Republic of Guinea

Project of Improvement of Drinking Water Supply in Conakry/
Project for Improvement of Drinking Water Supply in the Capital[1]

External Evaluator: Machi KANEKO, Earth and Human Corporation

0. Summary

The purposes of the Project were to increase water production at the Yessoulou Water Treatment Plant and to improve water flow of raw water (untreated) and treated water pipelines through such works as construction of a raw water pipeline from the Grandes Chutes Dam to the Yessoulou Water Treatment Plant, extension of the Yessoulou Water Treatment Plant and construction of a treated water pipeline from the Yessoulou Water Treatment Plant to the city of Conakry. As these purpose are relevant to the development policy of Guinea to increase water supply pervasion in the capital city of Conakry and contribute to the urgent task to increase water production in Conakry, the relevance is high.

Concerning effectiveness, the original target for water production volume at the Yessoulou Water Treatment Plant has been achieved. As for the flow rate of treated water pipes, it is believed that the entire treated water pipeline has achieved the expected level of flow rate as a result of increasing the flow rate of the existing 700 mm pipes from the plan. On the other hand, as the flow volume of the 1,100 mm pipes connected to the treated water pipeline developed in the Project is lower than the planned value after the outlet of the water treatment plant, the flow volume is considered to be restricted.

As for impact, while the served population and the water supply volume per person have exceeded the target values set in the original plan partly because of other donors' support, breakage of water pipes has caused water outage in part of the city and damaged houses and properties of the residents. Moreover, unexpected incidents have caused economic losses including compensation payments to residents and repair costs. Judging comprehensively from the above, the implementation of the Project has produced some impact; therefore the effectiveness and impact of the Project is fair.

The period of the Project had to be extended due to deterioration of public security and instability of political situation including a coup d'etat in the country. However, as there were other reasons for the extension of the project period, such as replacement of defective

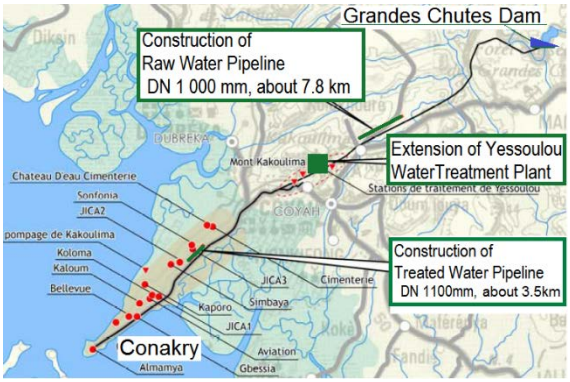
[1] The second phase construction of the Project of Improvement of Drinking Water Supply in Conakry was discontinued in 2007 due to security deterioration in Guinea. Therefore, it was brought forward after a verbal note for extension of E/N was exchanged, and the second phase was completed with some services related to D/D and bidding alone. Later, when security regained stability, recommencement of the suspended construction was requested. To avoid confusion in the future, E/N was signed under a new project name, the Project for Improvement of Drinking Water Supply in the Capital, and the construction was recommenced.

products and extension of a construction period for treated water pipes, the efficiency of the Project is considered fair. Compared with the planned amount of 1,503 million yen, the actual project cost was 835 million yen for Phase I of the Project of Improvement of Drinking Water Supply in Conakry, 30 million yen for Phase II and 700 million yen for the Project for Improvement of Drinking Water Supply in the Capital.

As for sustainability, while the Water Company of Guinea (SEG: Société des Eaux de Guinée) has no issue with its operation and maintenance structure or with operation and maintenance of the Yessoulou Water Treatment Plant and terminal water facilities, it has minor financial issues. On the other hand, the treated water pipes developed in the Project have repeatedly been broken and SEG is not able to prevent recurrence at this point, when causes for breakage are being investigated, though the pipes are operated at a lower pressure. Therefore, SEG considers it appropriate to replace fiberglass reinforced plastic mortar pipes (FRPM pipes) with ductile cast iron pipes. Based on the above, the sustainability of the impacts generated by the project is low.

In light of the above, the Project is evaluated to be unsatisfactory.

1. Project Description



Project Locations
(Grandes Chutes Dam, Yessoulou Water Treatment Plant and City of Conakry)

3rd Water Treatment Plant in Yessoulou
(Rapid filter)

1.1 Background

In Conakry, the capital city of the Republic of Guinea (hereinafter called Guinea), the World Bank carried out the Conakry Water Supply and Sanitation Project I (1978-1985) and developed a complete series of water supply system from water source development to the connection of water supply pipes. In the subsequent project, the Conakry Water Supply and Sanitation Project II (1989-1997), further water system development was carried out with support from such donors as the World Bank and Japan. In 1989, in response to the recommendation of the World Bank, the government of Guinea established the former Guinea

National Water Company (SONEG: Société Nationale des Eaux de Guinée) for facilities management in the water service sector and the Guinea Water Supply Operation Company (SEEG: Société d'Exploitation des Eaux de Guinée) for the operation of urban water supply services. With the participation of a consortium of foreign companies, SEEG received attention as the first privatized water business unit in West Africa. Privatization of the water company did improve its business management system in terms of capital increase and improvement of technical capabilities. However, when the company tried to increase its revenue by stopping water supply to non-paying users and raising water rates, illegal water connections increased and the situation of water supply got worse. Moreover, at the time of the first contract renewal in the 10th year after the privatization, SONEG did not approve the revision of water rates requested by SEEG and the joint venture with the private sector collapsed with large amounts of debts in 2000.

As a result, in 2000, the government of Guinea consolidated SONEG and SEEG into the Water Company of Guinea (SEG), a public corporation that the government had 100% ownership of, and announced the policy to stop privatization of water services for the time being till the outlook of financial reconstruction became clear. The World Bank, who was implementing the Conakry Water Supply and Sanitation Project III (1997-2004), decided not to provide the planned loans for the construction of raw water(untreated)/treated water pipelines and the extension of the Yessoulou Water Treatment Plant because the privatization of water services was suspended.

Under such circumstances, the Guinean government requested the Japanese government to provide a grant aid to improve water supply in Conakry and it was decided to implement the Project of Improvement of Drinking Water Supply in Conakry with the following contents.

① Construction of a raw water pipeline from the Grandes Chutes Dam to the Yessoulou Water Treatment Plant
② Extension of the Yessoulou Water Treatment Plant (construction of the 3rd plant)
③ Construction of treated water pipeline from the Yessoulou Water Treatment Plant to the city of Conakry
④ Procurement of equipment and materials to detect and repair water leakage

1.2 Project Outline

The Project aims to increase water production through such measures as development of raw water/treated water pipelines and extension of a water treatment plant for the purpose of supplying safe drinking water in a stable manner to the residents of Conakry, where water supply is not catching up with the increasing water demand caused by the population growth.

Grant Limit / Actual Grant Amount		- Project of Improvement of Drinking Water Supply in Conakry Phase I: 860 million yen (Phase II: 675 million yen) - Project for Improvement of Drinking Water Supply in the Capital 745 million yen
Exchange of Notes Date		- Project of Improvement of Drinking Water Supply in Conakry Phase I: June 2005 (Phase II: July 2005 [Verbal note for extension exchanged in March 2007]) - Project for Improvement of Drinking Water Supply in the Capital November 2007
Implementing Organization		Water Company of Guinea (SEG) under the Ministry of Energy and Water Resources
Project Completion Date		October 2009
Practitioners	Main Contractor	- Project of Improvement of Drinking Water Supply in Conakry (Phase I): Kitano Construction Corp. - Project for Improvement of Drinking Water Supply in the Capital: Tone Engineering Corporation (Former Urban Tone)
	Main Consultants	[Basic Design] Pacific Consultants International Co., Ltd. [Implementation review study and project works] Tokyo Engineering Consultants Co., Ltd.
Basic Design		- Basic design study Oct 2004 – Mar 2005 - Implementation review study Aug 2005 – Dec 2005 - 2nd implementation review study Jun 2007 – Nov 2007
Related Projects		[Grant Aid] - Project for the Improvement of Water Supply Facilities in the Eastern Part of Conakry (1990) - Project for Drinking Water Supply in the Eastern Part of Conakry (1993-1995) The above-listed two grand aid projects were implemented within the framework of the 3rd Water Supply Project. [Other donors] Based on the Conakry Water Supply Master Plan (1997), formulated by the World Bank in the Conakry Water Supply and Sanitation Project II (1989-1997), the World Bank and France provided aids as major donors for the development of water supply facilities.

2. Outline of the Evaluation Study

2.1 External Evaluator

Machi KANEKO, Earth and Human Corporation

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: September 2012 - February 2014

Local survey: January 24 – February 5, 2013

2.3 Constraints during the Evaluation Study

The second local survey was not conducted as originally planned because it overlapped with the consultant's survey concerning breakage of water pipes. Therefore, the evaluation of the operation and maintenance status of the facilities constructed in the Project is based on the information provided by the Guinean side and the result of on-site inspection during the above survey period.

3. Results of the Evaluation (Overall Rating: D[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance to the Development Plan of Guinea

The national development plans of Guinea at the time of the planning stage of the Project were the Vision 2010, which defined social and economic development strategies till 2010, and the Guinea Poverty Reduction Strategy Paper (PRSP) 2002, which was developed in 2002 under the Vision 2010. The PRSP 2002 positioned the water supply, education and health sectors as priority areas for basic social services and set numerical targets for the water supply sector of raising the drinking water access rate (rate of population with access to water supply) to 90% at the national level and 95% in Conakry by 2010. Another numerical target was to increase the water supply per person from 47 liters/day in 2000 to 63 liters/day in 2010.

The targets of PRST 2002 were not achieved in the target year of 2010 because of the lack of funding for water supply development caused by the worsening domestic situation from 2007 to 2010. Therefore, in the Poverty Reduction Strategy Paper developed in 2011 (PRSP 2011-12), the Guinean government positioned the improvement of access to basic social services (health and hygiene, education, drinking water, sewage and electricity) as one of the priority tasks and gave priority especially to the increase of the access rate to drinking water

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③: High, ②: Fair, ①: Low

and the water supply volume in Conakry.

The numerical target was to increase the access rate in Conakry to 86% (water supply per person: 63 liters/day) in the new target year of 2015, extended from 2010.

The purposes of the Project are to increase water production at a treatment plant and to construct treated water pipes that convey water produced at the plant to the water conveyance and distribution system in the city for the purpose of supplying safe drinking water in a stable manner to the residents of Conakry. Therefore, the Project is relevant to the development policy of Guinea.

3.1.2 Relevance to the Development Needs of Guinea

Guinea has such a high precipitation that it is called a “water tower of West Africa (le château d’eau de l’Afrique de l’Ouest)”. However, facilities for stable supply of safe drinking water are not well developed and water shortage is hindering economic growth especially in urban areas where the population is intensely increasing.

The water system in the capital city of Conakry takes water from the Grandes Chutes Dam, spring water at the foot of Mt. Kakoulima and groundwater in the city. Raw water from the Grandes Chutes Dam is treated at the Yessoulou Water Treatment Plant and distributed to the city of Conakry.

Accounting for 85% of all the water distributed in the city at the time of the ex-ante evaluation of the Project, water production at the Yessoulou Water Treatment Plant played an important role as drinking water for the residents of Conakry. Although the water supply pervasion was about 82%, the quantity of water supply was not enough to meet the increasing demand caused by the population concentration in the capital and the water supply was imbalanced. There was only a limited number of areas where water was supplied 24 hours and there were still many areas where water was supplied only for a few hours a day or was not supplied at all although the distribution pipeline had been developed. Thus increase of water production including development of new water sources was urgently required.

Although the total water production was said to be 96,000 m^3/day, the billable water quantity, i.e., accounted-for water, was only around 36,000 m^3/day. With about 26,000 m^3/day unbillable due to lack of meters and water theft and another about 34,000 m^3/day lost due to leakage, the rate of unaccounted-for water was very high.

Under such circumstances, the World Bank established the Conakry Water Supply Master Plan (1997) in the Conakry Water Supply Project II, which started in 1989. The master plan set the goal to raise the water supply pervasion in Conakry from 65% in 1996 to 80% by 2005 and presented a development plan for the “urgent phase” for 1997-2007 and the “2nd phase” up to 2005.

7 projects were planned for the “urgent phase” and 4 of them were carried out as the Conakry Water Supply Project III with loans from the World Bank. However, the privatization of water services proposed by the World Bank failed and the Guinean government decided to suspend privatization till the outlook of financial reconstruction became clear (2000). The World Bank cancelled the planned loans for the remaining 3 projects due to the discontinuation of water service privatization.

In light of the above, as the situation where water supply did not catch up with the increasing water demand did not improve, the Guinean government requested the Japanese government to provide a grant aid for the 3 remaining projects out of the 7 projects for the urgent phase. In response to the request, the Japanese government carried out basic design study and decided that, in order to supply safe water to the residents of Conakry, it would be necessary to increase water supply by developing raw water/treated water pipelines and extending water treatment facilities through the 3 projects. The following table shows the contents and schedule of the urgent phase projects.

Table 1 Summary of “Urgent Phase” Projects included in the World Bank’s Master Plan

	Project contents	Construction cost* (K USD)	Implementing body
1	Construction of raw water pipelines (100 m and 8 km)	4,710	Not implemented with funds from the World Bank, carried out by the Japanese government upon request
2	Construction of the 3rd Yessoulou Water Treatment Plant Water treatment capacity 1,050 L/sec → 1,500 L/sec	2,800	
3	Construction of treated water pipelines (1,100 m and 3.5 km)	2,112	
4	Construction of storage reservoirs and an elevated water tank Sonfonia distributing reservoir (3,000 m^3) Cimenterie distributing reservoir (3,000 m^3) + elevated water tank (1,000 m^3)	4,012	Carried out in the Conakry Water Supply and Sanitation Project III with funds from the World Bank
5	Development of treated water pipelines Sonfonia (17.35 km) Cimenterie (1.20 km)	5,515	
6	Development of a water distribution network 2nd piping: 107 km 3rd piping: 290 km No. of households to be connected: 33,000 Common faucet: 64 locations	9,671	
7	Water leakage investigation and repair campaign Effective water ratio 60% → 70% by 2000	1,600	

* Construction cost is based on the estimation in the Master Plan (1996). Design administration cost, inflation and foreign exchange fluctuations are not included.
Ref: 2nd Implementation Review Study Report (2007)

When we checked the progress of the Conakry Water Supply Master Plan in this ex-post evaluation, we found that, while the development works for the urgent phase had been completed with the cooperation of Japan and the World Bank, the second phase[4] had not been implemented at all for such reasons as the worsened domestic situation. However, the Conakry Water Supply Master Plan would still be effective till 2010 and was considered as an effective plan at the time of planning and completion of the Project.

The current plan for Conakry water supply development is the Plan for the Enhancement of Capabilities for the Production, Conveyance, Treatment and Storage of Drinking Water in Conakry (2013-2016), which is considered as the Conakry Water Supply Project IV and supported by the World Bank and other donors[5]. Its numerical goals are 100% access to drinking water in Conakry and 70 liters of water supply per person per day in the final target year of 2030. However, the target area for these goals is from PK0 to PK50, larger than the original plan of the Project. In the planning stage of the Project, the area for water supply was from PK0 to PK30, according to the administrative division of the city of Conakry. Later, as population increased and urbanization and industrialization progressed rapidly in the boom neighboring prefectures of Dubréka and Coyah from around 2007, the target area for the water supply project in Conakry was expanded to PK0-PK50, including these two prefectures.

Table 2 below shows the administrative division of the city of Conakry (PK0-PK30) and Table 3 shows population, served population and access rate to drinking water in the current water supply area (PK0-PK50). These tables show that the access rate of the target area set at the time of the project planning reached 80% by the time of the ex-post evaluation. However, the access rate of the current water supply area including two neighboring cities is 46%. It is important to further increase water production.

[4] Summary of the second phase projects: improvement of a water tank and pipes in Kagbelen District, improvement of the 2nd reservoir in Simbaya, installation of 16,000 intake pipes, development of common water faucets in 32 locations, etc., the total project cost 27,679,000 USD

[5] The World Bank plans to implement the Plan for the Improvement of Treated Water Conveyance to Conakry and Water Distribution in the Districts of Cimenterie and Kobaya-Plateau in 2014-2015 in the eastern zone of Conakry from PK26 to PK50 with a budget of 20,000,000 USD.

Table 2 Water Supply Area according to the Administrative Division of Conakry (PK0 – PK30)

Year	Total population (PK0-PK30)	Served population	Access rate to drinking water
2007	1,729,706	1,245,389	72
2008	1,781,597	1,318,382	74
2009	1,835,000	1,431,300	78
2010	1,890,050	1,493,140	79
2011	1,946,752	1,615,804	83
2012	2,005,155	1,604,124	80

Table 3 Current Water Supply Area (PK0 – PK50)

Year	Total population (PK0-PK50)	Served population	Access rate to drinking water
2007	3,298,092	1,353,389	41
2008	3,397,035	1,430,702	42
2009	3,498,946	1,553,387	44
2010	3,603,914	1,653,597	46
2011	3,712,036	1,777,804	48
2012	3,823,393	1,776,924	46

Ref: Data from SEG

As stated above, the Project was to contribute to the increase of water production in Conakry, which was urgently required at the time of the project planning. Therefore, it was relevant to the development needs of Guinea. As for the situation of water supply in Conakry, considering population concentration in urban areas and rapidly-progressing urbanization and industrialization in the city and its neighboring cities, increase of water production is still relevant to the development needs of Guinea at the time of ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

At the time of the project planning, Japan set a policy to provide aids mainly in the field of basic living for the purpose of supporting Guinea's efforts for democratization and economic reform. In line with the policy, Japan provided grant aids mainly in the fields of basic living including food, water supply and education as well as loan assistance in the field of transportation etc.

In Tokyo International Conference on African Development (TICAD) III of 2003, the water supply sector in Africa was taken up as a priority area for support to Africa and the Project was considered as part of this support.

Thus the Project supported the water supply sector in Guinea and therefore was relevant to the Japanese aid policy.

In light of the above, this Project has been highly relevant to the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[6] (Rating: ②)

The purposes of the Project were to "increase water production at a treatment plant and to construct treated water pipelines that convey water produced at the plant to the water conveyance and distribution system in the city for the purpose of supplying safe drinking water in a stable manner to the residents of Conakry". Therefore, for the evaluation of effectiveness and impact, the quantity of water produced at the Yessoulou Water Treatment Plant and the water flow rate of the water pipes should be examined and the access to safe water for the residents downstream of the water pipes developed in the Project should also be taken into consideration.

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Water Production at the Yessoulou Water Treatment Plant

Thanks to the third plant developed in the Project, the quantity of water produced at the Yessoulou Water Treatment Plant has reached the target, 123,000 m^3/day as shown in the following table.

As the existing first plant (constructed in 1964 with the support of KfW) is getting old, repair work is being planned with loans from the Islamic Development Bank. The second plant (constructed in 1994 with the support of the World Bank) is in operation without problem.

Table 4 Water Production at Yessoulou Water Treatment Plant

Indicator	Target (2009)	Actual production (2012)
Water production at Yessoulou Water Treatment Plant	1st plant: 49,000m^3/day 2nd plant: 37,000m^3/day 3rd plant: 37,000m^3/day Total: 123,000m^3/day	1st plant: 49,000m^3/day 2nd plant: 37,000m^3/day 3rd plant: 37,000m^3/day Total: 123,000m^3/day

Note: The quantity of water treated at the Yessoulou Water Treatment Plant is 1.50 m^3/sec, out of which, the portion increased after the extension work of the Project is 0.45 m^3/sec.

Ref: Data from SEG

The following Table 5 shows the total quantity of water produced by SEG for the city of Conakry, and the actual production in 2012 was 164,000 m^3/day. As the water quantity required for the expanded water supply area (PK0-PK50) is calculated as 286,000 m^3/day, there is still a shortage of 122,000 m^3/day. However, compared with the total water production at the time of the project planning, 97,300 m^3/day, the water production has increased by 169%. SEG continues measures to increase water production after the completion of the Project in order to meet the rapidly increasing water demand in Conakry and it is highly

[6] Sub-rating for Effectiveness is to be put with consideration of Impact.

appreciated.

Table 5 Water Production by SEG for Conakry and Calculation of Water Shortage

Water source	Water production in 2012
Grandes Chutes Dam (Yessoulou Water Treatment Plant)*	123,000 m^3/day
Lake Sonfonia (Sonfonia Water Treatment Plant)**	10,000 m^3/day
Kakoulima Spring	5,700 m^3/day
Groundwater	25,300 m^3/day
(1) Maximum water production by SEG	164,000 m^3/day
(2) Required water quantity (PK0-PK50)	286,000 m^3/day
(3) Shortage (1)-(2)	▲122,000 m^3/day

Ref: Data from SEG

Notes:

* Raw water from the Grandes Chutes Dam is conveyed to the Yessoulou Water Treatment Plant through a water pipeline (about 45 km). The water pipeline consists of two systems – an old system of 800 mm diameter and a new system of 1,000 mm diameter. The Project constructed the unfinished portion (7.8 km) of the new system.

** The Sonfonia Water Treatment Plant was built by Israel company (Global CST) with the fund of Guinea government.

(2) Water Flow of Raw Water/Treated Water Pipes

In the Implementation Review Study Report of the Project (2005), in addition to the increase of water production at the Yessoulou Water Treatment Plant (increased by 450 liters/sec through the Project) described in the previous section, improvement of the water flow rate from 1.05 m^3/second[7] to 1.50 m^3/second[8] was also expected based on the result of hydraulic analysis as a positive impact of the Project through the development of a dual water pipe system for both raw water and treated water. At the time of the planning of the Project, in some areas including Sonfonia, Cimenterie, there was no water distribution due to shortage of water supply although there was a water distribution network. Another expected positive impact of the Project was distribution of the additional portion of water in these areas via the raw water/ treated water pipelines developed in the Project.

According to the result of defect inspection conducted from September to October 2010, the 3rd Yessoulou Water Treatment Plant and raw water/treated water pipelines constructed in

[7] According to the Basic Design Report of the Project (2005), the raw water pipeline was partially designed as a single line and the planned flow rate was 1.05 m^3/sec.

[8] According to the Basic Design Report of the Project (2005), the result of hydraulic analysis confirmed that, after the Project developed the 7.8 km unfinished section of the raw water pipeline from the Grandes Chutes Dam to the Yessoulou Water Treatment Plant, the flow rate of the entire pipeline would be 1.50 m^3/sec. Moreover, the result of hydraulic analysis based on 1.50 m^3/sec water flow from the 3rd water treatment plant showed that the flow rate of the entire pipeline would be 1.50 m^3/sec if water pipes of 1,100 mm diameter were used for new construction.

the Project, including attached equipment, were properly operated and managed. It was also confirmed that no problematic defect was found. However, when we checked with SEG about the actual water flow of the raw water/treated water pipelines, they replied that the water flow rate of the treated water pipelines (about 3.5 km, 1,100 mm in diameter) developed in the Project was lower than the target rate while the flow rate of the raw water pipelines had achieved the original target of 1.50 m^3/sec.

Table 6 Water Flow Rate of Raw Water/Treated Water Pipelines in the Target Section of the Project

Indicator	Actual water flow at the time of project planning (2005)	Target (2009)	Actual (2012)
Water flow rate of the raw water pipeline in the target section *1 (Checked in Feb. 2013)	1.05 m^3/sec	1.50 m^3/sec	1.50 m^3/sec
Water flow rate of the treated water pipeline around the outlet of the water treatment plant *2 (Checked in Feb. 2013)	Total: 1.05 m^3/sec (Breakdown) 700mm pipe: 0.245m^3/sec 1,100mm pipe: 0.805m^3/sec	Total: 1.50 m^3/sec (Breakdown) 700mm pipe: 0.350m^3/sec 1,100mm pipe: 1.150m^3/sec	Exact measurements unknown

Ref: Data from SEG

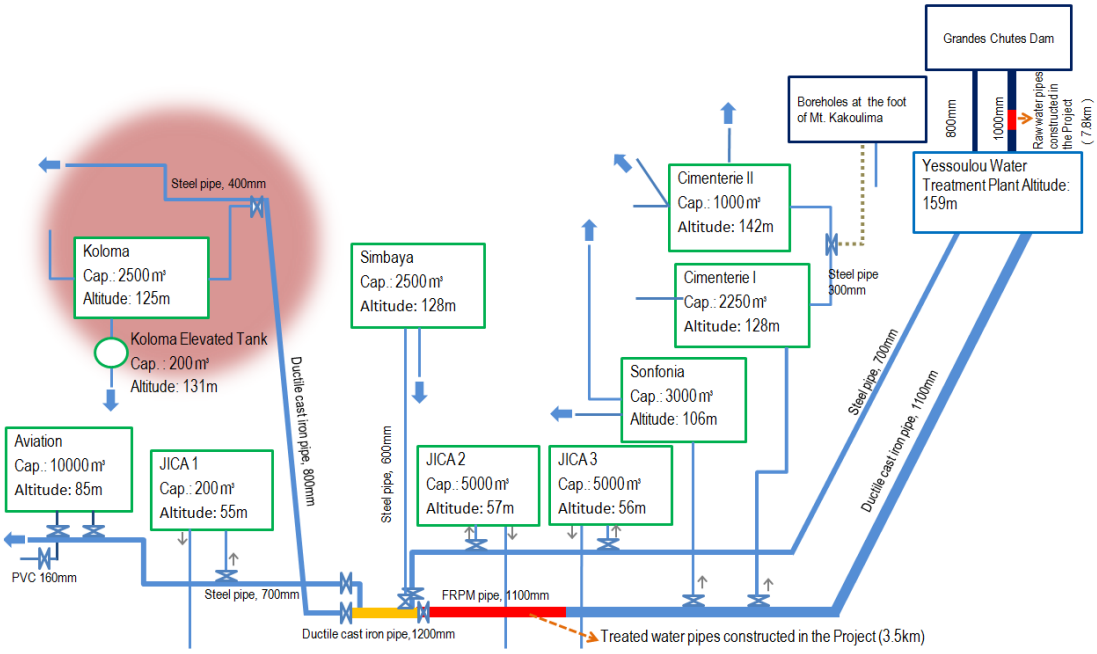
Note 1: Raw water pipes are used to convey raw water. The Project aimed at improving the raw water flow rate by developing the 7.8 km unfinished section of the raw water pipeline from the Grandes Chutes Dam to the Yessoulou Water Treatment Plant.

Note 2: Treated water pipes are used to send treated water from a water treatment plant to a water distribution station. The Project aimed at improving the treated water (=safe drinking water) flow rate by developing the 3.5 km unfinished section of the treated water pipeline from the Yessoulou Water Treatment Plant to the water conveyance/distribution system in Conakry.

According to the explanation of SEG, because the treated water pipes developed in the Project was broken four times after the defect inspection of September and October 2010 till July 2012, the flow rate has been restricted as a means to prevent recurrence. When the treated water pipeline had breakage, they also installed gate valves of 1,000 mm diameter at the both ends of the pipeline to prevent breakage and water leakage of the pipeline and make it easy to conduct repair works.

Moreover, because of the restricted water flow of the treated water pipes, water supply has to be restricted in the areas where flow can be easily restricted, including Koloma, where a distribution basin is located downstream of the water pipes developed by the Project. (See Figure 1 below.) SEG also takes a measure to increase the flow of the existing treated water pipes (DN 700 mm, steel, constructed in 1964) parallel to the treated water pipes developed in the Project, but this is not a fundamental measure against the increase of water outage time

as the water pipes are old and may leak if the flow rate becomes too high.



Ref: SEG Water Pipelines (2009)

Figure 1 Schematic Drawing of Raw Water Pipes, Treated Water Pipes and Distribution Basins (a portion)

When we asked SEG for information to check the latest status in November 2013, they replied that the current production rate (water production volume/raw water volume) at the Yessoulou Water Treatment Plant is 95% and the measurements at the outlet of a water treatment plant show that the flow rate for the entire pipeline is 1.42 m^3/sec (breakdown: 0.57 m^3/sec for 700 mm pipes, 0.85 m^3/sec for 1,100 mm pipes). Based on the information above, the flow rate of the entire pipeline seems to be maintained at 1.42 m^3/sec by setting the flow rate of the 700 mm pipes higher than the planned rate of 0.35 m^3/sec at the outlet of a treatment plant. On the other hand, the flow rate of the 1,100 pipes connected to the treated water pipeline developed by the Project is lower than the planned rate of 1.15 m^3/sec at the outlet of the water treatment plant.

3.2.2 Qualitative Effects

As the leakage detectors provided by the Project are kept at SEG's Aviation Branch and various sensors and flow meters are used for daily check of the pipelines and leakage detection, SEG's capabilities for leakage detection seem to have improved. However, portable sonic flow meters are not used because the batteries are not chargeable any more.

3.3 Impact

3.3.1 Intended Impacts

In addition to the urgent phase improvement projects carried out according to the World Bank's Conakry Water Supply Master Plan, other donors including France and USA also provided support for water service development in Conakry. Therefore, for the evaluation of the achievement of each indicator that was expected to generate impact, we noted that the Project was not the only contributor to the impacts and checked the status of assistance from other donors as much as possible. The result of the beneficiary survey of the residents who had contract with SEG was also used for the analysis to check the current status of water supply service although we were not able to single out the impacts of the Project.

(1) Water Distribution to the Areas Where It Used to Be Difficult

In the Basic Design Report (2004) and the Implementation Review Report (2005) of the Project, one of the expected impacts of the Project was water distribution to Sonfonia, Cimenterie and other areas where there was a water distribution network but there was little water distribution due to shortage of water supply.

Table 7 below is SEG's water supply plan for each water distribution area of Conakry, showing disparities within the city – 24-hour water supply in 4 areas, 10-hour water supply in 3 areas and no water supply in 2 areas[9]. The results of a site inspection and a beneficiary survey (to be described) indicate that even the 4 areas with 24-hour water supply experience water outage and water supply restriction and there are disparities within the same area. Such situation was caused by severe shortage of water production volume in addition to unexpected population increase in Conakry and surrounding cities as shown in Table 2 and Table 3. (Water deficit: 122,000 m^3/day)

Kagbelen do not have water supply as there are no storage reservoirs and water pipes. In the remaining 3 areas where 10-hour water supply is planned, water is supplied 1-3 times a week although there is restriction in number of days and time of water supply. However, according to SEG, in Koloma, located in the north, water outage increased after the completion of the Project due to restriction of water flow volume of the pipes installed in the Project. About 65% of the customers who responded to the beneficiary survey in Koloma replied that there was no water supply. It was confirmed that appropriate water supply service is not provided to the customers.

[9] Areas with no water supply due to lack of water supply quantity and underdevelopment of water pipes, storage tanks, etc. Residents in the areas get drinking water from wells and common faucets in other areas.

Table 7　Water Supply Plan in Each Water Distribution Area of Conakry (January 2013)

Water distribution area	Average number of hours of water supply per day	Number of days of water supply per year
1. Kaloum	10	156
2. Koloma	10	156
3. Simbaya	10	156
4. Sonfonia	24	364
5. Kagbelen	0	0
6. Aviation	24	364
7. Belle-vue	24	364
8. JICA (1, 2, 3)	24	364
9. Cimenterie	0	0

Ref: Data from SEG

Note 1: The table shows a water supply plan, not the actual result.

Note 2: “8. JICA (1, 2, 3)” in the table are the storage tanks developed with the grant aid of the Project for the Improvement of Water Supply Facilities in the Eastern Part of Conakry (FY1990) and the grand aid of the Project for Drinking Water Supply in the Eastern Part of Conakry (FY1993-1995), and they are called JICA 1, JICA 2 and JICA 3.

Note 3: There are no storage reservoirs and water pipes in Kagbelen.

Note 4: At the time of January 2013, water supply service wasn't yet begun though there were water storage reservoirs and water pipes in Cimenterie (the source of water is the boreholes at the foot of Mt. Kakoulima). However, according to SEG, watering service to Cimenterie is begun since August 15th, 2013.

Note 5: Operation is stopped once a year (for a day) for inspection and cleaning of water storage tanks.

The water supply status in Sonfonia, where 24-hour water supply is planned, has improved according to the beneficiary survey mostly because the Sonfonia Water Treatment Plant was constructed with the support of Israel. For Cimenterie, where currently there is no water service, there is a plan to develop 12 wells near Mt. Kakoulima to increase water production and water supply is expected to start by the end of 2013. This project is funded by the Guinean government (about 7 million euros) and SEG covers part of the budget (200,000 euros for installation of electric cables).

In ex-post evaluation, a beneficiary survey was conducted in the 5 areas (25 households in each area, a total of 125 households) of Koloma, Simbaya, Sonfonia, Aviation and JICA, selected from the water distribution areas listed in Table 7. As shown in Table 8, 37% were very or somewhat satisfied and 50% were somewhat or very unsatisfied. There were more unsatisfied respondents than satisfied ones. This trend varies in different areas. While Koloma and Simbaya have more dissatisfied respondents, Sonfonia and JICA have more satisfied respondents. In Aviation, it seems that the water distribution status is different in different locations within the area.

Table 8 Water Distribution Areas and Level of Satisfaction with the Hours of Water Supply

(Unit: No. of households)

Level of satisfaction / Water distribution area	Very satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied	Total
2 Koloma	0	2	0	**5**	**18**	25
3 Simbaya	0	0	3	**3**	**19**	25
4 Sonfonia	**3**	**17**	4	1	0	25
6 Aviation	2	6	4	6	7	25
8 JICA (1,2, 3)	**9**	**7**	6	2	1	25
Total	14 (11.2%)	32 (25.6%)	17 (13.6%)	17 (13.6%)	45 (36.0%)	125 (100.0%)

Ref: Data from the beneficiary survey

The Table 9 below shows the number of water service hours before the start of the Project and at the present time. The percentage of the households who found the service hours decreased is very high in Koloma. When we checked with SEG for the reason, they said that the number of service hours decreased because water supply is restricted in the northern region after the end of the treated water pipeline as a means of reducing pressure of the pipeline developed by the Project. On the other hand, in Sonfonia and JICA areas, the number of service hours has increased and the water supply status has improved. However, such improvement in Sonfonia is mostly because of the construction of the Sonfonia Water Treatment Plant.

Table 9 Water Distribution Areas and Changes in the Number of Water Service Hours

(Unit: No. of households)

Change / Water distribution area	Significantly increased	Somewhat increased	Neither increased or decreased	Somewhat decreased	Significantly decreased	Total
2 Koloma	1	3	3	**16**	**2**	25
3 Simbaya	4	4	8	**2**	**7**	25
4 Sonfonia	0	**16**	8	1	0	25
6 Aviation	1	3	9	9	3	25
8 JICA(1,2, 3)	**13**	0	6	5	1	25
Total	19 (15.2%)	26 (20.8%)	34 (27.2%)	33 (26.4%)	13 (10.4%)	125 (100.0%)

Ref: Data from the beneficiary survey

(2) Served Population, Water Supply Pervasion and Amount of Water Supply per Person

In the 2nd Implementation Review Study Report of the Project (2007), the population of the service areas of 2009 (target year) was estimated at 1,835,000, based on the census data from the Ministry of Planning. As for the water supply pervasion, as the distribution network

was not aggressively expanded in the situation where there was not enough water supply, the pervasion was not expected to increase in 2009 and the target was set at 82%, which was the actual pervasion of 2007. As for the amount of water supply per person, it was considered realistic to set the water usage basic unit of 2009 at the same level as the 2003 target defined in PRSP2002.

As shown in Table 2, at the time of ex-post evaluation, the served population in the target area of the original plan was 1.604 million, the pervasion was 80% and the amount of water supply per person was 62 liters/day. As shown in Table 10 below, the actual served population and the actual amount of water supply per person exceeded the targets.

Table 10 Target Achievement Status for Served Population, Water Supply Pervasion and Amount of Water Supply per Person

Item \ Target year	Target (2009)	Actual result (2012) (PK0 – PK30)
Population of the areas	1,835,000	2,005,000
Served population	1,505,000	1,604,000
Water supply pervasion	82%	80%
Amount of water supply per person	52 liters/day	62 liters/day

Ref: Data from SEG

Thanks to the increase of water production by 37,000 m^3/day through the implementation of the Project as well as the positive impact of the World Bank's emergency phase projects and other donors' support (development of water distribution facilities, water treatment plants, etc.), the numbers have generally improved although not all the indicators have reached the target level.

(3) Amount and Rate of Unaccounted-for Water

As described in the section of relevance, when the Project was planned, out of the total water production (96,000 m^3/day), the amount of accounted-for water for which water bills could be issued was around 36,000 m^3/day and the percentage of unaccounted-for water caused by lack of meters, water theft, water leak, etc. was as high as over 60%.

In such situation, the Project aimed at reducing unaccounted-for water through the provision of leak investigation devices and technical guidance. As shown in Table 11 below, the rate of unaccounted water in 2009 was 29% (44,226 m^3/day), much lower than the target rate of 40%, showing significant improvement from the planning stage of the Project. Behind this was aggressive support of other donors based on the Plan for Improvement of Technical Efficiency and Commercial Sales (PACT: Projet d'Amélioration des Critères Technico-Commerciaux). Specifically, from 2005 to 2011, the Investment in France Agency (AFD: Agence Française de Développement) and the U.S. Agency for International Development

(USAID) supported PACT activities and carried out activities to enlighten residents and raise awareness among consumers for the purpose of getting rid of illegal connections and nonpayment. AFD still supports PACT activities.

Table 11 Changes in Rate and Amount of Unaccounted-for Water

Item \ Year	2009	2010	2011	2012
Rate of unaccounted-for water	46%	31%	29%	29%
Amount of unaccounted-for water (m^3/day)	64,032	45,539	44,051	44,266
Annual water production (1,000 m^3)	n/a	52,973	53,778	53,673
Unaccounted-for water production included in the above (1,000 m^3)	n/a	36,787	38,090	37,853
Collection rate	n/a	69%	71%	71%

Ref: Data from SEG

The leak investigation devices provided through the Project are still used by SEG's leak detection team. Under the department established to promote PACT activities, the team carries out activities to reduce the unaccounted-for water rate together with technicians and sales personnel for leak investigation devices, meter checkers, etc.

On the other hand, water that is not distributed to the downstream northern region due to reducing pressure of the treated water pipeline is instead distributed to other areas and generates revenue. However, SEG says that an increasing number of residents are dissatisfied with the degraded service because water outage has increased and there is a concern that nonpayment might increase the amount of unaccounted-for water.

(4) Water Quality

As shown in Table 12 below, coliform bacterium contained in raw water are properly treated in water treatment plants and the target of 0 MPN/100 ml (after water treatment) has been achieved. During an inspection visit to the lab in the Yessoulou Water Treatment Plant, chemicals and devices were properly managed and consumables such as medical substances were stocked. According to the person in charge of the lab, they conduct inspection three times a day in a dry season and five times a day in a rainy season when turbidity is higher.

When we checked increase and decrease in waterborne disease in households through the beneficiary survey, 74% respondents said it decreased. As a result of a simple water quality test at water faucets in end beneficiaries' houses, no coliform bacterium were found.

Table 12 Result of Water Quality Test at the Yessoulou Water Treatment Plant

	Coliform bacterium (MPN/100 ml)	
	Raw water	Treated water
1st Water Treatment Plant		
Average	36	0
Highest	81	0
Lowest	5	0
2nd Water Treatment Plant		
Average	36	0
Highest	81	0
Lowest	5	0
3rd Water Treatment Plant		
Average	36	0
Highest	81	0
Lowest	5	0

Ref: Data from SEG
Note: Test result of December 2012

3.3.2 Other Positive and Negative Impacts

(1) Impact on the natural environment

As a result of checking with the documents provided by JICA and the concerned personnel of the Guinean side, no impact on the natural environment was found.

(2) Land Acquisition and Resettlement

At the time of the Basic Design Study (2004), it was decided that the treated water pipeline would go around the section of about 400 meters near the Anta Market that was illegally occupied by nearby residents on the planned route. However, three years later, when the construction started in November 2007, eviction had been completed. Therefore, the detour plan was changed and the distance of the treated water pipeline was reduced. During this local survey, we checked the eviction status and found an illegal building in the construction area where no residents had existed for the pipeline at the time of construction commencement. Therefore, the governments of the City of Conakry, Matoto Commune and Enta District[10] cooperatively negotiated with the owner of the building for eviction. As a result, the owner collected materials he needed and removed and disposed of the remaining items.

[10] Conakry Special City consists of 5 communes – Matoto, Ratoma, Dixinn, Kaloum and Matam. Each commune consists of multiple quartiers (districts). Conakry has about 100 quartiers.

(3) Negative Impact

The treated water pipeline constructed in the Project experienced breakage 7 times from June 20, 2011 to the end of May 2013. According to SEG, the breakage caused water outage in some areas in Conakry. In about a year from April 2012 to May 2013, the total period of water outage was equivalent to about a month. SEG also paid compensation to residents for damage on houses, shops and properties and also covered the cost for a total of seven remedial works. Table 13 shows the details of the seven breakage cases.

Table 13 Breakage of the Treated Water Pipeline Constructed in the Project

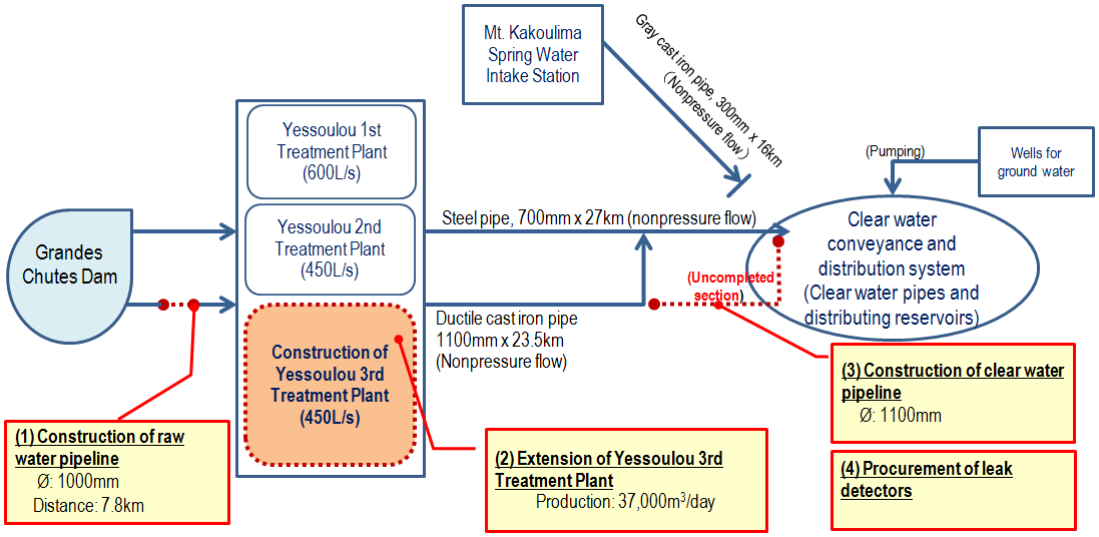
Location	Date	Damage by breakage
(1) KISSOSSO	June 20, 2011	Water spewed around and a woman was injured.
(2) SANGOYA	June 24, 2011	Part of the pipeline rose up.
(3) SANGOYA	May 21, 2012	Breakage occurred in the same area as (2). 6-meter FRPM pipes were replaced with ductile pipes to prevent recurrence. Gate valves were installed at the starting and ending points of the treated water pipeline to make it easier to reduce pressure of or stop water conveyance.
(4) SANGOYA	May 30, 2012	Water flew into houses.
(5) KISSOSSO	December 25, 2012	As the breakage occurred near the Kissosso Market, shops, merchandise, properties of residents, etc. were damaged.
(6) KISSOSSO/ENTA	May 4, 2013	Houses and Supports of 700 mm pipes were damaged.
(7) KISSOSSO	May 30, 2013	Houses were damaged. According to information from SEG, a woman was injured when hit by a rock carried by water and an infant held by the woman was killed.
The total amount of compensation for damage on residents' houses, shops and properties caused by the breakage cases from (1) to (4) was about 391,000,000 GNF, and the cost for remedial works covered by SEG was about 499,000,000 GNF.		

Ref: Date from interviews with SEG, and information from JICA

Concerning the effectiveness, the target for water production at the Yessoulou Water Treatment Plant defined in the original plan has been achieved. It is also believed that the flow rate of the entire pipelines is at the expected level because the flow rate of the 700 mm pipe has been increased from the plan. On the other hand, as the flow volume of the 1,100 mm pipes connected to the treated water pipelines developed in the Project is lower than the plan from the outlet of water treatment plants, the flow volume seems to be restricted. As for impact, while the served population and the water supply volume per person have exceeded the target values set in the original plan partly because of other donors' support, breakage of water pipes has caused water outage in part of the city and damaged houses and properties of the residents. Moreover, unexpected incidents have caused economic losses including compensation payments to residents and repair costs. Judging comprehensively from the above, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs



Note: shows the contents of the support provided by the Project.

Figure 2 Conceptual Diagram of the Raw Water/Treated Water Pipelines and Contents of Support Provided by the Project

As shown in Figure 2 above, the outputs from the Japanese sides are (1) construction of a raw water pipeline, (2) extension of the 3rd Yessoulou Water Treatment Plant, (3) construction of a treated water pipeline and (4) procurement of leak investigation devices. Table 14 shows the comparison between the plan and the actual result. Despite such changes as a) change of the type of pipes for the treated water pipeline (buried part, from ductile cast iron pipe to fiberglass reinforced plastic mortar pipes (FRPM pipes)), b) reduction of distance of the treated water pipeline, c) change of the number of bridge piers and length of a conduit bridge, etc., and d) change of numbers of locations with air choke valve chambers and sludge valves, etc., it is believed that there was no change in the scale of the support.

Change	Reason for change
a) Change of the type of pipes for the treated water pipeline	The Basic Design Study Report (2005) stated that the material of pipes would basically be ductile cast iron because the existing treated water pipelines consisted of ductile cast iron pipes. However, for the following reasons, the type of the pipes was changed to fiberglass reinforced plastic mortar pipe (FRPM pipe). (Reasons) As the currency exchange rate changed from 144.81 yen/euro at the time of detailed design (September 2006) to 154.64 yen/euro as of November of the year, it created a loss of about 37 million yen and affected the cost estimation of the bidders. Also, the construction period had to be shortened due to the timeframe of E/N. Therefore, it was considered to change the type of treated water pipes from ductile cast iron to fiberglass reinforced plastic mortar (FRPM),

	which has superior workability for pipeline construction and is also less expensive than ductile cast iron, and the Guinean side and the Japanese side finally agreed on the change.
b) Reduction of distance of the treated water pipeline	Concerning the section of about 400 meters near the Anta Market illegally occupied by nearby residents at the time of the basic design, the original plan was to go around the area. However, as eviction was completed, the distance of the treated water pipeline was reduced.
c) Increase of the number of bridge piers and the length of a conduit bridge and change of the treated water pipeline	When the plain view was created and more detailed line shape of a conduit bridge was determined at the time of detailed design, changes were made to the number of bridge piers and the length of the conduit bridge. With these changes, the length of the treated water pipeline was also changed.
d) Change of numbers of locations with air choke valve chambers and sludge valves and change of area of pavement restoration	With change of banking height in the section along Route 1, changes were made to the number of locations with air choke valve chambers and sludge valves and also the area of pavement restoration.

Table 15 shows the outputs from the Guinean side. It is believed that the scale of support has not been changed from the original plan.

Table 14 Outputs from the Japanese Side

Item	Plan	Actual
(1) Raw water pipe (diameter 1,000 mm)		
・ Ductile cast iron pipe (buried, partially above ground)	7.0km	7.0km
・ Steel pipe		
(Water pipe bridge)	7 bridges (0.8km)	7 bridges (0.8km)
(No. of bridge piers)	(44)	**(33)**
・ Attached equipment (air choke valves, sludge valves, etc.)	1 set	1 set
(2) 3rd Yessoulou Water Treatment Plant (Water treatment capacity: 37,000 m^3/day, 450 liters/sec)		
・ Chemical mixing chamber (Rectangular, concrete, capacity: 40 m^3)	1	1
・ Rapid filter (Rectangular, concrete, gravity rapid filter, 26.6 m^2/bed) (Filtration rate: 162 m/day; filtering area: 240 m^2; filtration flow control: natural balance system; filter: anthracite (45 cm), filter sand (25 cm), gravel stratum (30 cm); underdrain system: strainer type; cleaning system: reverse cleaning only; operation system: on-site manual operation),	9	9
・ Piping for chemicals (Piping from existing chemical injector to chemical mixing chamber (3 lines) and attached equipment)	1 set	1 set
・ Piping in the facility (Raw water pipes, treated water pipes and attached equipment)	1 set	1 set

Item	Plan	Actual
・ Exterior construction (Drainage, in-plant roads, etc.)	1 set	1 set
(3) Treated water pipe (diameter: 1,100 mm)		
・ Buried part	3,558m	**3,364m**
Type	Ductile cast iron pipe	**Fiberglass reinforced plastic mortar pipes (FRPM pipes)**
・ Water pipe bridge	1	1
Type	Steel pipe for water	Steel pipe for water
Diameter	1,100mm	1,100mm
Length of bridge	72m	**82m**
No. of bridge piers	5	**4**
・ Attached equipment		
Air choke valve	(8 locations)	**(7 locations)**
Sludge valve	(9 locations)	**(7 locations)**
Paving restoration	(878 m^2)	**(1148 m^2)**
(4) Leak investigation devices		
・ Cross correlation leak detector	1 set	1 set
・ Listening rod (1.5m)	4 sets	4 sets
・ Leak detector	4 sets	4 sets
・ Portable sonic flow meter	2 sets	2 sets
・ Metal detector	1 set	1 set
・ Metal pipeline detector	1 set	1 set
・ Nonmetal pipeline detector	1 set	1 set
・ Hydraulic gauge	2 sets	2 sets
・ Boring bar	2 sets	2 sets

Note: Changes from the original plan are shown in bold.

Table 15 Outputs from the Guinean Side

Item	Plan	Actual
(1) Securement of Temporary site (land owned by SEG next to the water treatment plant, premises of the Simbaya Office)	original plan	completion
(2) Securement of land for facilities (including land for construction and access roads)	original plan	completion
(3) Improvement of unevenness of the access road to the water treatment plant	original plan	completion
(4) Relocation of fences around the treatment plant	0.03 million yen	640,000 GNF (0.01 million yen)
(5) Provision of information about underground objects and attendance for drilling	original plan	completion
(6) Cooperation for connection of existing pipes and new pipes (Attendance at construction and communication of water outage)	original plan	completion
(7) Provision of water for flushing and hydraulic pressure test	original plan	completion
(8) Cooperation for chlorine sterilization work	original plan	completion
(9) Repair of existing equipment attached to the treatment plant (prechlorination and lime injection equipment)	original plan	completion

Item	Plan	Actual
(10) Removal of illegal houses, farm land, plantations, etc. from the planned construction sites for pipelines	original plan	completion
(11) Securement of land for equipment storage and facilities where the equipment will be installed	original plan	completion

Exchange rate: 1 GNF = 0.0181 yen, October 2009

3.4.2 Project Inputs

3.4.2.1 Project Cost

Compared with the planned project cost of 1,503 million yen, the actual cost was 835 million yen for the Project of Improvement of Drinking Water Supply in Conakry Phase I, 30 million yen for Phase II, and 700 million yen for the Project for Improvement of Drinking Water Supply in the Capital.

The Guinean government contributed about 73 million yen, which is within the planned amount (85%) of about 86 million yen, as shown in Table 15.

3.4.2.2 Project Period

The project period was extended for unavoidable reasons such as deterioration of public security and a coup d'tat. However, other reasons also caused delay in construction, and the period of the activities carried out by the Japanese side was longer than the plan (132% of the plan).

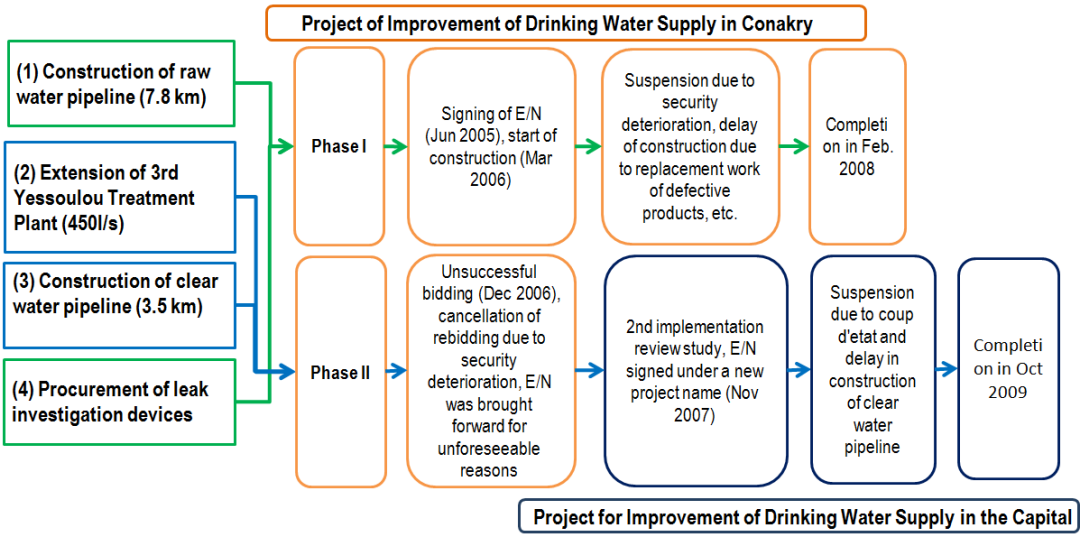


Figure 3 Aid Components and Processes of the Project

As shown in Figure 3 above, Phase I of the Project of Improvement of Drinking Water Supply in Conakry was significantly extended for deterioration of public security and delay in construction, and in Phase II, E/N was brought forward for unforeseeable reasons of unsuccessful bidding and unstable political situation. Later, when security is restored and the Guinean government requested the implementation of Phase II, the Project was recommenced as the Project for Improvement of Drinking Water Supply in the Capital and all aid components were completed as originally planned. The period from the signing of E/N for Phase I (June 2005) to the completion of the Project for Improvement of Drinking Water Supply in the Capital (October 2009) was 4 years and 5 months (53 months), including 6.5-month extension of the contract period caused by security deterioration. The total period of actual construction without this extended period was 46.5 months.

Below is the difference between the planned period and the actual period of each phase.

Project of Improvement of Drinking Water Supply in Conakry

Phase I:

June 2005 (signing of E/N) – February 2008 (2 years and 9 months, 33 months, including 4-month extension of the contract period due to security deterioration (end of March – end of July 2007). The actual implementation period is to be 29 months (132% of the plan).)

Phase II:

E/N was signed in July 2006. The general strike that occurred in Guinea in January 2007 made it difficult to secure a necessary construction period and the phase was terminated.

Project for Improvement of Drinking Water Supply in the Capital

November 2007 (signing of E/N) – October 2009 (1 year and 11 months, 23 months, including 2.5-month extension of the contract period due to security deterioration (mid March – end of May 2009). Considering the period of security deterioration, the actual implementation period is to be 20.5 months (132% of the plan).)

In light of the above, as the Project period exceeded the plan, therefore efficiency of the project is fair.

3.5 Sustainability (Rating: ①)

3.5.1 Institutional Aspects of Operation and Maintenance

The Water Company of Guinea (SEG), under the Ministry of Energy & Water Resources, is in charge of operation and maintenance for each facility developed in the Project. The

organization is run in the form of a public corporation and there is no privatization plan.

SEG currently has a total of 730 personnel (190 executives, 201 middle management personnel and 339 staff members) and the organization has become larger than in the planning stage. SEG has increased the number of sales offices in Conakry and also have established branches in 24 prefectures out of 33 across the country to meet the demand for urban water supply in inland areas.

Table 16 Personnel at the Yessoulou Water Treatment Plant

Position	No. of persons
Plant manager	1
Water treatment engineer	2
Driver	9
Total	12

Ref: Data from SEG

As Table 16 shows on the right, a total of 12 personnel including the plant manager works at the Yessoulou Water Treatment Plant, working on three shifts for operation and maintenance of all the facilities including the 3rd treatment plant extended in the Project. There are no issues in personnel or operation.

SEG's water clarification and conveyance division inspects raw and treated water pipes on a daily basis. Breakage of treated water pipes is responded by all SEG engineers under the leadership of the Simbaya Office, located in the area where treated water pipelines have been laid.

As described above, with increasing needs for urban water supply, SEG, who is in charge of operation and maintenance of the facilities developed in the Project, has increased the size of the organization to expand its service to inland areas as well as in the city of Conakry. As for the operation and maintenance of the Yessoulou Water Treatment Plant and SEG branches, there is a sufficient number of personnel assigned and there is a sufficient structure for the operation and maintenance of each facility developed in the Project.

3.5.2 Technical Aspects of Operation and Maintenance

As for the operation and maintenance of the Yessoulou Water Treatment Plant, as water analysis for water quality management, flocculation experiment for operation management, etc. are conducted on a regular basis, it is believed that the personnel has proper skills.

As described in the section of effectiveness, there were as many as seven cases of breakage of the treated water pipes laid in the Project in about three years after the completion of the construction. Each time, SNG conducted repair of FRPM pipes using engineers of its branch offices or vendors. They say that they conduct repair with careful attention to the manuals received from the pipe suppliers at the time of construction in the Project, especially when they bury FRPM pipes back, e.g., conducting elaborative tamping work with a tamping rod or by watering so that a sufficient amount of sand will go under the pipes.

On the other hand, the treated water pipes developed in the Project have repeatedly been

broken and SEG is not able to prevent recurrence at this point, when causes for breakage are being investigated, though the pipes are operated at a lower pressure. As described in Section 3.4.1 “Output”, unlike the pipes installed in the Project (3.5 km), all existing pipes (23.5 km) are ductile cast iron pipes.

In this situation, SEG judges that it is appropriate to replace FRPM pipes with ductile cast iron pipes for treated water pipelines.

In light of the above, it is believed that SEG does not have all the skills necessary for operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

Table 17 shows the production cost, amount of revenue collected and gross profit of the Water Service in Conakry, part of SEG’s business operation. The gross profit is negative.

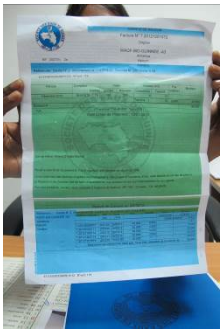
Table 17 Production Cost, Amount of Revenue Collected and Gross Profit of the Water Service in Conakry

(Unit: 100 million GNF)

Item \ Year	2010	2011	2012
(1) Production cost	1071.32	1121.12	1488.93
1-1 Labor cost	101.30	96.15	149.36
1-2 Maintenance	861.91	926.48	1199.15
1-2-1 Electricity	7.08	5.20	3.37
1-2-2 Fuel (diesel)	51.59	64.24	102.23
1-2-3 Chemicals	13.95	19.35	16.26
1-2-4 Repair cost	39.40	39.10	96.80
1-2-5Others	749.90	798.60	980.49
1-3 Depreciation	108.11	98.48	140.42
(2) Revenue collected	445.07	520.73	455.58
(3) Gross profit ((1)-(2))	▲626.25	▲600.39	▲1033.35

Ref: Data from SEG

However, as shown in Table 18 below, considering that the collection rate has recovered to 71% and the number of customers has been steadily increasing, it is believed that efforts toward sound management including rate revision (Table 19 and Table 20) have been made. The total business of SEG is in the black with subsidies from the government, etc. and it compensates loss from the Conakry business (Table 21 and Table 22).



Bill issued by SEG

Water bill payments are made in cash (small customers), by check (most large customers) and through bank transfer

(government offices). To increase the collection, they have increased branch offices, giving consideration especially to the convenience of small customers. They have also taken actions to improve payment methods such as allowing some branches (in administrative districts) to deal with bills issued by other branch offices through closer collaboration between branches.

Table 18 Collection Rate in Conakry

Item \ Year	2010	2011	2012
Annual water production (1,000 m^3)	52,973	53,778	53,673
Amount of accounted-for water included in the above (1,000 m^3)	36,787	38,090	37,853
Collection rate	69%	71%	71%

Ref: Data from SEG

Table 19 Number of Customers in Conakry Contracted with SEG

(Unit: Number of contracts)

	2008	2009	2010	2011	2012
No. of customers	76,139	82,898	86,456	93,605	96,436

Ref: Data from SEG

Table 20 SEG Water Rates in Conakry (per m^3)

(Unit: GNF)

Rate zone	2008	2009	2010	2011	2012	2013
1st rate zone	680	680	680	680	680	750
2nd rate zone	1,250	2,000	2,000	2,000	2,000	2,650
3rd rate zone	1,500	2,400	2,400	2,400	2,400	4,080

Data from SEG

Note 1: 1st rate zone – up to first 7 m^3/month

Note 2: 2nd rate zone – over 7 m^3/month to 30 m^3/month

Note 3: 3rd rate zone – large customers, business owners, government offices, etc.

Table 21 Government Subsidies for SEG

(Unit: 100 million GNF)

	2008	2009	2010	2011	2012
Amount of government subsidies	0	350	980	130.51	142.1

Ref: Data from SEG

Table 22 SEG's Financial Situation

(Unit: 100 GNF)

Item	2009	2010	2011
1. Total sales and general administrative expenses	1114.89	1880.07	1964.09
2. Total revenue	1297.61	1934.64	2114.47
3. Profit	182.72	54.57	150.39

Ref: Data from SEG

As described above, the rough profit from the water service business for Conakry is negative despite various efforts toward sound management such as increase of collection rate and number of customers, rate revision and changes of payment methods. Therefore, it is considered that there are issues with some part of the business operation.

3.5.4 Current Status of Operation and Maintenance

The Yessoulou Water Treatment Plant is an important facility that produced about 75% of the total amount of water supplied in Conakry at the time of ex-post evaluation. Each equipment of the plant is properly maintained and inspected and records of operation, water quality test, etc., do not indicate any issues with its operation.

The Plan for Improvement of Technical Efficiency and Commercial Sales (PACT) and the Plan for Reactivation of Terminated Contracts (PRR: Projet de Réactivation des Résiliés), which were carried out in the planning phase of the Project, have been consolidated and all activities are now carried out based on PACT. As stated earlier, USAID and AFD aggressively support PACT activities using NGOs, etc. Specifically, activities to enlighten residents and to improve consumers' awareness were carried out through NGOs in 5 communes from 2005 to 2011 for the purpose of getting rid of illegal connections and nonpayment. The cost was covered by USAID, AFD and SEG.

Moreover, SEG has established a PACT team for PACT activities in each water distribution area. Each team consists of the following members.

(1) Engineer (chief)
(2) Salespersons (in charge of the area)
(3) Inspectors (water meter for each house)
(4) Investigators (legal responses)
(5) Plumbers (to cut illegal bypass connection for water theft, etc.)

Now that the pipes and intake valves in Kaloum, Matam and Dixinn Communes have met the standards through the above-described PACT activities, activities for standards conformance will be started in Simbaya District of Matoto Commune in 2013 with financial aid from AFD as shown below. However, PCAT activities are not carried out in the other remaining areas due to financial issues.

Donor	Investment in France Agency (AFD: Agence Française de Développement)
Project	Project for Improvement of SEG's Skills and Sales Capacity in Simbaya
Period	2013-2014
Budget	1,200,000 euros
Target area	Simbaya District of Matoto Commune, Conakry
Numerical target	Improve production efficiency to 55-75% and bill collection rate to 70-90%
Contents of the project	Water leak repair, installation of intake pipes and standards conformity of intake pipes in the target area

As stated above, operation and maintenance of the Yessoulou Water Treatment Plant and terminal water supply facilities are properly conducted. Also, SEG has paid compensation to the residents affected by breakage of treated water pipes. However, considering frequency of breakage, increasing amount of compensation and remedial work cost, and safety reasons, the Ministry of Energy & Water Resources and SEG have decided that it would be appropriate to replace the current FRPM pipes with ductile cast iron pipes PN16. On the other hand, JICA plans to start follow-up support for the Project in December 2013, creating manuals for recurrence prevention and procurement of equipment for remedial works. Based on the causes for breakage, radical measures[11] should immediately be carried out.

As described above, there are minor financial issues with operation and maintenance of the Project. Breakage of the treated water pipes have repeatedly occurred and SEG has not been capable of preventing recurrence at this point, when causes for breakage are being investigated, though the pipes are operated at a lower pressure. Therefore, SEG considers it appropriate to replace FRPM pipes with ductile cast iron pipes. Based on such situation, the sustainability of the Project effect is low.

[11] As of November 2013, causes for breakage of treated water pipes are being investigated so that next steps can be considered.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The purposes of the Project were to increase water production at the Yessoulou Water Treatment Plant and to improve water flow of raw water and treated water pipelines through such works as construction of a raw water pipeline from the Grandes Chutes Dam to the Yessoulou Water Treatment Plant, extension of the Yessoulou Water Treatment Plant and construction of a treated water pipeline from the Yessoulou Water Treatment Plant to the city of Conakry. As these purpose are relevant to the development policy of Guinea to increase water supply pervasion in the capital city of Conakry and contribute to the urgent task to increase water production in Conakry, the relevance is high.

Concerning effectiveness, the original target for water production volume at the Yessoulou Water Treatment Plant has been achieved. As for the flow rate of treated water pipes, it is believed that the entire treated water pipeline has achieved the expected level of flow rate as a result of increasing the flow rate of the existing 700 mm pipes from the plan. On the other hand, as the flow volume of the 1,100 mm pipes connected to the treated water pipeline developed in the Project is lower than the planned value after the outlet of the water treatment plant, the flow volume is considered to be restricted.

As for impact, while the served population and the water supply volume per person have exceeded the target values set in the original plan partly because of other donors' support, breakage of water pipes has caused water outage in part of the city and damaged houses and properties of the residents. Moreover, unexpected incidents have caused economic losses including compensation payments to residents and repair costs. Judging comprehensively from the above, the implementation of the Project has produced some impact; therefore the effectiveness and impact of the Project is fair.

The period of the Project had to be extended due to deterioration of public security and instability of political situation including a coup d'etat in the country. However, as there were other reasons for the extension of the project period, such as replacement of defective products and extension of a construction period for treated water pipes, the efficiency of the Project is considered fair. Compared with the planned amount of 1,503 million yen, the actual project cost was 835 million yen for Phase I of the Project of Improvement of Drinking Water Supply in Conakry, 30 million yen for Phase II and 700 million yen for the Project for Improvement of Drinking Water Supply in the Capital.

As for sustainability, while SEG has no issue with its operation and maintenance structure or with operation and maintenance of the Yessoulou Water Treatment Plant and terminal water facilities, it has minor financial issues. On the other hand, the treated water pipes developed in the Project have repeatedly been broken and SEG is not able to prevent recurrence at this point, when causes for breakage are being investigated, though the pipes are operated at a

lower pressure. Therefore, SEG considers it appropriate to replace fiberglass reinforced plastic mortar pipes (FRPM pipes) with ductile cast iron pipes. Based on the above, the sustainability of the impacts generated by the project is low.

In light of the above, the Project is evaluated to be unsatisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

- ✓ The treated water pipes constructed in the Project experienced multiple cases of breakage in a short period of time, which affected residents. Therefore, measures to be presented in accordance with the result of cause investigation should be carried out immediately.
- ✓ Operation of urban water supply requires the establishment of foundation for bill collection and revenue and expenditure management. For the Project, the status of bill collection has improved with positive efforts for resident enlightenment, billing, etc. However, concerning revenue and expenditure management, the water supply business in Conakry alone is making loss and efforts to increase revenue should be made through improvement of water supply service, etc. To expand urban water supply to inland areas in the future, financial analysis and study on measures should be conducted for long-term operation and maintenance of water supply facilities in the whole city of Conakry.
- ✓ There are disparities in water usage among water distribution areas and even within an area and people are frustrated because they do not think the quality of the water supply service is worth the price. Although, with the current production volume, it is not possible to provide 24-hour water service in all the areas, it is necessary to take measures to reduce complaints, e.g., communication of water supply hours and reasons to the residents in advance.

4.2.2 Recommendations to JICA

The Ministry of Energy & Water Resources and SEG hope that Japan will provide further support to respond to leakage in the water supply network in Conakry as well as to meet the increasing demand for water supply in the city. We understand that cause investigation and study of measures are underway in Japan, but it is expected that responses to the request, including measures to prevent recurrence of leakage, will be promptly taken.

4.3 Lessons Learned

For the treated water pipelines developed in the Project, a new material was selected to reduce the estimated cost although it had never been used in similar projects in the country. For future design change, careful consideration should be given to the possible impacts on

other aspects than price (e.g. durability of equipment and safety).

In case JICA should learn that facilities and equipment developed in a project had incidents after defect inspection, JICA should investigate causes and promptly present measures to prevent recurrence when necessary as soon as it learns about the issue, although it is basically the owner who has to respond to such situation. For this, it is also necessary to establish a structure for quick investigation of the causes.