THE WEST BANK, PALESTINE
PALESTINIAN WATER AUTHORITY
JENIN MUNICIPALITY

PROJECT FOR STRENGTHENING THE CAPACITY OF WATER SERVICE MANAGEMENT IN JENIN MUNICIPALITY

PROJECT COMPLETION REPORT (MAIN REPORT)

OCTOBER 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

TEC INTERNATIONAL CO., LTD. (TECI)
PADECO CO., LTD. (PADECO)

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22-112

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

LIST OF ANNEX

1. Manuals, Guidelines and Plans - NRW

1.1 NRW Management Manual (Comprehensive Version) - English version

1.2 Cost-benefit Analysis of NRW Management Works - English version

1.3 DMA & Roll-out Plan of NRW Reduction - English version

2. Study Report and Plans - PPWM

2.1 Case Study of PPWM in Jenin Municipality (Results of Pilot Project) - English version

2.2 Prepaid Water Meter Installation Plan for Entire City of Jenin- English version

2.3 Case Study of Prepaid Water Meter

LIST OF ANNEX CD

No.	Materials	English version	Arabic version
1.	**Manuals, Guidelines and Information**		
1.1	Procedure Manuals for major tasks of Customer Service Management Activities (A) Examination of Water Meters with Zero or Minimum Monthly Consumption (B) Examination of Potential Illegal Connections (C) Random Check of the Installed PPWMs (D) Preparation of Customers; Door-to-Door Visitation of Customers Prior to PPWM Installation (E) Monitoring of Bill Collection Ratio; Preparation of Necessary Data and Calculation of Ratio (F) Collection Campaign; Soft Approach (G) Public Relations Activities	1.1.1	1.1.2
1.2	Report on Mobile Billing System (MBS) for Jenin Municipality	1.2	
1.3	Customer Database Survey (CDS) & GIS Work	1.3	
1.4	MIS Report 'Digital Business Transformation for Major Operations of Customer Service Management'	1.4	
1.5	Your City Water Explained Part 1, 2 and 3 (for Customer information)	1.5.1	1.5.2
1.6	Revised Water Supply Contract	1.6.1	1.6.2

No.	Materials	English version	Arabic version
1.7	Capacity Building Assessment of CSS and PR	1.7	
1.8	Collection Ratio Calculations and Charts (2017 to 2021)	1.8	
1.9	NRW Management Manual (Basic Version)	1.9.1	1.9.2
1.10	Equipment Usage Manual (Standard version)	1.10.1	1.10.2
1.11	Equipment Usage Manual (Simplified version for Technician) – Arabic version		1.11
1.12	Study on Existing Meter System and Prepaid Water Meter System, and Feasibility and Strategy for Introduction of Prepaid Water Meter System	1.12	
1.13	Implementation Plan of Introduction of Prepaid Water Meter System in Pilot Area-1 (PA-1)	1.13	
1.14	PPWM Booklet – for customers	1.14.1	1.14.2
1.15	Manual for Management of Prepaid Water Meter System in Jenin Municipality	1.15.1	1.15.2
2.	**Reports**		
2.1	Baseline Survey Report- 2018	2.1	
2.2	Endline Survey Report- 2021	2.2	
2.3	Annual Report on Water Supply Service in Jenin Municipality for the Year 2018, June 2019	2.3.1	2.3.2
2.4	Annual Report on Water Supply Service in Jenin Municipality for the Year 2018, June 2019- Digest Version	2.4.1	2.4.2
2.5	Annual Report on Water Supply Service in Jenin Municipality for the Year 2019, March 2020	2.5.1	2.5.2
2.6	Annual Report on Water Supply Service in Jenin Municipality for the Year 2019, March 2020- Digest Version	2.6.1	2.6.2
2.7	Annual Report on Water Supply Service in Jenin Municipality for the Year 2020, March 2021	2.7.1	2.7.2
2.8	Annual Report on Water Supply Service in Jenin Municipality for the Year 2020, March 2021- Digest Version	2.8.1	2.8.2
2.9	Annual Report on Water Supply Service in Jenin Municipality for the Year 2021, August 2022	2.9.1	2.9.2
2.10	Annual Report on Water Supply Service in Jenin Municipality for the Year 2021, August 2022- Digest Version	2.10.1	2.10.2
2.11	Terminal Evaluation Report August 2021	2.11.1	2.11.2
3.	**Plans and Job Descriptions**		
3.1	Water Service Management Plan 2018 – 2027 for Jenin Municipality- Initial 2018 Version – March 2019	3.1.1	3.1.2
3.2	District Service Improvement Plan (DSIP), 2019	3.2	
3.3	Action Plan (Updated) May 2022 for Terminal Evaluation	3.3	
3.4	Job Descriptions	3.4.1	3.4.2
4.	**PR Materials**		
4.1	Major Public Awareness Activities of Customer Service Section (CSS)	4.1	
4.2	Pre and Post Installation Surveys – Pilot Areas	4.2	
5.	**Seminar Presentations**		
5.1	Project Experience Sharing Seminar (1st Seminar)	5.1	
5.2	Project Experience Sharing Seminar (2nd Seminar)	5.2	
5.3	Project Experience Sharing Seminar (3rd Seminar)	5.3.1	5.3.2

Note: Attached as only digital copy in Annex CD.

LIST OF ABBREVIATIONS

AFD	Agence Française de Développement (French Development Agency)
CA, C/A	Capacity Assessment
CSS	Customer Service Section
CD	Capacity Development
CDS	Customer Database Survey
C/P	Counterpart
DMA	District Metered Area
GIS	Geographic Information System
ICT	Information and Communication Technology
JCC	Joint Coordinating Committee
JD	Job Description
JM	Jenin Municipality
JSC	Joint Service Council
JSC-JWV	Joint Service Council for Jenin Western Villages for Water and Wastewater
KPIs	Key Performance Indicators
LoRa	Long range
MBS	Mobil Billing System（MBS）
MIS	Management Information System
MNF	Minimum Night Flow
MoLG	Ministry of Local Government
MoSA	Ministry of Social Affairs
NIS	New Israeli Shekel
NRW	Non-Revenue Water
O&M	Operation and Maintenance
OJT	On the Job Training
PA	Palestine Authority
PA	Pilot Area
PC	Personal Computer
PD	Project Director
PDCA	Plan Do Check Act
PDM	Project Design Matrix
PI	Performance Indicator
PM	Project Manager
PO	Plan of Operation
PPWM	Prepaid water meter
PWA	Palestinian Water Authority
SDGs	Sustainable Development Goals
SIV	System Input Volume
TOT	Training of Trainer
UPWSP	The Union of Palestinian Water Service Providers
WBWD	West Bank Water Department
WSMP	Water Service Management Plan
WSRC	Water Service Regulatory Council
WWD	Water and Wastewater Department in Jenin Municipality

CHAPTER 1 OUTLINE OF THE PROJECT

1.1 Background

The West Bank region of Palestine has an annual precipitation of 400 to 700 mm which decreases towards the Jordan River. Securing water source during summer is a huge challenge in this region as the temperature increases and the precipitation decreases dramatically in this period. Ninety-three percentage (93%) of precipitation occurs between November and March and only 7% during April and October.

Groundwater and stream water are the main water sources in Palestine. Water consumption volume per capita is estimated to be 72.1 L/day. Comparing with that of Israel which is 300 L/day, water availability in Palestine is extremely low. In addition, water intake volume from existing water sources, over which Israel has a control, is decreasing and new water source exploitation such as drilling new wells requires permission from Israeli authority. The possibility of new source exploitation is politically restricted. Palestine currently purchases significant portion of its water supply from Israel which is also a huge financial burden. While there are various limitations and problems, the population of the Palestine is on increasing trend. In this context, effective countermeasures are required to promote efficient utilization of limited water resources.

Palestine consists of 16 governorates including 11 governorates in the West Bank and 5 in the Gaza Strip, and there are more than 130 cities and approximately 250 villages. In Palestine, a number of governmental institutions are involved in the water supply sector; namely Palestinian Water Authority (PWA) for the water resource management and water and sewerage regulation, Ministry of Local Government (MoLG) for administration of waterworks business, Ministry of Agriculture for irrigation regulation, and Ministry of Finance and Planning for the budgeting of the development projects. In respect to water services to the users, the entities that are involved in the waterworks are:

1) Government-owned entities which operate independently from the local municipality with their own finance and accounting (3 organizations: Jerusalem Water Undertaking (JWU), Water Supply and Sanitation Authority (WSSA), Costal Municipalities Water Utility (CMWU)),
2) Municipal water departments,
3) Extensive municipal council founded by MoLG and PWA, and
4) Community scale entities run by villages (Community water supply)

Reduction of non-revenue water (NRW) is one of the main policies of the water and sewage sector. However, the NRW ratio of the Palestinian main cities varies from 25% to 50%. And many water service providers are suffering from insufficient technical capacity such as the capacity to detect leakage and control water pressure, as well as institutional weakness to discover and control illegal connections and to improve low bill collection ratios.

Under these circumstances, PWA requested the Government of Japan (GOJ) for a technical cooperation

project to strengthen NRW management in Salfit. In response to this, JICA conducted the preliminary survey in 2014 with the result that the project area should be other than Salfit. The decision was made from the perspective of water supplied, population size, and the scale of waterworks.

Following this, JICA conducted the 1st detailed planning survey consisting of capacity assessment (C/A) of 11 water service providers and agreed with the Palestinian Authority in September 2015 that the target of the detailed survey would be limited to 1 to 2 service providers.

As a result of the survey on Jenin Municipality (JM) and Joint Service Council for Jenin Western Villages for Water and Wastewater (JSC-JWV) in December 2015, it was found that Jenin Municipality had the highest NRW ratio of 50% while the bill collection ratio was low (58%) and the financial status was particularly bad compared with other service providers.

Jenin Municipality, located in the northern part of the West Bank, Palestine supplies an average of 8,500 m^3/day of water to the population of 60,000 that is about 8,200 households. The Water and Wastewater Department (WWD) staffed with 76 personnel of the Jenin Municipality is responsible for the water supply service. In addition to the Jenin Municipality's geographical characteristic of water scarcity, the high level of NRW oblige Jenin Municipality to divide the service area into 6 districts and supply to each district every 6 days during summer season when demand increases greatly. The cause of the high level of NRW ratio is not only the leakage but also illegal connections and the situation where it is difficult to conduct an accurate meter reading because of aging meters. However, no major countermeasures against financial and personnel shortage was taken by Jenin Municipality so far. Furthermore, the absence of NRW reduction plan, institutional framework for monitoring work and basic information on facilities causes the further increment of NRW ratio. Moreover, Jenin Municipality was facing a deficit balance due to the high NRW and low bill collection ratio. As a result, it is difficult to allocate adequate budget for the maintenance cost and infrastructure investment in the future and this leads to further deterioration in service. NRW reduction is essential for the effective use of limited water resource, and more importantly, improvement in the bill collection ratio is necessary to establish sound financial status of waterworks, which, in turn, helps in implementation of the sustainable and effective NRW countermeasures.

Reflecting these, JICA conducted the 2nd detailed planning survey for Jenin Municipality in April 2016 and agreed with the Palestinian side on the scope and launching of the technical cooperation project to improve the water supply service of Jenin Municipality through comprehensively strengthening the capacity of water service management by means of NRW reduction, and improvement in bill collection ratio and financial balance.

1.2 Outline and Purpose of the Project

The outline of the Project Design Matrix (PDM) is shown in the table below.

Table 1-1 Outline of the Project

(1) Name of the Project	Project for Strengthening the Capacity of Water Service Management in Jenin Municipality (the Project)
(2) Overall Goal	Jenin Municipality's water service is improved.
(3) Project Purpose	Jenin Municipality's water service management capacity is strengthened.
(4) Output	1. Structure of NRW reduction activities and strengthening bill collection of Jenin Municipality is established. 2. Capacity to formulate plan for water service management of Jenin Municipality is strengthened. 3. NRW reduction capacity of Jenin Municipality is strengthened. 4. Direction for improvement of bill collection of Jenin Municipality is presented. 5. Project outputs and knowledge are shared among other water service providers.
(5) Project Area	Jenin Municipality
(6) Target Group	Jenin Municipality staff involved in the water service.
(7) Related Organizations	PWA, MoLG, MoSA (Ministry of Social Affairs), WSRC (Water Service Regulatory Council), UPWSP (The Union of Palestinian Water Service Providers), JSC-JWV
(8) Project implementation period	August 2017 – October 2022 (Original plan: August 2017 – August 2020)

1.3 Project Design Matrix (PDM) and Plan of Operation (PO)

1.3.1 Revision of PDM

The JICA and Palestine sides agreed to revise PDM three times, and the R/Ds were signed on 24th August 2020 for the first amendment, 24th June 2021 for the second, and on 8th February 2022 for the third amendment. The final PDM Version 3 is given in Appendix 1.

(1) 1st Amendment of R/D on 24th August 2020

- Additional Activities

Before	Amended Version
(PDM Version 0 Activities for Output 3)	(PDM Version 1 Activities for Output 3)
-	Add: 3.12 Prepare District Metered Area (DMA) plan for entire city 3.13 Start implementation of DMA plan according to the plan prepared in 3.12.
Reason: To ensure sustainability of project outcomes of NRW countermeasures.	
Before	Amended Version
(PDM Version 0 Activities for Output 4)	(PDM Version 1 Activities for Output 4)
-	Add: 4.10 Conduct the support activities in response to the COVID-19 emergency. 4.11 Prepare prepaid water meter (PPWM) replacement plan for entire city based on the results in Pilot Areas.

	4.12 Start replacement of customer meters with PPWM that Jenin Municipality purchases according to the plan prepared in 4.11.
Reason: To enable to respond timely to any demand for support activities required due to the COVID-19. To ensure sustainability of project outcomes of bill collection improvement.	

- Project Period

Before	Amended Version
Three (3) years from the dispatch of the first JICA expert. (September 25, 2017～September 24, 2020)	Four (4) years from the dispatch of the first JICA expert. (September 25, 2017～September 24, 2021)
Reason: Because of COVID-19, many project activities have been suspended. To achieve the project purpose through resumption of the existing activities and to ensure sustainability by implementing additional activities, the project duration needs to be extended.	

- Objectively Verifiable Indicators

Before	Amended Version
(PDM Version 0 OVI of Project Purpose) Jenin Municipality's NRW ratio at the Endline is XX % reduced compared with the Baseline. Bill collection ratio is XX% increased compared with the Baseline.	(PDM Version 1 OVI of Project Purpose) Jenin Municipality's NRW ratio at the Endline is reduced by 3% points compared with the Baseline. Bill collection ratio is increased by 9% points compared with the Baseline.
(PDM Version 0 OVI of Outputs) NRW ratio in Pilot Areas are XX % lowered compared with the Baseline. Bill collection ratios in Pilot Areas are XX% increased compared with the Baseline.	(PDM Version 1 OVI of Outputs) NRW ratio in Pilot Areas are lowered by 12% points compared with the Baseline. Bill collection ratios in Pilot Areas are increased by 35% points compared with the Baseline after installation of prepaid water meter.
Reason: The target values have now been specified based on the measured baseline values.	

- Important Assumptions

Before	Amended Version
(PDM Version 0 Important Assumptions in Overall Goal, Project Purpose, Outputs)	(PDM Version 1 Important Assumptions in Overall Goal, Project Purpose, Outputs)
-	Add: COVID-19 does not affect the implementation of the project activities.
Reason: If COVID-19 keeps affecting on the project activities significantly, overall goal, project purpose and outputs may not be achieved.	

(2) 2nd Amendment of R/D on 24th June 2021

- Project Period

Before	Amended Version
Four (4) years from the dispatch of the first JICA expert. (September 25, 2017～September 24, 2021)	Four (4) years and five (5) months from the dispatch of the first JICA expert. (September 25, 2017～February 24, 2021)
Reason: - Because of COVID-19, Experts are still unable to be dispatched as of June 2021 and some	

project activities have been delayed. - To achieve the project purpose through implementation of the existing activities continuously.

(3) 3rd Amendment of RD on 8th February 2022

- Project Period

Before	Amended Version
Four (4) years and five (5) months from the dispatch of the first JICA expert. (September 25, 2017～February 24, 2021)	Five (5) years and a month from the dispatch of the first JICA expert. (September 25, 2017～October 24, 2022)
Reason: - Due to the sudden change of the institution of custom clearance by Israel Government, the additional procurement of Pre-paid Water Meter (PPWM) within the Project has been significantly delayed. Israeli side currently impose the acquisition of certification of standards to import PPWM on Palestinian side, which can take up to 8 months, and the supplier started the process. Therefore, the Project will be extended by a total of 8 months including installation support after the delivery. - The installation of the PPWM is an essential input for the achievement of the project objectives. Both Japanese and Palestinian sides confirmed that this extension is based on the expected time to be required to deliver PPWM, and the duration of the Project may be extended or shortened again depending on the delivery status of PPWM.	

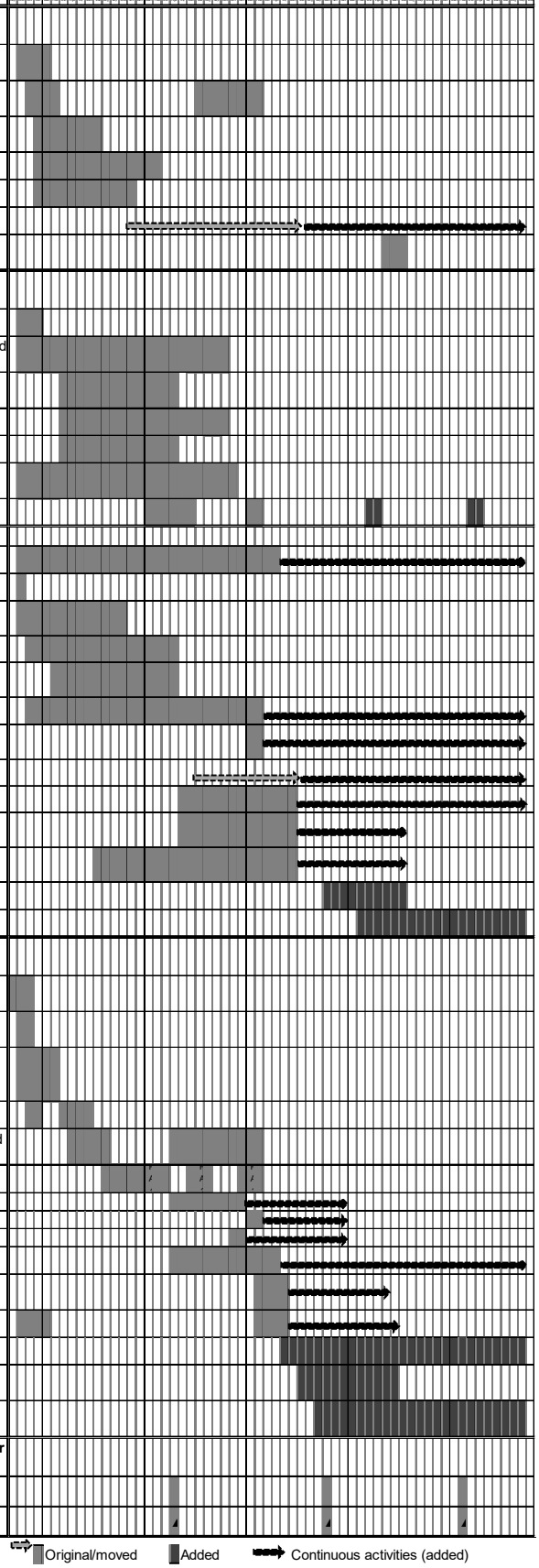
1.3.2 Plan of Operation

The final version of Plan of Operation (PO) is shown below.

Table 1-2 Plan of Operation version 4

Plan of Operation (PO) ver. 4
Project title：Project for Strengthening the Capacity of Water Service Management in Jenin Municipality
Target area：Municipality of Jenin

	Activity
1	**Structure of NRW reduction activities and strengthening bill collection of Jenin Municipality is established.**
1-1	Assess current situations and identify issues regarding Jenin Municipality's water services.
1-2	Revise the structure of Water and Wastewater Department to improve Jenin Municipality's water services
1-3	Examine existing Management Information System (MIS) and identify necessary data for the Project activities.
1-4	Measure the Baseline data.
1-5	Install necessary bulk meters to measure accurate water quantity.
1-6	Measure accurate NRW ratio every month.
1-7	Measure and evaluate the Endline data and propose recommendations for further improvement.
2	**Capacity to formulate plan for water service management of Jenin Municipality is strengthened.**
2-1	Establish Water Service Management Task Force.
2-2	Conduct trainings for corporate and financial management for water service operation and appropriate water tariff setting.
2-3	Formulate mid and long term water service operational business plans that include financial plans.
2-4	Formulate an annual plan including the financial plan.
2-5	Amendment for the water tariff is proposed
2-6	Improvement of financial and accounting rules and regulations for the Water and Wastewater Department is proposed.
2-7	Publish annual report of water service.
3	**NRW reduction capacity of Jenin Municipality is strengthened.**
3-1	Establish NRW reduction team and conduct NRW related trainings.
3-2	Select three Pilot Areas.
3-3	Prepare water distribution network drawings in Pilot Area 1, isolate an area hydraulically and install necessary bulk meters and gate valves.
3-4	Conduct OJT on leak detection in Pilot Area 1, and assess current physical losses.
3-5	Assess current commercial losses (illegal connections and customer meter inaccuracy etc.) in Pilot Area 1.
3-6	Conduct NRW reduction activities in Pilot Area 1.
3-7	Measure NRW ratio after the implementation in Pilot Area 1., then examine the cost effectiveness of activities and compile them into a report.
3-8	Continue monitoring NRW ratio at Pilot Areas, and maintain achieved NRW ratios.
3-9	Implement activities of 3.3-3.8 in Pilot Area 2 and 3.
3-10	Review Pilot Projects, then formulate cost effective NRW reduction roll-out plan for Jenin Municipality.
3-11	Compile NRW reduction methodology and usage of leak detection equipment and tools into manuals.
3-12	Prepare District Metered Area (DMA) plan for entire city
3-13	Start implementation of DMA plan based on the plan prepared in 3-12.
4	**Direction for improvement of water bill collection of Jenin Municipality is presented.**
4-1	Analyze details of current situation and issues regarding bill collection and finance of Water and Wastewater Department.
4-2	Conduct water user opinion survey on willingness to pay for water tariff and introductions of pre-paid meter.
4-3	Based on activities of 4.1 and 4.2, review Jenin Municipality's water service and water tariff, and identify direction for customer meter replacements including the possibility of prepaid meter introductions.
4-4	Submit proposed revisions of rules and regulations of bill collection.
4-5	Conduct public awareness raising activities for customer meter replacements in selected Pilot Areas.
4-6	Replace customer meters in selected Pilot Areas.
	Replace in PA1
	Replace in PA2
	Replace in PA3
4-7	Monitor bill collection ratios and customer satisfaction of Pilot Areas.
4-8	Analyze monitoring results and propose future direction for customer meter replacement.
4-9	Compile case studies about customer meter replacements.
4-10	Conduct the support activities in response to the COVID-19 emergency.
4-11	Prepare prepaid water meter (PPWM) replacement plan for entire city based on the results in Pilot Areas.
4-12	Start replacement customer meters with PPWM that Jenin Municipality purchases according to the plan prepared in 4.11.
5	**Jenin Municipality's project outputs and knowledge are shared among other water service providers.**
5-1	Share manuals produced by the Project among other water service providers.
5-2	Through the annual seminar, disseminate Project activities and lessons learnt.



CHAPTER 2 ACTIVITIES IN THE PROJECT

2.1 Input

2.1.1 Input of the Japanese side

Ten experts have been assigned since the Project started in September 2017. Total assigned man-months (M/M) are 118.8 in Palestine and Japan. The detail dispatch records are given in Appendix 5.

Table 2-1 Total assigned man-months of Experts

Site	Planned MM	Assigned MM	%
Palestine	88.93	87.88	98.8%
Japan	30.20	30.93	102.4%
Total	119.13	118.81	99.7%

(as of end of Sept. 2022)

2.1.2 Procurement of Equipment by Japanese side

The procurement of equipment for the Project activities was made by JICA Palestine Office and JICA Expert Team (JET) and divided into two parts: 1) the procurement that was made according to the original procurement schedule, and 2) the procurement as the special measure for COVID-19. The equipment and the materials procured by JICA Palestine Office and JET are summarized in Table 2-2 and Table 2-3 respectively, and the details are available in Appendix 3.

Table 2-2 Equipment procured by JICA Palestine Office

	Procurement lot	Model/ Specification	Q'ty	Year Procured	Status
A.	Original procurement schedule				
	1. Tools and equipment for leakage repair and piping work	Hammer drill, Pipe Saw, Pipe Threading Machine, Generator, etc.	1 lot	2018	Installed and in stock in the warehouse
	2. Vehicle for Leak Detection	Pickup, Mitsubishi L200, Diesel, 2018	1 no.	2018	In use
	3. Backhoe	CAT 428 F2, including accessories	1 no.	2018	In use
	4. PPWM (PA-1, 2 and 3)	PPWM (Baylan AK411), Cases, Server, PCs, etc.	1 lot	2019	Installed and in stock in the warehouse
	5. Flow meter, valves, fittings for DMA (PA-2, PA-3)	Flow & pressure logger (1P2F), Flowmeters (16bar, 25bar), Gate valve, Flange adapter, etc.	1 lot	2019	Installed and in stock in the warehouse
B.	COVID-19 procurement schedule				
	6. PPWM fittings for other area	Elbow, reducer, Nipple, etc.	1 lot	2020	Installed and in stock in the warehouse
	7. Mini Van	Volkswagen, Caddy	1 no.	2020	In use
	8. Bulk Meters and Accessories	Flowmeter, Data logger, etc.	1 lot	2021	Installed and in stock in the warehouse
	9. Maintenance materials	Pipes, Gate valves,	1 lot	2021	Installed and in

	Procurement lot	Model/ Specification	Q'ty	Year Procured	Status
	(leakage repair)	Butterfly valve, Elbow, Dresser Joint, etc.			stock in the warehouse
	10. Server	HPE Proliant 3.2 GHz	1 set	2021	In use in WWD
	11. PPWM & Gateway	PPWM (Baylan AK411), MultiTech	1 lot	-	Not yet delivered

Table 2-3 Equipment procured by JET

	Procurement lot	Model/ Specification	Q'ty	Year procured	Status
A.	Original procurement schedule				
	1. Equipment for Leakage Detection/Survey	Portable ultrasonic flowmeter, Pressure data logger, Ground microphone, listening sticks, etc.	1 lot	2018	In use
	2. Flow meter, vales, fittings for DMA (PA-1)	Data logger, Flowmeter, Butterfly valve, Gate valve, Flange adapter, etc.	1 lot	2018	Installed and in stock in the warehouse
	3. Portable meter test bench	ElectroMed	1 no.	2018	In use
	4. Experimental water meters including ultrasonic meter	Ultrasonic meter, Volumetric meter, Velocity meter	1 lot	2018	Installed and in stock in the warehouse
	5. PPWM fittings (PA-1, 2 and 3)	Joint, Nipple, Reducer, etc.	1 lot	2019	Installed and in stock in the warehouse
	6. Gateways	MultiTech	2 sets	2020	Installed
	7. GPS	Garmin Oregon 600	3 sets	2017	In use
	8. Compact digital camera	Nikon Coolpix W300	1 set	2017	In use
	9. Network printer	KMBT_C360	1 set	2017	In use
	10. Plotter	HP Design Jet T930	1 set	2017	In use
	11. PC (Laptop)	HP 400G4	2 set s	2017	In use
	12. PC (Desktop)	HP Desktop	2 sets	2017	In use
	13. Projector	EPSON EB-X31	1 set	2017	In use
	14. Speaker Phone system	Logitech Group Video Conferencing system	1 set	2020	In use
B.	COVID-19 procurement schedule				
	15. Chlorine doing pumps and barrel pump	Magdos LA4, PVC/FPM Lutz drum & container pump	1 lot	2021	Installed

Note: PA (pilot area)

2.1.3 Input of Palestinian side

Item	Contents
1. Counterpart personnel	The counterpart teams have been assigned. Project Director: The Mayor of Jenin Municipality Dr. Mohammed Abu Ghali stepped down from the mayor in August 2019 and Mr. Fayez Alsaadi become the mayor in September 2019. Mr. Nidal Obaidi has been elected as the mayor after the election in March 2022. Project Manager: Director of WWD Mr. Raghib Malhis (retired), Mr. Abd-Alhadi (appointed in April 2019 and retired in July 2022), Ms. Khiria Souqia (appointed as Acting Director in July 2022) 1. Water Service Management Task Force Leader: Director of WWD: Mr. Raghib Malhis (retired), Mr. Abd-Alhadi (Retired), Ms. Khiria Souqia (appointed as Acting Director in July 2022) Member: ● Overall coordinator (Deputy Project Manager): Khiria Souqia ● Director of Financial Department: Samir Omari ● Director of Engineering Department: Shireen Abu Wa'ar ● Director of Public Relation Department: Mayson Dawoud (transferred), Mohammad Zuobi ● Director of Administrate Department: Islam Al-Barbari (transferred) ● Head of Collection Department: Yazeed Shreim (retired) ● Head of Quality Unit: Yasser Ja'afar (retired) ● Head of Legal Unit: Nidal Samoudy 2. Non-Revenue Water (NRW) Reduction Team Leader, Director of WWD: Raghib Malhis (retired), Abd-Alhadi (retired), Ms. Khiria Souqia (appointed as Acting Director in July 2022) Member: ● Movement and Mechanics Department: Ahmad Abu Aziz ● Public Relation Department: Mayson Dawoud (transferred), Mohammad Zuobi ● GIS Department: Khiria Al Souqia ● Customer Services Section in WWD: Khalid Abu A'beid ● Water Section in WWD: Ramzi Ja'afar ● NRW team: Husam Riyal 3. Guideline and Manual Advisory Team Member: ● PWA ● Water Service Management Task Force ● Non-Revenue Water (NRW) Reduction Team
2. Office space and facilities	A project office with furniture in Water and Wastewater Department has been provided.
3. Necessary data/ information	Necessary information and data to implement the Project activities have been provided by C/P and through Project Manager. The coordination between WWD and Jenin Municipality head office has been made by Project Manager, when required.

Item	Contents
4. Local cost for implementation of the activities	• Procurement of chamber boxes, construction of flowmeter chambers and installation and replacement of flowmeters and valves. • Datalogger maintenance fee • PPWM installation (direct and subcontract work) • Procurement of 1,700 (1,200+500) PPWM out of which 1,390 have been already received and installed • 12 PPWM vending stations • Palpay contract • Mobile billing system • Jenin Municipality Website • License renewal of the DMAS system • Rehabilitation of collection centers, printers, scanners, firewall device, bicycles, etc.

2.1.4 Operating Expenses at Site

The operating expenses at site are summarized in the table below.

Table 2-4 Operating expenses at site

(1000 JPY)

Item	Sep 2017 - Mar 2018	Apr 2018 - Mar 2019	Apr 2019 - Mar 2020	Apr 2020 - Mar 2021	Apr 2021 - Mar 2022	Apr 2022 - Oct 2022	Total
1. General expenses	11,589	38,837	23,347	13,924	13,575	10,482	111,754
2. Equipment	1,565	12,508	531	1,354	11	12	15,981
3. Subcontract in Palestine	0	0	1,569	0	0	0	1,569
Total	13,154	51,345	25,447	15,278	13,586	10,494	129,304

Note: The data of Apr 2022 - Oct 2022 includes estimated amount of Oct 2022.
The expense of equipment includes only Expert procured equipment but not procurement by JICA Palestine office.

2.2 Activities Based on the Plan of Operation (PO)

2.2.1 Output 1: Structure of NRW reduction activities and strengthening bill collection of Jenin Municipality is established

1-1 Assess current situations and identify issues regarding Jenin Municipality's water services

1-1-1 Current situations and issues

(1) Related to overall water supply conditions

1) Irregularity of supply schedule- water imported from outside source (from Mek0rot company) is sometimes stopped suddenly and as a result Jenin cannot maintain its supply schedule. The irregular supply schedule is pointed out to be one of the most crucial issues by customers and recognized by WWD.

2) The source water flow is not monitored periodically. The demand and source of water balance by area is not clear. It is necessary to use more flow volume data for distribution control.

3) The supply is intermittent and supply duration is short. Actual supply condition (which area, when, and for how long) need to be clarified. This raises customers' dissatisfaction and also makes difficult for underground leak detection work.
4) The supply is rationed by daily opening and closing valves. This consumes substantial work time of technicians and accelerates wear and tear of valves.
5) Distribution flow is neither monitored nor managed since bulk metering does not exist in distribution network and the bulk meters are not working at distribution reservoirs.
6) Similar to flow, pressure in the network is also neither monitored nor managed. Since pressure zones do not exist, it is likely that pressure variation is significant within supply areas.
7) In the absence of flow and pressure monitoring, the supply is often inequitable.

(2) Real loss reduction (RL)

1) Leakage prone pipe materials
   a) Almost all pipe materials are metallic which are easily corroded and increase leakage.
   b) Most pipes are black steel (BS) for distribution mains and galvanized iron (GI) for service pipe and distribution sub-main. These are old-fashioned and nowadays not popular in other countries. Connection point of these pipes such as pipe to pipe, pipe to valve and pipe size change are generally welded, which need higher skill of welding and need pressure test after welding. Otherwise, leakage could occur. In addition, GI pipe has threaded ends, and the connections to fittings can be weak, resulting in rust and leaks.
2) Long response time to leak repair
   a) Finding of leaking point after developing surface leakage seemingly take time because exact pipe location and depth (earth cover) are unknown as no as-built drawing is available, and excavator is not easily available for digging. The longer the response time, the more is the leakage.
3) Lack of proactive leakage control
   a) Reported leaks are repaired but planned survey for surface leakage is not conducted.
   b) Underground leak detection survey is not conducted.
   c) There is no special team or section for leak detection.
   d) Leakage detection equipment is insufficient.
   e) There is no special vehicle for leakage survey.
4) Inappropriate leak repair method
   a) One of the leak repair methods in Jenin is welding. This method is old-fashioned and most of waterworks do not use it anymore. After a leak repair by welding, pressure test is required. The leak repair method should be reviewed. It needs more clamp and dresser for replacement of leaking pipe.
   b) The previous year, WWD implemented "Inserting Technique", inserting a smaller pipe into the existing leaked pipe, which reduces damage of pavement and excavation. However, this method reduces hydraulic capacity of pipe.

c) Technicians have a rich experience in leak repair, but they still need to learn about other methods of repair and need more training.

d) Depending on introduction of new pipe types, they should learn appropriate technique for connecting and repair of pipe.

5) Insufficient leak repair materials

a) Suitable materials are sometimes not available in the stock so that it takes time to repair leaks.

6) Non-standard method of service connection

a) No standard drawing is available for house connection. House connections are sometimes laid improperly. Instead of shortest distance possible from tapping point, sometimes house connections are made long in the private property. This increases the chances of leakage and illegal water connection.

b) House connections are made by non-standard method, welding. This increases the chance of leakage.

c) No pressure tests are conducted to confirm welding performance after new connections are made.

(3) Meter inaccuracy

1) The Class B velocity type meters are mostly used in Jenin. These are less accurate at low flow rates.

2) There is no working test bench for checking water meter accuracy. Accuracy of aged customer meters may be unacceptably low but it is not known yet.

3) Although not very common, some velocity meters are not installed horizontally. This increases meter inaccuracy.

4) Ownership of the meter is on customer. This makes difficult for the municipality to check or replace meters as it likes.

5) There is no replacement policy or regulation of inaccurate customer meter.

6) There is no meter maintenance team.

7) Existing GIS database has the age and status information of about 90% of the 6321 customer meters but the accuracy of this information is doubtful and needs confirmatory update.

(4) Unauthorized connections

1) There is no clear procedure for implementing the existing regulation about illegal connections.

2) There are no technical teams specialized in dealing with the illegal connections.

3) The Municipality's response is slow or sometimes no response when readers or collectors inform about any cases of water leak or illegal connections.

4) Meter readers fear attack if they report any illegal connection. Municipality doesn't provide any such protection needed.

5) Water from private water providers and private wells are used commonly mixed with municipal water system. It makes identifying illegal connection difficult.

(5) Reporting system

1) Monthly and annual reports of O&M are not prepared.

2) NRW reduction program requires systematic recording and reporting system. Currently, both reporting system and recording system are not at satisfactory level for the implementation of the NRW reduction activities.
3) Reporting is done mostly in oral form and some in hard copy written format. Computerized reports are not available which could help to plan O&M and preventive maintenance. The hand-written reports are rarely used for improving O&M.
4) Current reporting system of repair works needs to be improved in order to make the collected information more useful.

(6) Data management system

1) Basic information on facilities especially the as-built drawings, pump specifications, source flow data and so on are not easily available.
2) Since as-built drawings are not available, details of pipe depth, accurate pipe location, etc. which are needed for NRW reduction activities, are not available. This lack of pipe depth and accurate pipe location also increases leak repair time.
3) Inventory list is not updated regularly, and repair materials are not always available in stock.

(7) Challenges identified as most important by technicians of Water Section

The question about the top 5 problems for the water sector in the city were asked to technicians. The challenges identified as the most important by the technicians of Water Section are shown below.

Table 2-5 Challenges identified as the most important by the technicians

S. No.	Main challenges for the water sector in the city	Number of technicians who think this is among the top 5 problems
1	Many water leaks	13
2	Insufficient materials and equipment	9
3	Insufficient water source	8
4	Illegal connection	7
5	Customers' dissatisfaction for water supply	7
6	Water shortage	7
7	Old pump station	6
8	Inadequate water supply network	4
9	Insufficient staff	4
10	Low bill collection ratio	3
11	Weak management	3
12	No motivation to work	2
13	Low salary	2
14	Bad water quality	2
15	Meter malfunction or inaccuracy	1
16	High operation and maintenance cost	1
17	No operation and maintenance plan	1
18	Low water tariff	0
19	High cost of bulk water purchase	0
20	Less skill and technology of staff	0
21	Low water revenue	0

Note: A total of 16 technicians answered the above question.

1-1-2 Awareness on NRW

1) Many of the technicians are not aware of how much water is supplied to Jenin and how much is actually consumed by the customers. Some of them see additional water source as the solution of water problems in Jenin. It may be correct partially but given the difficult situation of Jenin in terms of acquiring new water sources, reducing NRW and utilizing the available water sources at maximum efficiency is most important. It is necessary to bring this awareness to the staff in WWD.
2) Awareness that 'water is money' and 'water leakage is wastage of money' needs to be instilled on each and every staff member. It is felt that the current awareness level is not enough.
3) WWD technicians indicated that they have no motivations to work for leakage detection at nighttime hours when it is needed.

1-1-3 Current situations and issues related to Customer Service Section

Followings are issues and challenges at Customer Service Section (CSS) including billing and collection.

Table 2-6 Issues and challenges related to existing billing and collection

Category of issues	Issues	Challenges
1. Meter reading	Careless customers: water meter is dirty, hidden between grass	There are some risks like insects and snakes especially in the summer, it's not easy to read
	Water meters inside home	Difficult to read it sometimes, easy to steal water and difficult for a technical person to check
	Location of water meter is in a high level	Difficult to read and some risks.
	Put a dog around water meter to prevent a reader from reading	Can't read water meter, and in this case customer can steal water by illegal connection
	Location of meters and some meters closed	Readers can't read meter
	No transportation, especially when they need to return to the office	More time and efforts, and paying transportation cost from their pocket when they return
	No supervision or check on readers in the field	Estimation of current reading by readers without going to water meters locations. They copy past readings and write new reads in estimation, they read water meters sometimes with error
2. Billing and collection	No protection for readers and collectors by the municipality	They do not care about getting the results or not. They protect themselves through non-collision with customers
	Late submission of the list of the meters read by the readers	Delays updating the customer database with the month's read water meter and this could delay the billing printing and delivery
	Need for printing machine	They have to go to other place in the municipality to copy any paper, it takes too much time
	Collectors don't have enough will to collect water tariff, there is no punishment policy in the municipality and no efficiency	Lack of collection
	No clear procedure for collection from municipality	Confusion in work and random work
	Collectors under pressure from Jenin Municipality to collect more money	There is no motivation to collectors to collect more money, collection rate still the same each month

Category of issues	Issues	Challenges
	Objection to invoice value from customers when collectors deliver to customers	Non-continuity in distributing the invoice to the person who objected
	Customers not receiving and expelling collector sometimes	Can't deliver the bills
	Sometimes the amount which is paid by a customer is not deducted from its accumulated credit balance	Expanding the gap between citizens and municipality and distrust of the municipality
3. Illegal connection	Jenin Municipality does not respond when readers or collectors inform about any cases	Continuous stealing of water and water losses
	There are no technical teams specialized in dealing with illegal connections	More illegal connections but no discovery of current illegal connections
	Unclear and unestablished procedure for implementing the already existing regulation about illegal connections	What exactly is the procedure, who are in charge, and who manages the whole procedure is not clear. People continue to steal water through illegal connections
	Water meter removed by customers	Readers cannot read meter, increases NRW rate, and this issue is illegal
4. Debt increase and repayment	Convenient installment base payment for debts	Encouraging customers not to pay, and rate of collection is too low
	Non-payment culture	Accumulation of debts and lack of collection
	No separation between the amount of debt and the current bill amount to be paid at the court	When amount is large, it doesn't help to pay, but when the current bill value is low itis easy to pay (Psychologically)
	High debtors pay a low amount of their total debt	When they go to the court and judgement is against the customer, the decision will be to pay as customer wants. (Convenient installment)
	Imaginary debts for some customers especially when customers are out of the city	Accumulation of debts, because collector put minimum tariff per month
	Problem in old accounting system, when customers get exemption, it is not migrated from customer account	Accumulation of debt
5. Owner	Water distribution is not fair	Some customers access water and others do not. This makes problem for readers and collectors when they read water meter or deliver bills
	Ownership of water meter in wife's name	Often wife does not need to do tax clearance, so debt is not paid
	Ownership of water meter in young people's name, less than 20 years	In this age no need to pay anything to municipality, it is easy to not pay water tariff
	Water meter in the name of died person	Heirs don't care to pay, and no direct responsibility for water meter and tariff
	Some water meters in the name of first and second name or third name	Can't go to the court in this case, court needs full name
	Abandoned houses especially in the old city	Water meters are damaged and there is no one to review
	Buildings under construction having water meter, in this case the owner should stop the subscription after finishing the construction	Accumulation of debts because collector put minimum tariff per month
6. Human resources	There are not enough readers and collectors	They cannot complete tasks on time, and more mistakes
	Inefficient allocation of readers and collectors among two sections; CS and Collection unit	The relation between the CSS and Collection unit is unclear regarding managing assignment of the 12 readers and collectors

Category of issues	Issues	Challenges
	Lack of enough technical persons in CSS	To maintain, repair, discover illegal connections and water meter technical problems, etc.
	Lack of enough employees	To help current staff in data entry and answer to customers complaints, the current staff is not enough to respond to the different needs of customers, this slows down the workflow
	No maintenance for water network and network is old. Complaints on network	Continuation of losing water and illegal connection
7. Collection from refugee camp	Collection rate in Jenin camp is too low, it is 1% and debts is 7 million NIS, and there are 1,362 customers in the camp	Does not contribute to the development of city's water sector. Does not help to maintain the water network and affect water sector in general
8. Water supply condition	Many depend on private wells	No commitment to pay for municipality because they rarely receive municipality water
	Use pump directly on house connection to pull water to the tank	Water pressure to other customers is less than who use pump, in this case water does not reach to all customers
9. Response by municipality	No quick response from the related section in the municipality	Lack of trust between citizen and municipality

1-1-4 Issues relate to the Public Relation (PR) Department and its activities

The issues relate to the Public Relation (PR) Department and its activities are summarized below.

- The department has no strategy or plan for public relations and awareness activities and thus prepares no report on such activities.
- There are no manuals for any public relations and awareness activities.
- There is neither written or official workflow or manual for responding to public complains nor interdepartmental workflow on this matter.
- When it receives a complaint, there is no record of the contents of the complaint.
- The department does not implement any water related awareness activities.
- The department sometimes announces to the public about water cut schedule of some areas, on the Jenin Municipality's Facebook, upon the request from WWD. However, PR has no positive experience with such public announcements because the water department fails to follow the announced schedule. This has caused the public to be indifferent towards such notices.
- The department has no PR materials for raising awareness on water related matters.

1-1-5 Capacity assessment

(1) Assessment method

It is acknowledged that the elements of capacity can be categorized into 3 dimensions such as core capacity, technical capacity and enabling environment. Technical capacity is particular technical capabilities in the form of techniques, knowledge and skills. Core capacity is underlying capabilities to handle and resolve the various issues by using technical capability. In other words, core capacity is management capability including leadership, problem-solving, the practical capability for executing operations, human resource development, empowering environment, and culture in general.

Technical capacity should be considered together with the core capacity since technical capacity is solely

not able to solve the issues without appropriate core capacity. Hence, the Project carried out core capacity assessment at the beginning of the Project. We focus on the four dimensions of organizational core capacity such as leadership, adaptive, management and operational which are mentioned in "Items of Assessment".

Table 2-7 Four core capacity model

Capacity	Description
Leadership	the ability of all organizational leaders to create and sustain the vision, inspire, model, prioritize, make decisions, provide direction, and innovate, all in an effort to achieve the organizational mission
Adaptive	the ability of an organization to monitor, assess and respond to, and create internal and external changes
Management	the ability of an organization to ensure the effective and efficient use of organizational resources
Operational	the ability of an organization to implement key organizational and programmatic functions

Reference: Patrick J. Rogers, Institute for Human Services, Inc. "Organizational Capacity Building"

(2) Core capacity assessment

The results of the organizational core capacity assessment are shown in Table 2-8, Figure 2-1 and Figure 2-2.

Table 2-8 Results of assessment of organizational core capacity

Category	No.	Topic	Results			
			WWD Average	Other dept. Average	All Average	By category
A. Leadership	Q1	Vision & mission	1.7	1.7	1.7	2.6
	Q2	Action plan	1.7	1.6	1.6	
	Q3	Relationship	3.0	3.9	3.6	
	Q4	Motivation	3.3	3.4	3.4	
B. Adaptive	Q5	Performance measurement	1.7	2.0	1.9	1.6
	Q6	Data usage	1.0	1.7	1.5	
	Q7	Gap assessment	1.5	1.4	1.5	
	Q8	Feedback to improvement	1.0	1.7	1.5	
	Q9	Improvement plan	2.0	1.4	1.6	
C. Management	Q10	Budgeting	2.7	2.3	2.4	2.6
	Q11	Monitoring of budget	3.0	1.7	2.1	
	Q12	Quality & quantity of staff	1.3	1.4	1.4	
	Q13	Duty and responsibility	3.3	3.6	3.5	
	Q14	Organizational process	1.7	1.9	1.8	
	Q15	Decision-making	3.7	4.0	3.9	
	Q16	Human resource planning	3.0	3.0	3.0	
D. Operational	Q17	Sharing plan	1.7	1.4	1.5	2.5
	Q18	Activity report	2.5	2.4	2.5	
	Q19	Sharing information	2.8	3.0	3.0	
	Q20	Operational planning	3.5	3.0	3.2	
Average			2.3	2.3	2.3	

Note: Other dept. (Public Relation & Media Dept., Financial Dept., Administration Dept., Engineering Dept., Procurement Dept., IT & Programming Dept., Collection unit)

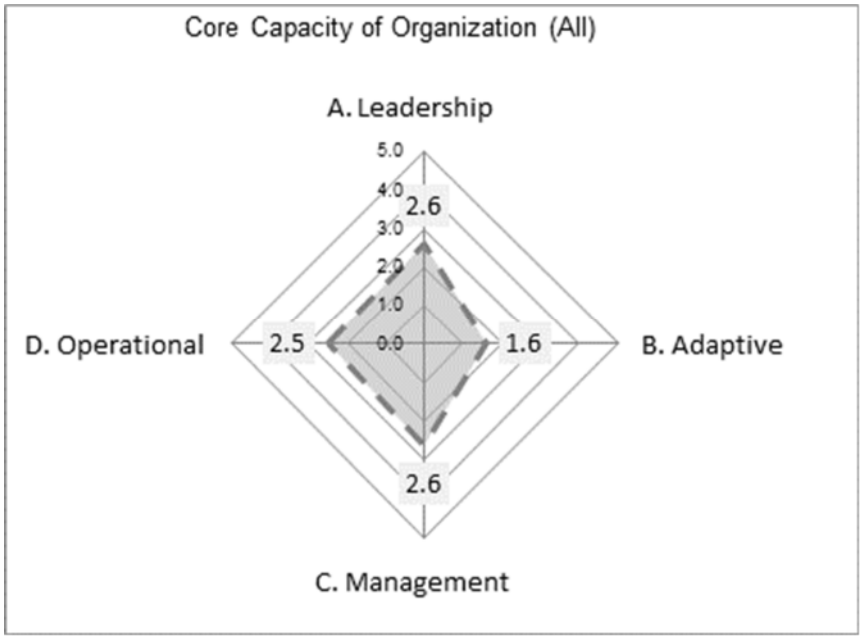


Figure 2-1 Average score of organizational core capacity assessment of Jenin Municipality

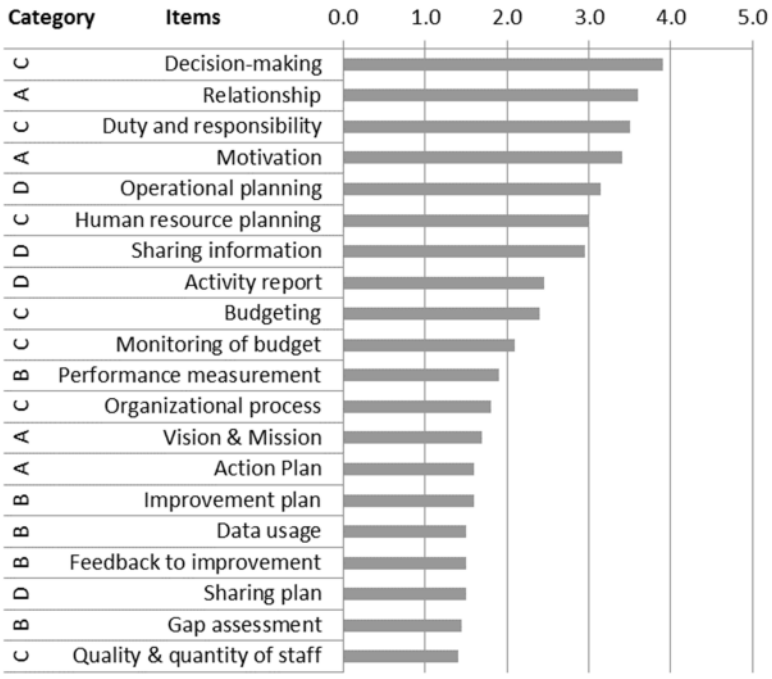


Figure 2-2 Averages score of organizational core capacity assessment of Jenin Municipality by item

(3) Technical capacity assessment on NRW

1) Technician level

Sixteen technicians were interviewed regarding various technical and non-technical issues. The results are summarized below.

- 11 of the 16 technicians have experience of 10 years or more, 12 are permanent staff and 13 technicians have secondary or higher education.

- 11 of the technicians are involved in network maintenance work. Following this, 9 are involved in daily valve operation works for rationing water supply, and 7 in new pipes connections / installation works.
- Lack of equipment was the biggest problem followed by lack of repair fittings, lack of machinery, and lack of transportation to site in that order.
- They try to find solutions to their best but some of the solutions like using recycled fittings are not good to reduce NRW.
- The majority of reasons for not being able to solve the problems on their own seem to be related to constraint of resources such as lack of proper machinery, fittings, and staff.
- Their suggestions to improve WWD indicated again the lack of equipment and machinery. Other important suggestions were to increase the number of staff and improve the technicians' experience (skill).
- Most of them think new water sources are the solution to the water problem in Jenin which is only partially correct. Only two of them think reducing NRW is important.
- The highest numbers (13) think that high number of leaks is the most critical challenge.
- Only three of them had taken some training; two of them in leak detection and one in meter maintenance.
- Their willingness to participate in the trainings to be conducted under this project is high.

2) Engineering level

Two regular engineers of WWD were administered NRW related technical questions categorized into three subject groups, and their answers were summarized and analyzed as shown in Table 2-9.

Table 2-9 Summary of result of test to C/P engineers

Subject Group	Score of C/P 1	Score of C/P 2	Average score
(1) Advance knowledge on NRW	82%	49%	65%
(2) DMA and conceptual analysis	61%	13%	37%
(3) Tools / equipment	36%	14%	25%
Overall	67%	33%	50%

3) Self-evaluation on NRW situation

In order to understand where WWD stands in terms of various indicators of NRW, a self-evaluation matrix was used. Summary of the self-evaluation by WWD head is shown graphically in Figure 2-3. As per the evaluation the items of the highest score are: Leak repair – distribution pipes and house connections (repair time). The items of the lower score are: Performance indicators, District metered areas (DMAs) and Pipe replacement.

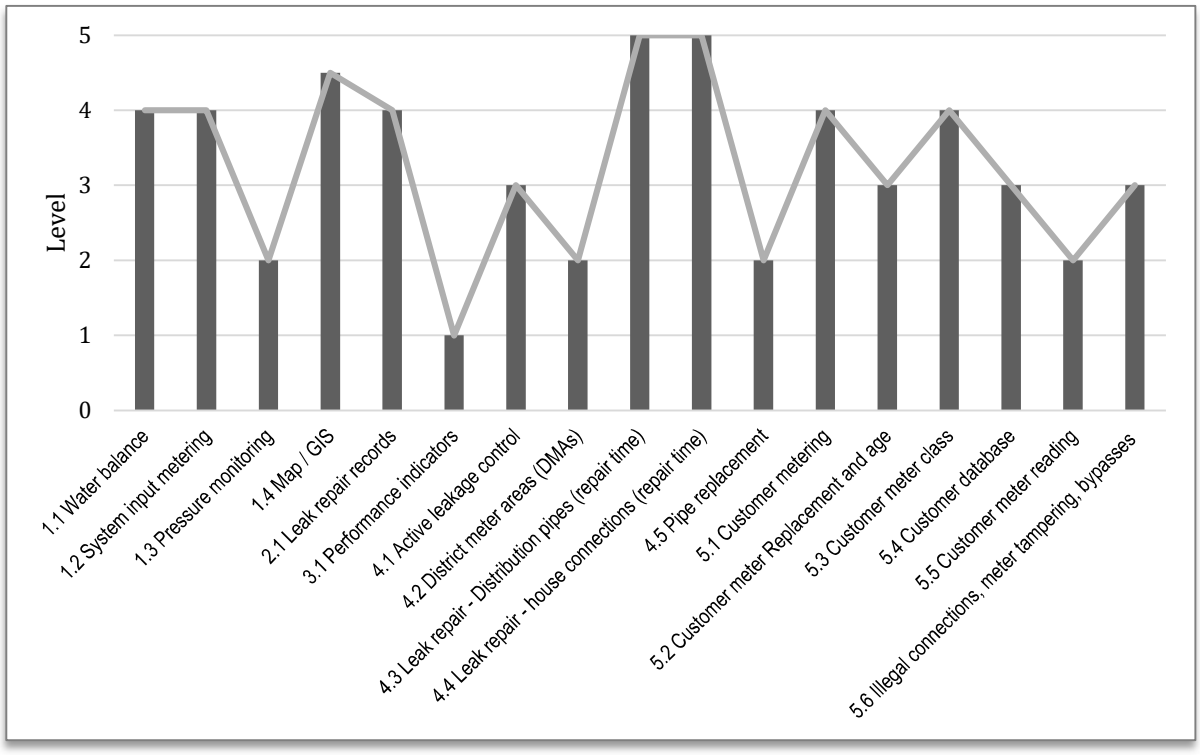


Figure 2-3 Summary of self-evaluation on NRW

1-2 Revise the structure of Water and Wastewater Department to improve Jenin Municipality's water services

WDD organization structure at the beginning of the Project in 2017 is shown in Figure 2-4, and the one proposed by Jenin Municipality that has been submitted to PWA is shown in Figure 2-5. The following improvements were made:

(1) Water Resources and Distribution Division and NRW divisions are created in Water Section.
(2) Projects Division and Data Bank/GIS are created in Studies and planning Section.
(3) Collection Section in the municipality head office has been transferred to Customer Service Section.
(4) PPWM Database and Monitoring unit is created in Customer Database Management Division (not shown in the figure).
(5) Division names of Customer Service Section are changed.

The organization structure at the end of the Project is shown in Figure 2-6.

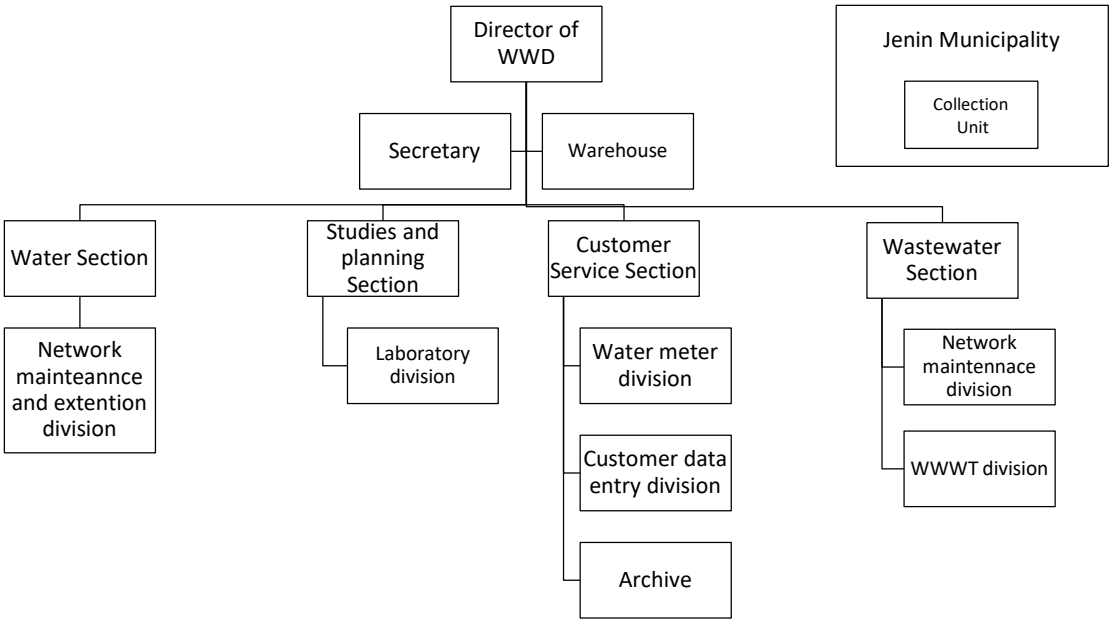


Figure 2-4 WDD organization structure at the beginning of the Project

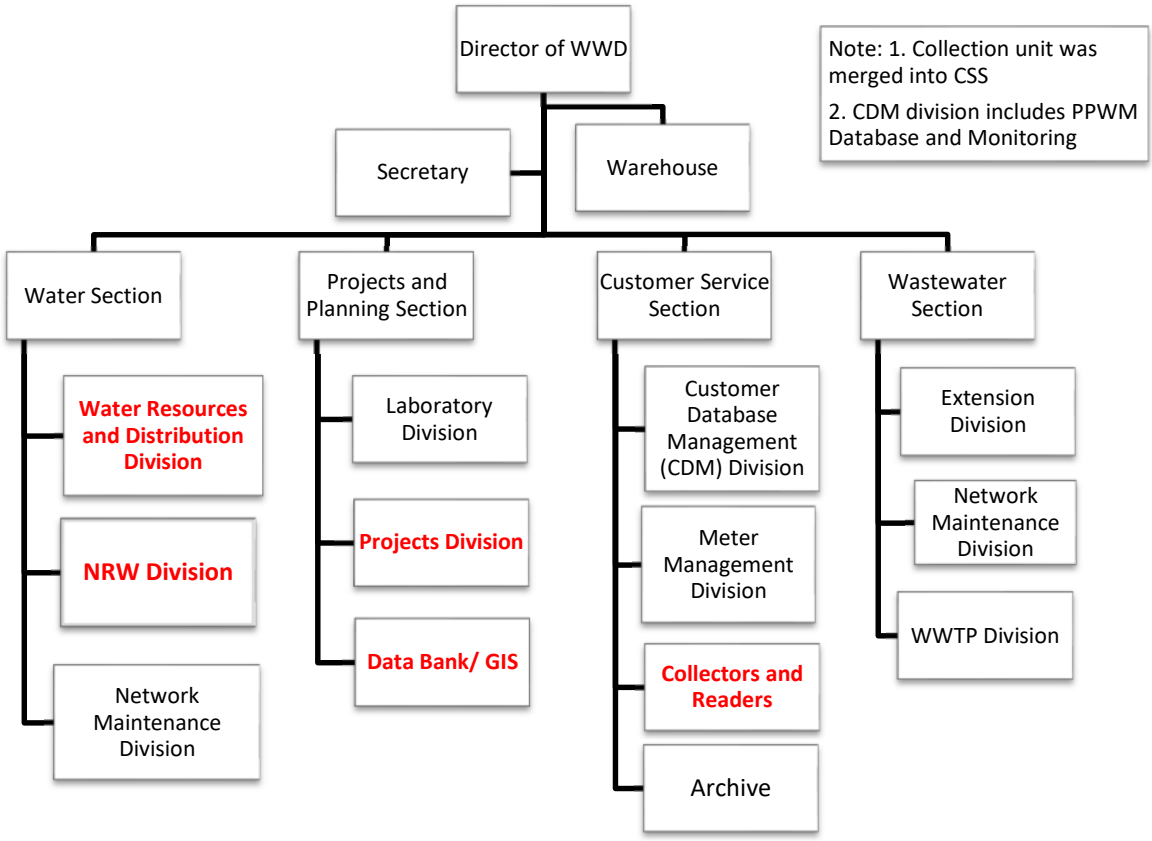


Figure 2-5 Proposed WWD organization by Jenin Municipality that was submitted to PWA

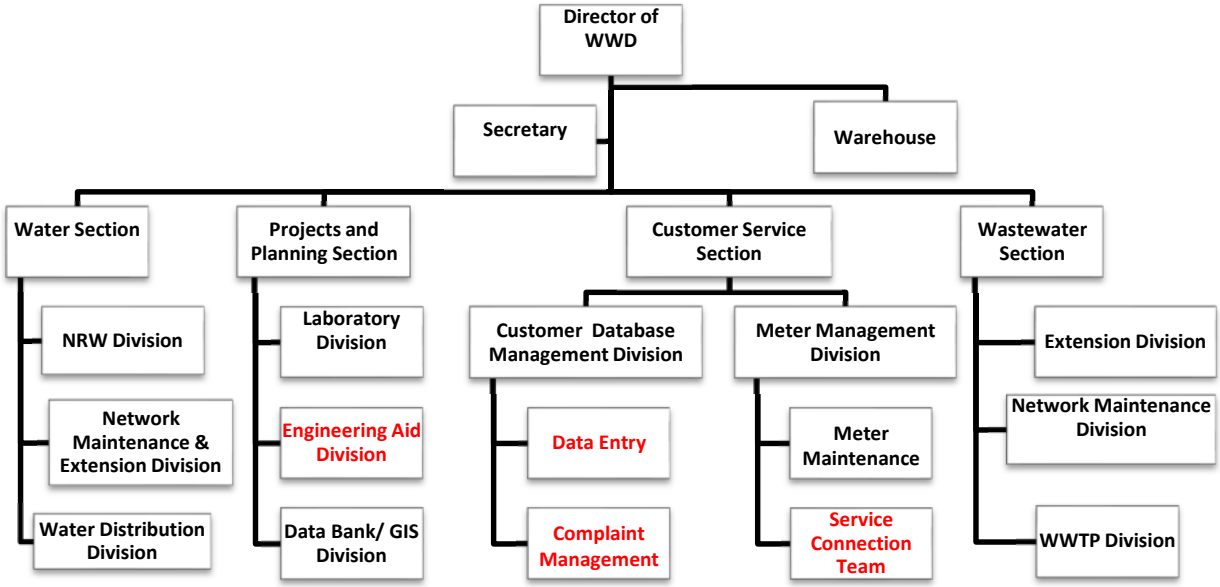


Figure 2-6 Organization Structure at the end of the Project

1-3 Examine existing Management Information System (MIS) and identify necessary data for the Project activities

The only existing MIS for water services are the indicators and formats that the WSRC requires all municipalities to submit. The information submitted by the Jenin Municipality to the WSRC for years 2015 and 2016 was collected and analyzed.

Based on the balanced scorecard perspective and the actual situation of intermittent water supply, additional indicators were proposed in the medium- and long-term water supply business management plan, based on ISO24510 (Activities related to drinking water and wastewater services – Guidelines for evaluation and improvement of services) and JWWAQ100 (Guidelines for water supply services). Using these as reference, the following five indicators were added: Continuity of supply, Percentage of complaints on Pressure of drinking water supply, Number of pipeline failures, and Staff training time (external and internal).

Table 2-10 KPIs and targeted values

No.	Index	Perspective of BSC	Reference	Jenin in 2016	JSC-JWV In 2016	Target	Notes
1	Average daily per capita water consumption	Customer	Note 1	69 l/c/d	39 l/c/d	-	
2	Average daily total per capita water consumption (domestic, industrial, commercial, touristic)	Customer		74 l/c/d	47 l/c/d	-	
3	NRW by volume	Internal Business Process		49 %	21 %	2018: 42% 2022: 35% 2027: 30%	.
4	NRW per km of network			9,542 m^3	566 m^3	-	

No.	Index	Perspective of BSC	Reference	Jenin in 2016	JSC-JWV In 2016	Target	Notes
	per year						
5	NRW per connection per day			410 l/c/d	127 l/c/d	-	
6	Personnel costs per m^3 of water sold	Financial		2.5 NIS/m^3	1.54 NIS/m^3	-	
7	Water purchase costs per m^3 of water sold	Financial		0.7 NIS/m^3	1.77 NIS/m^3	-	Debts due to WBWD: 31.7 mNIS as of 2015.
8	Energy costs per m^3 of water sold	Financial		1.4 NIS/m^3	1.16 NIS/m^3	-	Electricity charge has not been paid in Jenin.
9	Collection efficiency – water service	Financial		53.7 %	104 %	2018: 75% 2022: 100% 2027: 150%	Paid 5.3 mNIS; Receivable 35.8 mNIS as of Dec 2017.
10	Working ratio (efficiency ratio) for water service	Financial		1.08	0.88	2022: 1.00 2027: 0.8	O&M and administrative cost / operating revenue from water.
11	Water samples (taken from network) containing free chlorine residual	Internal Business Process		85 %	100 %	100 %	
12	Water samples (taken at source) free from total coliform contamination			100 %	100 %	100 %	
13	Water samples (taken at source) free from fecal coliform contamination			100 %	100 %	100 %	
14	Water samples (taken from network) free from total coliform contamination			100 %	100 %	100 %	
15	Water samples (taken from network) free from fecal coliform contamination			100 %	100 %	100 %	
16	Microbiological tests carried out			400 %	194 %	Not less than 100%	
17	Water samples taken at source free from Nitrate contamination			100 %	100 %	100 %	
18	Staff productivity index (SPI) per 1000 customers	Customer		6.0	5.0	2018: 5.6 2022: 5.6 2027: 5.2	Number of working staff / number of active subscribers / 1000 customers; 48 and 52 employees in 2018 and from 2019 respectively.
19	Percentage of complaints on Pressure of drinking water supply	Customer	Note 2	-	-	TBD	Number of pressure complaints / number of service

No.	Index	Perspective of BSC	Reference	Jenin in 2016	JSC-JWV In 2016	Target	Notes
							complaints (%)
20	Continuity of supply	Customer		-	-	TBD in each distribution zone wise	Number of hours when the system is pressurized /24 hours (%)
21	Unit tariff of water supply	Financial	Note 3	5.12 NIS/m^3	-	-	
22	Number of pipeline failures	Internal Business Process		-	-	TBD	Number of pipeline failures / 100 km of pipeline
23	External training time for staff	Learning &Growth		-	-	4 days/staff	Participate in training programs by UPWSP or others
24	Internal training time for staff			-	-	4 days/staff	Participate in JET trainings and workshops

Note 1: "The Performance of Water Service Providers in Palestine Summary of 2015-2016" (2017, WSRC)

2: ISO 24510 2007 (E) "Activities relating to drinking water and wastewater services – Guidelines for the assessment and for the improvement of the services to users".

3: JWWA Q 100: "Guidelines for the management and assessment of a drinking water supply service". (2005, JWWA)

4: BSC (Balanced Score Card)

5: mNIS: million NIS

1-4 Measure the Baseline data

(1) Baseline of NRW

1) Baseline NRW for whole Jenin

The project team started collecting and compiling supply and consumption data and started calculating NRW from Jan 2018. Average NRW of year 2018 was taken as a baseline, which was 60.0% of system input volume (SIV) or 156,617 m^3/month (Table 2-11).

Table 2-11 NRW of Jenin in year 2018

Month	SIV (m^3)	Billed Consumption (m^3)	NRW (m^3)	NRW (%)
Jan-18	241,282	102,612	138,670	57.5%
Feb-18	232,788	96,098	136,690	58.7%
Mar-18	236,026	104,852	131,174	55.6%
Apr-18	320,852	100,891	219,961	68.6%
May-18	278,123	111,758	166,365	59.8%
Jun-18	276,533	87,600	188,933	68.3%
Jul-18	287,549	131,632	155,917	54.2%
Aug-18	286,742	117,603	169,139	59.0%
Sep-18	261,812	106,112	155,700	59.5%
Oct-18	240,652	105,362	135,290	56.2%
Nov-18	222,910	96,625	126,285	56.7%
Dec-18	267,622	112,346	155,276	58.0%

Month	SIV (m^3)	Billed Consumption (m^3)	NRW (m^3)	NRW (%)
Total	3,152,890	1,273,491	1,879,399	60.0%
Av./month	262,741	106,124	156,617	**60.0%**

2) Baseline NRW for PA1

The DMA of Pilot Area (PA) 1 was set up and NRW measurement started from Sep 2018. Average NRW of the following 3 months (Oct. 2018-Dec. 2018) was taken as the baseline, which was 57.0% of SIV or 15,239 m^3/month (Table 2-12).

Table 2-12 NRW of PA1 during Oct-Dec 2018

Month	SIV (m^3)	Consumption (m^3)	NRW Adj. (m^3)	NRW (%)
Oct 2018	28,239	12,464	15,775	56%
Nov 2018	24,708	10,937	13,771	56%
Dec 2018	27,365	11,193	16,172	59%
Total	80,312	34,594	45,718	57%
Av./month	26,771	11,531	15,239	**57%**

3) Baseline NRW for PA2

The PA2 DMA was set up and NRW measurement started from Nov. 2019. The NRW of that month was 44.0% of SIV or 5,609 m^3/month. This was taken as the baseline initially. After that, customer meter replacement program with PPWM progressed in this PA but the Gateway system required to collect consumption data from the PPWM was still not ready. While waiting for the Gateway system procurement and setting, a new water source (private well) with pumping head of about 130 m was added within this PA which also supplied some area outside the PA. This addition changed the hydraulic within the PA (water flow direction was reversed at one location of bulk meter), increased supply pressure and supply duration drastically. To measure the quantity going out to other area one additional bulk meter was required. Also, the mechanical bulk meter at the location where the flow direction reversed did not work. It required to be replaced with a meter which could measure flow in both directions. These were finally arranged and NRW measurement started once again from April 2021. But it was found that compared to the value of Nov. 2019, the SIV increased by 260% and NRW ratio increased from 44% to 60%. Since the supplied volume, water pressure as well as supply duration changed drastically from the initial baseline period of Nov. 2019, it was considered that it is not logical to compare the current conditions with that of Nov. 2019. Thus, a baseline with an average NRW level of April, June and July 2021 was proposed and agreed as a new baseline. The new baseline thus calculated was 66.1% of SIV or, 23,269 m^3/month (Table 2-13). Major NRW countermeasures including stop-cock method and leak detection and repair work also progressed only after July 2021. In the month of May 2021, Jenin Municipality read all customer meters which were not read for a long time. Thus, the consumption value was not normal, so it was excluded from the baseline calculation.

Table 2-13 NRW of PA2 during Nov 2019-Jul 2021 period

S.N.	Month	SIV (m^3)	Consumption (m^3)	NRW (m^3)	NRW (%)	Remarks
1	Nov 2019	12,736	7,127	5,609	44.0	Initial baseline
2	Jul 2020	23,502	9,857	13,645	58.1	The SIV changed drasticall y compared to the month of Nov-2019
3	Aug 2020		11,530			NRW could not be measured due to problem related to supply condition
4	Sep 2020		14,972			
5	Oct 2021		12,117			
6	Nov 2021		12,117			
7*	Apr 2021	33,473	13,278	20,195	60.3	Month considered for baseline
8	May 2021	32,768	14,129	18,639	56.9	Many customer meters which were not read for a long time were read in this month
9*	Jun 2021	36,051	11,244	24,807	68.8	Month considered for baseline
10*	Jul 2021	36,051	11,244	24,807	68.8	Month considered for baseline
Total of S.N.7, 9, 10		105,574	35,766	69,808	66.1	
Av. of S.N.7, 9, 10		35,191	11,922	23,269	66.1	

4) Baseline NRW for PA3

The DMA was set up and NRW measurement started from Oct. 2019. The NRW for this month, which was 55.2%, or 9,375 m^3/month, was taken as a baseline.

(2) Bill collection ratio

The baseline for water bill collection ratio was measured by the average of the year 2018 considering that major improvement activities were prepared in 2018 and started in 2019. The baseline collection ratios for All City, PA1, PA2, and PA3 were 41.17%, 60.81%, 36.84%, and 47.98%, respectively.

Table 2-14 Baseline bill collection ratios (%)

Billed Month	All City	PA1	PA2	PA3
Jan-18	36.03	49.22	33.78	42.85
Feb-18	44.44	72.04	30.35	46.03
Mar-18	41.47	66.14	37.71	51.78
Apr-18	36.32	56.37	30.62	41.42
May-18	34.71	43.20	31.95	35.97
Jun-18	61.66	79.18	56.92	82.08
Jul-18	37.99	56.59	37.46	40.16
Aug-18	44.60	62.89	42.39	48.39
Sep-18	38.39	54.13	32.99	45.87
Oct-18	35.49	60.28	29.28	40.14
Nov-18	41.89	68.85	41.82	53.06
Dec-18	41.06	60.81	36.84	47.98
Average	**41.17**	**60.81**	**36.84**	**47.98**

1) Baseline bill collection ratios are without debt.
2) Measurement of the baseline collection ratio in PA2 included the new camp and governmental institutions.

1-5 Install necessary bulk meters to measure accurate water quantity

In the beginning of the Project all existing water sources supplying water to Jenin Municipality were checked for presence of bulk meters. All sources except one (Alaa Saadi well) were found to have functioning bulk meters. New water sources were added gradually at various stages of the Project. Each new source was equipped with a functioning bulk meter to measure water production. Status of source (bulk) meters in the beginning and as existing currently are summarized in Table 2-15. The quantity of water produced by the Alaa Saadi well, which did not have a bulk meter in the beginning, was estimated based on the size of its reservoir tank and the frequency of filling and emptying this tank per week. A new bulk meter was purchased and installed in this source later by the Project.

Table 2-15 Metering status of water sources

S.N.	Source Name	Source ownership	Metering status in the beginning (as of Jan 2018)	Current status (As of Aug 2022)	Remarks
1	Al Sadeh well	Municipality	Working meter	Working meter	
2	Al Mechanic well	Municipality	Working meter	Working meter	The old meter was replaced
3	Balama well	Municipality	Working meter	Working meter	
4	Mechanic well (Tanker Meter)	Municipality	Working meter	Working meter	The tanker feeding point was changed, this meter is not required any more
5	Farahaty well	Private	Working meter	Working meter	
6	Alawneh well	Private	Working meter	Working meter	The old meter was replaced
7	Jarrar well	Private	Working meter	Working meter	
8	Alaa Saadi well	Private	There was no meter	Working meter	A new meter was installed by the Project
9	Abu Sameer well	Private	JM was not using this source	Working meter	The owner's meter was replaced by a new meter by the Project
10	Abu Hatab well (No.1)	Private	JM was not using this source	Working meter	
11	Abu Hatab well (No. 2)	Private	JM was not using this source	Working meter	
12	JSC Meter	JSC	Working meter	Working meter	Water is taken in emergency cases only
13	Qasrawi well	Private	JM was not using this source	Working meter	
14	Turkman well	Private	JM was not using this source	Working meter	
15	Ashraf well	Private	JM was not using this source	Working meter	
16	Sabah Al Khir (Jalameh) transfer point	From Mekorot company	Working meter	Working meter	The old meter was replaced
17	Swetat transfer point	From Mekorot company	Working meter	Working meter	The old meter (mechanical) was replaced by an EMF
18	Abu Arab (Main) well	West Bank Water Department	Working meter	Working meter	New meter installed at JM supply area boundary by the Project

Number of active sources and total quantity of water record from these from Jan 2018 to Jun 2022 are as shown in Table 2-16.

Table 2-16 Number of active sources and total quantity of water

Year	Month	Number of active sources	Total quantity (m^3/mth)	Year	Month	Number of active sources	Total quantity (m^3/mth)
2018				**2020**			
	Jan	10	241,282		Jan	13	274,545
	Feb	10	232,788		Feb	13	266,281
	Mar	10	236,026		Mar-May	14	908,291
	Apr	10	320,852		Jun	15	305,340
	May	10	278,123		Jul	14	304,169
	Jun	10	276,533		Aug	15	331,648
	Jul	10	287,549		Sep	15	321,321
	Aug	10	286,742		Oct	16	306,950
	Sep	10	261,812		Nov	16	288,978
	Oct	10	240,652		Dec	16	317,089
	Nov	10	222,910				
	Dec	10	267,622				
Total of 2018			3,152,890	Total of 2020			3,350,067
2019				**2021**			
	Jan	10	264,719		Jan	16	294,788
	Feb	10	264,532		Feb	16	286,772
	Mar	10	294,489		Mar	15	295,420
	Apr	10	287,333		Apr	16	346,018
	May	10	294,317		May	16	343,905
	Jun	10	241,925		Jun	16	331,421
	Jul-Nov	12	1,452,579		Jul	16	321,977
	Dec	13	292,679		Aug	18	315,994
					Sep	17	283,792
					Oct	17	289,086
					Nov	17	266,295
					Dec	17	281,039
Total of 2019			3,392,574	Total of 2021			3,361,719
2022							
	Jan	17	284,532				
	Feb	17	282,632				
	Mar	17	308,248				
	Apr	17	312,698				
	May	17	312,727				
	Jun	17	289,106				

Accuracy checking of bulk meters

In order to confirm the accuracy of source meters, a program for checking source meters is being implemented and the result is as summarized in Table 2-17. The meters were checked by installing a portable ultrasonic flowmeter in series with them. The meters indicating errors in excess of ± 5% were replaced as far as possible and in cases where it was not possible to replace due to any reason the production volumes were corrected. This correction started from the month of September 2021.

Table 2-17 Result of source (bulk) meters checking

ID	Starting date	Test duration (hrs)	Quantity recorded (m^3)		Error of the Source Meter (%) compared to UFM	Size of bulk meter (mm)	Remarks
			By source's bulk meter	By UFM			
1	20-May-21	24	817.00	795.44	2.7%	75	Error within acceptable range
2	20-May-21	48	856.00	593.00	44.4%	75	The meter has been replaced since the test
3	02-Jun-21	24	405.00	390.05	3.8%	50	Error within acceptable range
4	14-Jun-21	24	818.00	779.40	5.0%	75	Error within acceptable range
5	14-Jun-21	24	678.00	607.80	11.5%	150	
6	21-Jun-21	48	1011.00	725.00	39.4%	75	The meter has been replaced since the test
7	26-Jul-21	24	592.00	640.52	-7.6%	75	
8	18-Aug-21	96	213.00	673.00	-68.4%	100	The meter has been replaced since the test
9	10-Oct-21	24	277.00	226.89	22.1%	75	Repeat test required to confirm the result
10	28-Oct-21	48	4772.00	3981.44	19.9%	150	Repeat test required to confirm the result
11	30-Oct-21	48	373.00	263.82	41.4%	75	The meter has been replaced since the test
12*	29-May-22	7	114.8	101.5	13.1%	75	

Note: * This is same as ID 1, UFM: ultrasonic flowmeter

Installing bulk meter at distribution area boundary

In the case of Abu Arab (Main) well (S.N. 18 in Table 2-15) the transmission pipe from the well passes through an area outside of the Municipality's distribution area including a stone cutting industrial area from which unknown water connections are suspected. To eliminate the potential inaccuracy caused by such (if any) unknown connections, a new bulk meter was installed at the boundary of the distribution area.

Pertinent issues related to accuracy of water quantity:

- Jenin Municipality has no direct access to bulk meters of Mekorot and WBWD supply lines but they have working bulk meters at transfer points. Quantities coming to Jenin from these sources are calculated based on the monthly invoice Jenin Municipality receives from them.
- Private wells from which Jenin Municipality purchases water often have their own bulk meters. Even if we suspect accuracy problem with such meters the well owners are sometimes reluctant and take time to replace such meters.
- No meter test bench which can test bulk meters of sizes bigger than 50 mm is available in or around Jenin. So, we use ultrasonic flowmeter (UFM) and compare the reading of source meters with the reading of UFM as the best possible method. However, the accuracy of UFM is affected by several factors, mainly by installation position (straight pipe sections before and after the UFM), and the accuracy of pipe and lining thickness input to the UFM. So there remains some degree of

uncertainty (potential error) in the quantity of input water.

The counterparts have now been well trained and fully capable of testing meters and measuring water quantity accurately on their own.

1-6 Measure accurate NRW ratio every month

NRW ratio of Jenin was calculated every month starting January 2018 by using standard IWA formula given below.

$$NRW = \frac{SIV\ \left(\frac{m3}{month}\right) - Billed\ Authorised\ Consumption(\frac{m3}{month})}{SIV\ (\frac{m3}{month})} \times 100\%$$

1) The system input volume was calculated by reading Jenin Municipality and private well bulk meters every month. For water volume imported from West Bank Water Department (WBWD)/Mekorot water bills were obtained from WBWD and received volume for each month was calculated from the data. For one source which did not have a bulk meter (Alaa Saadi well), the quantity was estimated based on the size of its storage reservoir and frequency of its filling/emptying per week until a bulk meter was installed on it.

2) Billed consumption for customers with mechanical meters was extracted from the customer meter reading database (Al-Shamel). For PPWM the consumption data was extracted from the Gateway system. The consumption volume of each customer was adjusted to make the duration exactly for one month to match with the duration of bulk meter readings. The result of NRW measurement from Jan 2018 to Jun 2022 is as shown in Table 2-18.

Table 2-18 NRW of Jenin (entire city) from Jan 2018 to Jun 2022

Month	SIV (m^3)	BAC (Billed Authorized Consumption) (m^3)	NRW (m^3)	NRW (%)
Jan-18	241,282	102,612	138,670	57.5
Feb-18	232,788	96,098	136,690	58.7
Mar-18	236,026	104,852	131,174	55.6
Apr-18	320,852	100,891	219,961	68.6
May-18	278,123	111,758	166,365	59.8
Jun-18	276,533	87,600	188,933	68.3
Jul-18	287,549	131,632	155,917	54.2
Aug-18	286,742	117,603	169,139	59.0
Sep-18	261,812	106,112	155,700	59.5
Oct-18	240,652	105,362	135,290	56.2
Nov-18	222,910	96,625	126,285	56.7
Dec-18	267,622	112,346	155,276	58.0
Jan-19	264,719	105,945	158,774	60.0
Feb-19	264,532	95,520	169,012	63.9
Mar-19	294,489	122,874	171,615	58.3
Apr-19	287,333	100,331	187,002	65.1
May-19	294,317	122,307	172,010	58.4
Jun-19	241,925	103,543	138,382	57.2
Jul-19	290,516	117,538	172,978	59.5

Month	SIV (m^3)	BAC (Billed Authorized Consumption) (m^3)	NRW (m^3)	NRW (%)
Aug-19	290,516	117,538	172,978	59.5
Sep-19	290,516	117,538	172,978	59.5
Oct-19	290,516	117,538	172,978	59.5
Nov-19	290,516	117,538	172,978	59.5
Dec-19	292,679	119,701	172,978	59.1
Jan-20	288,495	131,565	156,930	54.4
Feb-20	278,881	114,310	164,571	59.0
Mar-20	316,564	120,608	195,955	61.9
Apr-20	316,564	120,608	195,955	61.9
May-20	316,564	120,608	195,955	61.9
Jun-20	305,340	116,112	189,228	62.0
Jul-20	304,169	128,648	175,521	57.7
Aug-20	331,648	134,753	196,895	59.4
Sep-20	321,321	128,330	192,991	60.1
Oct-20	306,950	131,177	175,773	57.3
Nov-20	288,978	117,654	171,324	59.3
Dec-20	317,089	122,675	194,414	61.3
Jan-21	294,788	108,428	186,360	63.2
Feb-21	286,772	105,966	180,806	63.0
Mar-21	295,420	108,774	186,645	63.2
Apr-21	346,018	144,825	201,193	58.1
May-21	343,905	198,887	145,019	42.2
Jun-21	331,421	140,995	190,426	57.5
Jul-21	321,977	135,733	186,244	57.8
Aug-21	315,994	133,006	182,988	57.9
Sep-21	283,794	127,063	156,731	55.2
Oct-21	282,184	113,608	168,576	59.7
Nov-21	265026	116,002	149,024	56.2
Dec-21	281,039	117,615	163,424	58.1
Jan-22	284,532	122,178	162,354	57.1
Feb-22	282,632	108,998	173,634	61.4
Mar-22	308,248	116,190	192,058	62.3
Apr-22	312,698	139,326	173,373	55.4
May-22	312,727	134,522	178,205	57.0
Jun-22	289,106	132,981	156,125	54.0

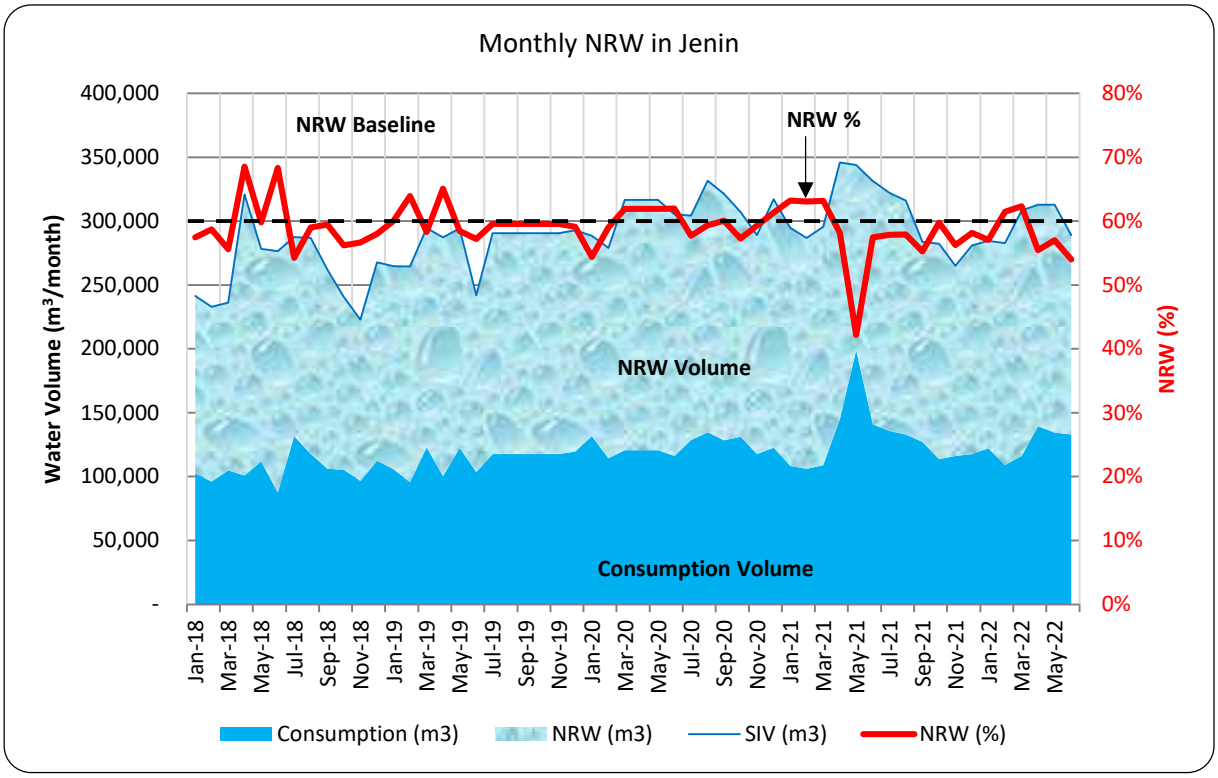


Figure 2-7 Monthly NRW of Jenin from Jan 2018 to Jun 2022

1-7 Measure and evaluate the Endline data and propose recommendations for further improvement.

The NRW ratios in the last 3 years are shown below. NRW ratios in PAs and entire city meet the targets at the baseline. For the further improvement, the cost effective NRW measures shall be implemented (refer 3-7 and 3-10).

(1) NRW ratio (%)

Area	Baseline	Apr-22	May-22	Jun-22	Average reduction points in Jun 22	Target
PA1	57.0	44	41.3	41.1	-15.9	Average 12 points reduction in total
PA2	66.1	53.9	57.3	56.2	-9.9	
PA3	55.2	47.6	45.3	41	-14.2	
PA average	59.4	48.5	48	46.1	-13.3	
Reduction points in PA	-	-10.9	-11.4	-13.3	-	
Entire City	60	55.4	56.2	54	-6	57
Reduction points in entire city	-	-4.6	-3.8	-6	-	-3 points

The collection ratios for the last 3 months are given below. The average collection ratios in PAs and entire city are slightly below the targets. For further improvement in bill collection ratio, more PPWMs shall be installed in PAs and entire city and debt collection measures will be implemented. For more detail, see 4-1 of bill collection increase of post-payment customers and 4-11 of implementation of PPWM installation plan in the entire city.

(2) Bill collection ratio (without debt) in entire city (%)

Area	Baseline	May-22	Jun-22	Jul-22	Average increase	Target
PA1	60.8	94.1	84.5	91.5	30.7	Average 35% increase in total
PA2	36.8	56.7	64.1	65.2	28.4	
PA2 without camp	48.0	65.2	72.3	70.2		
PA2 without Camp and Institution		99.7	91.2	89.1		
PA3	48.0	90.8	84.1	87.6	39.6	
PA average	48.5	80.5	77.6	81.4	32.9	
Increase points		32.0	29.0	32.9		
Entire city	41.2	49.6	45.5	49.0	7.8	50.2% (9 points)

2.2.2 Output 2: Capacity to formulate plan for water service management of Jenin Municipality is strengthened

2-1 Establish Water Service Management Task Force

The task force was established in Oct 2017 and the first meeting was held on October 4th, 2017. The task force members are as follow:

Jenin Municipality

- Leader: Director of WWD: Raghib Malhis (succeeded by Abd Al-Hadi Humran and Khiria Souqia)
- Member:
  - Director of Financial Department: Samir Omari
  - Director of Engineering Department: Shireen Abu Wa'ar
  - Director of Public Relation Department: Mayson Dawoud (succeeded by Mr. Baheer Matahen)
  - Director of Administration Department: Islam Al-Barbari
  - Head of Collection Unit: Yazeed Shreim (merged with CSS, succeeded by Khaled Abu Obaid)
  - Head of Quality Unit: Yasser Ja'afar
  - Head of Legal Unit: Nidal Samoudy
  - JICA Expert Team
- JICA Expert
  - Deputy Chief Advisor/Water Utility and Financial Management: Toshihiko Tamama (succeeded by Phatta Bahadur Thapa)
  - Customer Service (Customer Database &Awareness Raising): Fatemeh Masouleh
  - Project/Training Coordination/Awareness Raising Assistant/NRW&GIS Assistant: Yuhei Ito (succeeded by Mari Yasuda)
  - NRW Reduction Planning-2 (Customer Meter/Commercial Loss): Yoichi Harada
  - Leakage Detection/Plumbing Technique: Naoto Koike
- National Specialist/Staff

- Project Officer: Samah Sawalha (succeeded by Weam Abu Hanud)
- Public Relations Specialist: Mohammad Azmoty (Succeeded by Alaa Turkman)
- Interpreter & Translator/ Project Office Assistant: Weam Abu Hanoud

2-2 Conduct trainings for corporate and financial management for water service operation and appropriate water tariff setting

OJT was provided to solve specific management issues e.g. business process improvement and institutional setup on bill collection and financial management. There was a total of seven (7) training sessions with the task force for development of business plans from Oct 2017 to March 2018. The followings were planned afterward:

- Compile Business Plans and collect comments, Apr 2018 -Jun 2018
- Develop Annual Business Plan for 2019 and collect comments, Jul 2018 -Sep 2018
- Implement Business Plans, Oct 2018 -Dec 2018

The training sessions included topics 1) Staffing, 2) Organogram, 3) Financial, 4) Capex, 5) MIS, 6) Regulations, 7) Customer Service and PR, and 8) ICT.

Table 2-19 Work breakdown structure for developing business plan with trainings schedule

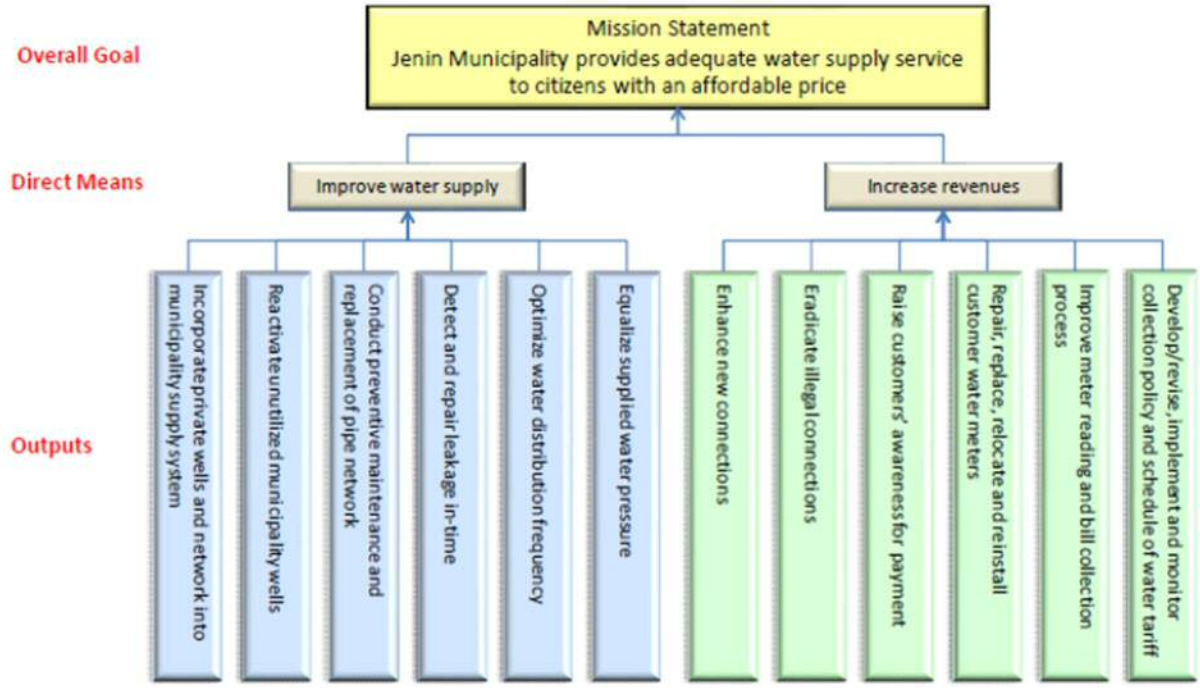
Category	Component	Status	Oct-17 10 20 30 / Nov-17 10 20 30 / Dec-17 10 20 30	Jan-18 to March 18 Jan Feb Mar	Apr 2018 – Jun 2018	Jul 2018 – Sep 2018	Oct 2018 – Dec 2018
			Identify Problems	Develop Components of Business Plan	Compile Business Plans and Collect Comments	Develop Annual Business Plan for 2019 and Collect Comments	Implement Business Plans
Event		Set up management task force	**Trg. 1** **Trg.2** ***Set up Working groups*** **Trg.3** **Trg.4**	**Trg.5** **Trg. 6** **Trg. 7**			
Staffing	Staff Inventory	Collected; Updating	-Initial Data Collection - Translation from Arabic to English / -Clarification through Interviews - Check Updated Status / Identify Challenges	Develop: -Phased Plan of Organization Restructuring - Brushed-up Job Description of Each Division/Section -Job Description of Each Division/Section after Organization Restructuring - Brushed-up Job Description of Each Designation -Phased Plan of Recruiting New Staff -Staff Re-Allocation Plan -Staff Training Program including Ones to be Provided by This Project -Prospect of Personnel Cost	-Compile Developed Materials into Mid/Long Term Business Plan (Mid/Long BP) and Annual Business Plan (ABP) 2018 (trial ABP) - Collect Comments from Mayor, Municipality Council, PWA, MoLG and WSRC	Develop ABP 2019 based on Mid/Long BP, prior to the Beginning of Budget Preparation in October - Collect Comments from Mayor, Municipality Council, PWA, MoLG and WSRC - Implement ABP 2018 by Putting All Defined Activities into Practice; the Experts will Assist the Whole Implementation Process	Continue Implementing Business Plans by Putting All Defined Activities into Practice; the Experts will Assist the Whole Implementation Process
	Job Descriptions (Position-Wise)	Collected; Preparation launched					
	Qualification and Salary Scale	Collected; Under analysis					
	Performance Evaluation	No data					
	Promotion Criteria	Collected /Under analysis					
	Training Program	Capacity assessment launched	Capacity and Training Needs Assessment through Questionnaire Survey and Interviews				
Organogram	Current Organogram	Collected; Updating	-Check Updated Status from 2016 Version -Clarify Acting and Duplication of Posts and Permanent/Temporary /Dormant/Trainee Staff				
	Job Description (Division/Section Wise)	No data; Preparation to be launched	-Initial Data Collection - Translation from Arabic to English / -Clarification through Interviews - Check Updated Status				
	Workflow	Under preparation	Collect Formats and Grasp Procedures and In-Charge Staff on Budget Preparation /Implementation through Interviews				
		Under preparation	Collect Formats and Grasp Procedures and In-Charge Staff on Customer Registration and Meter Installation through Interviews				
		Under preparation	Collect Formats and Grasp Procedures and In-Charge Staff on Meter Reading and Bill Printing/Delivery /Collection through Interviews				
		Preparation to be launched	Collect Formats and Grasp Procedures and In-Charge Staff on Performance Evaluation /HR Management through Interviews				
Financial	Budget	Data collected except annual report/ Under analysis	Initial Data Collection Translation from Arabic to English / Clarification through Interviews	Develop: -Demand and Supply Prospect in Short/Mid/Long Term -Revenue and Expenditure Plan in Short/Mid/Long Term after Elaborating Prospected Parameters -Revised Schemes for Water Tariff and Wastewater			
	Financial Statements						
	Tariff Scheme and Bill Format						
	Revenue Collection Ratio						
	Annual Report						
Capex	Capex related	Data					

Category	Component	Status	Oct-17			Nov-17			Dec-17			Jan-18 to March 18			Apr 2018 – Jun 2018	Jul 2018 – Sep 2018	Oct 2018 – Dec 2018
			10	20	30	10	20	30	10	20	30	Jan	Feb	Mar			
			Identify Problems									Develop Components of Business Plan			Compile Business Plans and Collect Comments	Develop Annual Business Plan for 2019 and Collect Comments	Implement Business Plans
	to NRW Reduction	collection on-going										Tariff -Capital Investment Plan in Short/Mid/Long Term after Elaborating Prospected Parameters					
	Capex related to Meter Replacement																
	Capex related to Network Expansion /Rehabilitation and Others																
MIS	Data submitted to WSRC and PWA	Data collected	Data Collection including Original Resources			Clarification through Interviews						Develop a Revised Platform of MIS					
Regulations	HR Management	Data collected /under analysis	-Initial Data Collection - Translation from Arabic to English			Clarification through Interviews						Develop: -Revision Draft of Existing Rules and Regulations -Draft of New Rules and Regulations including New HR Rules and Tariff Scheme for PPWM					
	Finance and Accounting																
	Customer Management on Water Supply																
Customer Service and PR	Strategy of Awareness Raising	Data collected /preparation to be launched	Initial Data Collection and Clarification through Interviews									Develop: -Public Awareness Raising Plan including PPWM					
	Baseline /Customer Needs Survey	PA-1 finished; whole city area under survey (from 7th Nov)	-Design a Survey Sheet -Hire and Train Engineer /Surveyors			Conduct baseline/customer needs survey in PP1,2 and 3						Conduct Service Connection Survey in PP1, 2 and 3					
	Water Meter Replacement	Data collected; satisfaction survey to be done in JSC-JWV and Nablus	Collect Information from Preceding WSPs and Dealers						Identify Challenges			Develop a Policy for Water Meter Replacement	Develop a Guideline for Meter Testing, Installation and Replacement (with Guideline &Manual Team)				
ICT	Billing, Accounting, GIS and Other Software Applications	To be launched	Grasp Functions, Maintenance Cost, Advantages and Disadvantages through Interviews									Develop: -ICT System Improvement/Development Plan					

2-3 Formulate mid- and long-term water service operational business plans that include financial plans

Water Service Management Plan (WSMP) 2018-2027 for Jenin Municipality was developed in June 2018 and approved by Municipality council in April 2019. In this WSMP, overall mission statement was set as "Jenin Municipality provides adequate water supply service to citizens with an affordable price."

To achieve this goal, two direct means are established as “Improve water supply” and “Increase revenues.” Under these direct means, 6 outputs are developed as shown in Figure 2-8.



Source: Water Service Management Plan (WSMP) 2018-2027

Figure 2-8 Strategy map of Jenin Municipality for managing water supply services

A series of extensive OJT was conducted for WWD engineers and technicians to formulate District Service Improvement Plan (DSIP) for entire Jenin Municipality divided into 3 districts excluding PA1, 2 & 3. Development of this plan was requested by PWA to accelerate the water supply improvement in whole Jenin Municipality and was made mandatory during the years 2019-2021 in the mid/long-term business plan. The 2019 version of DSIP was finished and reported to JICA and PWA in October 2019 which consists of:

(a) Distribution zoning plan on GIS (plan of DMA zoning) in entire Jenin Municipality;
(b) Detailed mapping of current distribution schedule on GIS with corresponding sluice valve operation; and
(c) Water supply improvement plan and its implementation, which includes change of valve operation and new valve installation.

2-4 Formulate an annual plan including the financial plan

The mid/long-term business plan (Water Service Management Plan 2018-2027 for Jenin Municipality; in English and Arabic) included an annual rolling plan and budget till 2027 and revised based on the comments from the counterparts. The revised version was submitted to and approved by the Municipality Council in April 2019.

The annual plan with financial forecast was included in mid/long term business plan. The annual plan was prepared in 2018 after reviewing the financial status since 2012 and was revised in 2019 and 2020. The plan covered several topics such as the followings:

- Overview of the service provision
- Sequence of key activities in the business plan
- Managerial performance at a glance showing KPIs and targeted values
- Implementation & achievement status of the "Water Service Management Plan 2018-2027" as of end of each financial year
- Financial highlight including the financial balance of WWD by end of each financial year

According to the annual plan (report of 2020), the financial balance of WWD separated from the financial statements of the whole Municipality is shown in Table 2-20 from FY 2012 to FY 2020. The total expenditure has not been covered by the total revenue and the coverage ratio is 48.9% and 55.8% in FY 2020 and on average in the last 9 years, respectively. The deficit has been covered by drawing cash from the insurance reserve paid by customers (e.g. new connection). Besides, the water purchase cost from the WBWD has not been paid. It should also be noted that though the current revenue increased in 2020 from 2019, it was mostly collected by the PPWM customers while the current revenue from the mechanical water meter customers decreased from 34% in 2019 to 22% in 2020.

Table 2-20 Balance in financial statements for WWD from 2012 to 2020 (Unit: NIS) with breakdown of revenue and expenses

Item		2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	
Revenue	Current water revenue (current collected bills)	3,188,158	2,847,284	2,562,345	2,300,735	2,540,842	2,989,693	2,867,383	2,549,418	3,222,552	22,551,335	52%
	Water subiscription fee	98,084	107,050	104,005	110,264	90,034	101,661	111,472	108,477	276,000	1,107,047	3%
	Sewerage fee	168,892	189,022	132,308	144,755	144,276	188,584	157,619	177,693	569,802	1,872,951	4%
	Water tanker revenue	106,361	87,021	77,500	118,610	109,505	94,825	94,523	115,035	110,490	913,870	2%
	Collected debt	1,346,652	1,045,614	1,131,732	4,890,573	1,477,370	2,321,073	1,853,533	1,484,882	928,665	16,280,094	37%
	Other	28,758	44,574	76,627	43,037	41,783	59,625	57,236	108,652	242,000	702,292	2%
	Total Revenue (X)	4,936,905	4,320,565	4,084,517	7,607,974	4,403,810	5,755,461	4,941,766	4,544,157	5,349,509	43,427,589	100%
Expense	Personal expense	2,955,048	2,974,900	3,460,002	3,118,229	3,328,137	3,416,255	3,315,771	3,640,613	3,771,020	29,979,975	57%
	Water purchase fee (Private well)	791,043	1,467,838	1,378,078	899,555	1,279,097	472,618	835,306	901,188	1,122,279	9,147,002	17%
	Pump maintenance, Network maintenance, Oils and motor fuels, Car maintenance, insurance & Other	2,430,877	1,025,163	1,222,526	1,136,979	1,303,556	1,330,838	1,583,975	1,289,148	2,436,717	13,759,779	26%
	Sub-total	6,176,968	5,467,901	6,060,606	5,154,763	5,910,790	5,219,711	5,735,052	5,830,949	7,330,016	52,886,756	68%
	Water purchase fee (WBWD, unpaid)	2,706,210	2,928,250	925,158	2,884,726	2,894,034	2,990,286	2,990,000	2,990,000	3,600,000	24,908,664	32%
	Total Expense (Y)	8,883,177	8,396,151	6,985,764	8,039,489	8,804,824	8,209,997	8,725,052	8,820,950	10,930,016	77,795,420	100%
	Dficit (X-Y)	-3,946,272	-4,075,586	-2,901,247	-431,515	-4,401,014	-2,454,536	-3,783,286	-4,276,793	-5,580,507	-34,367,831	
Total Revenue/Total Expenses (%)		55.6%	51.5%	58.5%	94.6%	50.0%	70.1%	56.6%	51.5%	48.9%	55.8%	

2-5 Amendment for the water tariff is proposed

In WSMP, the section on revision of water tariff includes the tariff table proposed by the Water Service Regulatory Council and an example of tariff revision which proposes lowering the block tariff to benefit small volume water users. It also suggests that if the bill collection ratio becomes 100%, there is no need for tariff revision to balance the revenue and expenditure of the utility.

Table 2-21 Current water tariff system at Jenin Municipality

Step (m^3)	Residential NIS/m^3	Commercial NIS/m^3	Industrial NIS/m^3	Other NIS/m^3
1-50	4.35	4.35	4.35	-
More than 50	6.2	6.2	6.2	-
Minimum Tariff	23.56	23.56	23.56	23.56
Wastewater fee	0.5	0.5	0.5	0.5

Source: Water Sector Regulatory Council (WSRC)

There has been a proposal by PWA and WSRC in 2021 to unify water tariff method for all water providers. The new tariff steps will include 4 categories, each category having 5 steps. As of June 2022, Jenin Municipality has sent all the required financial data to WSRC to finalize the tariff steps calculation. It is still under calculation by WSRC and waiting to get the Cabinet approval. Thus, it has neither been approved nor applied in any water providers in Palestine.

2-6 Improvement of financial and accounting rules and regulations for the Water and Wastewater Department is proposed

Following notable activities were implemented for proposals for revision of financial and accounting rules and regulations. The revised customer contract is given in Annex CD 1.6 [Revised Water Supply Contract in English and Arabic].

Table 2-22 Key proposals for revisions in finance and accounting sections

Section	Detail of activities
Human resource	• Job descriptions and workflows for WWD, Financial Department, Collection Unit and other departments & units related to water supply service were developed. • Performance evaluation system has been proposed based on the job descriptions. • Motivation allowance scheme for meter readers and collectors was developed and implemented from Feb. 2019.
Financial	• Modifications of existing financial software (Al-Shamel) was implemented.
Accounting	• Accounting policy and schedule to shift cash-based accounting to accrual accounting system were approved by Municipal Council in Oct. 2019. However, it is still on transition.
Customer management	• A revision draft of existing customer water supply contract was developed and discussed in the Water Service Management Task Force in December 2017, based on the comparison study of the contracts of other leading municipalities, JSCs, and the regulations by the PWA and the WSRC. The contract was approved and WWD has used it since then.

2-7 Publish annual report of water service

The full and digest versions of annual reports from 2018 to 2021 were prepared both in English and Arabic and made available on the Municipality's website. Its link was announced on Facebook by the PR department. They can be seen at Jenin Municipality's website https://jenin.city/?app= article.cat.33.

2.2.3 Output 3: NRW reduction capacity of Jenin Municipality is strengthened

3-1 Establish NRW reduction team and conduct NRW related trainings

Initially in the 2nd JCC two separate groups were proposed within Water Section for NRW management; one group for Real Loss management and another for Apparent Loss management. Trainings were provided to the technicians. After about one and a half year of project commencement Jenin Municipality recruited 2 engineers and 6 new technicians. NRW trainings were also provided to these engineers and technicians. Considering the limitation of available human resources and situation of water supply in Jenin which involves day-to-day operation of rationing valves, Jenin Municipality proposed a NRW Division under Water Section and assigned an engineer to it. No technician is specifically assigned to this division, but a number of selected technicians are provided OJT for NRW reduction activities who then work for NRW Division whenever required. The detail of trainings provided to technicians is given in Appendix 2.

3-2 Select three Pilot Areas

During JICA preparatory survey three potential Pilot Areas were preliminarily identified. The R/D provided a main criterion for pilot area (PA) as the number of customers between 300-1000.

Immediately after commencement of the Project searching of potential pilot areas started. In addition to the criteria of 300-1000 customers, other important criteria as listed below were considered:

1) Pipe network is easy to separate
2) The amount of water used at night is small
3) Water supply method inside the PA can be changed (extension of supply hours is possible for minimum night flow (MNF) measurement)
4) Water supply change in the area does not affect other areas
5) The pipe network drawing is well maintained
6) Nighttime work for leakage survey is possible
7) Training for NRW reduction measures can be done. The effect of reducing NRW is expected to be high.

Pipe network maps were printed, and potential areas were surveyed by joint team of Jenin Municipality counterpart and JICA experts. A sample picture of the confirmation process is shown in Photo 2-1.

Photo 2-1 Example of site work for selecting Pilot Areas and confirming distribution pipe network

Eight potential areas were tentatively identified at first. After screening of these, three areas were proposed and finally decided. Characteristics of these three selected areas are given in Table 2-23. The areas mentioned in JICA preliminary survey, all surveyed areas and finally selected areas are shown in Figure 2-9. For more detail of selection process please refer to Annex 1.1 NRW Management Manuals (Comprehensive Version).

Table 2-23 Characteristics of PA at the time of selection

PA	Area	Characteristics	Area (m^2)	No. of Customers[1,2]
1	Sabah Al Khir, Kharoube, and Nasraa Street	• The area is mainly residential with some commercial establishments • The area is slightly hilly, not perfectly flat • The area is separated into 3 sub-areas • Main supply source is by a pump, but there is some possibility that water also enters from adjoining area when the pump is not operating • The area is newly developing, new connections will increase in future • The total area is relatively large	1,741,900	606
2	Al Zahraa, and Jenin Camp (new)	• The PA consists of two parts; Al Zahraa area and New Camp area • Al Zahraa area is flat and big, New Camp area is at the back side and steep hilly • The Al Zahraa area is mixed of both residential and commercial types whereas the New Camp area is residential • Al Zahraa area is newly developing area, it has a good scope of future population growth	705,629	466
3	Sharqiya	• The area is hilly • Water is supplied by online booster pumps from lower to higher elevation • There are two separate distribution mains and booster pumps • It is almost all residential area • Future population growth potential is not so high	501,887	361

Note:

1: the numbers are based on GIS database. Latest customer records for whole Jenin show about 35% more number of customer connections compared to the numbers in GIS. So, the number of connections at present will likely increase in all these PAs by about 20-40%.

2: The number of customers in the PAs increased significantly from the initial values shown above.

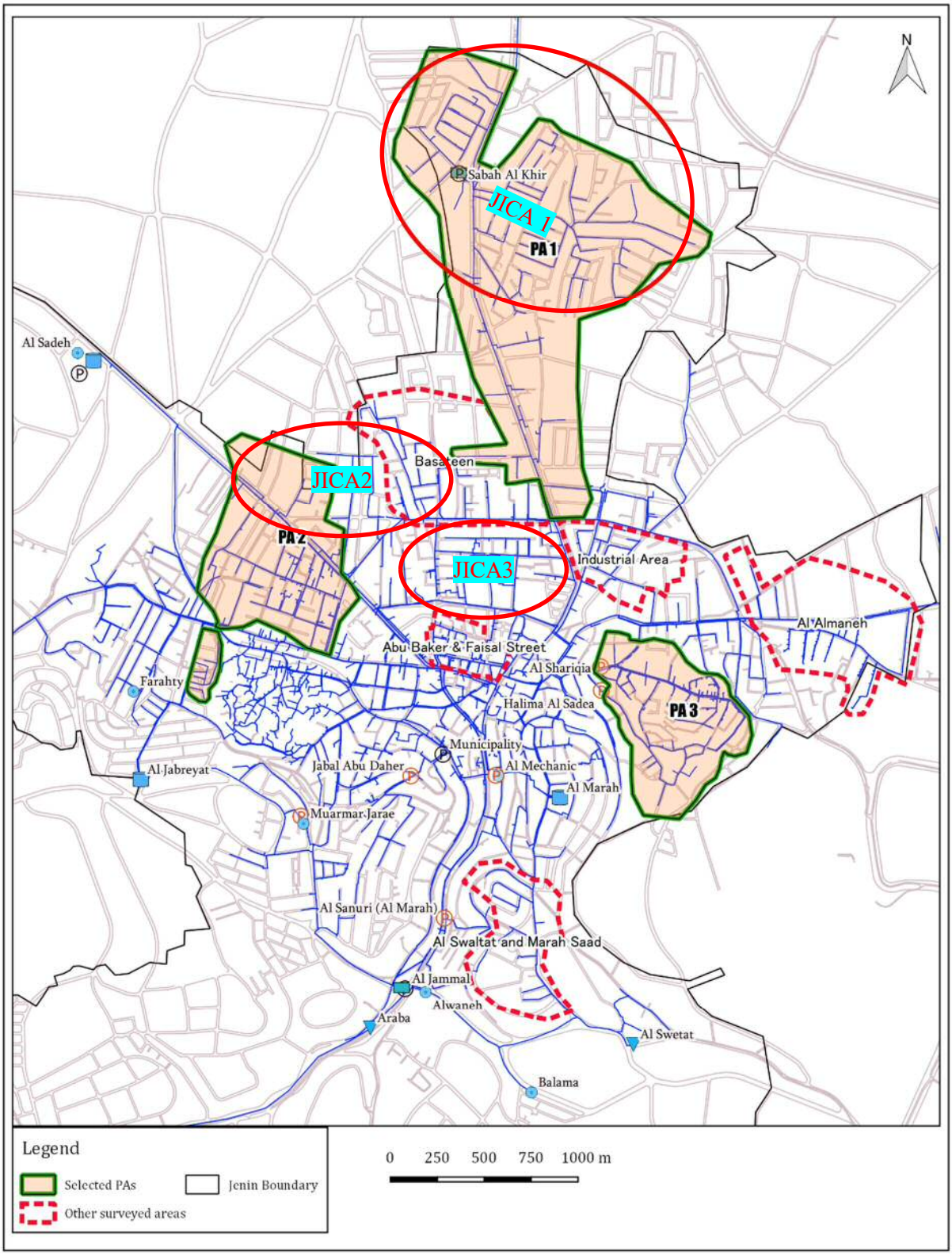


Figure 2-9 Areas surveyed for selecting Pilot Areas

3-3 Prepare water distribution network drawings in Pilot Area 1, isolate an area hydraulically and install necessary bulk meters and gate valves

After selection of pilot area, distribution pipe drawings were prepared following the process mentioned below.

1) Paper maps of the pilot area to the scale of 1:1000 or 1:500 were printed. The maps contained satellite image as a base map and layers of pipe network and valves available in GIS system of Jenin Municipality.
2) The maps were taken to site, and hearing survey with knowledgeable counterpart was conducted at site to confirm the alignment, size, and valve position.
3) Pipe network confirmation survey was then conducted by using metallic pipe locator and high precision GPS. By using the locator, locations of pipes 50 mm and bigger in diameter were confirmed.
4) Locations of customer meters were marked on the paper map and route of house connection from the meter to the distribution pipe was visually traced and marked on the map.
5) All collected information was then digitized and converted into GIS shape file.

At the same time each household within PA1 was surveyed to update customer database (called CDS). This survey provided important information such as the accurate number of customers, proportion of unserved population, size of their storage tanks, other sources of water and so on. Schematics of the pipe network was prepared to identify the required number of bulk meters and gate vales. The schematics for PA1 is as shown in Figure 2-10.

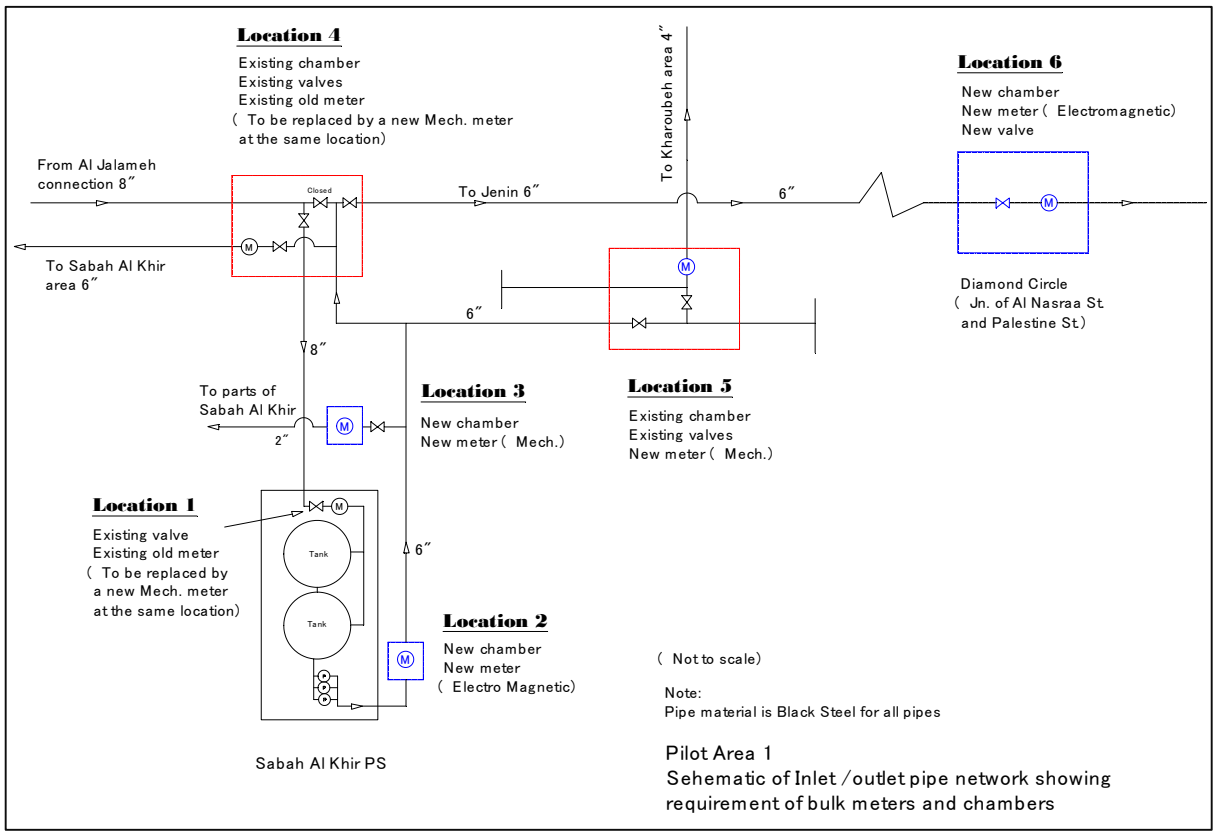


Figure 2-10 Schematics of pipe network indicating requirement of bulk meters and chambers in PA 1

Procurement of bulk meters, gate valves, data loggers and other accessories progressed in parallel with the preparation of water distribution network drawings and customer database update survey. Jenin Municipality prepared the chambers for installation of vales and bulk meters and as soon as they were available, they were installed. The process of DMA establishment is summarized in Figure 2-11.

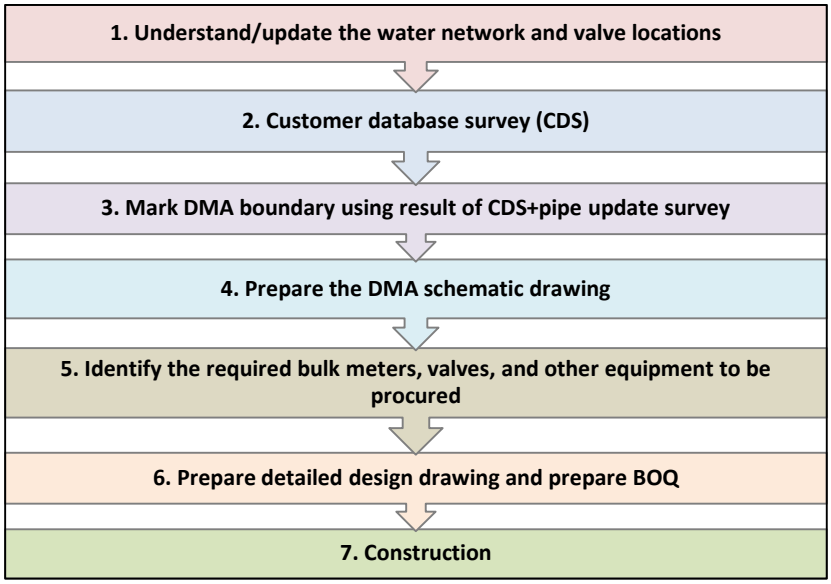


Figure 2-11 Procedure of DMA establishment

PA1 was an already isolated area except at one location, Location 6 shown in Figure 2-10. Since the adjoining area, Al Basateen, was also supplied from the pipeline running through PA1 it was not possible to install isolation valve at this location. Instead, an electromagnetic flowmeter was installed there which could measure water flowing in both directions, just in case water entered PA1 from this location.

3-4 Conduct OJT on leak detection in Pilot Area 1, and assess current physical losses

3-4-1 OJT on leak detection

A team of technicians was selected for OJT on leak detection and OJT was provided in PA1 in two stages; the first stage from 5 to 29 August 2018 and the second stage from 12 Nov to 16 Dec 2018. The leak detection work was divided into two types (Figure 2-12); which could be done during day time and which required working at night. For the nightwork, permission from COGAT (Coordinator of Government Activities in the Territories of Israel) was required for security reasons.

Three technicians from Water Section of WWD participated in the OJT. The trainings were provided in two shifts; the evening shift from 6 pm to 9 pm and the morning shift from 10 am to 11:30 or 12:00 am. In the first stage there were a total of 17 sessions and the OJT was done only in PA1. In the second stage there were a total of 13 sessions out of which 6 were in PA1 and the rest in PA2.

In these OJTs, the technicians were trained on all aspects of leak detection starting from the preparation for the survey, how to read the pipe network map, how to use the leak detection equipment properly at

real site condition, how to mark the suspected leak locations, and how to prepare a survey report.

The supply system in PA1 is intermittent except for a small branch connected directly to distribution main where the supply is continuous. An intermittent system with huge customer tanks like in PA1 is not favorable for underground leak detection as during supply time customers will be filling their tanks which generates water flowing sound. This makes difficult to find the leak noise with sounding equipment. As a result of the OJT leaks were suspected at 15 locations out of which some sort of leak was found at 7 locations after excavation.

I. Area Stage

Listen to sound from the domestic meter in daytime by listening stick.

II Line Stage

Hearing distribution line in nighttime by ground microphone.

Reporting

- Size(amount) of leakage
- Location of leakage point

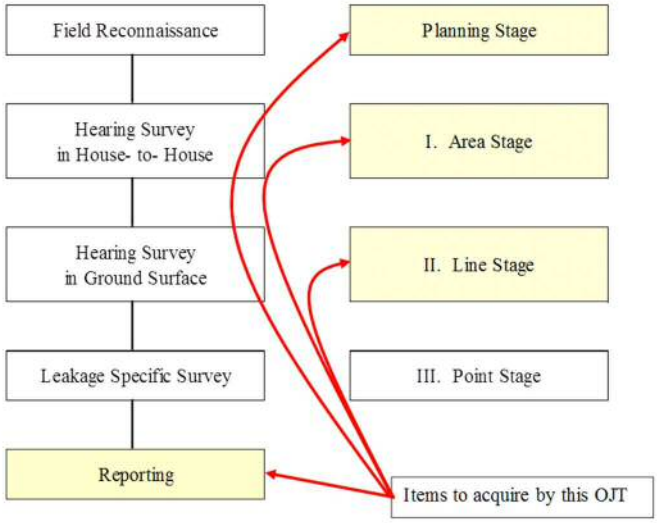


Figure 2-12 Procedure of OJT in PA 1

3-4-2 Assessing current physical losses

The most reliable method of assessing physical losses is through bottom-up approach by measuring minimum night flow (MNF). This requires all customer demands to be satisfied before MNF measurement, which is rarely achieved in places like Jenin where the supply is intermittent and most of the customers have big reservoir tanks. But an attempt was made to measure MNF in a small area near Sabah Al Khir pumping station (sub-area 1 of PA1) where the supply is continuous. Inflow and pressure in the area were measured in the night of 24th -25th Sep 2018. The result is summarized in Table 2-24. According to this result, the physical losses (which is mainly leakage) is estimated at about 33% of SIV. Of total NRW, the physical loss occupied about 81% (605/748).

Table 2-24 Summary of MNF analysis in sub-area 1 of PA1

S.N.	Description	Value	Unit	Remarks
1	System Input Volume (SIV)	1,832	m^3/month	From Oct bulk meter reading
2	Billed Authorized Consumption	1,084	m^3/month	From Oct Al-Shamel record
3	NRW (=1832-1,084)	748	m^3/month	41% of SIV
4	Average zonal pressure	35	m	From pressure measurement
5	Pressure adjusted leakage volume	605	m^3/month	33% of SIV, 81% of NRW
6	Apparent losses	143	m^3/month	8% of SIV, 19% of NRW

3-5 Assess current commercial losses (illegal connections and customer meter inaccuracy etc.) in Pilot Area 1

Commercial losses can be divided into 1) metering inaccuracy, and 2) unauthorized consumption. Metering inaccuracies are further divided into meter error, no or malfunctioned meter, estimate error in unmetered consumption, and error in water bill processing. Unauthorized consumption is the various types of illegal uses. Both have been notably seen in Jenin.

Of commercial losses, meter accuracy test on site was conducted using portable test bench. As a result of this on-site accuracy test, about 28% of the tested meters were found to be not accurate. Concerning illegal use, several confirmed and potential illegal connections were found during CDS.

(1) Meter accuracy test using portable test bench

Seventy (70) existing meters in PA1 were tested by the end of December 2018. The brands of the tested meters in order of majority were "Baylan" (35 nos.), "ARAD" (22 nos.), "RB" (12 nos.), and "Unknown" (1 no.). Cumulative consumption of the tested meters ranged from about 29 m^3 to 5,387m^3. The age information of the meters was not available.

As a result of the test, measurement error of 20 of the 70 samples (about 28%) exceeded the acceptable error range (±5%). No relationship between measurement error and cumulative consumption volume was found. A plot of cumulative consumption versus measurement error is shown in Figure 2-13.

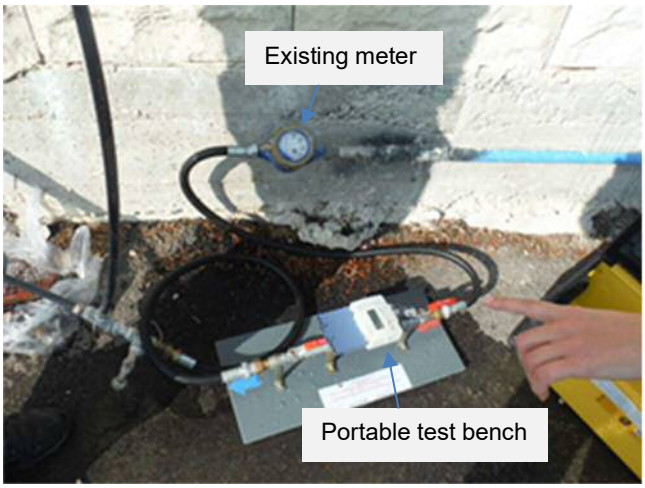


Photo 2-2 On-site accuracy (error) test

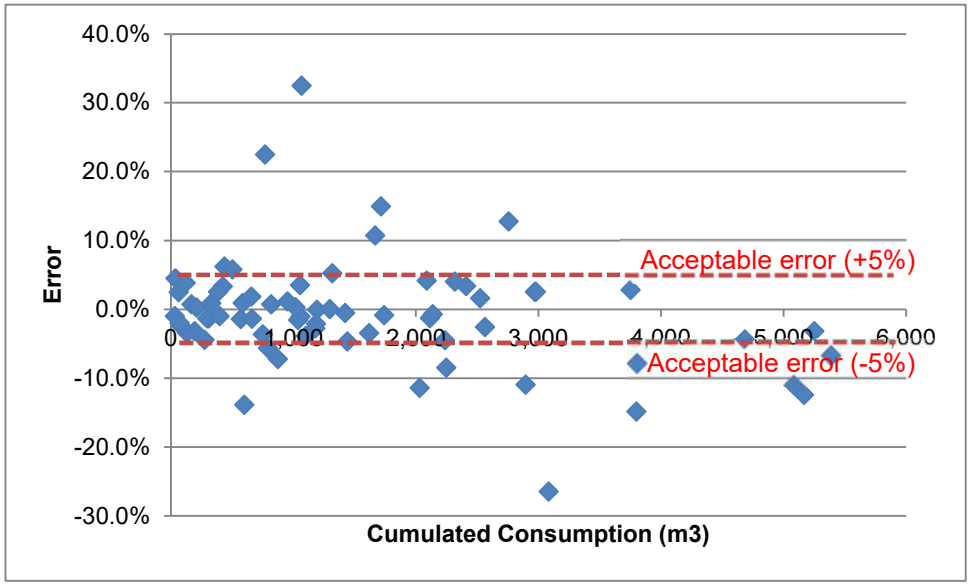


Figure 2-13 Relationship of meter accuracy and cumulative consumption

(2) Training of meter accuracy test

Testing existing water meters mentioned above was carried out by three technicians of CSS as On-the-Job-Training (OJT). As a final training, training of trainer (TOT) was held in December 2021. One of CSS's technicians was assigned as a trainer, and he gave a training to his colleagues using the draft version of the manual. Based on this activity, a quick reference for on-site accuracy test for water meters was prepared (Annex 1.1). After the training, the trained technicians have conducted meter accuracy test in response to the customers' complaint about meter readings, especially of high consumption case.

(3) Zero (0)-meter consumption (reading)

There is a special case of commercial loss in Jenin, namely "zero-meter reading". This is not categorized in meter inaccuracy, but this is notable in Jenin. The water consumption data of customers in PA1 for 2018 was extracted from Al-Shamel (financial and billing software of the Municipality) and summarized as shown in Table 2-25. The case of "zero-meter reading" occurred with 15% of the total households in PA1, and it showed a tendency to slightly increase in winter.

Table 2-25 Data on "zero (0)-meter reading" in 2018 in PA1

	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Count of "0-meter reading"	115	93	108	106	86	87	74	86	109	135	139	169	109
Percentage of "0-meter reading" to total number of households (%)	15.8	12.8	14.9	14.6	11.8	12.0	10.2	11.8	15.0	18.6	19.1	23.3	15.0

Note: *total number of households in PA1.: 726

According to the interviews to meter readers, "0-meter reading" consisted of the breakdowns as shown in Table 2-26. The majority are "Door closed or no response", "Working but unreadable meter" and

"No reading". "No reading" may be related to insufficient capacity of meter reading. Allotted localities and customer numbers may be more than what a reader can read, and they cannot make repeat visits. For this reason, when they cannot read meters due to unavoidable circumstances such as no answer from customers, absentee, unreadable meter, broken display of meter, etc., these cases would lead to "0-meter reading".

Table 2-26 Breakdown of reasons of 0-meter reading

Category	Number	%
Working but unreadable meter (including meter buried underground)	51	19.2
Abandoned house (including empty apartment and single-family house)	1	0.4
Door closed or no response	86	32.5
Private well user	8	3.0
Water tanker user	0	0.0
Low consumption user	9	3.4
No meter in the site (including potential unmetered connection)	32	12.1
Illegal use (including potential illegal connection)	1	0.4
Under construction building	2	0.8
No reading (meter is working)	44	16.6
Broken meters	31	11.7
Unbilled authorized consumption connection	0	0.0
Total	265	100.0

3-6 Conduct NRW reduction activities in Pilot Area 1

NRW reduction activities in PA1 were planned as shown in Figure 2-14.

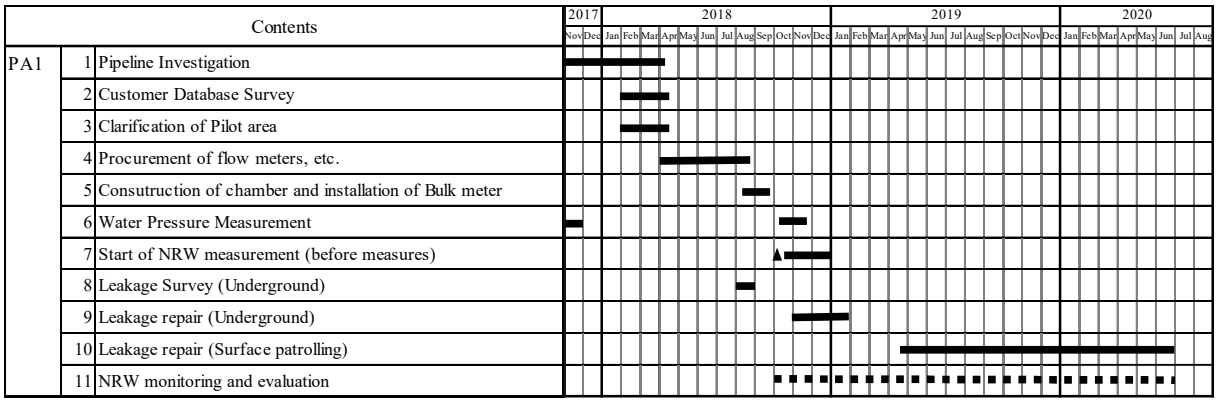


Figure 2-14 Implementation schedule of NRW reduction activities in PA 1

The activities consisted of the following:

1) Pipeline investigation
- Preparation of map of existing pipe network and valves on GIS base map showing roads, landmarks, and other available details
- Going to site with the map, pipe locator, and GPS machine
- Confirming alignment (route) of pipe and location of valve, when necessary, by using pipe and metal locators
- Recording the position of pipe and valve with GPS
- Preparing AutoCAD pipeline network from the survey data
- Digiting from AutoCAD to GIS
- Inputting pipe and valve attributes by referring to previous records, hearing from the staff, and when not clear, by excavation

2) Customer database survey (CDS)
- Preparation work
  - Confirmation of the DMA boundary
  - Obtaining high resolution base map of the area (through line ministry or other route)
  - Digitizing to create building polygons
  - Inputting address to each building
- Printing maps for site work
- Deciding data collection items
- Preparing data collection format
- Collection of data by site survey
- Recording the survey data
- Compiling and summarizing the survey data

3) Clarification of pilot area
- Walking along the proposed boundary and investigating suspicious locations where there might be a possibility of any pipe crossing the proposed boundary
- Further investigation of pipe crossing the proposed boundary by pressure measurement or pipe tracing when required
- Updating DMA boundary after confirmation
- Preparing schematic drawing and estimating required number of valves, flowmeters etc
- Preparing detailed drawings
- Designing chambers and preparing BOQ

4) Procurement of flowmeters, valves, loggers, etc
- Estimating the required numbers and sizes
- Preparing specifications
- Preparing bidding documents
- Inviting bids
- Concluding contract agreement with the priority bidder
- Receiving materials
- Conducting site inspections (by JICA or JICA assigned person)
- Handing over to JM and obtaining a handover certificate

5) Construction of chambers and installation of bulk meters
- Preparing construction schedule
- Deciding the type of chamber (cast-in-situ or pre-cast)
- Preparing required tools and equipment such as excavator, welding machine, and drainage pump
- Preparing tapping points for pressure measurement
- Implementing pipe re-arrangement (re-routing) work
- Installing isolation valve when required
- Installing bulk meters
- Installing valves
- Installing and setting flow and pressure data loggers

6) Water pressure measurement
- Selecting candidate locations and preparing tapping points
- Preparing and programming pressure loggers
- Installing the loggers
- Retrieving the loggers at the end of recording period
- Downloading and analyzing data

7) Initial NRW measurement (before measures)
- Deciding a fixed period (generally a month)
- Reading DMA meter(s) in the beginning of the period
- Reading customer meters in the beginning of the period (data of regular readings by customer service section can be used after adjusting for meter reading lag period)
- Second reading of DMA meters and calculating system input volume (SIV)
- Second reading of customer meters, adjusting for meter reading lag period
  - For PPWM, getting consumption data from Gateways for the required duration
- Estimating for unmetered consumption, or customers whose meters could not be read by any

reason but which are billed
- Calculating billed authorized consumption from the above
- Calculating NRW by subtracting billed authorized consumption from SIV

8) Leakage survey (underground)

(a) Leakage survey as OJT

- Preparing survey team (training candidates)
- Preparing survey schedule based on water supply schedule
- Preparing pipe network maps
- Conducting daytime survey
  - Listening for any leak sound in all available exposed portions of pipe such as house connections, fire hydrants, valves, etc. within a selected area, also called 'area-wise approach' by many leak surveyors
  - Conducting ground microphone survey, also called 'line-wise approach'
- Obtaining permission from related agencies for nighttime work
- Conducting nighttime survey where daytime work was not possible due to heavy traffic or noises
- Recording suspected leak location
- Informing maintenance team for excavation and repair of leaks

(b) Intensive leakage survey by two other methods

The following two type of surveys were done to further intensively search for underground leak and illegal water use:

Step test

- Identifying blocks where this test could be applied (it required isolation valves to isolate portions of network in sequence)
- Checking functional status of existing valves, installing new valves when required
- Checking if any available bulk meter could be used to monitor flow
- If not, preparing space for installing portable ultrasonic flowmeter
- Sequentially isolating a portion of the network while recording inflow
- Plotting flow profile and finding out the step in which the greatest decrease occurred
- This gave the indication which portion of the network was having greatest leakage/ illegal water use

Stop-cock method combined with sounding survey

- Checking if any available bulk meter could be used to monitor flow
- If not, preparing space for installing portable ultrasonic flowmeter
- Closing all known taps (customer meters) within the planned area
- Checking if the flowmeter shows zero reading or not
- If zero, the area has no leakage and no illegal water use
- If not zero, listening to exposed pipe, valves, or house connections for any sound of leakage or water use
- Narrowing down the area similarly until finding the leak or illegal water use
- Marking the suspected leak locations and illegal water uses and handing over to maintenance section and customer service section for action
- This method was developed in this project

9) Leakage repair (underground)

- Preparing required materials and equipment
- Excavating and confirming the leak
- Isolating the section by shutting down required valves
- Repairing the leak by standard method
- Filling up the leak repair form
- Recording the detail in GIS

10) Leakage repair (surface patrolling)

- Daily patrolling of supply area for any visible mark of leakage
- Noting the location, taking a photo, and reporting to water section whenever a leak is found or suspected
- Confirming the leak point by sounding survey or other method
- Repairing the leak by maintenance section

11) NRW monitoring and evaluation
- Repeating the NRW calculation every month
- When NRW was found to be still high, repeating the countermeasures
- Evaluating the effect of different measures on NRW reduction

For customer meter replacement, a separate detailed plan was prepared because it was decided that all the meters within PAs would be replaced by ultrasonic type prepaid meters. This type of meter was new and detailed planning was required for convincing customers and installing meters successfully. The customer meter replacement plan for PA1 was as shown below in Figure 2-15.

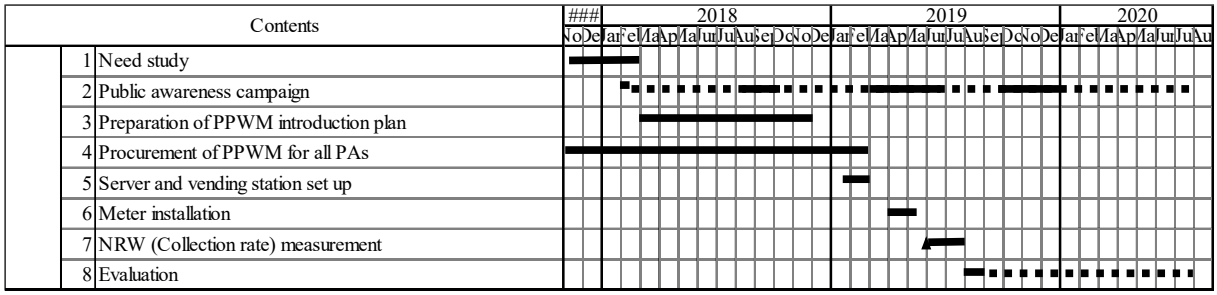


Figure 2-15 Schedule of customer meter replacement in PA 1

The implementation mostly followed the planned schedule. Often multiple NRW countermeasures including customer meter replacement works were implemented in parallel.

The C/P are now trained well and are capable of implementing various NRW countermeasures on their own. They can conduct customer database and pipe network update surveys, design DMAs, supervise chamber construction and flowmeter and valve installation works, extract monthly consumption data from regular meter reading and Gateways, conduct water balance and calculate NRW, and conduct leak detection surveys by both conventional sounding survey as well as stop-cock method. They can also do proper recording and mapping of repaired leaks in GIS.

3-7 Measure NRW ratio after the implementation in Pilot Area 1, then examine the cost effectiveness of activities and compile them into a report

NRW ratio was measured every month starting from the baseline period (Oct-Dec 2018). The result of this measurement including the result of latest month is shown in Figure 2-16.

Cost effectiveness of activities has been compiled into a report Annex 1.2 Cost-benefit Analysis of NRW Management Works. The cost components included nine major items as follows:

- Provision and installation of bulk meters, valves, fittings, data loggers
- Construction of chambers for bulk meters and valves
- Customer database update survey
- Network update work
- Leak detection survey

- Leak repair
- Provision of prepaid meters, Gateways, fittings
- PPWM installation
- Illegal connection survey and rectification

For the benefit the main part came from the reduced NRW volume and monetizing it at the average selling price of water.

After determination of the baseline NRW ratio, preparatory works started in the pilot area. NRW reduction activities (NRW countermeasures) were then planned and executed. But sometimes it became necessary to apply multiple countermeasures in parallel to avoid the loss of water for a long time from big visible leaks or to stop illegal water use found during the preparatory work. This made it challenging to preciously know the effect of individual countermeasure on NRW reduction. In such cases contribution of individual countermeasure to NRW reduction was estimated based on the significance of applied countermeasure and NRW reduction achieved at any particular period.

The result of the analysis showed that all the applied NRW countermeasures in PA1 were cost effective resulting in an overall benefit-cost ratio of 3.53. The highest ratio was for leak detection and repair, its effect mainly came from repairing of visible surface leaks which did not require much effort to find and repair. Customer meter replacement by PPWM showed the lower benefit-cost ratio mainly because of its higher cost compared to ordinary mechanical meters. But in this analysis only the benefit of NRW reduction was considered. PPWM has even more important benefit of increasing collection ratio to 100%. If that was also considered, the benefit-cost ratio of meter replacement would have been much higher. If the meters were replaced by the conventional mechanical (volumetric type) meters available in the local market, the benefit-cost ratio for the meter replacement would have been increased by more than twice.

In the context of Jenin where the existing NRW level is very high (still more than 50%), illegal connections are widespread, water resources are scared, water supply is intermittent, there is a security concern for nighttime work, supply pressure is extremely high in some localities, and water utility (Jenin Municipality)'s financial situation is weak, the countermeasures of NRW in order of decreasing cost-effectiveness may be as listed below:

(1) Conducting daily patrolling for finding surface leakage and quickly repairing any found leak,
(2) Implementing measures against illegal connections by regularly analyzing customer consumption data and checking customer meters which show zero-consumption,
(3) Checking accuracy of, and replacing defective source meters,
(4) Conducting combined stop-cock method and sounding survey in suspicious blocks/branches and repairing leaks quickly,
(5) Testing customer meters and replacing defective ones,

(6) Pressure management,

(7) Underground leak detection survey using conventional acoustic system and timely repair, and

(8) Replacing leak-prone/worn out water network and facilities.

3-8 Continue monitoring NRW ratio at Pilot Areas, and maintain achieved NRW ratios

Monitoring of NRW was continued on monthly basis. The NRW ratio from Oct 2018 until June 2022 is as shown in Figure 2-16.

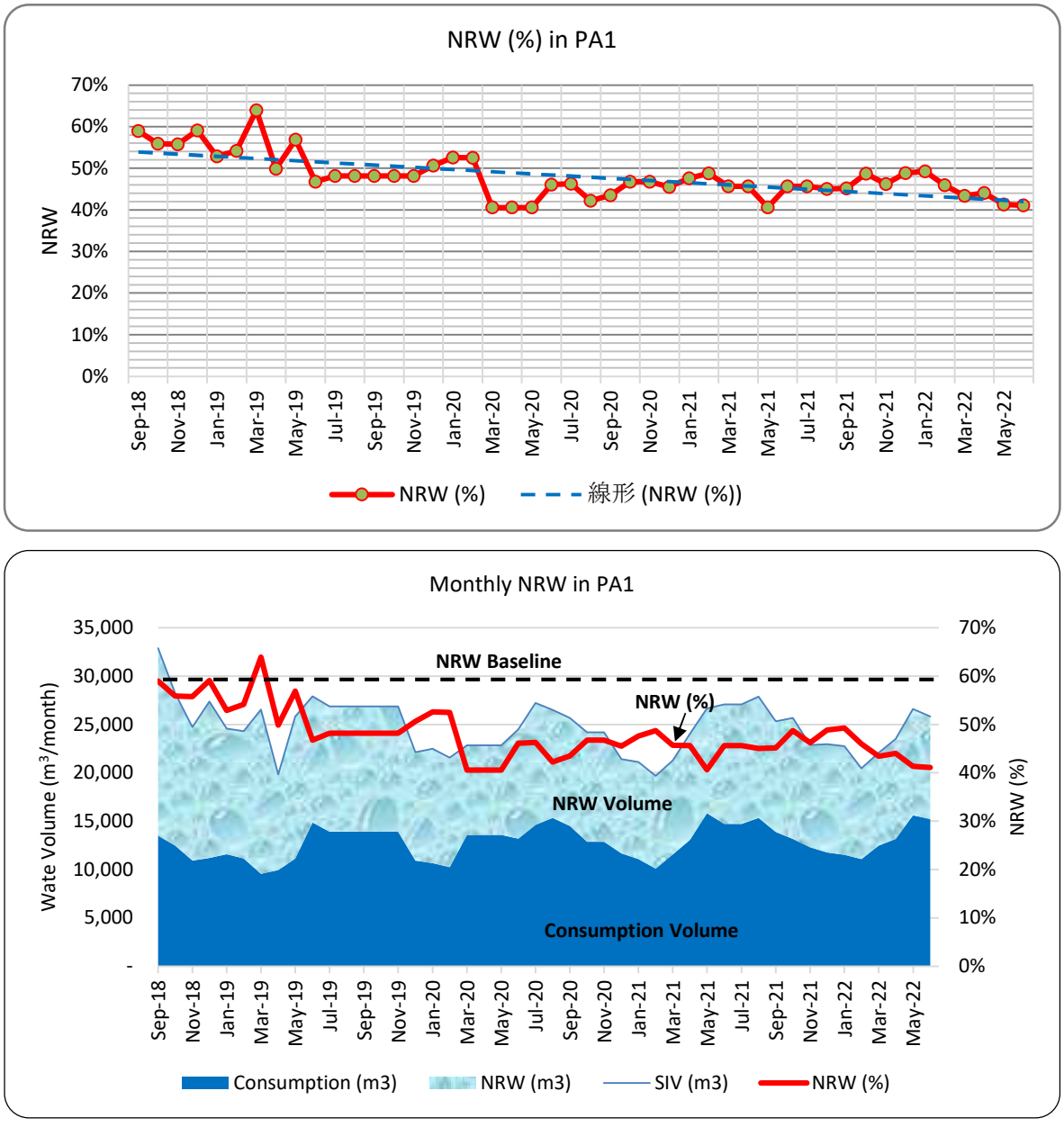


Figure 2-16 NRW in PA 1

As can be seen in the figure, in PA1 the NRW ratio reduced down to 40% in some months but it did not remain at that level for long. In order to maintain NRW to the lowest level achieved or reduce it further, intensive leak detection and illegal water use searching works were carried out by step-test and stop-

cock methods in the most problematic sub-area of this PA, i.e., the sub-area 1 where the water supply is continuous and the NRW ratio was highest.

In the step test, the sub-area was divided into four blocks by valves and supply to the blocks was closed sequentially by closing valves while inflow to the area was monitored by a portable flowmeter installed at the inlet of the area. Disproportionately large reduction in inflow resulted when supply to one block was stopped by closing the valve. This block was then identified as the potentially problematic area and stop-cock method was applied for further investigation.

The stop-cock method is a simple method in which the inflow is monitored by an existing meter or portable flowmeter at the inlet of the area and all known customer connections are closed by closing the valves near the customer meters. If the inflow becomes zero when all the known customer connections are closed, it indicates there is no leakage or illegal water use. But in contrary, if there is still an inflow even after closing all known customer connections, there is either a leakage or unknown/illegal water use. Then the network is surveyed for any leak or water flow sound by acoustic method, using listening stick to listen sound at house connections or any exposed valve, pipe, or fitting. This helps further narrow down and finally pinpoint the leak or illegal water use area. When the stop-cock method was applied in this block an unknown underground connection was found. Closing this connection reduced the inflow to this sub-area and subsequently lowered the NRW of PA1 to near 40% again.

In PA2 as explained in 1-4, it was not possible to measure NRW correctly for a long time. Only after April 2021 is it being regularly measured. The NRW ratio started decreasing slowly from June 2021 as shown in Figure 2-17.

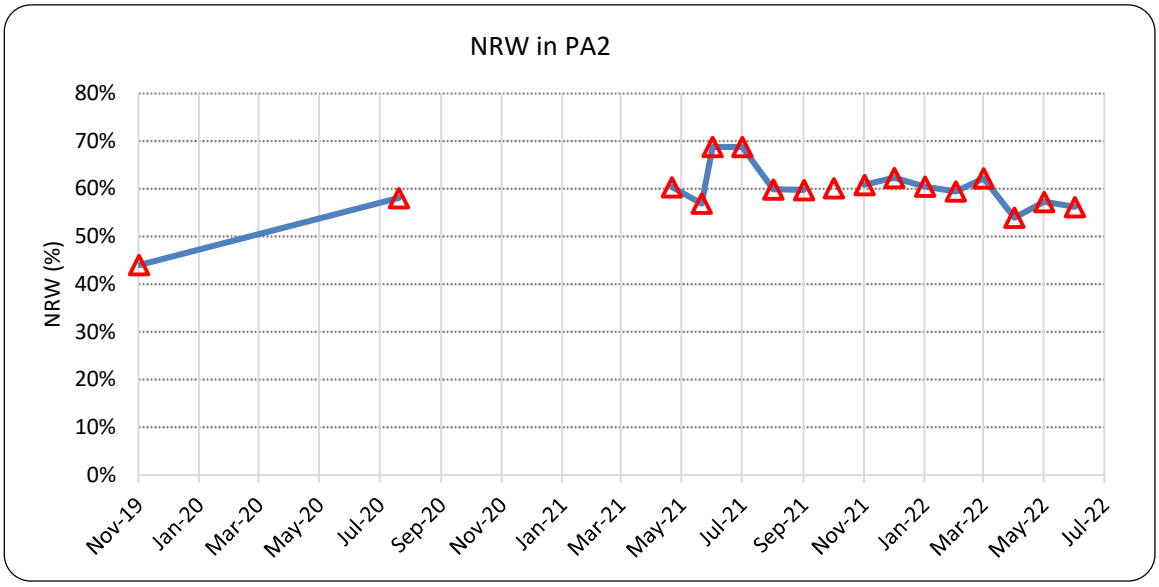


Figure 2-17 NRW ratio in PA 2

The situation of NRW in PA3 is as shown in Figure 2-18.

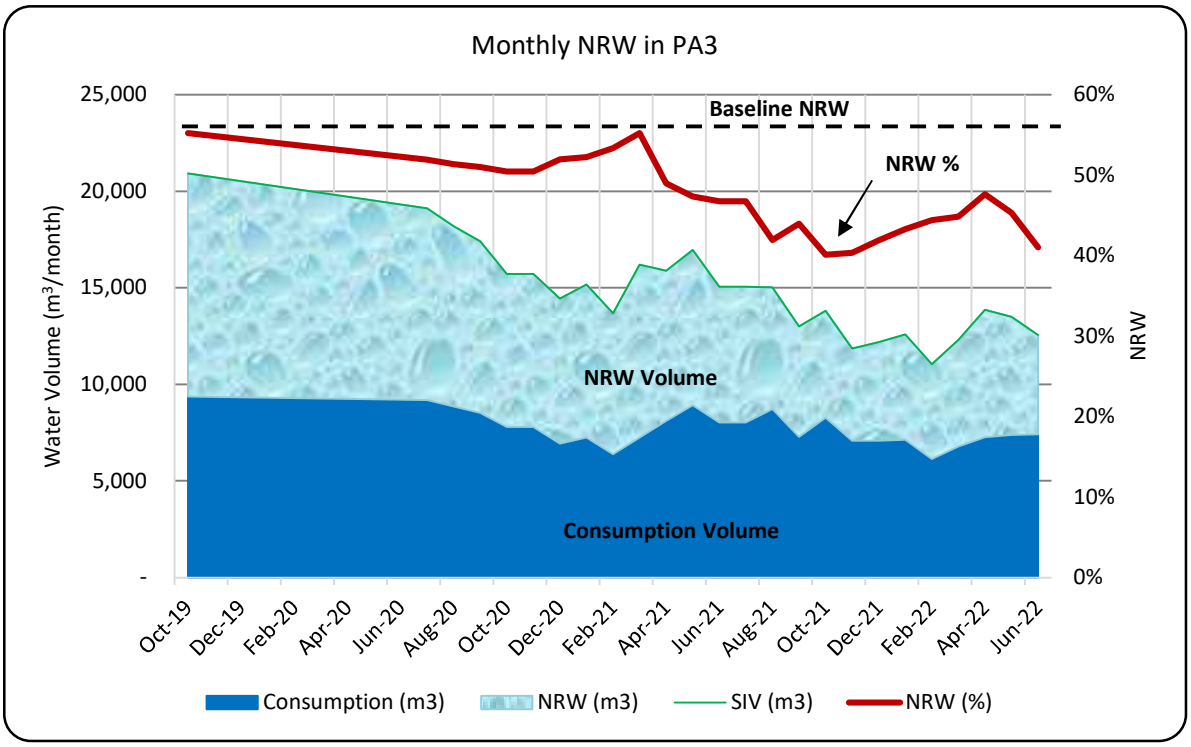


Figure 2-18 NRW in PA 3

3-9 Implement activities of 3-3 to 3-8 in Pilot Area 2 and 3

Implementation plans for activities in PA 2 and PA3 were prepared as shown below. And the activities were implemented as per the plan.

		Contents	2017	2018	2019	2020
PA2	1	Pipeline Investigation				
	2	Customer Database Survey				
	3	Clarification of Pilot area				
	4	Procurement of flow meters, etc.				
	5	Consutruction of chamber and installation of Bulk meter				
	6	Water Pressure Measurement				
	7	Start of NRW measurement (before measures)				
	8	Leakage survey (Underground)				
	9	Leakage repair (Underground)				
	10	Leakage repair (Surface patrolling)				
	11	NRW monitoring and evaluation				
PA3	1	Pipeline Investigation				
	2	Customer Database Survey				
	3	Clarification of Pilot area				
	4	Procurement of flow meters, etc.				
	5	Consutruction of chamber and installation of Bulk meter				
	6	Water Pressure Measurement				
	7	Start of NRW measurement (before measures)				
	8	Leakage Survey (Underground)				
	9	Leakage repair (Underground)				
	10	Leakage repair (Surface patrolling)				
	11	NRW monitoring and evaluation				

Figure 2-19 Implementation schedule of NRW reduction activities in PA 2 and 3

Implementation plan of customer meter replacement in PA2 and PA3 was as shown below.

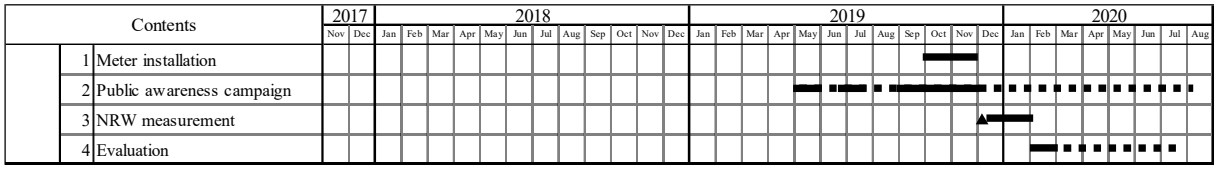


Figure 2-20 Schedule of customer meter replacement in PA 2 and PA3

The sequence of implementation after PA1 was PA3 followed by PA2. PA3's boundary was clear except at one location, and it was easier to isolate. It also required only one bulk meter. In contrast, PA2's boundary was not clear at several locations, and it required multiple bulk meters and isolation valves.

Implementation of NRW activities in PA2 faced significant challenges because of the complicated nature of boundary and unplanned addition of a private water source. The area was already isolated, bulk meters were installed and NRW measurement had started in Nov. 2019 when the above new source was introduced. After addition of the source some water was to be supplied to adjoining area. This required an additional bulk meter. Also, the hydraulic within the area changed affecting one of the bulk meters (flow direction reversed). Due to use of high-head pump by the new source, many pipe bursts might occur. Thus, NRW countermeasures needed to be applied with more effort to reduce NRW ratio.

3-10 Review Pilot Projects, then formulate cost effective NRW reduction roll-out plan for Jenin Municipality

Detailed cost-benefit analysis was conducted for PA1. Summary analysis was conducted for PA3. Based on the result of these analyses and experience of PA2 a NRW reduction roll-out plan (Annex 1.3) was prepared. A brief outline of the roll-out plan is presented in the following section.

(1) Basic considerations of the NRW reduction roll-out plan

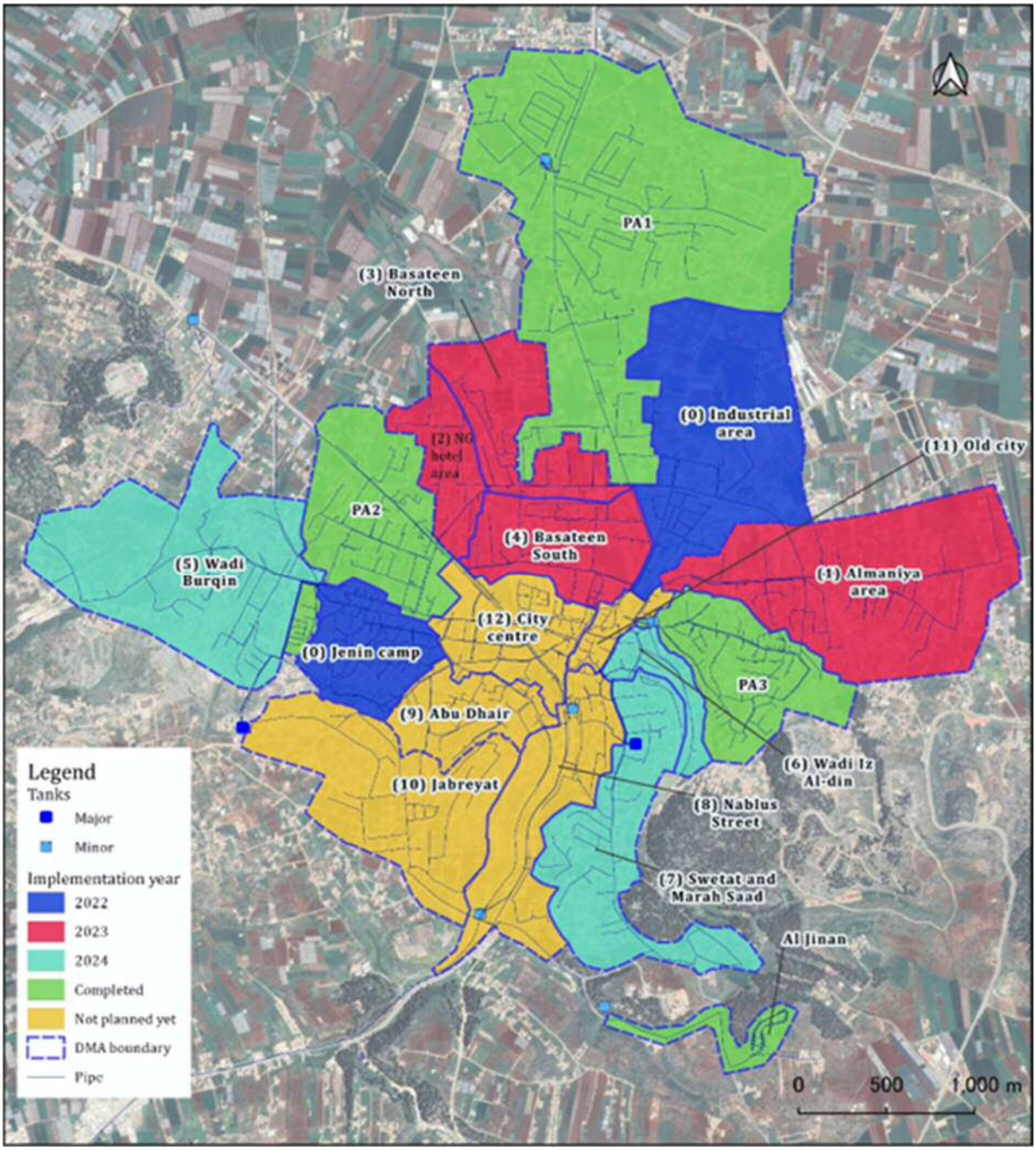
The followings are considered while preparing the roll-out plan:

1) A DMA plan was first prepared in which the whole Jenin is divided into 18 DMAs. These included three project PAs which were already implemented.
2) When delineating the DMA boundary considerations were given to existing rationing supply blocks, ground level variation, length of distribution pipe, and number of customers within the DMAs. Experience gained while implementing pilot projects has been utilized for the above.
3) Of these, three pilot areas (PA1, PA2, and PA3) have been completed and NRW countermeasures have been implemented. However, various NRW countermeasures including followings are needed on regular basis even in these DMAs to further lower or sustain the achieved level of NRW.
   - patrolling for surface leakage detection
   - investigation of zero-consumption meters for possible illegal connections or problem of meter
   - monitoring of flow and pressure profiles for abnormal patterns

- step test and stop-cock methods of suspicious sections
- investigation for under-ground leakage/ illegal connections of suspicious sections

4) In addition, Al Jinan DMA has been established and NRW monitoring is ongoing in it.
5) Preparatory and DMA establishment works are also progressing to various levels in some other DMAs; namely Almaniya, Al Basateen North, and Industrial area DMAs, which were initially identified as priority DMAs.
6) Customer database survey and bulk meter installation are completed in Al Basateen North DMA.
7) CDS has been completed in Almaniya (Almaniya and Ibrahimyin and school street) and is about 40% completed in Industrial Area DMA.
8) The DMAs have been assigned priority levels based on degree of progress of preparatory works, ease of isolation, and availability of suitable bulk meters in stock. The four completed DMAs have been excluded from the priority. Jenin Camp and Industrial Area have been assigned zero priorities because they can be taken up quickly, possibly within the end of this year.
9) Based on the priority, four DMAs with the highest priority (from 1 to 4) are proposed to be implemented in the first one year.
10) Next set of 3 DMAs from priority level 5 to 7 are proposed to be implemented in the following year.
11) The task of customer database survey is excluded from this plan as it will be covered under the PPWM installation plan. This is a separate plan prepared for installing PPWM in the whole city.

The outline of DMAs along with their priority of implementation is shown in Figure 2-21.



Note: The numbers before the name indicate implementation priority. The green colored areas are completed DMAs.

Figure 2-21 Outline of DMAs and their priority of implementation

(2) Activities included in the roll-out plan

The following NRW reduction activities are included in the roll-out plan:

- Clarification and confirmation of DMA boundary
- Confirmation of required flowmeters, valves, etc.
- Procurement of flowmeters, valves, etc.
- Pipeline investigation and update
- Customer database survey and update

- Water pressure measurement
- Construction of chamber and installation of bulk meters
- NRW measurement (before and after measures)
- Leakage survey (Underground and surface patrolling) and repair
- Zero consumption meter checking, illegal use survey and rectification
- NRW evaluation, monitoring, and repetition of last three items (leakage survey, repair, and zero consumption & illegal use rectification) as necessary

3-11 Compile NRW reduction methodology and usage of leak detection equipment and tools into manuals

The following six main manuals were prepared and given in Annex:

1) NRW manual (comprehensive)_English (Annex 1.1)
2) NRW manual (basic)_English (Annex CD 1.9.1)
3) NRW manual (basic)_Arabic (Annex CD 1.9.2)
4) Equipment usage manual (standard)_English (Annex CD 1.10.1)
5) Equipment usage manual (standard)_Arabic (Annex CD 1.10.2)
6) Equipment usage manual (simplified)_Arabic (Annex CD 1.11)

3-12 Prepare District Metered Area (DMA) plan for entire city

The DMA plan for entire city has been prepared in NRW reduction roll-out plan (Annex 1.3) and a brief explanation was made in 3-10 above.

3-13 Start implementation of DMA plan according to the plan prepared in 3.12.

After completion of establishing three PAs and before the preparation of DMA plan of the entire city, WWD continued DMA implementation starting with the easier parts of the city. As of this reporting, DMA establishment work has been completed in two DMAs (Al Basateen, and Al Jinan). Meter replacement and other countermeasures have been completed in Al Jinan. In addition, customer database survey has been completed in Almaniya and about 40% completed in Industrial area DMAs. Due to depleted stock of PPWM customer meter replacement and related public awareness works have been pending until arrival of new PPWMs. Also, NRW level is still not stable in three project PAs. Thus, currently emphasis has been given to NRW activities in these three PAs, especially in PA2.

2.2.4 Output 4: Direction for improvements of bill collection of Jenin Municipality is presented

4-1 Analyze details of current situation and issues regarding bill collection and finance of Water and Wastewater Department

The Baseline Survey Report in 2018 (Annex CD 2.1) provides details on analysis on issues with bill collection and finance of WWD. The following major issues related to the bill collection are discussed with the countermeasures taken for improvement.

Table 2-27 Issues relevant to bill collection, and the taken actions

Major issues	Actions	Status
• Low collection ratio	Replacement of water meters with PPWM	Collection improved. Collection ratio mainly improved in pilot areas. Though the overall collection ratio was affected by Covid-19 and economic hardship, JM realized the significant extent of role PPWM can play in collection and thus in finance of JM. The concern would be that the revenue should be utilized towards improvement of the water service.
Ownership of water meters by customers and thus difficulty for Jenin Municipality in monitoring and maintenance of meters	Revision of service subscription contract, ownership transferred to Jenin Municipality	Solved
• Insufficient monitoring of water meters with zero or minimum consumption • Monitoring for unauthorized and illegal connections • Monitoring for malfunctioned water meters • Areas with no meter reading	Improvement of monitoring activities, clear workflow, staff allocation	Solved
• Delay in processing tasks that needed site visits to customer complaints	Improvement of means of transportation	Solved
• Lack of disconnection policy, • Insufficient legal actions by JM for high debtors and collection campaigns	Public awareness and collection campaigns	No major improvement. However, steps are being taken by Jenin Municipality for financial improvement. Though PPWMs are set to collect 10% of debt, the collection is slow. The total debt is very high and requires more effort from Jenin Municipality to tackle the issue.
• Insufficient and overloaded workflow and staffing issues • Inaccurate customer database	Improvement of management information system (MIS) and digital business transformation	Solved. However, MIS needs to be maintained and upgraded.

More details on the countermeasures and the above taken actions are provided below.

1. Replacement of water meters with PPWM

The most effective way to deal with the low collection ratio in Jenin is replacement of the post-paid water meters with pre-paid water meters.

Over 3,000 water meters are replaced with PPWM and it has a great effect on improvement of the current collection ratio. Jenin Municipality will continue the replacement for the entire city. This system ensures a 100% payment of current water tariff fee and deduction of at least 10% of customer debt. For details

on the plan, refer to Annex 2.2 Prepaid Water Meter Installation Plan for Entire City of Jenin, for details.

The installation of the PPWMs in pilot areas, extended DMAs, and in Jenin City is explained in Table 2-28 and the summary for procurement of PPWMs is given in Table 2-29. It should be noted that Jenin Municipality has procured 1,200 and 500 PPWM from Fury Trade Company by own fund and they have received the Lot 1 and 190 PPWM in Lot 2. The installation work has been finished in Al-Jinan DMA and started in Al-Basateen DMA.

Table 2-28 Total installation of PPWM as of June 2022

Area	Total Customers	Installed	% Installed
PA1	863	737	85%
PA2 (without camp)	671	538	80%
PA3	577	533	92%
Al-Jinan DMA	58	44	76%
Al-Basateen DMA	383	110	29%
Almaniya DMA	130	100	77%
Out of PAs	-	1,111	-
All City	9,690	3,173	32%

Table 2-29 Summary for procurement of PPWMs (as of 15th Sept 2022)

Item	The number of procurement	The number of procured (received)
JICA 1st stage	1,850	1,850
JICA 2nd stage	4,350	4.350
JM Lot 1	1,200	1,200
JM Lot 2	500	190
Total	7,900	7,590

2. Revision of service subscription contract

According to the old subscription (customer) contract, ownership of post-paid meters belonged to the customer because the customers purchased the meter. This ownership issue caused Jenin Municipality difficulties in monitoring the water meters and replacing broken meters or sending them for repair. When Jenin Municipality noticed broken meters and requested customer to replace, there were often cases that customers didn't follow the request. Revision of the customer contract and changing the ownership from customer to Jenin Municipality for PPWM has a great effect in monitoring and management of the meters.

3. Improvement of monitoring activities, clear workflow, staff allocation

There were insufficient workflow of key monitoring and inspection activities, at the baseline survey, for major issues such as:

a. Water meters with recorded zero or minimum consumption
b. Unauthorized and illegal connections
c. Malfunctioned water meters
d. Areas with no meter reading

With improvements in monitoring workflow and staff allocation, currently the following monitoring and inspection activities are conducted in daily basis. Details on improved workflow is given in Annex (CD) 1.1 Procedure Manuals for major Customer Service Management.

1) Monitoring and inspection of water meters with zero or minimum monthly consumptions by site visit

The purpose of this activity is to examine the reasons when water meters have recorded zero or minimum consumption, usually for a period of few months. The possible reasons could be:

i. The customer's building is still under construction though has a registered water meter,
ii. There is no water supply by Jenin Municipality thus no consumption,
iii. Customer receives water from private well,
iv. The water meter is broken,
v. The customer is not using the water meter i.e. they are away from the city or the house is not occupied by tenant or owner,
vi. Illegal use,
vii. Wrong readings of the meter by Jenin Municipality,
viii. No water meter on the site (which resulted readers to record as zero or minimum consumption).

As seen in table below, since January 2020, CSS has inspected a total of 845 mechanical water meters with record of 0/minimum readings and replaced 95 with PPWM. CSS is waiting for the new PPWM delivery to replace all broken meters.

Table 2-30 Total inspection of water meters with 0-reading records on Al-Shamel system from January 2020 to June 2022

0-reading		Y 2020	Y 2021	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Total
Total checked meters		300	915	37	45	40	30	44	30	1,441
Recorded broken		134	315	9	15	8	5	7	15	508
Actions	Fixed	23	27	0	0	0	0	0	0	50
	Replaced with mechanical	49	117	8	12	7	3	7	14	217
	Replaced with PPWM	63	95	0	0	0	0	0	0	158

Photo 2-3 0-meter reading visit, broken meter and new meter after replacement

2) Examination of potential illegal connections by site visit

The aim is to periodically check for any illegal use in a selected area. The selected areas are chosen randomly. Below is a summary table of data on discovered illegal connections and actions taken.

Table 2-31 Monitoring of illegal connections (post-paid water meters)

Actions taken after discovery	No. of cases
Paid 1000 NIS penalty	1
Paid 500 NIS penalty	1
Sent to the Court	8
Sent to the Legal unit	18
Total	28

3) Random check of the installed PPWMs for any possible malfunction by site visit

The purpose of this activity is to check the installed PPWM after a certain period for any issues and malfunctions. The examination may discover issues such as:

i. Damage of the PPWM protection box i.e. broken sliding cover or meter body,
ii. Closed valves,
iii. Uncharged PPWM cards (no consumption),
iv. Inactivated LoRa system,
v. Brocken or damaged PPWM,
vi. Unsealed PPWM box,
vii. Illegal connections, by-passing of the meter,
viii. Issues with the installation of PPWM by the subcontractor.

Table 2-32 Issues solved by random check of PPWM during December 2019 to June 2022

Issues	No. of Cases	% of Cases
Box not sealed	300	46.2%
Box issues (other)	3	0.5%
Valve issues	180	27.7%
Meter uncharged	138	21.3%
LoRa not activated	11	1.7%
Meter is broken	17	2.6%
Total No. of cases	649	100%
Total checked	1,659	

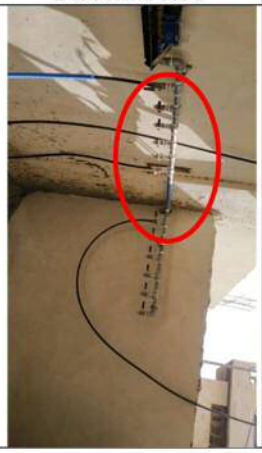
1	2	3	4
Illegal Connection in new House was found // they get water direct from pipe	Illegal Connection was found at residential building // he get water direct from Municipality pipe	Illegal Connection was found at residential building directly from pipe	Illegal Connection was found
Disconnected	Disconnected	Disconnected	Disconnected
			

Photo 2-4 Illegal Connections

4) Examination for possible malfunction in installed PPWM by monitoring from the Gateway software CSS staff monitor the warning notifications on the Gateway LoRa system for potential malfunctioning of the installed PPWMs and check the meters at site. The staff take the required actions either to fix the PPWM within WWD or to send it to the maintenance center of Fury Trade Company. The following table provides a summary of the failures of the installed PPWMs as of a total case by June 2022.

Table 2-33 PPWM failures summary from Feb. 2021 to Jun. 2022

Type of malfunction	Number of failure
Broken (not counting)	12
Leakage inside the meter	65
External damage in the meter	4
Internal wires connection	1
Card does not match with the PPWM number	2
Opens fire mode automatically	2
Internal wires connection and reverse flow	6
Leakage inside the meter and valve failure	3
Counting more than the real consumption	6
Valve failure	82
Dead battery	15
Reverse flow	7
Consume water without deducting charge from card	1
Valve failure and low battery	1
Leakage inside the meter and dead battery	2
Uses water without charge/valve does not close even when the balance is zero	2
Total	211

5) Reading all water meters throughout the city

For years, there were areas where water meters were not read but the consumption is estimated on minimum basis and billed based on this estimation. At the baseline survey time, the meter readers/collectors belonged to the Collection Unit in Jenin Municipality. To supervise their activities more closely, they have been reallocated to the CSS in December 2019 and are now supervised by the Head of CSS. The issue of some areas without meter reading was resolved since mid-2021 and finally all water meters have been covered by the readers. For this, the meter readers have been offered some motivational scheme. The full coverage of reading has a considerable effect in bill collection.

4. Improvement of means of transportation

Shortage of means of transportation caused many delays in conducting CSS activities. JICA procured a van for this section's daily activities. It has helped to conduct many activities that were postponed or delayed before when there was no sufficient access to car and CSS had to share car with other sections. In addition, Jenin Municipality has also procured three battery-powered bicycles and started using them since January 2020 to speed up daily work.

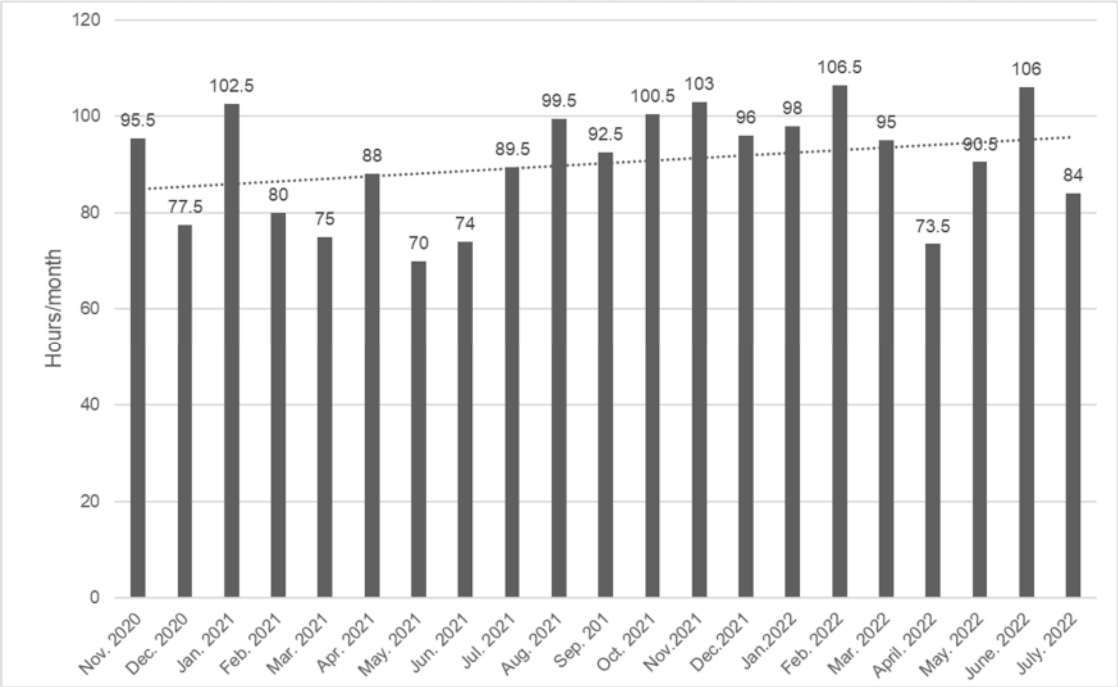


Figure 2-22 CSS's use of car procured by JICA in each month by total number of hours

(Note: Number of hours for Feb.2021 to May 2021 were estimates.)

Photo 2-5 CSS's van provided by JICA

Photo 2-6 CSS's battery-powered bicycles provided by Jenin Municipality

5. Public awareness and collection campaigns

Since the Project, C/P has paid more attention to the importance of PR for collection improvement. However, it has still been a challenge and not much improvement has been achieved in the collection of debt. The main reasons are 1) lack of supportive policy for disconnection, and 2) lengthy procedures for debtors who are referred to court for legal actions against their high debt.

As of June 2022, the total debt is 51,648,203 NIS. There are a total of 461 customers whose debt exceeds 20,000 NIS (total debt: 18,334,919NIS).

Table 2-34 Customer debt by amount

Debts (NIS)	No. of customer	Debts (NIS)	No. ofcustomer	Total debt (as of Jun 2022)
0-999	3745	11000-11999	161	
1000-1999	795	12000-12999	150	
2000-2999	608	13000-13999	112	
3000-3999	592	14000-14999	109	
4000-4999	501	15000-15999	91	
5000-5999	425	16000-16999	80	
6000-6999	368	17000-17999	72	
7000-7999	267	18000-18999	57	
8000-8999	257	19000-20000	47	
9000-9999	201	More than 20000	461	
10000-10999	189			
Total debt				51,648,203

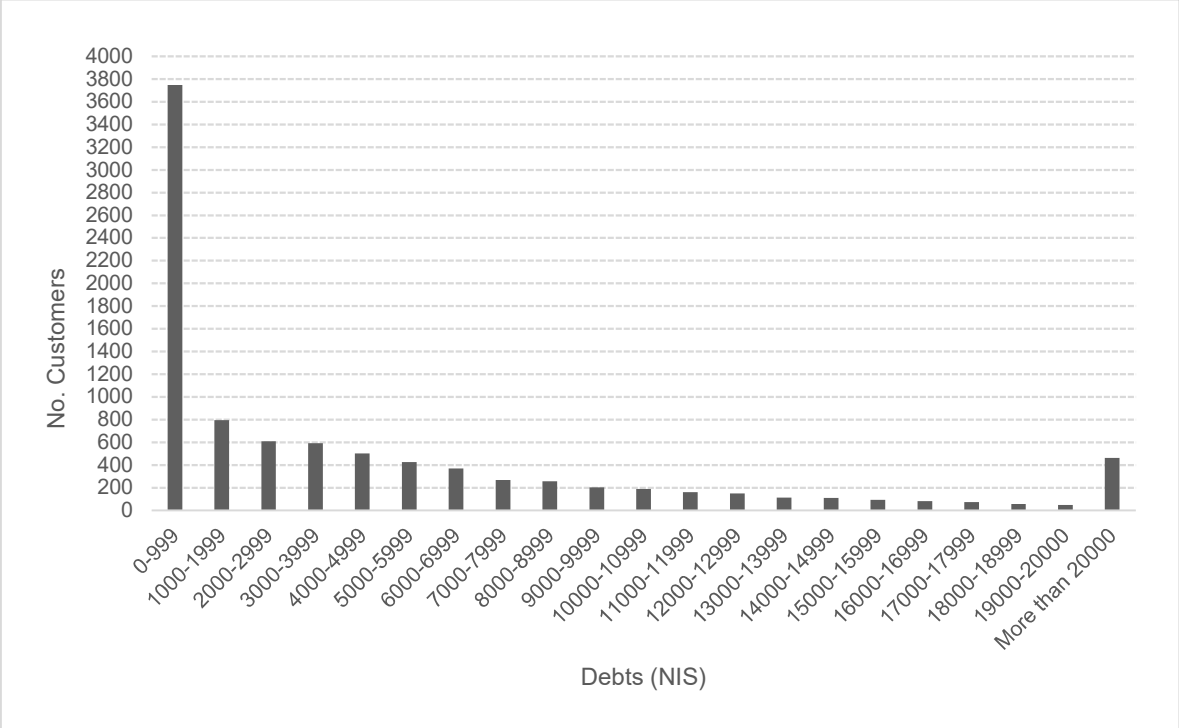


Figure 2-23 Distribution of debt as of June 2022

Table 2-35 Number of customers with over 20,000 NIS of debt and total amount by category

Category	Number of Customer	Total Debt (NIS) as of Jun. 2022
Commercial	9	314,348
Domestic	391	11,732,389
Governmental	43	3,607,535
Industrial	4	137,861
Jenin JSC	1	1,669,779
JM facilities	13	873,005
Total	**461**	**18,334,917**

In April 2019, the project experts conducted a model soft-approach collection campaign for 3 days with stages of follow-up afterward. The result was positive, and the method was recommended to WWD to

conduct further collection campaigns. Details on the campaign method is given in Annex (CD) 1.1 (Procedure Manuals for major Customer Service Management). Since the pandemic of COVID-19, the recommended collection campaign was delayed and re-started in May 2021 with assistance of PR Department. Table below is a sample of the conducted soft approach as door-to-door visits of the high debtors.

Table 2-36 Sample door-to-door visits of high debtors and request to pay their debts

Customer Name	HC-ID	Debt Amount (NIS)	Date of Visit	Remaining Balance (NIS)	Remarks of the visiting day
x.x.x.x.x.x	W522	39, 952	25-05-21	39,944	Needs to check the debt amount for possible errors.
x.x.x.x.x.x	W6040	34,176	25-05-21	34,247	Family dispute on who should pay.
x.x.x.x.x.x	W709	14,268	25-05-21	14,268	He will pay 200 NIS next week, and will pay every new bill and 100 NIS from debts.
x.x.x.x.x.x	W5130	19,728	22-06-21	19,728	He will install PPWM with 50 NIS deducted each charge.
x.x.x.x.x.x	W714	19,510	04-06-21	19,510	He will pay 50 NIS every day to the area's collector (Mr. Amin Alnasra) until the full amount is paid.
x.x.x.x.x.x	W5069	19,289	04-06-21	19,289	He will come to JM to make a deal and pay the full amount.
x.x.x.x.x.x	W2229	16,597	04-06-21	16,597	He didn't receive any bill. He asked JM to provide him the bill and he will pay 50 NIS daily.
x.x.x.x.x.x	W9333	15,517	04-06-21	15,517	He paid to JM by a check for the amount of 10 thousand NIS in 2017 and PPWM has been installed for him recently.
x.x.x.x.x.x	w1152	27,538	04-06-21	27,538	He will install PPWM and will come to JM to make a deal.
x.x.x.x.x.x	W4821	45,805	22-06-21	45,805	Dispute over ownership of the subscription. Customer will review the current owner and make a settlement with him.
x.x.x.x.x.x	W4615	26,265	22-06-21	26,265	Willing to install a PPWM and pay part of debt each charge. The customer is unemployed and does not have the money to pay.
x.x.x.x.x.x	W3613	77,549	15-08-21	77,549	He has problems with JM, he is ready to sit with JM to solve it.
x.x.x.x.x.x	W4698	19,966	15-08-21	19,966	He is outside of Palestine, when he returns, he will follow up the debts with JM.
x.x.x.x.x.x	W3809	88,636	15-08-21	88,636	They will divide the debts among the brothers, if JM offers a discount, they will pay the full amount.
x.x.x.x.x.x	W8960	86,722	15/82021	86,722	He will ask JM to reduce the debt (plea of clemency). He said that the bill for the month of January 2021 amounted to 41 thousand NIS.

Although, debt collection is a major challenge for Jenin Municipality, there are some actions taken:

1) A new staff at PR Department is assigned to make follow up phone calls to the visited customers on the status of their payment promises.
2) To take more serious action, the Mayor of Jenin Municipality, in November 2021 has announced a new policy for collection of debt and has signed official warning letters to the high debtors (Commercial and residential) calling them to visit Financial Department (FD) within 15 days to

schedule their debts. The announcement was podcast on the well-known radio channel of Good Morning Palestine and published on the Municipality's FB page. Below is a translation of the announcement.

"Jenin Municipality announced that since December 9th ,2021 all the files of customers with accumulative water debts would be transferred to the Palestinian authority institutions for collection purpose. In case such files are transferred, customers services by the Palestinian authority institutions will be stopped, till customers have a settlement with Jenin municipality. Thus, Jenin Municipality calls upon the targeted category, who has been officially notified many times, to visit the municipality and settle their debts before December 9th,2021.

Mayor of Jenin Municipality

Mr. Fayyz Al Saadi"

Photo 2-7 Screenshot of announcement of new policy on collection of high debts podcast on radio (left) and on Municipality's FB page (right)

6. Improvement of Management Information System (MIS) and Digital Business Transformation

Use of digital solutions has helped to reduce unnecessary workload and instead to direct the efforts of staff work towards more productive activities. It also helped to clean up existing customer data and create more reliable database. Details are given in Annex (CD) 1.4 (MIS Report: Digital Business Transformation for Major Operations of Customer Service Management).

Below is a brief of the activities:

Annex (CD) 1.4 "MIS Report" provides details on the newly utilized digital solutions and software at WWD, mainly the CSS. Below is a brief review of steps taken for digitization of the activities:

1) Upgrade of the customer database management system (Al-Shamel software) including the

server improvement and backup system

2) Digitalization of water service applications via Document Management and Archiving System (DMAS software)
3) Mobile water meter reading and billing system (Mobile Billing System; MBS)
4) Use of prepaid water meters and vending stations (Baylan Software)
5) Digital monitoring of pre-paid water meters (BMS System; Gateway LoRa system)
6) Automation of bill collection (Palpay System)
7) Establishing GIS-base customer database
8) Digital processing of customer complaints (Municipality Website-base Customer Complaints and Online Chat)
9) Use of SMS to remind customer for bill payment
10) Use of Google Sheets for file sharing
11) Scanning and digitally archiving of paper customer service contracts and all their application documents (customer files)
12) System integration

1) Customer Database Management System (Al-Shamel)

Al-Shamel has been in use by WWD since 2010. The software, developed by Al-Israa company, contains solid waste and water customer accounts with variety of functions. There were several issues with Al-Shamel addressed by the Project and solved in 2018.

To increase the processing speed of Al-Shamel, Jenin Municipality also implemented a new server and moved the upgraded Al-Shamel software to the new sever in July 2018. This transfer speeded up functions such as searching customer names and IDs on Al-Shamel even when several users are using the software all together at the same time. The new server is faster in processing power and has high data storage capacity. To have a secure backup of the customer database on Al-Shamel, the Jenin Municipality set up the new backup system in addition to the new server.

2) DMAS Software

WWD started using DMAS software (Document Management and Archiving System) for digitalization of processing service applications since 2018 to replace their paper-based application forms. Now, many processes i.e. for new service connections, disconnection of service, re-connection of service, water meter ownership change, and water meter re-location are processed by this system successfully. As of the time of this reporting, the Jenin Municipality is in discussion to replace DMAS software with a newer software in the market.

3) Mobile Billing System (MBS)

The mobile reading and billing system was proposed by the Project in 2018 and was lunched in the beginning of 2020 (Annex CD 1.2 (Report on Mobile Billing System (MBS) for Jenin Municipality)). MBS allows Jenin Municipality to carry out the process of billing and collecting bills during the same

month, paperless, and within a period not exceeding the 15th day of each month. The readers' and collectors' teams were trained to use the system in December 2019. With MBS and shortened reading time, almost all water meters (98%) are read every month with the current number of readers compared to previous 70 % reading. The following photos show the training of the readers on how to use the MBS.

Photo 2-8 Mobile billing system training and discussion meetings

4) Baylan Software (PPWM) and Vending System

Baylan system manages the PPWMs and the relevant operations. This is the interface for the vending stations, contains the subscribers' database and manages the depts deduction. This system is integrated unidirectionally with Al-Shamel i.e. any deduction through Baylan is reflected on Al-Shamel as a credit note. The system's main purpose is to increase water bill collection ratio in Jenin Municipality. Status of PPWM system in Jenin is summarized in Table 2-37.

Table 2-37 Status of PPWM system in Jenin

Start Year	City	Target Area	Initial procurement (units)	Total Current Installation	Population Served	Average Annual Installation
Feb. 2019~ongoing	Jenin	Pilot areas, extended DMAs, other	1,850	3,173 as of June 2022	~15,000	~1,380

Brand	Price (USD)	Type	Vending Method	Guarantee Period	Product Life (Actual)	Battery Life (Actual)
BAYLAN	150	Ultrasonic	Smart card	3 Years	10 (not experienced)	Expected 10 (not experienced)

PPWM Functions		After Sale Services
Realtime clock Remaining credit Reserve for emergency Low credit alarm	Friendly credit Tariff setting Debt recovery Consumption limit	Software support 24/7- 5 yrs Technical support 24/7 – 5yrs Onsite support on request – 5yrs

City	Customer Database Software	Data Collection Method	Web-bases Data Transfer	Gateway LORA	Accounting Software
Jenin	Integrated	Server	Yes	Yes	Integrated

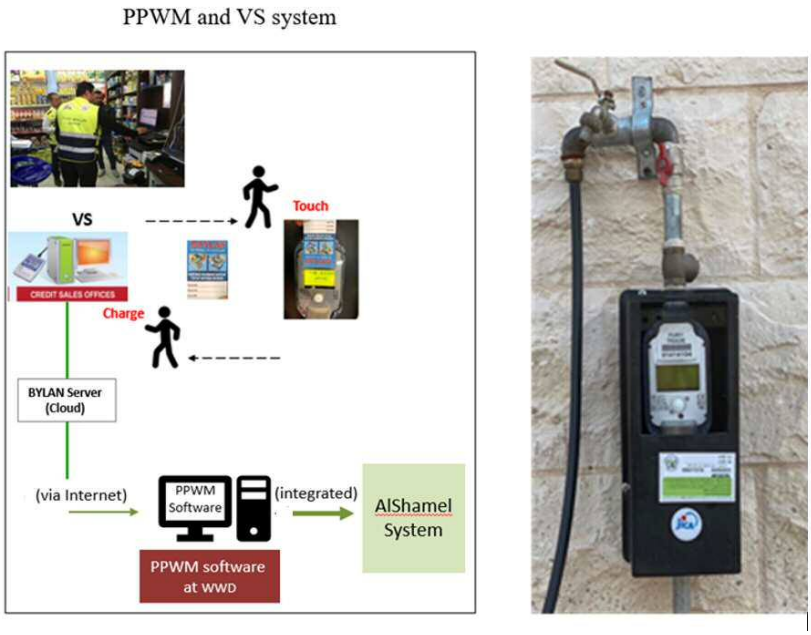


Figure 2-24 Integration of Al-Shamel and PPWM software

5) BMS (Gateway System)

The PPWM software does not regularly measure the amount of consumed water by the customers. Thus, it was necessary to introduce Baylan Metering System (BMS: software manages Gateway) using LoRa and Gateway (collector antennas) technology. Gateway is a tool which allows communication with the installed PPWMs remotely using LoRa (Long Range Wireless) technology. The captured data from Gateway contains cumulative consumption, current remaining credit, valve status (open or closed), warnings, and so on. It is also possible to send various commands to individual PPWM by using this system. Thus, the BMS is a great tool to monitor installed PPWMs and customer consumption behavior.

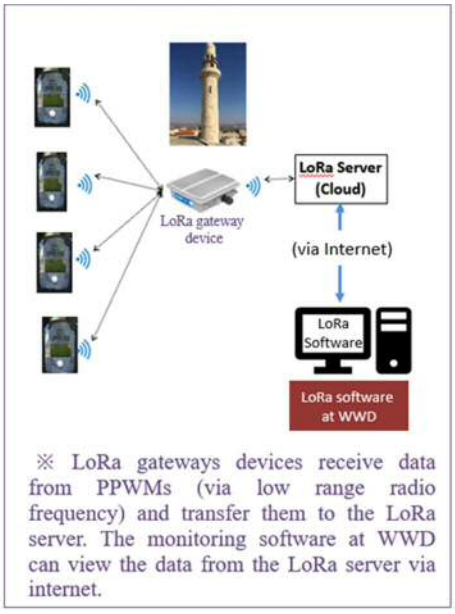


Photo 2-9 PPWM and LoRa Gateway system

6) Automated Bill Collection by Palpay

In addition to the traditional bill collection by the collectors, Jenin Municipality has commissioned Palpay system as a financial operating system for digital bill collection. The Palpay devices are set up at vending stations (payment points) throughout Jenin City, mainly at supermarkets where customers have easy access. The customers can pay their water bills and debt by Palpay which is automatically deposited in the Municipality's bank account.

As of June 2022, there are 12 vending stations for PPWM customers to charge credits for their PPWMs or pay their debts. Out of the 12 vending stations 2 vending stations are operated by the municipality staff and the rest 10 are operated by Palpay. There are 45 vending stations including the above 10 for mechanical water meter customers where they can pay their water bills. This system saved time and efforts of municipality staff and customers. New 5 vending stations are under preparation to be added to the operation.

7) GIS-based Database

GIS-based map of water facilities and customer meter locations was first introduced to WWD in 2015 as a part of Master Plan Project funded by French Cooperation (AFD). But these maps were not updated till 2018 when the Project started. The water network within pilot areas was updated using devices such as pipe locator, and the customer database was updated by conducting customer database survey (CDS). More detail is given in Annex CD 1.3 (Customer Database Survey (CDS) & GIS Work). The GIS based map of Jenin Water Supply System, produced by the WWD, as shown below, is a sample of many GIS-base work maps created by the Project.

The GIS database is extensively used in preparation and mapping of the activities by NRW Division, CSS, and PR, locating customers and their network connections, locating new service applications within the water network area, locating customer meters, and finding customer information. The GIS-based mapping could be further updated and utilized for many more activities such as mobile data collection, monitoring and maintenance on the site and so on. With the availability of open-source free GIS programs like QGIS, GIS based mapping is becoming a popular and most widely used tool in WWD.

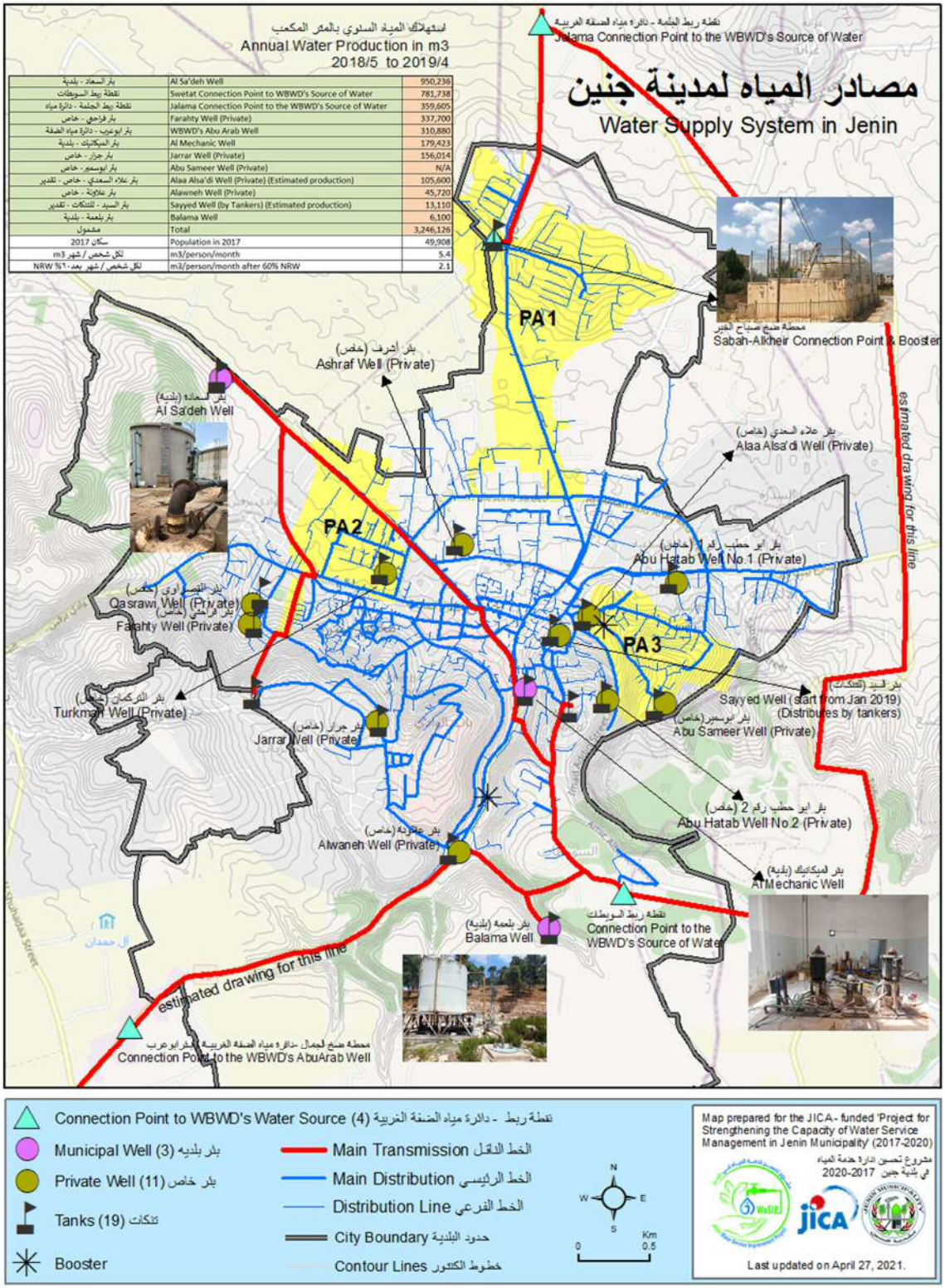


Figure 2-25 Map of Jenin water supply system using GIS

Table 2-38 Summary table for data entered by PR staff (GIS) as of June 2022

GIS database for PPWMs in new DMAs and outside the DMAs		
Area	Total Customer	Entered Customers
Al-Jenan DMA	61	40
Al-Basateen (North and South) DMA	396	112
Almaniya DMA	136	87
Al-Ibrahemian DMA	246	210
Industrial Area	97	23
Outside DMAs (Total)	649	573

8) Website-Based Customer Complaint Interface and Online Chat

The municipality's new website <http://www.jenin.city> was launched on 19th of February 2019. It provides built-in digital solution for online complaints and live chat with customers. For WWD, the customer complaints are divided into two groups: 1) water and 2) wastewater. Also, the website interface includes SMS function in order to provide the customers with information about their complaint status and to clarify the flow and processing status of the complaint. There are certain data that need to be filled in the electronic form of the complaint interface such as details of customer (Name, mobile number, water subscription number if available), location, type of complaint, description of the complaint, and attachment of the original paper complaint form.

The interface provides options for the customers to apply for the complaint from home, and if not familiar with the system the customer can go to the Customer Service Citizen Center in Municipality and fill the paper form and the employee will scan the complaint and upload it to the interface as attachment. In both cases the electronic reply is available.

Recording of the customers' complaints is mostly daily by CSS staff. The activity has been done since Dec. 2019. Complaints are solved in a timely manner. CSS also has a 24 hours/ 7 days of phone available for customer complaints calls and this complaints phone number is published regularly on municipality's FB page.

Table 2-39 Complaints by Type and Number between December 2019 to June 2022

Type of Complaint		Number of Cases
PPWM Customers	Leakage	102
	Manufacture defect / broken meter	163
	Relocation	16
	Accuracy	75
	Card charging issues / Card not matching with the PPWM number	49
	Card charging issues / customer didn't know how to charge	28
	No water (valve was closed)	360
	No water	80
	Replace vertical pipeline	1
	Request to activate the fire mode	45
Mechanical Customers	Broken meters	178
	Leakage	61
	No water	34
	High bill amount (high reading)	645
	Bills not received	124
Total		1,961

9) SMS Reminders

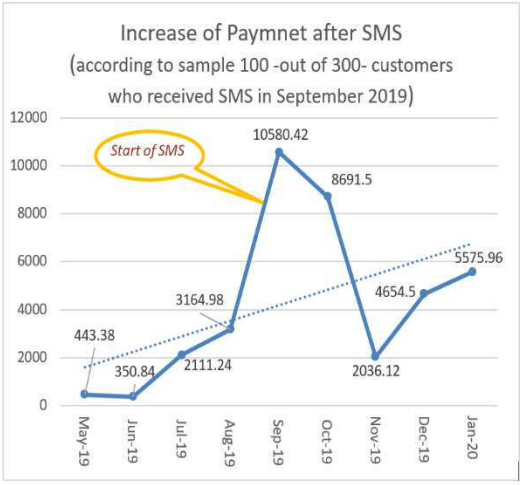


Figure 2-26 Analysis of SMS effectiveness in increased water

With assistance of the Project experts in September 2019, Jenin Municipality conducted a model SMS reminder to 300 customers with a history of zero or low payment and sent SMS to request them to pay their monthly bills. Payment behavior of 100 customers (out of the 300) was then monitored and analyzed for the next months. The result showed an overall increasing trend in the payment of their bills. Jenin Municipality, thus, continued to send SMS reminders to phone numbers available on customer database and gradually collected more customer phone numbers. The SMS reminders increased to 800 customers by the end of 2020 as more customer phone numbers were collected into Al-Shamel.

10) Use of Google Sheets

The teams at CSS and Water Section have prepared and utilized Google Sheets for sharing the databases and activity records and reports on the clouds. The authorization is defined for the relevant staff as 'only reader' or with 'editor' rights. The Google Sheet database is constantly being updated in several organized worksheets on a daily basis. As of the time of this report, the municipality's IT department is in process of upgrading the WWD's Sharing System on the municipality's server with higher security and capacities.

11) Digital Archive

Paper-based customer service contracts and all their application documents (customer files) are being

digitized. Currently 4,939 of old customer files are scanned and saved on the municipality server. It is an ongoing activity. It has helped CSS to have faster access to digital files of customers.

12) System Integrations

The followings are the system integration status at Jenin Municipality between Al-Shamel, PPWM, and Palpay for the purpose of data sharing and payment transactions. It has greatly improved WWD's services in terms of efficiency, time, and data accuracy.

For PPWM customers:

System integration for PPWM customers provides them two ways to charge their cards: 1) via Palpay System (charge PPWM card at a Palpay vender), or 2) directly at the municipality's collection centers.

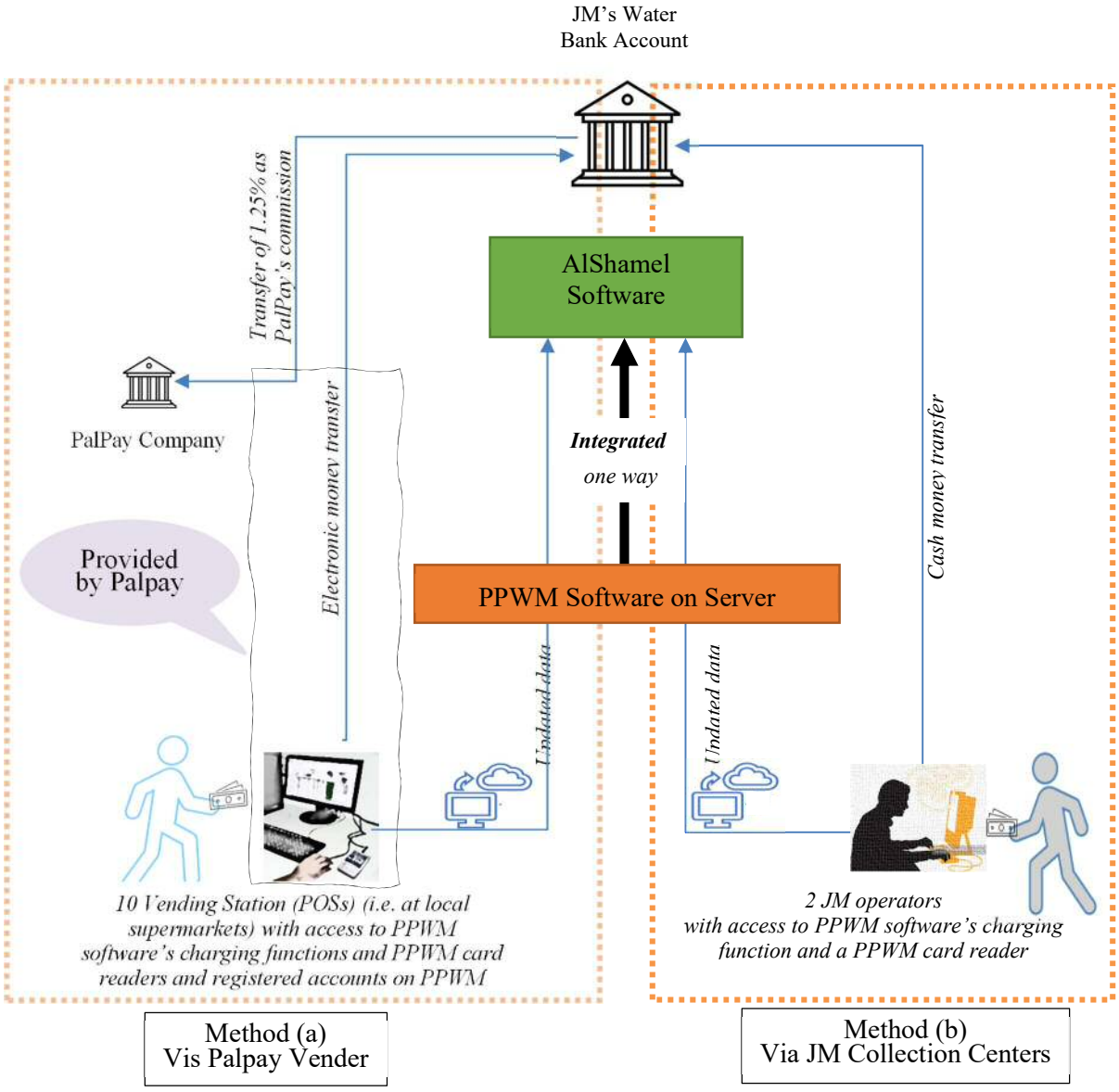


Figure 2-27 One way integration of Palpay to Al-Shamel via PPWM software for PPWM customers

For mechanical water meter customers:

System integration for mechanical water meter customers provides them two ways to pay their bills: 1) via Palpay System (pay at a Palpay vender), or 2) pay directly at the municipality's collection centers.

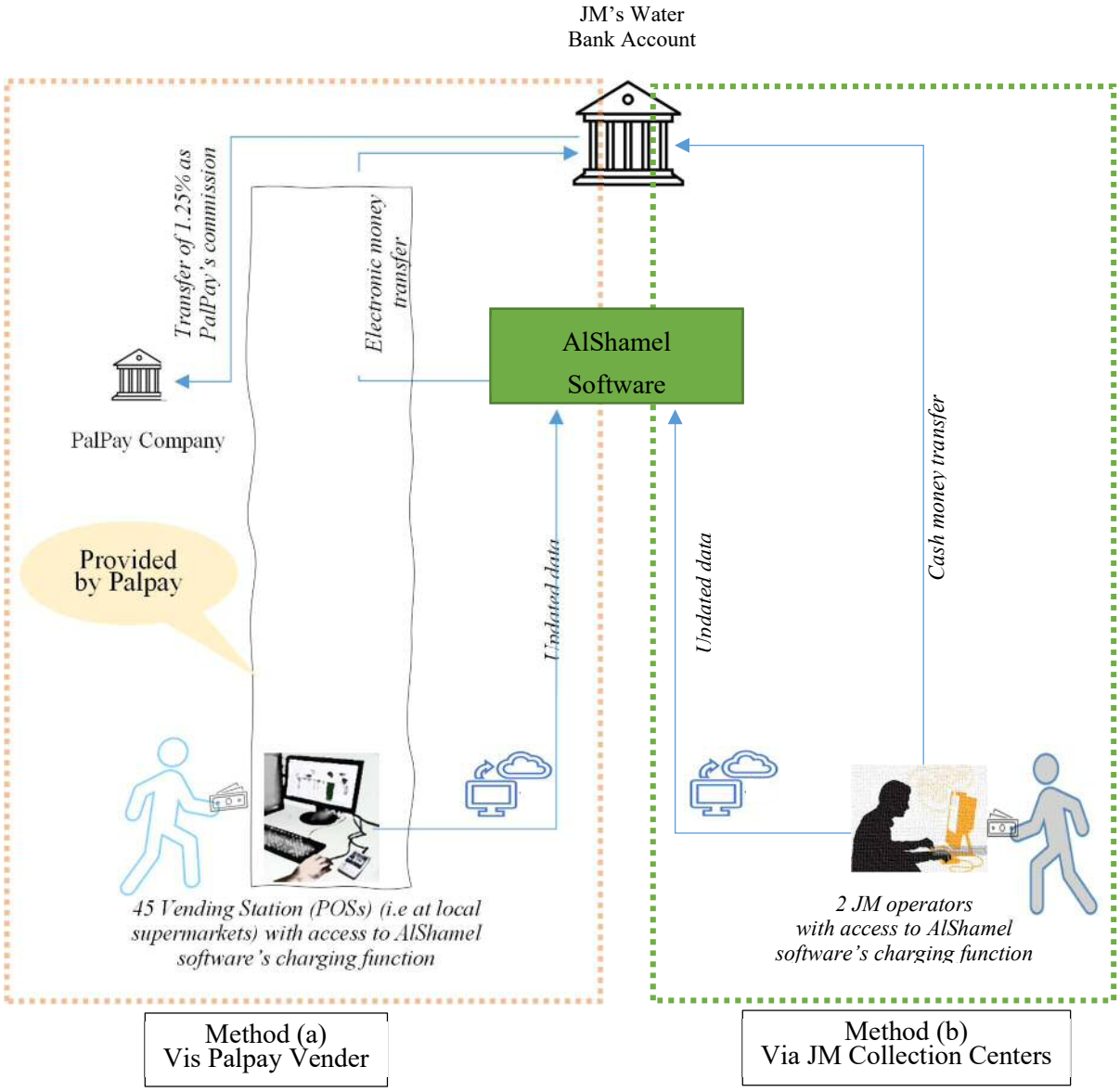


Figure 2-28 One way integration of Palpay and Al-Shamel for mechanical water meters

4-2 Conduct water user opinion survey on willingness to pay for water tariff and introductions of pre-paid meter

In addition to the basic information, the social survey collected information on:

1) Customer satisfaction of municipality's water service,
2) Willingness to pay in case of any increase in water tariff, and,
3) Public's opinion on PPWM if the Project decides to install PPWM.

A total of 124 questionnaires were filled out in the PA 1 area, and 100 questionnaires in Jenin city (citywide) including PA2 and PA3, in cooperation with the PR Department in October to November 2017 at the beginning of the Project. Detail is given in Annex (CD) 2.1 (Baseline Survey Report- 2018). The results on willingness to pay and opinion about PPWM were as follow. For details on the survey result refer to the Baseline Survey Report.

(1) Willingness to Pay in PA1

- 83.3% of the connected surveyed population said that they pay their bills, 9.3% don't pay and the rest pay sometimes.
- 70% of the 124 surveyed people did not know about the amount of current water tariff.
- When explained about the current tariff of Jenin Municipality and some other cities in Palestine, only half of them (50%) believed that it is a fair rate and mostly believed that it is still expensive.
- If water services improved, over half of the respondents are willing to pay a little more (4.87NIS/m^3 instead of the current 4.3NIS/m^3).

The 45.5% who are not willing to pay more have the following reasons for their opinion:

1. It's municipality responsibility.
2. They do not have enough money.
3. It's already so expensive.
4. They don't trust municipality.
5. They are happy with the private well water they purchase so no need to improve and pay more.

(2) Opinion on PPWM in PA1

- From the total 124 respondents, 81 (65%) prefer PPWM and the rest don't.
- If Jenin Municipality takes a decision to install PPWM, slightly higher number of residents accept PPWM (67%). This means an obligatory PPWM installation will not make a difference in the public's acceptance of PPWM.

The reasons for accepting PPWM were:

1. Customer pays regularly.
2. To get water every day without cutting.
3. This system is better.
4. Easier for customers and municipality.
5. More accurate and charge depends on how much people consume.

Reasons for not accepting were:

1. Not enough money to charge regularly.
2. It costs more money.
3. Don't trust municipality.
4. We are paying cash so no need for this system.
5. This WM reads more than consumed.

6. Not suitable for poor people.

(3) Willingness to pay in Citywide survey

Eighty-two percentage (82%) of the 100 surveyed people did not know about the amount of current water tariff. When explained about the current tariff of Jenin Municipality and some other cities in Palestine, only half of them (60%) believed that it is a fair rate and 34% believed that it is still expensive. If water services improved, half of the respondents are willing to pay a little more (4.98NIS/m^3 instead of the current 4.3NIS/m^3). The other half who are not willing to pay more have the following reasons for their opinion:

1. Financial status is bad.
2. It is Municipality's responsibility.
3. No need.
4. No need to get better services.
5. We already pay a lot for Jenin Municipality.

(4) Opinion on PPWM in Citywide survey

From the total 100 respondents, 56 prefer PPWM and the rest don't. If Jenin Municipality takes a decision to install PPWM, slightly higher number of residents accept PPWM (61). This means an obligatory PPWM installation will not make a difference in the Publius's acceptance of PPWM. The reasons for accepting PPWM were:

1. Customer pays regularly.
2. Makes customer periodic.
3. To get water every day without cutting.
4. This system is better.
5. Easier for customers and municipality.
6. More accurate and depends on how much people consume.
7. We don't need to pay attention for bills every month.
8. Water will be available always.
9. Better to control consumption.

Reasons for not accepting were:

1. Not enough money to charge regularly.
2. It costs more money.
3. Don't trust municipality.
4. We are paying cash so no need for this system.
5. This WM reads more than consumed.
6. Not suitable for poor people.
7. More difficult system.
8. Lack of money.
9. Paying every month is better, and the financial status is bad.

10. Too much commitment.

4-3 Based on activities of 4.1 and 4.2, review Jenin Municipality's water service and water tariff, and identify direction for customer meter replacements including the possibility of prepaid meter introductions

The existing issues related to billing and collection in Jenin Municipality were reviewed. Low bill collection ratio in the Jenin Municipality is the result of existing meter's problems, customers' dissatisfaction, meter readers' inefficient work, private water venders, intermittent water supply, etc. The problems of existing domestic meters could be divided into 0-meter reading and estimated consumption and as further shown below.

- Many inaccurate water meters exist
- Many broken meters exist (display is broken, but operational)
- Many unreadable meters exist
- Long or frequent absentees in house exist
- Customers who use private water vender exist
- Meter readers are responsible for meter reading and bill collection in a huge area
- Many customers with high consumption complain about their water bill
- Water users who do not receive water bills exist
- Many customers are not satisfied with the current water supply situation (intermittent supply)

According to the agreement between the Municipality and the customer, WWD could request the customer to replace the meter when it suspects some problems in the meter, but only the customers who are conscious of high consumption replace the meter. Most of the customers leave the meter as it is because the post-paid meters belong to the customers.

In case of broken meter and/or unreadable meter, CSS estimates water consumption based on customer's past consumption. However, there is no system to confirm the accuracy of such estimation and thus it is not known how accurate such estimations are.

Under such circumstances, the introduction of PPWM is a potential solution for improving bill collection. The expected improvement after introduction of PPWM was identified as shown in the summary table below.

Table 2-40 Summary of expected improvement after introduction of PPWM

Existing Issues	Improvement after introduction of PPWM
Meter reading	- No reading activity on site. - No reading error and input error. - All meter reading issues can be solved (No more meter reading).

Existing Issues	Improvement after introduction of PPWM
Billing and collection	- No billing and collection activity on site. - Collection rate is almost 100%. - No manual data input and no bill printing is required. - Data of meter reading and billing is accurate. No protection of readers and collectors from customers is required. - All billing and collection issues can be solved.
Illegal connection	- PPWM has tamper protection function and can reduce illegal connection. - Once the customer removes the meter, the water consumption data will be zero on the database. - Illegal connection is easy to find using accurate database.
Debt increase and repayment issues	- Debt does not increase, 100% collection. - PPWM has debt repayment function.
Meter owner	- Customers have to pay water charge according to water consumption. - PPWM does not discriminate owner, pay according to consumption. - If PPWM is damaged, no water supply and no data are coming. Water meter damage is found through data analysis. Data collection can be done by handheld machine (Portable meter reading terminal) or Gateway. - Suppose the owner stops using the water meter for any reason. In that case, the data of zero water consumption will be sent to the owner. Cessation of meter usage is discovered through data analysis.
Human resources (staff)	- Introduction of PPWM can reduce manpower. Reading and collecting staff are not required. - Reduced manpower may be assigned to other sections, which lead to more efficient use of human resources.
Collection from refugee camp	- No installation is planned due to political reason.
Water supply condition	- Water consumption may decrease as customers become more aware of use of water and use water wisely since they must pay for entire consumption. Illegal consumption decreases. - Water can be supplied to more customers by reduced water consumption of high use customers. - Consumption limit mode can be used in summer if required, for equitable supply of water.

The following items on PPWM were reviewed and covered in the baseline survey report:

- Type of meter for PPWM system
- Existing PPWM system in other water supply utilities
- Social survey on PPWM
- Workshop for strategy of introduction of PPWM based on study results of existing PPWM system
- Lesson learned, issues and challenges on PPWM
- PPWM satisfaction of current users in other water providers

Then, a feasibility study for introduction of PPWM was carried out on the following items.

- Main factors for success and strategy to introduce PPWM: The strategy with success factors was prepared.
- Advantages and disadvantages for customers and Jenin municipality: Many advantages.
- Technical sustainability: Ultrasonic type water meter was selected.
- Financial sustainability: PPWM will make very high financial return.
- Social sustainability: The failure risk of PPWM introduction was to be avoided, recommendations

were prepared for this.

- Confirmation of political will and backup: The municipal council will make full backup.

Finally, direction for customer meter replacements including the introduction of PPWM was proposed in the 2nd JCC and decided with the following policy of introduction of PPWM.

Policy for Meter Replacement

Introduction of PPWM was agreed but it was understood that the introduction of PPWM could have potential risk that it may provoke customers' protest. To avoid such a situation, it was confirmed that the Jenin Municipality should carry out necessary measures such as public awareness activities, improvement of water supply condition, and improvement of customer service, to ease the introduction of PPWM assisted by the Expert Team. In addition, the Jenin Municipality confirmed to implement the followings:

- To set up "PPWM Implementation Team" comprising of following members and holding periodic meetings:
  - Team Leader
  - Public awareness and relations
  - Customer service
  - IT and database
  - O&M of water supply facility
- To prepare detailed implementation plan
- To make periodic monitoring and evaluation during implementation

After preparation of the detailed implementation plan and selection of the type of water meter, JICA started to procure the PPWM and the introduction of PPWM.

It was confirmed that the Jenin Municipality would consider the increased revenue from PPWMs installed by JICA in pilot areas towards the purchase of additional PPWMs for future expansion and cost of meter maintenance.

Decision on meter type for PPWM

Selection of appropriate type of flow meter is most important for technical sustainability. The following procedure was adopted to select the best type of PPWM to ensure technical sustainability.

- The performance of existing water meters in Palestine was studied.
- Ultrasonic meter together with mechanical meter (volumetric and velocity type) was tested in actual use and its validity was checked.

Velocity, volumetric and ultrasonic meters were assembled into a set (Photo 2-10), and 11 sets were installed at 11 sites which are located at different supply zones and different elevations (Figure 2-29).

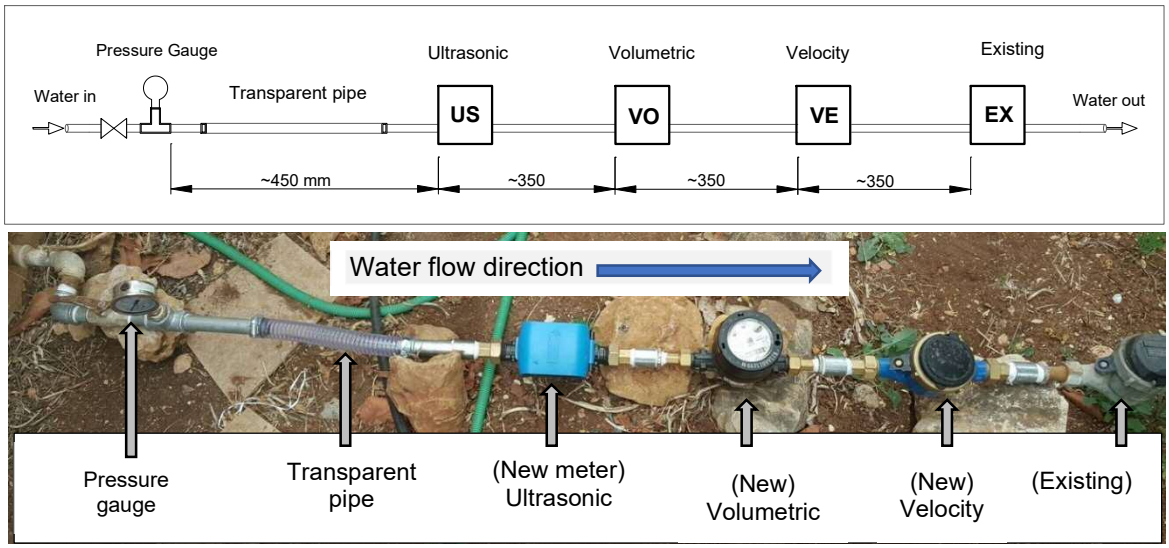
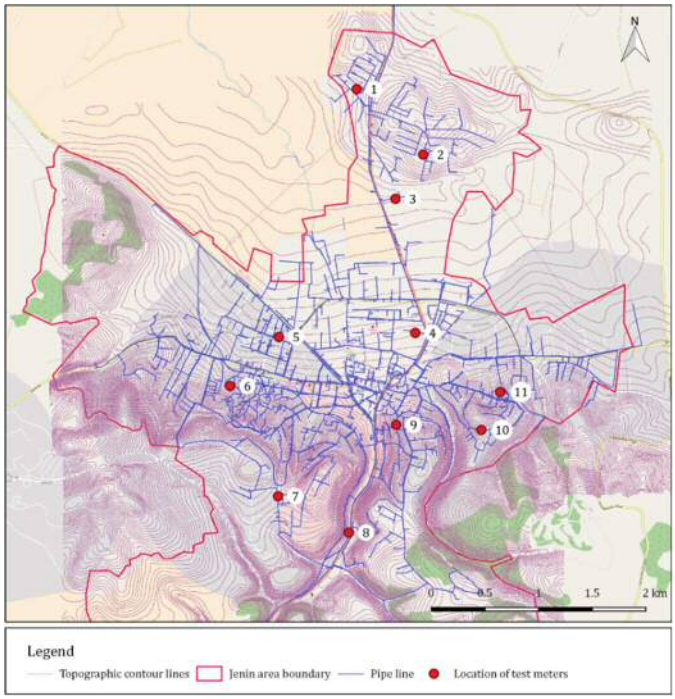


Photo 2-10 Typical installation arrangement of meters (above: schematics, below: real cases) for experiment test



ID	Terrain	Water supply time (hours/week)	Existing meter	
			Type	Years of installation
1	Flat	48	Vel	>15
2	Flat	48	Vel, Class B	>15
3	Flat、lowland	76	Vel, Class B	ND
4	Flat	90	Vel, Class B	ND
5	Flat	24	Vel, Class B	>15
6	Middle	24	Vel, Class B	3
7	Hilltop	48	Vel, Class B	10
8	Valley	48	ND	>15
9	Middle	24	Vol, R=200	4
10	Hilltop	Very short period, low pressure	Vol, R=200	-
11	Middle	24	Vel	23

Vel.: Velocity, Vol.: Volumetric, ND: No data

Figure 2-29 Location of experimental water meters and data on water supply, etc.

The summary of evaluation results of the three types of water meters is shown in the following table. As a result, the ultrasonic type was selected.

Table 2-41 Summary of evaluation of three types of water meters

Item	Meter type		
	Velocity	Volumetric	Ultrasonic
Evaluation	- Less accurate at low flows - Mechanical parts may be damaged. - The accuracy decreases by aging. - Air intrusion may not affect the counting of water consumption significantly. However, because there is a perception of counting air by customers, it is difficult to remove this perception.	- Jamming by particles is serious - Air intrusion may not affect the measured value significantly. However, because there is a perception of counting air by customers, it is difficult to remove this perception.	- Good performance (low minimum flow rate) - Air and air mixed water are not measured. - Long life is expected due to absence of mechanical parts. - Meter doesn't clog by mixed objects and sand particles, and can be used as a household meter during intermittent water supply or when there may be contamination such as rust, sand, and calcium in the water.

4-4 Submit proposed revisions of rules and regulations of bill collection

(1) Motivation allowance scheme

A motivation allowance scheme for meter readers and collectors was designed, proposed and started implementation from March 2019.

(2) PPWM customer contract

There were no existing rules and regulations of bill collection of PPWM; a revision draft of customer subscription contract was agreed by C/P in December 2017 and the contract for PPWM was finalized with review of Legal Unit. Now all new customers install PPWMs using the finalized contract. The following are main revised parts.

Table 2-42 Main revised parts in the subscription contract for PPWM customers in Jenin Municipality

Term	Revised content
Connection fee	Increased from 682 to 1150 NIS
Term 2: Insurance fee when reconnecting water lines	The insurance fee (50JD) for the new connection has been canceled
Term 10: Water meter preservation	1. Penalties for PPWM were added: a. Any illegal case is 5,000 NIS and estimated consumption during the illegal use b. If customer damages the meter: 3,000 NIS for minor parts or illegal use fine amount (5000NIS+) for main part of meter c. Pipe connected before meter, playing with meter system: illegal use fine amount (5000 NIS + consumption) d. If the customer sells municipal water to others, will pay 10,000 NIS as penalty. e. If the customer installs pump directly to the network: 2,000 NIS, and the pump is removed and taken to Municipality. 2. Transferred the ownership: The water meter, even if it is installed in customer's property, is owned by the Municipality
Term 17: Minimum tariff	1. The minimum tariff (17.36NIS) has been canceled for PPWM customers.

Term	Revised content
	2. The Municipality is authorized to collect monthly 6.2 NIS from the customer as the cost of the network maintenance and 1 NIS for water meter maintenance.
Term 19: Transfer subscription	The insurance fee for transfer subscription has been canceled

(3) Penalty

Effective measures and actions are taken/ penalties are imposed when any of the above is discovered. All these penalties are included in the new customer contract.

- Any illegal case is 5,000 NIS and estimated consumption during the illegal use
- If a customer damages the meter: 3,000 NIS for minor parts or illegal use fine amount (5000 NIS+) for main part of meter
- Pipe connected before meter, playing with meter system: illegal use fine amount (5000 NIS + consumption)

4-5 Conduct public awareness raising activities for customer meter replacement in selected Pilot Areas

Following public awareness raising activities for customer meter replacement were conducted:

1) Meetings with community leaders in PA1, PA2 and PA3 were carried out to understand their opinion and to request for their cooperation.
2) Meetings with Ministry of Religion and Chamber of Commerce were carried out.
3) Public meeting for PPWM introduction in PA1 was held on 8th Aug, 2018, in PA3 was held on 26th Aug, 2019.
4) Meeting with Refugee Camp Committee was held on 13th July 2019.
5) Pre- installation door to door (DtD) visits were completed by visiting a total of 1,803 customers (as in PA1 (753 customers), PA2 (524 customers), and PA3 (526 customers)).
6) As for the new installation, it was planned to start pre-installation DtD from two weeks before the installation of PPWM. Data entry was done for the completed areas. The table below summarizes the data from the field survey done by PR staff.

Table 2-43 Summary for data entered by PR staff (DtD) as of October 2021

DtD visits progress in the PAs and extended DMAs:			
Area	Estimated total customers	Current progress	Rejecting customers
PA1	753	753	38
PA2 (without new camp)	525	525	23
PA3	526	526	33
Al-Jenan DMA	57	57	15
Al-Basateen (North and South) DMA	400	65	1
Almaniya DMA	130	0	0
Al-Ibrahemian	250	0	0
Industrial DMA	250	0	0
Total	2891	1926	110

Note: The DtD paused since October 2021 due to the delay in PPWM delivery.

7) The rejecting customers (PA1: 29, PA2: 15, PA3: 25) are being re-visited to make them agree to install.
8) The rejecting customers increased during installation (PA1: 66, PA2: 24, PA3, 40). The rejecting customers have been revisited. As of March 2021, 47 were convinced and installed. The revisiting activity has stopped since March 2021 due to no PPWM available in stock for installation.
9) Project billboards were designed and installed at several prominent locations in the city for PR purpose.
10) PR related posts on municipality's Face Book (FB) page are ongoing on weekly and monthly basis.
    - Published public announcement to encourage the residents to pay via the Palpay system on municipality website and FB page weekly.
    - Published the link of complaints website and WWD's emergency phone number.
    - Published about water saving benefits.
    - Published the vending station (VS) locations and their work time.
    - Published about PPWM features.
    - Published about project activities in the entire city.
11) A public awareness movie to extend PPWM to the entire city was prepared and released.
12) An animation movie was produced and released in June 2022 for promotion of PPWM installation.

4-6 Replace customer meters in selected Pilot Areas

The procurement of PPWM started in September 2018 when the tender for the PPWM system was announced by JICA Palestine Office according to the PWA technical specifications and guidelines. Two companies, Fury Trade and Electromed, responded. After evaluation, the bid was won by Fury Trade, which offered Baylan water meters. The procured PPWM system is shown below. The delivery was completed in February 2019. The installation work of PPWM into PAs started in April 2019 and mostly completed at the end of 2021. In addition, the Jenin Municipality has procured 1,700 PPWMs by its own fund.

Table 2-44 Procured items of PPWM system

No.	Items and Specifications	Quantity procured by JICA	Quantity procured by JM
1	Prepaid water meter (DN20), PN 16 bar, Ultrasonic type	1,850	1,700
2	Check valves (DN20mm), PN 16 bar	1,850	1,700
3	Ball valves (DN20 mm), PN 16 bar	3,700	3,400
4	Rigid plastic box for installing PPWM, valves, fittings	1,850	1,700
5	Complete vending station with hardware equipment and software	4 sets	6 (Only card reader and license)
7	Server management software and hardware	1	0
8	Installation including commissioning for Server management	1	0
9	Handheld Unit (field verifier)	3	0
10	Gateway	3	0

As of October 2021, there are a total of 737, 538, 533, and 3,208 PPWMs installed in PA1, PA2 (without new camp), PA3, and the entire city, respectively as shown in the following tables. The DtD paused since October of 2021 due to the delay in PPWM delivery and no further progress has been made after that as of August 2022.

Table 2-45 Summary for PPWMs installation in PA1 as of Oct 2021

Category	Total	Installed	Uninstalled customers
1. Domestic	856	733	123
• Household	822	730	92
• JM employee	32	3	29
• Abandoned house	2	0	2
2.Public Institution	7	4	3
• School	2	2	0
• Governmental institution	1	0	1
• Mosque	4	2	2
• Others	0	0	0
Total	863	737	126

Table 2-46 Summary for PPWMs installation in PA2 as of Oct 2021

Category	Total	Installed	Uninstalled customers
1. Domestic	553	524	29
• Household	544	521	23
• JM employee	6	3	3
• Abandoned house	3	0	3
2.Public Institution	16	14	2
• School	4	4	0
• Governmental institution	9	7	2
• Mosque	2	2	0
• Hospital	1	1	0
• Others	0	0	0
3. Refugee Camp (New)	102	0	102
Total	671	538	133

Table 2-47 Summary for PPWMs installation in PA3 as of Oct 2021

Category	Total	Installed	Uninstalled customers
1. Domestic	572	530	42
• Household	543	508	35
• JM employee	24	22	2
• Abandoned house	5	0	5
2.Public Institution	3	3	0
• School	1	1	0
• Governmental institution	0	0	0
• Mosque	2	2	0
• Hospital	0	0	0
• Others	0	0	0
Total	575	533	42

Table 2-48 Summary for PPWMs installation in entire city as of Oct 2021

Area	Total Customers	Installed	% Installed
PA1	863	737	85%
PA2 (without camp)	671	538	80%
PA3	577	533	92%
PAs total	2,111	1,808	86%
All city except PAs	7,442	1,400	19%
All city	9,553	3,208	34%

Table 2-49 Summary for uninstalled customers in PAs as of Oct 2021

Status	PA1	PA2	PA3	Total
Rejecting/Legal unit	38	23	33	94
Needs another visit	50	0	0	50
Ready to install	1	0	2	3
JM employee	29	3	2	34
Requires to confirm by CSS	3	0	0	3
Mosque	2	0	0	2
Hospital	0	0	0	0
Abandoned house	2	3	5	10
Governmental institution	1	2	0	3
Refugee Camp (New)	0	102	0	102
Total uninstalled customers	126	133	42	301

PA1:

About 84.5 % is completed, remaining are the domestic customers who rejected PPWM, Jenin Municipality staff and institutional customers. The percentage increased to 85.12% and remained almost the same (85.4%) as of July 2021 due to no PPWM in stock to be installed for some customers who previously rejected but later agreed to install.

PA2:

About 80% is completed, remaining are the domestic customers who rejected PPWM, Jenin Municipality staff and institutional customers. The installation percentage remained the same as of December 2021 due to no PPWM in stock to be installed for some customers who previously rejected but later agreed to install.

PA3:

About 91.8% is completed, remaining are the domestic customers who rejected PPWM and Jenin Municipality staff. The percentage increased to 92.6% and remained the same as of June 2021 (92.6%) due to the same reason as in PA2 and PA3 stated above.

4-7 Monitor bill collection ratios and customer satisfaction of Pilot Areas

4-7-1 Monitor bill collection ratios

The bill collection ratios have been measured and monitored since 2017 for both With Debt and Without Debt and will cover a total of 70 months by October 2022 and will be an ongoing monthly activity of CSS.

Table 2-50 Available monthly measured collection ratios during project period

Type of meter	Category	2017	2018	2019	2020	2021	2022	Total
All City	With debt	○	○	○	○	○	○	
	Without debt	○	○	○	○	○	○	
PA1	With debt	○	○	○	○	○	○	
	Without debt	○	○	○	○	○	○	
PA2	With debt	○	○	○	○	○	○	
	Without debt	○	○	○	○	○	○	
PA2 (without new camp)	With debt	○	○	○	○	○	○	
	Without debt	○	○	○	○	○	○	
PA2 (without new camp and government institutions)	With debt	-	-	-	-	○	○	
	Without debt	-	-	-	-	○	○	
PA2 (new camp only)	With debt	○	○	○	○	○	○	
	Without debt	○	○	○	○	○	○	
PA3	With debt	○	○	○	○	○	○	
	Without debt	○	○	○	○	○	○	
Total months of measurement		12	12	12	12	12	10 (till Oct. 2022)	70

The details of the measurement method and the step-by-step calculation and the necessary data are provided as reference in Annex (CD) 1.1 (Procedure Manuals for major Customer Service Management in English and Arabic).

The necessary data on billed amount and paid amount were collected from Al-Shamel and PPWM. GIS was utilized for extracting customers data from the pilot areas. Detailed collection ratios for each of the above months are available to view in Annex (CD) 1.8 (Collection Ratio Calculations and Charts (2017 to 2021)). Persons in charge of monthly calculation of bill collection ratio are identified as bellow:

Name	Section	Specialty	Tasks related to monthly measure of collection ratio
Mr.Khaled Abu Obaid	Head of Customer Service Section		Overviews the monthly calculation ratio
Mr. Omar Fazaa	Customer database Management division -CSS	Operation of Al-Shamel software	Provides data on mechanical meter customers
Mr. Naseem Saaydeh	Meter Management division-CSS	Operation of PPWM software	Provides data for PPWM customers
Ms. Eng.Baraa Abu Tabeekh	Project Division	GIS specialist	Collects the above data in the end of each month and calculates the collection ratio in Excel and uses GIS for the calculation of the ratio in PAs.

4-7-2 Monitor customer satisfaction

In September 2019, public relations team started visiting PPWM customers in PA1 (Post-installation door to door visits) to measure customer satisfaction and to follow up if any customer faced any problems with PPWM usage. For PA2 and PA3 the survey was implemented in June 2020. The overall satisfaction with PPWM was generally high. The reasons for lower satisfaction towards PPWM are mostly due to the short and low-pressure water supply rather than related to their PPWM.

Table 2-51 Summary of post-installation door to door visits

Post-installation door to door visits	PA1	70 visit (10% of total customers)
	PA2	65 visit (10% of total customers)
	PA3	60 visit (10% of total customers)

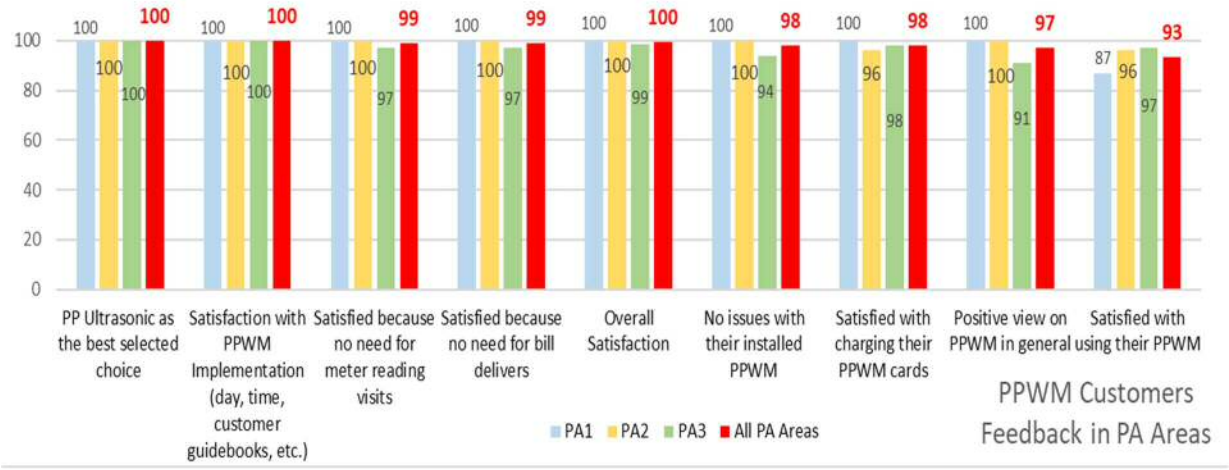


Figure 2-30 Post-installation door to door visits in PAs

4-7-3 Deal with rejections properly

Since rejection is a major issue in PPWM acceptance in general, in case of Jenin City's pilot project there have been a number of rejections. These needed to be addressed.

As a soft approach solution and to tackle with the rejecting cases, the Project team and the PR staff conducted a re-visiting activity accompanied by the higher level of municipality's management i.e. council members and tried to convince these customers to install. Although the activity is ongoing, however, it has shown a positive impact and some customers have installed PPWMs after the revisits. As of April 2021, the rejection percentage has reduced to 4% in PA1.

Table 2-52 Rejection after the re-visits

Pre-DtD (year)	Total Customers (Installed)	Rejecting (On Installation Day)	Rejecting after Revisits	Remarks
PA1 (2021)	860 (732)	66 (8%)	38 (4%)	Remaining rejecting customers were referred to JM's legal unit.
PA3 (2021)	667 (534)	40 (6%)	23 (3%)	Revisiting is on-going.
PA2 (2021)	568 (526)	24 (4%)	24 (4%)	Revisits not started yet.
Total	2,095 (1,792)	130 (6%)	47 (4%)	% of rejecting customers are expected to be lower after completion of re-visits.

As a harder approach, the persistent cases of rejecting customers are referred to the municipality's legal unit for taking legal actions. The overall reasons for rejection were:

- Customer has private wells and thus no need to install PPWM,

- Customer has general unhappiness and no trust with overall services of Jenin Municipality such as water pressure and supply,
- Hidden reasons to refuse PPWM installation such as high debt or illegal usage.

4-7-4 PPWM maintenance contract

The warranty of the 1850 PPWMs initially procured by JICA expired in January 2022. Jenin Municipality is now under discussion on additional maintenance contract with the same supplier.

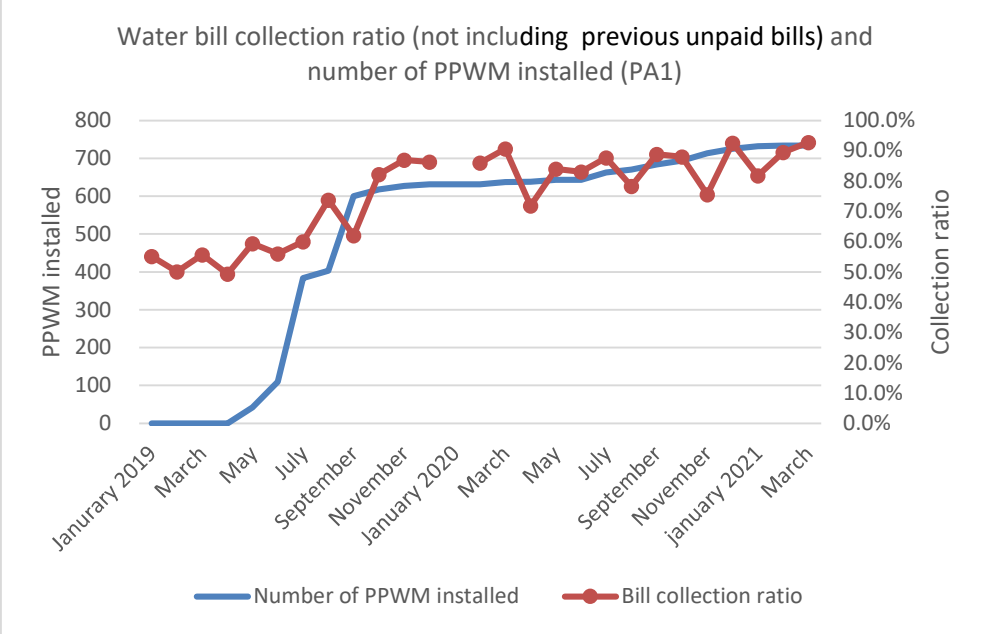
4-8 Analyze monitoring results and propose future direction for customer meter replacements

PPWM installation significantly improved the collection ratio of PAs, as shown in the following figures and summary table. PA2 has a large number of customers from refugee camps and public institutions. The bill collection ratio is low for these customers because PPWM has not been installed. If these customers are excluded, the collection ratio reaches about 90% in this PA as well. The detail analysis of monitoring results is included in Annex 2.1 (Case Study of PPWM in Jenin Municipality).

Table 2-53 Bill collection ratios in pilot areas and the entire city before and after PPWM installation

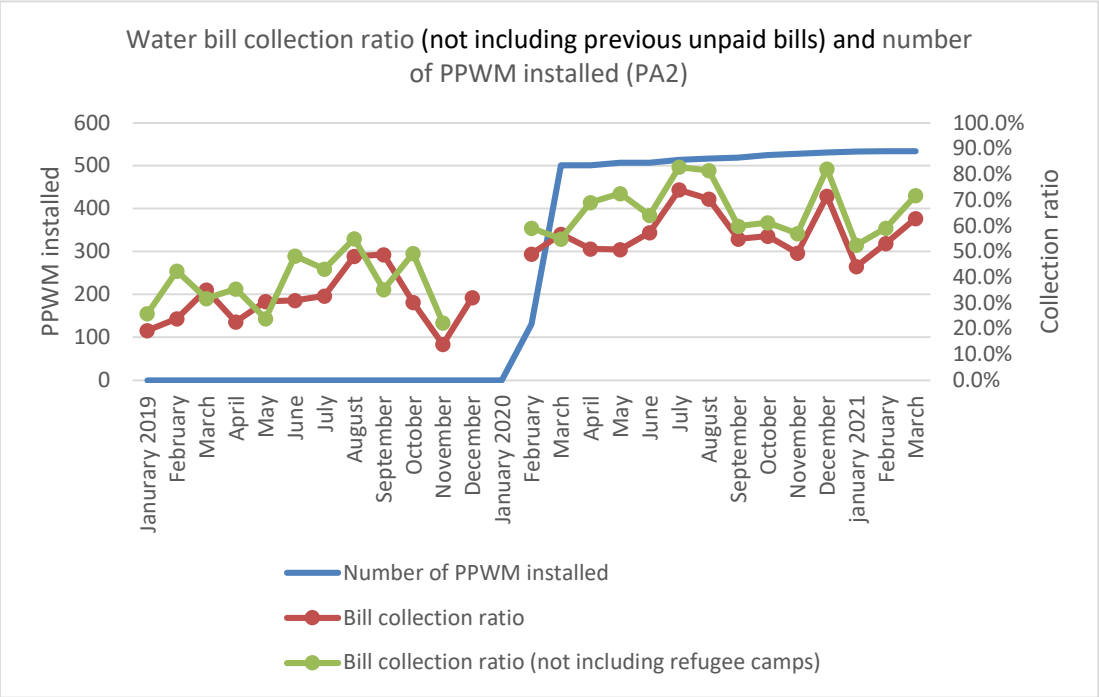
Area	Before installation	After installation
PA1	About 50%	About 90%
PA2	20-50%	50-80%
PA3	20-50%	80-95%
Entire city	30~40%	48%

Note: Only current month's tariff, not including collection of previous unpaid bills



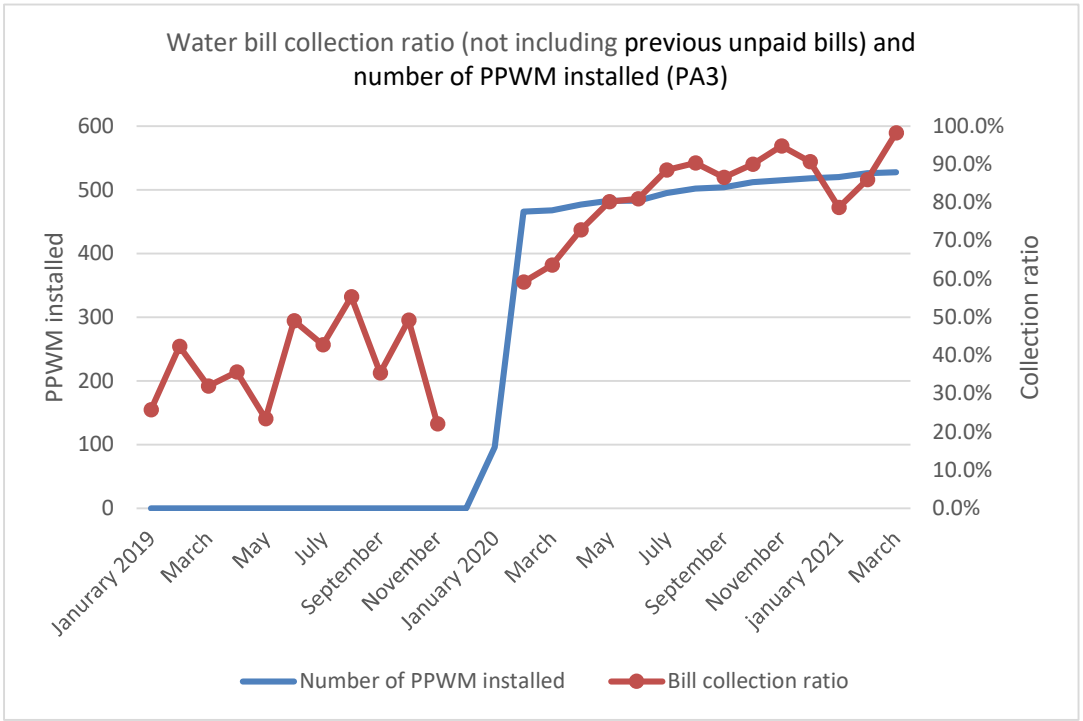
Note: PPWM installation started in April 2019

Figure 2-31 Improvement in bill collection ratio according to increase in number of PPWM installed in PA1



Note: PPWM installation started in February 2020

Figure 2-32 Improvement in bill collection ratio according to increase in number of PPWM installed in PA2



Note: PPWM installation started in January 2020

Figure 2-33 Improvement in bill collection ratio according to increase in number of PPWM installed in PA3

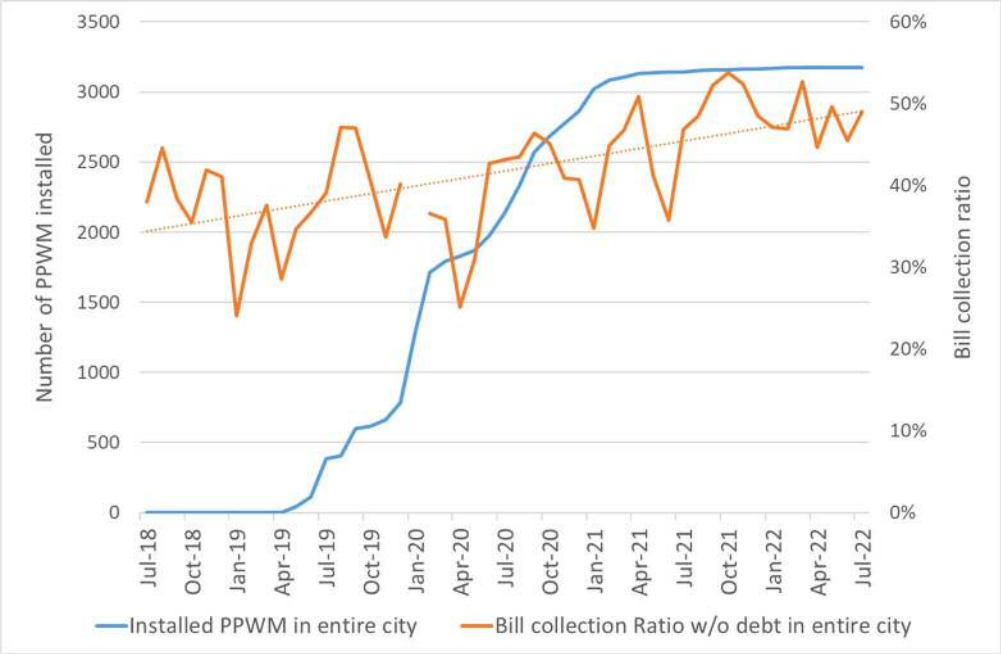


Figure 2-34 Improvement in bill collection ratio according to increase in number of PPWM installed in the entire city

Decision to procure 6,500 PPWM in addition to 1,850 numbers procured for three pilot areas is made by Jenin Municipality. Jenin Municipality started procurement of 1,200 and 500 PPWM. As of July 2021, about 1,391 PPWMs have been installed outside PAs by meters procured by the Municipality. No PPWM is in available in the stock, and the 364 PPWMs (out of the 500) are still waiting to be released by the Israeli custom. JICA procurement of 4,350 PPWMs was also in Israel's custom but they were released in the early September 2022 with permission of custom clearance and delivered to Jenin Municipality. Jenin Municipality has already prepared the installation plan as referred in Annex 2.2 Prepaid Water Meter Installation Plan for Entire City of Jenin.

4-9 Compile case studies about customer meter replacements

The cases studies of pilot area of PPWM are compiled in Annex 2.1 (Case Study of PPWM in Jenin Municipality) with the following contents:

(1) Issues on Bill collection and Expected Improvement by Prepaid Water Meter
(2) Lessons Learned on PPWM Introduction from Other Water Service Providers in Palestine
(3) Concerns on Introduction of PPWM by Customers (result of social survey)
(4) Introduction of PPWM (before installation)
(5) Procurement of PPWM System
(6) Installation of PPWM
(7) Operation and Maintenance of PPWM
(8) Effects of PPWM
    - Establishment of new responsibilities and procedure for PPWM in Jenin Municipality
    - Collection ratio
    - Analysis of collection from individual customers (big data analysis) before and after PPWM

installation

- PPWM Malfunction
- Collection rate under COVID-19 Pandemic
- PPWM Customer Satisfaction
- Change in attitude and culture after introduction of PPWM

(9) Study on Social Cases

(10) Issues/challenges and lessons learned

4-10 Conduct the supportive activities in response to the COVID-19 emergency

Following supportive activities of procurement in response to the COVID-19 emergency were conducted together with JICA Palestine Office.

Table 2-54 Supportive activities of procurement in response to the COVID-19 emergency

Item	Contents	Implemented by
1. Chlorine	Liquid Chlorine (Concentration 11%-12%) suitable for drinking water disinfection: 10,000 kg with 5 lots	Project team
2. Chlorine injectors and drum pump	Chlorine dosing pumps: six (6) sets, Barrel pump: one (1) set	Project team
3. PPWM fittings	Fittings and miscellaneous items Polyethylene pipe	JICA office
4. Flow meters for DMA	Electromagnetic flowmeter (4) Mechanical flowmeter (13) Gate valve (15) Strainer (14) Data logger (8)	JICA office
5. Maintenance materials for leakage repair	Pipes (650 pcs. 12 rolls) Valves (589) Elbow pipes (235) Dresser joints (50) Repairing clamps (120) Flange adapter (5) Blind flanges (20) Reducers (30) T pipes (20) Flexible joint (5)	JICA office
6. Vehicle for customer service	MiniVAN (MPV:Multi-Purpose Vehicle): 1	JICA office
7. Additional fittings	PPWM fittings (Elbow, Reducer, Nipple, joint, Tee, Union, PE pipe, Pipe fiber, Teflon)	JICA office
8. IT server for PPWM	HPE ProLiant DL380 Gen10 8SFF 2U Rack Server Processor: Intel Xeon-Silver 4215R (3.2GHz/8-core/130W) (1) HP Monitor 20.7”(1) WinSvrSTDCore 2019 OLP 16Lic NL Gov CoreLic (1) WinSvrCAL 2019 OLP NL Gov UsrCAL (5) SQLSvrStd 2019 SNGL OLP NL (1)	JICA office
9. Maintenance materials	Elbow, Gasket, Dresser, Valves, Coupling, Teflon, Hose, Nipple, Joint, Tee, Union, Steel pipe	
10. Additional PPWM	Baylan AK-411 Lora Remote Reading and Prepaid	JICA office (delivered

Item	Contents	Implemented by
	Ultrasonic Water Meters, Check valves, Ball valves, Meter boxes (4350 sets) Gateway MultiConnect Conduit (6)	and under inspection)

4-11 Prepare prepaid water meter (PPWM) replacement plan for entire city based on the results in Pilot Areas

4-11-1 Introduction

The Jenin Municipality decided to install PPWM for the entire city. JICA procures additional 4,350 PPWMs to support the Municipality's installation plan. It was planned that the procured 4,350 PPWMs would arrive to Jenin in July 2021. However, the PPWM were not released long time from the Israeli custom due to new procedures and thus the PPWM installation has paused. PPWMs were finally delivered in the early September 2022.

Since the PPWM system, like the server, software and integration is already in place, Jenin Municipality would need to increase the number of the system's vending stations and Gateway devices as the number of the installed PPWM increases.

Table 2-55 Current status of vending stations in Jenin City for PPWM customers

No	Vending Station	Location
1	Aljalil supermarket	PA1
2	AlThahir supermarket	PA2
3	Almadeena supermarket	PA3
4	Haifa st. center's VS (Transferred to WWD)	WWD building.
5	City center's VS	City center
6	Taiba center (New)	Nazareth Street
7	Alsadi supermarket (New)	PA3
8	Suhail Mobile (New)	City center
9	Rida supermarket (New)	PA1
10	Abu Alia supermarket	PA3
11	Alhadaf supermarket	Alhadaf
12	Haifa supermarket	PA2

Currently there are additional 37 points of sale for mechanical meter customers to pay their bills. As the PPWM installation increases, the appropriate points of sale can also be equipped with PPWM card readers and thus provide services to PPWM customers and VS location.




Photo 2-11 Computer with access to PPWM software (on server) and card readers for PPWM customers

4-11-2 Implementation plan

Implementation of the PPWM installation is based on the experience of the installation in the pilot areas. The installation will be for all customers. Jenin Municipality will decide whether to install PPWM in the refugee camp. As for the governmental institutions, Jenin Municipality decided to install postpaid water meters and most of them have already installed.

Table below shows the related departments in Jenin Municipality which plays different roles by providing specific services. The Water and Wastewater Department (WWD) plays the biggest role in execution of the Project by involvement of mainly its Customer Service Section with assistance of the Water Section, the GIS unit and the PR department of Jenin Municipality.

Table 2-56 Departments and sections involved in PPWM implementation

Organization	Major involvement
Water and Wastewater Department	Customer Service Section, Water Section, Studies and Planning Section, Warehouse
Public Relation Department	Public awareness and door to door visits
IT Department	Technical issues with PPWM software and servers, VS
Financial Department	Customer payments database, financial reports
Public Citizen Center	Service applications on DMAS system
Legal Unit	Process for illegal users, enforce penalties
Human Resources Department	Hire of new staff if needed
City Council	Provide support for the team when needed
Mayor's office	Provide support for the team when needed

The figure below describes the workflow of the CSS and involvement of the other sections and

departments.

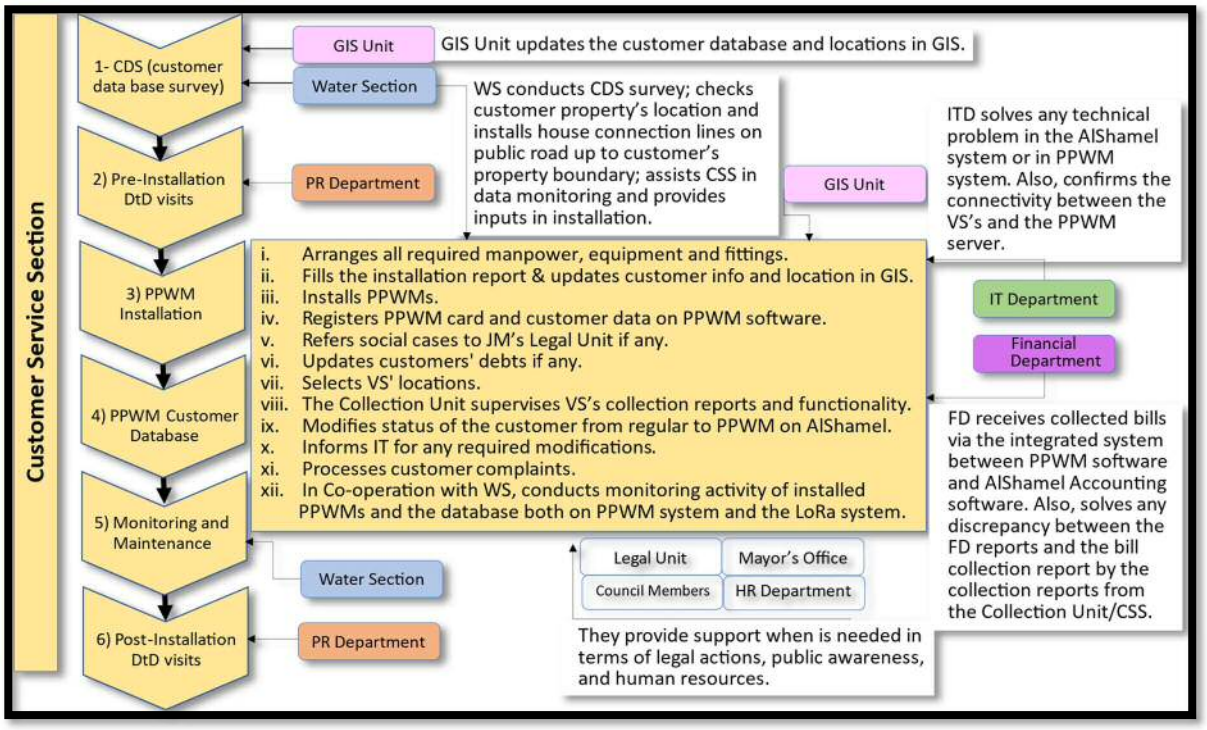


Figure 2-35 PPWM implementation plan and tasks by section and department

4-11-3 Installation plan

The installation plan is as follows:

1- WWD intended to go with one multi-stage tender.
2- The installation stages will be according to the number of expected customers in the zones selected for the installation.
3- Priority of the installation areas will be first given to the new DMAs, then for other areas with good water supply and no meter reader.

The following is the strategy/process that will be adopted and implemented during the installation process of the 4,350 PPWMs. This strategy was applied in Jenin Municipality during the installation of PPWMs in the PAs. The main strategy for the PPWM installation works is that the city will be divided into 4 areas. The following table provides descriptions of the major implementation tasks.

Table 2-57 Process of PPWM installation

Tasks	Responsible	Start	End	Days	comments	Attendance	Status
Preparation							
Set kick-off meeting	Eng. Khairia	25-Aug	25-Aug	1	Meeting with FT to set timeline for installation	Eng. Abd Al-Hadi, Eng. Khairia, Ameed Shafie (FT), Eng. Alaa	**Complete**
Agree on objectives	All Parties	26-Aug	26-Aug	1	Agree on the activities of	Eng. Abd Al-Hadi, Eng. Khairia, Ameed	**Complete**

Tasks	Responsible	Start	End	Days	comments	Attendance	Status
					FT teams, JM teams (PR and WWD)	Shafie (FT), Eng. Alaa	
Initiation - 2022							
Installation areas	WWD	25-Apr-21	10-May-21	15	Determine the installation areas and targeted customers		**Complete**
Document Preparation	WWD	4-Sep	5-Sep	1	Forms		**Complete**
Delivery of 4,350 PPWM	FT	5-Sep-22	10-Sep-22	5			**Not Started**
Customer Data Survey (CDS)	PR	4-Sep-22	20-Apr-23	228			**In progress**
Installation							
Training	WWD	25-Sep-22	1-Oct-22	6	Train the contractor's teams to fill the forms		**Not started**
Preparation of daily works	WWD and PR	25-Sep-22	25-Apr-23	212	will continue with the installation process		**Not started**
Site map preparation	CSS	25-Sep-22	25-Apr-23	212	will continue with the installation process		**Not Started**
DtD visits	PR	15-Sep-22	25-Apr-23	222	will continue with the installation process		**Not started**
1st Stage (installation of 1600 PPWM)	Contractor under the supervision of WWD	25-Sep-22	25-Nov-22	61			**Not started**
2nd Stage (installation of 850 PPWM)	Contractor under the supervision of WWD	27-Nov-22	30-Dec-22	33			**Not started**
3rd Stage (installation of 970 PPWM)	Contractor under the supervision of WWD	2-Jan-23	15-Feb-23	44			**Not started**
4th Stage (installation of 1170 PPWM)	Contractor under the supervision of WWD	19-Feb-23	12-Apr-23	52			**Not started**
Inspection of Installation and Sealing	WWD	26-Sep-22	25-Apr-23	211	Weekly		**Not started**
Operations							
PPWM Data Entry and Registration	CSS	25-Sep	25-Apr	212			**Not started**
Customer Data Management	CSS	25-Sep	13-Apr	212	Continue after the installation if need		**Not started**
Card Distribution	CSS	25-Sep	13-Apr	212	Continue after the installation if need		**Not started**
End Line							

Installation is planned to be in 4 stages.

Table 2-58 Detailed activity for stages of installation process

Stage			Current Status as of August 2022				
			Estimated Number of Customers	**Installed PPWMs**	**Remaining Customers**	**CDS Status**	**DtD**
1	Stage 1	Ibrahemeen+School St. (est.)	250	84	166	Completed	Not Started
2		Almaniya (est.)	200	102	98	Completed	Not Started
3		Al-Basateen	465	111	354	Completed	Not Started
4		Industrial Area (est.)	250	29	221	Ongoing	Not Started
5		Al-Hadaf+Wadi Burkin (est.)	350	129	221	Not Started	Not Started
6		other areas within stage1 of installation	285	0	285	Not Started	Not Started
7		Al-Jinan	57	44	13 (Rejecting)	Completed	Completed
Total Number of Customers Stage 1					1857		
Total Number of PPWMs to be Installed Stage 1					1358		
1	Stage 2	Wadi Izz Al-Dien	500	0	500	Not Started	Not Started
2		Al-Swaitat and Al-Marah	350	0	350	Not Started	Not Started
Total Number of Customers Stage 2					850		
1	Stage 3	Nablus St.	485	0	485	Not Started	Not Started
2		Khalet Al-Soha	340	0	340	Not Started	Not Started
3		Al-Jabriyat	145	0	145	Not Started	Not Started
Total Number of Customers Stage 3					970		
1	Stage 4	City Center (Commercial Square)	670	0	670	Not Started	Not Started
2		Old City	500	0	500	Not Started	Not Started
Total Number of Customers Stage 4					1170		
Total Customers for Installation					4348		

4-11-4 Revenue forecast

The revenues of the installed PPWMs are calculated based on the trends of the revenues of Dec 2019 to July 2021. Since there was no installation due to the delays in the PPWMs by the Israel customs during July 2021 to September 2022, this period was excluded for the above trend to avoid a break in the trend. The estimated revenue from October 2022 is based on the trend. The installation time schedule from contractor were into consideration for the forecast till the end of the 4,350 PPWMs by April 2023. After April 2023, the installations would be only for the new customers – which is counted as average 40 new PPWMs customer per month. The following tables present the forecasting of the revenues after 3 years of installation.

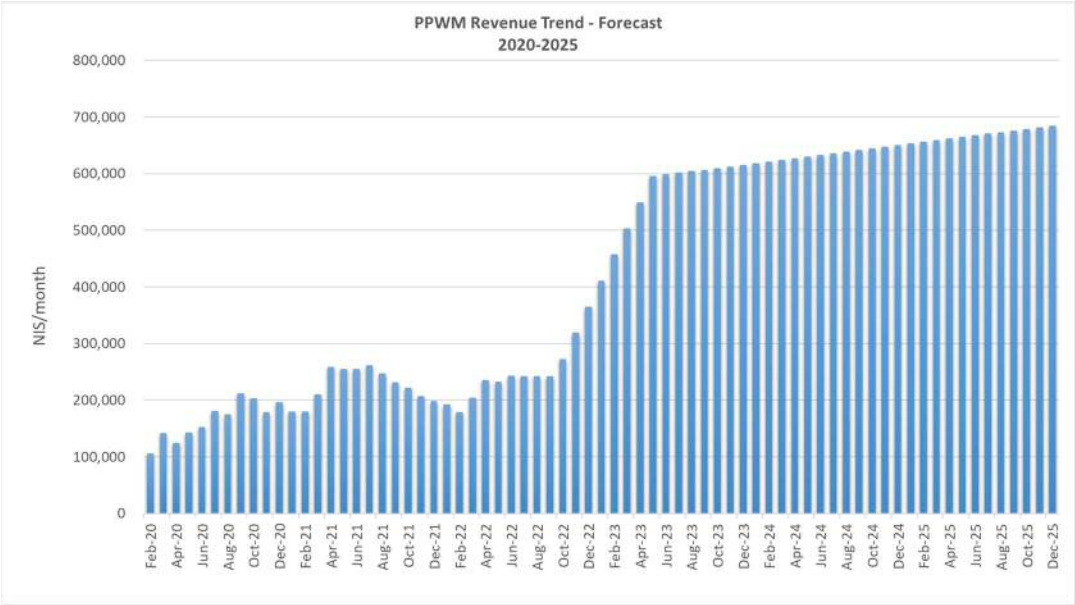


Figure 2-36 Revenue (with debt recovery) forecast by month for PPWM

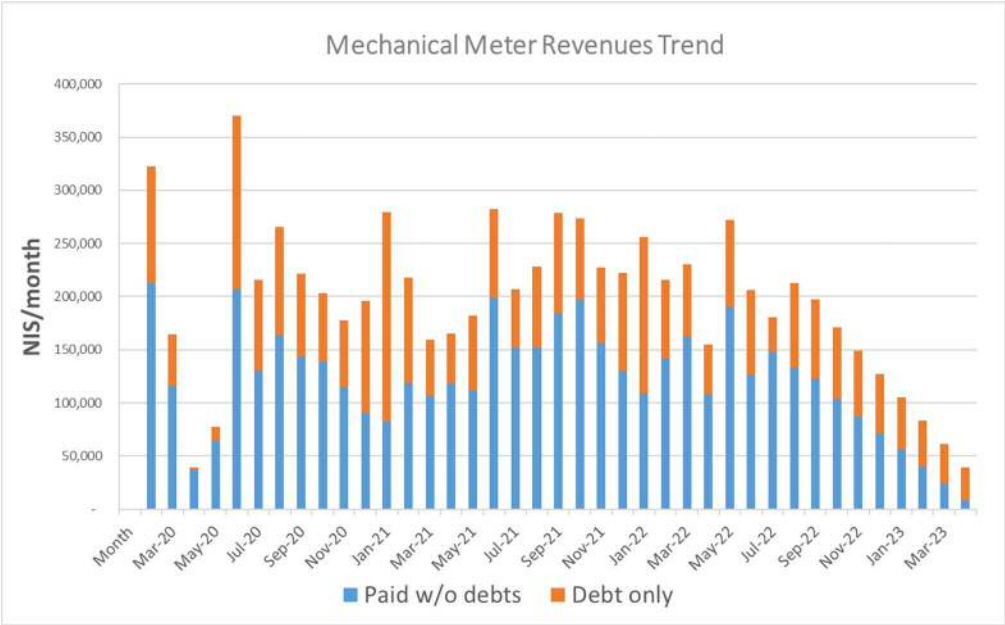


Figure 2-37 Revenue (with debt recovery) forecast by month for mechanical meters

4-12 Start replacement of customer meters with PPWM that Jenin Municipality purchases according to the plan prepared in 4-11

Once the procured PPWMs are delivered to Jenin Municipality, Jenin Municipality will complete the tendering for installation sub-contractor and will start the installation according to the above plan. The installation team will be as 1) CDS Team, 2) GIS Team, and 3) Coordinator team with the sub-contractor to monitor the installation. There will be PPWM monitoring team and PPWM fittings team.

Table 2-59 Breakdown of installation teams

Team/Names			Remark
Coordination with contractor			
Head Supervisor	Member	Supervisor Engineer	Contractor
Proposed Teams			
Team 1	Member	Foreman	
	Member	Water Technician	
	Member	Technician Assistant	
Team 2	Member	Foreman	
	Member	Water Technician	
	Member	Technician Assistant	
Team 3	Member	Foreman	*Stand-by Team/ Contractor*
	Member	Water Technician	
	Member	Technician Assistant	
CDS team			
Team 1	Member	Nasir Ghazal	PR/ JM
	Member	O	Assistant
Team 2	Member	Mohammad Zo'bi	PR/ JM
	Member	O	Assistant
DtD/PR team			
Team1	Member	Nasir Ghazal	PR/ JM
	Member	O	Assistant
Team 2	Member	Mohammad Zo'bi	PR/ JM
	Member	O	Assistant
GIS team			
WWD	Member	Eng. Bara Abu Tabiekh	CSS/WWD/JM
PPWM cards/registration, etc			
WWD	Member	Mr. Naseem Saaydeh	CSS/WWD/JM
	Member	Mr. Sharif Alafif	CSS/WWD/JM
PPWM monitoring team			
WWD	Member	Eng. Maen Hindawi	WS/WWD/JM
	Member	Eng. Fadi Nasharti	WS/WWD/JM
PPWM Fittings Monitoring			
WWD	Member	Mr.Abdullah Abu Al-Hija	Warehouse/WWD/JM
	Member	Mr.Hisham Aqhash	
Top Supervisor			
WWD	Member	Eng. Khiria Souqia	WWD/JM

Table 2-60 Productivity of taskforce; Estimated installation by team and month

Role	Avg Expected Installed Per Day	# Of Working Days Per Month	Avg/ Installed/ Month
Contractor			
Team 1	15	20	300
Team 2	15	20	300
Team 3	0	0	0
Total			600
PR (CDS+ DtD)			
Team 1	15	20	300
Team 2	15	20	300
Total			600
GIS			
Team 1	30	20	600
Card Registration			
Team 1	30	20	600
Fittings Monitoring			
Team 1	Al-Shamel Monitoring		

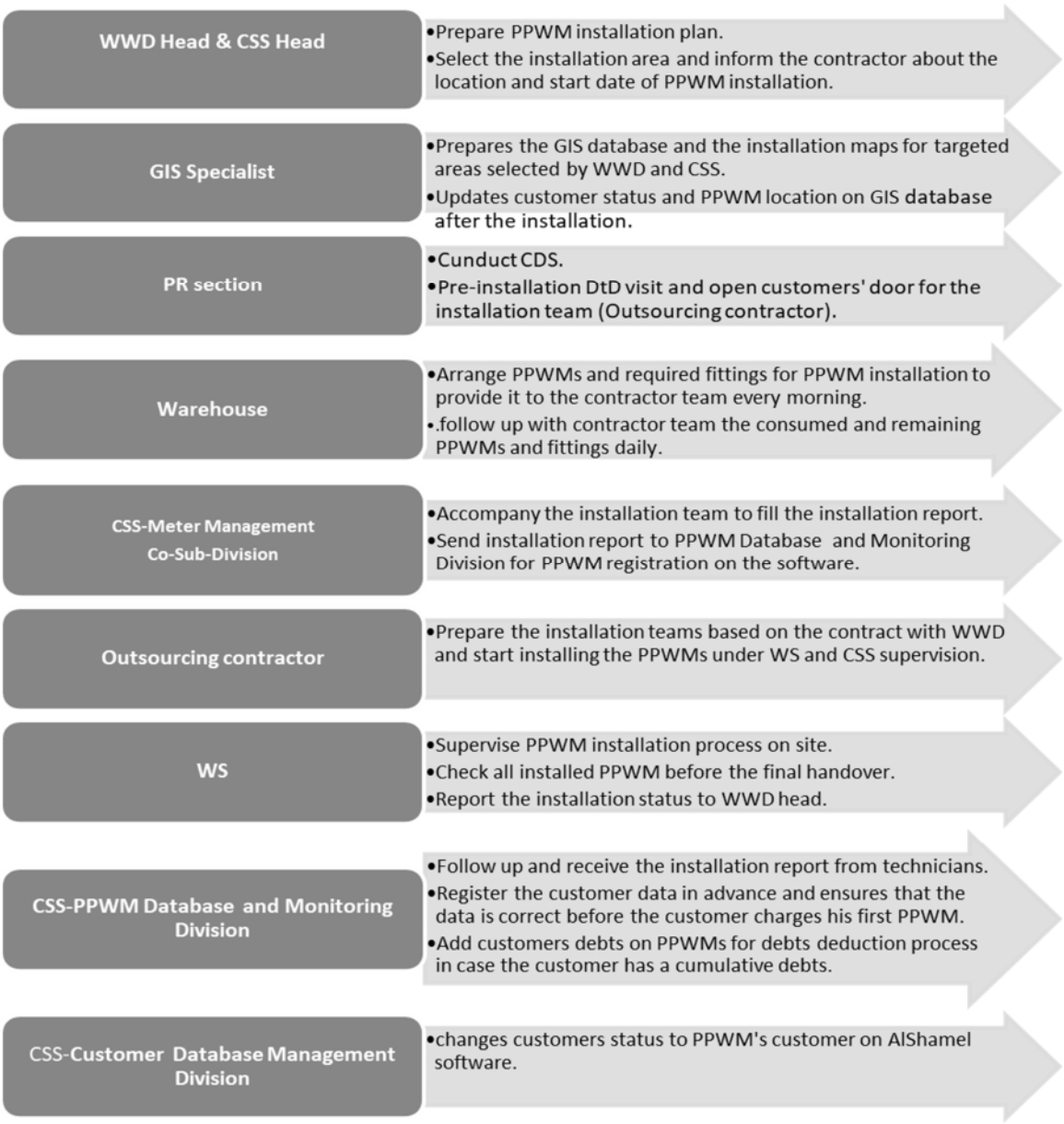


Figure 2-38 Workflow diagram for PPWM installation by contractor

2.2.5 Output 5: Project outputs and knowledge are shared among other water service providers.

5-1 Share manuals produced by the Project among other water service providers

The following manuals, guidelines, reports and plans were prepared in the Project and distributed to other water service providers by USB memory in the occasion of the 3rd Seminar on 22nd May 2022.

Table 2-61 Manuals, guidelines, reports and plans distributed to water service providers

Materials	English version	Arabic version
Manuals, Guidelines and Plans- NRW		
1- NRW Management Manual (Comprehensive Version)	✓	
2- NRW Management Manual (Basic Version)	✓	✓
3- Equipment Usage Manual (Standard version)	✓	✓
4- Equipment Usage Manual (Simplified version for Technician)		✓
5- Cost-benefit Analysis of NRW Management Works	✓	
6- DMA & Roll-out Plan of NRW Reduction	✓	
Manuals, Guidelines and Information – CSM (customer Service management)		
1- Procedure Manuals for major Customer Service Management (A) Examination of Water Meters with Zero or Minimum Monthly Consumption (B) Examination of Potential Illegal Connections (C) Random Check of the Installed PPWMs (D) Preparation of Customers; Door-to-Door Visitation of Customers Prior to PPWM Installation (E) Monitoring of Bill Collection Ratio; Preparation of Necessary Data and Calculation of Ratio (F) Collection Campaign; Soft Approach (G) Public Relations Activities	✓	✓
2- Report on Mobile Billing System (MBS) for Jenin Municipality	✓	
3- Customer Database Survey (CDS) & GIS Work	✓	
4- MIS Report 'Digital Business Transformation for Major Operations of Customer Service Management	✓	
5- PPWM Booklet – for customers	✓	✓
6- Your City Water Explained Part 1, 2 and 3 (for Customer information)	✓	✓
7- Revised Water Supply Contract	✓	✓
Study report, Plans and Manuals - PPWM		
1- Study on Existing Meter System and Prepaid Water Meter System and Feasibility and Strategy for Introduction of Prepaid Water Meter System	✓	
2- Implementation Plan of Introduction of Prepaid Water Meter System in Pilot Area-1 (PA-1)	✓	
3- Case Study of PPWM in Jenin Municipality (Results of Pilot Project)	✓	
4- Prepaid Water Meter Installation Plan for Entire City of Jenin	✓	
5- Manual for Management of Prepaid Water Meter System in Jenin Municipality (English)	✓	✓
Seminar Presentations and YouTube Movies		
1- Project Experience Sharing Seminar (1st Seminar)	✓	Partially
2- Project Experience Sharing Seminar (2nd Seminar)	✓	Partially
3- Project Experience Sharing Seminar (3rd Seminar)	✓	✓
4- Project Experience Sharing Seminar (1st Seminar) ~ Project explanation (Interviews) https://www.youtube.com/watch?v=rq0XGmkTj1M		✓
5- Project Experience Sharing Seminar (2nd Seminar) ~ PPWM movie https://www.youtube.com/watch?v=NT3LqzhWKK4		✓
6- Customers satisfaction (PPWM) https://www.youtube.com/watch?v=iY-Dto2zwtc		✓

5-2 Through the annual seminar, disseminate Project activities and lessons learnt

Project activities and lessons learnt were disseminated through three annual seminars and one customer service center workshop with following agenda.

No.	1st Seminar, 10th April 2019
1.	Project outline
2.	Project Movie
3.	NRW; management and tools 1. Strategy of NRW management and pilot project 2. Estimation of NRW by DMA (District metered area) 3. Leakage reduction 4. Water meter management 5. Monitoring of meter reading (zero reading)
4.	Study of water supply improvement using the hydraulic model
5.	Bill collection; management and tools 1. Increase/enhance method of payment • PPWM • Debt collection campaign • New collection center • Palpay 2. Update GIS-base customer data and upgrade customer database system 3. Digital workflow; MBS, DMAS, Complaints 4. PR and social assessment of customers
6.	Business management plan 1. Financial prospect and key measures for its improvement 2. Motivation allowance for field collectors and the effect after its implementation 3. Customer database cleanup and its breakthrough for smooth meter replacement and bill collection

No.	2nd Seminar, 27th Oct 2020
1.	Project outline (Scope of work) and overall progress
2.	NRW; management and tools 1. Outline of NRW Activities 2. Establishment of DMA/ Monitoring System and Estimation of NRW 3. Countermeasures of NRW (Real losses) 4. Countermeasures of NRW (Commercial losses) 5. Capacity Building 6. Review of the Hydraulic Modeling 7. Further Development of the Project
3.	Bill collection; management and tools 1. Mobil Bulling System (MBS), SMS Reminder 2. PPWM Installation and Management 3. Enhancement of Method of Payment • Expansion of collection centers • Palpay for water bill collection • Debt collection campaigns (soft approach) • PPWM vending stations 4. Customer Follow-up Activities

	• Monitor Water Meters • DMAS System • Customer Database • Customer Complaints Management 5. PR and Customer Satisfaction 6. Overall summary for CSS and PR

No.	3rd Seminar, 22nd May 2022
1.	Project Outline (Scope of Work) and Overall Major Outputs 1) Progress in NRW reduction rate 2) Progress in bill collection ratio
2.	Section (1) Non-Revenue Water (NRW); Management & Tools
	1) DMA establishment and monitoring system 2) NRW estimation 3) Countermeasures for NRW reduction a) Real losses • accuracy check of source meters and replacement • leak detection (by conventional acoustic system) • stop-cock method and sounding survey b) Commercial losses • detection of illegal connections • investigation of zero consumptions • accuracy check of customer meters and replacement • Remaining major challenges and way forward • water pressure management • aged pipe replacement • DMA and rollout plans
3.	Section (2) Customer Service Management & Tools
	1) Update of Customer Information on Al-Shamel • customer database survey (CDS); planning, implementation, data entry • digital archiving of customer files (via Archive Department) 2) Digital Monitoring of Customer Complaints (Web-based) 3) Update of Customer Information and Water Supply System on GIS • data entry, data updates, data maintenance, • use of the GIS data/maps in daily services 4) Installation of Pre-Paid Water Meters (PPWM) • planning and implementation; installation scheduling, teaming, tasks, data entry • outsourcing and contracts • importance of customer satisfaction with installation 5) Digital Monitoring of PPWMs 6) Digital Meter Reading, Billing, and Payments 7) Digital Processing of Customer Applications 8) Software Improvement (via IT department) • software integrations • licensing for new software and/or license extensions • JM server, data security and backup system • updates of software functions • data/information sharing system 9) Customer Awareness Activities (via PR Department) • use of social media; FB and YouTube • use of new software • production of posters, calendars, movies • visits of every customer for PPWM installation

	10) Debt Collection; Additional Approaches 11) Improvement in Means of Transportation for Daily Activities 12) Remaining Major Challenges and Way Forward • assets monitoring, repair, and maintenance • high debt collection • overtime tasks

No.	Customer Service Center Workshop, 10th November 2021
1.	1. JM Service Center presentation 2. Tubas Service Center 3. Qabatia Service center 4. Open Discussion 5. Recommendations and conclusion

2.3 Other Activities

2.3.1 Monitoring Mission and Joint Coordinating Committee (JCC) Meeting

The following 10 JCCs were held and a monitoring mission from JICA HQ participated in the 4th JCC. The Minutes of Meetings of JCC are given in Appendix 4.

JCC	Date	Major contents
1	28th September 2017	• Current status of water supply in Jenin Municipality • Outline of the Project • Discussion and Confirmation of R/D ➢ PDM and PO ➢ Implementation organization of the Project ➢ Undertakings of Palestinian side ➢ Securement of budget
2	28th March 2018	• Policy of meter replacement • Proposed organization in WWD and OJT • Training in Japan
3	2nd October 2018	• Progress and Issues ➢ Water Service Management Plan ➢ NRW reduction activities ➢ Collection and billing improvement activities ➢ Progress of PPWM Implementation ➢ Confirmation of PDM indicators ➢ Next schedule up to the next JCC after 6 months
4	9th April 2019 (6th -11th April 2019 Monitoring mission from JICA HQ)	• Final version of Water Service Management Plan • NRW reduction activities • Collection and billing improvement activities and customer service management • Progress of PPWM • Proposal of Objectively Verifiable Indicators and discussions
5	11th November 2019	• Progress and Issues ➢ NRW reduction ➢ Progress of PPWM ➢ Collection and billing improvement activities, customer service management and PA
6	20th July 2020	• Progress, Issues and discussion

JCC	Date	Major contents
	(online)	➢ NRW reduction ➢ Water supply improvement ➢ PPWM ➢ Bill collection improvement, Customer service management and PA • Status of JICA additional assistance for equipment and materials related to countermeasure of COVID-19 • Modification of PDM ➢ Objectively verifiable Indicators (OVIs) in PDM ➢ Additional activities ➢ Project period
7	28th January 2021 (online)	• Progress, Issues and discussion ➢ NRW reduction and water supply improvement ➢ Customer service management & PPWM ➢ PR activities ➢ Bill collection • Evaluation of the status of achievement of targets and proposal to achieve the targets at the end of project
8	10th August 2021 (online)	• Overall progress and review of minutes of previous JCC and bi-monthly meetings • Summary of terminal evaluation survey result on the Project including Recommendations and discussion
9	24th May 2022	• Current activities, challenges and discussion ➢ NRW reduction and water supply improvement ➢ Customer service management & PPWM ➢ PR activities ➢ Bill collection • Explanation of Monitoring Sheet version 9 (Achievement and challenges) including progress of PPWM procurement • Progress of Action Plan
10	26th September 2022	• Overall briefing on achievement status of targets of Project Purpose and Outputs • Recommendations to the Overall Goal • Outline of PPWM installation plan for entire city of Jenin • Outline of DMA & Roll-out plan for NRW reduction • Handover ceremony of PPWM, fittings, and Gateways

2.3.2 Record of Seminars, Trainings and Periodical Meetings

(1) Record of seminars

The record of the seminars is presented in 5-2 of 2.2.5.

(2) Trainings

1) Training in Japan

a) Outline of training in Japan

1) Course title	Training for improvement of water utility management for Jenin Municipality and Palestine Water Authority
2) Language	Japanese – Arabic translation, presentation materials are mainly in Arabic

3) Concept	• The training is for an opportunity to conduct research to find ideas and solutions, in training in Japan and prepare action plan to improve problems, rather than to receive training/lecture and conduct site observation • Before training in Japan, ➢ The participants identify key problems of their departments /sections, find a research theme, and prepare questionnaire that the participants will ask to lecturers in Japan. ➢ The participants prepare preliminary action plan • During the training in Japan ➢ The participants need active participation in training ➢ The participants prepare action plan to improve key problems based on the training. ➢ The participants make presentation of action plan • After training in Japan ➢ The participants finalize action plan and make presentation of the results in Palestine. ➢ The participants carry out action plan and utilize the results of the training.
4) Objective	• To understand water utility management • To find ideas and solutions for the problems that Jenin Municipality and PWA are facing in the water utility management • To apply what they learned in Japan to Palestine
5) Training main themes	Water utility management style, finance and water tariff, utility organization, NRW management, awareness raising (public relations/consensus building), amalgamation of small water utilities
6) Topics	• National water administration and research institution (Japan Water Research Center) ➢ Utility management in Japan ✧ History of waterworks in Japan ✧ Japanese water utility management system ✧ Monitoring of performance indicators, bench-marking tools ✧ Approach to development of human resources for water utility in Japan ✧ Water management and disaster (drought, etc) management • An autonomous water utility (Iwate Chubu Reginal Water Authority) ➢ Utility management and amalgamation example in a water utility ✧ Water supply system in water utility ✧ Restructuring of water supply facilities ✧ Business plan and tariff setting ✧ Organization and human resource development ✧ NRW management ✧ Bill collection and public awareness ✧ Meter reading • Water works bureau in a municipality (Yahaba town) ➢ Utility management in a water supply bureau in a municipality ✧ Methodology of public awareness, public relation activities, and consensus building ✧ Business plan ✧ Exercise of consensus building workshop with the citizen • A leakage detection manufacture ➢ NRW Countermeasures in Japan and developing countries ➢ Training of leakage detection in a yard
7) Method	Lecturing, workshop, discussion and site visit
8) Participants	• Jenin Municipality (8) Mr Ragheb M.R. MALHIS Mr Yazid K.M. SHRAIM Mr Samer H.K. ALIMARI Mr Khaled N.A. ABUIBAID Ms Khayria A.A. SOUQIA Mr Ramzi A.R. JAFAR Mr Islam H.M. ALBARBARI Mr Mohammed F.K. ZOUBI

	• Palestine Water Authority (2) Mr Kamal M.I. ISSA Mr Fady M.H. NOFAL	
9) Training institution	• Japan Water Research Center (JWRC)	➢ National research center for utility management in Japan
	• Iwate Chubu Reginal Water Authority	➢ Autonomous amalgamated water utility
	• Yahaba Waterworks Bureau	➢ Waterworks in municipality
	• Fuji Tecom Inc.	➢ Leak Detection and Locating Technology company
10) Target to be achieved	• Understanding of utility management and business plan in Japan • Understanding of amalgamation of water utilities in Japan • Understanding of methods of consensus building on water supply service • Preparation of action plan of improvement of water supply management	
11) Output	• A report on water utility management • An action plan to improve water supply management in Jenin Municipality (Jenin Municipality) • A report of amalgamation in Japan and adoption to Palestine (PWA)	
12) Follow up	After coming back to Palestine, a seminar would be held with the participants of the training as the presenters, to share the knowledge acquired and the contents of the report they prepare. The result would be briefed to the Mayor and Minister of PWA as well.	

b) Training schedule

No.	Date		Stay	Visit	Content
1	24th June	Sun			• Depart Palestine
2	25th	Mon	Tokyo		• Arrive at Tokyo
3	26th	Tus	Morioka	JWRC	• Lecture by JWRC • Move to Morioka
4	27th	Wed	Morioka	Yahaba	• Presentation by Palestinian sides • Lecture by Yahaba town • Workshop on consensus building • Visit water treatment plant
5	28th	Thu	Morioka	Iwate-Chubu	• Presentation by Palestinian sides • Lecture by Iwate-Chubu
6	29th	Fri	Morioka	Iwate-Chubu	• Facility observation and bill collection activities • Follow-up discussion
7	30th	Sat	Tokyo		• Holiday • Move to Tokyo
8	1st Jul	Sun	Tokyo		• Holiday
9	2nd	Mon	Tokyo	Fuji Tecom	• Lecture by Fuji Tecom • Training of leakage detection in a yard
10	3rd	Tus	Toyo		• Wrap-up meeting • Preparation of report and action plan • Presentation of draft plan and report
11	4th	Wed			• Departure for Palestine
12	5th	Thu			• Arrive at Palestine

2) Training in the Project

The number of persons who received training in the Project and the number of trainings, seminars, and meetings are summarized in the following tables. The details of training records are given in Appendix 2.

Table 2-62 Summary of the number of persons who received training

Item	Sep 2017 - Mar 2018	Apr 2018 - Mar 2019	Apr 2019 - Mar 2020	Apr 2020 - Mar 2021	Apr 2021 - Mar 2022	Apr 2022 - Sep 2023	Total
Technical training	45	232	157	28	160	18	640
Seminar	0	0	65	23	30	52	170
(Bi)weekly meeting	93	79	133	69	125	30	529
Monthly meeting	12	44	47	0	0	0	103
Total	150	355	402	120	315	100	1,442

Table 2-63 Summary of the number of trainings, seminars, and meetings

Item	Sep 2017 - Mar 2018	Apr 2018 - Mar 2019	Apr 2019 - Mar 2020	Apr 2020 - Mar 2021	Apr 2021 - Mar 2022	Apr 2022 - Sep 2023	Total
Technical training	12	21	29	12	16	0	90
Seminar	0	0	1	1	1	1	4
(Bi)weekly meeting	22	37	30	17	23	5	134
Monthly meeting	2	3	3	0	0	0	8
Total	36	61	63	30	40	6	236

2.3.3 Baseline and End Line Survey

(1) Social survey

In the Project, JICA expert team conducted 3 social surveys:

- Baseline survey for Pilot Area 1 (PA1) from 22nd to 28th October 2017 (1st survey)
- Baseline survey for City-wide area at 7th, 8th and 11th November 2017 (2nd survey)
- Pre-paid Water Meter (PPWM) post-implementation survey for PA1 (4th, 11th, and 25th September, and 19th, 20th and 22nd October, and 14th and 21st November 2019), PA2 (3rd, 6th, 7th and 8th June 2020) and PA3 (9th, 11th, 13th and 15th June 2020) (3rd survey).

In the Baseline surveys, 1) Customer satisfaction of water service of Jenin Municipality, 2) Willingness to pay in case of any increase of water tariff, and 3) Public 's opinion on PPWM if the Project decides to install PPWM were surveyed.

After the introduction of PPWM, the questionnaire survey was conducted to find out the customer satisfaction of PPWM in the 3rd survey.

The Endline survey is the 4th survey. The purposes of the Endline survey are 1) To compare the results with that of the Baseline survey, and 2) To analyze the change and the customer's recognition on PPWM before and after the Project. The questionnaire survey was conducted to the customers of municipality's

water service in PAs and outside of PAs.

The summary of major findings are as follows. The detail analysis is included in Annex (CD) 2.2 (Endline Survey Report, September 2021).

- In PAs, water access and water access satisfaction at Endline survey were higher than those in the Baseline survey. In addition, the satisfaction of water supply service at Endline survey was also higher than that of the Baseline survey. However, since 39.8% of the respondents still purchase water from private vendors, and the request of more days of water access and more water supply amount were higher than that in the Baseline survey, the supply may not be keeping up with the demand for water. This will be an issue for the future.
- There were many positive responses regarding the introduction of PPWM in PAs, with 77% of respondents preferring PPWM to post-paid meter and 80.6% answering that the Jenin Municipality should introduce PPWM.
- Less respondents at PAs were willing to pay for the improvement of municipality's water service at Endline survey than that in the Baseline survey. It is considered that the economic situation of the local people is related to this, and economic difficulties may be one factor, as the impact of the COVID-19 has been hurting the economy in recent years.
- In the outside PAs, same as in the PAs, water access and water access satisfaction level at the Endline survey were higher than that in the Baseline survey. In addition, the satisfaction level of water supply service at the Endline survey was also higher than that in the Baseline. However, since 50% of the respondents still purchase water from private vendors, and the request of more days of water access and more water supply amount at the Endline survey are higher than that in the Baseline survey, the supply may not be keeping up with the demand for water. This will be an issue in the future.
- Regarding customer satisfaction at outside PAs, the satisfaction of bill distribution, meter reading, and payment method at Endline survey decreased from the Baseline survey.
- As for Willingness to pay in the outside PAs, the results were similar to those for PAs, and less respondents were willing to pay for improvement of municipality's water service at Endline survey than that in the Baseline survey. One possible reason is the worsening economic situation of local people due to COVID-19.
- In the outside PAs, when asked whether they prefer PPWM or not, the answer of No was slightly higher than that of Yes, indicating backward-looking views on PPWM.

(2) Core capacity assessment

1) Target of assessment

The target of endline core capacity assessment was the main responsible persons in WWD, namely, head of WWD, head of water section, head of customer service section, head of projects and planning section, and the head of NRW division. The baseline assessment also included several other departments and units of JM, but they were not included in the endline assessment as not much capacity improvement activities were targeted to those departments and units in this project.

2) Items of assessment

The endline core capacity assessment was done by administrating the same set of questionnaires and unified criteria as baseline capacity assessment which covered four core capacity dimensions consisting of leadership capacity, adaptive capacity, management capacity and operational capacity.

3) Results of core capacity assessment

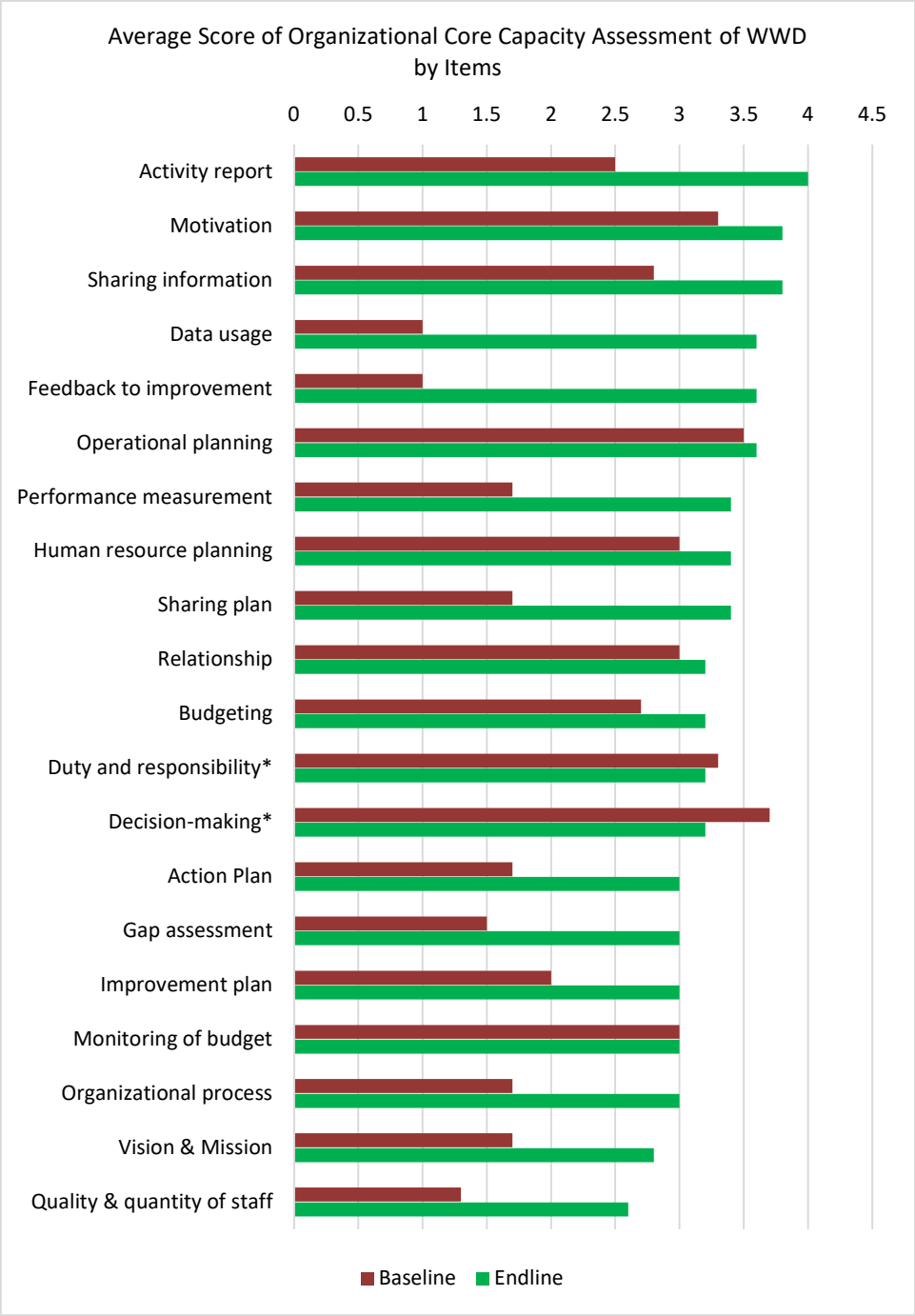
The assessment sheets were given to the respondents by JICA Expert and asked them to answer. Each question in the assessment sheet has 5 answer choices. The answer choices were prepared in accordance with the status of progress/or development in each topic. The number of answer choices is also equal to the rating of the status of progress/ or development. For instance, the rating was given along a scale ranging from, "Can be a model for benchmarking" with the highest "5" to "Does not exist" with the lowest "1". The respondents were asked to select one answer among the 5 choices which is reflecting current status more accurately.

The results of the assessment are summarized in Table 2-64, and presented graphically in Figure 2-39, and Figure 2-40. Figure 2-39 shows result of core capacity assessment by items. In two items (Decision making, and Duty and responsibility) no increase was seen. This was probably due to inaccurate assessment of baseline. Their current levels are reviewed and found acceptable by the evaluators. The increase in five other items was marginal but, in the rest, there was a significant increase. The increase was drastic in Data usage and Feedback to improvement.

Table 2-64 Results of Baseline and Endline assessment of organizational core capacity of WWD

Category	No.	Topics	By topics		By category	
			Baseline	Endline	Baseline	Endline
A. Leadership	Q1	Vision & Mission	1.7	2.8	2.4	3.2
	Q2	Action Plan	1.7	3		
	Q3	Relationship	3	3.2		
	Q4	Motivation	3.3	3.8		
B. Adaptive	Q5	Performance measurement	1.7	3.4	1.4	3.3
	Q6	Data usage	1	3.6		
	Q7	Gap assessment	1.5	3		
	Q8	Feedback to improvement	1	3.6		
	Q9	Improvement plan	2	3		
C. Management	Q10	Budgeting	2.7	3.2	2.7	3.1
	Q11	Monitoring of budget	3	3		
	Q12	Quality & quantity of staff	1.3	2.6		
	Q13	Duty and responsibility	3.3	3.2		
	Q14	Organizational process	1.7	3		
	Q15	Decision-making	3.7	3.2		
	Q16	Human resource planning	3	3.4		
D. Operational	Q17	Sharing plan	1.7	3.4	2.6	3.7
	Q18	Activity report	2.5	4		

Category	No.	Topics	By topics		By category	
			Baseline	Endline	Baseline	Endline
	Q19	Sharing information	2.8	3.8		
	Q20	Operational planning	3.5	3.6		
Average			2.3	3.3		



Note: * The baseline assessment of these two items seems to be on higher side than actual

Figure 2-39 Comparison of WWD's average score of organizational core capacity by items at baseline and endline

Figure 2-40 shows the result of core capacity assessment by category. The results show that there has been significant improvement in all dimensions of core capacity compared to baseline level. Markedly significant improvement is seen in all four categories.

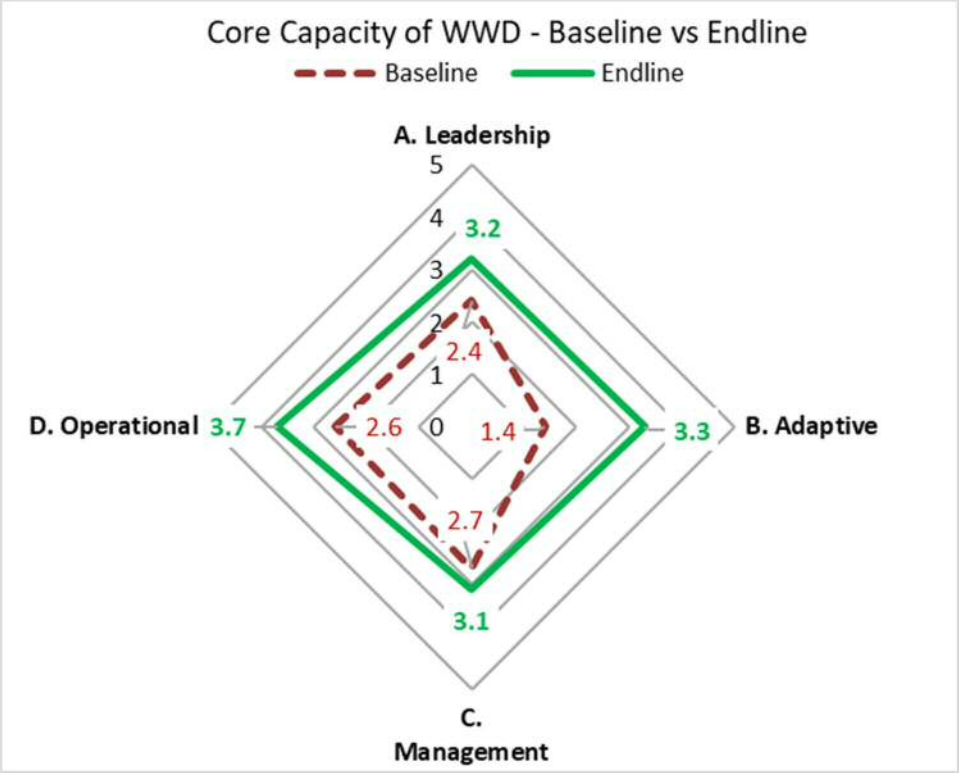


Figure 2-40 Comparison of WWD's score of organizational core capacity at baseline and endline by category

(3) Technical capacity of technicians

Technical capacity of technicians was assessed by a test which included questions on subject related to NRW such as practical skills on leak detection, use and maintenance of equipment, water flow and pressure measurement, meter reading, various components of NRW, and causes of and methods of NRW reduction.

The first assessment was conducted in the beginning of the Project during the baseline survey. After that the technicians were provided trainings. In 2019 JM recruited several new technicians. Then a refresher training was provided to all the technicians including these newly recruited. Following this training, the second assessment was conducted. In Nov-Dec 2021 all the technicians were again provided refresher trainings and at the end of the training assessment of their technical capacity was done.

Figure 2-41 shows the number of technicians and overall result of technical capacity in three assessments. This shows a clear improvement in their technical capacity.

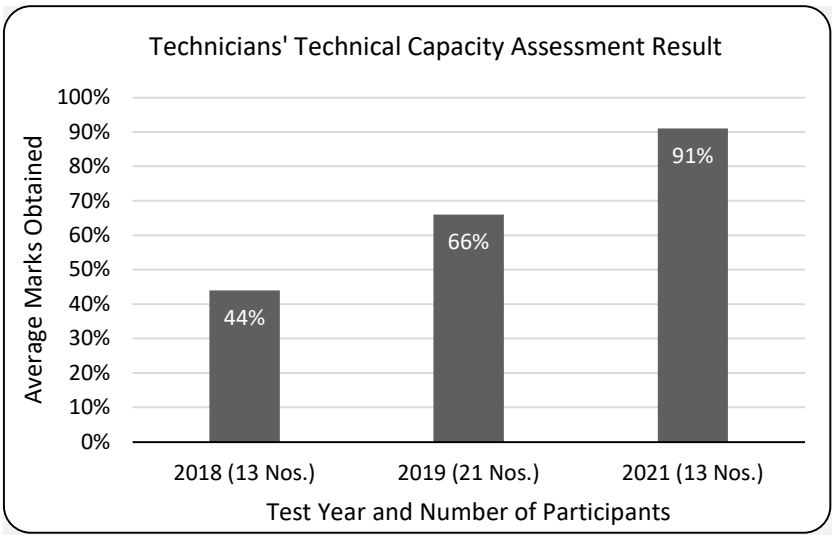


Figure 2-41 Number of technicians and overall result of technical capacity assessment in three tests

Figure 2-42 shows the comparison of baseline and first follow-up assessment. The overall score improved from 44% to 66%. Almost all the individual technicians performed better. The persons with serial numbers from 14 to 21 were either newly recruited (they were not there during the baseline assessment) or absent during the baseline assessment.

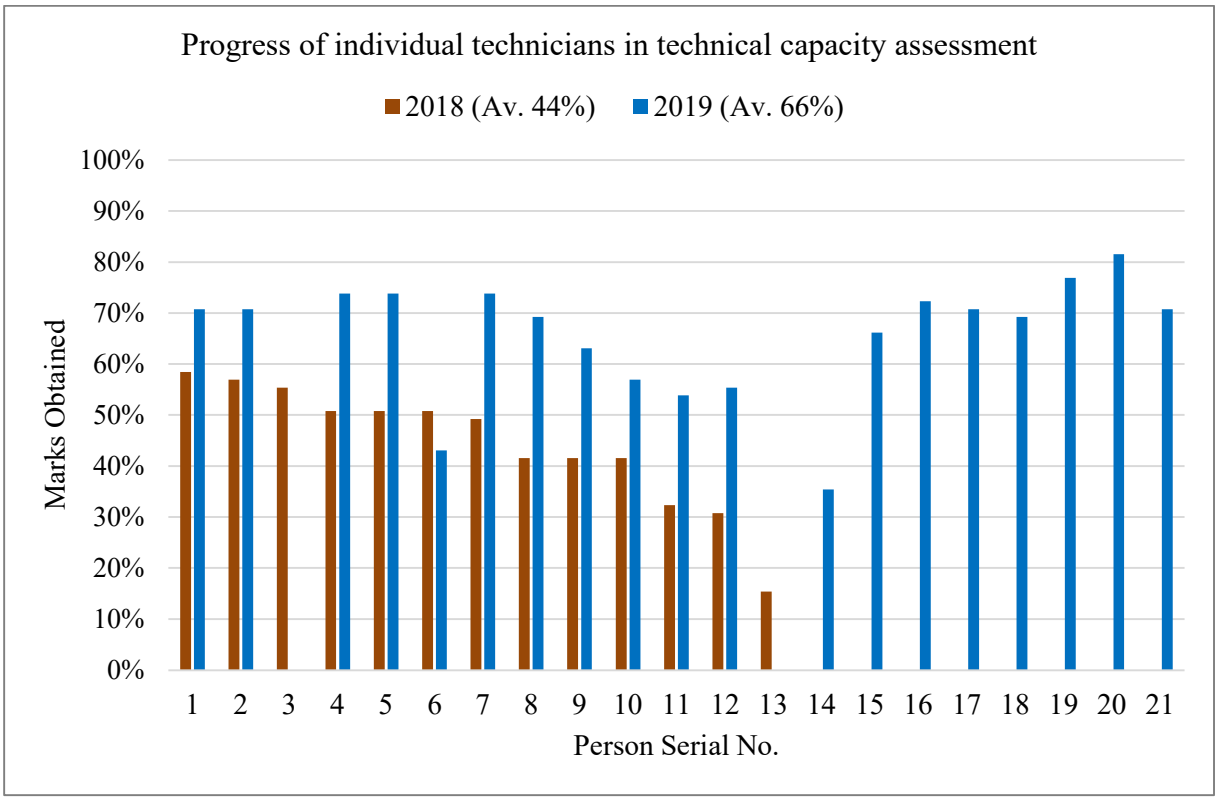


Figure 2-42 Marks obtained by each technician in the NRW technical test (Baseline and intermediate assessment)

Figure 2-43 shows the marks obtained by individual technicians in the third assessment. The test questions were of similar nature and difficulty as the baseline and follow-up assessment, but the results were much better in the final assessment. This indicates that the technicians' technical capacity related to NRW has been developed significantly.

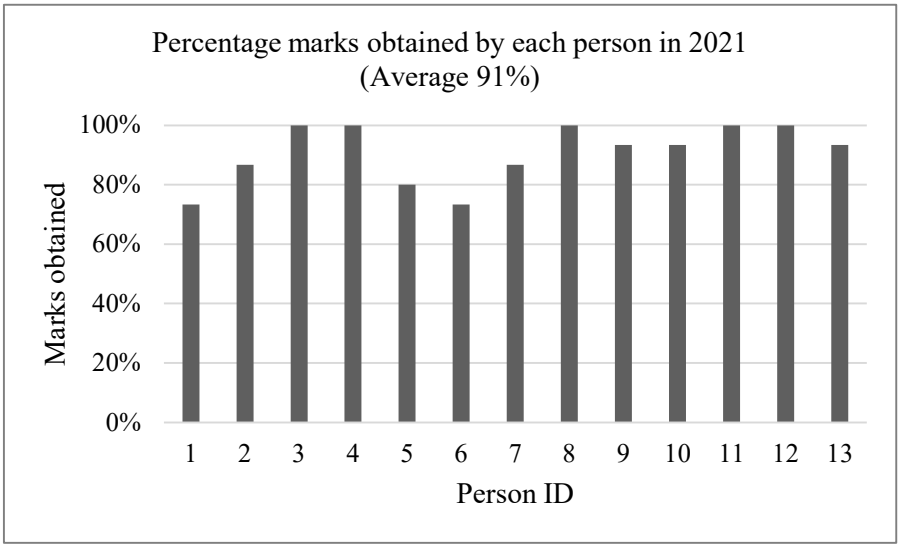


Figure 2-43 Marks obtained by each technician at the endline assessment

(4) Technical capacity of engineers

NRW related technical capacity of engineers working in WWD was tested in the beginning and end of the Project. The test questions of the baseline assessment were divided into three subject groups; questions related to advance knowledge on NRW, DMA and conceptual analysis, and tools and equipment. During the course of the Project the engineers were provided trainings in Japan as well in Jenin by the JICA experts. The trainings in Jenin covered subjects such as hydraulic modeling with pressure-dependent demand and its use to investigate deficiency of pipe network, pressure management and so on. In Dec 2021 assessment of their technical level was done by means of a written test consisting of 14 questions covering advanced subjects of NRW. The questions were not separated into groups in this time. The percentage scores obtained by these counterpart engineers during baseline and endline assessment are given in Table 2-65.

Table 2-65 Scores of counterpart engineers during baseline and endline assessments

Counterpart Engineer	Baseline				Endline	Remarks
	Subject group 1	Subject group 2	Subject group 3	Total	Total	
Eng 1	82%	61%	36%	67%	88%	
Eng 2	49%	13%	14%	33%	-	Not available for endline
Eng 3	-	-	-	-	73%	Was not yet employed during baseline
Average score	65%	37%	25%	50%	81%	

The results indicate that counterpart engineers' technical level related to NRW management has been

increased significantly by the Project.

(5) Technical capacity assessment at organizational level by self-evaluation (NRW)

WWD's organizational level of NRW was assessed by Self-Assessment Matrix three times; once in the beginning of the Project, then in Nov 2019 and the last one in the end of the Project. The initial assessment was reviewed and revised by WWD sometimes later to make it realistic as possible.

The result of these evaluation is shown in Figure 2-44. This shows that there was no change in three issues (No. 1.1, 4.5, and 5.3), but in the remaining 13 issues there was a significant improvement during the project period.

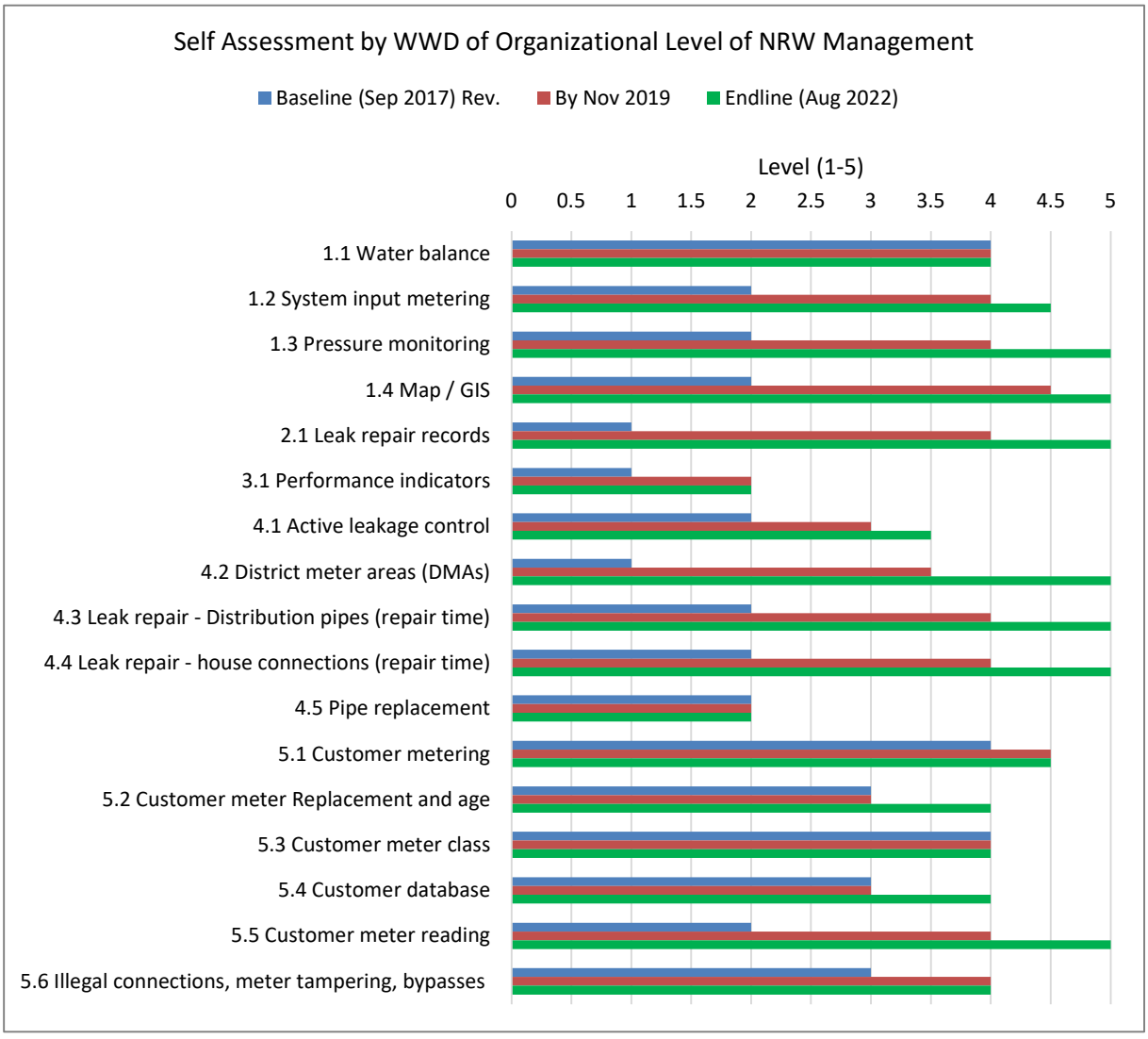


Figure 2-44 Self-assessment by WWD of organizational level of NRW management

(6) Capacity assessment of customer service section and PR

Besides the core capacity building assessment as presented in the section above, this section provides a summary review on the specific major improvements in CSS and the PR department in comparison with

their status at the baseline. Detail is given in Annex (CD) 1.7 Capacity Building Assessment of CSS and PR. Four scale levels were taken into account to measure their capacity status at the baseline and endline stages as given in Table 2-66:

Table 2-66 Scales for measurement of capacity building for CSS and PR Dept

Measurement scale level	Measuring item
0	Does not exist.
1	Exists but not working.
2	Exists but working only to some extent.
3	Exists and working well.

The following categories were taken into account while measuring the status at baseline and endline;

a) Organizational level
b) Technical and automation level
c) Activities level
d) Equipment level

(7) Overall status of the capacity building of CSS

The assessment scale numbers were judged based on the status of the built capacity of CSS at the endline level compare with the baseline. As seen in the figure below, the section has reached to the overall scale of 2.7 which is close to the 'Working well' level, though the section needs some improvements such as:

1) To get hands on experience with maintenance of the PPWM and improve the maintenance section.
2) To increase monitoring of the installed PPWM and the mechanical meters for any malfunctions or misuse.
3) To improve automation of its inventory system and warehouse using Al-Shamel instead of paper-based inventories.
4) To enhance CSS's capacity in terms of preparation of plans, planning, report generation, and data analysis: the activities need skills such as working experience with Microsoft Office Suite. Shortage of such skills among some of the staff could be a challenge for CSS to assign staff for higher level data entry and report generation.
5) To take preventative measures to reduce customer complaints.
6) To increase bill collection ratio of the customers with mechanical meters and also increase collection ratio of debt amount. Take actions and follow up with the collection campaign and re-payment model introduced by the Project (for both PPWM and mechanical meter customers).

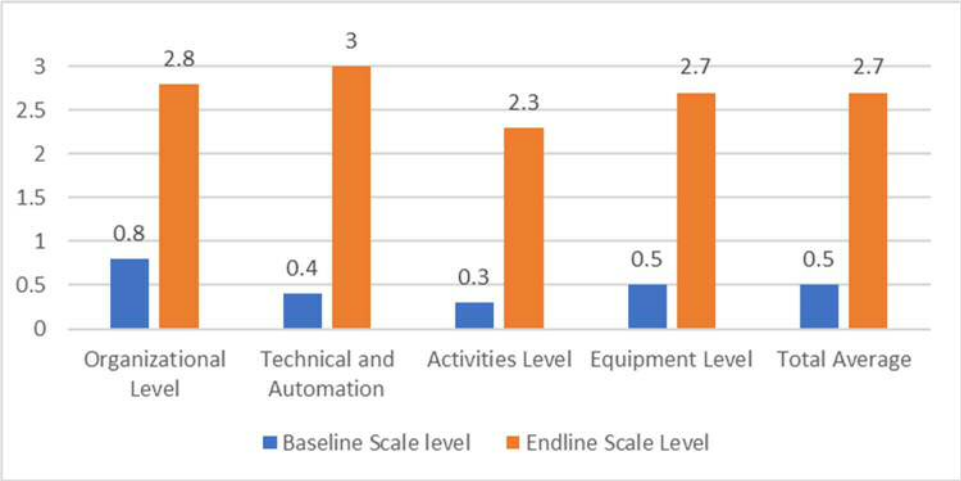


Figure 2-45 Progress of capacity building of CSS

(8) Overall status of the capacity building of PR Department

The assessment scale numbers were judged based on the status of the built capacity of the PR Department at the endline level in comparison with the baseline. As seen in the figure below, the Department's average capacity building improved from 0.4 to the scale of 1.8 to as 'Exists but working only to some extends'. The followings are among the remaining matters that need improvement:

1) Close monitoring of the monthly activities as planned.
2) Lack of annual plans and goals.
3) Clarification of tasks by each staff according to the job description.
4) Improvement in preparation for public meetings such as selection of targeted residents and areas.
5) Training of the PR staff and use of software for PR material production and presentation.
6) Shortage in coverage of PR activities in inter-departmental level.
7) Need car and photography tools.

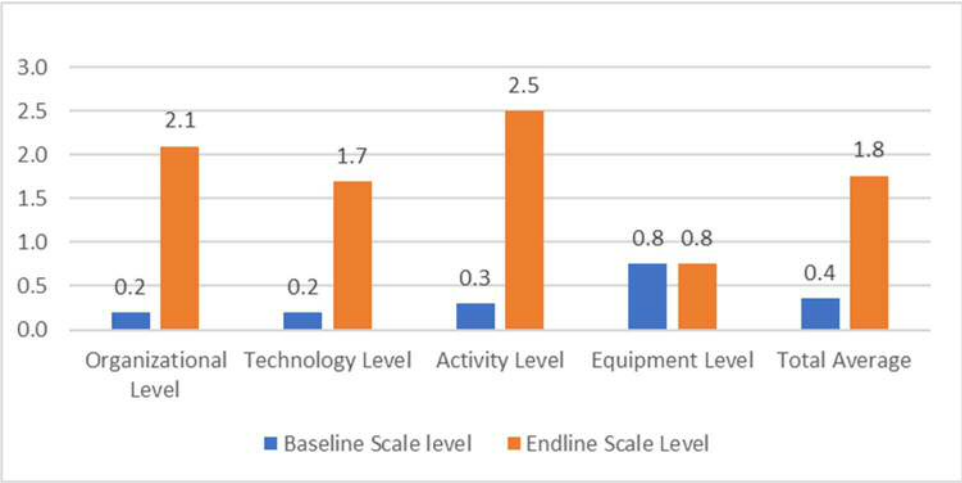


Figure 2-46 Improvement in capacity building of PR Department

2.3.4 Public Relations

CSS of WWD, in cooperation with PR Department, lunched extensive PR activities for the Project. the PR activities played an important role in the resident's awareness and acceptance of PPWM with only a low percentage of rejections. In the following, JET reviewed the public relations activities that were implemented during the project period some of which are still on going.

a. Baseline social survey in PAs, Jenin city and in other municipalities in Palestine
b. Customer database survey (CDS)
c. Neighborhood meetings and meetings with community leaders
d. Preparation of PPWM PR materials
e. Door to door visits prior to installation of PPWM for awareness purpose
f. Re-visit of customers who initially rejected PPWM installation
g. Post-installation visits (Customer satisfaction survey visits)
h. Using social media channels, project movies and promotion animation
i. Preparation of PR materials
j. Social case study in cooperation with WWD
k. Cooperation with other institutions for raising public awareness in the city
l. Bill collection campaigns (soft-approach)
m. End line social survey

For details on each of the above activities and further understanding of the countless effort and cooperation of the PR Department, refer to the Annex (CD) 4.1 PR Materials for the major public awareness activities of CSS in cooperation with the PR Department.

2.3.5 Major Output Materials/Reports Prepared in the Project

The following major output materials were prepared along with other materials.

1. Manual for NRW Reduction
2. Manual for Operating Leakage Detection Equipment (including simplified version)
3. Report on Replacing Customer Water Meter
4. Report on Cost/Benefit Analysis of NRW Reduction Activities
5. NRW Reduction Roll-Out Plan

The list of materials is given in the following table and filling locations (Annex or Annex (CD)).

Table 2-67 List of materials prepared in the Project

No.	Materials	English version	Arabic version	Filling location
1.	**Manuals, Guidelines and Plans- NRW**			
1.1	NRW Management Manual (Comprehensive Version)	✓		Annex
1.2	NRW Management Manual (Basic Version)	✓	✓	CD
1.3	Equipment Usage Manual (Standard version)	✓	✓	CD
1.4	Equipment Usage Manual (Simplified version for Technician)		✓	CD
1.5	Cost-benefit Analysis of NRW Management Works	✓		Annex
1.6	DMA & Roll-out Plan of NRW Reduction	✓		Annex
2.	**Study report, Plans and Manuals - PPWM**			
2.1	Study on Existing Meter System and Prepaid Water Meter System and Feasibility and Strategy for Introduction of Prepaid Water Meter System	✓		CD
2.2	Implementation Plan of Introduction of Prepaid Water Meter System in Pilot Area-1 (PA-1)	✓		CD
2.3	PPWM Booklet – for customers	✓	✓	CD
2.4	Case Study of PPWM in Jenin Municipality (Results of Pilot Project)	✓		Annex
2.5	Manual for Management of Prepaid Water Meter System in Jenin Municipality	✓	✓	CD
2.6	Prepaid Water Meter Installation Plan for Entire City of Jenin	✓		Annex
3.	**Manuals, Guidelines and Information – CSM (Customer Service Management)**			
3.1	Procedure Manuals for major Customer Service Management Activities (A) Examination of Water Meters with Zero or Minimum Monthly Consumption (B) Examination of Potential Illegal Connections (C) Random Check of the Installed PPWMs (D) Preparation of Customers; Door-to-Door Visitation of Customers Prior to PPWM Installation (E) Monitoring of Bill Collection Ratio; Preparation of Necessary Data and Calculation of Ratio (F) Collection Campaign; Soft Approach (G) Public Relations Activities	✓	✓	CD
3.2	Report on Mobile Billing System (MBS) for Jenin Municipality	✓		CD
3.3	Customer Database Survey (CDS) & GIS Work	✓		CD
3.4	MIS Report 'Digital Business Transformation for Major Operations of Customer Service Management	✓		CD
3.5	Your City Water Explained Part 1, 2 and 3 (for Customer information)	✓	✓	CD
3.6	Revised Water Supply Contract	✓	✓	CD
3.7	Capacity Building Assessment of CSS and PR	✓		CD
3.8	Collection Ratio Calculations and Charts (2017 to 2021)	✓		CD
4.	**Reports**			
4.1	Baseline Survey Report- 2018	✓		CD
4.2	Endline Survey Report- 2021	✓		CD
4.3	Annual Report on Water Supply Service in Jenin Municipality for the Year 2018, June 2019	✓	✓	CD
4.4	Annual Report on Water Supply Service in Jenin Municipality for the Year 2018, June 2019- Digest Version	✓	✓	CD
4.5	Annual Report on Water Supply Service in Jenin Municipality for the Year 2019, March 2020	✓	✓	CD
4.6	Annual Report on Water Supply Service in Jenin Municipality for the Year 2019, March 2020- Digest Version	✓	✓	CD
4.7	Annual Report on Water Supply Service in Jenin Municipality for the Year 2020, March 2021	✓	✓	CD

No.	Materials	English version	Arabic version	Filling location
4.8	Annual Report on Water Supply Service in Jenin Municipality for the Year 2020, March 2021- Digest Version	✓	✓	CD
4.9	Annual Report on Water Supply Service in Jenin Municipality for the Year 2021, September 2022- Digest Version	✓	✓	CD
4.10	Annual Report on Water Supply Service in Jenin Municipality for the Year 2021, September 2022- Digest Version	✓	✓	CD
4.11	Terminal Evaluation Report August 2021	✓	✓	CD
5.	**Plans and Job Description**			
5.1	Water Service Management Plan 2018 – 2027 for Jenin Municipality- Initial 2018 Version – March 2019	✓	✓	CD
5.2	District Service Improvement Plan (DSIP), 2019	✓		CD
5.3	Action Plan (Updated) May 2022 for Terminal Evaluation	✓		CD
5.4	Job Descriptions	✓	✓	CD
6.	**PR Materials**			
6.1	Signboards, Logo, Safety west (with logos), Calendar, Project Movies, Billboards, PPWM Booklet, Posts on social media i.e. FB and YouTube, Radio Talk, TV Program talk, PPWM; How To charge PPWM Card, Project animation	✓		CD
6.2	Pre and Post Installation Survey – Pilot Areas	✓		CD
7.	**Seminar Presentations and YouTube Movies**			
7.1	Project Experience Sharing Seminar (1st Seminar)	✓		CD
7.2	Project Experience Sharing Seminar (2nd Seminar)	✓		CD
7.3	Project Experience Sharing Seminar (3rd Seminar)	✓	✓	CD
7.4	Project Experience Sharing Seminar (1st Seminar) ~ Project explanation (Interviews) https://www.youtube.com/watch?v=rq0XGmkTj1M (accessed on 15/08/2022)		✓	Youtube
7.5	Project Experience Sharing Seminar (2nd Seminar) ~ PPWM movie https://www.youtube.com/watch?v=NT3LqzhWKK4 (accessed on 15/08/2022)		✓	Youtube
7.6	Customers satisfaction (PPWM) https://www.youtube.com/watch?v=iY-Dto2zwtc (accessed on 15/08/2022)		✓	Youtube
7.7	Project movie: https://www.facebook.com/JeninMunicipality/videos/2399831336906296 *(accessed on 15/08/2022)*		✓	JM Facebook
7.8	PPWM movie: https://www.facebook.com/JeninMunicipality/videos/1361795583981204 *(accessed on 15/08/2022)*		✓	JM Facebook
7.9	MBS movie: https://www.facebook.com/JeninMunicipality/videos/1529285360569666 *(accessed on 15/08/2022)*		✓	JM Facebook
7.10	Animation movie on introduction of PPWM https://drive.google.com/file/d/1KbOaRRSezl3o3yn1yupqZwKqvg2Kf6vS/view	✓	✓	Youtube

CHAPTER 3 ISSUES, MEASURES AND LESSONS LEARNED IN IMPLEMENTING AND MANAGING THE PROJECT

3.1 Addressing Management Issues

(1) The Expert requested to increase the number of counterparts (C/P) to enable adequate capacity building of the organization.

1) Issues

The C/P organization had only two engineers, including the director of the department. It had insufficient number of technicians, especially the young technicians. Most of the technicians were busy with the daily work of water distribution control and leak repair, and the organizational structure was not capable of carrying out project activities and capacity building.

2) Measures

Since the existing staff could not be reallocated to handle the project activities, the Expert requested the Municipality to increase the number of staff in WWD. The Municipality responded by recruiting two young engineers and six young technicians and assigned them to WWD. The Expert was present during the selection process and signed the evaluation form to ensure that the best persons from among the applicants were hired.

3) Results and lessons learned

The eight hired staff became the C/P of the Project, with one engineer responsible for NRW management and another for data management and GIS. The technicians are assigned to NRW Management Division and CSS and perform project tasks of NRW management and PPWM operation and maintenance. Without the recruitment of these staff, project implementation would have been extremely difficult. **For the capacity building project, it is necessary to first establish an organizational structure that enables capacity building activities.**

(2) The C/P, who had been taking the lead in implementation of the activities, coordination, and management of the Project, was placed in a key position in the project midway through the Project, thereby strengthening the project implementation structure.

1) Issues

The project manager, the head of WWD, retired, and a new project manager was assigned, but the new head has not participated in project activities.

2) Measures

Taking advantage of this opportunity, the C/P who had been taking the lead in project activities and project coordination and management tasks was assigned as the project coordinator/deputy project manager to strengthen the project implementation structure.

3) Results and lessons learned

After the assignment as a project coordinator/deputy project manager, she continued to take the initiative in getting involved in the Project, coordinating and supporting many activities,

and greatly contributed to promoting the progress of the Project and achieving the outputs. **The C/P who has actively participated in the project activities needs to be promoted to a key position in the Project and provided motivation so as to strengthen the project activities.**

(3) The C/P learned local practices and knowledge from many experienced water supply providers in Palestine via PPWM study tour visits to 4 water supply providers.

1) Issues

PPWM is used in many water supply providers in Palestine and there may be many lessons learned, success story and good practices. The C/P was expected to learn from them for success of PPWM introduction to Jenin.

2) Measures

Several study tours to 4 water supply providers were planned and conduced and as a result, the C/P learned the followings on before and after introduction of PPWM.

- Water sources & supply condition
- Meter owner and location
- Type of PPWM introduced and warranty/maintenance contract
- Public awareness campaign
- Water tariff and debt recovery
- Payment method (Vending station)
- Meter problems
- Illegal use and penalty
- Operation and maintenance
- Social case/Socially vulnerable people
- Challenge encountered and encountering
- Customer contract
- Reason for success
- Recommendations for PPWM introduction strategy

3) Results and lessons learned

i) The training through study is intended to be more practical and the concept are to study good practices to apply them to Jenin case assessing and comparing the cases of practice with Jenin Municipality. Based on the study tours, PPWM introduction strategy and implementation plan were prepared for Jenin Municipality. Furthermore, more study tours were planned and conducted initially by the Expert team, but later by the initiative of the C/P. These training include below.

- NRW management
- Integration of PPWM with Al−Shamel
- GIS use in water supply service
- Debt management and illegal use management
- Social case/ socially vulnerable people

- Shifting current cash basis accounting to accrual method of accounting

ii) The C/P expanded the learnings from the PPWM study tours to other areas of their practices. As a result, the C/P applied the learnings to management of post-paid water meters as well, as follows:

- Routine monitoring of illegal connections, and taking proper actions
- Routine monitoring of water meters with zero reading, and taking proper actions
- Routine monitoring of water meter functional status and meter replacement when needed
- Lunch of mobile reading and billing system
- Automation of customer service applications and processing
- Campaigns for debt collections
- Additional methods and points of payments such as use of Palpay
- Enhanced cooperation with the PR department for use of social media and public awareness
- Launch of a new website for the Municipality for information dissemination
- Launch of an online system for receiving and processing of all customer complaint

Locally, there are many practices, experiences, and knowledge to be learned and adopted. It is worth exploring them for more effective training and improving the C/P capacity and the performance of water supply service.

(4) Continuous capacity development (CD) was implemented through regular weekly (bi-weekly) meetings.

1) Issues

Weekly meetings were initiated to report and share the progress and results of project activities. Minutes were taken at the meetings, but no follow-up on activities included in the minutes was made. Weekly meetings were held only when the Expert was in the site. Therefore, continuous CD was not possible.

2) Measures

Minutes were always taken at the meetings, a list of activities to be followed up based on the minutes was made, and the results of implementation of the activities were reviewed at the next meeting based on the list. During COVID-19 pandemic, bi-weekly meetings were held online, and the progress of activities and follow-ups were reviewed every other week online. After relaxation of travel restrictions caused by COVID-19 pandemic, online bi-weekly meetings were continued so that all experts in the site or Japan could participate.

3) Results and lessons learned

As of August 2022, a total of 135 weekly (biweekly) meetings were conducted. After the meetings, the C/P conducted follow-up activities based on the list of activities in the minutes and reported the results at the next bi-weekly meeting. Continuous follow-up of activities and capacity building were made possible. All experts are now available to support project activities at all times, and capacity building (CD) activities are implemented continuously.

Continuous communication opportunities and follow-ups are important for CD.

(5) The project activities were recorded digitally so that digital data could be used efficiently to monitor activities and improve operations.

1) Issues

At the beginning of the Project, WWD had few activity records. Even if they did exist, they were paper-based records and documents only. Therefore, the recorded data could not be used effectively.

2) Measures

The practice was made in the Project to record data digitally for the purpose of calculating NRW ratio and bill collection ratios. Subsequently, a process was established to record all other project activities also as digital data, and an Excel table was created. Leak repair records were converted from paper-based to GIS-based so that leak locations and repairs could be visually understood.

3) Results and lessons learned

Digital recording of data has continued, and performance indicators (PIs) other than project indicators have been created to enable ongoing monitoring of activities and indicators. They are also used to develop improvement measures. **Digital data are vital for effective monitoring and planning of improvement measures.**

(6) Google Sheets and own server were used to enable efficient inter-departmental sharing of data and information.

1) Issues

Data and information were owned by individuals in related activities and could not be effectively utilized by the organization. As a result, the activities were not efficient.

2) Measures

Complaint reporting data and other data that the Project started collecting were recorded in a cloud-based Google Sheet for inter-departmental sharing of information on the web. The Project then purchased a server and shared data and information within the server.

3) Results and lessons learned

Many data can now be shared among departments and individuals which has improved the operational efficiency. Complaint responses were also expedited, and their data could be shared.

(7) Monthly report preparation by the C/P was initiated, leading the C/P's ownership of project monitoring and management through the preparation of monthly reports.

1) Issues

The C/P and project output teams understood the project activities partially or individually; reporting of project activities to JICA was done by the Expert in Japanese. Therefore, the C/P did not understand the overall project activities.

2) Measures

For C/P's ownership of the project activities, the Expert proposed that the C/P prepare their own reports on the project contents on a regular basis and report to each other on a monthly basis, as the Expert believed it was important for the C/P to report to each other on a regular basis.

3) Results and lessons learned

Monthly reports have been prepared continuously by the C/P since January 2021, and the C/P now have a comprehensive understanding of their activities. In addition, the monthly reports submitted to JICA are accompanied by the monthly reports prepared by the C/P. By this, the C/P can understand the overall content of their activities and are now able to report to JICA without the Expert. **Monthly reports prepared by the C/P contributes to strengthening the C/P's ownership of the project management.**

(8) Project activities were carried out autonomously and continuously by national assistants even in the absence of the Expert during COVID-19 pandemic.

1) Issues

It was necessary to continue project activities and capacity-building activities even in the absence of the Expert during COVID-19 pandemic.

2) Measures

The Project employed assistants for NRW management, revenue collection management, and awareness-raising activities and a secretary. During the period before COVID-19 pandemic, the Expert had transferred skills related to project activities to these assistants as well as to the C/P. The Project was able to continue by the assistants in the absence of the Expert during COVID-19 pandemic.

3) Results and lessons learned

These assistants are very competent and have been implementing the project activities full time with the C/P, so a lot of knowledge has been transferred to these assistants. The assistant team continued to autonomously implement the project activities in collaboration with the C/P without interruption. To compensate for the activities in the absence of the Expert whose stay in Palestine was intermittent, **the assistants with sufficient capacity were hired and trained on-the-job to create autonomous collaboration between the assistants and the C/P.**

3.2 Addressing Technical Issues

(9) A simpler method than Step test for NRW detection is developed and appropriate time for ground microphone survey is set.

1) Issues

The step test is a survey method to narrow down the potential leakage area by constructing NRW block and measuring the amount of water flowing into the block at the time of minimum night flow. Jenin has an intermittent water supply system, and customers keep receiving water

even during the night. Therefore, it is difficult to determine the presence or absence of leakage by the step test. It is also impossible to check for leakage using a listening stick. In addition, the construction of NRW block and the night work of NRW survey require labors and costs. In addition, ground microphone survey was required to pinpoint the leakage point but a survey at night when street noise is minimum is not possible in Jenin due to security reason.

2) Measures

Instead of the step test, the stop-cock method was developed. All customer meter valves of the service pipes connected to the section of pipeline where leakage or illegal use of water is suspected are closed, and a listening stick is placed on service pipes to listen to the sound inside the pipeline. Since all customer meter valves are closed, there should not be any sound of water flow, but if any sound is heard, there is a possibility of leakage or illegal use of water in this pipe section. Then listen to all service pipes and narrow down the suspected area of leakage/illegal use. If necessary, use a leak detector (ground microphone) to further pinpoint the suspected location. Instead of working at night, the ground microphone survey was set at Friday early morning, when people's activities are not yet started in Palestine and the streets are quiet.

3) Results and lessons learned

The stop-cock method is a very simple and less costly NRW detection method. Currently, the C/P use this method most frequently to conduct NRW survey. This method was developed in the Project while conducting leakage surveys and is adapted to local conditions. Ground microphone survey was successfully done on Friday morning through which the C/P could pinpoint the leak location. **When the C/P are provided appropriate guidance by the Expert they can become more proficient in the techniques and can develop locally adapted methods of solution.**

(10) PPWM implementation was carried out with reduced risk through in-depth research, planning, and advance awareness campaigns. Even after the introduction, the customers were carefully handled.

1) Issues

It was anticipated that the introduction of prepaid water meters would face opposition from residents. If there was large opposition, the installed PPWM would have to be replaced with a post-paid meter again.

2) Measures

In order to reduce the risk of opposition from residents and to ensure the success of the PPWM installation, a detailed survey, planning, and public awareness campaign were conducted as described below.

1. Survey for the current status of existing water meter reading, billing, and collection systems
2. Case studies of other water service providers that have introduced PPWM
3. PPWM manufacturers and product surveys
4. Social survey on PPWM (pre-installation survey)

5. Feasibility study for introduction of PPWM (Evaluation of sustainability and preparation of strategies)
6. Preparation of PPWM implementation plan
7. Preparation of operation and maintenance plan
8. Selection of water meter type by experiment
9. Holding of stakeholder meetings
10. Improvement of water supply

During and after implementation, the following customer support was carried out.

11. Development of management system of PPWM
12. Increase of vending stations for customer convenience
13. Post-installation survey (satisfaction survey)
14. Continuous monitoring and maintenance of PPWM by Gateway
15. Improvement of complaint handling

3) Results and lessons learned

Most residents accepted the PPWM installation without any resistance, although a very small number of residents rejected PPWM. Satisfaction surveys showed over 90% satisfaction. **By anticipating risks in advance and preparing and implementing countermeasures, opposition to the introduction of PPWM could be avoided.**

(11) PPWM was introduced with less difficulty by referring to the examples, lessons learned, and recommendations of other water utilities that have already introduced PPWM.

1) Issues

As this was the first attempt to introduce PPWM in Jenin, the C/P and the Expert did not know how it should have been implemented.

2) Measures

Four other water supply providers that have already implemented PPWM were visited, their implementation procedures, challenges, and lessons learned were studied, and advice on how to implement PPWM in Jenin was obtained. The important advice obtained was that installation of PPWM should be aimed at improving water supply, not at increasing revenue collection. The results of the analysis were shared with the C/P in a workshop and strategies for PPWM implementation were discussed by all.

3) Results and lessons learned

The C/P seriously considered improving the water supply and implemented measures such as changing the control method of sluice valves, purchasing water from private wells, etc., to improve the water supply and introduce PPWM simultaneously. **When introducing new equipment, the experiences, lessons learned, and advice of water providers that have already introduced them should be utilized.**

(12) Based on the demonstration result of water meters at site, the best type of water meter for PPWM was selected.

1) Issues

The results of the existing water meter survey revealed that there were many problems with existing water meters. To solve those problems, the C/P and the Expert wanted to adopt an ultrasonic water meter, but there had been no actual introduction record of such a meter in Palestine.

2) Measures

Three types of water meters, including ultrasonic water meters, were actually installed in customers' houses for several months to compare and demonstrate the performance of the water meters.

3) Results and lessons learned

As a result of the experiment, the ultrasonic type was selected as the best water meter for PPWM in Palestinian conditions. Although this was the first introduction of ultrasonic meters as domestic water meters in Palestine, there were barely any complaints, failures, and other problems related to the functioning of meter after installation. **The demonstration experiment was effective for the first introduction.**

(13) Efficient monitoring of customer PPWM using digital solution (Gateway) to improve service.

1) Issues

To obtain PPWM data for each customer, it is necessary for the customer to charge the credit at vending station or for the WWD staff to visit the customer's meter with a mobile terminal. This data can be used to address PPWM problems of customers. However, the frequency of obtaining the data was very low, making customer service inadequate.

2) Measures

The PPWM already had a built-in communication device of LoRa Technology. A Gateway was installed to collect information and data and control PPWM remotely using this device.

3) Results and lessons learned

The PPWM can be controlled, and information can now be monitored remotely through the Gateway without much effort. The system has allowed the C/P to quickly identify PPWM problems remotely, which has contributed to improved customer service. **Customer service is improved through remote information gathering and control by utilizing digital solutions in PPWM.**

(14) Improved operational efficiency by utilizing digital solutions.

1) Issues

Paper-based procedures and manual data entry were time-consuming, especially for CSS, delaying many services and burdening staff with unclear procedures and workload.

2) Measures

The following digital solutions are implemented.

- Upgrade of the customer database management system (Al-Shamel software) including the server improvement and backup system

- Digitalization of water service applications via Document Management and Archiving System (DMAS software)
- Mobile water meter reading and billing (Mobile Billing System; MBS)
- Use of prepaid water meters and vending stations (Baylan Software)
- Digital monitoring of pre-paid water meters (BMS System; Gateway LoRa system)
- Automation of bill collection (Palpay System)
- Establishment of GIS-based customer database
- Digital processing of customer complaints (JM Website-based Customer Complaints and Online Chat)
- Use of SMS to remind customer for bill payment
- Use of Google Sheets for file sharing
- Digital archiving of paper customer service contracts and all their application documents (customer files)
- System integration of PPWM with Al-Shamel
- Updating GIS-based customer data and upgrading customer database system

3) Results and lessons learned

CSS' operational capacity was increased, allowing for activities that could not be done before or that needed to be done minimally; C/P's existing capacity was not underestimated but was leveraged into a digital solution based on what had been achieved over many years of experience. Jenin in general, and WWD/CSS in particular, has been open to embracing digital solutions and has overcome many challenges. **While there may still be challenges, the C/P have gained a lot of experience in implementing digital solutions and has acquired the potential to update such digital solutions in the future.**

(15) C/P's increased interaction with residents has led to improved customer service.

1) Issues

Public relations and interaction with residents were not very important to the C/P . Cooperation with the public relations (PR) department was almost non-existent. These factors contributed to residents' dissatisfaction with the services provided by the Municipality.

2) Measures

In order to increase opportunities for interaction with customers and improve services, WWD, together with the PR department of Jenin Municipality, actively conducted the following awareness activities prior to the introduction of PPWM.

- Meetings with community leaders to understand their opinion and to request for their cooperation.
- Meetings with the Ministry of Religion and Chamber of Commerce.
- Public meeting for PPWM introduction.
- Meeting with Refugee Camp Committee.
- Pre- installation door to door (DtD) visits for PPWM installation.

3) Results and lessons learned

Satisfaction surveys of customers with PPWM and water services after PPWM installation showed a high level of satisfaction. Both departments recognized the importance of face-to-face communication with customers; the door-to-door activity for the replacement with PPWM resulted in a successful collaboration between the two. Teamwork and cooperation play a major role in achieving success and goals. **Water service providers need to focus on PR activities and motivate their staff to recognize the importance of understanding customer feedback (both positive and negative) to provide good service and satisfy customers.**

(16) Clear work processes for key activities using business management support tools and equipment were stablished.

1) Issues

Due to the lack of clear work processes for conducting daily operations, staff members were constantly seeking direction from the department or section head. And the department or section heads were busy directing them.

2) Measures

The tools established clear work processes for key activities, utilizing effective work management support tools such as customer database, water maps, GIS, PPWM monitoring tool (Gateway), Google Sheet database, upgraded software, etc., as well as transportation measures (bikes and cars) and communication tools for implementation of customer service.

3) Results and lessons learned

The C/P have acquired the skills and knowledge to carry out activities according to the work process and, by using work management support tools, the C/P are now able to manage departmental operations in a more managerial role, without constant direction from the section or department head. **It is important to invest in work management support tools to streamline the processes and to enable staff to operate the Project with ownership and greater efficiency. The use of equipment is also important for capacity building.**

3.3 Measures and Effects for achieving SDGs

Measures for achieving SDGs goal 6 that were taken in the Project and their effects are explained below.

SDG 6 Clean Water and Sanitation ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL Target 6.1: SAFE AND AFFORDABLE DRINKING WATER By 2030, achieve universal and equitable access to safe and affordable drinking water for all. Target 6.4: INCREASE WATER-USE EFFICIENCY AND ENSURE FRESHWATER SUPPLIES By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

(1) Achieving of equitable water supply by introduction of PPWM

1) Measures

PPWM is introduced to Jenin Municipality, and so far one third of the existing customer meters have been replaced with PPWM.

2) Effects

After introduction of PPWM, customers' water consumption has leveled and become more equitable. While many customers used large amounts of water during post-paid metering, many others did not have enough and used only a little or no water at all. After switching from post-paid meters to PPWM, customers who used large amounts of water reduced their consumption, while customers who used minimal or no water increased their consumption. High water users' reduction in water consumption has been transferred to customers who previously did not have access to sufficient water. This demonstrates that PPWM plays a role in promoting equitable use of water.

The Municipality decided to introduce PPWM to the entire city and has prepared a plan for this, which indicates that equitable water supply will be expanded in the entire city and continued in the future.

(2) Increase water use efficiency by measures of NRW reduction

1) Measures

Many NRW reduction measures have been introduced to Jenin Municipality and adopted to selected pilot areas, and the staff members of WWD have been trained for NRW management.

2) Effects

After introduction of NRW reduction measures, NRW ratio of Jenin Municipality was reduced by 6% points from 60% to about 54%, which indicates that the water use efficiency has increased, and water loss has decreased.

The Municipality prepared NRW reduction rollout plan to the entire city. Based on the plan, NRW reduction activities will be implemented in the entire city starting from high priority areas, which will further reduce NRW. This indicates that the water use efficiency will further improve and continue improving in future.

CHAPTER 4 ACHIEVEMENT STATUS OF THE PROJECT

4.1 Status of Achievement based on PDM

This section is prepared based on the result of the terminal evaluation by updating the latest data and information.

4.1.1 Achievement Status of Outputs

(1) Output 1: Structure of NRW reduction activities and strengthening bill collection of Jenin Municipality is established.

No.	OVI	Achievement
1-1	Accurate NRW ratio is regularly measured and publicized.	Achieved
1-2	Persons in charge and their responsibilities for NRW reduction and bill collection are identified.	Achieved
1-3	Accurate water production is measured.	Achieved

1-1: Accurate NRW ratio is regularly measured and publicized.

The latest NRW ratio of entire city is 54.0% (Jun 2022). From February 2021, WWD has been issuing monthly report where NRW ratio of entire city and PAs are reported. Thus, OVI 1 has been achieved.

All water source volume of entire Jenin has been monitored since January 2018. Since then, NRW ratio has been monitored and recorded. During the lockdown due to COVID19 pandemic, meter reading of postpaid meters had to be stopped and the water was billed in estimate. Water consumption measurement of PPWMs had to be wait till Gateway systems were installed. The measurement and calculation procedure of monthly NRW has been established and CP are again measuring the monthly NRW since mid-2020.

1-2: Persons in charge and their responsibilities for NRW reduction and bill collection are identified.

At the inception stage, the baseline survey was conducted. The survey included interviews of managers and staff of WWD. At the time of baseline survey, WWD had 57 personnel, 28 personnel (without Director of WWD) were in charge of water section. In response to JICA experts' recommendation, Jenin Municipality recruited two (2) new engineers and six (6) new technicians for WWD in 2019.

- The results of baseline survey indicated that only four (4) personnel (director of WWD, heads of water sector, planning and studies, and wastewater) had written job descriptions.
- The project conducted capacity and skills assessment of staff, then established/developed job descriptions and workflow for WWD, the collection unit and financial department and other related departments of Jenin Municipality in relation with water services.
- Organizational reform plan for collection unit, financial department and WWD (customer service section) has been developed and discussed. New organizational structure for NRW reduction has been proposed to WWD (Figure 4-1). The structure needs to be approved by the Ministry of Local

Government (MoLG). Jenin Municipality has submitted it to MoLG and is waiting for approval.

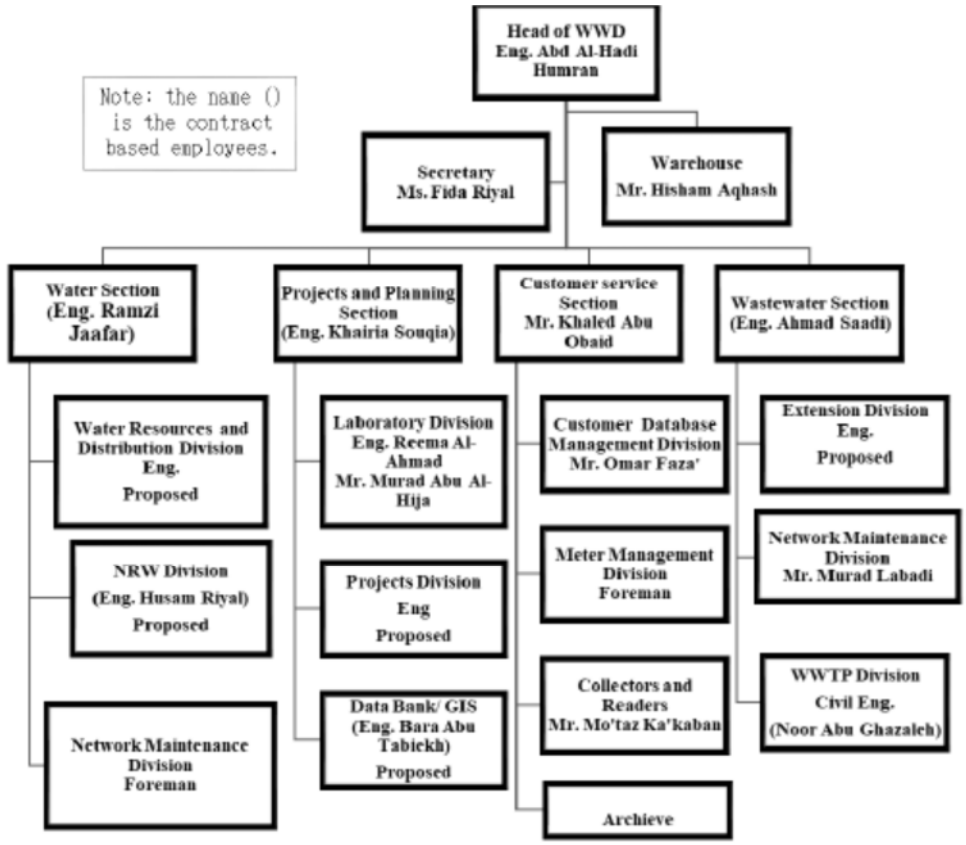


Figure 4-1 Proposed WWD organization chart

Regarding bill collection, three ways to collect bills have been set up and their responsibilities are as follows.

Means of Collection		Method
1) By MBS	When readers/collectors read the mechanical water meters, they also print the bill using the Mobile Billing System and deliver the bills. Many customers choose to pay to the collectors at the time of reading.	
	Person in charge:	12 readers/collectors (CSS)
	Supervisor:	Head of Collection Division (CSS) (Mr. Yaser Abu Saryeh)
	Manager:	Head of Customer Service Section (CSS) (Mr. Khaled Abu Obaid)
2) By Palpay system:	Customers pay their bills at Palpay vending stations which automatically transfers the collected bill to JM's bank account.	
	Person in charge:	Customer Database Management Division (CSS) (Mr. Omar Fazaa)
	Manager:	Head of Customer Service Section (CSS) Head of Financial Department
3) By PPWM	Customers purchase credits at vending stations and thus pay their bills in advance.	
	Person in charge:	Meter Management Division (CSS) (Mr. Shareef Zakarneh and Mr. Naseem Saaydeh)
	Manager:	Head of Customer Service Section (CSS) (Mr. Khaled Abu Obaid)

1-3: Accurate water production is measured.

Source meter reading of Jenin Municipality's own sources and private sources (wells) from which Jenin Municipality purchases water, has been carried out since Jan. 2018 on monthly basis. Source volume of the other sources, namely purchased from Mekorot and WBWD well is taken from the monthly invoice of those sources. They are combined and monthly volume of production is generated as a total water input, as shown in Figure 4-2. During implementation of the Project the number of private wells connected to municipality's network increased causing in an increase in monthly water input compared to the beginning of project. Checking of production (source) meters by portable ultrasonic flowmeter started as a regular activity. Any meter found to have error in excess of maximum permissible error (±5%) was replaced as soon as possible. When it is not possible to replace it immediately by any reason, the production volume was adjusted to account for the error.

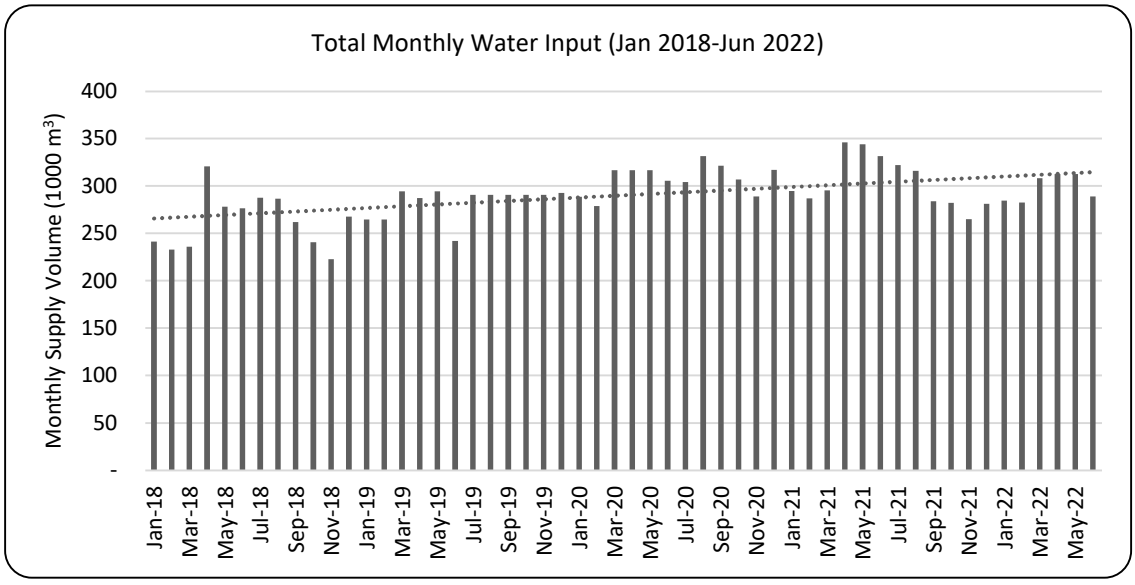


Figure 4-2 Total water input volume of Jan 2018 to Jun 2022

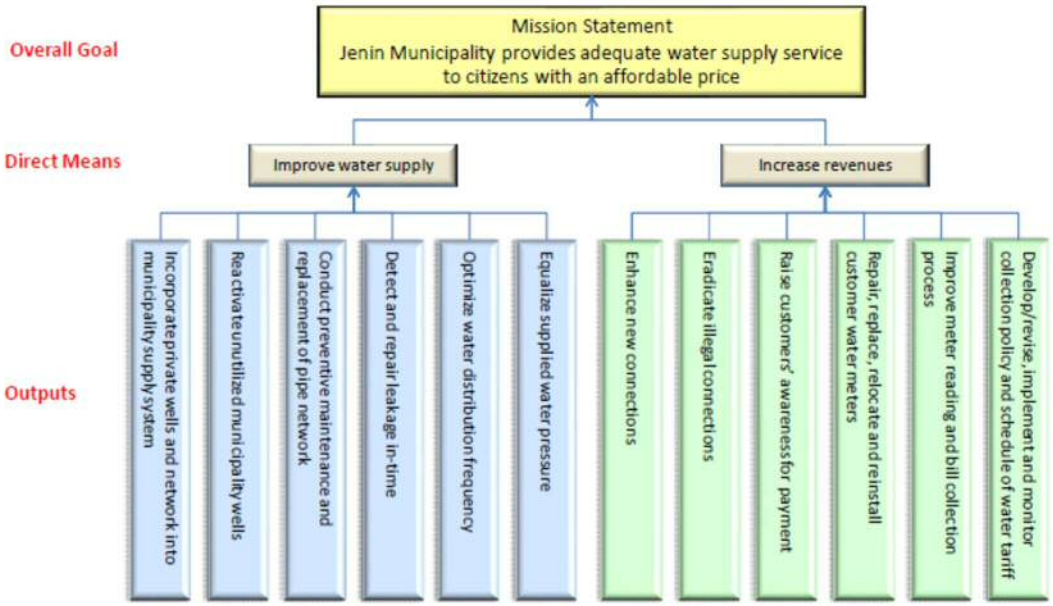
(2) Output 2: Capacity to formulate plan for water service management of Jenin Municipality is strengthened.

No.	OVI	Achievement
2-1	Business plan is submitted to the Jenin Municipal Council.	Achieved
2-2	Annual water service management plan and budget based on the plan are formulated.	Achieved
2-3	Proposal for the revisions of water tariff, and financial and accounting rules and regulations are formulated.	Achieved

2-1: Business plan is submitted to the Jenin Municipality Council.

Mid/long-term business plan (Water Service Management Plan 2018-2027 for Jenin Municipality) was developed in June 2018 and updated in March 2019 as the 2019 rolling, which was submitted to and approved by the Municipality Council in April 2019.

In WSMP, overall mission statement was set as "Jenin Municipality provides adequate water supply services to citizens with an affordable price." To achieve this goal, two direct means are established as "Improve water supply" and "Increase revenues." Under these direct means, 6 outputs each are developed as shown in the Figure 4-3.



Source: Water Service Management Plan (WSMP) 2018-2027

Figure 4-3 Strategy map of Jenin Municipality for managing water supply services

OJT has been provided to formulate District Service Improvement Plan of which development is mandatory in the mid/long-term business plan.

2-2: Annual water service management plan and budget based on the plan are formulated.

WSMP developed in 2-1 includes an annual rolling plan and budget till 2027. The plan was revised as necessary every year. Annual report in English and Arabic and its digest version for 2019, 2020, and 2021 were prepared and the digest versions are published on municipality's website.

2-3: Proposal for the revision of water tariff, and financial and accounting rules and regulations are formulated.

In WSMP, the revision of water tariff includes the tariff table proposed by the Water Service Regulatory Council and example of tariff revision which proposes lowering the block tariff to benefit small volume water users. It also suggests if the bill collection ratio becomes 100%, there is no need for tariff revision to balance the revenue and expenditure of the utility.

Regarding the proposals for revision of financial and accounting rules and regulations, following notable activities were implemented.

1) Revision draft of water tariff was developed and included in the mid/long-term business plan.

2) Performance evaluation system has been proposed based on the developed job descriptions.
3) Motivation allowance scheme for meter readers and collectors was developed and its implementation started from Feb. 2019.
4) Revision draft of current customer subscription contract and subscription contract for PPWM customers were developed and finalized by Legal Unit.
5) Various modifications of current financial software (Al-Shamel) were proposed and implemented (both in software and hardware), to obtain necessary accounting/billing outputs and to accelerate the speed of processing.
6) Consultation was provided to integrate the accounting items into Ministry of Local Government (MoLG)'s budget management system.
7) Accounting policy and schedule were developed to shift the current cash-based accounting to the accrual method of accounting and were approved by the Municipality Council in Oct. 2019.

(3) Output 3: NRW reduction capacity of Jenin Municipality is strengthened.

No.	OVI	Achievement
3-1	NRW ratio in Pilot Areas are lowered by 12% points compared with the Baseline.	Achieved
3-2	Leak detection activities are carried out regularly.	Achieved
3-3	Cost-effective NRW reduction activities are carried out.	Achieved

3-1: NRW ratios in Pilot Areas are lowered by 12% points compared with the Baseline.

NRW baseline and ratio in PAs are given in Table 4-1. On average, the NRW ratio in PAs have been lowered by 14.6% compared to the baseline when considered the minimum achieved, and by 13.3% when considered the latest available month. This OVI is achieved.

Table 4-1 NRW baseline and ratio in pilot areas

Area	NRW ratio % (baseline)	Lowest NRW ratio achieved so far %	Decrease from baseline	Latest NRW ratio achieved%			Decrease from baseline in Jun 2022
				Apr 2022	May 2022	Jun 2022	
PA 1	57 (Oct. - Dec.2018)	40.6 (Mar~May 2020)	-16.4	44.0	41.3	41.1	-15.9
PA 2	44 (Nov. 2019) 66.1*(Apr, June, July 2021)	53.9 (Apr 2022)	-12.2	53.9	57.3	56.2	-9.9
PA 3	55.2 (Oct 2019)	40.1 (Oct 2021)	-15.1	47.6	45.3	41.0	-14.2
Simple Av. of three PAs	59.4	44.9	-14.6	48.5	48.0	46.1	-13.3
Entire city	60 (NRW of 2018)	54.0 (Jun 2022)	-4.6	55.4	56.2	54.0	-6

*As explained in 2.2.1 (Output 1) 1-4, the NRW baseline of PA2 has been amended to 66.1%.

3-2: Leak detection activities are carried out regularly.

On the Job Trainings (OJT) on leak detection were carried out in Aug-Nov. 2018 in PA1 and PA2. Leak detection activities have been done in all PAs and still ongoing except the period of around April 2020. During this time, the activities had to be slowed down due to the Covid-19 restriction of visiting customer homes. Still WWD continued leak detection and repair works on main road or less populated area.

At the beginning of the Project, there was only one CP (director of WWD) who had responsibility on NRW reduction in the job descriptions. Leak detections were carried out only when the leakages were reported. In 2019, Jenin Municipality recruited 8 new counterparts (2 engineers and 6 technicians), much of skills and technologies of NRW reduction including leak detection activities are transferred to those new staff as well. According to the experts' monthly report in mid. 2020, CPs skills to find leakages have been improved very much. The number of repaired points by month (Figure 4-4) and the average response time (Figure 4-5) are shown in the figures below. The figures show that more leakages were found and repaired, and the average response time was shortened from 3 days in around Nov. 2018 to 1 or less than 1 day by July 2022, indicating active leakage activities, improved skills and well-organized leakage repair responses.

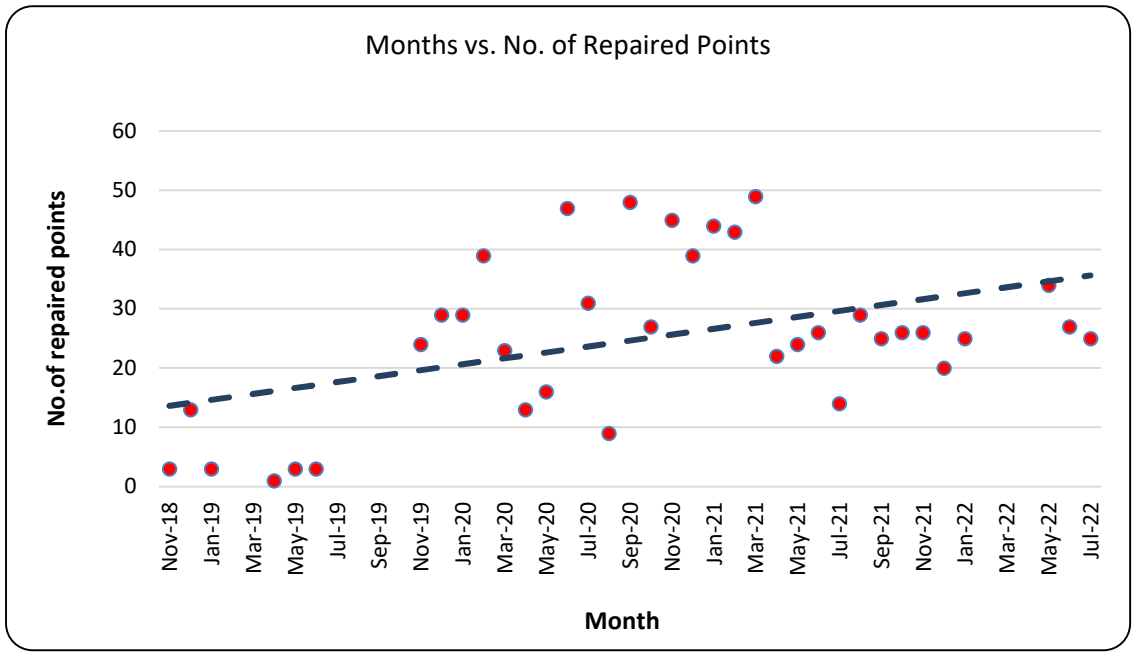


Figure 4-4 Number of leak repairs per month (Nov 2018-Jul 2022)

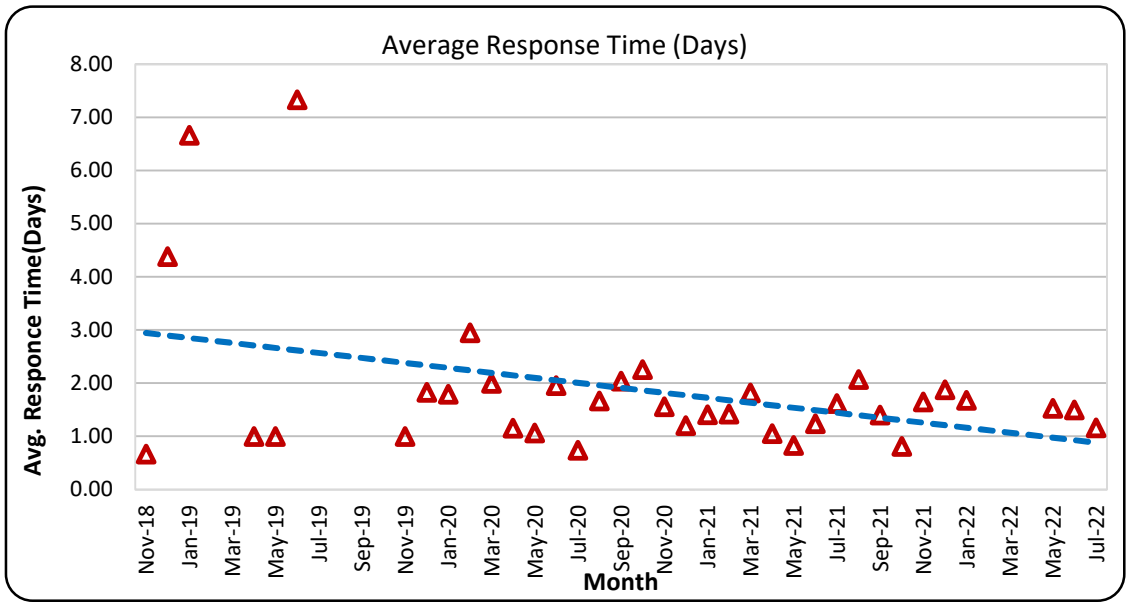


Figure 4-5 Average response time to leaks (days)

3-3: Cost-effective NRW reduction activities are carried out.

Detailed cost benefit analysis of NRW activities in PA1 was prepared (Annex 1.2) which showed the implemented NRW reduction activities are very cost effective. WWD implemented similar activities in PA3 which is proved very cost-effective by a brief analysis done for this PA (included as a section of the above-mentioned report). WWD is implementing the cost effective NRW activities in PA2 as well.

Below are some cost-effective countermeasures for NRW reduction in Jenin in the order of decreasing cost-effectiveness considering the current level of NRW in Jenin (more than 50%):

- Conducting daily patrolling for finding surface leakage and quickly repairing,
- Implementing measures against illegal connections by regularly analyzing customer consumption data and checking customer meters which show zero-consumption,
- Checking accuracy of and replacing inaccurate source meters,
- Conducting combined stop-cock method and sounding survey in suspicious blocks/branches,
- Replacing defective customer meters,
- Pressure management,
- Conducting conventional leak detection survey using acoustic system and timely repair, and
- Replacing leak-prone water network.

The combined stop-cock method and sounding survey in suspicious blocks/branches, which has been developed in the Project, is found to be easier to implement and much cost-effective than conventional leak detection survey in Jenin.

(4) Output 4: Direction for improvements of bill collection of Jenin Municipality is presented.

No.	OVI	Achievement
4-1	Bill collection ratios in Pilot Areas are increased by 35% points compared with the Baseline after installation of prepaid water meter.	Almost achieved although it has ups and downs.
4-2	Compiled case studies of customer meter replacement are presented.	Achieved

4-1: Bill collection ratio in Pilot Areas is increased by 35% points compared with the Baseline.

The table below presents the collection ratios in PAs in comparison with the baseline target ratio and shows that the target is almost met and this OVI is almost achieved. When considered the latest available month (July 2022), the average bill collection ratio in PAs increased by 32.9%. When considered the highest achieved collection ratio of 88.5%, the average bill collection ratio in PAs increased by 40.0%.

Table 4-2 Comparison of (without debt) bill collection ratios of PAs

Area	Baseline	Highest collection ratio achieved so far %	Increase point	May 2022	Jun 2022	Jul 2022	Average increase in Jul 2022	Target
PA1	60.8	99.6 Jul-21	38.8	94.1	84.5	91.5	30.7	Average 35% increase in total
PA2	36.8	67.7 Sep-21	30.9	56.7	64.1	65.2	28.4	
PA2 without camp	48	76.0 Mar-2022		65.2	72.3	70.2		
PA2 without Camp and Institution		99.7 May-22		99.7	91.2	89.1		
PA3	48	98.3 May-22	50.3	90.8	84.1	87.6	39.6	
PA average	48.5	88.5	40.0	80.5	77.6	81.4	32.9	
Increase points		40.0	40.0	32	29	32.9		

* Overall average is used for baseline bill collection of PA2.

PPWM collection ratio is 100% but there are still customers who have not installed PPWM such as government institution, refugee camp and rejecting customers.

Activities to improve the collection ratios:

1) Installation of PPWMs in the PAs include the municipality employees and institutions, and also customers who rejected to install earlier. The rejecting customers were initially 69, then increased to 130 by August 2021, however the number decreased to 94 as of Oct 2021 as result of the re-visit activity of CSS and installation of PPWM for some of the rejecting customers.

PA2 has refugee camp (New Camp) and many government institutions. The bill from the government institutions consists 50% of water bills in PA2. From the interview to PWA, the payment of the bills

owed by ministries and other institutions of Palestinian Authority can be processed and paid by Jenin Municipality submitting the list to PWA/Jerusalem Water Works. For the installation of PPWMs in New Camp, Jenin Municipality decided it to be on voluntary bases. But initial discussion of introduction was done to the representatives of the New Camp.

Bill collection ratios according to increase of PPWM installed are shown in Figure 2-31 to Figure 2-33, and present the positive connection of increase in installation of PPWM and improvement in the collection ratio in each PA.

2) In addition to the installation of PPWMs, WWD implemented following measures to enhance bill collections:

a) door to door visits for debt collection by using soft approach,
b) keep up customer satisfaction and resolve complaints in timely manner with 24/7 for complaint calls
c) customer database cleanup,
d) introduction of mobile meter reading and billing system (MBS),
e) meter reading of all mechanical water meters,
f) zero-meter readings and replacements of non-functional meters,
g) examination of illegal connections,
h) introduction of electric payment system (Palpay system),
i) sending reminder SMS for bill payment and debt,
j) introduction of motivation schemes for the meter readers,
k) extensive PR activities and use of social media, signboards and billboards, promotional movies, poster, and giveaway promotional PR materials such as calendar.

Further, following organizational changes were implemented.

a) Meter readers and collectors reallocated to cover reading of all of the city's mechanical meters on monthly basis. of all meter readings,
b) Bill collection unit has been moved from the municipality building to WWD building,
c) The mechanical meters with zero reading records in Al-Shamel were investigated outside PAs and replaced them if they were broken or damaged,
d) Jenin Municipality added one water sources in PA2 and one source in PA3 which increased water flow. The combination of PPWMs introductions, increasing water supply, and customer service and bill collection activities contributed to the increase of bill collection ratio,
e) Job descriptions (JD), workflow and motivation allowance system were developed.

4-2: Compiled case studies of customer meter replacement are presented.

As mentioned in section 4-9, case studies of customer meter replacement are compiled in reports and presented in JCC and 3 annual seminars.

(5) Output 5: Project outputs and knowledge are shared among other water service providers.

No.	OVI	Achievement
5-1	Manuals produced by the Project are distributed to other water service providers.	Achieved.

As mentioned in section 5-1 and 5-2, manuals, guidelines, reports and plans are prepared in the Project and distributed to other water service providers in USB memory. Project outputs and knowledge are also shared among other water service providers in 3 annual seminars.

4.1.2 Achievement Status of Project Purpose

Jenin Municipality's water service management capacity is strengthened.

No.	Indicators	Achievement
1	Jenin Municipality's NRW ratio at the Endline is reduced by 3% points compared with the Baseline.	Achieved
2	Water service hours at the Pilot Areas are extended.	Achieved
3	Bill collection ratio is increased by 9% points compared with the Baseline.	Almost achieved

OVI 1 : Jenin Municipality's NRW ratio at the End-line is reduced by 3% points compared with the Baseline.

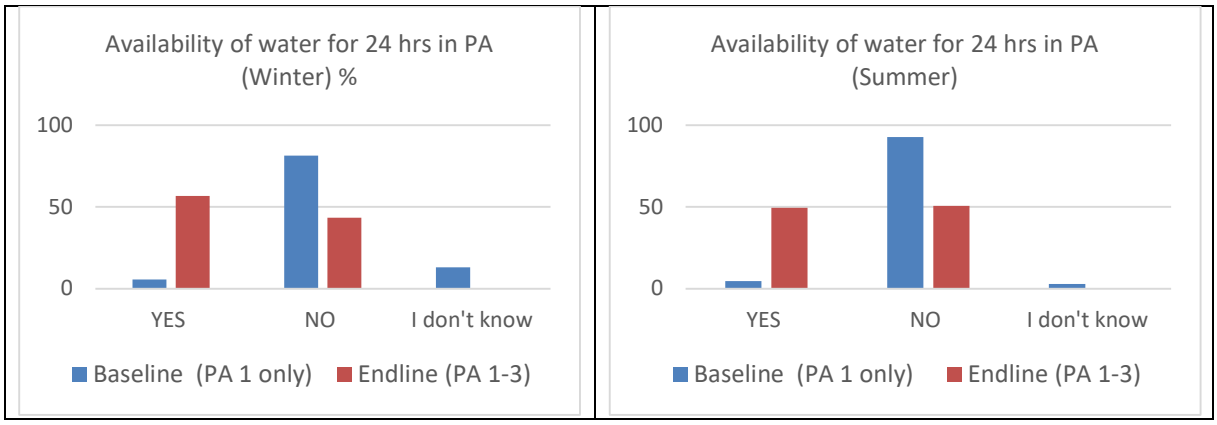
In May 2021, the NRW ratio decreased to 42.2% while it was 58.1% a month before. This decrease was temporarily caused by full readings of entire city customers in May 2021 (about 2,000 meters were not read regularly until April 2021). The ratio bounced back again to 57.5% in June 2021. But the ratio is stabilizing and as shown in Table 2-18, the latest measured NRW ratio of Jenin for Jun. 2022 became 54.0%. Compared to the baseline value of 60%, this is a decrease of 6.0%. Thus, this OVI is achieved.

OVI 2: Water service hours at the Pilot Areas are extended.

The comparison of customer responses between baseline and endline studies about the availability of water indicated the overall improvement of water supply hours both in PAs and citywide. Although the responses do not indicate the service hours, clearly the percentage of customers who feel more water is available have increased compared with baseline. Thus, this OVI is achieved.

Response to the questions: Do you have access to municipality water everyday?

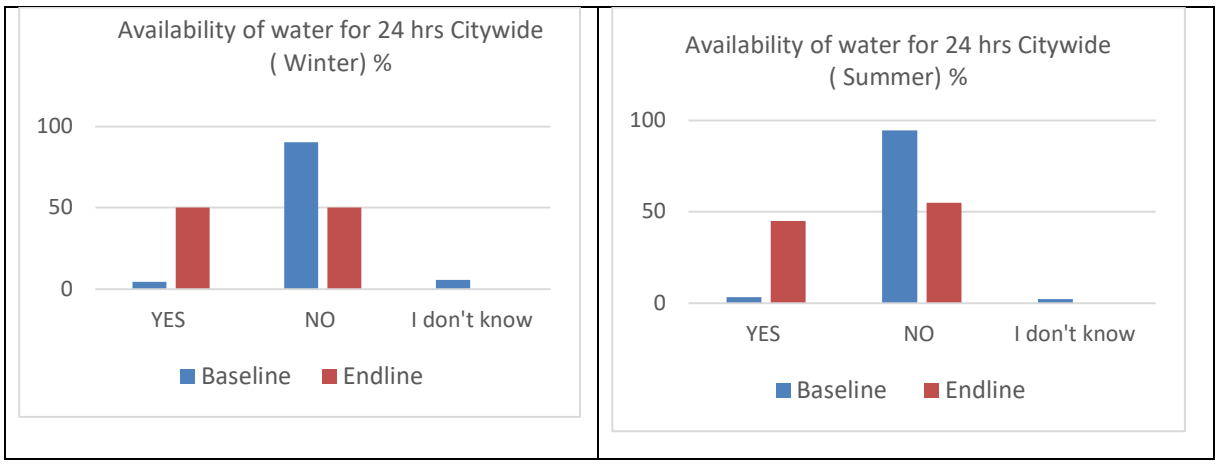
1. Pilot Areas



(Source: Baseline and endline studies)

Figure 4-6 Availability of water for 24 hr. in PAs

2. City wide



(Source: Baseline and endline studies)

Figure 4-7 Availability of water for 24 hr. citywide

The number of people who need to buy water from outside of Jenin Municipality has also decreased.

- In PAs, 50% of people stated that they needed to buy water from the venders in the baseline. In the endline, 39.8% of people said so.
- Citywide, 61.5% of people stated that they needed to buy water from the venders in the baseline. In the endline, 50% of people said so.

The situation of supply in three PAs is summarized in Table 4-3.

Table 4-3 Supply duration in PAs before and after the Project

S.N.	Area/ sub-area	Supply duration (hrs/week)		Remarks
		Before the Project	Now (as of Dec. 2021)	
1	PA1			
1.1	24-hr area	168	168	
1.2	Sabah Al Khir	36	48	
1.2	Kharoubeh	36	48	
1.4	Nazareth Street	60	72	
2	PA2			
2.1	New camp	12	24	

S.N.	Area/ sub-area	Supply duration (hrs/week)		Remarks
		Before the Project	Now (as of Dec. 2021)	
2.2	Al Zahara	24	168	2 days high pressure (additional supply from Al Jabriyat reservoir), rest moderate pressure from Turkman well
3	PA3			
3.1	All area of PA3	24	168	

OVI 3: Bill collection ratio is increased by 9% points compared with the baseline.

The table below presents the collection ratio in all city, in comparison with the baseline target ratio and shows that the target is almost met and this OVI is almost achieved. The bill collection ratio for current month bills (without debt) was 41% in 2018- as the baseline measure. The collection ratio achieved was 53.8 % in October 2021, however dropped to 49.6 % in May 2022, 45.5 % in June 2022, and 49% in July 2022. When considered the latest available month (July 2022), the bill collection ratio in all city increased by 7.8% points. When considered the highest achieved collection ratio, the ratio increased by 12.6% points.

Table 4-4 Comparison of (without debt) bill collection ratio for the entire city

Area	Baseline	Highest collection ratio achieved so far %	Increase point	May 2022	Jun 2022	Jul 2022	Average increase in Jul 2022	Target
Entire city	41.2	53.80 (Oct 21)	12.6	49.6	45.5	49	7.8	50.2% (9 points)

The reason of the drop in recent months is mostly due to the impact of Covid-19 and economic situation, also the on-going delays in delivery of the JICA's additionally procured PPWMs and thus the pause in replacement of the post-pay meters with PPWMs. As shown in Figure 4-8, the trend of bill collection ratio increased as the number of PPWM installation increased. Jenin Municipality should continue to install PPWMs and thus improve the collection ratio.

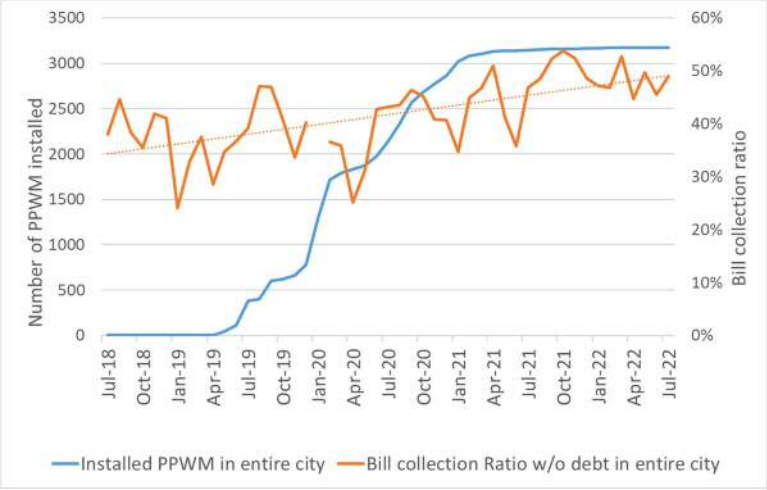


Figure 4-8 Increasing trend in collection ratio since installation of PPWM

4.1.3 Achievement Prospect of Overall Goal

Jenin Municipality's water service is improved.

No.	Indicators	Achievement
1	Average hours of water supply of Jenin Municipality is extended compared with the Baseline.	Achieved. Will likely continue improving further.
2	Cost-effective NRW reduction activities are continued to be carried out.	Achieved. Will likely continue improving further.
3	Replacement of customer meters are continued.	Achieved. Waiting PPWM delivery.

OVI1: Average hours of water supply of Jenin Municipality is extended compared with the Baseline.

This OVI has already been achieved but there is always scope for improvement until all areas get 24-hr continuous supply. Two anticipated following projects by JICA and Agence Française de Développement (AFD) to support increasing the water supply for Jenin will be implemented in the next few years.

a. Connection Point Project

Connection Points Ramallah and Jenin Water Supply Project (Connection Points Project) was initially funded by United States Agency for International Development (USAID)[1] but currently refinanced by AFD. The project of Jenin aims to extend 25 km transmission lines and 16 km distribution lines, construction of regional reservoir and 3 booster stations, from the Mekorot water (900 m^3/hr.) to Jenin and surrounding Jenin North-West Village.

b. JICA Grant Aid project

JICA's Grant Aid project, "Improvement of water supply in Jenin Municipality" is aiming at (i) replacing and upgrading the portions of existing water transmission and distribution facilities to reduce water leakage and optimize water pressure, (ii) rehabilitating the existing water intake facilities to increase water production capacity, and (iii) constructing new distribution networks to increase the rate of population served. Through these interventions, the Project will improve the water supply services.

If those projects are completed, the water supply of Jenin Municipality will improve to a high level and supply hours will be increased dramatically.

OVI2: Cost-effective NRW reduction activities are continued to be carried out.

Cost-benefit analysis of NRW reduction activities in PA1 and PA3 was completed in Nov. 2021 which showed that the NRW activities conducted in these PAs were highly cost-effective. WWD is

[1] Initially the project was called Jenin Bulk Water System project in 2018. The design firm was contracted and 30% of design had been completed. The new project is based on the existing design, financed by AFD.

implementing similar cost effective NRW activities in PA2 as well. It is expected that WWD will continue such cost-effective NRW reduction activities in future.

OVI3: Replacement of customer meters are continued.

As of October 2021, a total of 737, 538, 533, and 3,208 PPWMs have been installed in PA1, PA2 (without new camp), PA3, and All City, respectively. The installation will continue as planned when the PPWMs are delivered.

4.2 Self-Evaluation from 6 Evaluation Perspectives

This section is prepared based on the result of the terminal evaluation by updating the latest data and information.

4.2.1 Evaluation perspectives

The project is evaluated in five scales: high, moderately high, medium, moderately low and low in following perspectives.

Relevance	Examines the extent to which the Project activity is suited to the priorities of donor and counterpart country. • Does the goal of the Project meet the needs of beneficiaries? • Is the Project approach appropriate for solutions of problems and challenges? • Are the Project activities consistent with the policies of counterpart country?
Coherence	• Consistency with the development cooperation policies of the Government of Japan and JICA • Collaboration with other projects and support within JICA (synergistic effects / synergies) • Cooperation with other domestic and foreign organizations, cooperation with international frameworks, etc.
Effectiveness	Measures the extent to which a program or a project attains its objectives and benefits the target society and the beneficiaries.
Efficiency	Measures the outputs in relation to the inputs to determine whether the aid uses the least costly resources possible to achieve the desired results.
Impact	Examines positive and negative changes as a result of the Project. This includes direct and indirect effects and expected and unexpected effects.
Sustainability	Sustainability relates to whether the benefits of the Project are likely to continue after the closure of the Project.

4.2.2 Relevance

Relevance is considered as high with the following reasons.

(1) Responding to the water needs of Jenin Municipality

In the detailed planning survey, the key challenges that Jenin Municipality was facing in water services are: 1. acute water shortage due to limited water sources and by high NRW ratio (60%, baseline 2018); 2. low water bill collection ratio (41%, baseline 2018) due to the lack of trust on Jenin Municipality /WWD on water service delivery; 3. Lack of budget and personnel for the water services, the low bill collection ratio as one of the factors. To respond to these challenges, the Project focused on the reduction

of NRW and increase in bill collections through the introduction of PPWMs and NRW reduction activities. The results of endline survey shows that the respondents in PAs and city wide recognized the increase water supply since the Project started. The installations of PPWMs in PAs increased the bill collection ratios, achieving or almost achieving the targeted ratio in PAs and citywide. The responses of the questionnaire to CPs and experts also indicate that 14 out of 15 respondents think that the achievement of project purpose responds to the needs of Jenin's water services. With these reasons, the Project can be said that it is responding to the water needs of Jenin Municipality.

(2) Appropriateness of target organizations and beneficiaries

Jenin was selected based on the results of capacity assessments conducted in 11 Palestinian water service providers and in consultation with PWA during the detailed planning survey. Among 11 providers, Jenin had the highest NRW ratio (50%, 2015[2]) and the very low bill collection ratio (58%, 2015). This was the reason why Jenin city was selected as the target city of the Project and this selection is considered as appropriate.

4.2.3 Coherence

Coherence is considered as high with the following reasons.

(1) Coherence with Japan's aid policy

One of the main pillars of Japan's assistance strategy to Palestine is contributing to the stability and improvement of Palestinians' lives from the point of human security. Infrastructure of water and waste water is considered very important infrastructure which can contribute to increasing human security of Palestine. The same strategy also indicates that the low collection levels of public services' fees such as water is challenge for quality and efficiency of public services thus negatively affecting financial status of municipalities. Japan will support Palestinian for more independent, efficient and financially sustainable public services. The project addresses these two points by improving municipality's water services through improving bill collection ratio and NRW reduction. Therefore, the Project is as coherent with Japan's assistance policy to Palestine.

(2) Coherence with Palestine's development policy

In the Strategic Development Plan (2017-2022) of Palestine, the priority goal of water services is to improve the quality and reliability of water supply services as well as ensure fair water distribution. In terms of financial arrangements, the priority goal is to ensure the financial sustainability of water utilities and water service providers. The project focused on increasing water supply and reliable services while reforming organizational structure of WWD and related department of Jenin Municipality. Thus the Project is in line with Palestine's priority goal of water services.

[2] the detailed planning survey report 2015

4.2.4 Effectiveness

Effectiveness is considered as high with the following reasons.

(1) Achievement of project purpose

At the moment of terminal evaluation, all of the OVIs of Outputs and Project purpose have been achieved or likely to be achieved. Project's Outputs: NRW reduction, organizational reform, and increasing bill collection ratio all contributed for achieving the project purpose of improving the capacity of WWD to manage water services in Jenin.

(2) External and hampering factor

Spread of COVID 19 pandemic worldwide is the most serious external factor which hampered achieving project purpose. The pandemic affected the Project mainly in two ways:

- Traveling of experts to Jenin had to be stopped. The experts cannot be on site to transfer their skills and knowledge which was the core part of technical cooperation project; the activities are largely done via online and through the assistant of local project staff.
- Jenin Municipality and WWD had to stop the project activities for a few months due to the restriction of movements. Door to door activities such as meter readings and leak detections of service connections had to be stopped. Also the municipality was operating in 30% capacity, focusing on essential issues only. The water bill collection (post-paid) went down as water users in Jenin were affected economically by losing employments or unpaid salary, this negatively affected the financial situation of WWD.

(3) Strong ownership of CPs as contributing factor

Jenin Municipality and WWD had strong ownership of the Project. This was confirmed by CPs and experts through the interviews and questionnaires. It is worth noting that the top management of Jenin Municipality strongly supported the Project. The Mayor attended the by-monthly meetings whenever possible and aware of the progress of the Project. Similarly, PWA was involved in monitoring of the progress. Contribution by Jenin Municipality in terms of the amount of input shows the municipality's strong commitments: new staff were recruited, Jenin Municipality procured additional PPWMs and other equipment such as mobile billing system (MBS) to enhance meter readings and bill collections by own fund, municipality's top management and municipality's councilors participated in the public meetings and door to door customer service activities. These all contributed to the achievement of the Project.

4.2.5 Efficiency

Efficiency is considered as high with the following reasons.

Regarding the input from Japan and Palestine, both CPs and experts evaluated that they were appropriate

for achieving the project purpose. COVID 19 pandemic disrupted the dispatch of JICA experts from March 2020 to October 2021, and February to April 2022. Experts and CPs regularly communicate via online. It is worth noting that without local project staff, the continuation of project activities may have had more challenge.

There were additional inputs by Japanese and Palestinian sides which were not originally planned. Those outputs contributed for achieving project outputs and some will contribute for sustainability of project activities.

(1) Input by Japan

In overall, CPs and experts evaluated positively about the inputs from Japan (experts, equipment/tools, and training in Japan.)

- Most of the respondents to questionnaires (CPs and experts) evaluated that dispatch timing, expertise and length of stay of JICA experts as very good or appropriate.
- Most of the respondents to questionnaires (CPs and experts) evaluated that the timing of input, quality and quantity of equipment and tools from JICA as very good or appropriate.
- Regarding the evaluation of trainings in Japan, the responses varied but the majority of them evaluated as appropriate with the contents and number of participants to the trainings.

Japanese inputs of equipment and tools to support WWD during COVID 19 pandemic includes additional PPWMs, vehicles for customer service activities, pipes and fittings, chlorine, and chlorine dosing pumps and barrel pump. Those inputs aimed at promoting sustainability of project activities and assistance for WWD during COVID 19. Additional inputs of PPWMs, which is now stopped at the custom of Israel, and their fittings will increase the number of customers with PPWMs in Jenin, thus will contribute for achieving the overall goal of the Project. Similarly, additional pipes and fittings will be used for the reduction of leakages thus lowering NRW ratio in Jenin.

(2) Input by Palestine/Jenin

In overall, CPs and experts evaluated positively about the inputs from Palestinian side. Jenin Municipality recruited additional staff for WWD who gained knowledge and skills from the experts. Additional personnel also made it possible to conduct NRW reductions in PAs and various customer service activities. WWD now has NRW reduction team and customer service team with dedicated personnel for PPWMs and post-paid water meters. Without these additional staff, the project activities might have struggled with achieving targets as the number of existing staff were not enough to cover all the activities.

Input by Jenin Municipality which were not originally planned had contributed to the success of achieving target. Especially inputs in customer services section such as introduction of electric payment system, additional vending machines for PPWMs and purchase of mobile billing system made the meter

readers and bill collection activities more efficient, in return increasing bill collections and revenues.

- Majority of respondents (CPs and experts) answered that expertise, timing of dispatch and number of CPs are very good or appropriate in relation to achieving the project purpose.
- Many respondents (CPs and experts) answered that timing and amount of budget from Jenin Municipality is appropriate, some considered as very good while others said more or less or not at all.

(3) Effect from the other projects

There was collaboration with Nexus project by AFD by frequently sharing information on Jenin Municipality for integration work. In addition, the project team worked with JSC-Jenin water provider, which introduced PPWMs first in the country and has much experience in PPWM and NRW activities. The project and Jenin Municipality learned a lot from this provider. When two new projects: JICA's grant aid project; and Connection Point project are completed, the water supply in Jenin Municipality will be expected to improve dramatically.

4.2.6 Impact

Impact is considered as high with the following reasons.

(1) Likelihood of achieving overall goal

The Overall goal of the Project is that Jenin Municipality's water service is improved. OVIs of the Overall goal is likely to be achieved within a few years after the completion of project with some continuation and additional efforts made by WWD/Jenin Municipality. The reasons are as follows:

- Average hours of water supply in Jenin Municipality will likely increase with anticipated JICA's grants aid project and Connection Point project. These projects are not related with the achievement of this project. For the sake of monitoring of this project's effects, WWD is advised to continue monitoring water in-flows and measuring the NRW ratio so as to understand the increase of water supply is caused by the project activity or non-project activities.
- Jenin Municipality is committed to continue replacing customer meters by PPWMs in the entire city. This will bring additional revenue to Jenin Municipality/WWD as the bill collection ratio will be increased.
- If WWD continues NRW reduction activities after the Project, based on the compiled cost-benefit analysis of NRW activities, this OVI will be achieved. However, to expand NRW reduction activities to achieve more challenging target of NRW reduction, Jenin Municipality is advised to increase the number of staff at WWD.

(2) Effect of project to other areas

One of the key comments from the interviews of CPs was that they would like to share their

achievements of the Project with other water service providers and municipalities. This can be done through sharing the number of manuals developed by the Project. (ex. PPWM case study). Some CPs indicated that they have received calls and inquiries from the neighboring water service providers on how to reduce NRW or other activities. The Water Service Management Plan (WSMP) for Jenin Municipality caters for Jenin Municipality, nevertheless the plan touches many common issues that other water service providers are also facing in Palestine. The analysis and recommendations of WSMP can be a good example for other water service providers who are facing similar challenges like Jenin Municipality.

(3) Consideration towards social cases

Social cases are referred as needs for consideration for the vulnerable group such as economically disadvantaged families, elderly or people with refugee status. During the preparation of PPWM introduction, the Project studied how the social cases were treated by other water service providers who installed PPWMs. Lessons learnt from those examples were taken into consideration.

Refugee camp in Jenin (New camp) has the lowest bill collection ratio in Jenin (12%, baseline study) but Jenin Municipality decided not to mandate the installation of PPWMs in the camp. The decision seems to be made due to the political reasons. Nevertheless, it is advisable that WWD measures the water consumption of camp area so that the accurate NRW ratio can be measured.

Proposed water tariff revision in WSMP includes the consideration for disadvantaged groups or social cases. WWD assisted by the experts is developing water tariff which reduces the base fee but the price will incrementally increase so that the small volume water users can benefit from the tariff revision.

From March 2020 to date, due to the COVID 19, many families were economically affected such as loss of employments or unpaid salaries. WWD took these cases. When they were requested, they opened PPWMs so the families who were facing difficulty could get water and delay the payment. They had cases of elderly customer where charging of PPWMs was difficult, WWD reversed PPWM to postpaid service in such cases. Consideration of social cases are included in the activities of the Project.

4.2.7 Sustainability

Sustainability is considered as moderately high with the following reasons.

(1) Sustainability in Policy

In the questionnaires, all of CPs and experts responded that current water policy and strategy of Jenin Municipality will continue after the completion of the Project; one of the respondents was the Mayor of Jenin. Jenin Municipality Council already approved the replacements of PPWMs in the entire city and the adoption of WSMP 2018-2027 formulated by the Project. Therefore, Jenin' strategy and policy on water services which were introduced by the Project will continue.

(2) Financial sustainability

Many questionnaire respondents (CPs and experts) are not so sure that Jenin Municipality will have enough budget to support the continuation of project activities. The responses to the question of "if Jenin Municipality will have enough financial resources to continue or expand the project activities after the completion of project", the majority's responses are more or less (9 out of 12). This may be because of not so positive view on financial status of Jenin Municipality among the respondents.

At the beginning of PPWM installation, the Project presented Jenin Municipality a financial model of PPWMs installation by using half or full revenue from the PPWMs (water bill collected) to reinvest for the purchasing of additional PPWMs. Fortunately, additional 7900 PPWMs have been already committed by Jenin Municipality and JICA (as additional input for the COVID 19 assistance). When all of the PPWMs are installed, this will account 82% of all the customers in Jenin Municipality. The water revenue is expected to increase, and this revenue should be allocated for other water service-related activities so that water services operation in Jenin Municipality can be self-sustainable.

In WSMP 2018-2027, the revenue and expenditure prediction was analyzed and presented. According to the prediction, with 65% bill collection ratio and 10% debt collection ratio, the revenue will start covering the expenditure in year 2023. This is in existing tariff structure. Since this prediction was before COVID 19, the situation at the moment may differ. However, the bill collection ratio will surely be increased as the number of customers with PPWM increases.

In the Project, existing Al-Shamel financial software was modified for the customer service. This had increased efficiency of accounting and billing system. Jenin Municipality Council approved shifting current cash-based accounting system to the accrual methods of accounting system, recommendation by JICA team as well as MoLG. This shift will provide more accurate picture of cash flow of WWD. This process is still ongoing and will continue after the Project.

(3) Sustainability of human resources

For the sustainability of human resources to continue project activities, some of the respondents (CPs and exerts) are more optimistic that Jenin Municipality/WWD will have enough human resources to continue or expand the project activities after the completion of the Project: 9 responded as "Very much" or "Likely", while 3 said "More or Less" and another 3 said "Not really" or "Not at All".

In 2019, additional two engineers and six technicians were recruited, and they were trained by JICA experts. Continuation of their employment will be critical to sustain the project activities. For further expansion of activities at a faster pace WWD may need to increase the staff number.

In their interviews, some CPs and experts said additional staff are needed for NRW Section and Customer Services Section. Continuation and expansion of installation of PPWMs will require additional staff, especially in Customer Service Section. The proposed organizational chart of WWD is

already submitted by Jenin Municipality to MoLG for the approval. When the chart is approved, Jenin Municipality will be able to increase more staff in WWD.

(4) Sustainability of skills and knowledge

From the responses of questionnaires, all of CPs and experts are confident that WWD will continue using skills, standards and systems developed by the Project. (All of 15 responded "yes.") Many experts evaluated that CPs now have enough skills and techniques to conduct NRW reduction and customer service activities. This is not limited to specific skills, managerial skills were also improved. The mayor as well as other CPs and experts observed the changes in how the daily tasks were done in WWD. Staff now work according to the work plan, previously they were given instructions each day at the meeting. In the field work, decisions on dealing with situation is made in the field, and the results are reported. Engineers and technicians are confident to make necessary decisions. Staff now know how to act or react themselves to solve problems without arguing how to and what to do or waiting the instructions.

The introduction and enhancement of automated system for the customer service such as the Al-Shamel customer service database, the Online Customer Complaint system (Via the municipality's website), and the DMAS system for automated water service application will be continuously used as those systems increased efficiency in the daily work of customer service personnel. They also have enhanced skills in measuring collection ratios in monthly basis since 2017 and for different categories i.e for PPWM and non-PPWM customers as for 'with debt', without debt', 'and only debt'. This helps them in evaluating and making decisions for collection improvement.

(5) Contract and maintenance of tools and vehicles.

Some of the systems such as Al-Shamel and Gateway require the annual subscriptions. Jenin Municipality/WWD should include those subscription fees into the budget every year. Vehicles and backhoe provided by JICA have been maintained by Mechanical Section of Jenin Municipality. The services are outsourced to the specialized companies.

4.2.8 Conclusion

The project achievements and implementation processes have been confirmed and the evaluation was made by using JICA's evaluation criteria.

- Relevance is high as the Project responds to the needs of water services of Jenin Municipality. Jenin Municipality is the appropriate target city in Palestine for the project as they had serious challenges of providing quality water services.
- Coherence is high as the Project is in line with Japan's assistance policy and PWA's water strategy.
- Effectiveness is high. The project purpose was achieved in the Project as all of OVIs have already been achieved or almost achieved. COVID−19 pandemic was the major hampering and external factor. Contributing factor was the strong ownership by Jenin Municipality/CPs

- The project impact is high. Most of the overall goal have been almost achieved. The increase of water supply has occurred by reducing NRW and purchasing private well water which is injected into existing network. In addition, more increase is expected by anticipated grant aid project by Japan and Connection Point project. It is advisable that WWD monitors regularly water flows and measures NRW ratio to understand whether the increase in water supply is caused by project activity or other (those aids) activities. The introduction of PPWMs took serious consideration of social cases so that the socially vulnerable groups will not be negatively affected by the introduction of PPWMs.

Sustainability is moderately high. Jenin Municipality will continue policies and directions of installation of PPWMs and other activities to increase water supply in Jenin city. The financial continuity does not earn high expectation among CPs and experts. But they all believe skills and technologies acquired from the Project will continue to be used.

CHAPTER 5 RECOMMENDATIONS TO ACHIEVE OVERALL GOAL

5.1 General Recommendations

1. Continuation of employment for newly recruited counterparts

Since project started, Jenin Municipality recruited additional 8 employees in WWD. These personnel along with other CPs received technical trainings and OJTs from the experts. For instance, managers in charge of NRW reduction and main staff of Customer Service Section are all newly employed CPs. Without them, the activities may not be continued. Since current employment status of these new staff is temporary which will not provide good job securities to them, it is recommended that Jenin Municipality consider offering more stable contracts to those staff who were trained by the Project so to keep the activities continue. The managements of Jenin Municipality already indicated that Jenin Municipality plans to continue employing those staff. This is an encouragement. It is also advised that PWA and MoLG provide their support for Jenin Municipality's efforts to confirm the employment contracts. This is important not only for the continuation of the project activities, but also to support implementation of anticipated JICA's grant aid project "Improvement of water supply in Jenin Municipality".

2. Sharing the skills and knowledge gained

The objective of JICA's technical cooperation project is to transfer the knowledge and skills from JICA experts to the CP to achieve the project purpose set in the Project. It is important that the knowledge and skills transferred to the CP do not belong to the individuals, but it is transferred to other members of WWD/Jenin Municipality. When the number of the CP with knowledge and skills increases, it will lift up the organizational capacity, thus WWD can provide better services to the water user. Therefore, it is recommended to those who acquired knowledge and skills from the trainings or OJT in the Project to be conscious about transferring their knowledge and skills to his/her colleagues. It is also important to note that the organization has enough number of staff so that this transfer of skills and knowledge will be more effective.

3. Sharing the success of project to other water service providers

Many CPs expressed the importance of sharing the success of the Project to other water service providers so that others can replicate the success experienced in Jenin. One good example of success was the process and activities applied for the introduction of PPWMs. In the Project, PPWMs were introduced based on the detailed studies and lessons from the introductions of PPWMs by other municipalities. In that sense, the PPWM report provides good case studies to other water service providers who are considering or planning the introduction of PPWMs. Other manuals developed by the Project can also be shared with other water service providers.

4. Continue producing and sharing monthly reports and weekly meeting

WWD started preparing monthly report with performance indicators in February 2021. This is a good

practice and it should be continued after the Project. Therefore, it is recommended WWD to submit the monthly report to Jenin Municipality every month so that the improvement of the operation can be shared among the stakeholders. For this purpose, it is recommended the preparation of the monthly report be compulsory to submit it to the manager or mayor in Jenin Municipality as a rule of municipality.

Weekly meeting or periodical meeting shall be continued for sharing information and data with managers and staff members, and management based on PDCA (Plan-Do-Check-Action) cycle shall be implemented.

5.2 Increase in average hours of water supply of Jenin Municipality

1. Establishment of DMA in the rest of area and implementation of NRW reduction rollout plan

Establishment of DMA will improve water supply management in both water supply hours and NRW. Implementation of NRW reduction rollout plan will reduce leakage and increase water supply volume for actual consumption of the residents. These two measures will further extend average hours of water supply in Jenin.

2. Purchase of private well water for additional water sources

Purchase of private well water and injection to municipality network will increase water supply hours. However, injection pumps of private well water usually have a very high head, which increases leakage. Therefore, appropriate pump head shall be selected when private well water is purchased.

5.3 Continuation of implementation of cost-effective NRW reduction activities

1. Implementation of Cost-effective NRW reduction activities

The countermeasures of NRW in the order of decreasing cost-effectiveness listed below should be implemented according to NRW reduction rollout plan to the entire city.

(1) Conducting daily patrolling for finding surface leakage and quickly repairing,
(2) Implementing measures against illegal connections by regularly analyzing customer consumption data and checking customer meters which show zero-consumption,
(3) Checking accuracy of and replacing defective source meters,
(4) Conducting combined stop-cock method and sounding survey in suspicious blocks/branches and repairing leaks quickly,
(5) Testing customer meters and replacing defective customer meters,
(6) Pressure management,
(7) Leak detection survey using conventional acoustic system and timely repair, and
(8) Replacing leak-prone/worn out water network and facilities.

2. Continuation of NRW monitoring and reduction activities

When two project, JICA's grant aid project and Connection Point project are completed, the water

supply volume of Jenin is expected to increase. However, it is important for WWD to continue NRW reduction activities even though the water supply is increased. The reduction in NRW not only increases available water supply but also increases the revenue from water. It is recommended that WWD continues measuring accurate NRW ratio and implementing NRW reduction activities.

5.4 Continuation of replacement of customer meters

1. Implementation of replacement plan of PPWM to the entire city

Jenin Municipality already committed to continue the installations of PPWMs to the entire city. As observed from the increase in bill collection ratio at PAs, PPWMs can increase bill collection ratio, thus can bring much needed revenue to Jenin Municipality/WWD. JICA is assisting in procurement of 4,350 PPWM and Jenin Municipality is also procuring additional PPWMs by its own fund. It was planned that the procured 4,350 PPWMs would arrive in Jenin in July 2021. However, they were stopped at the Israeli custom. Finally, they were released from the custom and delivered to Jenin Municipality in the early September 2022. Immediately after delivery of PPWMs to Jenin, it is recommended that the PPWM replacement should be implemented as per the prepared replacement plan of PPWM to the entire city. The process of PPWM replacement has been prepared in the Project, WWD needs need to follow this.

2. Soft approach of PPWM installation

It is acknowledged that Customer Service Section of WWD and Public Relations Department in Jenin Municipality main office gained skills and know-how on how to approach, sensitize and convince customers for the installations of PPWMs. Therefore, WWD/Jenin Municipality is encouraged to continue expanding installations of PPWMs by using soft approach so that it can be implemented successfully and bring more revenue to the water services.

3. Maintenance of PPWM

The warranty of the 1850 PPWMs initially procured by JICA expired in January 2022. Jenin Municipality is considering continuing warranty or additional maintenance contract with the same supplier. It is recommended that Jenin Municipality/WWD establish PPWMs maintenance system including workshop or make additional maintenance contract with the supplier for ensuring sustainability of PPWM system as soon as possible.

4. Maintenance of the customer database

It is recommended that WWD continues maintaining the customer database on PPWM system, Al-Shamel System and the GIS database. It is necessary to update the database on a timely basis as the number of PPWM customers increase. Some of the database and automated systems require annual subscriptions. Jenin Municipality/WWD is recommended to include those subscriptions into the operational budget of WWD.

5. Consideration given to social cases/disadvantaged group

Although PPWMs can increase the bill collection ratio to WWD, consideration should be given to the social cases such as economically disadvantaged group among water users. It is understood that water charge of customers identified as socially vulnerable cases should be taken care by the Ministry of Social Affairs while Jenin Municipality provides the list of such cases to them. The rules and responsibilities for the payment of water charge of social cases needs to be clarified so that appropriate actions can be taken by Jenin Municipality. A new tariff is being prepared by the WSRC which will hopefully consider the needs of disadvantaged groups.

5.5 Other measures to improve revenue collection and financial sustainability

1. Debt collection

Unpaid water bill (debt) is especially high in governmental institutions. For instance, in PA2, the highest debtors are government institutions. Through the Project, customer services section has been conducting door to door visits for debt payment. Combined with PPWMs installations, debt payment has been increasing among individual customers. For the institutional customers with high debt, the mechanism to pay-off debt (by subtracting debts by Jenin Municipality to West Bank Water Department) has already been established. It is encouraged that Jenin Municipality continues pursuing the payment of debt by government institutions with support provided by PWA.

2. Financial independence of WWD

The operation and maintenance cost recovery efficiency is one of the indicators for assessing the health of water operation. The indicator measures water bills actually collected as percent of the cost of operation and maintenance in water supply services. The ratio above 1 is considered as healthy meaning that the cost of O&M is recovered with the water bills collected.[3] For WWD to have sustainable water service operation, it is crucial that WWD's financial account be established, and its revenue and expenditure are monitored. Therefore, it is recommended that establishment and continuous monitoring of finance of WWD as independent from the other accounts of Jenin Municipality be carried out.

The Project recommended Jenin Municipality to shift their accounting system from the current cash-based system to the accrual methods of accounting system. The recommendation was already approved by the Jenin Municipality Council. However, the transition process has not been completed. Therefore, it is recommended that the shift of accounting system be completed sooner.

[3] This does not include large infrastructure investments.