population of 1,570,000 people, and 3,830 people per city on the average) in four eastern Prefectures. More specifically, water supply system was improved in 41 cities, and sewerage system was improved in 7 cities. IDB implemented a similar project in 96 cities excluding the eastern Prefectures. Besides, it extended support to the modernization of water supply and sewerage systems and the improvement of operation and maintenance capacity of ANDA.

## 1.3 Background

It was pointed out in the ex-post evaluation report that it was difficult to analyze a degree of contribution of this project to improvements in the water supply and sewerage services because similar projects had been implemented by other donors or governments nationwide. Furthermore, it was reported that this project had a characteristic of emergency rehabilitation support and that priority was placed on timeliness rather than on a sufficient feasibility study. According to the report, neither wastewater treatment facilities had been constructed nor had the existing sewage treatment facilities been refurbished because the water supply system was in great need for improvements. It was further pointed out that the IDB project had failed to produce a good effect in strengthening the institutional capacity of ANDA, which indicated the difficulty of consolidating the strengthened capacity of the staff.

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<sup>1</sup> Ex-post evaluation report on the ODA loan projects (FY2003):  
[http://www.jbic.go.jp/japanese/oec/post/2003/pdf/project36\\_full.pdf](http://www.jbic.go.jp/japanese/oec/post/2003/pdf/project36_full.pdf)

As a result, this ex-post monitoring was carried out with the chief purposes of confirming the operation of sewerage systems including whether or not wastewater was treated, examining the pollution of river water and grasping the progress of institutional capacity development of ANDA carried out by IDB as well as revalidating the effectiveness of the project in the target cities.

## 2. Results from monitoring

### 2.1 Effectiveness (effect)

#### Summary of the effect

This project played an important role in improving the water supply service in the eastern Prefectures. However, its effect is rather limited due in part to the fact that the project was tinged with a characteristic of emergency support. In the aspect of operation, there still remains the necessity of improving services in terms of the short duration of water supply, inequality, collection of the water rates and customer services. The sewerage systems were improved in 7 cities, thereby increasing the percentage of the population served. However, wastewater is still discharged without being treated. Hence, effect in improving the hygienic environment is limited.

#### 2.1.1 Water supply and sewerage sector in the four eastern Prefectures

The four eastern prefectures have a population of 1,200,000 people (430,000 in urban districts and 770,000 in rural areas: 2006 projection by the Statistics Bureau: about 20% of the total population of El Salvador) and 87 cities. Many of the cities are small in size with a population of approximately 5,000 on the average. ANDA delivers its water supply service in 47 cities that have a comparatively larger population.<sup>2</sup>

ANDA primarily depends upon deep wells for the source of its water supply and, in part, upon springs. The water is chlorinated and stored in water distribution tanks for distribution. In the eastern Prefectures the areas blessed with affluent sources of water supply are rather limited. Conversely, many areas do not have water sources. 16 cities are equipped with sewerage systems, but wastewater is not treated. That is, untreated wastewater is discharged into swamps or rivers in the suburbs. Domestic night soil is not necessarily discharged into sewers in general although gray water from kitchen and bathroom is discharged into sewers. Night soil is treated in a long-drop toilet in many houses.

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<sup>2</sup> ANDA supplies water in 149 cities out of 262 cities in the nation.

The ex-post evaluation report stated that the percentage of a population that has access to safe water increased by 12~29%, that there was an upward trend in the consumption of water per person and that the percentage of a population that has access to sewerage system by 3~17% during the time from 1992 to 1999. It argued that this project had evidently contributed to these improvements, but a degree of the improvements could not be discerned. This field survey revealed that the number of households connected to the service of ANDA increased by 8.7% in four years from 2002 to 2006 (4.9% in urban districts and 70.1% in rural areas), and water consumption increased by 19.9%.<sup>3</sup>

Table 1: Water supply and sewerage services of ANDA in the four eastern Prefectures (2006)

	Usulután	San Miguel	Morazán	La Unión	Total of the eastern Prefectures
Population (in thousand)	303	476	156	264	1,199
The number of cities	23	20	26	18	87
No. of cities served by ANDA	21	12	4	10	47
No. of cities receiving sewerage service from ANDA	7	4	2	3	16
No. of cities included in this project (water supply/sewerage)	18/2	11/2	4/2	8/1	41/7
Percentage of population receiving water supply service from ANDA	84.8%	57.0%	21.1%	69.2%	62.6%
Percentage of urban populations connected to ANDA's water supply systems	30.7%	48.9%	16.1%	29.1%	37.8%
Water production of ANDA's water supply systems (one million m <sup>3</sup> /month)	NA	NA	NA	NA	3.02
Consumption of water supplied by ANDA (one thousand m <sup>3</sup> /month)	721.8	1,017.5	64.6	267.0	2,070.9
Water consumption per capita of water supplied by ANDA (m <sup>3</sup> /month)	6.7	8.3	6.1	4.7	7.0

Source: ANDA Statistics Bulletin 2006

### 2.1.2 Project's effect and its affecting factors in each city

The project's effect was analyzed based upon the data on population, water consumption and the number of households connected to water supply system/sewerage system in 1994 (before the start of the project), in 2001 (after the completion of the project) and in 2006 (most recent) in each city. The following table shows the transitions in the water supply and sewerage indicators in the target 41 cities.

<sup>3</sup> The data which could be directly compared with the data of the time of ex-post evaluation were not available.

Table 2: ANDA's water supply and sewerage indicators in each target city of the project

	1994	2001	2006
Water supply system (41 cities)			
Water consumption (thousand m <sup>3</sup> /month)	504	701	801
No. of households connected (in thousand)	16.7	26.0	30.7
Water consumption per household connected (m <sup>3</sup> /month)	30.2	27.0	26.1
Percentage of population served	41%	NA	78%
Sewerage system (7 cities)			
No. of households connected (in thousand)	3.3	5.0	5.8
Percentage of population served	22%	NA	40%

Source: Prepared based on the ANDA Statistics Bulletin: It contains some projected figures. The percentage of the population served is an estimate based on the assumption that a household consists of four members.

#### (1) Water supply system

The main purposes of improving the water supply system under this project are threefold; (a) to increase water production capacity, (b) to expand the areas served, and (c) to improve water distribution systems.

##### a. To increase water production capacity

To increase the water production capacity, 33 deep wells were constructed, spring water intake facilities were constructed and the existing deep wells were remodeled or strengthened under this project. It was confirmed that the project produced a sufficient effect (in terms of increasing water production capacity) in 17 cities according to the data on water consumption from 1994 to 2001. On the other hand, a significant increase was not observed in water consumption in 10 cities due partly to the fact that a new well did not supply adequate water (or a well is not used for some reason) or the fact that a water intake amount from springs did not increase.

Water consumption increased by 39% in 41 cities during the seven years from 1994 to 2001 due primarily to this project. Currently, it is projected that approximately 40% of water consumption in the 41 cities comes from new wells and springs constructed under this project, and about 40% comes from the existing well facilities where pumps were remodeled or strengthened under this project. Thus, in all likelihood the project contributed to water production by some 30% in the whole eastern Prefectures.

Since 2001, it is observed that water consumption has decreased in 12 cities (water coming from deep wells in 4 cities and from springs in 8 cities.) The main reason presumably lies in the fact that the intake facilities of wells and springs have not been

appropriately managed or operated. There is a tendency in which the levels of groundwater have been lowering in the eastern Prefectures, which likely affects the decreases in water production.



A well constructed in the city of Santa Elena



Spring water intake facility in the city of Nueva Esparta (not properly maintained)

b. To expand the areas served

Under this project, water supply pipes to the end users were laid down for about 30km in total in 17 cities, thereby connecting the pipes to presumably about 2,000 households. It was confirmed that in 12 cities the size of population served by water supply had increased nearly as had been planned by 2001.

In the period from 1994 to 2001 the number of households served by water supply increased by approximately 9,000 in 41 cities. This project directly contributed to such increase by constructing water supply pipes and indirectly contributed by increasing the amount of water supply. The percentage of the population served by water supply in 41 cities is estimated at about 41% as of 1994, and this project has directly pushed up presumably by about 5 points. On the other hand, for the entire eastern Prefectures, it is conjectured that this project has directly pushed up the percentage of the population served by water supply by about 2%.

c. To improve water distribution systems

This project improved water distribution through constructing distribution water storage tanks and laying or strengthening water distribution pipes in 13 cities. Judging from increases in the amount of water supply and the population served by water supply, it is considered that this project has effected in 9 cities.

Based upon the above, it may be concluded in general that the project has yielded a satisfactory effect in 21 cities and an acceptable effect in 13 cities out of 40 cities. There are 6 cities in which it has not brought about much effect primarily because of the failure to secure water sources from deep wells and springs. There are some cases in which sufficient water production cannot be ensured due to defectiveness or deterioration in water distribution facilities or a broken well pump at an early stage even though water sources are adequately secured.

## (2) Sewerage systems

12 cities out of 41 cities are equipped with sewerage systems<sup>4</sup>. This project carried out the following facility improvements in the cities:

- Constructing sewer pipes to expand the areas served: 5 cities (connected approximately 800~900 households)
- Moving the discharge point of sewage effluent by 200~1,000 m to the suburbs: 3 cities
- Constructing a manhole for inspecting sewer pipes: 1 city

The population connected to sewerage systems in the target seven cities increased by approximately 1.5 times during the period from 1994 to 2001. It is conjectured that this project has successfully brought about nearly the half of the increase and pushed up the percentage of the population served by sewerage system in cities by 0.8%. At the time of ex-post evaluation (in 2001), collected wastewater was not treated, and even now wastewater is not treated. That is, the situation has unchanged. (Refer to the section of impact.)

## (3) Factors affecting the project's effect

This monitoring study revealed that the project plan had lacked sufficient coordination with other projects in about one quarter of all cities. It confirmed that there was a case in which the pump had to be replaced due to its deficient capacity only a few years after the completion; there was a case in which a well was not in full use due to underdevelopment of water distribution facilities or water production facilities; there was a case in which enough water was not available even though water source had been developed. The reasons are that medium to long-term viewpoint or a comprehensive viewpoint had not been taken and that surveys on the source of water supply (in particular, groundwater) were not fully conducted.

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<sup>4</sup> According to ANDA, after this Ex-Post monitoring survey, a sewerage treatment facility was constructed at Puerto el Triunfo, one of the targeted cities of this project in 2008.

Investments in the improvement of water supply systems under this project were short-term and partial in that it was implemented as emergency assistance to rehabilitate and strengthen as quickly as possible the antiquated systems that had been neglected during the civil war. Therefore, a lot of investment was continuously needed after the end of this project. It is assumed that the amount of investments including financial support by IDB, etc. was 2.5 times of the input made under this project. Above all, in the 17 cities included in the decentralization program of management assisted by IDB (to be discussed later), a lump sum was invested to improve their water supply systems. With this fund, pumps and other equipment supplied under this project were already replaced by new ones to expand the capacity. With such continuous investments, in the 41 target cities of this project, the amount of water consumption, the population connected to the water supply and sewerage systems and the percentage of the population served have greatly increased during 12 years from 1994 to 2006.

### 2.1.3 Present water supply and sewerage service and evaluation by residents

In this monitoring study we inspected the operation conditions of the facilities in 10 cities, carried out a questionnaire survey to 140 residents of four cities (one city per Prefecture) and had interviews with the municipal government (mayor, etc.) in each of 41 cities. The main findings are summarized below:

- 72 percent of residents are satisfied with the water supply service. The greatest reason for dissatisfaction stems from the limited amount of water supplied and the duration of water supply followed by the collection of water rates and water quality.
- Sixty-nine percent of municipal governments are satisfied with the current water supply service. On the other hand, there were some people who raised criticisms about the fact that residents' needs were not fully met due to the lack of sufficient investigations for the project planning/designed by ANDA and the fact that water distribution networks were not properly operated. Thus, 15% expressed their dissatisfaction.
- Wells are put to operate for 8~16 hours per day to store water in the distribution tank. Because of the shortage of the amount of water, there are not many cities where the facilities are operated for 24 hours. In many cities water supply to each district is controlled by adjusting a valve by time of the day. In the majority of cities water is supplied every day. On the other hand, in other cities water is supplied once in 2~4 days. In the 4 cities where the questionnaire survey was conducted, approximately 30% of the residents are highly dissatisfied with inequality and difference in water



pressure and duration of water supply depending upon district and short or inconstant duration of water supply.

- The water rates per household are \$6.6 on the average. Dissatisfaction is widespread over the water rates and the water rates collection system. Twenty percent of the residents have a strong sense of dissatisfaction. The dissatisfaction is caused by inaccurate reading of the water meter or inaccurate estimate of used water amount, and marked inequality in the amount of water supply despite the fixed-sum contract without meter.<sup>5</sup> One factor to provoke users' dissatisfaction is that responses to grievances about water leak and suspension of water supply are slow. However, it seems that in 6 cities where the management has been decentralized for nearly 10 years such dissatisfaction has decreased to a great extent because the performance in the collection of the water rates and response to claims has improved.
- In the cities where deep wells are used as water source residents give good ratings to the quality of water, whereas users give low ratings in cities which use spring water as water source because it contains dirt such as sand during the rainy season.<sup>6</sup> Our questionnaire survey reveals that about one-third of the respondents have a sense of dissatisfaction in the cities that use spring water as the source of water supply. In a certain city, many residents do not drink tap water and buy expensive bottled water for drinking instead.

## 2.2 Impacts

### 2.2.1 Improvements in environmental hygiene

According to the survey carried out at the time of ex-post evaluation, 48% of households benefited from rehabilitated water supply systems reported that there were some improvements in their living and their half specified that there were improvements in health and hygiene conditions. At the same time, 31% of the households benefited from the project reported that environmental hygiene had improved.

According to the findings of the questionnaire survey conducted this time, one-third of the residents who have gained access to the water supply service replied that the frequencies of washing hands and washing clothes have increased. Similarly, two-thirds of the residents connected to sewerage system consider that their home

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<sup>5</sup> In the eastern Prefectures 54% of users pay their water rates based upon the reading of water meter. Thirteen percents of users have a contract based upon payment according to the schedules of rates, but the meter is broken. As a result, they pay their water rates based upon their past records or the amount of water used by users in the neighborhood. The rest users, 33%, have a fixed-sum contract without meters. (as of fiscal 2006)

<sup>6</sup> The Ministry of Health periodically carries out inspections on the quality of tap water nationwide and maintains that 95% of samples of tap water delivered by ANDA pass the water quality criteria. That is, the quality of ANDA's water is more stable in comparison to the water supplied by other water supply systems which are under the management of local governments or private enterprises.

hygienic environment has improved due to the sewerage service.

According to the data from the Ministry of Health, the incidence of diarrhea has decreased by 30% in the period from 2001 to 2003 in the eastern Prefectures, but it has leveled off since then. It is estimated that the incidence of diarrhea in the eastern Prefectures was 244 cases per 10,000 people in 2006. It was reported that it was difficult to indicate a quantitative impact on improvements in environmental hygiene brought about by this project based upon health statistics such as prevalence of diarrhea and parasite at the time of ex-post evaluation. In this survey we did not carry out a similar analysis, either.

It is believed that this project has contributed to improving environmental hygiene in urban districts in the 5 cities where 800~900 households were newly connected to the sewerage system under this project. According to the questionnaire survey, 20% of residents who are connected to the sewerage system think that the environmental hygiene of their neighborhoods has been improved. However, the improvements in environmental hygiene are in fact limited in that there are houses of which toilets are not connected to the sewerage system and all wastewater is discharged into rivers without being treated. There were cases in which residents living in the vicinity of the discharge point of untreated sewage effluent complained about foul smells. The ex-post evaluation report pointed out that the discharge of untreated wastewater will no doubt inflict an adverse effect on environment. Even now wastewater is not treated and the situation remains the same.<sup>7</sup> On the other hand, in three cities in which the point of discharge has been moved away to suburbs, it is reckoned that urban environmental problems such as fole smells and pollution have been slightly alleviated.

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<sup>7</sup> Hygiene problems have been removed from urban districts and dumped in the suburbs. As long as wastewater is not treated, there will always be the possibility of polluting surface water and groundwater. Similarly, when toilets are not connected to the sewerage system and night soil is made to infiltrate into the ground, groundwater may be polluted. There is a possibility that pollutants may seep into drinking water through a broken point of water distribution pipes. The city of Jocoro banned night soil from discharging onto roads by the Environment Ordinance stipulated by the city in 1998. Thus, each house is mandated to connect to the sewerage system as much as it can, whereby sewerage connection rate is high (70~75%) and almost all toilets are connected to sewerage. As a result, the quality of wastewater is very bad due to night soil. The city mayor seeks for fund sources to construct the city's own wastewater treatment facilities without depending upon ANDA.



A road newly equipped with sewer pipes in Chinameca



Untreated sewage effluent in Santa Elena

### 2.2.2 Prevention of environmental pollution

In El Salvador including San Salvador, capital city, wastewater is not treated by the sewerage system.<sup>8</sup> In the backdrop against not treating wastewater, lie problems in the legal system, finance and institutional capacity.

- The law regulating wastewater was stipulated in 2000 with a grace period until 2003. The effluent quality standards which are under discussion are strict. As a result, the industrial circles and governmental organizations raise strong oppositions, and effluent quality standards have not been stipulated as of now. Furthermore, under the circumstances in which there is no water law, that is, legal framework not fully developed, it is difficult to apply effective regulations.
- ANDA does not have any financial reserves and is unable to construct wastewater treatment facilities. Even if a treatment plant is built with financial support from external sources, ANDA does not have funds to appropriate a budget for its operation and maintenance. ANDA is not sufficiently equipped with experience and technical capacity to plan and operate wastewater treatment system.
- The Ministry of Environment suffers from the scarcity of manpower and the lack of capacity to supervise and monitor compliance with the regulations. Even if a violator is fined, there is a high probability of continuing the violation at the cost of paying the fine.

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<sup>8</sup> In El Salvador there are 5~6 sewage treatment plants constructed or rehabilitated with financial aid from Germany and Spain.

As a result, many rivers in El Salvador are polluted by domestic wastewater. In particular, the quality of river water has been deteriorated in the lower reaches of a river from a heavily populated area. In the eastern Prefectures, it is reported that the quality of water of the San Miguel has been deteriorated.<sup>9</sup>

## 2.3 Sustainability

### Summary of sustainability

The ANDA East Office lacks human resources and equipment, thereby being unable to fully carry out operation and maintenance. One factor is its system in which the headquarters' approval is required for budget and procurement. It is assumed that the decentralization of management, which has been under way in some cities, will improve the quality of operation and maintenance to a certain degree. The issue underlying a great number of problems is the fact that the water rates cannot be raised to an appropriate level without national parliamentary approval. It is difficult to solve such problems before the enactment of the water law.

### 2.3.1 Executing agency

#### 2.3.1.1 Structural organizations of operation and maintenance

##### (1) Legal system

In El Salvador the framework of legal systems is underdeveloped in the domain of water supply and hygiene. A pending issue is the stipulation of a basic water law. However, there is no clear outlook about introducing the bill to the national parliament from various political conditions of El Salvador. Under the circumstances, there will remain many issues such as coordination among related organizations, rationalization of water use, rationalization of the water rates, maintenance of public investment level and conservation of the water environment.

##### (2) Organization and operation/maintenance system of ANDA

At ANDA the power is centralized at the headquarters concerning the management of budgets and planning, thereby limiting the powers of local offices. That planning, changing the plan and procurement take time to have approval from the headquarters impedes the work efficiency of a local office. For instance, a local office can have only an eight-month contract, instead of a one-year contract, with the business concerned with repair and connection work because of the time-consuming procedures

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<sup>9</sup> "Diagnóstico Nacional de Calidad de Aguas Superficiales" Servicio Nacional de Estudios Territoriales/Servicio Hidrológico Nacional

for the approval. What this means is that it is unable to have spare parts required for repair work when necessary.

Since 2003 a local office has been reinforced as can be seen from the fact that several engineers/technologists who have university-level technology were assigned to the East Office to be engaged in planning/designing since five years ago. The personnel system has been somewhat strengthened compared to the time of ex-post evaluation. That is, the staff size of the East Office consists of 263 persons as of December 2006. ANDA assigns its staff at each city's system for operation, maintenance and inspection of wells (pump and motor), tanks and valves. The East Office visits the system once a month to replenish the chlorine sterilizing agent and inspect the system. However, it is not very efficient to centrally control water supply and sewerage systems many of which are located in remote areas or mountainous areas. In fact, as will be discussed later, the East Office is unable to operate and maintain them sufficiently due to its constraints in human resources and equipment.

### (3) Decentralization program supported by IDB aid<sup>10</sup>

The systems in 24 cities out of the 41 target cities of this program are under the control of the ANDA East Office. The systems of other 17 cities have been included in the decentralization program and their management is under the control of four companies. The systems of six cities were placed under the control of Tetralogia, a company that assumes the operational responsibilities, as early as in December 1999. Other three companies are entrusted with the management of eleven cities' systems in succession from 2007 to 2008. At present, they are in the process of transition with technical support from the East Office. The ANDA headquarters supervise the decentralized systems.

Tetralogia, for instance, improved the performance of operation and maintenance after decentralization. That is, it has successfully established a fixed schedule of water supply, increased the number of connections (legitimization of illegal connections), systematically carried out preventive maintenance, increased the collection ratio of the water rates and improved measures to address water leak (that is, shortened the time

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<sup>10</sup> Decentralization program: Under the IDB project that was undertaken in 1998, ANDA has implemented the decentralization program in which a local water supply system is locally controlled. That is, in this program ANDA commissions the operation and maintenance of water supply and sewerage systems to a company established by multiple city governments and representatives of residents and at the same time makes investments for the improvement of facilities with the purposes of realizing efficient operation and maintenance from a closer point to the system through capacity development of operation and maintenance, changing (i.e. raising) the water rates and delegating powers and securing sustainability by collecting invested funds through revenue from the water rates. In reality, facility improvements and capacity development could be achieved with funds from IDB, but the water rates could not be changed because the legal system has not been developed. Moreover, ANDA has not fully delegated its powers. As a result, the initial purposes have not been fully attained.

until repair). However, the system of Tetralogia needs a large-scale pumping-up, which costs a large amount of money. Thus, it is in the red financially. Tetralogia receives financial supplementation from ANDA but is unable to reserve funds for improving or expanding the systems.

#### 2.3.1.2 Technical capacity of operation and maintenance

According to the ex-post evaluation report, under the project financed by IDB, the process of operation and maintenance was clearly delineated as a component of strengthening institutional capacity. However, neither the result of investigations nor the proposal had been put to practice because ANDA failed to recognize their significance. For instance, as a result of moving staff members who had undergone training to other sections, it became difficult for ANDA to strengthen its institutional capacity. Despite continued efforts made by ANDA East Office to improve the operation and maintenance capacity of its staff, there were reports of some employees who quit the office for private companies with higher rewards.

The findings of our hearing to the ANDA East Office and our visits to check the operation and maintenance of facilities in ten cities demonstrate that the staff members of the ANDA East Office are sufficiently equipped with basic knowledge and experience required for the operation and maintenance of urban water supply and sewerage systems.

Rather, a greater constraining factor on operation and maintenance is the dearth of personnel and equipment/supplies of the East Office. The following difficulties were confirmed concerning the operation and maintenance of facilities by the East Office.

- There are 157 wells in the eastern Prefectures. Their preventive maintenance and repairs were under the management of one company. Due to the procedures for procurement, there are 3~4 months out of one year for which there is no contract. During that time, a team (consisting of 4 persons) of the ANDA East Office takes direct responsibilities for preventive maintenance and repairs. However, since it does not own a crane, it must rent it from an external source. Due to budgetary constraints, it is unable to carry out sufficient maintenance/repair works. The frequency of preventive maintenance is less than one-third of the plan. Thus, troubles often take place, which, in turn, makes the team busy, thereby having little time for preventive maintenance.<sup>11</sup> An inventory of spare parts runs short and it

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<sup>11</sup> It had been planned for 2007 to carry out preventive maintenance 314 times a year on 157 wells. However, it was

takes time to go through the procedures for receiving approval for procurement from the headquarters, it is unable to do repairs promptly.

- ANDA's operating budget covers the repair expenses to fix troubles of wells (plugging-up of a screen and damaged casing pipe, etc.) but does not cover preventive maintenance costs. The inspection and maintenance of the intake facilities of spring water are not carried out. It is considered that the lack of maintenance work of water source reduces water production.
- Four teams (one team consisting of 7~8 persons) take responsibilities of repairing water supply distribution networks. There are many water distribution pipes that were laid forty years ago. That is, there are many places of water leak to which they can fully tend. The East Office believes that it would need to increase the number of teams by 2~3 times in order to deal with the leak problem properly. It does not have water leak detectors. In addition, due in part to the scarcity of personnel, it is impossible to fully carry out maintenance to prevent water leak. There is one team that repairs sewer pipe networks, but it is often the case that it is unable to do proper repair work without having equipment including heavy machines.
- Database has not been created for inventory information on the existing systems and the records of the past maintenance works in the computer. It is, hence, difficult to analyze information necessary for the planning of operation and maintenance.

Since 2005, Luxemburg has been implementing an aid project for the East Office. So far, it provided technical training and investment for water supply in rural areas, supplied computer equipment to the administrative section of the East Office, and built the management system of clientele. In the future, it is planned to create database for the existing 48 systems including GIS, procure water leak detectors, and teach how to use them. On the other hand, JICA plans to implement a technical cooperation project with the chief aim of developing the capacity of ANDA to address the issue of non-revenue water control measures at the request of the government of El Salvador.

### 2.3.1.3 Financial status in operation and maintenance

It is reported in the ex-post evaluation report that ANDA showed a red-ink figure amounting to 3~4 million dollars in 1999 and 2000, but moved into surplus of 41 million dollars in 2001.

Although ANDA receives subsidies from the government, it shows a red-ink

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done only 99 times.

figure consecutively in the past three years. The water rates do not cover production costs, but under the present legal system it is necessary to have an approval from the national parliament for changing the water rates. They have been left untouched since 1994 due to political reasons.<sup>12</sup>

Table 3: Revenue of ANDA (in million dollars)

	2005	2006	2007
Gross revenue	252.4	262.2	311.1
Business income (Income from water charge)	67.5	74.1	84.7
Other revenues (Note)	184.9	188.1	226.4
Gross expenditure	258.5	280.5	318.1
Production & sales costs	49.4	54.3	59.3
Personnel costs	18.9	19.5	21.8
Other costs (See the note.)	190.2	206.7	237.0
Balance	-6.0	-18.3	-6.9

Source: ANDA Annual Report

Note: Other revenues and other costs include transfers between the headquarters and local offices (approximately 155 million dollars in 2006). Thus, the actual gross revenue and gross expenditure are much smaller than indicated in this table.

The trend of the budget for operation and maintenance of the East Office cannot be so simply analyzed because a budget for the system to transfer to the decentralization program has been added to the budget of the headquarters in succession. The operating budget drastically dropped in comparison to the time immediately after the completion of the project and has been declining gradually for the past three years. The budget for operation and maintenance was extensively cut down due to constraints in the national budget in 2006, and was increased to the same extent in 2007. As stated above, the East Office has neither enough personnel nor equipment such as vehicles and heavy machines for operation and maintenance. That is, the scarcity of the budget imposes a great constraint.

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<sup>12</sup> In recent years the connection charge and some service charges, which do not require a parliamentary approval, were raised although the water rates per 1m<sup>3</sup> have not been raised.



Table 4: Actual budget for operation/maintenance of  
ANDA East Office (in thousand dollars)

	Maintenance	Operation	Total
2000	750	3,500	4,250
2001	1,200	5,500	6,700
2002	1,750	5,500	9,500
2003	1,755	3,363	5,118
2006	449	3,189	3,638
2007	2,449	3,037	5,482

Source: Responses of ANDA to the questionnaire (From 2000 to 2002, at the time of ex-post evaluation and after 2005, at the time of this survey)

When the decentralization program was introduced with financial aid from IDB, the initial purpose was to collect the water rates in proportion with the unit cost of water supply which differs by system, thereby aiming at reserving investment funds to remodel or improve the facilities in the future. However, because the legal system has not been fully developed, it is not possible to establish differentiated tariffs in accordance with different costs of each system, thereby being unable to raise the water rates. As a result, Tetralogia is inevitably in the red under a system in which it puts pumps to full use. Although ANDA compensates the deficit, but there are no cohesive rules about financial shares. There is no reserve as investment capital, either.

### 2.3.2 Current operation and maintenance

ANDA stated in its annual report that there were 3,828 repair cases for water supply systems and 802 repair cases for sewerage systems during 2006. There were roughly 4,000 complaints about water leak of public water pipes, out of which only less than 60% were tended to. In the same year the rate of non-revenue water was 27.8% nationally, whereas in the eastern Prefectures it was 31.2%. The percentage of the households equipped with water meters was 57% in 2002, which increased to 64% in 2006. In the eastern Prefectures also it increased from 40% to 54% during the same period.

Six cities out of the ten cities that we visited for this study had participated in the decentralization program ten years ago and received investments. In these cities the facilities in general have been maintained in good conditions and we did not find big problems in particular. On the other hand, in other four cities, including two cities that were added to the decentralization program recently, the maintenance of their facilities

is not satisfactory. Although the facilities are in operation, there were many cases of damage in the building, distribution tank and its preventive fence. ANDA believes, based upon its experience in the decentralization program, that the decentralization of management indeed improves maintenance. However, it is considered that it will take time to build a system and develop human resources for the program. The abovementioned result of our field study endorses this statement.

The result of our site visit, the fact that a massive amount was additionally invested and what was told in our hearing made to ANDA all obviously indicate that there is a number of motors and pumps, which had been installed under this project, were replaced by new ones. Main causes that shorten the life of a motor can be traced to frequent stops because it is not a 24-hour operation, the lack of preventive maintenance and voltage fluctuations.

### 3. Conclusions, Lessons learned and Recommendations

#### 3.1 Conclusions

This project importantly contributed to the improvement of water supply systems and sewerage systems in the eastern Prefectures, with the help of additional investments after its completion from other donors. Nonetheless, there remain a variety of challenges in terms of the operation and maintenance of the systems in local small cities. That is, there is still a lot of room for improvements. The decentralization program of the system that has been carried out under the auspices of IDB in some cities has been yielding a good effect, but it has limitation in funding. In order to solve these problems, it is essential to change the water rates proportionately.

#### 3.2 Recommendations

[For the government of El Salvador and ANDA]

- It is necessary for the government of El Salvador to stipulate the basic water law, thereby establishing an appropriate schedule of water rates and developing a modern legal framework so that the conservation of water environment can be enhanced by wastewater treatment.
- It is vitally important to alleviate financial constraints to solve a variety of issues accumulated in the sector of water supply and sewerage systems. The key lies in changing the water rates. The government of El Salvador should raise the water rates as quickly as possible to an appropriate level and give flexibility to the current nationally uniform schedules of water rates based upon logical reasoning without

being influenced by political affairs.

- ANDA is required to address the following issues in order to improve the planning, operation and maintenance of local water supply and sewerage systems.
  - To delegate authorities in terms of budget, planning and procurement to the local office that is closest to the site and users (residents and city government: the headquarters focus on macro-level budget and planning, developing the capacity of local offices, and monitoring evaluation.)
  - To design medium and long-term and comprehensive plans for each city
  - Proper maintenance and management of water sources: to carry out surveys on water sources
  - To reduce the rate of non-revenue water
  - To improve the operation of water supply systems that have a limited water source (particularly the control of water distribution)
  - To strengthen the operation and maintenance system (specially of equipment) at the East Office
  - To promote decentralization that makes it possible to improve the operation and maintenance of systems; Note that there is room for improvement concerning cooperation system between an entrusted organization and ANDA (in particular, financial aspect)
  - To select cities that have top priority and investigate and formulate a plan to introduce a sewerage system for those cities
  - To carry out activities to educate and disseminate information about the importance of wastewater treatment and toilets being connected to sewer pipes

There are many problems to be addressed in the water supply and sewerage sector. However, a considerable amount of additional investments has been injected after the completion of this project. Hence, it is not necessary for JBIC to follow up the project in specifics.

### 3.3 Lessons Learned

- In order to keep the sustainability of water supply and sewerage services, it is essential to have a schedule of water rates which is logically decided without being influenced by political affairs and also to have a mechanism to secure funds continuously for the operation and maintenance and repairs and expansion of the facilities.
- It is believed that especially for the infrastructure project in local cities performance will improve if an office that is closest to the infrastructure scattered in local small

cities designs a plan and executes the plan and it takes responsibilities for the operation and maintenance of facilities by eliminating the excessive centralization of authorities in its management.

### **Comparison of main plans and achievement**

Item	Plans	Plans executed
Output Improvement of water supply and sewerage systems	34 cities	Improvement of water supply system: 41 cities Sewerage system: 7 cities
Duration	March 1993 ~ October 1996	February 1995 ~ December 2000
Project costs		
Foreign capital	¥ 3,509,000,000	¥ 3,418,000,000
Domestic capital	¥ 399,000,000	¥ 781,000,000
Total	¥ 3,908,000,000	¥ 4,199,000,000
ODA loans out of the total	¥ 1,210,000,000	¥ 1,191,000,000