

Republic of Benin

FY2021 External Ex-post Evaluation Report of  
Grant Aid Project

"Project for Access Improvement to Drinking Water in Two Communes,  
Glazoue and Dassa-Zoume"

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## **0. Summary**

The project aimed to increase water consumption in the target area by developing new water sources and constructing water supply facilities in Glazoue and Dassa-Zoume in the Republic of Benin. The project was consistent with Benin's urban water supply development policy and their development needs from the planning to the ex-post evaluation, of which the plans and approaches were appropriate. Considering the project is consistent with Japan's development policy and has been appropriately coordinated with other donors' projects with confirmed outcomes, the relevance and consistency have been highly assured. The efficiency is high because the output was almost as planned, the cost was within the plan, and the project period was kept slightly longer than planned. Regarding the effectiveness, neither city achieved the planned targets set by the project for "daily water withdrawal." This project indicator was not secured as planned due to a reduction in the groundwater level. Although the amount of water withdrawal in both cities increased compared to the plan, the amount of water supplied per capita decreased compared to the plan due to a significant increase in the number of individual hydrant subscribers and the population supplied with water. The project has been confirmed effective for reducing water fetching activities among children and women for households connected to individual hydrants after the project. Regarding the impact, the improvement of the sanitary conditions in the community and a decrease in the incidence of water-borne diseases have not been confirmed while the project's contribution to promoting women's participation in socio-economic activities through reducing the hours of water fetching activities was limited. Therefore, the empowerment of women was not confirmed. Project effects were confirmed for the improvement of children's school enrollment. Based on the above, the effectiveness and impacts of the project are moderately low.

Although slight issues have been observed in the financial aspects, including the status of the operation and maintenance system, there are good prospects for improvement/resolution.

Therefore, the sustainability of the project effects is high.

Based on the above, this project is evaluated to be satisfactory.

## 1. Project Description



Project Locations Map  
City of Dassa-Zoume and Glazoue  
(Source: Prepared by the evaluator)



Water Source Facility  
at Dassa-Zoume (3-SE8)  
(Photo taken by the evaluator)

### 1.1 Background

Benin is a country in West Africa facing the Gulf of Guinea. At the time of planning, the country's Gross National Income (GNI) per capita was \$810 (World Bank, 2014), and its Human Development Index was 165th out of 187 countries (UNDP, 2013) under such harsh socioeconomic circumstances. Access to safe water was one of the country's major social issues in this socio-economic context. The country's national development plan was *Growth Strategy for Poverty Reduction (2011–2015)* (*Stratégie de Croissance pour la Réduction de la Pauvreté*), hereafter referred to as *SCRIP*. The basic policy in the *SCRIP* was to "improve the livelihoods of the people and achieve the Millennium Development Goals," and "improving access to safe water" was a priority issue. The national water supply rate in Benin was 57% in 1990 and 78% in 2015 (UNICEF). Although there was a significant improvement over five years, regional disparities remained an issue. *The National Action Plan for Integrated Water Resources Management (2006–2015)* (*Plan D'action National De Gestion Integree Des Ressources En Eau*), which was developed as an urban water supply policy, set a target of an urban water supply rate of 75% by 2015.

The water supply rates in the project's target areas, the cities of Glazoue and Dassa-Zoume, were 47% and 58%, respectively (Société Nationale des eaux du Bénin [SONEB], 2013). The water supply rates were lower than in other regions, which made accessing safe water difficult. In addition, there were concerns that the water supply situation in both cities would further deteriorate due to increased water demand caused by population growth and decreased water withdrawals from existing water source wells.

Under these circumstances, to improve access to safe water, the Government of Benin requested the Government of Japan to implement the grant aid project that aimed at increasing water supply by developing new water sources and improving water supply facilities.

## 1.2 Project Outline

To increase the water supply, the project would develop new water sources and construct water supply facilities, such as distribution pipes and elevated water tanks, in Glazoue and Dassa-Zoume in Benin. This would contribute to reducing water-borne diseases, improving the residents' living environment, and reducing water fetching activities.

Grant Limit/Actual Grant Amount	1,071 million/1,008 million
Exchange of Notes Date /Grant Agreement Date	March 2016/March 2016
Executing Agency	National Water Company of Benin
Project Completion	February 2019
Target Area	Dassa-Zoume and Glazoue
Main Contractor	Joint venture between Nissaku Co., Ltd. and Koken Boring Machine Co., Ltd.
Main Consultants	Joint venture between CTI Engineering International Co., Ltd. and Eight-Japan Engineering Consultants Inc.
Preparatory Survey	August 2014–May 2015
Related Projects	(Grant aid) “The Project for Reinforcement of Drinking Water Supply System in Couffo and Plateau Departments” (2021)

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Ruiko Hino, Foundation for Advanced Studies for International Development

### 2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: November 2021–November 2022

Duration of the Field Study: February 13–March 1, 2022 (first round of field survey)<sup>1</sup>

<sup>1</sup> The second field survey was conducted remotely.

### 3. Result of the Evaluation (Overall Rating: B<sup>2</sup>)

#### 3.1 Relevance/Coherence (Rating: ③<sup>3</sup>)

##### 3.1.1 Relevance (Rating: ③)

###### 3.1.1.1 Consistency with the Development Plan of the Republic of Benin

The *SCRCP*, which was Benin's national development policy at the time of planning, identified "improving access to safe water" as one of the critical issues. In addition, the National Strategy for Urban Water Supply 2006–2015, a development strategy for the urban water supply sector, set a target of a 75% water supply rate in urban areas by 2015.

The succeeding national development policy of the *SCRCP*, the *Programme d'Actions du Gouvernement (PAG) 2016–2021* (Government Action Plan 2016–2021), set one of the priority goals to ensure access to safe water for 2.5 million people in rural areas and 2.7 million people in urban areas by 2021, to achieve a water access rate of 100%. The *Programme d'Actions du Gouvernement (PAG) 2021–2026* (Government Action Plan 2021–2026) The latest national development strategy at the time of ex-post evaluation, allocates approximately 20% of the total budget to the sector of drinking water supply in urban areas. In addition, the latest national policy for urban water supply, the National Urban Water Supply Strategy 2016–2030 (*Stratégie Nationale de l'Alimentation en Eau Potable en Milieu Urbain et Périurbain 2016–2030*) sets the goal of 100% urban drinking water supply by 2030.

Thus, because ensuring access to safe water for urban residents has been a priority in Benin's national development policy and sectoral strategy from the time of planning to the time of ex-post evaluation, the project is consistent with the national and sectoral policies in Benin.

###### 3.1.1.2 Consistency with the Development Needs of the Republic of Benin

At the time of planning, the water supply rates in the target areas, Dassa-Zoume and Glazoue, were 47% and 58%, respectively (SONEB, 2013), which were lower than the national average of 78% (WHO/UNICEF, 2015). Moreover, the average amount of daily water supply per capita from the urban water supply facilities was very low at 10.4 L/person/day in both cities, while the national average was 39.40 L/person/day (SONEB, 2012–2013).<sup>4</sup>

At the ex-post evaluation, the urban water supply rates in Glazoue and Dassa-Zoume were 65.95% and 65.5%, respectively (SONEB questionnaire responses, 2020); however, the National Urban Water Supply Strategy 2016–2030 mentioned that a target of urban water supply rate would be 100%. This means that the need for urban water supply improvement remains high.

From the above, the need for urban water supply improvement in Glazoue and Dassa-

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<sup>2</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>3</sup> ④: Very high, ③: High, ②: Moderately low, ①: Low.

<sup>4</sup> The World Health Organization (WHO) defines the guideline for access to safe water as "the availability of 20 liters of water per person per day within 1 km."

Zoume has been high from the time of planning to the time of ex-post evaluation.

#### 3.1.1.3 Appropriateness of the Project Plan and Approach

Based on the lessons learned from the previous projects, it was decided at the time of planning that (1) seasonal and interannual fluctuations at the groundwater levels would be reflected on the preparatory survey design, (2) a soft component for the procedure of connecting to individual hydrants would be implemented, and (3) the executing agency would monitor the groundwater levels and the connection status of individual hydrants after construction. For (1), a pumping test was conducted again at the time of designing details, and based on the results, the pump to be procured was designed. As a response to (2), the technical assistance was provided to encourage residents to connect their own hydrants through the soft component "Public Awareness/Hygiene Education." For (3), the technical assistance was provided to the executing agency through the soft component to enable monitoring of groundwater level after the installment of the facilities by the project. As a result, it was confirmed that the executing agency continuously monitored and recorded the groundwater levels at the ex-post evaluation.

From the above, the lessons learned from other projects, which were recognized at the time of planning, were appropriately reflected at the time of planning and implementation.

### 3.1.2 Coherence (Rating: ③)

#### 3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning, Japan's development cooperation policy for Benin, the Country Assistance Policy for the Republic of Benin (2012), set the basic policy of "supporting sustainable growth and poverty reduction that contributes to the improvement of citizen's livelihood." The project is in line with this policy.

#### 3.1.2.2 Internal Coherence

At the time of planning and implementing the project, there were no other JICA projects targeting the water supply sector in Benin and no JICA projects in the same target areas. This made it difficult to envision and implement specific linkages with other JICA projects.

However, through planning and implementing the project, which was the first Japanese grant aid for SONEB, the executing agency, knowledge and experience at the time of planning and implementing the Japanese grant aid were accumulated within SONEB. This led to easy facilitation of the planning process for the planned grant aid project, Project to Strengthen Drinking Water Supply Systems in the Kufo and Plateau Departments (Exchange Document Signed in 2021) (JICA Benin Office, interview with SONEB).

### 3.1.2.3 External Coherence

SONEB has placed the project and other donor projects (KfW,<sup>5</sup> Netherlands, etc.) in Benin's urban water supply development plan of Benin; therefore, urban water supply development is being promoted without duplication among the projects (SONEB questionnaire responses). In addition, JICA Benin Branch regularly participated in donor meetings to share information among donors, which avoided duplicate support, as mentioned above (JICA Benin Branch interview).

The project is consistent with Benin's development policies and development needs. Lessons learned from other projects were appropriately reflected at the time of planning and implementing the project, which shows that the project design and approach were appropriate. The project was also consistent with Japan's development policy. Although it was difficult to collaborate with other JICA projects directly, the project enhanced the executing agency's planning and implementation. It was adequately coordinated with other donors' projects, and promoted the development of Benin's urban water supply. Therefore, its relevance and coherence are high.

## 3.2 Efficiency (Rating: ③)

### 3.2.1 Project Outputs

As shown in Table 1, the output of the project was mainly in line with the plan. There were some minor changes, but these were reasonable and did not impair the effectiveness. Some items borne by the Benin side were delayed, such as installing fences at the construction facilities and securing power sources for well pumps and water supply pumps, but they were implemented almost as planned.

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The project cost was 1,076 million yen (including 1,008 million yen for the Japanese side and 68 million yen for the Benin side<sup>6</sup>), which was within the plan (95% of the plan, see Table 2).

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<sup>5</sup> KfW has implemented a 7-year urban water supply development project starting in 2018, targeting the de facto capital of Cotonou, Abomey Calavi in Atlantique department, and Seme-Podji and Porto-Novo in Oueme department, with the goal of increasing the number of SONEB hydrants subscribers by 250,000. The main project activities are constructing the wells and expanding the water supply network. The Netherlands has implemented a 3-year urban water supply development project starting in 2020. The project includes constructing new wells in Adjara, renovating existing wells, constructing a water treatment plant, renovating water towers, constructing underground water tanks, and expanding and renewing the water supply network. The project aims to increase the water supply from less than 50 m<sup>3</sup>/h to 310 m<sup>3</sup>/h.

<sup>6</sup> 357 million CFA francs; calculated in yen using the average exchange rate for 2016–2019 (578.66 CFA francs/USD, 110.10 JPY/USD).

Table 1 Project Outputs (Planned and Actual)

	Plan		Actual (variance from the plan)	
	Facilities and equipment			
	Glazoue	Dassa Zoume	Glazoue	Dassa Zoume
Water source facilities	2 intake wells (exploratory wells) <sup>7</sup> 2 well pumps (1 × 0.34 m <sup>3</sup> /min, 1 × 0.1 m <sup>3</sup> /min)	2 intake wells (exploratory wells) <sup>8</sup> 2 well pumps (0.84 m <sup>3</sup> /min)	Change of well pump capacity <sup>9</sup> (0.1 m <sup>3</sup> to 0.05 m <sup>3</sup> )	No difference
Raw water supply facilities	Raw water pipe Diameter 150mm × 2.07km Diameter 75mm × 1.01km 1 raw water storage tank (160 m <sup>3</sup> )	Raw water pipe Diameter 150mm × 0.37km 1 raw water storage tank (210 m <sup>3</sup> )	No difference	No difference
Disinfection facility	2 dissolution tanks (with agitator) 2 injection facilities	2 dissolution tanks (with agitator) 2 injection facilities	No difference	No difference
Water supply facilities	2 water pumps (0.29 m <sup>3</sup> /min × 2) Water supply pipe Diameter 150mm × 1.34km	4 water pumps (0.46 m <sup>3</sup> /min × 2, 0.24 m <sup>3</sup> /min × 2) Water supply pipe Diameter 200mm × 3.57km Diameter 150mm × 3.66km	No difference	No difference
Water distribution facilities	1 elevated water tank (new installation) (200 m <sup>3</sup> ) Water distribution pipe Diameter 200mm × 0.96km Diameter 150mm × 3.29km	1 elevated water tank (new installation) (300 m <sup>3</sup> ) Water distribution pond (existing) 1 pond (114 m <sup>3</sup> ) Water distribution pipe Diameter 150mm × 1.06km Diameter 200mm × 2.39km	No difference	No difference
Building	1 administrative office 3 generator rooms 1 shade for disinfection equipment	1 administrative office 3 generator rooms 1 shade for disinfection equipment	No difference	No difference
Equipment	2 water quality analysis equipment (for measuring fluorine, pH, electrical conductivity, nitric acid, and residual chlorine) Complete set of water level gauges (2 fixed and 1 portable)	2 water quality analysis equipment (for measuring fluorine, pH, electrical conductivity, nitric acid, and residual chlorine) Complete set of water level gauges (2 fixed and 1 portable)	No difference	No difference
Consulting services (software components)				
	<ul style="list-style-type: none"> <li>Strengthen capacity for water intake and water quality control</li> <li>Raise awareness of sanitation among residents, etc.</li> </ul>		No difference	

(Source: Prepared by evaluator based on materials JICA provided)

<sup>7</sup> The new wells in Glazoue are 7-SE8 (84.3 m depth) and 7-SE10 (52.0 m depth).

<sup>8</sup> The new wells in Dassa-Zoume are 3-SE4 (56.8 m depth) and 3-SE8 (86.0 m depth).

<sup>9</sup> Only one well changed pump capacity.

Table 2 Project Cost Plans and Actuals

(Unit: listed in table)

	Planned Cost (millions of yen)	Actual Cost (millions of yen)	Percentage of Actual Cost to Planned Cost (percentage)
Total Project Cost	1,137	1,076	95%
Japan's Project Cost	1,071	1,008	94%
Benin's Project Cost	66	68	103%

(Source: Prepared by the evaluator based on materials JICA provided and SONEB questionnaire responses)

### 3.2.2.2 Project Period

The project period was 36 months, from March 2016 to February 2019, which was slightly longer than the plan (116% of plan). Construction of the water supply facilities was completed in July 2018, while the soft component was completed in February 2019.

The project duration exceeded the plan because the supply of lumber for form and form timbering was drastically reduced in Benin. It was difficult to secure the necessary lumber for forming the main frame construction of the elevated water tank and the raw water storage tank, which affected the construction's progress (consultant questionnaire response).

The project's output was in line with the plan, and the project cost was within the plan; however, the project period slightly exceeded the plan.

Therefore, the efficiency of the project is high.

## 3.3 Effectiveness and Impacts<sup>10</sup> (Rating: ②)

### 3.3.1 Effectiveness

#### 3.3.1.1 Quantitative Effects (Operational and Effect Indicators)

The project's effectiveness indicator is the daily water withdrawal for each city. Table 3 shows the baseline, target, and actual values.

<sup>10</sup> When providing the sub-rating, Effectiveness and Impacts are to be considered together.



Table 3 Operational and Effect Indicators

(Unit: m<sup>3</sup>/day)

	Baseline value 2014	Target value 2021	Actual value 2021		(Reference) Actual value (2019–2021 average)	
Glazoue Daily Water Intake	240	590	277	46%	318	53%
Water intake from wells newly constructed during the project	-	350	180	51%	181	51%
Existing well withdrawals	240	240	97	40%	137	57%
Dassa-Zoume Daily water withdrawal	352	1,352	738	54%	911	67%

Source: Ex-ante evaluation table p.3 and SONEB questionnaire responses)

Note: Target water withdrawal is the amount of water withdrawal adjusted to keep fluorine concentration below the water quality standard in Benin (1.5 mg/liter). It is an average value during the dry season (March to May). The measurement points are the water meters at each well.

As shown in Table 3, neither Glazoue nor Dassa-Zoume reached their target values. This is because the groundwater level had dropped, and the water could not be withdrawn at the capacity assumed at the time of planning (actual inspection, interview with SONEB).<sup>11</sup>

The groundwater in the wells that the project constructed is in the unconfined aquifer,<sup>12</sup> and rainfall easily affects the groundwater level. At the time of planning, it was pointed out that if drought occurred or annual rainfall decreased drastically in the areas, the amount of water withdrawal would be limited; thus, the planned water withdrawal might not be secured because of these factors (Preliminary Evaluation Report, p. 3). The executing agency measured the amount of water withdrawal and the groundwater level regularly, which was reflected on the operation plan, and it recovered the groundwater level properly as much as possible. This shows that they suitably dealt with operation for recovering the groundwater level. Therefore, it can be considered that this was caused largely due to external factors.

Confirming the amount of rainfall around Dassa-Zoume, wells have not been recharged enough due to inadequate rainfall in 2020 and 2021.<sup>13</sup> In addition, the wells constructed in the project were equipped with wire-wound screens made of stainless steel; however, the screen clogging may have reduced the pumping rate<sup>14</sup> (consultant interviews).

<sup>11</sup> At the defect inspection, a drop in the groundwater level was noted. At well 7-SE10 in Glazoue, the pumping pump was temporarily stopped, and pumping was not possible due to the drop in the groundwater level. During the ex-post evaluation, a significant drop in the water level was confirmed at 3-SE4 in Dassa-Zoume, and pumping was stopped at 7-SE8 in Glazoue in 2020 due to the drop in the groundwater level.

<sup>12</sup> An unconfined aquifer is an aquifer sandwiched between geological features that allow water to pass through easily, and geological features called "impermeable layer" which do not allow water to pass through easily.

<sup>13</sup> On <https://www.worldweatheronline.com/dessa-zoume-weather-averages/collines/bj.aspx> Accessed March 5, 2022.

<sup>14</sup> In Japan, wells are renovated (e.g., cleaned) in every few years. The renovation restores the pumping capacity of the wells whose screens have become clogged due to long-term use and whose pumping capacity has decreased through cleaning and other means. The inside of the well is checked in advance with a well camera to determine what kind of repair is needed (specifically, the inside of the well can be visually confirmed by rotating and lowering an underwater camera into the well while taking pictures of the inside conditions). After the repair, the camera will be used again to confirm that the well is unclogged (consultant hearing).

The daily water withdrawals in both cities increased compared to the time before the project implementation (115% increase in Glazoue and 209% increase in Dassa-Zoume compared to the actual values in 2021 and 2014, respectively); however, they did not reach the target values. In addition, the increase in water withdrawals and the lower initial cost of connecting to individual hydrants had significantly impacted<sup>15</sup> the increase of the number of individual hydrants well beyond what was expected at the time of planning. As a result, the population having water supply significantly increased (see Table 4). This caused the water supply per capita to go below the planned amount in both cities. Moreover, the water from the most widely used water facilities, public wells with hand pumps, was sold at 10–25 CFA francs per 25 liters. The water charge of individual hydrants by SONEB was 5-11 CFA francs per 25 liters in ordinary households. Considering the water charge by SONEB hydrants was the same as or cheaper than the water cost from public wells with hand pumps, connecting to individual hydrants has probably become an incentive to residents.

However, the water supply per capita in both cities decreased compared to its amount at the time of planning. This might have been caused because the population with access to water supply significantly increased and also because the amount of the daily water withdrawals did not reach the target value the project was expected to achieve.

Regarding water quality, the chlorine concentration, fluorine concentration content, and nitrate-nitrogen concentration in the water supplied from the water supply facilities installed by the project were within the standards that Benin determined, which shows that water quality was effectively managed (data provided by the SONEB and SONEB questionnaire responses). A qualitative survey<sup>16</sup> was conducted with individual hydrant subscribers to investigate their satisfaction with the water quality. In Dassa-Zoume, 100% of respondents, and in Glazoue, 80% of respondents answered that they were satisfied with the water quality.<sup>17</sup>

In contrast, due to less amount of water withdrawals than planned and the significant increase in the population served, 24-hour water supply service has not been initiated. Water

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<sup>15</sup> The initial fee, which was 10,000 CFA francs until 2017, was reduced to 5,000 CFA francs in 2018. This is a nationwide promotion (executing agency hearing).

<sup>16</sup> To ascertain the project's effectiveness after implementation, the survey targeted households that started using SONEB hydrants after 2018 (Glazoue: 20 people [8 men and 12 women; 5 in 30s, 3 in 40s, 3 in 50s, 6 in 60s, 2 in 70s, and 1 in 80s]; Dassa-Zoume: 21 people [9 men and 12 women, 1 in 20s, 5 in 30s, 5 in 40s, 5 in 50s, and 5 in 60s]). However, because the individual hydrant subscribers were widely scattered in both cities and it was extremely difficult to identify them, one user in Dassa-Zoume and two in Glazoue who subscribed in the second half of 2017, the year before the project was put into service, were included due to the limited survey period. In addition, a water sanitation awareness workshop was conducted as part of the project's soft component, aiming to promote a correct understanding of the SONEB water supply project among residents and ensure safe and hygienic water use. Considering a questionnaire was sent to the workshop participants, asking questions related to water-borne diseases, it was planned to include the workshop participants in the qualitative study to compare before and after the project implementation. However, most of the workshop participants could not be contacted, making it difficult to include them in the qualitative survey. Therefore, a comparison with the results of the questionnaire administered in the soft component was not conducted in this evaluation.

<sup>17</sup> Twenty valid respondents in Glazoue and 21 valid respondents in Dassa-Zoume.

supply hours vary from district to district. There are almost no water interruptions in some districts, while water is supplied for only 2 to 3 hours per day in others. Therefore, the satisfaction level with the amount and hours of water supply is not high among the individual hydrant subscribers. Sixty-five percent of the respondents in Glazoue and 36% in Dassa-Zoume were “dissatisfied” with the amount of water supply. In contrast, 35% in Glazoue and 59% in Dassa-Zoume were “dissatisfied” with the hours of the water supply (qualitative survey). However, despite being “dissatisfied” with the amount and hours of the water supply, no subscribers were willing to cancel the SONEB individual hydrant contract because of the availability of water fetching near their houses and the good water quality (qualitative survey).

Table 4 (Reference) Related Indicators

(Unit: listed in table)

Reference indicators	2014 at the time of planning	March 2018 (Note 4)	Estimated value at the time of planning (2020) (Note 5)	Actual results 2021	Changes since the time of planning
<b>Glazoue City</b>					
Number of hydrants at household (unit: number of hydrants)	772	1,342	875	1,885	224%
Population of water supply district (unit: person) (Note 1)	27,288	-	32,224	33,400	122%
Population served (unit: person) (Note 2)	9,264	-	10,496	22,620	244%
Water supply per capita (unit: liter/day)	25	-	40	12	48%
<b>Dassa Zoume City</b>					
Number of hydrants at household (unit: number of hydrants)	1,260	1,997	1,803	3,232	257%
Water District Population (unit: person)	29,571	-	32,487	33,673	114%
Population of water supply district (unit: person) (Note 3)	15,120	-	21,636	38,784	257%
Water supply per capita (liter/day)	23	-	40	19	82%

(Source) Cooperative Readiness Survey Report, Soft Component Completion Report, and SONEB questionnaire responses.

(Note 1) The population served is calculated by multiplying the number of hydrants × 2 (households) × 6 (persons). In Benin, one hydrant is considered to benefit two households (including adjacent households) multiplied by the average number of household members (6) (interview with SONEB).

(Note 2) The actual population served is estimated based on the population of the water districts as of 2014, using the population growth rate of each city from 2014 to 2021 (Glazoue: 2.93%, Dassa-Zoume: 1.87%).

(Note 3) Although the actual value of 2021 exceeds the population of the water supply district, this is used because some of the population may benefit beyond the water supply district. If the population of the water supply district (33,673) is used to calculate the water supply per capita in 2021, its volume would be 22 liters.

(Note 4) At the end of the software component.

(Note 5) Because these are projected values based on estimates at the time of planning and not the project’s target values, comparisons with actual values (2021) are made with actual results at the planning (2014).

### 3.3.1.2 Qualitative Effects (Other effects)

The qualitative effect expected in the project, “the reduction in water fetching activities for women and children,” has been examined in both target areas. The afield survey was conducted for those primarily responsible for the work to determine whether the time spent fetching water has been reduced compared to the time before connecting to the individual hydrants.

In Dassa-Zoume and Glazoue, as in other areas, the individual hydrants were located along the streets or on the premises adjacent to each residence. It was confirmed at the time of ex-post evaluation that residents fetched water from the hydrants located 2-10 meters apart from their houses and carried them to use. In this evaluation study, no one was using water pipes extended to their residence. Besides individual hydrants, both cities’ water sources were public deep wells with hand pumps, improved shallow wells, traditional shallow wells, and water purchased from the SONEB hydrants of neighboring households. The public deep well with a hand pump was the most common source of water use. At the time of planning, the average distance residents needed to travel to fetch water ranged from 143 m to 275 m in Glazoue and 226 m to 309 m in Dassa-Zoume. The average distance residents need to travel to fetch water is estimated to have decreased significantly among households with individual hydrant connections.<sup>18</sup>

In Glazoue, wives and children fetched water before and after the connection of hydrants (see Table 5). Households where wives, wives and children, and children were the main collectors of water, accounted for 84% and 89% of the households before and after the connection, respectively. Households in which wives and children, including those under 12, were (or are) the primary collectors of water accounted for more than half of all households (57%) before and after connection. When asked about changes in hours spent fetching water before and after connection to individual hydrants, 16 of 18 valid responses (88%) indicated that it had decreased significantly.<sup>19</sup>

Similarly, in Dassa-Zoume, wives, and children fetched water before and after the connection of hydrants. Households where wives, wives and children, and children were the primary collectors of water accounted for 91% and 82% of the households, respectively, before and after the connection. Wives and children, including those under 12, led more than half of the households (68% before and 55% after the connection) in fetching water.

When asked about the change in time spent on fetching water before and after the

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<sup>18</sup> Cooperative Readiness Survey Report, p.2-51; however, it was observed that hydrant subscribers also used other sources of water in combination, not only individual hydrants. The most common source of water used in combination was public deep wells. In Glazoue, many households used rainwater for washing clothes during the rainy season (qualitative study).

<sup>19</sup> The remaining two respondents reported no change. We asked questions using the largely decreased to slightly-increased method.

connection to the individual hydrants, 17 of the 18 valid responses (94%) indicated that it had decreased significantly, while one remaining respondent indicated that it had been reduced slightly.

The following estimates were made regarding the decrease in water fetching activities in both cities. According to the information obtained from the qualitative survey of individual hydrant subscribers, the average daily water consumption per capita in Glazoue and Dassa-Zoume was 31 and 22 liters, respectively. Since the amount of water supplied by SONEB hydrants in each city was 12 and 19 liters (see Table 4), it can be assumed that SONEB's individual hydrants supplied 38% and 86% of the water. Since the average household size in Benin is six, the average daily water consumption per household was 186 liters in Glazoue and 132 liters in Dassa-Zoume. If 25 liters of water were transported per fetch, the average household had to fetch water 7.5 times a day in Glazoue and 5.2 times a day in Dassa-Zoume before connecting to the individual hydrants. After connecting to individual hydrants, it is estimated that SONEB provides 38% of the water in Glazoue and 86% in Dassa-Zoume, which means users may fetch water up to 3.9 times per day in Glazoue and 0.7 times in Dassa-Zoume.

This shows that water fetching activities decreased dramatically among households connected to individual hydrants after the implementation of the project.

On the other hand, as water supply per capita decreased among households connected to individual hydrants before the project, water fetching activities might have increased.

Table 5 Primary water collectors by household

(Unit : Number of Households)

	Glazoue				Dassa Zoume			
	Before connection		After connection		Before connection		After connection	
	Number of Households	(%)	Number of Households	(%)	Number of Households	(%)	Number of Households	(%)
Wife	2	11%	2	11%	10	45%	4	18%
Wife and children	3	16%	3	16%	3	14%	7	32%
Households with children under 12 years old	3	16%	3	16%	2	9%	4	18%
Children	11	58%	11	58%	7	32%	7	32%
Households with children under 12 years old	6	32%	6	32%	3	14%	4	18%
Husband	1	5%	1	5%	1	5%	2	9%
Husband and Children	0	0	0	0	0	0	1	5%
Households with children under 12 years old	0	0	0	0	0	0	0	0
Other	2	11%	2	11%	1	5%	1	5%
	19	100%	19	100%	22	100%	22	100%

(Source: Prepared by the evaluator)

Thus, wives and children, including children under 12, are the primary water collectors in both cities. In most households, the time required to fetch water decreased significantly after connecting to individual hydrants. From the above, the implementation of the project has been effective in reducing the water fetching activities among women and children.

### 3.3.2 Impacts

#### 3.3.2.1 Intended Impacts

The impacts expected to emerge through the project were “improvement of the sanitary conditions in the community and reduction of the incidence of water-borne diseases,” “promotion and empowerment of women’s participation in social activities through reduction of water fetching activities among women and children,” and “improvement of children’s school enrollment.”

- 1) Improvement of the sanitary conditions in the community and reduction of the incidence of water-borne diseases

The qualitative survey of residents confirmed the situation of water handling related to hygiene and hand washing. Regarding the situation of water handling, it was confirmed whether covers were placed on containers when carrying water, whether covers were put on storage containers for drinking water, and whether storage containers for drinking water were clean.<sup>20</sup>

Approximately 60% of valid respondents in both cities used containers with covers for carrying water.<sup>21</sup> The containers most used in the target areas were 25-liter capacity polyethylene and metal washtubs. Water was carried in metal washtubs without covers. Regarding storage containers for drinking water, 73% of valid respondents in Glazoue and 100% in Dassa-Zoume used covers.<sup>22</sup> While the most common storage containers for drinking water were polyethylene containers in Dassa-Zoume, more households used metal washtubs in Glazoue. Although there were differences between the two cities in storage containers for drinking water, in a survey of residents conducted in both cities in March 2018, 62% of respondents mentioned using covers to carry and store drinking water. The



Individual hydrant and a polyethylene container for carrying water (Photo by the evaluator)



Metal washtub used to fetch water (Photo by the evaluator)

<sup>20</sup> Some households did not transfer the drinking water from the carrying container to the storage container, but kept the drinking water in the carrying container. In this case, they answered that the carrying container was also used as the storage container.

<sup>21</sup> 19 valid respondents in Glazoue and 22 in Dassa-Zoume.

<sup>22</sup> 15 valid respondents in Glazoue and 20 in Dassa-Zoume.

survey did not distinguish between containers for carrying and storage. However, no improvement in the management of water regarding the situation with/without covers was observed in both cities, at least for transport containers.

Regarding the frequency of cleaning storage containers for drinking water, 53% of valid respondents in Glazoue and 74% in Dassa-Zoume washed containers at least once a week.<sup>23</sup> In the 2018 survey, 66% of respondents washed and kept their carrying and storage containers clean. Regarding the frequency of cleaning storage containers, there was a slight improvement in Dassa-Zoume, but no improvement was confirmed in Glazoue.

In conclusion, it is difficult to say that drinking water was carried hygienically in both cities and adequately managed, and confirmed that the sanitary conditions were not good enough.

The prevalence of water-borne diseases (diarrhea, cholera, dysentery, and typhoid fever) has been examined from 2017 to 2021 in a qualitative survey of residents. The results showed that there were few cases of water-borne diseases in households. There were no cholera cases in either city, and there were one to three cases of dysentery and typhoid fever each year in each city.<sup>24</sup> The number of cases of diarrhea was also low, with 87% of respondents in Glazoue and 80% in Dassa-Zoume reporting no cases in their households.<sup>25</sup> Two valid respondents in both cities reported the decrease in the number of cases of water-borne diseases in their households after connecting to the SONEB hydrant.<sup>26</sup> However, as the sample size was very small, the result does not serve as sufficient evidence that hydrant connection improved sanitation conditions and reduced water-borne diseases.

Table 6 shows the number of cases of water-borne diseases from the medical institutions in both cities (four institutions in Glazoue and one institution in Dassa-Zoume).<sup>27</sup> The number of cases of diarrhea, dysentery, and typhoid fever did not necessarily decrease over time; the number of SONEB hydrant subscribers has increased 1.6 times in Dassa-Zoume and 1.4 times in Glazoue since 2017. However, the following information does not indicate a negative correlation between the number of hydrant subscribers and the number of water-borne diseases.

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<sup>23</sup> 13 valid respondents in Glazoue and 19 valid respondents in Dassa-Zoume

<sup>24</sup> 19 valid respondents in Glazoue and 19 valid respondents in Dassa-Zoume.

<sup>25</sup> Number of valid respondents in Glazoue: 16; Number of valid respondents in Dassa-Zoume: 15. Excluding respondents who chose “don't know”.

<sup>26</sup> The two respondents who started using SONEB hydrants in Dassa-Zoume in 2020 indicated that one each household member had diarrhea and typhoid fever in 2018, prior to the signing of each unit hydrant contract, but that there were no water-borne diseases in the household in other years.

<sup>27</sup> The names of the medical institutions are: Hospital de Zone de Dassa-Zoume, Centre de Sante communal de Glazoue, Centre de Sante d'arrondissement de Ouedeme (CSA), Centre de Sante d'arrondissement de Magoume, Missionnaires Medicales de Marie de Zaffe.

Table 6 Number of Patients with Water-borne Diseases

(Unit: Number of patients)

	Glazoue					Dassa-Zoume				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Diarrhea	260	351	340	287	348	118	114	209	291	284
Dysentery	88	48	107	74	55	9	4	4	15	8
Typhoid fever	20	38	51	37	14	42	36	70	52	58
Number of subscribers to individual house hydrants	-	1,342	1,719	1,801	1,885	-	1,982	2,649	2,915	3,232

(Source: Prepared by evaluator based on information from medical institutions.<sup>28</sup>)

From Table 6, the qualitative survey conducted in the evaluation and the statistical information obtained from medical institutions did not confirm the impact of the project in reducing the incidence of water-borne diseases among residents through the improvement of sanitary conditions.

2) Promotion and empowerment of women's participation in social activities through the reduction of water fetching activities among women and children

In Glazoue, households in which wives fetched water used the time generated by reducing water fetching activities after hydrant connection for other household chores (four respondents, 80%), income-generating work (two respondents, 40%), and sleeping or eating (one respondent, 20%).<sup>29</sup> When asked to identify changes in family and social relationships after hydrant connection, none indicated that wives became more confident or financially independent or had more time for family conversation.

In Dassa-Zoume, households in which wives fetched water used the time generated by reducing water fetching activities after the hydrant connection for other household chores (nine respondents, 75%), income generating work (four respondents, 33%), and sleeping and eating (four respondents, 33%).<sup>30</sup> When asked to identify changes in family and social relationships, one respondent (8%) indicated that his wife became more confident, but no one indicated that wives became more financially independent or had more time for family conversation.

Based on the above, as the results of this evaluation study show, the project limitedly contributes to the promotion of women's participation in socio-economic activities but not to women's empowerment.

<sup>28</sup> No cases of cholera were identified.

<sup>29</sup> Five valid respondents, based on multiple answers.

<sup>30</sup> Twelve valid respondents, based on multiple answers.



### 3) Improved school enrollment of children due to reduced hours of water fetching activities

In Glazoue, households in which children fetch water used the time generated by reducing water fetching activities after connecting to the hydrants for “study” (seven respondents, 58%), “other household chores” (five respondents, 42%), and “games, recreation, or rest” (three respondents, 25%) (12 valid responses, multiple answers). Regarding changes in school enrollment, five (45%) respondents answered that children who had enrolled in school without attending were now participating in schools, and one (9%) answered that their child enrolled in school after connecting to individual hydrants.<sup>31</sup>

In Dassa-Zoume, households in which children fetch water used the time generated by reducing water fetching activities after connecting to the hydrants for “study” (seven respondents, 46%), “other household chores” (four respondents, 26%) and “games, recreation, or rest” (three respondents, 20%).<sup>32</sup> Regarding changes in school enrollment, five (33%) respondents answered that children who had enrolled in school without attending were participating, and one (6%) answered that their children enrolled in school after connecting to individual hydrants.<sup>33</sup>

Based on the above, from the evaluation survey results, the project has contributed to a certain extent to the improvement of children’s school enrollment.

#### 3.3.2.2 Other Positive and Negative Impacts

##### 1) Impacts on the Natural Environment

The project was considered to fall under Category B based on the *JICA Guidelines for Environmental and Social Considerations* (formulated in April 2010). At the time of planning, the project was not anticipated to significantly impact on the natural environment as target areas were not easily affected by national parks or near such areas. Negative impacts on the natural environment were not identified from the environmental monitoring sheet (June 2018)<sup>34</sup> and SONEB questionnaire responses. In addition, accidents during construction or after service were not identified.

##### 2) Resettlement and Land Acquisition

At the time of planning, it was assumed that land acquisition involving involuntary resettlement would not occur.

The ex-post evaluation confirmed that land acquisition did occur in both cities, but all of it was on public land, and none involved involuntary resettlement (SONEB questionnaire responses).

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<sup>31</sup> Twelve valid respondents, based on multiple answers.

<sup>32</sup> Fifteen valid respondents, based on multiple answers.

<sup>33</sup> Fifteen valid respondents, based on multiple answers.

<sup>34</sup> *Fiche de Suivi Environnemental daté de juin 2018*

### 3) Gender Equality

After connecting to individual hydrants, it confirmed the effect of reducing the hours of water fetching activities in households. In the target areas, women and girls are relatively engaged in water fetching activities more than men and boys, which appears that females benefited more than males by reducing the hours of water fetching activities.<sup>35</sup>

### 4) Marginalized People

Within the scope of the evaluation survey, there were no differences in beneficiary status by gender, age, ethnicity, or religion. However, some households may find it difficult to install individual hydrants by themselves due to the initial cost. Thus, the project depends on the income level of residents. For people without individual hydrants, some communities have public hydrants, and it may be possible to buy water from households with individual hydrants.<sup>36</sup> People who cannot afford to connect to individual hydrants can access safe or purified water.

### 5) Social Systems and Norms, Human well-being, and Human Rights

The qualitative survey has also examined if there were changes in life satisfaction between 2017 and 2021. In Glazoue, 13 respondents (62%) stated that their life satisfaction had increased, and eight (40%) cited improvement in public services (water supply) as the reason.<sup>37</sup> In Dassa-Zoume, ten respondents (48%) stated that their life satisfaction had increased, and five (23%) cited improvement in public services (water supply) as the reason.<sup>38</sup> Thus, among the households connecting to individual hydrants, approximately 40% of people in Glazoue and 20% in Dassa-Zoume perceived an increase in life satisfaction through the project. This indicates that the project has produced a partial yet certain level of impact on the residents' well-being.

“Daily water withdrawal,” an indicator of the effectiveness of the project, did not achieve the target in either city. On the other hand, compared to the time of planning, the amount of water withdrawal in both cities increased, and the number of subscribers to individual hydrants and the population served also increased significantly; but the amount of water supply per capita decreased. We confirmed that the reduction of water fetching activities among children and women was effective in households connected to individual hydrants after the project implementation. Regarding the impact, improvement of the sanitary environment in the community and reduction of the incidence of water-borne diseases were not confirmed, and the limited contribution was confirmed to the promotion of women's participation in socio-economic

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<sup>35</sup> In Glazoue, more girls than boys were engaged in water fetching (13 girls and eight boys). In Dassa-Zoume, slightly more girls than boys were engaged in water fetching (13 girls and 12 boys) (Based on qualitative research).

<sup>36</sup> In the target area, it is common for households with SONEB individual hydrants to sell water to those without (actual inspection).

<sup>37</sup> 20 valid respondents

<sup>38</sup> 21 valid respondents

activities by reducing the hours spent on fetching water, and women’s empowerment was not confirmed. The effect on the improvement of children’s school enrollment was confirmed.

From the above, the project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the project are moderately low.

### 3.4 Sustainability (Rating: ③)

#### 3.4.1 Policy & System

As indicated in the relevance section, the direction of the expansion of water supply services in urban areas of Benin has not changed from the planning to the ex-post evaluation, and it is expected to continue in the future.

#### 3.4.2 Institutional/Organizational Aspect

The operation and maintenance of water supply facilities constructed under the project are conducted by the Dassa-Zoume Branch office under the supervision of SONEB headquarters and the Direction Régionale Abomey-Bohicon (“DRAB”). Table 7 shows the division of roles within SONEB for the operation and maintenance of the project. It has not changed since the time of planning.

Table 7 Division of roles within SONEB for maintenance at the project

SONEB Headquarters	Repair of major facilities (well rehabilitation, pump replacement, etc.) Management of expenditures for staff salaries, electricity fees, and purchase of necessary materials and equipment (chemicals, etc.) (Including expenditures at local offices)
DRAB	Repair of medium facilities and issue of bills
Dassa-Zoume Branch Office	Operation and management of deep wells (operation of well pumps, operation records) Minor repairs (e.g., repair of leaks in water pipes, etc.) Reading water meters and collecting water charges Connecting to new hydrants Removal of water meters for non-payers and suspension of water supply

(Source: Prepared by the evaluator based on SONEB questionnaire responses)

Table 8 shows staff allocation at the Dassa-Zoume Branch Office, which is responsible for operating and managing the water supply facilities constructed by the project. It was identified that there was no shortage of personnel as required for the project operation and maintenance, based on SONEB questionnaire responses. Although the number of meter readers has decreased from the time of planning, the staff of the executing agency explained that it was possible to handle the current number of personnel (interview with SONEB).

Table 8 Staff Allocation at Dassa-Zoume Branch Office

(Unit: persons)

	2016	2019	2020	2021	2022
Director	1	1	1	1	1
Deputy Director	1	0	0	0	0
Secretary	1	1	1	1	1
Accountant	1	1	1	1	1
Facility Operations Leader	1	1	1	1	1
Facility Operator (Note 1)	1	1	4	4	4
Repair and maintenance Personnel (Note 2)	1	3	3	3	3
Glazoue Branch Manager	1	1	1	1	1
Dassa-Zoume Meter Reader	3	1	1	1	1
Glazoue meter reader	2	1	1	1	1
<b>Total</b>	<b>13</b>	<b>11</b>	<b>13</b>	<b>14</b>	<b>14</b>

(Source: Prepared by the evaluator based on SONEB questionnaire responses)

Note 1: Three staff at Dassa-Zoume Branch Office and one staff member at Glazoue Branch Office.

Note 2: Two of them have been temporary employees since 2019.

### 3.4.3 Technical Aspect

At the ex-post evaluation, all facilities developed by the project were generally adequately managed and operated. It was also confirmed that several activities supported by technical assistance under the soft components (see Table 9) had been adequately implemented. As of February 2022, when the evaluator conducted the field survey, groundwater level monitoring was conducted almost daily in Dassa-Zoume and once a month in Glazoue (interview with SONEB). It was confirmed in the field survey that the Dassa-Zoume Branch staff would provide technical assistance to the Glazoue Branch staff. Subsequently, improvements were made according to the direction, and as of July 2022, groundwater levels were measured daily in Glazoue (interview with SONEB).



Table 9 Technical Assistance with the Soft Component

1	Monitoring of water storage and distribution
2	Monitoring of groundwater level and data collection and feedback of data to operational management
3	Monitoring of water quality (fluorine concentration, residual chlorine, etc.) and feedback of data to operational management
4	Proper operation of individual equipment such as pumping equipment, disinfection equipment, emergency generators, etc.

The training was also provided to improve technical skills. Two staff members from the

Dassa-Zoume Branch participated in training for the maintenance of the metering pump.<sup>39</sup> Manuals for the maintenance and management of water supply facilities were also in place and were used by staff daily. Three staff members trained through the soft component (technical assistance) of the project continue to engage in the operation and maintenance of water supply facilities in Dassa-Zoume and Glazoue.

The above indicates that although there were some problems in the frequency of groundwater level monitoring in Glazoue, they have already improved. This means that the executing agency has sufficient technology for the operation and maintenance of the water supply facilities developed in the project.

#### 3.4.4 Financial Aspect

Table 10 shows the overall financial status of the executing agency from 2016 to 2020. SONEB's overall operation status was good, with revenues exceeding expenditures<sup>40</sup>. Information on the financial status of the Dassa-Zoume Branch was not available. However, the SONEB headquarters has managed the revenues and expenditures of the Dassa-Zoume Branch. Thus, there was no problem with the financial status of the operation and maintenance of the water supply facilities constructed by the project. In addition, we identified no shortfalls in the maintenance costs of the water supply facilities constructed under the project (SONEB questionnaire responses).

Receivables in both cities increased significantly in 2021, the percentage of which was about 20% (see Table 11). It was attributed to the problem in SONEB's servers in December 2021, which resulted in canceling the SONEB-wide end-of-year campaign to collect unpaid water bills. Therefore, future improvement in collecting receivables is expected (interview with SONEB). If water gills are not paid for a certain period, the Dassa-Zoume Branch Office will press for payment and stop the water supply for those who have not paid. As shown in Table 7, those who have not paid fees will not be able to use the water while fees remain unpaid.

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<sup>39</sup> A pump capable of repeatedly injecting a defined fixed amount of liquid with high accuracy.

<sup>40</sup> The "Others" category of revenue includes revenues from services rendered, transfers for the purchase of equipment and materials, depreciation, reversals of provisions and impairments, and changes in inventories.

Table 10 SONEB Financial Status

(Unit: thousands of CFA francs)

		2016	2017	2018	2019	2020
Annual Revenue	Collection of water charges	16,921,556	16,754,287	16,228,005	15,877,773	16,966,917
	Subsidiary aid	77,394	3,500	340,859	1,125,086	11,000
	Others	5,194,933	7,255,731	9,492,275	7,561,842	13,762,953
	Total	22,193,882	24,013,518	26,061,138	24,564,701	30,740,870
Annual Expenditure	Purchase of equipment and materials	4,239,827	4,249,981	6,207,258	4,407,243	4,969,236
	Personnel expenses	6,066,326	6,751,018	6,775,840	6,418,434	6,667,717
	Depreciation and amortization	6,745,358	7,057,435	8,077,395	9,304,887	10,557,113
	Others	4,950,415	3,770,614	4,708,643	3,566,673	4,796,948
	Total	22,001,925	21,829,049	25,769,137	23,697,238	26,991,015
Profit		191,957	2,184,469	292,001	867,463	3,749,855

(Source: Prepared by evaluator based on SONEB questionnaire responses)

Table 11 Water Charges Collected, Receivables, and Percentage Receivable in Glazoue and Dassa-Zoume

(Unit: CFA francs)

		2018	2019	2020	2021
Amount collected	Glazoue	26,482,882	37,146,990	39,038,325	33,658,690
	Dassa-Zoume	52,294,182	86,360,558	93,588,037	96,535,533
Accounts receivable	Glazoue	8,013,061	5,909,087	4,257,069	8,844,332
	Dassa-Zoume	4,289,098	8,895,606	5,451,671	26,430,832
Percentage of receivable	Glazoue	23%	14%	10%	21%
	Dassa-Zoume	8%	9%	6%	21%

(Source: Prepared by the evaluator based on information provided by SONEB<sup>41</sup>)

### 3.4.5 Environmental and Social Aspect

At the time of planning, the project was supposed not to have negative impact on the natural environment. Even after the project was handed over, there were no negative environmental or social impacts (JICA-provided materials, SONEB questionnaire responses, and actual inspections).

<sup>41</sup> In July 2022, DRAB presented another set of data, but only on the amount collected and not on the amount receivable; thus, we used the data from the questionnaire responses here.

#### 3.4.6 Preventative Measures to Risks

During the planning stage, the following five external conditions were assumed for achieving the overall project plan (Preparatory Survey Report, pp. 4-1, 4-2).

- (1) Public security in Benin, including the target areas, will not affect the implementation of the project
- (2) Financial status of SONEB will not deteriorate significantly
- (3) SONEB staff trained in the project will continue their work
- (4) No significant changes in Benin's water supply sector policy
- (5) No extreme deterioration of water quality or reduction of pumping rate at intake wells

Regarding (1), no deterioration in public security was observed from the time of planning to the time of ex-post evaluation. Regarding (2), the financial status of SONEB is good, as mentioned above. Regarding (3), the three staff members who received technical training through the soft component of the project are still engaged in operation and maintenance at the time of ex-post evaluation. Regarding (4), as confirmed in section 3-4-1, "Policy and Institutions," there have been no significant changes in Benin's policies in the water supply sector.

Finally, regarding (5), as indicated in the effectiveness section, the groundwater levels in wells drilled in the project decreased, and the amount of water withdrawn was not adequate as planned at the time of ex-post evaluation. Under these circumstances, staff at the Dassa-Zoume Branch pumped water while measuring the groundwater level in the wells and checking the amount of groundwater daily. In addition, well pumps were changed to smaller capacities when necessary due to the decrease in the groundwater level (interview with SONEB). The problem of infrequent measuring of groundwater level in Glazoue has already improved, meaning that the risk was appropriately managed to a certain degree.

#### 3.4.7 Status of Operation and Maintenance

At the time of ex-post evaluation, the facilities constructed under the project were generally adequately maintained, and there was no severe damage or loss.

As for the equipment provided, both water-quality analysis equipment and water-level gauges were used for daily operations and inspections. At the time of the defect inspection, the portable water level gauge was not functional at the Glazoue Branch, but at the time of ex-post evaluation, they were functional in both cities. However, the water level gauges of the elevated water tanks were not functioning in either city (actual inspection and interview with SONEB).

Part of the operation records, as well as the management ledger holding water levels and water quality data, was misplaced at the Glazoue Branch due to the retirement of a staff member (actual inspection, interview with SONEB). The executing agency was aware of the need to manage operation records, water levels, and water quality data and expressed the will to make

improvements. As a result, as of July 2022, operation records and water level and water quality data were recorded in the management ledgers in both cities (interview with SONEB).

From the above, while minor issues have been observed in the financial aspects, including the status of the operation and maintenance system, there are good prospects for improvement/resolution. Therefore, the sustainability of the project effects is high.

#### **4. Conclusion, Lessons Learned and Recommendations**

##### 4.1 Conclusion

The project aimed to increase water consumption in the target area by developing new water sources and constructing water supply facilities in Glazoue and Dassa-Zoume in the Republic of Benin. The project was consistent with Benin's urban water supply development policy and their development needs from the planning to the ex-post evaluation, of which the plans and approaches were appropriate. Considering the project is consistent with Japan's development policy and has been appropriately coordinated with other donors' projects with confirmed outcomes, the relevance and consistency have been highly assured. The efficiency is high because the output was almost as planned, the cost was within the plan, and the project period was kept slightly longer than planned. Regarding the effectiveness, neither city achieved the planned targets set by the project for "daily water withdrawal." This project indicator was not secured as planned due to a reduction in the groundwater level. Although the amount of water withdrawal in both cities increased compared to the plan, the amount of water supplied per capita decreased compared to the plan due to a significant increase in the number of individual hydrant subscribers and the population supplied with water. The project has been confirmed effective for reducing water fetching activities among children and women for households connected to individual hydrants after the project. Regarding the impact, the improvement of the sanitary conditions in the community and a decrease in the incidence of water-borne diseases have not been confirmed while the project's contribution to promoting women's participation in socio-economic activities through reducing the hours of water fetching activities was limited. Therefore, the empowerment of women was not confirmed. Project effects were confirmed for the improvement of children's school enrollment. Based on the above, the effectiveness and impacts of the project are moderately low.

Although slight issues have been observed in the financial aspects, including the status of the operation and maintenance system, there are good prospects for improvement/resolution.

Therefore, the sustainability of the project effects is high.

Based on the above, this project is evaluated to be satisfactory.



## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

The water-level gauge of the elevated water tank should be repaired as soon as possible, as it is a necessary piece of equipment for the proper operation and management of the pumps that supply water to the elevated water tank.

To secure the amount of pumped water, well diagnosis should be conducted by means of a pumping test, measurement of pumping capacity (or depth of burial), and in-well investigation by using well cameras; if there is a need to renovate the wells including casing and screen, renovation work through well cleaning should be conducted shortly.

Since the executing agency has a technical team that can operate well cameras, it would be helpful to have the participation of the technical team to investigate the well conditions using well cameras and make the necessary modifications.

### 4.2.2 Recommendations to JICA

JICA should provide appropriate technical assistance (e.g., dispatch of short-term experts) as necessary for the renovation of the wells, as mentioned in the recommendation to the executing agency.

## 4.3 Lessons Learned

### Consideration of operation and maintenance plans from a medium- to long-term perspective

In general, there is no high awareness of renovating wells in developing countries, and the wells are commonly re-drilled when the water supply stops. At the time of planning of the project, there was no company in Benin that owned well cameras, and no engineers were available. Therefore, the renovation using well cameras was considered unrealistic, and the executing agency received no explanation. However, the situation has changed by the time of ex-post evaluation, and the executing agency now has a technical team that can use well cameras. As described above, there are maintenance methods that may not be realistic at the time of planning but could be handled within the executing agency over the medium to long term. Therefore, it is expected that JICA will discuss the maintenance and operation plan after the provision of the facility with the executing agency; thereby, the executing agency will proactively consider introducing new maintenance methods from a medium- to long-term perspective at the time of planning.

## **5. Non-Score Criteria**

### 5.1 Performance

#### 5.1.1 Objective Perspective

The project consultant reported progress monthly to the JICA Benin Office and the JICA Financial Cooperation Implementation Department in Japan during the project implementation period. This ensured appropriate communication among all the parties concerned.

By considering the lesson learned from the existing projects, which is "it is important to investigate and design based on seasonal and interannual variations of groundwater, and to monitor the water supply to residents after the project is completed," pumping tests were conducted again during the detailed design study of the project, and the pump design was changed. In addition, the soft component was implemented for the executing agency to be able to monitor groundwater fluctuations over time after the project. At the ex-post evaluation, the executing agency measures groundwater levels continuously. The project was implemented based on the lessons learned from the existing projects, and it has contributed to improving the project's sustainability.

### 5.2 Additionality

None.