Federal Democratic Republic of Ethiopia

FY2015 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Rural Water Supply in Tigray Region"

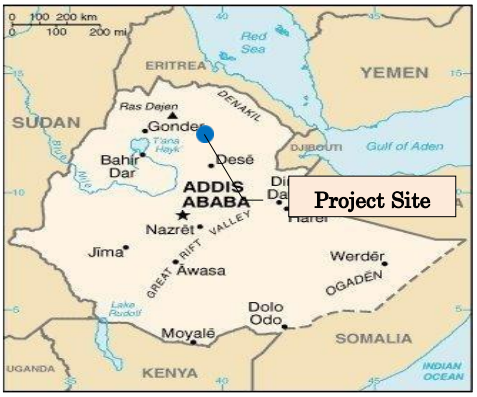
External Evaluator: Noriyo Aoki, Alfapremia Co.,Ltd.

0. Summary

This project aimed to develop water facilities to improve reliable access to safe drinking water in 91 villages across 10 districts in the Tigray Region. The project is highly relevant, as its contents are consistent with both the prioritized areas of the development policies of Ethiopia and the Japanese ODA policy, with the great need for development. The efficiency is low in terms of contents cost and time period, significantly exceeding the plan due to unfavorable outcomes in the bidding process. The project effects expected in the planning stage have been observed: The target water supply population was achieved at the time of ex-post evaluation, and safe, stable water supply was secured in general. With greater volume of water, improved water quality and improved hygiene behavior, water-borne illnesses decreased, and productive activities increased on account of reduced time spent on water-fetching labor. The project has high effectiveness and impact, as demonstrated by improvements in the living environment. Under the supervision of the Regional Water Resources Bureau, adequate maintenance structures are established at every level, and monitoring and reporting systems are also functioning. Financials are favorable at every level and future budgets are expected to be allocated sufficiently; thus, future financials are likely to be sustainable. The technical level of the staff at the District Water Resources Offices and elsewhere is strengthened, enabling them to address on-site problems immediately. The implementing agency recognizes the need to provide refresher trainings (re-training) for technical staff in committees, and the District Water Resources Offices plan training sessions and execute them periodically. The maintenance status is favorable as a result of these initiatives, and the sustainability of the effects generated by the project is high.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Location

Hand-pumped Water Fetching Site
(Enderta District)

1.1 Background

Ethiopia is a landlocked country located at the heart of the "Horn of Africa" in East Africa, with an area of 1.127 million km^2, a total population of 99.39 million, and a 2.5%[1] population growth rate. The project target area, the Tigray Region, is located in northern Ethiopia at the western edge of the Great Rift Valley, and its total population was estimated to be 6.31 million[2] in 2014. Its topography includes mountainous regions and plateaus at an altitude around 2,000 m. Annual average precipitation is 200-800 mm, with much of the precipitation concentrated in the wet season from June to September. As a result, most rivers in the region are seasonal rivers that flow exclusively in the rainy season. The region is known for its serious drought damages, and all 10 districts selected for the project are classified as drought districts[3].

1.2 Project Outline

Reliable access to safe water is improved by development of water facilities in 91 villages[4] across 10 districts in the Tigray Region, thereby contributing to improving the livelihood environment.

E/N Grant Limit or G/A Grant Amount /Actual Amount		1st Detailed Design - 6 million yen / 26 million yen 1st Construction and Equipment －737 million yen / 4 million yen 2nd Detailed Design -104 million yen / 0.9 million yen 2nd Construction and Equipment－1,264 million yen / 1,151 million yen
Exchange of Notes Date (Grant Agreement Date)		1st Detailed Design - Dec. 2007/Dec. 2007 1st Construction and Equipment － Jun. 2008/Jun. 2008 2nd Detailed Design - Feb. 2010/Feb. 2010 2nd Construction and Equipment － May 2010/May 2010
Implementing Agency		National State of Tigray, Water Resources, Mines and Energy Bureau (planning stage) Name changed on Oct. 2010 National State of Tigray, Water Resources Bureau (ex-post evaluation stage)
Project Completion Date		Completed Jan. 2013 Completion of soft components Apr. 2013
Contractors	Main	Construction: Tone Engineering Co., Sato Kogyo Co., Ltd. Equipment: Toyota Tsusho Co.
	Consultant	Kokusai Kogyo Co., Ltd.
Basic Design		Basic Design Study on Project for Rural Water Supply in Tigray Region Dec. 2006 Implementation Review Study on Project for Rural Water Supply in Tigray Jul. 2009
Detailed Design		1st Detailed Design Study on Project for Rural Water Supply in Tigray Region Dec. 2007 2nd Detailed Design Study on Project for Rural Water Supply in Tigray Region Feb. 2010

[1] World Development Indicators Database, World Bank (July 2016).
[2] Estimation based on 2007 Census by the Ethiopian Central Statistical Agency.
[3] The districts in which water shortage is significantly severe and livestock and crops are as vulnerable as people (definition by the Ethiopian Ministry of Water, Irrigation and Energy).
[4] There are 97 settlements. The smallest administrative unit is the village.

Related Projects	Technical Cooperation Project "Groundwater Development and Water Supply Training Project" (Phase 1) (1998-2005) Technical Cooperation Project "Ethiopian Water Technology Center Project" (Groundwater Development and Water Supply Training Project) (Phase 2) (2005-2008) Technical Cooperation Project "Ethiopian Water Technology Center Project Phase 3" Groundwater Development and Water Supply Training Project (Phase 3) (2009-2013)

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriyo Aoki (Alfapremia Co., Ltd)

2.2 Duration of Evaluation Study

Studies for this ex-post evaluation were conducted during the following periods:

Duration of the Study: October 2015 –February 2017

Duration of the Field Study: February 18 – March 2, 2016; May 27 – June 1, 2016

2.3 Constraints during the Evaluation Study

During the study, the location for some of the facilities could not be identified from its district name, village name, and facility ID alone. This problem affected the efficiency of the study because it took time to physically find the facilities during the visits. After three to four years since completion of the project, name plates for the facilities were faded, damaged, or even removed. These name plates contained technical information, such as the drilling depth and moving water level during drilling, which would be important in determining the cause of non-function or in predicting future possibility of operation after repairs. The difficulty in identifying facilities became a constraint upon analyzing the sustainability of the project during the evaluation.

3. Results of the Evaluation (Overall Rating: B)[5]

3.1 Relevance (Rating: ③)[6]

3.1.1 Relevance to the Development Plan of Ethiopia

The government of Ethiopia identified the promotion of water resource development as a high-priority subject in its national five-year development plan (Plan for Accelerated and Sustained Development to End Poverty [PASDEP], 2005-2010)[7]. A national strategy that aligns with the Millennium Development Goals proposed by the United Nations, "Universal Access Plan" (UAP), was also formulated in 2005 as a national plan for the water sector. UAP defined the volume for rate of rural water supply as 15 L/day per person, and set the goal of raising the national rate of rural water supply from 35% (2005) to 98% by target year, that is, 2012. The Tigray Region set its own target at 88% by 2012, lower than that of UAP, based on

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

[6] ③: High, ②: Fair, ①: Low

[7] Implementation Review Study Report on Project for Rural Water Supply in Tigray P.S-i

the lower rural water supply rate at 33% across the region.[8]

At the time of the ex-post evaluation, supply of safe drinking water was positioned as a strategically important subject. It was identified as essential for socio-economic development, improved quality of peoples' livelihood, and reduction of poverty by a new national five-year development plan formulated in 2010, the "Growth and Transformation Plan" (GTP, 2011-2015). A new target rate for rural water supply was defined in the GTP, and the definition of rural water supply rate was updated to 15 L/day per person (within 1.5 km radius). A target for rural water supply rate, similar to that of the GTP, was also set in the updated UAP (2011), the national plan of the water sector.

GTP II (2016-2020) began in 2016 with a new target for rural water supply rate and the volume of rural water supply was defined as 25 L/day per person (within 1.0 km radius). The Tigray Region set its new target to 85% by 2020 to be increased from its rural water supply rate of 49% in 2016 under the new definition, and is planning additional facility construction and expanding its staffing accordingly[9].

In light of the above, this project was consistent with the development policies of the government of Ethiopia at the time of planning and at the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of Ethiopia

At the planning stage, many residents in the project target area had no choice but to use unhygienic water due to chronic water shortages, and therefore suffered from water-borne illnesses. The necessity of water-fetching labor that consumed many hours affected the livelihood of women and children. Water shortage in the target area was an urgent problem. Therefore, it was regarded as highly urgent need.[10]

At the time of the ex-post evaluation, the needs identified at the planning stage were satisfied by this project, which will be discussed later in detail in the section for effectiveness.

While there are demands for additional facilities to achieve the new target rural water supply rate set by GTP II, the highly urgent development needs identified in Tigray Region at the planning stage were satisfied by the project at the time of the ex-post evaluation, and the project priority and selected target area are deemed highly relevant.

3.1.3 Relevance to Japan's ODA Policy

The Japanese government selected "environmental conservation" as a priority area for assistance in its "Country Assistance Program for the Federal Democratic Republic of Ethiopia," formulated in August 2000, and stated that it would extend water and sewage water development assistance. At the Third Tokyo International Conference on African Development (TICAD III, 2003), the need for specific assistance in water resource development and water supply was reinforced in two of the three emphasized fields in the Japanese Assistance for

[8] Implementation Review Study Report on Project for Rural Water Supply in Tigray P.1-2. Comparison of quantitative data before and after the project was not possible due to lack of quantitative data on the needs of the target area (target settlements, etc.) at the planning stage.

[9] Interview survey with the Regional Water Resources Bureau

[10] Implementation Review Study Report on Project for Rural Water Supply in Tigray P.1-2.

Africa, “human-centered development” and “reduction of poverty by economic growth”.

In view of the above, the implementation of the project is in full conformity with the development policies and development needs of Ethiopia, as well as with Japan’s assistance policy; therefore, its relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

Table 1 shows the outputs developed and provided by Japan, Table 2 shows the procured equipment provided by Japan, and Table 3 shows the outputs developed and provided by Ethiopia.

Table 1 Outputs developed and provided by Japan (planned vs. actual)

Item	Plan		Actual
Number of hand pump wells (level 1): 82			
77 villages	Water source	Wells built: 82	As planned
(82 settlements)	Facility	Hand pumps attached: 82	As planned
		Platforms: 82	As planned
Powered pump-based piped water facility (level 2): 9			
11 villages	Water source	Wells built: 6	As planned
(12 settlements)		Use of test wells: 3	As planned
	Reservoir	Above-ground reservoirs: 10	As planned
		Overhead tanks: 1	As planned
	Machine room	Power generator rooms: 6	As planned
		Pressurized pump rooms: 1	As planned
		Switchboard rooms: 3	As planned
	Pipeline	Water supply: GS/DI 23.6 km Water distribution: GS/DI 11.8 km	As planned
	Power installation	Exchange and installation of power generators: 3 Exchange and installation of submersible pumps: 3	As planned
	Power source	Diesel generators: 6 Secondary wiring of commercial power: 4	As planned As planned
	Public faucet	Public faucets: 22	As planned
	Water fountain for livestock	Water fountains for livestock: 9	As planned
Improvements to existing powered pump-based piped water facilities (level 2)			
3 villages	Reservoir	Overhead tanks: 3	As planned
(3 settlements)	Machine room	Power generators: 3	As planned
	Pipeline	Water supply: GS 0.045 km	As planned
		Water distribution: GS 0.47 km	As planned
	Power installation	Exchange and installation of power generators: 3	As planned
		Exchange and installation of submersible pumps: 3	As planned
	Public faucet	Additional installation of public faucets: 3	As planned
	Water fountain for livestock	Water fountains for livestock: 3	As planned

Source: Interview survey with the Regional Water Resources Bureau, Implementation Review Study Report on

Soft component deliverables (workshop reports; usage rules; operation and maintenance plans, including plan of action for malfunctions; activity reports; monitoring results evaluations; training reports; and records of health patrols and instructions) were submitted as planned. Hygiene education reports were embedded within the training report.[11]

Table 2 Procured equipment provided by Japan (planned vs. actual)

Item	Plan	Actual
1) Well repair equipment		
	1. Service rig[12]: 1	As planned
2) Equipment for pumping tests		
	1. Crane truck: 1	As planned
	2. Submersible pump: 1	As planned
	3. Power generator: 1	As planned
	4. V-notch weir: 1	As planned
	5. Water gauge: 1	As planned
	6. pH meter: 1	As planned
	7. Electrical conductivity/TDS meter: 1	As planned
	8. ORP meter: 1	As planned
	9. Turbid meter: 1	As planned
3) Equipment for construction and transportation		
	1. Crane trucks: 2	As planned

Source: Interview survey with the Regional Water Resources Bureau, Implementation Review Study Report on Project for Rural Water Supply in Tigray, JICA provided documents

Table 3 Outputs developed and provided by Ethiopia (planned vs. actual[13])

Plan	Actual
1) Acquisition of construction sites	As planned
2) Construction of access roads	As planned
3) Provision of property for temporary residence during construction	As planned
4) Construction of fences and gates	Almost as planned[14]
5) Installation of motor pump and generators for rehabilitation work	As planned
6) Installation of power transmission and distribution lines	As planned
7) Coverage of government staff's expenses for onsite activities, transportation, lodging, and allowances	As planned
8) Requests to the central government and acquisition of approval for activities with EWTEC[15]	Partially completed
9) Coverage of expenses related to EWTEC and human resource provisioning for training (daily allowance, transportation fees)	As planned

Source: Implementation Review Study Report on Project for Rural Water Supply in Tigray P.3, 65-73; interview surveys with relevant parties; documents provided by implementing consultants.

Most items under Ethiopia's responsibility were completed.

[11] Implementation Review Study Report on Project for Rural Water Supply in Tigray , JICA provided documents, interview surveys with the Regional Water Resources Bureau, etc.

[12] Excavator for repairing non-operating wells.

[13] Information on expenditures related to these outputs was not obtained (questionnaire survey with the Regional Water Resources Bureau).

[14] Fences were to be built by the residents in this project.

[15] EWTEC (Ethiopian Water Technology Center) is a technical professional training center from phase 1 of the "Groundwater Development and Water Supply Training Project" started from 1998, which continued on to phase 2 and phase 3. Refer to the "Related Projects" row on P.2.

A design change was made for the site which had to build a 3 km access road to the well , and was judged to be beyond the development capability of the district and target village; as a result, the well site was changed to a nearby village, but its influence on the project effect is not confirmed. Changes in well location from unsuccessful wells to successful wells were made within the same village in the same district, and were thus implemented with maximum attention to the local conditions.[16] Some of the water supply pipes had to be extended due to changes in the position of well drilling, which slightly affected the amount of work, but not the construction period or cost.[17] Therefore, no influences on the project cost and period resulted from changes in design.

At the time of project implementation, the Tigray regional government sent its staff to the Ethiopian Water Technology Center (EWTEC) for training in coordination with the project, to ensure that staff learned the necessary water supply techniques for maintenance works.

The capacity building activities for operation and maintenance (hereafter referred to as ‘’soft component’’) were generally executed as planned. Soft component activities included awareness-raising workshops with participation from village water committees[18] and other water committees[19] (both hereafter referred to as “committees”); formulation of operation and maintenance plans including rules of use and plans of action in case of malfunction; technical workshops on facility repair for facility managers within committees; and hygiene education, health hygiene patrol and instructions for residents. The original plan for technical workshops on facility repair was to be conducted by the Japanese consultants with support from EWTEC or EWTEC trainees, but the construction contractors provided technical instructions during construction. Residents and committees alone were the intended participants in the training for resident meetings and resident participation, but according to the interview survey, the village council also participated as an observer.

3.2.2 Inputs

3.2.2.1 Project Cost

Based on the Basic Design Study, this project planned to conduct detailed design in 2007 and build facilities in 2008 and 2009. Bidding took place three times in July 2008, September 2008, and December 2008, but all instances were unsuccessful; the project was thus cancelled, as completion of the project within the timeline defined in the E/N became impossible. Following the results of the Implementation Review Study of the project and a conclusion of the E/N in January 2010, the project was confirmed for re-implementation.

Based on this course of events, because costs were incurred since the initial planning stage, this evaluation combined the planning cost of 26 million yen for the detailed design from December 2007 (item 1 in Table 4) with the planning cost of 737 million yen (item 2 in Table

[16] JICA provided documents and interview survey with implementing consultants.
[17] Implementing consultants.
[18] Committees responsible for operation and maintenance of piped water facilities. Specifically, committees consisting of users from areas covered by piped water facilities. Depending on size, a committee may reflect a settlement level or a village level.
[19] Committees responsible for operation and maintenance of hand pump wells. Specifically, committees consisting of hand pump users near the hand pump well facilities.

4) for construction, yielding a total planning cost of 789 million yen. Actual cost incurred was calculated by adding the Detailed Design cost of 26 million yen (item 5 in Table 4); the actual cost from the cancelled construction[20], 4 million yen (item 6 in Table 4); the amount spent on investigations for specific planning after E/N conclusion in January 2009 (item 7 in table 4), 90 million yen; and construction cost 1.151 billion yen which started from May in 2010 (item 8 in Table 4), for a combined total of 1.271 billion yen (161% of the planned cost). This amount significantly exceeded the plan.

Table 4 Timeline for Detailed Design and implementation of the project

	E/N Concluded	Status	Planned Cost	Actual Amount
Dec. 2007	Detailed Design	Completed	26 million (1)	26 million (5)
Jun. 2008	Construction	Cancelled due to unsuccessful bidding	737 million yen (2)	4 million yen (6)
Feb. 2010	Detailed Design	Completed	104 million yen (3)	90 million yen (7)
May. 2010	Construction	Completed	1.264 billion yen (4)	1.151 billion yen (8)

Source: JICA provided documents

Comparison of the soft component input plan and the actual values shows that while the plan was 4 MM (man-months) for Japanese experts and 12 MM for local consultants, for a total of 16 MM,[21] actual result was 5 MM for Japanese experts and 26 MM for local consultants, where MM for local consultants increased by 14 MM.[22] A major reason for the increase was uninterrupted implementation of soft component activities such as monitoring at each target site during a period during which procurement of materials and equipment for the piped water supply system was delayed. Additionally, MM at the planning stage did not account for geographic accessibility or telecommunication difficulties, which resulted in a need for higher MM during execution of planned activities. As a result, total MM increased, but because the increased local consultant MM costs were covered by the implementing consultant's own cost, project costs were not affected.[23] It should be noted that the project cost covered by the Ethiopian side could not be verified.

3.2.2.2 Project Period

From the initial E/N conclusion in December 2007 to completion of construction in December 2012 and then to completion of soft components in April 2013, the project took 65 months. Given that the initial plan was designed to last 27 months, actual time spent was 241% greater than the plan, significantly exceeding the planned project period. Project period excess was due to three rounds of unfavorable bidding.

In light of the above, both the project costs significantly exceeded the planned total and the project period exceeded the planned term; therefore, the efficiency of the project is low.

[20] Costs related to bidding for the project construction.
[21] Implementation Review Study Report P.3-72,73.
[22] JICA provided documents.
[23] Interview survey with implementing consultants.

3.3 Effectiveness (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

This project uses water supply population utilizing facilities as its major indicator, and evaluates effectiveness based on the operation rate of the facility, improvements in water quantity and quality, and so on.

The definition of water supply rate in Ethiopia varies depending on the formulation period of water sector policies. This project defines water supply population[24] as the effective indicator, verifying actual values by re-configuring the baseline and target values at the ex-post evaluation. Changes in the definition of water supply rate in Ethiopia do not affect the indicator of water supply population as the major indicator.

3.3.1.1 Water Supply Population

Target values for water supply population in the planning phase had used the 2006 village population taken from the data in the request document, and made calculations with consideration for rate of population increase. Values calculated at the ex-post evaluation had to use a similar data acquisition method, but because settlements are lower in level than administrative villages, population data could not be obtained; additionally, given that these settlements have undergone new deep well construction in recent years to improve water supply rate, and that it is difficult to assess the number of facilities outside of the project, beneficiary population of the project could not be extracted.

In lieu of this, target value and actual value for increase in water supply population were calculated by adding the population that uses each hand pump wells and piped water facilities built by the project.[25] According to these calculations, target water supply population by this project was 38,347. Given that the water supply population[26] three years after completion of the project was 40,266 (based on the information collected at the ex-post evaluation), the project was deemed to reach a target achievement rate of 105%.

Table 5 Major effect indicator of this project (units : persons)

Indicator	Baseline	Target	Actual	Actual
	2009	2013	2013	2016
	Planning Year	Year of Completion	Year of Completion	3 Years after Completion
Water Supply Population	0	38,347	N/A	40,266

Note: Water supply population is defined as the population able to access safe water. Base water supply unit is 15 L/person/day.

Source: Implementation Review Study Report on Project for Rural Water Supply in Tigray, documents provided by JICA, and reports from the District Water Resources Offices

[24] Population able to draw water more than 15 L/day per person.

[25] Water is supplied to 5,547 people by hand pump wells (5,309 from increased population by new facilities and 238 from refurbished facilities). Calculation of expected water supply population assumes that one hand pump well supplies 400 people (3-26 design standard from the Implementation Review Study Report); 400 people x 82 wells = 32,800 people; and the project's expected water supply population is 38,347.

[26] Since the telecommunications environment is poor in the target area, CD-ROMs with a list of questionnaire items on water supply population by facility were distributed to the District Water Resources Offices. The CD-ROMs were collected after the responses were recorded, and the results were aggregated.

3.3.1.2 Rate of facility operation[27]

The number of hand pump wells was 82 and the number of piped water facilities was 12, for a total of 94 facilities. Of these, 76 were in operation at the ex-post evaluation, meaning that overall operation rate was 81%. Drought persisted for several years leading up to the time of ex-post evaluation (conducted three years after the project's completion), and the number of unavailable facilities was on the rise, especially during the first on-site surveys, due to lower groundwater level. Of the 16 non-operating hand pump wells, 12 were non-operating because of lowered groundwater level.[28] Factors such as lowered groundwater level are external conditions, but the operation rate was nevertheless 80%, showing that sufficiently high project effectiveness.

Table 6 Number of water facilities and

Indicator	Target	Actual	Actual	Actual
	Year	2013	2013 and 2014	2016
	Time	Completion	Defect Inspection	Ex-post Evaluation
	Years of Completion	Year of Completion	1-2 Year after Completion	3 Years after Completion
Hand Pump Wells	82	82 (100%)	82 (100%)	66 (81%)
Piped Water Facilities	12	12 (100%)	11 (92%)	10 (83%)
Total and Average Rate of Operation	94	94 (100%)	93 (99%)	76 (81%)

Source: Responses to questionnaires sent to the District Water Resources Offices, and documents provided by JICA

According to the beneficiary survey[29] with water committees on operating facilities, 87% reported that their facility had not malfunctioned in the three to four years since completion of the project.

3.3.1.3 Improvements in Water Quality and Volume

According to the results concerning water quality in the beneficiary survey of water users, turbidity, smell, and taste improved significantly. For water volume, 97% of survey respondents indicated that it was "improved." As shown in Table 7, 63% of previously used

[27] The definition of "operating" is having the capability to draw water, regardless of volume or quality, (i.e., "usable"). Rate of operation was calculated as number of operating facilities ÷ total number of facilities.

[28] Reasons for non-operation other than decreased groundwater level were delayed procurement of spare parts (2 facilities); need for repair of hand pump wells manageable at the district level (2 facilities); and for piped water facilities, breakdown of power generators (difficulty in procuring spare parts, because the manufacturer is foreign) or malfunction of power pumps (difficulty in procuring spare parts, because the manufacturer is foreign).

[29] Two types of beneficiary surveys were conducted. One surveyed water users, and the other the water committees or village water committees. In this report, the former is referred to as "the beneficiary survey with water users," and the latter as "the beneficiary survey with committees." Face-to-face interview surveys were conducted using different questionnaires. Target sites covered all 10 districts and selected operating facilities to compare status before and after the project. By consulting with the District Water Resources Offices, taking into account accessibility and local security, and planning a route maximizing the number of sites surveyed within the time allotted for onsite surveys, 55 facilities in 46 out of 91 villages were visited, and 147 samples for water users were extracted. No more than five samples from a single facility were taken, and they were randomly extracted in layers with minimal bias in terms of age group or sex. One sample was extracted per facility from all 55 facilities for committee samples. Of the 55 extracted samples, 50 contained valid responses. Attributes of water users were as follows: 24% teenagers, 25% in their 20s, 23% in their 30s, 12% in in their 40s, 13% in their 50s, 1% in their 60s, 1% in their 70s or above; 34% male and 65% female. Attributes of committees were as follows: 28% in their 30s, 41% in their 40s, 20% in their 50s, 9% in their 60s, 9% in their 70s or above; 67% male and 33% female. The ratio of organizational attributes was 80% for village water committees and 20% for water committees. 47% of respondents were committee heads, 26% treasurers, 2% caretakers or operators, 2% cleaners, 15% security guards, and 4% others.

water sources were rivers or streams. Protected shallow wells accounted for 20% of the previously used water sources.

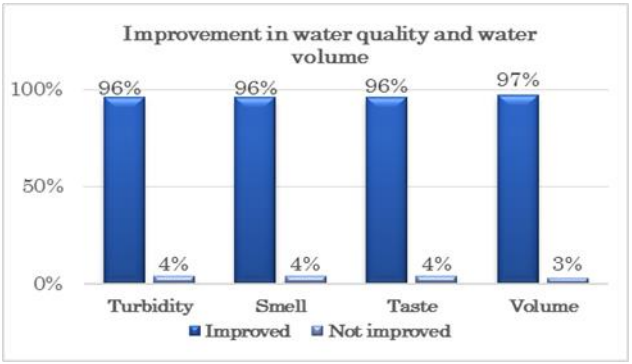


Chart 1 Improvement in Water Quality and Water Volume
Source: beneficiary survey of water users

Table 7 Previously used water sources (multiple responses)

Water Source	Responses	Ratio
Rivers or Streams	93	63%
Protected Shallow Wells	29	20%
Unprotected Shallow Wells	4	3%
Spring Water	5	3%
Purchased Water Tanks	0	0%
Others (Usually Ponds)	16	11%

Note: Users may have had access to multiple water sources.
Source: Beneficiary survey of water users.

3.3.1.4 Decrease in Time Spent Fetching Water

Time and travel distance required for water-fetching labor were significantly shortened for water users. 50% of water users said that time was shortened by 1 hour to 2 hours. About 10% of water users said the time was shortened by 2 to 3 hours, and 5% said between 3 to 4 hours.

Table 8 Shortened time and distance for water-fetching labor

	Shortened	Not Shortened
Distance	99%	1%
Time	97%	3%

Source: Beneficiary survey of water users

Table 9 Shortened time

Shortened Time/Day	Ratio
Not Shortened	3%
A Few Min to 30 Min	22%
30 Min to 1 Hour	8%
1 Hour to 2 Hours	50%
2 Hours to 3 Hours	10%
3 Hours to 4 Hours	5%
4 Hours to 5 Hours	1%
Other	1%

Source: Beneficiary survey of water users

3.3.1.5 Number of Established Committees, Rate of Water User Fee Collection

At the time of the ex-post evaluation, the establishment rate of committees for hand pump wells was 88%, and establishment rate of village water committees for piped water source facilities was 92%. The water user fee collection rate for established committees was 100%. The water user fee collection rate for the entire project, including non-available facilities, was 88% (83 of 94) at the time of the ex-post evaluation, and was thus considered to be high.

Table 10 Committees established in the project (number of committees/number of facilities)

Indicator	Target	Actual	Actual	Actual
	Year	2013	2013 and 2014	2016
	Time	Completion	Defect Inspection	Ex-post Evaluation
	Years of Completion	Year of Completion	1-2 Year after Completion	3 Years after Completion
Number of Committees Established				
Hand Pump Wells	82	82 (100%)	82 (100%)	72 (88%)
Piped Water Facilities	12	12 (100%)	11 (92%)	11 (92%)
Number of Committees Collecting Fees				
Hand Pump Wells	82	82 (100%)	82 (100%)	72 (88%)[30]
Piped Water Facilities	12	12 (100%)	11 (92%)	11 (92%)[31]

Source: Basic Design Study documents, documents provided by JICA, responses from the District Water Resources Offices

3.3.2 Qualitative Effects (Other Effects)

3.3.2.1 Volume of Water

Of the operating facilities, some hand pump wells experience water shortages during the dry season. Piped water facilities are able to supply water stably during both dry and wet seasons. Water is secured consistently by adjusting the running time for the power pump based on the judgment of the village water committee responsible for the maintenance of the piped facility. There are no problems with water pressure at the faucets. Drought was not observed during the dry seasons in piped water facilities.

3.3.2.2 Transition to Safe Water-Fetching Ways

Hand-dug, unprotected wells[32] are few in the Tigray Region because the position of water sources are deep. Falling accidents at rivers during water-fetching were reported in the past, as 63% of the previously used water sources were rivers and streams (according to the results of the beneficiary survey). Completion of the project secured safety in water-fetching labor.[33]

3.3.2.3 Rehabilitation of Facilities beyond the Project Scope

According to the Regional Water Resources Bureau, the service rig provided by the project to fix non-operating wells improved the number of wells repaired annually across the Tigray

[30] Fees continued to be charged at non-operating facilities to fund their repair.
[31] Fees continued to be charged at non-operating facilities to fund their repair.
[32] Refer to Table 6 for previously used water sources.
[33] Interview surveys with the District Water Resources Offices.

Region from 0 per year to 54 per year, contributing to improvement in well operation across the region.

3.4 Impacts

3.4.1 Intended Impacts

3.4.1.1 Improvements in Hygiene Activities Related to Water Use

According to the beneficiary survey with water users, 99% of respondents indicated that "awareness on water usage and sanitation has improved." Specifically, as shown in Table 11, the improvement rate of "increased hand washing" was highest. The rates of "increased washing clothing" and "Increased body washing" also illustrate changes in sanitation activities due to increase in usable water. "Increased boiling water" rate remains low, but according to the interview survey with the water resource office and the local water supply expert, this is perhaps related to accessibility of fuel.

Table 11 Shift in Hygiene Activities (multiple responses)

	Responses	Ratio
Increased Hand Washing	131	89%
Increased Body Washing	86	59%
Increased Washing Clothing	67	46%
Increased Boiling Water	11	7%

Source: Beneficiary survey with water users

3.4.1.2 Decrease in Water-borne Disease[34]

99% of water users reported in the beneficiary survey that water-borne disease had decreased. In an interview at the town of Gerjele in Alamata District (piped water facility, 3 public faucets, water supply population 1,640), a health center staff member said that the occurrence of diarrhea and dysentery decreased significantly as a result of this project.[35]

3.4.1.3 Use of Excess Time Generated by Shortened Water-Fetching Labor

Beneficiaries use the time gained from reduction in time required for water-fetching labor, a result of this project, for agricultural activities, non-agricultural income-generating activities, and community activities. According to the results of beneficiary survey of water users, 81% of multiple respondents said that they use the excess time for agricultural work, and 73% of multiple respondents use the time for non-agricultural income generating activities. 53% of multiple respondents answered they use the time for community activities.[36]

3.4.1.4 Impact on Children in Water-Fetching Labor

[34] Includes illnesses or infections spread by water, such as parasites.

[35] 1,640 beneficiaries of piped water facilities from the project reside in the surveyed target area, which was chosen because it was deemed sufficiently large to clearly assess changes in conditions surrounding the beneficiaries. In other areas, locations with large enough numbers of beneficiaries for similar interview surveys could not be found.

[36] For the utilization of the excess time by disaggregating gender, 54% out of total women's respondents said they engage in agriculture work. 82% of total women's respondents said they use the time for non-agricultural income generating work. It can be concluded that reduction of women's water-fetching labor has an effect contributing to income generating activities.

According to the results from the beneficiary survey of water users, 99% said that the role of children in water-fetching labor itself has not changed, but that the project did have an impact. 43% also indicated that time spent studying increased as a result of reduced water-fetching labor time requirements.

3.4.1.5 Impact on Other Village Activities by Residents

During the interview, village water committees and water committees stated that villagers began participating in mutually supportive activities with a sense of responsibility as a result of the establishment of a villager-based operation and maintenance system. In the beneficiary survey with water users, 84% responded positively to the question asking whether they observed or felt that community activities had become more prominent as a result of this project. As stated in the section of 3.5.1.2.3. Village Water Committee and Water Committee, since the project set a basic principle of equal participation by men and women, the project promoted women to participate in decision-making for formulating regulation on operation and maintenance, and to become members in committees, thus women actively get involved in operation and maintenance.

3.4.2 Other Positive or Negative Impacts

3.4.2.1 Impact on the Natural Environment[37]

According to the interview with the District Water Resources Offices, there were no impacts such as ground subsidence by the project. The regional environmental protection bureau conducted a region-level environmental monitoring project during construction and after start of facility use, and determined that there was no negative impact to the environment as a result of this project.[38]

3.4.2.2 Resettlement and Land Acquisition

This project did not cause any resettlement or land acquisition.[39]

3.4.2.3 Impact of Construction on Nearby Residents

There was no impact on irrigation wells, water rights, water use, or other wells. During construction, following discussions with the residents, construction work inside farm fields was conducted during non-planting periods. Upon selecting the location for well drilling, work was done during the day to minimize the impact of noise and vibration to the surrounding area, based on explanations made to and discussions with the nearby residents.

In light of the above, this evaluation verifies that the major water supply population target was achieved, and that effects of the project's implementation were as planned, such as improvement of water volume and quality, reduction of time and travel distance required for

[37] There was a possibility that EIA report was described in the Basic Design. It was confirmed whether the implementing consultant and implementing agency might have information on EIA. However, it was not possible to obtain it.

[38] Interview surveys with the Regional Water Resources Bureau.

[39] Interview surveys with the Regional Water Resources Bureau.

water-fetching labor, and securement of safety in water-fetching labor. Additionally, incidence of water-borne disease decreased, hygiene behavior improved, and productive activities increased as a result of the reduced time required for water-fetching labor; the impact on the living environment is being generated. Therefore, the effectiveness and impact of the project are evaluated to be high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

Table 12 shows the maintenance structure organized by departments relevant to water supply facilities, and the distinct roles and responsibilities of technical staff; roles are defined at every level.

Table 12 Maintenance structure, and roles and responsibilities of technical staff at each level

	Roles and Responsibilities	Communication System, etc.
Regional Water Staff[40]	Conducts large-scale repairs and repairs too complex for the District Water Resources Offices; supplies spare parts to the District Water Resources Offices	Monitoring and reporting system is functioning, and all facility updates are acquired monthly at the regional level
District Water Staff	Provides operational support for spare parts revolving funds[41]; provides district technical staff to conduct repairs	
Technical Experts (Village)	(One allocated per 3 villages) Provides monitoring and instruction on technical matters in facility operation and maintenance; reports facility status to the District Water Resources Office monthly	
Village Water Committee (1)	Operates and maintains facilities; collects user fees	
Water Committee (2)	Operates and maintains facilities; collects user fees	

Notes: (1) Village water committees are responsible for most maintenance in piped water facilities. User groups maintain the public faucets at the end. (2) Committees set up for each hand pump well comprising of users for operation and maintenance.
Source: Interview surveys with the Regional Water Resources Bureau and District Water Resources Offices

3.5.1.1 Regional Water Resources Bureau

The implementing agency was renamed in October 2010 from the "Regional Water, Minerals, and Energy Bureau" to the "Regional Water Resources Bureau." The Regional Water Resources Bureau consists of five departments: the water supply department, water resource management department, irrigation department, administrative department, and coordination department. The water supply department includes the survey and design assessment division, the construction supervision division, and the monitoring, support, and maintenance division. The Regional Water Resources Bureau underwent organizational reform in October 2008 in an attempt to improve the organization's efficiency; instead of conducting lay-offs, it expanded its

[40] Includes staff from the Regional Central Workshop.
[41] A system in which the District Water Resources Offices increase profit by selling spare parts supplied to the region by donors and NGOs; these profits are allocated to cover costs when large-scale repairs are needed. There are cases in which the District Water Resources Offices run the operation, and cases in which village water committees run it.

staff, enabling it to handle necessary operations. The Regional Water Resources Bureau exerts a strong supervising influence over the District Water Resources Offices.

The Regional Central Workshop is a unit within the water supply division of the Regional Water Resources Bureau. It employed eleven technicians at the time of the ex-post evaluation. The Regional Central Workshop assists with repairs that are too difficult for the District Water Resources Offices to handle independently. Specifically, the technical staff repair electrical control panels, submersible pumps, wells, and power machines, etc.[42]

Table 13 Transition in number of technical staff at each level (units: persons)

	Planning	Ex-post Evaluation	Future Plan
Year	2009	2016	2019
Regional Technical Staff	56	87	131
District Technical Staff (1)	3-6	9-14	18-20

Note: (1) District technical staff are also responsible for irrigation and energy areas. They specialize in areas such as hydrogeology, electrical engineering, environmental management, water resource management, and water administration; 1-2 engineer-level technical positions are also assigned to strengthen the district office's capabilities.
Source: Interview surveys with the Regional Water Resources Bureau and District Water Resources Offices

3.5.1.2 District Water Resources Offices

The District Water Resources Offices are organizationally positioned as offices under the District Government, but in technical and staffing terms, they are local supervised branches of the Regional Water Resources Bureau. Irrigation and energy staff also work at the District Water Resources Offices, assuming multiple responsibilities as needed. Staff specialize in areas such as hydrogeology, electrical engineering, environmental management, water resource management, and water administration, and an additional 1-2 engineer-level technical staff positions are also assigned, strengthening the functions of the office. According to the Interview with the offices, the 9-23[43] water supply points[44] were assigned to each staff member specializing in water supply at the time of ex-post evaluation. The number of staff will increase as additional facilities are built under the GTP II plan, and the number of water supply points assigned per staff member will even out.

At the time of planning, District Water Resources Office staff communicated with the committees only when facilities broke down at a level beyond the committee's capacity to respond. No periodical patrol was conducted by District Water Resources Office staff. A technical expert position was assigned to the office in 2014, responsible for visiting villages and monitoring the water supply facilities, irrigation facilities, and energy-related facilities at least once a month, and for reporting from the district to the region. One technical expert is assigned per village, and assists in solving technical problems that cannot be addressed by the committee alone. According to the interview with the District Water Resources Offices,

[42] EWTEC offers an electrical machine maintenance course (basic course and advanced course), allowing regional-level technical staff to learn technique for electrical repairs of submersible pumps and control panels. According to the interview with Regional Central Workshop, some staff from the Tigray Regional Central Workshop attended the courses.
[43] Compared to the number of water points assigned to water supply staff in other east African countries, this number is less and is at a manageable level for monitoring.
[44] Refers to faucets and well pumps, that is, the points at which a user uses water.

village-level technical experts are also responsible for work on irrigation and energy.

3.5.1.2.1 Spare Parts[45] Supply System

According to the beneficiary survey of committees, 15% of surveyed committees own spare parts that are exchanged periodically. The District Water Resources Offices stock major spare parts and the committee purchases them from the office. Repair is free.

3.5.1.2.2 Information Management at the District Water Resources Offices

Report documents received from the implementing agency, such as Completion Reports and Detailed Design reports, are supposed to be distributed to the responsible District Water Resources Offices in a hard copy[46]. However, information was not shared properly with some offices in which the staff member in charge was transferred to a different position. Soft component manuals are distributed from the regional level in a hard copy to the District Water Resources Offices, and are used. District staff gave guidance in the language used at the villages based on the manual. Records of health patrols and instructions were used by the health staff at the District Water Resources Offices during periodical patrols and instruction.

3.5.1.2.3 Village Water Committees and Water Committees

The village water committees and the water committees are organizations of water users designated to operate and maintain the facilities, each consisting of six members—head, sub-head, treasurer, facility manager, accountant, and health staff member—elected by vote at a villager meeting. The ratio of male to female members is generally even, but women are the majority in some cases[47]. At the time of the committees' establishment, election of women was encouraged through awareness-raising activities within the project's soft components. In the case of piped water facilities, a maintenance group for public faucets collects water user fees, presents the collected fees to the village committee accountant, and manages the water area at the public faucets.

For hand pumped wells, the water committee itself acts as the maintenance committee for the water-fetching site, collects water user fees, manages accumulated fees as bank savings, and records collected fees.

The committee also has ownership to judge over matters such as providing households who have difficulties in paying fees with discounts or in exchange for labor.[48]

[45] "Spare parts" in this report refers to frequently exchanged parts, for example O-rings, U seals, foot valves, and so on. Price varies by area, but O-rings are usually 6.18 birr, U seals 9.27 birr, and foot valves 107.12 birr (Interview survey with Enderta District Water Resources Office).

[46] Interview surveys with the Regional Water Resources Bureau.

[47] Many committees understand participation rate by men and women shall be men to women by 50:50. The soft component also deal with a basic principle to promote participation by men and women.

[48] In the soft components of the project, residents were instructed to make proactive decisions to avoid excluding economically vulnerable households or individuals.

Table 14 Exemptions for the economically vulnerable

	No. of Responses	Ratio
Available	37	67%
Not available	18	33%

Source: Beneficiary survey of committees

3.5.2 Technical Aspects of Operation and Maintenance

3.5.2.1 Technical Level of the Regional Staff

The technical level of the regional staff, including those from the Regional Central Workshop, was sufficient, and they are capable of fixing wells and maintaining water supply facilities. As part of the JICA technical cooperation project "Groundwater development and water supply training project," 67 staff were trained during phase 1 (1998-2005), 71 during phase 2 (2005-2008), and 103 during phase 3 (2009-2013), for a total of 241 staff, the majority of whom (according to the interview survey) were regional government staff and employees of public corporations for water works.[49] Training content included drilling techniques, groundwater investigation, drilling machine repair, electrical machine maintenance, water supply management, and water supply techniques. The regional government bears responsibility for the training needs of their staff, and conducts refresher training sessions for necessary training items once every half a year.

3.5.2.2 Technical Level of the District Water Resources Office Staff

To strengthen the capabilities of the office, technical staff with specialty in areas such as hydrogeology, electrical engineering, environmental management, water resource management, and water administration are placed at the District Water Resources Offices, along with 1-2 engineer-level technical positions. According to an interview survey with a local water supply expert, the technical level of the district staff was verified to be sufficient for operation and maintenance of the facilities built by this project. The Regional Water Resources Bureau provides periodical training on well maintenance techniques to the technical staff at District Water Resources Offices to improve their ability to repair facilities.[50]

3.5.2.3 Technical Level of Committee Technical Staff

Technical staff members for piped water facilities are called operators, whereas technical staff for hand pump wells are called caretakers. Operators and caretakers receive technical training from District Water Resources Office staff and technical experts sent to the village as needed.[51] Furthermore, the District Water Resources Offices also provide necessary technical training to 20 operators and caretakers from each committee every year. In terms of the soft components, a sufficient technical level is maintained at the committee level through training for committee technical staff in operation and maintenance, provided by the staff of each District Water

[49] At the time, the water work and construction enterprise was involved in construction for this project. Twelve employees participated in the EWTEC training in phase 1, 13 in phase 2, and 18 in phase 3, for a total of 43 employees(EWTEC Participant List).
[50] Interview surveys with the Regional Water Resources Bureau.
[51] Interview survey with the District Water Resources Offices.

Resources Office.

3.5.3 Financial Aspects of Operation and Maintenance

3.5.3.1 Regional Water Resources Bureau

Table 15 shows the expenditures and budget for the Regional Water Resources Bureau. Human resources, maintenance, and new facility development costs are on the rise each year, and budget is also expected to continue increasing to achieve the goals specified under GTP II.[52] The region, which is semi-arid and vulnerable to drought, also receives a large sum of donations from NGOs,[53] an amount that far exceeds aid funds received from international donors such as UNICEF. These NGOs provide spare parts to the regional government, intended for use in the spare parts revolving funds managed by the District Water Resources Offices. Elsewhere, budgets for Millennium Development Goals and Sustainable Development Goals are received continuously from the federal government, but because allocations vary by category each year and the budget is specified for the entire region, securing a specific amount for a water resource bureau is difficult, and this is therefore not included in the expenditures and budget listed in Table 15. According to the interview survey with the Regional Water Resources Bureau, the regional government receives donations that exceed those from international donors every year, and this can be expected to continue in the future.

A budget for the Tigray Regional Water Resources Bureau has been definitively allocated in the past, and because the region is a drought area, it is likely to receive allocations with emphasis from the central government. The evaluation of the overall situation reveals no financial problems.

Table 15 Actual expenditures and 2015 budget for the Regional Water Resources Bureau (1)

(units: 1,000 birr)

	2012-2013	2013-2014	2014-2015	2015-2016
	Expenditure	Expenditure	Expenditure	Budget
Labor Cost	12,442	14,899	17,989	19,195
Maintenance Cost	13,721	15,502	22,957	23,394
New Facility Development Cost	141,203	156,335	268,000	290,493
International Donors, etc.	145,450	165,000	275,000	295,000
Tigray Region NGOs	153,866	175,962	216,153	N/A[54]
Total	466,682	527,698	800,099	628,082

Note: (1) Fiscal year is from July 1 to June 30 of the following year.
Source: Documents provided by the Regional Water Resources Bureau

3.5.3.2 District Water Resources Offices

The budget for the District Water Resources Offices is allocated from the district administration and Regional Water Resources Office. Employee payroll, bonuses, and pension

[52] Interview survey with the Regional Water Resources Bureau.
[53] A specific NGO works exclusively in the Tigray Region. It is involved in local development with some support from international NGOs. While many NGOs provide water supply-related support, REST (Relief Society of Tigray) in particular provides approximately 8 million US dollars (year 2015) only in the water supply sector for water supply facilities in the Tigray Region.
[54] This amount is not able to be confirmed, although it is to be increased.

funds are funded by the district administration. According to the interview survey, a sufficient budget for indispensable maintenance is allocated to each District Water Resources Office from the Regional Water Resources Office and the regional government.

According to the survey, water users are typically responsible for facility maintenance costs, but repair costs are also covered by the spare parts revolving funds managed by the District Water Resources Offices. Committees that cannot cover repair costs can receive loans from the District Water Resources Offices that manage the funds, and are exempt from interest for a given period of time. Power pumps malfunctions do not occur frequently, but such cases often require exchange for a new pump; soft components stress the necessity for village water committees to secure purchasing funds from income gained from daily water user fees. In cases of malfunction where accumulated funds from water user fees are insufficient, and an expensive repair is required for components like power pumps or power generators, the District Water Resources Office and Regional Water Resources Bureau cover the cost of repair as needed.

3.5.3.3 Committees

Water user fees for both piped water supply facilities and hand pump wells are determined by each committee based on the cost of operation and maintenance as well as the accumulated income from water use. In the beneficiary survey of committees, 98% replied that they record the water user fees they collect, which is high.[55]

Water user fees are charged by village committees of piped water facilities, and water supply meters and accumulation of water user fees were recorded in detail in most cases.[56] In the case of piped water facilities, accumulated water user fees vary by the size of the facility or the number of public water faucets, but range between 60,000 birr[57] (approx. 360,000 yen) and 80,000 birr (approx. 480,000 yen). The state of fee collection is generally favorable. The accumulated sum of water user fees increases along with the number of water users. Among the piped water facilities that use a fuel-based power generator, some mitigate fuel use by limiting operation of the generator to two hours in the morning and two hours at dusk. Three out of 12 facilities (25% of the piped water facilities) use commercial power. According to estimates by a District Water Resources Office, comparison of power pump operation using commercial power and operation using diesel fuel shows that operational costs of the power pump vary by facility and local fuel costs, but that use of commercial power can run the pump at a third of the cost of diesel fuel. As a result, accumulated water user fees for village committees that use commercial power are greater than those that use diesel fuel, due to the lower fuel costs. However, at the time of ex-post evaluation, few facilities could find commercial power equipment in their proximity.

To account for future maintenance, water user fees are also collected by water committees at

[55] Interview surveys with the committees.

[56] Soft components provided guidance on areas such as pricing for water use and fee collection, observance of rules of use, and verification of residents' roles.

[57] Converted assuming 1 birr = 6 yen (currency exchange rate as of the end of March 2016).

hand pump wells. Accumulated water user fees are usually between 3,000 birr and 5,000 birr. The state of fee collection is generally favorable.

The committees also hold operational rights over exemption policies for households who struggle to pay for water; exemptions are determined at the discretion of the committee.

98% of committees replied that they consult the District Water Resources Offices if funds to cover repair costs are insufficient, suggesting that the committees depend on the District Water Resources Offices not only technically but also financially.

Table 16 Cumulative water user fees (bank deposits)

	Average Cumulative Amount (1)
Piped Water Facilities	50,394 birr
Hand Pump Wells	3,692 birr

Note: (1) Extracted from operating facilities only
Source: Beneficiary survey of committees

Table 17 Measures in case reserves are insufficient for repair

	No. of Responses	Ratio
Consultation with District Water Resources Office	54	98%
Consultation with Village Bureau	1	2%
Other	0	0%

Source: Beneficiary survey of committees

Record of a reserve and bankbook

Piped water facility public water faucets

People waiting in line to fetch water

Bade Arga settlement in Raya Azebo District
(piped water facility, using a power pump by public power)

3.5.4 Current Status of Operation and Maintenance

To evaluate facility use and current maintenance status, status of each facility was organized into a table by the District Water Resources Offices, and the evaluator visited 55 sites on foot to confirm current status of operation and maintenance.[58]

Facility rules were organized at each facility, and were respected by users. Users tended to determine rules autonomously via dialogue. Specifically, users agreed on their own on regulation items, such as implementation of a no-shoes policy,[59] limitation on the accessible time period, placement of a watchman during well use, and assignment of nighttime patrol.[60]

The committees conduct maintenance activities, such as cleaning and drainage around the

[58] Facilities located in nine settlements were studied on-site by the evaluator.
[59] A rule for removing shoes upon entering the platform, to maintain hygiene standards.
[60] Interview surveys with the committees.

water pumping area, and the status of maintenance is generally favorable. Hand pump wells are disinfected and reservoir tanks of piped water facilities are cleansed and disinfected periodically. The rate of fence installation was 83% at hand pump wells and 100% at piped water facilities at the time of the ex post evaluation.

According to the beneficiary survey of committees, 49% replied that unusable periods due to repair were 2-3 days in length, 18% replied more than 2-3 days but less than a week, 27% replied more than a week but less than a month, and 6% replied more than a month; 27% of committees indicated that they "stock consumable spare parts." Time required for repair of facilities built by this project is short, and facilities are maintained well.

With respect to repair of out-of-order facilities, foreign-made power pumps have malfunctioned and power generators have broken.[61] Purchase of replacements is being considered in both cases, using accumulated water user fees and assistance from the District Water Resources Offices.[62]

In light of the above, no issues were found in maintenance of the project from institutional, technical, or financial perspectives; the current status of operation and maintenance was favorable, and thus the sustainability of the impact generated by this project is evaluated to be high.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project aimed to develop water facilities to improve reliable access to safe drinking water in 91 villages across 10 districts in the Tigray Region. The project is highly relevant, as its contents are consistent with both the prioritized areas of the development policies of Ethiopia and the Japanese ODA policy, with the great need for development. The efficiency is low in terms of contents cost and time period, significantly exceeding the plan due to unfavorable outcomes in the bidding process. The project effects expected in the planning stage have been observed: The target water supply population was achieved at the time of ex-post evaluation, and safe, stable water supply was secured in general. With greater volume of water, improved water quality and improved hygiene behavior, water-borne illnesses decreased, and productive activities increased on account of reduced time spent on water-fetching labor. The project has high effectiveness and impact, as demonstrated by improvements in the living environment. Under the supervision of the Regional Water Resources Bureau, adequate maintenance structures are established at every level, and monitoring and reporting systems are also functioning. Financials are favorable at every level and future budgets are expected to be allocated sufficiently; thus, future financials are likely to be sustainable. The technical level of the staff at the District Water Resources Offices and elsewhere is strengthened, enabling them to address on-site problems immediately. The

[61] Deletie and Kepan settlements in Raya Azebo District.
[62] Interview survey with the Regional Water Resources Bureau and Raya Azebo District Water Resources Office.

implementing agency recognizes the need to provide refresher trainings (re-training) for technical staff in committees, and the District Water Resources Offices plan training sessions and execute them periodically. The maintenance status is favorable as a result of these initiatives, and the sustainability of the effects generated by the project is high.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to Implementing Agency

Information Management at the District Water Resources Offices

According to the interview surveys with the Tigray Region Water Resources Bureau, report documents acquired from the implementing agency, including the Completion Reports and the Detailed Design Reports, were already distributed to the District Water Resources Offices as hard copies. However, information was not shared properly with some offices in which staff members in charge moved to other positions. Information must be thoroughly managed at the District Water Resources Office level in order to properly store design drawings and so forth, which are needed for maintenance and management and to utilize them when repairs are needed.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Raising awareness among residents on importance of name plates with information for wells

Facility name plates have already worn out in the three to four years since their installation, and finding target facilities was often difficult if only based on district, village, and facility ID information alone. The facility name plates included technical information such as drilling depth and moving water level during drilling, which are important for assessing cause of malfunction and future operational outlook, and the poor conditions of the name plates hindered the investigation on sustainability aspects.

Well name plates including valuable information such as drilling depth and moving water level were not recognized as important by residents in most cases, and were often removed by children's pranks. An awareness raising activity among residents on the value of this information for the well maintenance should be integrated into the soft components.

Requirement of recording facility location in official project documents such as completion report, and submission of well drilling data to JICA

As stated in the constraints of evaluation, due to the lack of information of facilities location, it took an unexpected time for surveyors to find the facilities.

Positional information, such as coordinates of Universal Transverse Mercator (UTM) and

GPS, should be described in the Completion Report. When contractors and consultants alone possess this positional information, obtaining the data is difficult without a special request to them. Additionally, data such as well drilling depth and moving water level should also be submitted electronically to JICA headquarters and the local JICA office.

(At present, positional information for facilities is not required for the Completion Report. Well drilling depth and moving water level data are found in as-built drawings submitted by the contractor to the implementing agency these as-built drawings, which include more than a dozen booklets as hard data, are also not required to be submitted to JICA.)

Placement of technical expert at the village level

The Tigray Region assigns a technical expert to each district office which manages water supply, irrigation, and energy facilities including district water resources. The technical experts visit each water supply facility at least once a month, and instruct the facility operators and caretakers on its maintenance. Development of such a thorough operation and maintenance system is an effort unique to the Tigray Region, and has contributed to improvement in operation and maintenance and decrease of the non-operating water supply facilities. This is a good practice given that the monitoring systems for many cases of water supply in rural areas are generally weak.