JICA PROJECT BRIEF NOTE

Republic of Malawi
Project for Strengthening the Capacity of Non-Revenue Water Reduction for Lilongwe Water Board (LiSCaP)

- Building sustainable Non-Revenue Water measures with a focus on capacity development of staff -

June 2020

1. Project Background and Challenges

Lilongwe City has a population growth rate of 3.8%, which is higher than the national average of 2.9% (2018 Malawi Population and Housing Census), and the water demand of the city has increased accordingly. As a result, the duration of water supply in Lilongwe decreased from 24 hours/day to 18 hours/day during the period 2010 to 2015 (LWB Strategic Plan 2015-2020).

The Government of Malawi has focused on "Agriculture, Water Development, and Climate Change Management" as a key priority area under the national strategy, “the Malawi Growth and Development Strategy III 2017-2022”. Based on the strategy, the Government is planning to develop a large-scale dam to improve access to water resources in Lilongwe City, but the plan is not progressing as expected.

The Lilongwe Water Board (LWB) has been suffering from high non-revenue water (NRW) rate, and it was as high as 36% in 2015 (LWB Strategic Plan 2015-2020). The NRW is caused by water leakage (physical loss) due to aging water supply and distribution pipes, and unbilled water (commercial loss) due to faulty water meters. LWB set the target of NRW reduction to 28% by 2020, and has been implementing relevant activities to reduce water losses for the effective use of water resources.

Photo 1: Water pipe repair work by LWB Staff

However, these activities are not sustainable and have

only limited effects in NRW reduction. Under these circumstances, the Government of Malawi requested JICA to support LWB in strengthening its technical capacity of NRW reduction as well as the capacity for comprehensive, effective, and sustainable NRW reduction planning. In response, JICA started "The Project for Strengthening the Capacity of NRW Reduction for Lilongwe Water Board (Project)" in June 2019. The Project consists of two phases and the planned completion date is in June 2023.

2. Approach to Solving Challenges

(1) Overall Approach

The overall approach of the Project is to address NRW challenges at LWB and to ensure the sustainable activities. Therefore, the Project focuses on strengthening the capacity of LWB staff towards reduction of NRW, so called "soft" components.

On the other hands, LWB is being supported by other donors such as the World Bank and EIB to reduce the NRW. Their focus is on infrastructural development, i.e., the so called "hard" components such as rehabilitation and extension of water supply facilities as shown in Fig.1.

In solving the problem of reduction NRW, there is the Project need to include "soft" components, in collaboration with "hard" components approach.

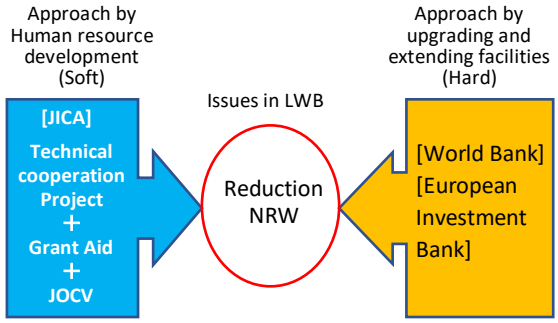


Fig.1 Conceptual framework of the Project approach

The Project is a part of JICA's approach aiming to contribute to solving LWB's challenges mainly from a Capacity Development (hereinafter, CD) perspective. Moreover, the Project is characterized by its synergistic impact achieved by combining a range of cooperation methods besides technical cooperation.

Multiple Approach for the Project:

a) The capacity of LWB staff is strengthened through the dispatch of Japanese experts through the Project
b) Equipment procurement for NRW countermeasures through Japanese government grant aid project
c) Cooperation with JICA Japan Overseas Cooperation Volunteer (hereinafter, JOCV) Water Security Action Team (hereinafter, W-SAT)
d) Collaboration with the Project for Conservation and Sustainable Management of Dzalanyama Forest Reserve

(2) Approach Taken in the Project

The Project's overall goal is "NRW reduction activities are systematically implemented in Lilongwe City". By the end of the project term, the Project aims to have strengthened LWB's capacity for NRW reduction management. Specifically, this aim will be achieved through the three Outputs described in Fig.2. Same as, Fig.3 shows the implementation framework of the Project.

(3) Specific Activities

1) Output 1: Development of NRW Reduction Plan

Under Output 1, the project will enhance LWB's planning capacity for NRW reduction through the development of sustainable and implementable plans. Specifically, LWB revises the existing NRW reduction 5-year Rolling plan, considering to first ascertaining and analyzing the current status of NRW, and discussing the direction of NRW reduction activities. The project will support implementation of part of the plan, including monitoring and revision of the plan where necessary.

Ensuring Effectiveness of NRW Reduction Plan

To ensure effectiveness of the NRW reduction plan in Output 1, it will utilize NRW reduction activities in Output 2 such as its results and lessons learned on site.

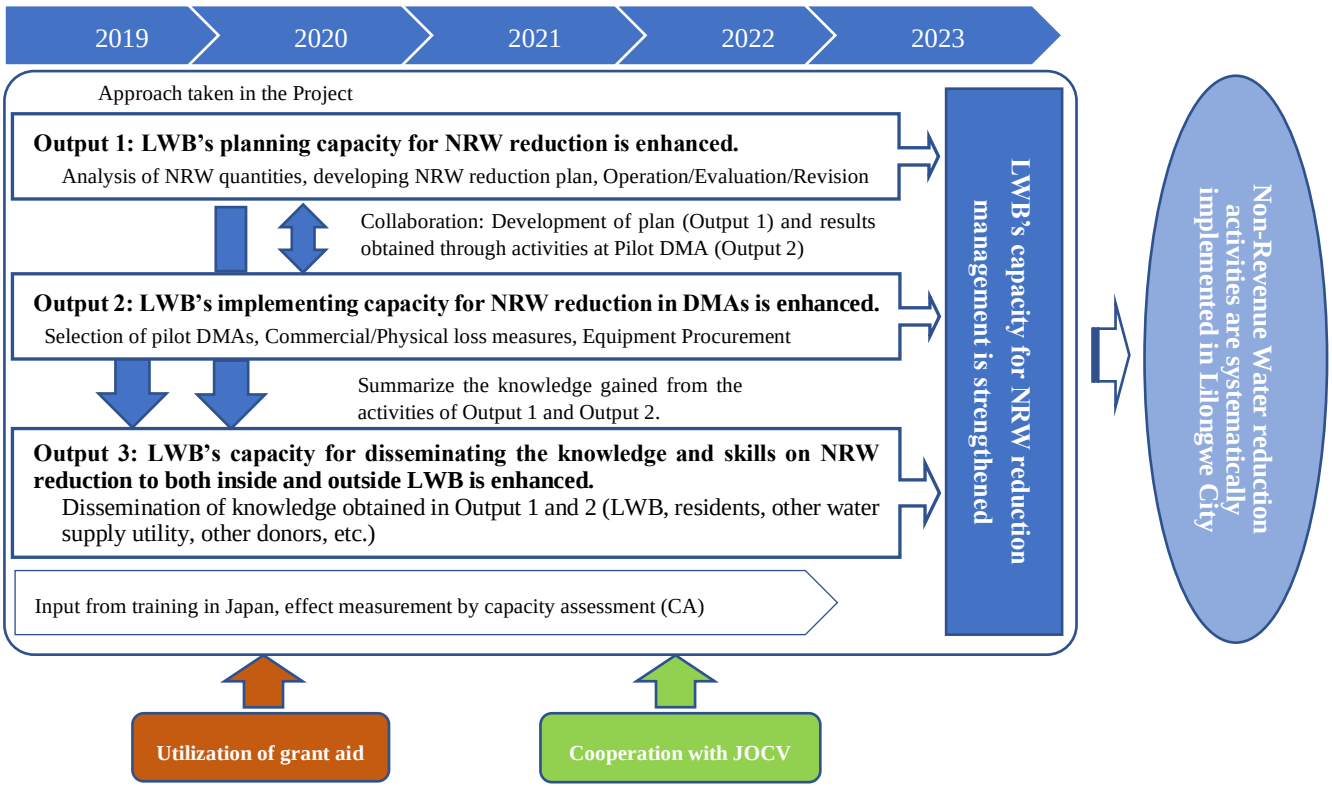


Fig.2 Approach taken in the Project

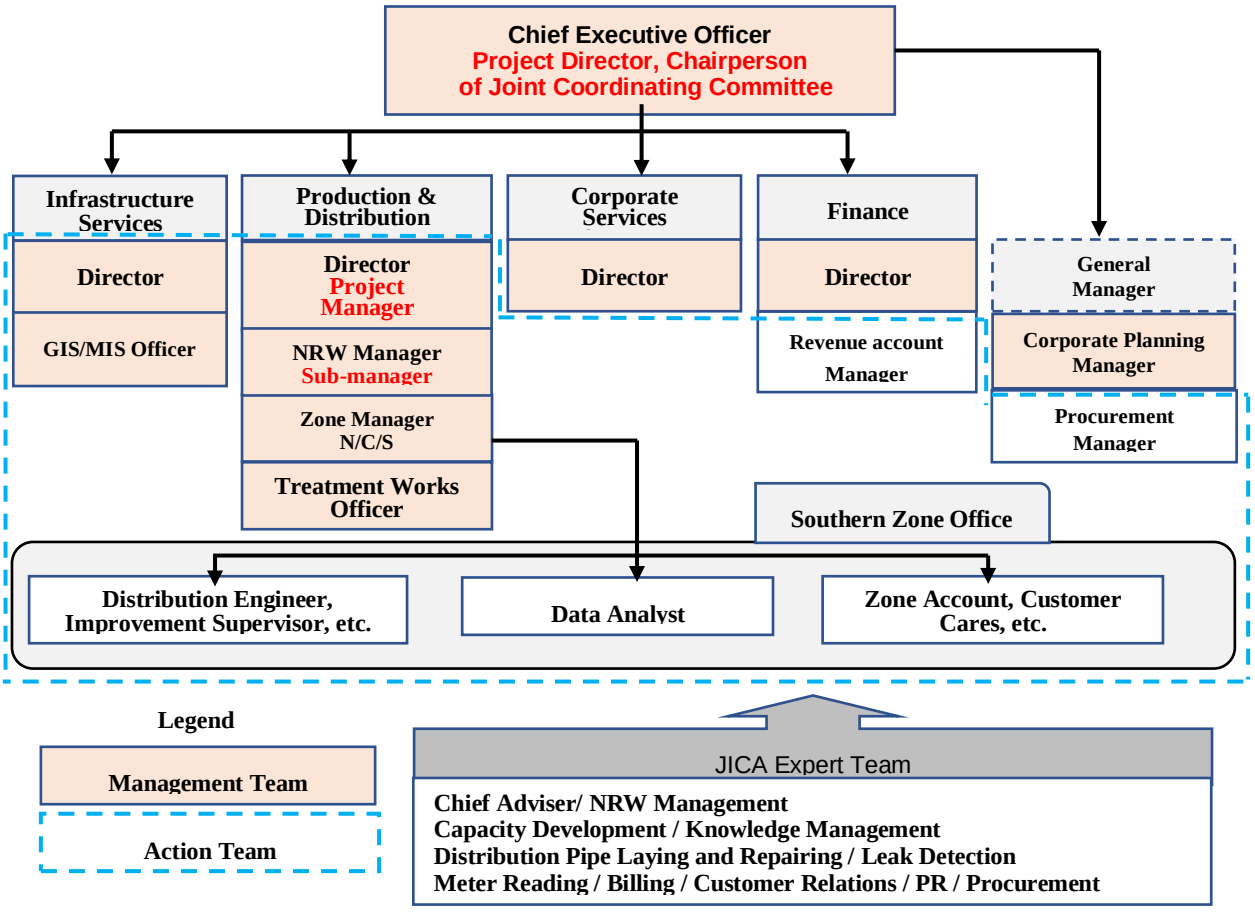


Fig.3 Implementation framework of the Project

Ensuring Sustainability of NRW Reduction Activities

To ensure the sustainability of NRW reduction activities, the NRW reduction plan will be interlinked with LWB's strategic plan and annual budgets, as shown in Fig.4. The point of the reducing NRW is that LWB ensures an annual budget for development of CD and institution framework for NRW reduction countermeasures.

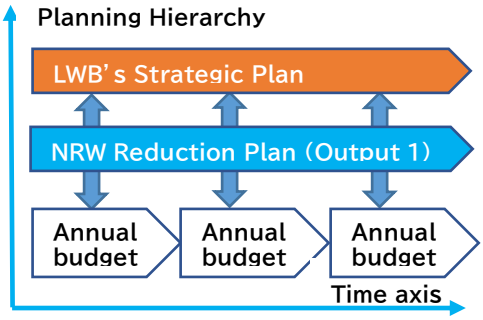


Fig.4 Linking strategic plan and annual budgets

2) Output 2: NRW Reduction in Pilot DMAs

For Output 2, the Project will introduce necessary skills/methods as suited to the local conditions in addition to support improving NRW activities currently being conducted by LWB. In the first Phase, preparation work will be carried out for the NRW reduction activities outlined in Fig.5.

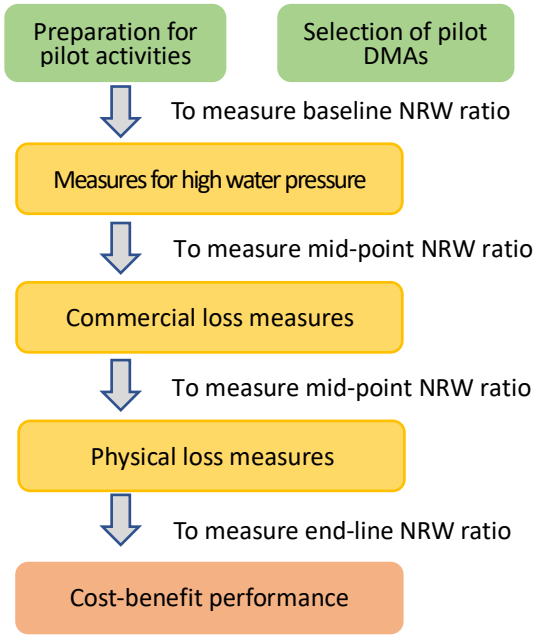


Fig.5 Flowchart of pilot project activities

From the second Phase, on-the-job training (hereinafter, OJT) will be implemented to strengthen specific skills and NRW reduction activities. Through these activities, the Project will facilitate continuous NRW reduction activities at LWB into the future.

The OJT of NRW reduction activities will focus on four District Metered Areas (hereinafter, DMA: definition of DMA is shown in Fig.6 with differing conditions.

What is DMA (District Metered Area)?

- Area that is hydraulically separated with a certain number of customers in water supply
- Area to manage water supply volumes, and allow the volume of inflowing and outflowing water to be calculated
- Area to be evaluated on the impact of each NRW reduction activity

Fig.6 Definition of DMA

The selection of the pilot DMAs will be based on eight standards set to cover the technical factors. As pilot activities get underway, it will be important to accurately evaluate their impact. The project will support various tasks, such as surveys to confirm DMA boundaries and making customer lists, to appropriately measure baseline and end line NRW ratio.

One of the NRW reduction activities will instruct the usage of water leakage detection equipment newly provided by the Project. The other is an important quality improvement base for activities already being implemented by LWB. The Project will support quality improvement activities included in CD of staff and improvement of services (pipe repair, water meter reading, public relations and so on).

Fig.7 shows outline of PDCA cycle related to quality improvement activities. Regarding evaluation of the results in quality improvement activities, level of customer satisfaction will be set as an LWB's capacity assessment (hereinafter, CA) indicator. Through these activities, the Project will facilitate the improvement of awareness of LWB employees toward each NRW activity.

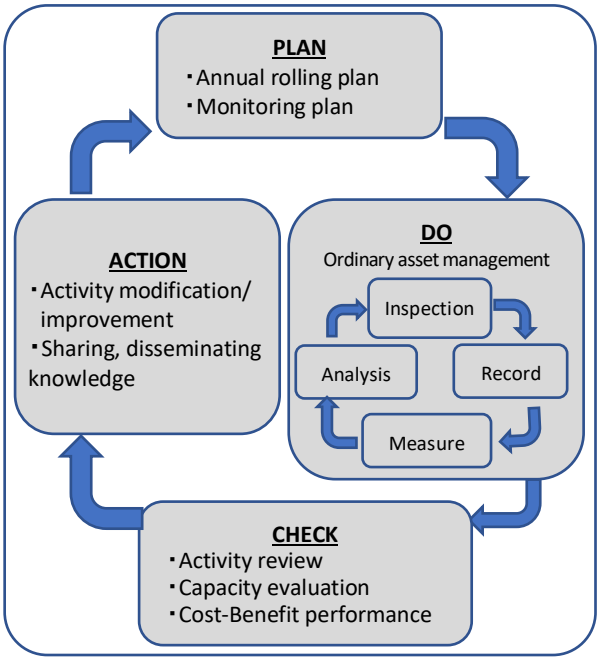


Fig.7 PDCA for pilot activities

Commercial Loss Measures

The representative of commercial loss is faulty water meters, misreading of water meters and illegal connections. The following two points are necessary for NRW reduction activities, including commercial loss measures.

-To analyze NRW volumes with water balance sheet
-To evaluate a volume of commercial losses within the total volume of NRW.

To evaluate a volume of commercial losses, the following water meters in the pilot DMAs will be identified through random sampling, collected for accuracy testing, and replaced if necessary. Then, the accuracy of the collected water meters is confirmed by using LWB's water meter flow measurement device (see Photo 2). The impact of the water meter replacement will be evaluated by measuring the change in NRW volume and NRW ratio in the pilot DMAs.

a) Aging water meters
b) Faulty water meters
c) Large scale customer meters

Photo 2: LWB proprietary water meter accuracy test

Physical Loss Measures

Lilongwe City has the topographic characteristic with large elevation difference. High water pressure is one cause of water leakages (see Photo 3), due to significant strain on pipes.

In each pilot DMA, the relevant issues will be identified through fact-finding surveys, considering the geographical characteristics unique to each DMA and the actual physical losses. The Project will take action to respond these issues developing method of monitoring, leakage detection, and analyzing important pipelines etc.. Therefore, the Project will develop the capacity of LWB staff to effectively implement NRW monitoring and leakage detection through OJT. Especially, the countermeasures for underground leakage will be introduced through new technology and techniques.

Photo 3: Ground leakage

Procurement of Equipment

The project will assess the existing equipment possessed by LWB, operating conditions of the

equipment, and the actual conditions in DMAs. Afterwards, the necessary equipment such as below will be selected for conducting pilot activities.

In addition, the Project will give instruction on how to use the previously procured equipment for following up support for the grant aid project.

a) Water meter accuracy testing,
b) Underground leakage detection, and
c) Pipeline repairs

3) Output 3: Development of Capacity for Communicating and Sharing LWB Knowledge

The causes of NRW in Lilongwe City, physical losses and commercial losses are challenges spanning the entire city area. The activities of the Project limited to the pilot DMAs will not solve the challenges facing the entire city. Therefore, it is necessary to communicate and share the knowledge gained in the activities in pilot DMAs throughout LWB. Another challenge is the motivation of LWB staff toward improving the quality of the laying and repairing of water supply pipelines. It is important for LWB to make residents aware of leakages and illegal connections.

To manage these challenges, the Project aims to share the knowledge within LWB.

Development of Knowledge Sharing Strategy

LWB develops a framework for learning together and sharing knowledge and know-how. An example of a knowledge sharing framework within LWB is given in Fig.8. This Knowledge Centre is responsible not only for aggregating and systematizing knowledge from within and beyond LWB but also disseminating knowledge. In addition, the Knowledge Centre is to promote active knowledge sharing between "peers".

LWB staff communicate and share the knowledge gained in the Project to inside of LWB and to other water supply utilities in Malawi and in other countries. These activities will help improve their self-motivation, confidence, and satisfaction in their work. Not only that, it will help to improve the capacity for reducing NRW at LWB and other water supply utilities in Malawi and other countries.

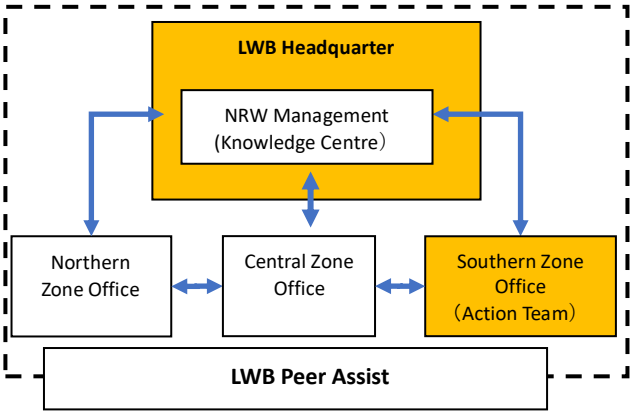


Fig.8 Knowledge sharing system inside LWB

Provision of Information to and Raising Awareness of Water Users

It is also important to engage with residents and relevant organizations for awareness raising and information dissemination activities. Particularly, the active support and understanding from residents is necessary for NRW reduction.

LWB has already developed the Communication and Stakeholder Engagement Strategy (hereinafter CSES). Therefore, the Project supports to develop an action plan of Awareness Raising for NRW reduction which will be a part of the CSES. This action plan will be developed with LWB and used to effectively raise awareness and disseminate information to residents and relevant organizations. Interlinking the action plan with CSES, will help to ensure the sustainability of the action plan implementation.

Capacity Assessment (CA)

The purpose of conducing a CA is firstly to gauge the ability of C/P to solve certain challenges. The CA evaluates changes of organizational or individual capacities, during implementation of a project. It also assesses the level of achievement of project outputs, and the impact of these changes in capacity and achievement of outputs.

At the beginning of the Project, the CA was conducted throughout sufficient discussion with LWB (Fig.9 shows CA process). The CA would be categorized as the first step in Capacity Development (CD), and the results

of the CA would be reflected in the CD.

Fig.9 CA process in LiSCaP

3. Results of Project Implementation to Date

(1) Output 2 Preparatory Work for the First Pilot DMA

Confirmation of the DMA Boundary

Through the site visits at the first pilot DMA, it was found that the actual DMA boundary differed from the boundary indicated on LWB's GIS, as shown in the map in Fig.10. For this reason, the DMA boundary needs to reset with topographical boundary conventions. This meant that the area of the DMA with roughly 150 households (approx. 10% of total households) should be changed.

It was also found that one bulk meter needed to be installed at a crossover point additionally. Therefore, the Project will support to improve creation of DMA for more accurate and reliable system of NRW ratio measurement.

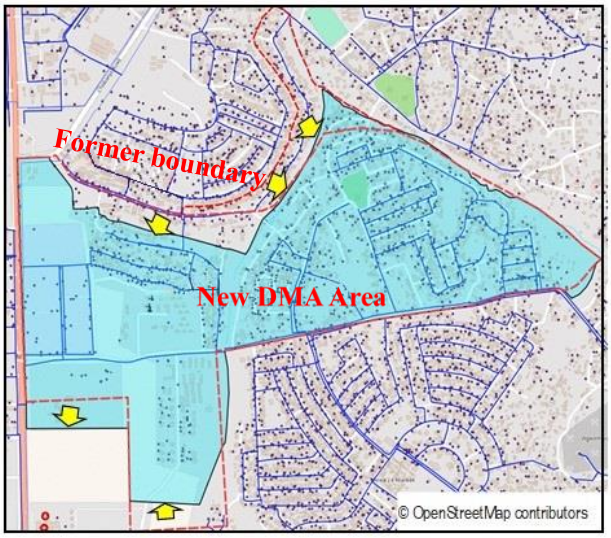


Fig.10 Reset of DMA boundary

The Project implements the setting of small boundaries with the aim of establishing five sub-zones within the DMA through installation of gate valves as preparatory works (see Fig.11). It can be expected that the sub-zones will be of benefit not only for easy detection of leakage but also to shorten time for water cutoff during pipe repairs.

After this system is established, the Project plans to take an effective approach for reduction of physical losses by narrowing them down based on priority.

Fig.11 Sub-zones

Creation of Customer List

There were no customer lists at the DMA level. Therefore, a survey was conducted of all households in the pilot DMA, and location data obtained and identified for all the customers living within the DMA. Through the survey above, a master list of the identified customers in DMA was created. It was then possible to calculate the monthly water use volumes of these customers easily, and accurately by assigning the DMA code to them in the water tariff collection database.

Commercial Loss

A map showing the age of water meters installed in target areas of the Project is shown in Fig.12. This is the data of 31,325 customers in the Southern Zone and 1,046 customers in the first pilot DMA. This data shows the distribution of aged water meters eight or more years since their installation (orange and dark red in Fig.12). The percentage was as high as 48% in the Southern Zone and 60% in the first pilot DMA.

For next step, the Project conducted water meter accuracy testing to ascertain the characteristics of water meters according to age. In this test, 280 water meters were randomly selected from the first pilot DMA. The average error rate of all water meters was calculated to be -8.3%, including faulty water meters that show no flow rate even though water passes through the water meter.

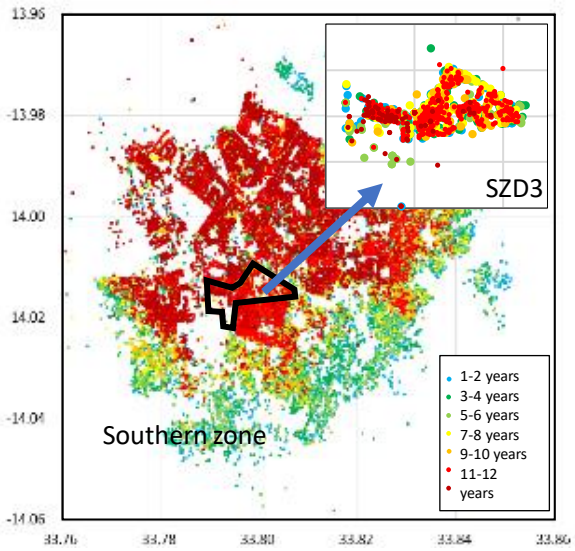


Fig.12 Distribution of water meter installation years in the Southern Zone and pilot DMA

Fig.13 shows the percentages of faulty water meters, categorized for less than eight years, and more than eight years since installation.

a) 69.1% of meters have good condition in any age
b) 11.4% are faulty meters due to unreadable or broken
c) 19.6% of meters are low accuracy with more than ±5% of meter error
d) Meters of eight years and over have higher percentage of faulty and low accuracy than less than 8 years

With reference to the situation of such a water meter, it is planned to formulate a meter's renewal plan taking into account its cost effectiveness as a means of NRW reduction.

(2) Output 3

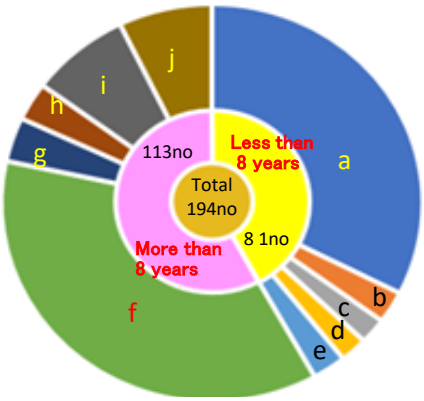
Water Utilities Regional Partnership

As part of the knowledge sharing strategy, cooperation with water utilities in the African Region is being conducted. In this framework, water utilities as peers are cooperating and learning each other. Participants in this framework are the LWB, the Water and Sanitation Corporation (hereinafter WASAC) of Rwanda, and Embu Water and Sanitation Company (hereinafter EWASCO) of Kenya.

This initiative began in 2018 before the start of the Project, the second workshop was held in Malawi with the assistance of the Project. The second workshop had attendees from four other Malawian water boards- Blantyre, Northern Region, Central Region and Southern Region, and Yokohama City Waterworks Bureau (hereinafter YWWB).

Capacity Assessment (CA)

For making policy of CD program in the Project and LWB's own CD activities, CA analysis had been conducted by JET and C/P jointly (see Fig.14).



Conditions	Less than 8 years			More than 8 years		
	graph	no.	%	graph	no.	%
Normal	a	63	32.5	f	71	36.6
Unreadable	b	5	2.6	g	7	3.6
Broken	c	4	2.1	h	6	3.1
Defctive1	d	4	2.1	i	15	7.7
Defctive2	e	5	2.6	j	14	7.2
Total		81	41.8		113	58.2

Defective1 (The error is ±5-10%) Total 81+113=194
Defective2 (The error is more than ± 10%)

Fig.13 Percentage of faulty water meters by installation years

In this Project, the training contents have been developed by JET and LWB jointly based on the CA analysis results (see Fig.15).

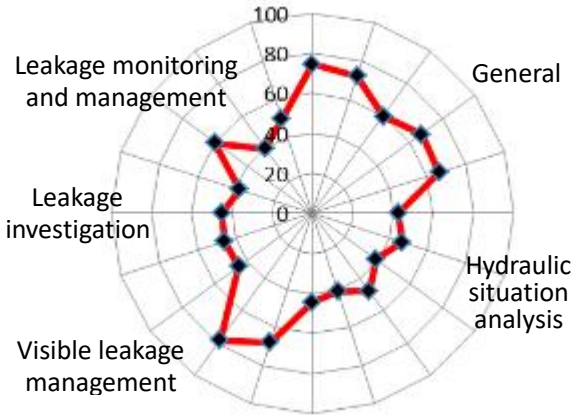


Fig.14 Example of CA Baseline
(Leak detection and management ability)

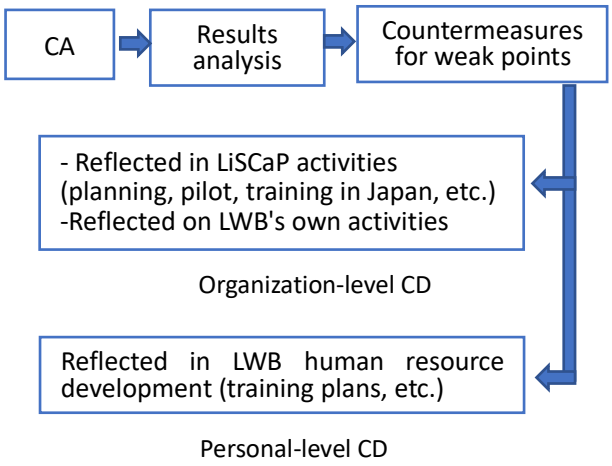


Fig.15 Image of CA utilization

As a result, LWB's understanding of the training in Japan has deepened, and LWB C/P have growing motivation to actively participate in the training.

Additionally, in terms of utilization of the CA, LWB has begun considering utilizing and linking the results of the CA in its internal CD plans.

4. Effective Approaches and Lessons Learned in Implementation of the Project

(1) Effective Approaches

Cooperation with Yokohama City Waterworks Bureau

The Project is effectively utilizing the expertise of Japanese water supply utilities through the long-term experts from YWWB. YWWB has established its own support system for other waterworks utilities outside of the country, and they have been accepting trainees for many years especially from African waterworks utilities.

Utilization of Existing Networks

The Project is utilizing LWB and Malawi's existing domestic and international networks, and is working to disseminate and scale up the outputs effectively and sustainably. The Project is utilizing the following existing networks.

a) Water Utility Regional Partnership
b) Water Services Association of Malawi (hereinafter WASAMA)
   WASAMA is an association established with the participation of water utilities all over Malawi.
c) Sector Working Group (hereinafter, SWG)
   SWG is one of the project coordination meetings among water sector stakeholders in Malawi such as governments, NGOs, and other development partners.

Utilization of PR Items and Public Relations Section of LWB

The cooperation of various stakeholders including residents is essential measures for reducing NRW. Therefore, the Project has focused on public relations activities, and has undertaken public relations through actively cooperating with the public relations section of LWB. Specifically, this has involved showcasing Project activities on LWB's website, via mass media and on LWB's internal newsletter.

In addition, the Project designed the Project logo shown in Fig.16, and came up with the abbreviated Project name, "LiSCaP" -short for Lilongwe Strengthening Capacity Project-.

Fig.16 Logo design full of project feelings

Internalization of Project Activities

The internalization of the activities is an important focus in ensuring the sustainability and LWB's independent ownership of Project activities. The following are specific examples of this.

a) Linking Project activities with LWB's annual budget plan (Output-1)
b) Initiatives to support making NRW reduction activities become part of routine work at LWB (Output-2)
c) Utilization of Capacity Assessment in LWB's human resources development plan

Continuation of Project Activities during COVID-19 Pandemic

Since March 2020, JET has had to return temporary to Japan due to COVID-19. In order for the Project to continue with activities under this condition, LWB and JET has been connecting remotely for communication. One specific example is the holding of two regular online video meetings for sharing information and exchanging opinions between LWB and JET. Another example is the replacement of water meters and conducting of water meter reading accuracy testing by online support from JET in Japan.

(2) Lessons Learned

Continuous Capacity Development for the Success of the Project

The level of expectation of the Project has been high from within and outside of LWB. LWB has been making an organization-wide and positive effort in regard to the Project, such as discussions on the various proposals from JET. Moreover, all staff of LWB is making an effort to ensure a high level of motivation toward work. To ensure that the Project continues to make progress, the efforts of LWB and JET in their respective fields of responsibility are vital. It is necessary for JET to deliver measures—in response to various issues—that are of high level and are readily achievable in a short