JICA PROJECT BRIEF NOTE THE PROJECT FOR WASAC UTILITY TURNAROUND WITH KAIZEN PPROACH

January 2024



1. Outline of the Project

1.1 **Project Background and Issues**

The City of Kigali, the capital of Rwanda, and its surrounding seven sectors ("the target area") are a social and economic center of the country where the urban area is developing rapidly and therefore its water demand is increasing. In particular, the Kigali area, home to 1.7 million people (13% of Rwanda's 13.2 million population), has achieved some success in expanding water supply facilities, with access to safe water reaching about $97\%^{1}$. The Water and Sanitation Corporation Group Ltd (WASAC)², which is responsible for the construction and maintenance of water supply and sanitation systems, supplies 330,000 m³/day of drinking water to more than 360,000 customers throughout the country³.

However, due to the lack of capacity of the water

¹ Access to improve drinking water sources. Source: NISR (2022) 5th Rwanda Population and Housing Census.

² In September 2023, through organizational restructuring, WASAC (Water and Sanitation Corporation Ltd.) became a conglomerate consisting of two business entities: Utility, responsible for maintenance

and management operations, and Development, focused on business development. The holding company overseeing these entities is named WASAC Group Ltd. In this document, the term "WASAC" refers

collectively to both WASAC and WASAC Group Ltd.

³ Source: WASAC Action Plan 2023/2024.

supply and distribution system, there is a serious shortage of water in some areas where water is supplied only once or twice a week. High non-revenue water (NRW) (41.8%, Year 2022/2023⁴) and high energy consumption are challenges of water supply, and improving the efficiency of the water supply system is the most significant challenge.

Profit/Loss Statement of WASAC for financial year (FY) 2022/23 shows that profit/loss of the period in FY 2021/22 and FY 2022/23 were RWF 295 million and RWF 2,162 million (profit), respectively, which were equivalent to USD 289 thousand and USD 1,859 thousand according to the exchange rates at the times. These figures, however, do not show actual financial status, as the concession agreement between the Government and WASAC has not been concluded yet and WASAC has not paid the concession fee to the Government. Further, WASA bears only the operation and maintenance (O&M) cost to Kigali Water, which supplies bulk water to WASAC (the investment cost is born by the Government), while WASAC has received all revenue generated by the bulk water supply. Besides, O&M budgets are sometimes not allocated as requested by the divisions in charge, and some necessary O&M works are not carried out.

Under these circumstances, the "Kigali City Water Supply Improvement Master Plan Project" (referred to as M/P) implemented from March 2019 to November 2021 aimed to address the significant increase in future water demand until 2050. To ensure a stable water supply, the project involved the strategic expansion of water facilities and devising a comprehensive M/P to efficiently and effectively utilize both existing and new water supply systems over the long term.

The 15-year investment plan to achieve the water supply development scenario (master scenario) included in the M/P estimates that the average annual investment required by 2035 is 34 million USD. The Prime Minister's Order for the Establishment of WASAC provided that the Government should continuously own the water treatment plants and that water transmission and distribution networks should be transferred to WASAC. With this concept, it is supposed that the development costs for water treatment plants have to be secured by the Government and that WASAC has to prepare the funds for the development, rehabilitation, repair, and replacement of water transmission and distribution networks. However, WASAC has continuously depended on the Government and development partners for the development of the networks together with water treatment plants because there is no written consensus between the Government and WASAC that clearly describes demarcation for securing funds for the development and replacement of the networks, and WASAC has suffered losses for the period until FY 2020/21. As WASAC has fund sources for investment only with tariff collection, other than those with cost reduction and NRW reduction, WASAC has to prepare a tariff revision proposal aligned with the financing plan. In order to secure a huge amount of funding for the implementation of the M/P, both the Government and WASAC are required to accelerate investment as well as promote cooperation with development partners. WASAC, as an implementing entity, has to develop its capacity for implementation and financial management, as well as its capacity for O&M of commissioned facilities.

1.2 Objectives and Expected Outputs of the Project

The project being implemented as a JICA technical cooperation project sets the overall goal as "WASAC will be able to provide reliable water services in a sustainable manner." The project purpose is defined as "WASAC's capacity for planning and implementation of the Water Supply Master Plan(M/P) is enhanced." This project will be

⁴ Yearly average NRW for all WASAC branches in Rwanda. Source:

WASAC Action Plan 2023/2024.

conducted over three phases, and this project brief note was prepared at the end of the first phase, which is from February 2022 to January 2024.

	Project Period	2022	2023	2024	2025	2026	2027
Period	Feb.2022-Mar.2027 62Months						
Phase1 Phase2	Feb.2022-Jan.2024 24Months Feb.2024-Jul.2025 18Months						
Phase3	Aug.2025-Mar.2027 20Months						



Figure 1.2-2 illustrates the overall goals, project purpose, and expected outputs of this project. The project aims to support the establishment of the implementation framework for the Master Plan (M/P) and focuses on financial sustainability, non-revenue water reduction, and efficiency. The overall goal is to enhance WASAC's operational and organizational capabilities, strengthening its capacity to implement projects effectively.

		Goal and Output		Perform	ance Indicator (R/D)
Expanding and improving efficient and sustainable water supply systems by achieving sustainable utility management	Overall Goal Project Purpose	WASAC will be able to provide reliable water services in a sustainable WASAC's capacity for planning and implementation of the Water Supply Master Pla (M/P) is enhanced	e an	Formulate and implement efficier Decrease in the number of comp Formulate and implement a cost Identify medium- and long-term M/P and management reform Appropriate budget allocation for	annual non-revenue water reduction plan
lssues i	in Project area			Approach an	d Outut of the Project
Many cross-cutting issues Urgent need to improve customer service Delay of cost cutting and efficiency improvement	Lack of	cross-organizational ation / coordination mechanism		Establish cross-organizational coordination mechanisms Strengthen coordination with relevant ministries and agencies Organizational behavior change	Output 1 : Framework for implementation of the "utility turnaround strategy" is established and WASAC is enabled to solve cross- organizational problems
Unclear cost structure Delay in proper tariff revision Lack offundraising capacity	Need t	o improve in come and expenditure efinancial management capacity		Improvement of Financial Management Capacity Fundraising strategy	Output 2 : Financial Management Capacity to implement the M/P is enhanced
Budget shortfall for NRW reduction Im balanced water pressure Low quality of Service Connection	Dela Massi 8	y in NRW reduction	[Visualizing the result of improvement activities Realizing the progress at branch level	Output 3 : Capacity of efficient implementation of NRW reduction is enhanced
Huge power consumption Lack of main tenance of groundwater sources High turbidity water source	Need pi	to improve facility anning, O&M toppage of WTP	[Improve water quality management and planning capacity Optimization of chemical injection	Output 4: Water supply facilities are cost- effectively operated

Figure 1.2-2 Overall Goal, Project Purpose and Expected Outputs of This Project

Problem Resolution Approach

2.

2.1 Establishment of One Strategic Team

(OST) and support for a 5-year strategic business plan, including a 3-year rolling action plan

The necessity of the OST was mentioned under the M/P, and the WASAC also recognizes and emphasizes its importance. The following points are particularly emphasized as the role of the OST:

- To extract the problems of the WASAC's vertically divided organization and to solve the problems across its organization.
- Coordinate the relevant government agencies in Rwanda through the separately established Program Support Committee (PSC5).
- Foster organizational behavioral changes to enhance customer service and ensure more efficient operations while driving forward this project.

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MINECOFIN, RURA, and WRB).
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⁵ The PSC is comprised of members from WASAC (CEO and Deputy CEO) and representatives from relevant institutions (MININFRA,

This OST is expected to be an organization that not only formulates/implements a strategic plan but also addresses such cross-organizational issues, and the establishment of this organization is expected to ensure the implementation of the M/P and the success of the other three project Outputs.



Discussion with Acting CEO (at the time) at the start of the project

In order to ensure the successful implementation of M/P, OST is actively working on strengthening the organizational structure, with the fundamental basis being WASAC's 5-Year Strategic Business Plan (5YSBP). The review of the previous 5YSBP covering the period from 2015/16 to 2019/20 has been completed. To support preparation for the next 5YSBP, it is necessary to share the review results of the previous five-year plan with the JICA Expert Team (JET).



Figure 2.1-2 One Strategic Team (OST) and Activities for Outputs 1 to 4

The new five-year plan will also include the respective goals of Outputs 2, 3, and 4, and incorporate improvement activities. After the preparation of the five-year plan, a three-year rolling action plan will be formulated. The three-year action plan will be reviewed at the end of every fiscal year, and modifications or adjustments will be made, if

necessary, based on the review results.

Additionally, alongside the establishment of the aforementioned OST, the Program Support Committee (PSC) has been formed. The PSC is composed of members from WASAC (CEO and Deputy CEO) and representatives from relevant institutions (MININFRA, MINECOFIN, RURA, and WRB). The role of the PSC is to coordinate the relevant government agencies in Rwanda towards the more efficient implementation of the 15-year investment plan outlined in the Kigali City Water Supply Master Plan.

As the OST takes the lead in driving this project forward, it aims to foster organizational behavioral changes to enhance customer service and ensure more efficient operations.

2.2 Strengthening Financial Management Capacity

This technical cooperation project aims at establishing a solid base for the implementation of the M/P. Under the current financial status of WASAC, it is difficult to implement the investment plan proposed in the M/P with the own funds of WASAC. It is necessary for WASAC to realize profit by reducing costs and non-revenue water, as well as to formulate financing plans to obtain financial support from related organizations, prepare tariff revision proposals, and persuade regulatory and supervising organizations for approval of the tariff revision in order to enhance its self-financing Figure 2.2-1 indicates how the capacity. development of financial management capacity works in this technical cooperation project.



Figure 2.2-3 Position of Development of Financial Management Capacity

2.3 Efficient NRW Reduction

The NRW reduction activity under this project will apply lessons learned from the small-scale pilot area of the previous technical cooperation project "The Project for Strengthening Non-Revenue Water Control in Kigali City Water Network." Furthermore, these efforts extend to the implementation of broader, branch-level NRW reduction activities (Table 2.3-1). The activities include selection of a pilot branch (Kacyiru branch, approx. 120,000 customers), establishment of NRW measurement methodology, measurement of baseline NRW ratio, formulation of NRW action plans and measures for post- and preventive maintenance at the branch level, and demonstration and training on the cost-effectiveness of NRW reduction through actual activities with evidence. The pilot branch was selected as the Kacyiru branch. The jurisdiction of the Kacyiru branch includes the project area of the Japan Grant Aid project, namely "The Project for Improvement of Water Supply Services in North-Central Kigali", which is currently being implemented. The effects of pipe replacement, pressure control, etc. can be evaluated at the branch level under this project as well, and thereby, strong cooperation with the Grant Aid project can be achieved.

This technical cooperation project aims to disseminate the insights and evidence gained from the pilot branch activities, with the goal of transmitting these efforts throughout the entire WASAC organization.

Table 2.3-2 Activities for Efficient NRWreduction (Output 3)

(Data) Items	Major Activities				
1. Selection of A pilot	- Selection of A pilot branch				
branch and monitoring	- Establishment of a method for calculating				
of Non-Revenue	NRW ratio in pilot branches				
Water	- NRW baseline measurement				
2. Development of a	- Development of a NRW reduction action				
Non-Revenue Water	plan for the pilot branch				
Reduction action plan					
3. Reactive	- Zone management for leakage response				
Maintenance	- High-quality and rapid leak repair				
	(allocation of technicians, equipment and				
	materials for leak repair)				

(Data) Items	Major Activities					
4. Preventive	- Planning, procurement, implementation,					
Maintenance	and training for pipeline renewal program					
	- Underground sound leakage survey (door-					
	to-door sound audiometry)					
	- Handbook for installation of water pipes and					
	its implementation					
5. Cost-benefit	- Conduct training for Cost-benefit					
Analysis	analysis					
6. 5-year non-revenue	- Revised 5-year NRW reduction plan					
water reduction plan						
Other: Kaizen	- Kaizen workshops, 5S activities					
Activities	_					



Door-to-Door Acoustic Survey



Workshop for Leakage Detection Results

2.4 Effective Operation of Water Supply Facilities

(1) Optimization of Chemical Dosage in the Water Treatment Plants

For the water treatment plants, an assessment will be carried out to see if there are any parts that are inefficient in terms of their operation and maintenance. Focusing on the chemical dosage at water treatment plants, it is observed that the Nzove water treatment plant's operation is often stopped during high turbidity of raw water, which is one of the causes of water outages and insufficient water supply. In addition, reducing the amount of chemical dosage at water treatment plants is one of the important factors in examining cost reduction factors for facility maintenance.



Survey on the Karenge WTP



OTJ for selecting optimal coagulants dosage

The turbidity of raw water fluctuates depending on the season and climate, and it is necessary to verify whether the dosage rate of the coagulant is maintained at an appropriate level at the site. For that purpose, the JET will clarify the process for determining the chemical dosage at each water treatment plant and will support the preparation of SOPs (Standard Operation Procedures). Then, the current chemical dosage amount and the dosage amount after the procedure manual will be compared, and their effect will be quantitatively evaluated.

(2) Energy Saving of Water Supply Facilities

The current assessment of existing facilities will be conducted to formulate energy-saving measures for electricity consumption, which accounts for most of the energy consumed by WTPs and pumping stations, and then energy-saving measures will be formulated. The selection of pilot equipment to reduce energy consumption will be decided based on the assessment results, the selection of some pumping stations that have a lot of room for energy savings and taking into consideration the future pipeline maintenance plans and aging of the equipment.

3. Results of Applying These Approaches

The major activities implemented based on the aforementioned approach are outlined below. It should be noted that the activities listed took place during Phase 1 (from March 2022 to January 2024).

3.1 Results of Activities for Output 1

(1) Establishment of the OST

One Strategic Team (OST) is established in Output 1 to monitor the activities and achievements of Outputs 2, 3, and 4. OST is composed of senior management, directors of related departments of each Output, and administrative staff who should be allocated as OST members. OST is a decisionmaking platform with the function of identifying cross-organizational issues and examining measures to solve them.

On June 2, 2022, an appointment letter was issued from the CEO to the OST members, officially establishing the OST as an organization. The OST kickoff meeting was held on August 19. The selection of OST members included the heads of each branch and the head of each water treatment plant at the request of the CEO.



The 1st OST Meeting

Since the establishment of OST, a total of five OST meetings have been held to discuss the progress of various outcomes, challenges, and other related matters. Additionally, discussions have taken place regarding the proposed table of contents for the 5-Year Strategic Business Plan (5YSBP) and the information to be included. Specific activities at the Kachiru Branch, identified as the pilot branch for Outcome 3, were also deliberated.

As for the crucial role of OST in cross-organizational issue resolution, discussions have primarily focused on sharing challenges, given the recent establishment. However, there are plans to further deepen these discussions in the future.

In September 2023, there was a reorganization of WASAC, leading to the initiation of a new organizational structure. As there is a possibility of changes to the OST members, OST meetings are temporarily suspended. The reformation of the OST in alignment with the new organizational structure is desired.

(2) Formulation of the 5YSBP

Discussions on how to create a 5YSBP under WASAC leadership have been ongoing since the beginning of the project in February 2022. The previous 5YSBP (2015/16~2019/20) was developed under consultant leadership, and WASAC had raised concerns that it could not implement and monitor it with WASAC ownership. Taking these concerns into account, the project started with the goal of having WASAC take the lead in developing the 5YSBP to the extent possible.





Workshop on 5YSBP Preparation

By August 2022, the table of contents had been finalized collaboratively with JET and CPSD (Cooperate Planning and Strategy Division) officials. In the second Steering Committee (SC) meeting in September 2022, CPSD department officials presented the table of contents, which received approval from the SC. From October 2022 to May 2023, a series of workshops involving WASAC staff were conducted, facilitating discussions led by WASAC. By May 2023, a draft was finalized, and the situation currently awaits approval from WASAC. The 5YSBP is structured as a five-year plan that integrates the directions of WASAC's "Planning/ Development Department (Development)" and "Business Department (Utility)".

As mentioned earlier, due to the organizational restructuring of WASAC in September 2023, the content of 5YSBP has also been necessitated to be revised.

3.2 Results of Activities for Output 2

(1) Selection of Priority Areas

After a capacity assessment of the financial management of WASAC, the following seven priority areas have been selected for the capacity development of this project:

- a) Optimization of Budgets and Costs
- b) Formulation of a Financing Plan and Preparation of a Tariff Revision Proposal
- c) Improvement of Internal Control on Inventory
- d) Improvement of Treasury Management

- e) Review of the Financial Policy and Procedure Manual (FPPM)
- f) Enhancement of Knowledge on Tax
- g) Other Areas

Activities related to a) and b) were identified as priority areas from the detailed planning survey stage and recognized as essential elements for enhancing financial management capabilities in the implementation of the Master Plan (M/P). As for c) and d), the previously strengthened "financial accounting" (accounting for accurate and timely reporting of financial status to external stakeholders) has reached the required level. Going forward, there is an intention from the Chief Financial Officer (CFO) to shift the focus towards improving "management accounting" (accounting for effective and efficient improvement of the management of the organization) and "financial management" (management of funds and assets to support the organization's management and growth) (refer to Figure 3.2-1), and these have been added to the list of priority areas.



As for the above e), the current FPPM does not exactly match the "Comprehensive Standard Operation Procedure Framework for Government-Controlled Companies" issue by the Ministry of Finance and Economic Development (MINECOFIN) in 2019 and the current practices of the Directorate of Finance.

In regard to the above f), substantial assistance is deemed necessary to respond to the opinions of the external audit, with support mainly from the local advisor employed by JET. Further, the above g) has been added to promote improvements by applying KAIZEN approach or other methods if necessities arise from time to time.

(2) Budget and Cost Optimization

Until now, cost reduction activities of i) analyses of historical WASAC financial/management indicators as preparatory works, ii) establishment of a cost reduction team, and iii) examination of areas for cost reduction by Output Team 2 have been implemented, in addition to support for non-revenue water reduction by Output Team 3 and reduction of electricity and chemical dosing costs by Output Team 4.

(3) Improvement of Internal on Inventory

So far, i) estimation of the Cash Conversion Cycle (CCC, inventory turnover, and days of difference between purchase payable and sales receivable) and examination of CCC reduction measures; ii) understanding the necessity for the preparation of lists of long-term dead stock; and iii) physical inspection at the Central Sore and Masoro

storehouses with staff of the Logistic Division have been conducted. At present, the manners to sell, dispose of, and write off the dormant inventory have been examined.



Long-term dead materials kept in the Central Store

(4) Review of FPPM

For the moment, 29 workshops to identify points to be revised and 9 workshops to examine the draft were held, and the draft was submitted to senior management. The draft, however, has not been approved due to the WASAC re-organization. It would be necessary to review the draft to cope with the reorganization.

(5) Tax Training

So far, 24 meetings for consultation and guidance have been held, and the persons in charge have acquired a lot of knowledge on i) corporate income tax, ii) deferred tax, iii) handling of value-added tax (VAT) for water charges to public institutions, iv) import tax, v) new tax laws, etc. The manager of tax has moved to another post due to the WASAC reform. Though the change of the manager at the stage of shifting to capacity development of the organization, based on the enhanced individual knowledge of the previous manager accumulated through the training conducted so far, has brought a challenge, the new manager has energetically commenced the knowledge enhancement with the tax training report prepared by JET and is actively dealing with new tasks, such as coping with new tax laws.



Discussion on Review of Financial Policy and Procedure Manual

3.3 **Results of Activities for Output 3**

(1) Isolate selected pilot branches and monitor inflows

In undertaking the NRW reduction activities, it was essential to understand the intricate pipeline system of the pilot branch (Kacyiru branch) to measure the distribution volume. A monitoring infrastructure capable of tracking flow rates needed to be established. While a monitoring system had been previously implemented by the former NRW technical cooperation project, it was not being fully utilized due to the introduction of additional new pipelines and operational changes. In this complex and frequently modified water management system within Kigali City, it was found to be challenging to continuously monitor non-revenue water solely through a monitoring system. Therefore, it is necessary for WASAC engineers to accurately understand the status of pipelines in the branch and update them using a simple and effective model. Developing capabilities over time is essential for this process. The model concerned was provided at the workshop, and training was conducted by demonstrating the process of writing water balances by hand, checking the locations one by one, and writing out the model. The implementation of the workshop indicated that it would take time for the WASAC engineers to understand the model, so it is necessary to continue technical cooperation and follow up until the branch engineers are actually able to handle the model.



Output 3 Workshop

(2) Zone Management for Quick Repair

The Kacyiru branch has 23,000 customers and a large water supply area of 72 km². In contrast, the technical department of the branch has an engineer in charge of water distribution (Water Engineer for Network Management), five technicians (Technician) and five directly employed workers (MTT), all based in principle at one location in the Kacyiru branch. In remote areas away from the branch, there tends to be a tendency to overlook surface water leakage.

Taking into consideration the proposal from WASAC, "Zone Management" is being implemented, wherein water distribution areas are divided into multiple areas and dedicated technicians are assigned to each area. Regarding the concept of Zone Management, it was recognized from the beginning of the project that efforts to eliminate aboveground leaks were necessary. In addition, the method



A child plays at the leak site, where the leak is like a river channel (Gisozi)

of dividing the area into zones and establishing leakage repair offices is a method generally taken by entities in Japan to speed up leakage repair. The Kacyiru branch will be divided into three sections, with additional technicians hired for each section. Assigned technicians will prioritize addressing water leaks in their respective sections and respond promptly to any ground leaks discovered during routine patrols, ensuring swift repairs.

(3) Preparation of tools for proper leak repair by a technician

In WASAC's leak repair activities, the equipment used to make pipe connections was not well maintained, and the threading was not clean, resulting in poor connections and leaks from such connection points. In response to this situation, the project decided to purchase the minimum necessary tools to implement adequate leak repair with appropriate repair equipment. This was positioned as an experimental effort to develop a standard tool list for WASAC as a whole.



(left) Pipe threader with a missing blade (right) Polyethylene pipe being threaded



(left) PVC pipe chamfering with a stone (right) Result of chamfering with a stone

(4) Accurate leak recording using Application

In each branch in Kigali City, the Water Engineer for Network Management (Water Engineer) of the branch is supposed to input data on all water leakage repairs that occurred to the GIS staff of DUWSS. However, since the engineers in charge of water distribution were busy and sometimes entered data for several days at a time, there were suspicions that the number of reports was less than the actual number in Kigali City. At the Kacyiru branch, although it was stated that all leaks were being reported, leak reporting was not immediate, and the time from leak report to repair was not being accurately recorded.

As an indicator for improving immediate response measures, measuring the time to report a leak is important for measuring the effectiveness of the measures, so a system was needed that could report leaks without delay at the field level when they were reported and follow up sequentially to record the exact time to repair them.

The project established a leak recording application using cloud-based software called "AppSheet" to enable technician-level personnel to report and record the status of leaks and repairs.



Technician record Real-time and On-site AppSheet Demo Figure 3.3-1 Overview of the "AppSheet" used to accurately record leak

The application is now user-friendly even at the technician level on-site, and water leak records are captured in real-time. In future technical cooperation, the accumulated data will support monitoring and the

formulation of improvement strategies through the analysis of issues identified using the data.



Workshop for sharing the survey results to C/Ps

(5) Pipeline renewal planning and pipeline renewal

The "Pipe Renewal Plan" is a necessary activity to create a cycle of budgeting and implementing pipe renewal to reduce non-revenue water. Since DUWSS and the branch engineers have technical knowledge of the conditions of the existing pipelines and pipes that frequently leak, both DUWSS and the branch were to be the main counterparts in implementing the pipe renewal with technical assistance on the renewal planning method. As a result of discussions at the workshop with WASAC Kacyiru Branch, the area planned for pipe renewal was selected as a lowelevation area (Gi4) in the Gisozi area, where water pressure is high and leakage is common.

The plan going forward is to proceed with the actual renewal work, starting with pipelines with high priority, using the procured equipment mentioned above.





Procurement of Pipe Materials

Inspection of Pipe Materials

3.4 Results of Activities for Output 4(1) Conduct survey and assessment on water

treatment plants (WTPs)

To understand the maintenance status of the water treatment plants and identify the issues that are inefficiently operated, a survey on Nzove, Kimisagara, and Karenge WTPs was conducted by the JET.

Major common challenges related to O/M of WTPs are summarized as follows:

- Coagulants price hike.
- Frequently change coagulants, and there is a big working load on coagulant selection.
- Frequent change of WASAC staff designated for technical cooperation (Counterpart: C/P)

The JET also conducted an assessment on groundwater treatment plants (Nzove 1 WTP) and surface water treatment plants (Nzove 2 and New Nzove 1 WTP) and found that if the raw water turbidity of the Nyabarongo River is higher than 2,600 NTU (wet season), the treatment costs of groundwater are cheaper than those of surface water in cases using Sudfloc as a coagulant.

(2) Development of SOP of optimization of chemical dosing in WTPs.

Since currently there is no SOP for optimizing coagulant dosing in WTPs, firstly, a draft SOP was prepared by the JET and C/Ps for each kind of coagulant. Then the draft SOP was applied to actual operations to identify any areas for improvement of the SOP. Finally, the draft SOP was revised based on the results of the actual operation.

(3) Identify and analyze facilities with high and/or inefficient electricity consumption

The survey results were summarized, characteristics were extracted, and information was shared with C/Ps and manager staff at each water treatment plant. Specifically, by comparing P/Q (power consumption per unit of water volume), we were able to grasp the actual power consumption of each facility and system. Differences by WTP, water delivery system, etc. were identified.

- Energy consumption at the pumping stations is good, except for a few pumping stations.
- Energy consumption at WTP is good except for the intake wells at the Nzove WTP, which consume slightly more energy than the other plants due to its treatment method.
- Energy requirements for water distribution vary greatly depending on the distribution route.



Pilot facility selection workshop



Survey of potential pilot facility sites

Among the various possible energy conservation measures, we identified the following ideas that could be implemented as pilot projects within the framework of this technical project:

- A pressure control plan for water distribution pumps,
- A proposal to control the volume of water in the Nzove well group,

• In-line pressure boosting with Birembo PS

The characteristics of each of the above measures, as well as the items and issues required for their maintenance, were first shared with the C/Ps through the workshop. Then, we reached a common understanding that in-line pressure boosting with Birembo PS is a promising measure that can improve energy consumption by improving mechanical and electrical equipment.

In Phase 1, the equipment for this in-line pressure boosting will be procured, and the installation of the equipment is scheduled to take place in Phase 2.

4. Creative Solutions and Lessons in Project Implementation

(1) Cultivating Ownership of WASAC

Output 1 of this project was the development of a five-year strategic business plan (5YSBP). Initially, a draft table of contents was discussed with WASAC's C/P, approved in an OST meeting, and then it was agreed that relevant departments within WASAC would write/develop the plan based on this table of contents. However, WASAC's C/P expressed concerns about the difficulties of starting the plan from scratch.



Workshop on 5YSBP Preparation

To address this, a workshop was organized for plan development, and C/Ps were invited to participate, allowing for discussions and the collaborative creation of the plan by all attendees. Workshops were held for each section of the proposed table of contents. Basic information related to the chapters was extracted by M/P from JET and presented to C/Ps as a basis for discussions. This participatory approach, where attendees collectively formulated the five-year plan through discussions during the workshops, was considered effective in fostering WASAC's ownership rather than having individuals develop the plan on their own.

(2) Adjusting the Timing of Expert Dispatch

Throughout the project, various concerns accumulated, making it challenging to communicate with WASAC remotely. The limited duration of expert assignment in Kigali further complicated the situation, and when it seemed that a solution was not in sight, it was decided to dispatch experts to Rwanda even though these dispatches were not originally scheduled.

During their stay in Kigali, they held face-to-face discussions with WASAC to address each concern one by one and work towards finding solutions. In cases where a resolution was not reached, JET ensured that communication channels were in place for remote support during their stay in Japan, ensuring that JET could assist even from a distance.

(3) Establishment of a Remote Working Environment

Due to the communication difficulties with WASAC in Kigali and the limited on-site presence of experts, remote work became crucial. However, WASAC's headquarters did not always have sufficient communication infrastructure, making remote work challenging.

To address this, requests were made to WASAC's IT department for improvements in the communication system. Additionally, measures were taken to establish a better communication environment, such as installing dedicated fiber-optic connections within the JET office at WASAC headquarters. These actions aimed to improve the situation and enable effective remote work.



WASAC Project Personnel (WATER REGIONAL UTILITY PARTINERSHIP (WURP) Forum)