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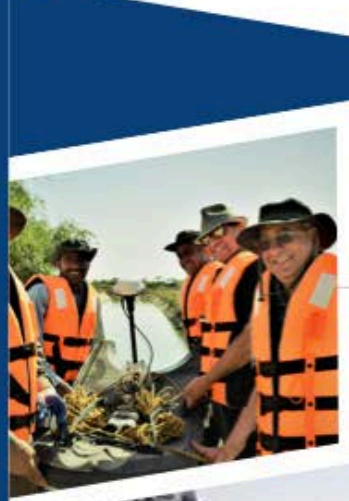
Innovative Interventions for Sustainable Water Management

in Jordan



Innovative Interventions for Sustainable Water Management

in Jordan

By USAID Water Management Initiative (WMI)

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This report was prepared by:
Tetra Tech
159 Bank Street, Suite 300
Burlington, Vermont 05401 USA
Telephone: (802) 658-0282
Fax: (802) 658-4247
E-Mail: international.development@tetratech.com

Tetra Tech Contacts:
José Valdez, Chief of Party, jose.valdeznovillo@tetratech.com
David Favazza, Project Manager, david.favazza@tetratech.com

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ACRONYMS

ACWUA Arab Countries Water Utilities Association
AWC Aqaba Water Company
BPR Business Process Re-engineering
CIS Customer Information System
CRR Cost Recovery Ratio
EBS E-Business Suite
ERP Enterprise Resource Planning
FA Fixed Asset
GIS Geographic Information System
GIZ Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German Development Agency)
GOJ Government of Jordan
HR Human Resources
ICTU Information and Communication Technology Unit
IMF International Monetary Fund
IT Information Technology
GOJ Government of Jordan
JSMC Jordan Social Marketing Center
JSMO Jordan Standards and Metrology Organization
JV Jordan Valley
JVA Jordan Valley Authority
KAC King Abdullah Canal
KPI Key Performance Indicator
M&E Monitoring and Evaluation
MCC Millennium Challenge Corporation
MPWH Ministry of Public Works and Housing
MWI Ministry of Water and Irrigation
NGWA Northern Governorates Water Administration
NRW Non-Revenue Water
O&M Operation and Maintenance
PMU Performance Management Unit (formerly Program Management Unit)
RFP Request for Proposals
ROU Regional Operating Unit
SCADA Supervisory Control and Data Acquisition System
USAID United States Agency for International Development
W4LS Water for Life Solutions
WAJ Water Authority of Jordan
WHO World Health Organization
WMI Water Management Initiative
WSP Water Safety Plan
WUA Water User Association
YWC Yarmouk Water Company

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FOREWORD

The present publication compiles innovative activities that WMI has been developing over the past three years. This is the product of close collaboration with our counterparts at the Ministry of Water and Irrigation (MWI), Water Authority of Jordan (WAJ), Jordan Valley Authority (JVA), Miyahuna, Yarmouk Water Company (YWC) and Aqaba Water. Credit for these innovations is given equally to the staff of WMI and to our counterparts.

Most of what is being presented here is a work in progress, and due to piloting new ideas, the outcomes are sometimes uncertain. Thus, the purpose of this publication is not to present final results and celebrate achievements, but rather to shed light on what is being pursued and on the significance of the proposed activities with the potential for replication and final impact. Implementing these initiatives will certainly bring about some positive results, and eventually, concrete impact and potential for scaling up.

We at WMI and our counterparts are actively engaged in out-of-the-box thinking, analyzing day-to-day problems and looking for alternative solutions that have never yet been examined in Jordan or, to the best of our knowledge, in other countries. Most of the new ideas presented here have passed the theoretical tests and are currently in the piloting phase and in the process of assessing their financial and technical sustainability.

Amongst the most relevant contributions we would like to highlight are the following:

- With the introduction of advanced technologies to simulate continuous supply testing in pilot areas in Amman, Irbid and Karak, we are exploring new ways to reduce NRW without the need for any significant, additional water to enhance water leak detection and pressure management.

- With the creation of the Ma'ana program, Miyahuna will be able to give advice to its customers on advanced water-saving devices, thus reducing inefficiency and water loss in household premises with significant impact on water savings.

- With the introduction of advanced technologies such as the use of smart metering, remote sensing and water tanker tracking systems, WAJ will be able to reduce illegal abstraction of underground water, thus generating significant additional revenues for the sector.

- The new institutional system and technological improvements will contribute to more accurate measurement and exact water distribution to farmers, which will help create a more advanced and fairer system in the Jordan Valley.

- The adoption of the Enterprise Resource Planning (ERP) system in all utilities and the integration of a centralized IT system under WAJ will expand the use of technologies in management, thereby enhancing the exchange of accurate information and monitoring the sector performance in real time.

- The introduction of new approaches through decentralized management at Yarmouk Water Company (YWC) and Miyahuna will allow for more effective and balanced control of operations and customer service functions, thus contributing to solving the problems of integrated NRW management systems.

- The Internship Program in utilities that WAJ, MWI, and WMI have launched is an attempt to bring young talent to the sector. The sector benefits from their great potential and energy while offering them the opportunity to enter the labor market in Jordan.

WMI is committed to a five-year plan for the implementation of these innovations and ultimately providing the sector with transformational and sustainable changes.

We thank the MWI, WAJ, JVA and the water utilities for allowing us to work with their talented professionals to produce this publication.

José A. Valdez
Chief of Party

George Rizkallah
Deputy Chief of Party

Amman, July 2019

INTRODUCTION

The Water Management Initiative (WMI) is a five-year funded initiative implemented by Tetra Tech. The purpose of the project is to support the Government of Jordan (GOJ) to achieve measurable improvement and greater sustainability in the water sector by providing technical assistance to maintain the GOJ's reform momentum, to enhance policy development and implementation, and to support capacity-building efforts.

WMI's reporting period extends from April 2016 to April 2021 with total funding amounting to 29.5 million US dollars, in addition to 5 million US dollars allocated for equipment. Tetra Tech is implementing WMI in close collaboration with two Jordanian Subcontractors: Orient Engineering Consultancy and Design and the Jordan Social Marketing Center (JSMC). It also works closely with SEGURA Consulting and Water for Life Solutions (W4LS), two international organizations with strong ties to Jordan.

WMI's 43 long-term technical assistants are supported by 14 short-term technical assistants, in addition to the interns who enroll in WMI's internship program for on-the-job training for a period of six to twelve months.

WMI works in close collaboration with the Government of Jordan (GOJ) through the Ministry of Water and Irrigation (MWI), the Water Authority of Jordan (WAJ), the Jordan Valley Authority (JVA), water utilities including Miyahuna, Yarmouk Water Company (YWC), Aqaba Water, Water User Associations (WUA), and civil society organizations. WMI also collaborates with other Jordanian ministries, agencies, and municipal authorities, as well as other bilateral and multi-lateral donor programs.

ACKNOWLEDGMENT

The successful completion of this endeavor would not have been possible without the support of His Excellency Raed Abu Al-S'oud, Minister of Water and Irrigation. Special thanks go to Their Excellencies at the Ministry of Water and Irrigation:

Secretary General, Ali Subah.

WAJ Secretary General, Iyad Dahiyat.

JVA Secretary General, Ali Al-Kouz and their teams.

Special thanks and appreciation go to the Water Utilities CEOs and their teams, for their superb cooperation, in particular:

Ghazi Khalil, CEO of Miyahuna.

Khalid Obaidyn, CEO of Aqaba Water.

Nabil Zoubi, CEO of Yarmouk Water Company.

WMI's team would like to express their sincere gratitude for the following Assistant Secretary Generals for their valuable contributions:

ASG for Financial and Administrative –Affairs - MWI, Ahmed Azzam;

ASG for Financial and Administrative Affairs - WAJ, Majed Al-Qtaishat;

ASG Communication – MWI, Adnan Al-Zoubi;

ASG Labs – WAJ, Ahmad Ulimat;

ASG for Strategic Planning – JVA, Khalil Absi; and

ASG for Northern and Middle Jordan Valley - JVA, Ghassan Obidat. .

Special thanks go to MWI Project Manager, Rana Al-Bashtawi.

As any success can never be achieved by a single effort, all staff members of WMI enumerated below are gratefully acknowledged for their valuable contributions:

Jose Valdez, Chief of Party

George Rizkallah, Deputy Chief of Party

Satany Qandour, Director of Finance and Administration

Maram Barqawi, Senior Performance, Monitoring, Evaluation, and Learning Specialist

Shadia Nassar, Youth, Gender, and Vulnerable Population Specialist

Imad Zureikat, Senior Water Utility Expert

Saddam Khleifat, Water Technology and Engineering Team Lead

Tamer Al-Assad, Water Sector Governance Advisor

Sofian Qurashi, Project Communication Specialist

Ahmed Harb, Utility Commercialization and Finance Specialist

Naem Saleh, Utility Management Specialist

Mohammad Malkawi, Utility Management Specialist

Khalid Sewiti, Utility Commercialization and Finance Specialist

Maha Al-Tarawneh, Water Resources Data, IKMS, and GIs Expert

Eman Al-Hamdan, Senior Water and Wastewater Engineer

Mohammad Mufarih, Water Engineer

Maha Dergham, Behavior Change Specialist

Mohammad Shaaban, Irrigation Management Specialist

Qais Owais, Institutional Irrigation Specialist

Bashar Kawaleet, Information and Communication Technology Unit Expert

Mahmoud Al-Alawneh, Junior Irrigation Engineer

Helena Hlavaty, Research, Monitoring, and Evaluation Coordinator

Rasha Al-Bireh, Procurement and Subcontractor Manager

Duha Al-Khrisat, Procurement and Subcontractor Specialist

Ala'a Hanafiah, IT Manager

Abdullah Al-Azzam, Accountant

Iyad Al-Qassir, Utility Commercialization and Finance Specialist

Ahmad Al-Awamleh, Utility Operations Assistant

Malek Al-Taani, Utility Management Assistant

Mohammad Malkawi, Utility Management Specialist

Eyad Sahawneh, Maintenance Management Assistant

Ahmad Abu Hijleh, Groundwater Management and Wastewater Reuse Specialist

Noor Esoh, Water Demand Management Specialist

Saqer Al-Salem, Wastewater Processes, Biosolids, and Reuse Expert

Hiba Al-Omari, Administrative Assistant

Mai Dahshan, Administrative Assistant

Dina Abida, Project Coordinator

Nisrine Kawasmi, Human Resources and Administration Manager

Khalid Abu Kaff, Driver/Logistician

Ayman Al-Suht, Senior Driver/Expeditor

Zaid Al-Dahleh, Driver

MANAGEMENT

Enterprise Resource Planning System Implementation and Operation at Yarmouk Water Company

Ahmad Harb, Utility Commercialization and Finance Specialist, WMI
Bashar Kawaleet, Information and Communication Technology Unit Expert, WMI
Mahmoud Al-Zoubi, IT Manager, YWC

A State-of-the-Art ERP

Nowadays YWC is enjoying the most comprehensive management system in Jordan's entire water sector. The installation of the up-to-date version of Oracle's Enterprise Resource Planning (ERP) solution at YWC is complete. Between April, 2017 and June, 2018, a local developer supervised the replacement of the older version of Oracle (EBS 11i), which had been in place since 2006, with the latest version (R12).

In the process, the business cycles of the ERP's nine sub-modules, including financial management, procurement, and human resources activities, were reengineered. The 22 officers in charge of these activities thoroughly examined the reengineered cycles prior to releasing them to YWC end users. Up to 276 personnel were subsequently trained in sessions lasting for 24 days in Irbid.

The ERP system is divided into 3 main functions:

- Financials: (1) General Ledger, (2) Accounts Payable, (3) Accounts Receivable, (4) Fixed Assets, (5) Cash Management.
- Procurement: (6) Purchasing and (7) Inventory.
- Human resources: (8) Core Human.

Achievements

- Procure-to-Pay cycle is fully automated. Each step of this cycle is approved by the authorized staff online through the ERP system.
- All the 18 warehouses are connected to the centralized system and data on quantity and cost is kept updated.
- Water distribution and wastewater collection as well as tanker revenue transactions are being posted automatically to the Accounts Receivable Module of the ERP system.
- The Cash Management Module is importing the transactions from the bank account on a weekly basis. Bank reconciliation is then processed in an automated way.
- All related modules of the ERP are transferring data to the General Ledger Module for the first time since the older version was launched in 2006 (the date of NGWA).
- As of July 2018, the employee payroll has been generated by the ERP with %100 accuracy.

Financial Solutions

- Developing new scalable Chart of Accounts (CoA) and Cost Centers (CC).
- Recoding the inventory items, starting building up a fixed asset register, and re-structuring the natural accounts.
- Activating the cash management module, thus automating bank reconciliations.
- Changing the inventory calculation method from periodic to perpetual.
- Building an approved hierarchy for the procurement activities.
- Fixing the recurring formulas and master data of the HR and payroll modules.

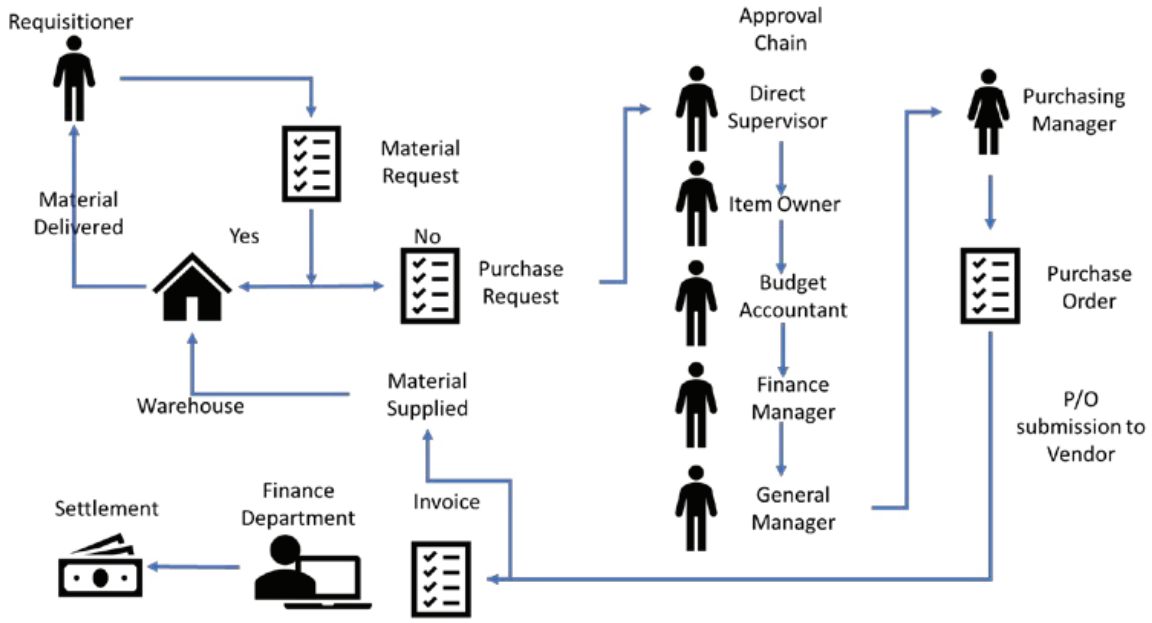


Figure 1: ERP process from the requisitioner to the purchase order

Business Solutions

- Integrating the accounts receivable module of the finance department with the cash desk software of the customer service department.
- Activating the regional financial and procurement process as well as the HR branch activities by the application of the ERP system for the first time since 2006.

Training, Staffing and Support

- Around 300 staff members participated in ERP training courses.
- WMI keeps providing user support for YWC personnel for all modules.
- WMI appointed an application manager to maintain the Oracle ERP system and finalize the year-end closing of 2018.
- Two consultants have been contracted by WMI to help the application manager in verifying the 2018 input data and producing accurate reports for stakeholders.
- YWC will help in establishing a Support Solution Center (SSC) to take over the responsibilities of managing this system.

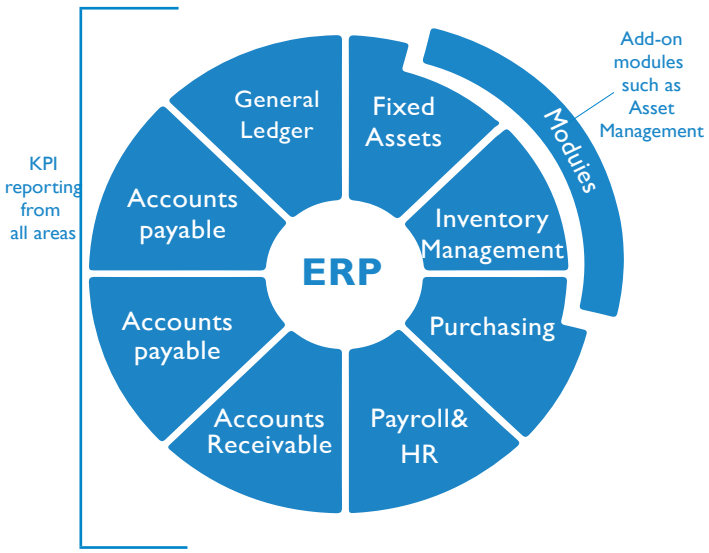


Figure 2: ERP covering various modules

Who Is Using ERP?

WMI has trained 20 key users from every YWC department.

However, the company still needs qualified super users. YWC lacks users of this category for many reasons, most notably because it has hardly recruited any specialists to perform these tasks since 2006.

To ensure that the system continues to function properly and

to prevent any future hindrance, YWC will have to hire an ERP specialist to work alongside the IT department at the company. In the coming months, WMI will offer an intensive training course for the staff members to enable them to reach the desired level of system management and maintenance. Once trained, the staff members will provide technical assistance to all operating departments within the utility.

Although ERP is being maintained primarily by staff at headquarters, it is also being used by staff at each Regional Operating Unit (ROU). The staff at ROU are required to post the transactions they make to the system in order to get feedback from headquarters staff on their inputs. This mechanism keeps the ROU staff aware of their performance and the output of their work at any given time.

Head Office:	**263**
Irbid Governorate:	**173**
Irbid Qasabah	77
Ar-Ramtha	23
Bani Obeid	24
Bani Kinanah	15
North Shuna	16
Al-Kourah	18
Mafraq Governorate:	**57**
Mafraq	35
The Northern Badia	22
Jerash Governorate:	**40**
Jerash	40
Ajloun Governorate:	**24**
Ajloun	24
Total	**557**

Figure 3: Linkages among HQ and ROUs

Data-Driven Decisions

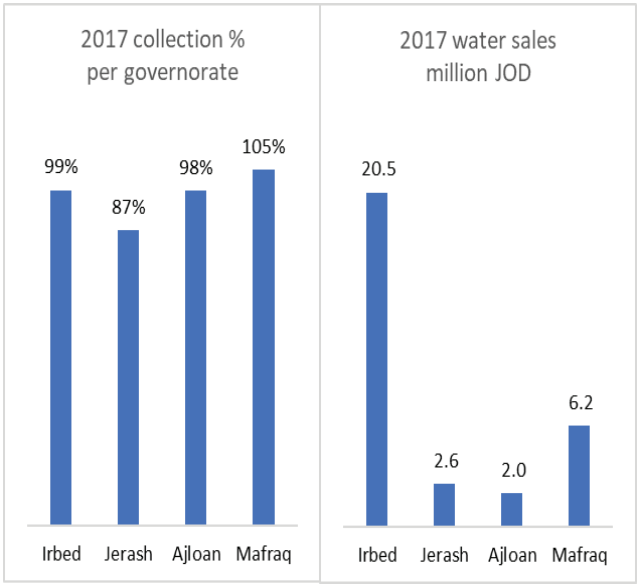
Business Intelligence (BI) applications are essential to optimizing corporate profits and performance. The most valuable BI systems pull data from across the enterprise and present information to users in a meaningful way to improve the decision-making process. A successful utility needs to augment revenues and increase profitability while effectively managing costs. Accessing and understanding BI can improve YWC's ability to manage costs and grow margins.

However, to be able to provide answers to critical business questions, BI must be complete, current and adequate. Most organizations struggle to access and extract the right data from multiple systems and to offer audience the necessary insight they need at the right time. The upcoming ERP Business Intelligence module will collect and analyze data from various systems, though. In light of that, reports will be produced in dashboard forms for users. As a result, this real-time reporting facility will enable YWC to reach peak performance at any time.

The Impacts Achieved

Major Characteristics of ERP system implementation:

- Enhancing financial functions.
- Control measures.
- Transparency.
- Accuracy.
- Modernity.
- Expandability.
- Decision-making.
- Integration.
- Unification.
- Real time.
- Reducing duplicate screens.
- Redesigning entire workflow.
- Reducing the number of steps to complete key tasks.
- Increasing shared services.
- Single database operations.
- Reporting and access across operating units.



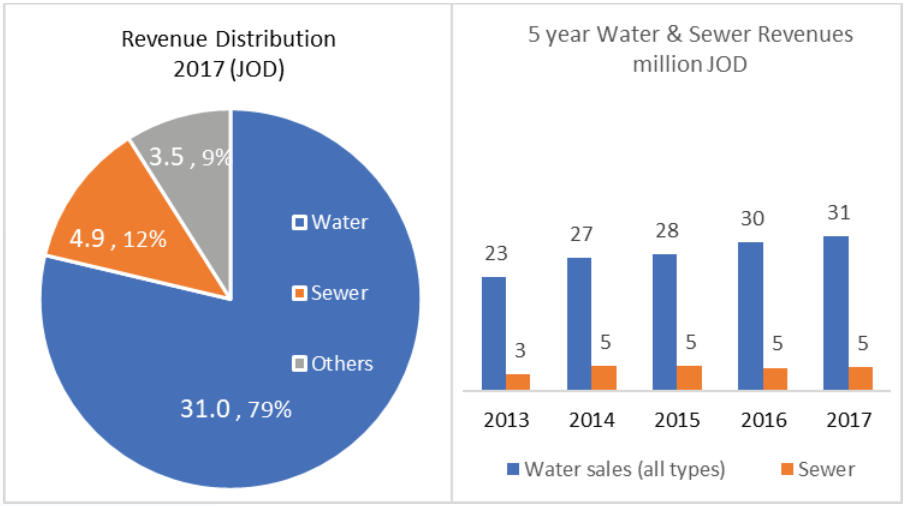


Figure 4: Dashboards produced by ERP to help utility take informed decisions

Introducing Integrated ERP Systems and ISO in Jordan Water Utilities as an Essential Tool to Improve Performance

Mahmoud Al-Zoubi, IT Manager, YWC
Tamer Al-Assa'd, Water Sector Governance Advisor, WMI

Background:

As part of WMI's endeavors and attempts to support the water sector in Jordan through implementing integrated Enterprise Resources Planning (ERP) systems, in July 2018 WMI awarded a Business Process Reengineering (BPR) contract to a local consulting firm, thus expanding the scope of work to include business process standardization across the whole sector and setting up a building block for an integrated ERP system for the whole sector and for ISO 9001:2015 qualification (certification) for Miyahuna and any other entity that might have potential for that. This service started in October 2018 and will have been substantially completed by the summer of 2019. The BPR will entail optimization, improvement, and streamlining of the business processes, procedures, and cycles undertaken at Miyahuna. This will contribute to the validation and verification of the current business model, document the undocumented processes, propose a future business model, and expand this model to the utility companies in the sector as a whole.

The final result of our BPR exercise will yield a scope of work definition for an ERP system implementation. The implementation of the ERP systems will enable Miyahuna to be qualified for ISO 9001:2015 certificate and simplify the business processes to be carried out with full documentation. Thus far, the BPR has brought the industry's best practices to Miyahuna's business landscape, therefore integrating them with various business functions, and ensuring the seamless and smooth running of operations. Such a model will later reach other entities in the sector.

Approach and Methodology:

The new effective approach is to acquire and implement one ERP system for the water sector (except for AWC) through adopting one ERP application, one database in a single centralized data center. (One ERP) solutions will provide fully integrated core modules (financials, human resources, payroll, procurement, inventory, etc.) that help run the main business functions of the water sector using a single point of entry. A single unified platform guarantees the use of a single business process tool that cuts across processes and domains to ensure workflow consistency. The new approach will help the water sector provide excellent customer service, enhance performance, reduce rates and ensure quality products.

The enablers for this new approach are efficiency, effectiveness, reliability and quality. These enabling factors will indubitably impact greatly on all water sector resources, including staff members, processes, assets, materials and technology. For that impact to happen, an appropriate IT tool (system, application, software), which is driven by business needs, has to be selected. WMI's presentation on the vision of (One ERP) solutions was meant to create a dialogue among the water sector decision-makers on the benefits of adopting this approach for improving the sector as a whole.

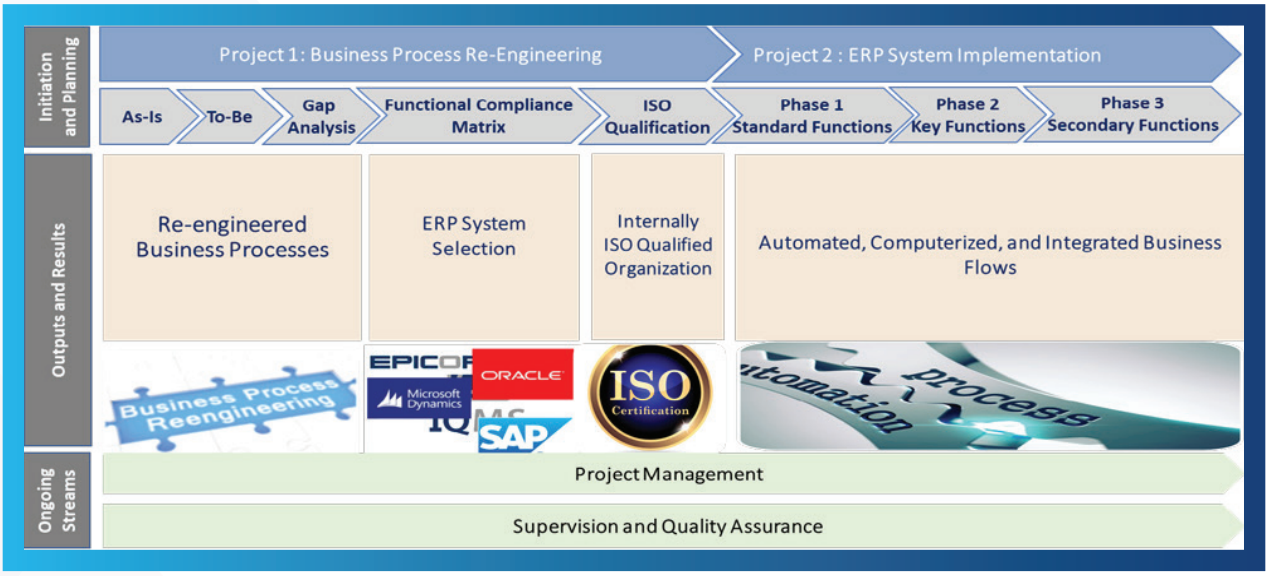


Figure 5: ERP integrates business process re-engineering with system implementation

Implementation of ERP

The effective implementation of one ERP as a concept requires passing through a series of high-level, business-process-standardization steps across the whole sector. For that effective implementation to happen, the upper management should take the following factors into consideration and cascade them down to all processes:

- One integrated business model.
- Integrated systems across the entire water sector.
- ERP system (including all business modules and technological tools).
- Process standardization and information modeling.
- Database management.
- Optimized hardware environments (less costly to maintain and sustain).
- IT manpower efforts.
- Faster implementation.
- Knowledge transfer in the ERP systems.
- Utilization of functionalities of a true Customer Information System (CIS).

Below are the three phases for the implementation of the ERP system:

- **Phase I:** Finance, human resources, and Supply Chain Management (SCM).
- **Phase II:** Asset management, Customer Relation Management (CRM), and field force automation.
- **Phase III:** Business intelligence and dashboards.

Below is a sketch that illustrates a simple ideal solution (connectivity) for all water companies:

- Unified database and application.
- ERP, CIS, CRM, HRMS, SCM, budgeting, and consolidation of financial reports for the holding/ mother company, WAJ in this case.

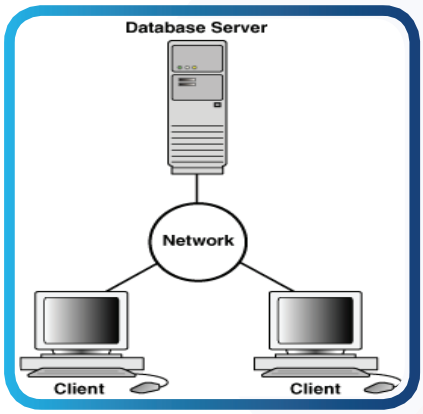


Figure 6: Idea to connect for the sector into a single database structure

Expected Impact

The expected impact of this concept realization and system implementation will be crystalized directly and indirectly as indicated below:

- **Direct Benefits:**

Table 2: Direct benefits of implementing the ERP system at YWC and their descriptions

Benefit Item	Benefit Description
ERP License	1. Reducing license costs for database. 2. Reducing license costs for application users. 3. Reducing the annual maintenance or user support fee.
ERP Hardware	1. Eliminating redundant hardware usage. 2. Using a centralized information, communication and technology unit. 3. Using a more secure network and hardware. 4. Enforcing using common standards. 5. Reducing hardware maintenance and support costs. 6. Using visualization technologies hardware. 7. Reducing IT support staff. 8. Reducing hardware maintenance time.
ERP Implementation	1. Shorter implementation life cycle. 2. One Request for Proposal (RFP). 3. Lower implementation cost. 4. Water sector business strategy.

- **Indirect Benefits:**

Table 3: Indirect benefits of implementing the ERP system at YWC and their descriptions

Benefit Item	Benefit Description
Information Availability for Decision Making	1. Reducing significantly the reporting period. 2. Creating redundant reports. 3. Improving accessibility. 4. Reducing the manual compilation of data. 5. Fewer staff members needed for collecting and preparing information.
Quick Access to Information	1. Streamlining the water sector business processes. 2. Allowing data access across the water sector. 3. Creating Key Performance Indicators (KPIs) and dashboards once.
Maintaining IT Systems	1. One system support contract. 2. Solution Support Center (SSC). 3. Upgrades and updates.
Integration	1. No more issues in terms of duplicate or wrong data. No issues in terms of data dissemination across the separate databases. 2. All information will be hosted in a single location. 3. Integrating the Customer Information System (CIS) with Customer Relation Management (CRM). 4. Single-sign-on and add-on modules.

Sustainability

Introducing concepts into the whole sector as a big-bang approach is bound to have some ramifications due to its massive impact, which requires continuous sustainability, focused support and substantive maintenance.

The following success factors and sustainability criteria should be set in place to ensure smooth and seamless continuity of this approach:

1. Top management commitment to:

a. Unified reengineered business processes.

b. Change management and staff resistance.

2. Staffing responsibilities:

a. Technical and functional expertise.

b. Who does what?

3. Initial investment:

a. Infrastructure.

b. Licenses.

4. Operations, maintenance, and upgrading budget allocation:

a. Contract renewals of technical support services.

b. Continuous update and improvement.

Managing the Merger of Multi-City Utilities – Central Control Units, a Tool and a Way for Sustainability

Naem Saleh, Utility Management Specialist, WMI
Mohammad Malkawi, Utility Management Specialist, WMI
Iyad Al-Qassir, Utility Commercialization and Finance Specialist, WMI
Malek Al-Taani, Utility Management Assistant, WMI

Background

One of the main challenges of managing the merger of multi-city utilities into one central entity is the implementation of a centrally unified approach, strategy, policy, and identity. The sustainability of the achieved improvements is another challenge, which may turn the transformation into absolute failure.

The key tool to overcome these challenges is the empowerment of the headquarters' central control over the various subunit operations, keeping the decentralized operations at the minimum acceptable level.

The approach adopted by WMI for establishing central control units was developed to improve performance and sustain improvements in Jordanian water companies. Case studies of the Customer Service Control Unit at Yarmouk Water Company and the National Customer Complaint Center at Miyahuna were presented and discussed, covering all phases and results.

Yarmouk Water Case Overview

Figure 7: Yarmouk Water Company covering area

- 29,000 square kilometer service area.
- 330 thousand customers.
- 10 branches in four governorates.
- 96 Million Cubic Meters (MCM) of water supplied (2018).

Main Challenges:

- Shortage of water resources (68 liters per capita in 2018).
- Great increase in population due to the Syrian refugee crisis (660,000 refugees in Yarmouk service area).
- High energy bill (%70 of Operation Expenditure (OPEX)).
- Low cost recovery (2017 Cost Recovery Ratio (CRR) is%61)[1] .

Organization Structure Features:

- Decentralized management of water, wastewater and customer service.
- Centralized management of financials, IT, HR and supply chain.
- Overlapping of some major functions between central departments and branch departments.
- No clear performance-accountability matrix.

Billing/Collection Efficiency – Q2017/3 Snapshot

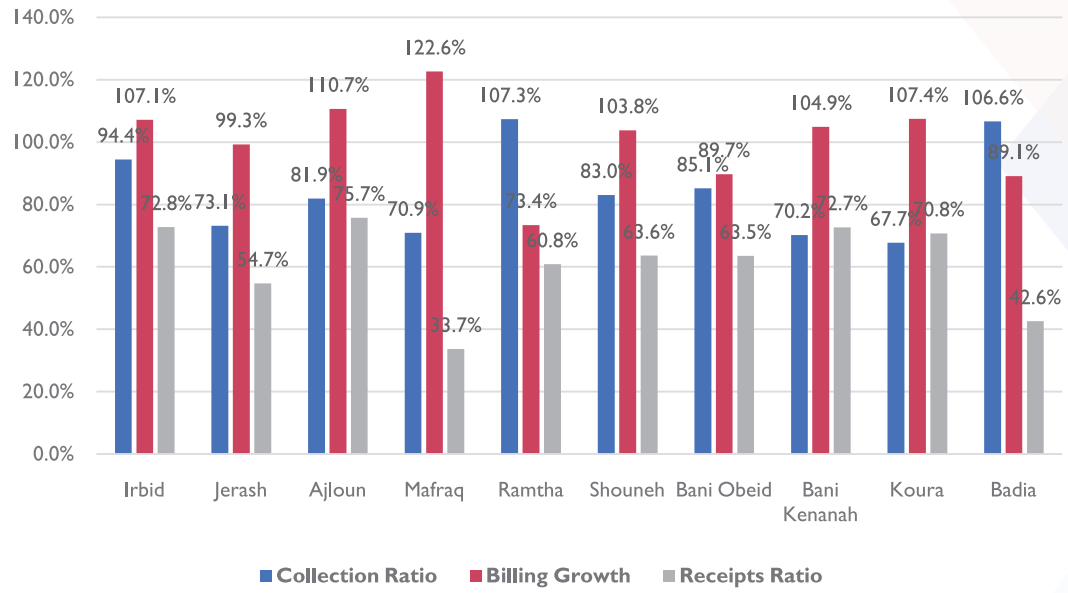


Figure 8:Yarmouk Water Company billing/collection efficiency – Q2017/3 snapshot

1- All data on Yarmouk Water Company comes directly from the company's own data.

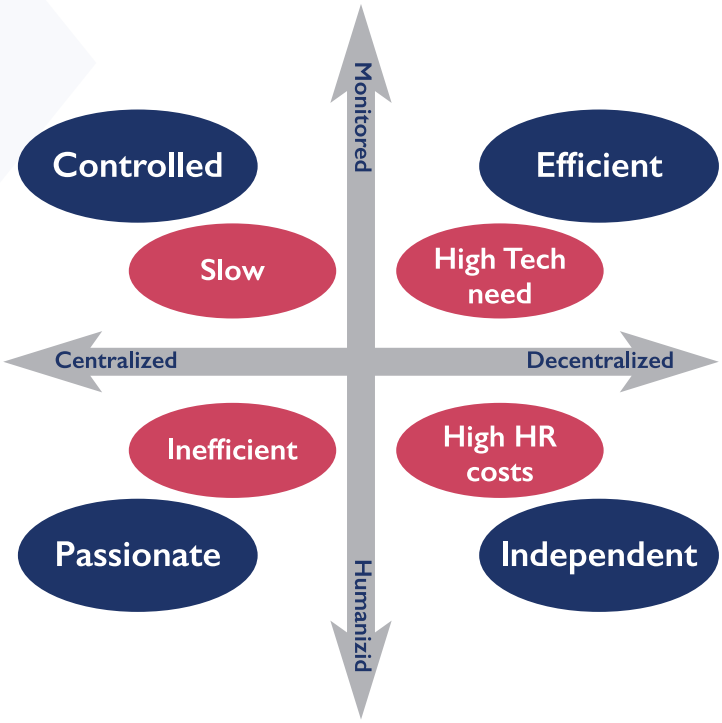


Figure 9: Centralization/Decentralization

Why Control Units?

- Standardize implementation of regulations among branches.
- Unification of work methodologies and parameters among branches.
- Strategize planning of activities and operations among branches.
- Build a monitoring and follow-up unit in headquarters.
- Manage assets and resources for best efficiency.

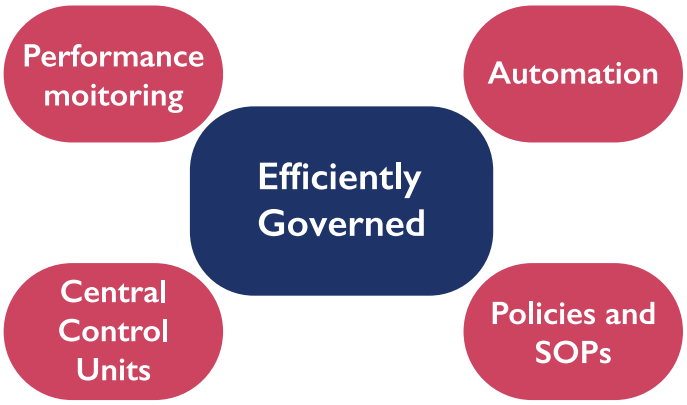


Figure 10 : Hybrid approach

Yarmouk Water Control Unit

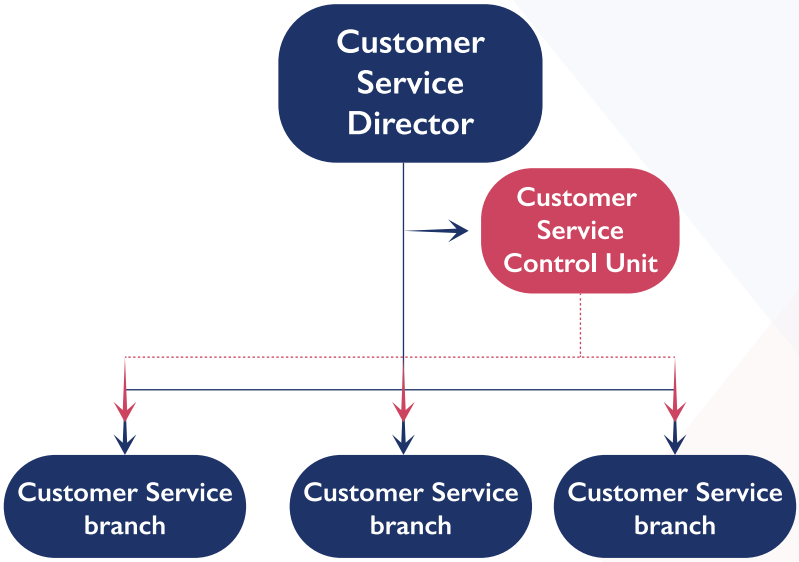


Figure 11: Structure in the control unit

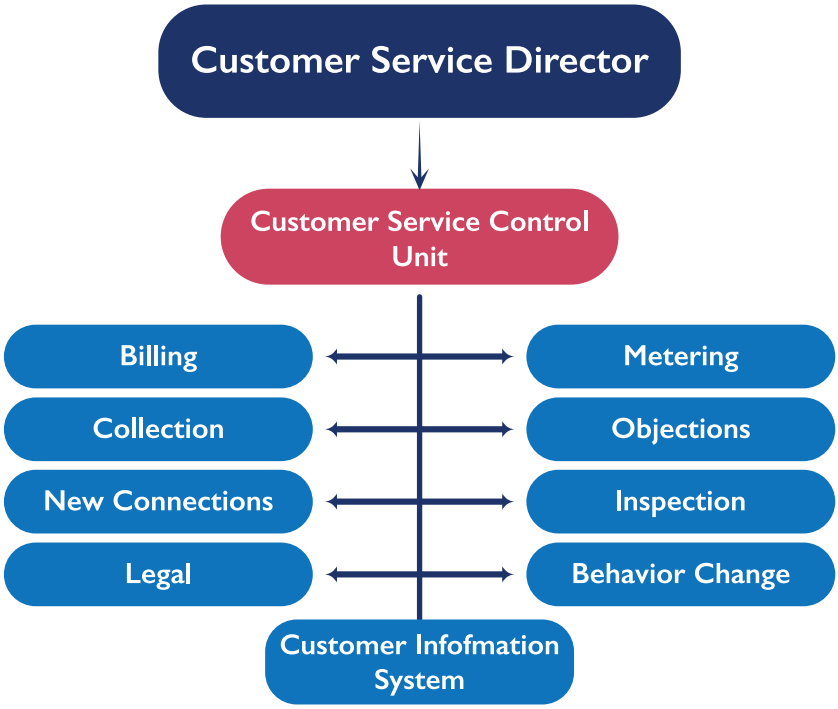


Figure 12: Control unit functions

Implementation Plan

1. Preparation phase (Sep-Dec 2017):

a. Top management workshop.
b. Office and equipment preparation.
c. Training for control unit staff (140 training hours).
d. Reference manual production.
e. Training for employees at different branches.

2. Launching support phase (Jan-Jun 2018):

a. Resident full-time supervisor.
b. CIS-X7 implementation and data cleaning.
c. Hands-on training on report generation.

Challenges Faced

1. Preparation phase (Sep-Dec 2017):

a. Weak management support.
b. Shortage of suitable staff available to move to the control unit.
c. Outdated CIS-COBBOS system.
d. Bad customer database (full of data errors).

2. Launching support phase (Jan-Jun 2018):

a. Resistance in branches and headquarters.
b. Delays in CIS-X7 implementation.
c. Uncertain or missing historical data needed to build benchmarks and baselines.
d. Absence of clear reporting lines in the organization structure.

Impact

Billing/Collection Efficiency – Q2018/4 Snapshot

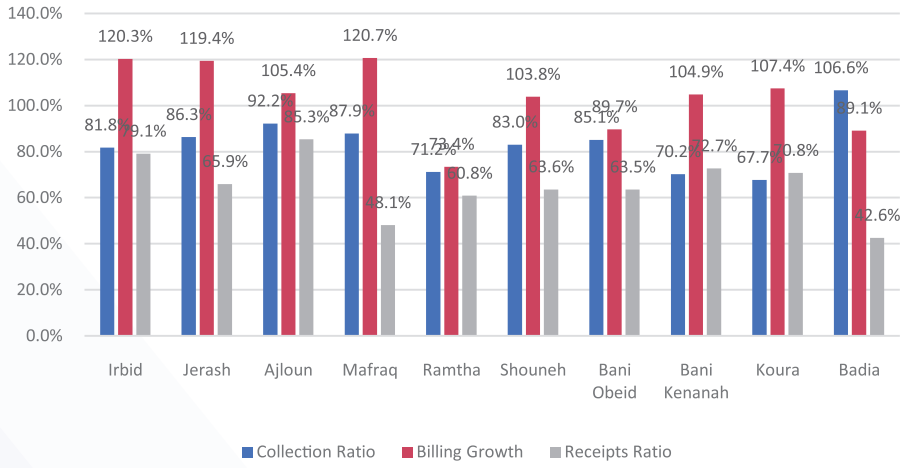


Figure 13: Billing/Collection efficiency – Q2018/4 snapshot

Reforming the Management of Irrigation Systems in the Jordan Valley

Qais Oweis, Institutional Irrigation Specialist, WMI
Ghassasn Obeidat, ASG for the Northern and Middle Jordan Valley, JVA

Background

In 1977, the Jordan Valley Authority (JVA) was established with the mandate to carry out integrated socioeconomic development of the Jordan Valley area. 30,000 hectares were developed and irrigated by traditional irrigation systems. In the early of 1980s, irrigation water availability was a big challenge for JVA, due to the limited renewable water resources and the competition between irrigation and other water sectors. Water allocation for irrigation was reduced and the conflict between JVA and farmers expanded. To bridge the gap between the demand and supply, one main approach for JVA was to engage farmers with irrigation water management through the concept of Water User Associations (WUAs), aiming to increase irrigation efficiency and decrease water losses in distribution systems. The long-term vision of JVA for irrigation water management and distribution involves contractual relationships with farmer-based WUAs. JVA will serve as the bulk water supplier and the WUAs will serve as the retail water provider through distributing the irrigation water to individual farms within their service areas.

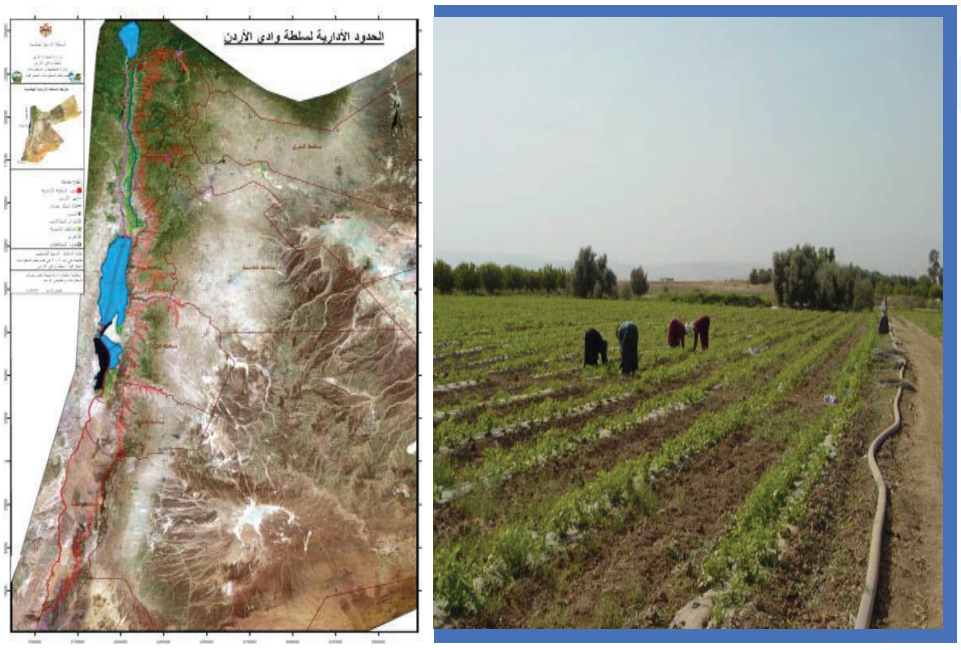


Figure 14: Jordan Valley scene and map

The current situation and characteristics of water management in the Jordan Valley

- Fluctuation in annual water allocations based on water availability from the surface water resources.
- Increased water losses and illegal use at both levels, conveyance and distribution networks[2].
- Low water tariff. The average water tariff for irrigation water is about 12 fills, whereas the average Operation and Maintenance (O&M) running cost is about 75 fills in the year 2017.
- Low cost recovery. The average cost recovery for 2016 was %54, including the revenue from industrial water supply.
- Insufficient use of modern technology such as smart metering on distribution networks and farm gates.
- Lack of equity in water distribution among farmers due to the lack of metering system.
- Low physical properties of water quality due to insufficient or bad operation and maintenance for the existing filtration system.

Approach and Methodology:

After many meetings and long discussions with different levels of JVA officials and the existing WUAs in the Jordan Valley, a new vision was developed to govern the relationship between JVA and the WUAs through the establishment of four regional WUAs covering the entire Jordan Valley. The reform approach of the management of irrigation systems in the Jordan Valley was based on:

1. Separation between bulk and retail water resources management:

a. JVA as a bulk water supplier.
b. WUAs would manage the retail water from the supply area to the farm gate.

2. Promote and apply governance standards through JVA reform:

a. Responsibilities and roles between JVA and WUAs.
b. Financial sustainability for WUAs.
c. Regulatory framework to govern the relationship between JVA and WUAs.

WMI Institutional and Technical Support to JVA and WUAs

1. Support JVA reform:

a. Assess JVA needs for institutional reform.
b. Provide technical assistance in JVA reform actions.

2. Establish a call center for JVA and WUAs in the Jordan Valley:

a. Develop establishment plan for the call center.
b. Support JVA to establish the call center including capacity building.

2- WMI report on King Abdullah canal losses

3. Develop establishing three costumer services in the Northern Jordan Valley, including capacity building for JVA and WUA staff.
4. Prepare the core for Geospatial Information Systems (GIS) Unit in the Northern Jordan Valley, including capacity building for five of JVA and WUA employees.
5. Prepare assets inventory database for the northern Jordan Valley.
6. Prepare for JVA and WUAs the current annual cost for O&M retail services in the northern Jordan Valley.
7. Develop the Key Performance Indicators (KPIs) for WUAs.
8. Support introducing new water management technologies in the Jordan Valley.

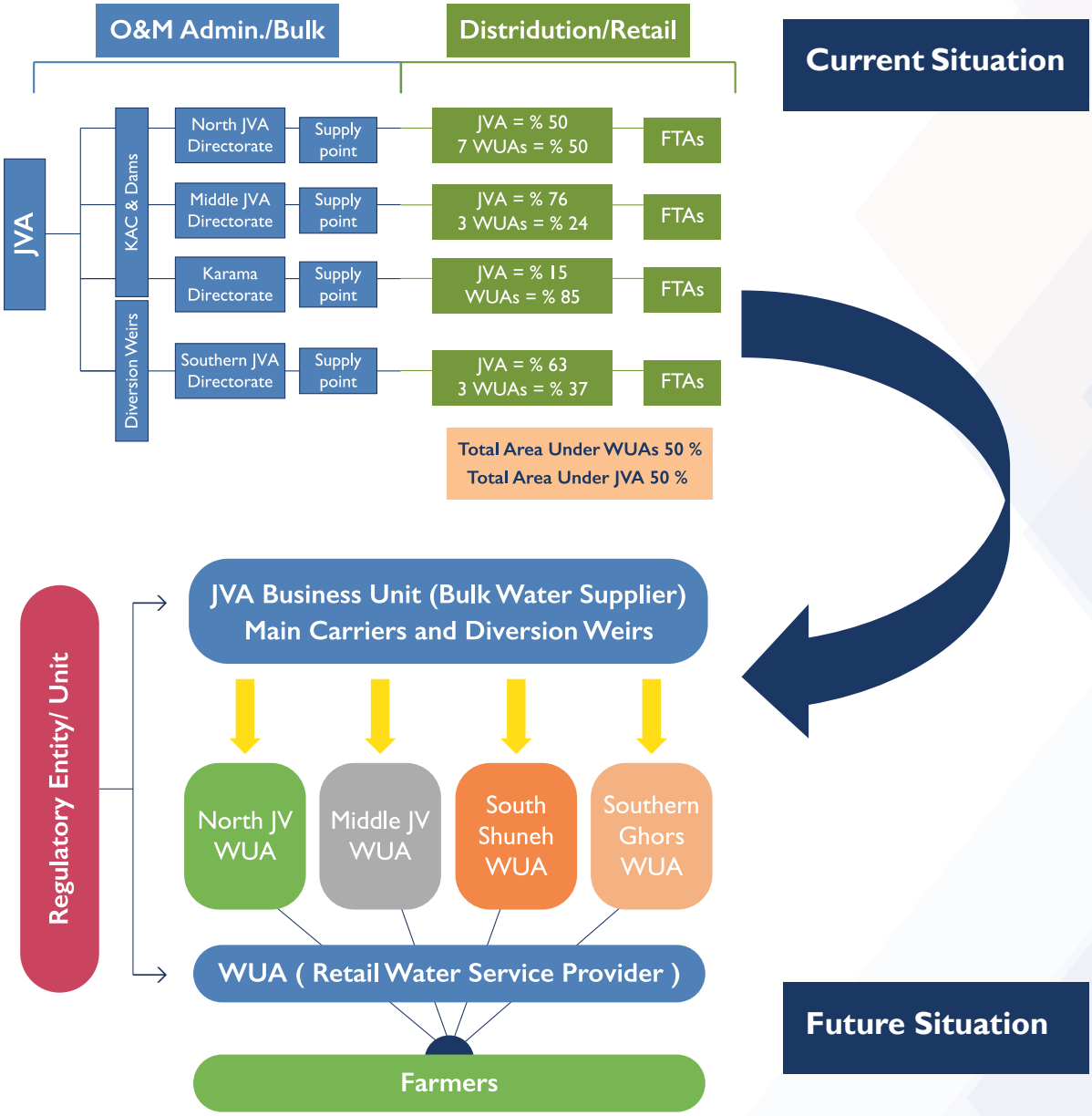


Figure 15: Current and future situation of water management in the Jordan Valley

North Jordan Valley Pilot Site

WMI is planning to develop a pilot area within the Northern Jordan Valley region to install an intelligent system solution and all related equipment and accessories for remote monitoring and controlling of the water supply for 60 farm units and 7 main pipelines with different diameters. Installing that will help remotely control the quantity given for each farm unit, monitor the real and accumulative flow, and the operating pressure throughout the distribution system (main and lateral pipelines), which will improve operations and service delivery within the pilot area, as well as provide a model for operational improvements that can be replicated throughout the Jordan Valley.

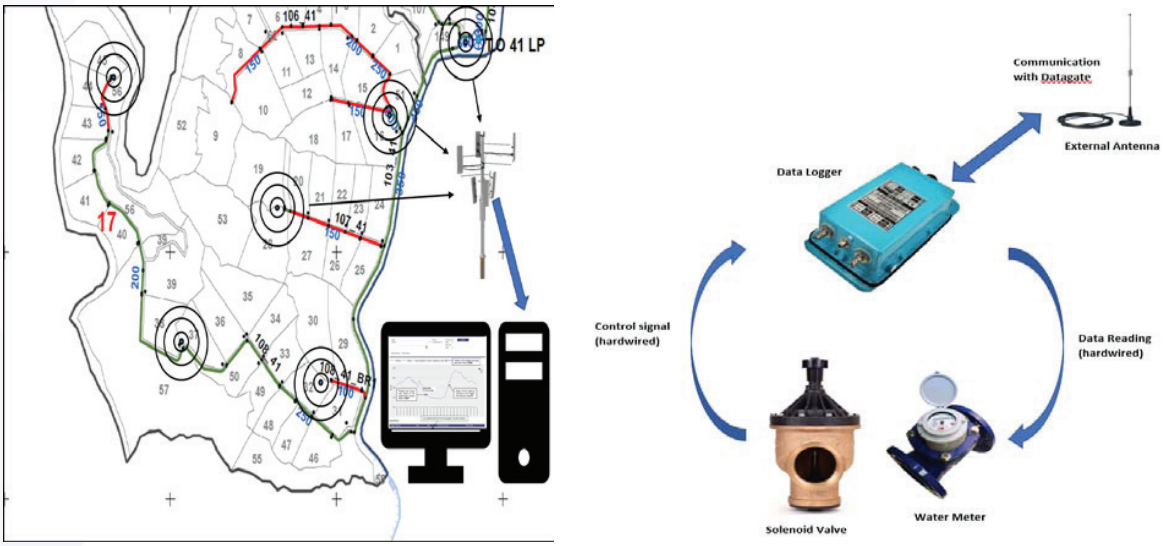


Figure 16: Technologies in use

Expected Impact

- Improve the management of Operation and Maintenance (O&M) at both the bulk supply level and the retail supply level, including capacity building for both JVA and WUAs.
- Improve the level of service delivered to farmers.
- Develop self-sustainable WUAs at the administrative and financial levels.
- Improve the physical properties of water quality.
- Introduce modern technologies for better management and for distribution equity.
- Maximize the water value in the irrigation sector in the Jordan Valley, which might lead to the implementation of a concept of water trade between JVA and WUAs or between WUAs and farmers.

NRW REDUCTION

Downstream Control: Transitioning from IWS to 24x7 Under Severe Demand Shortage Conditions

Tamer Al-Assa'd, Water Sector Governance Advisor, WMI
Bambos Charalambous, NRW International Expert
Mohammed Shafie, NRW Local Expert
Eyad Sahawneh, Maintenance Management Assistant, WMI
Sami Masreki, Intern, WMI

Abstract

Operating under continuous water supply is an essential precondition for preserving the integrity of water distribution networks and enabling sustainable water loss management practices such as pressure management and active leakage control. However, many utilities in developing countries operate under Intermittent Water Supply (IWS), which has proven detrimental to the structural integrity of water networks infrastructure, requiring continuous and costly replacement of mains and connections. In addition, the networks are exposed to increased risk of water contamination and a social and economic cost is imposed on customers.

In most cases, transitioning from IWS to 7/24 water supply is possible through a carefully planned gradual transition that traditionally focuses on a simple concept: "Leakage reduction". In the short term, it is translated into more supply hours, which results in stable pressure conditions in the network and facilitates a long-term leakage reduction strategy to be adopted. This concept assumes that the water demand remains stable, or in some proven cases, is reduced after achieving supply continuity. This does not eliminate the need for additional water supply during the transitioning period from IWS to 7/24, which of course will be reduced systematically during the transitioning period through effective methods of leakage control that can be applied under continuous supply. However, the fact remains that there are cases where the current water demand shortage exceeds the amount of leakage that could be reduced under continuous supply. Allowing longer supply hours would result in higher user consumption, and therefore the system will not be able to return to the water supply quantities used before the transition, which would hamper the effort until additional water resources are available.

The longer we operate under IWS, even for cases of high demand shortage, the higher the network deterioration rate would be, which may cost more than the cost of investing in new water resources, given that water distribution networks are often the most expensive asset in the water system. To devise a solution to this problem, a novel method is proposed, which focuses on downstream control of water supply at the customer level instead of the water distribution level, therefore eliminating the detrimental effects of IWS, allowing the conditions for effective pressure management and active leakage control, and therefore providing overall sustainability without pressuring available water supply. Downstream control is a mechanized water demand management system that provides fair distribution of water available to customers that can be implemented in different forms of varying sophistication.

The most basic form of downstream control is to pressurize the distribution network at DMA level in order to supply each customer with a predefined volume of water. When this volume is supplied, the control mechanism, which is normally located at the customer water meter, is automatically activated and shuts off the supply to the customer. Once all the customers in a DMA are supplied with the predefined volume for each one, the inlet PRV is used to minimize the pressure in the DMA network, maintaining the minimum possible pressure without emptying the network. The benefits (technical, social, environmental, financial, etc.) shall be elaborated in the presentation and full paper.

Background

WMI through ACWUA developed Jordan's NRW reduction master plan. The plan aims to establish a unified framework for NRW management in Jordan, define good NRW management practices in a responsible, accountable and sustainable way, optimize investments in a strategic and meaningful way, and establish a path forward, which avoids previous pitfalls and mitigates challenges.

During the plan's development, an assessment of the current situation was conducted, and the major finding was the uncontrolled operated systems that cause high physical and commercial losses. Thus, the need for continuous water supply to prevent most bursts was one of the high priority actions. Therefore, WMI will be demonstrating the possibility to transfer the water supply into 7/24 without additional water supply by reducing leakage.

Although the water sector in Jordan has been putting a lot of effort in this regard, the fact of Jordan's limited water supply inhibits effective leak detection, as a constant supply is generally required to detect leaks. The table below summarizes the impact on the network and customers under each supply condition.

Impact on	Intermittent Water Supply (IWS)	Downstream Control (DSC)
Network	• Emptying and refilling • Uncontrolled pressures • Cross connections • System out of control	• Continuously full • Pressure control • Network efficiency • System under control
Customers	• Inequity of supply • Poor water quality • High coping costs • Revenue los	• Controlled supply • Improved water quality • Reduced interventions • Increased revenue

Table 4: Impact on the network and customers under supply conditions

Approach and Methodology

In coordination with Miyahuna, water companies and WAJ, WMI is seeking to introduce new technologies using "Smart Valves," which will be installed at the intake and connection points. The valves enable the network to capture water outside of water distribution hours, which allows for continuous leak detection and pressure management. This will reduce shocks to the system and therefore help decrease non-revenue water.

WMI is working to develop a pilot area within selected demonstration sites, through collecting the needed data, developing hydraulic models, and conducting hydraulic analysis of the demonstration sites. After developing the technical specifications of needed equipment, WMI will be applying remote control valves (shut-off valves), PRV, bulk meters, pressure logging sensors and controllers, at the house connection in the demonstration sites. A full study on the impact of 7/24 supply on the existing network will be conducted, followed by recommendations for required modifications. Additionally, a model for operational improvements will be provided, which can be replicated throughout the water companies.

The figure below demonstrates the approach that aims to transfer the IWS into 24X7 through simulating this, using the downstream control valve at the house connections level. The concept is about using the same water supply or even less so as to meet the service level and the water needs of the end users, through recovering water loss.

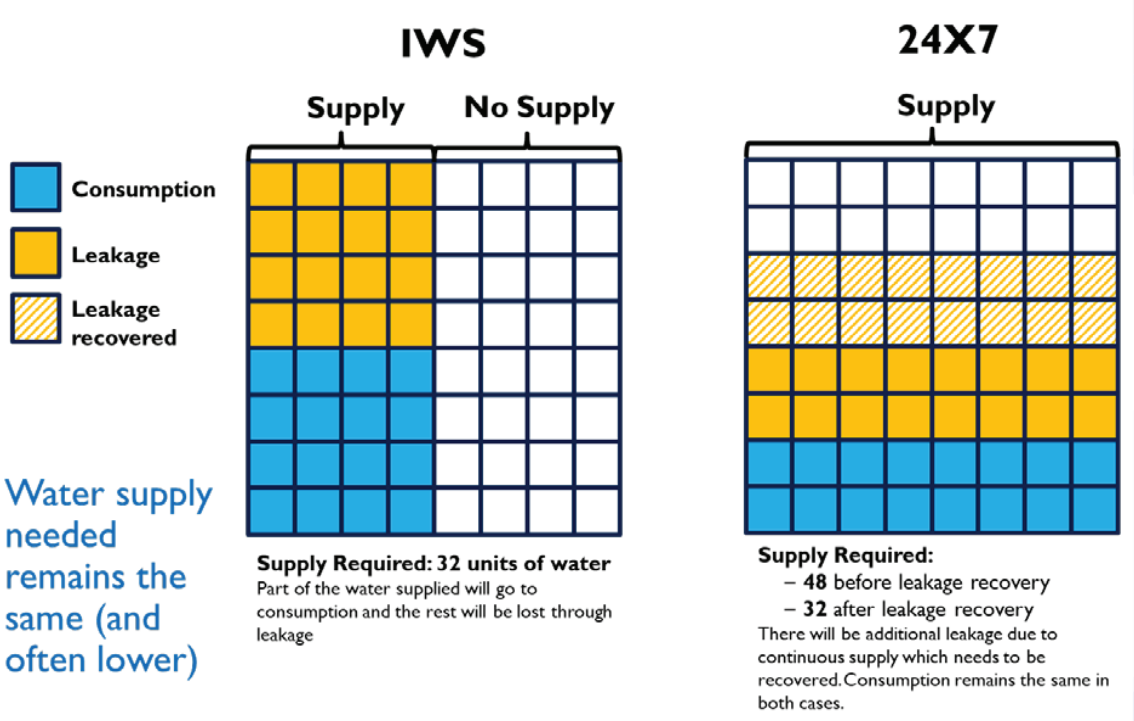


Figure 17: Transition from IWS to 24x7 – The "easy" scenario

The following figures explain the concept of downstream control (DSC) where water will be supplied through the water network all the time yet distributing water to customers can be done according to the rational water supply program. **With this, DSC allows for:**

- Local or remote control depending on the time of the day.
- Water quantity allocation per customer.
- Accurate measurement of leakage and unauthorized consumption (UAC) with or without the use of smart customer meters, as well as minimum night flow (MNF) analysis.

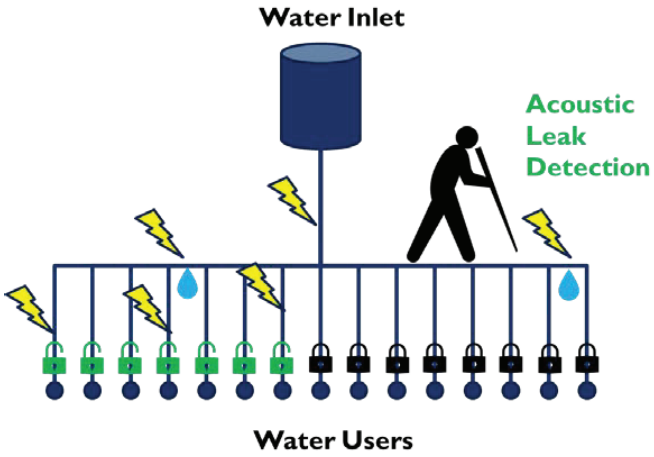


Figure 18: Demonstration of how DSC works in the pilot site

- Accurate use of acoustic leak detection devices for leakage and illegal connection surveys by eliminating interfering noise by reducing customer water flow to a minimum or to zero.
- Step-testing that becomes a very powerful and precise method for locating leaks, illegal connections, and meter bypasses.

Also, DSC enables application of pressure management to optimum pressures when customer valves are either open (supply mode) or closed.

Technologies Used

The following are the key technologies used to implement DSC for reducing NRW:

- Combined control valve and smart meter will be used to control and measure household consumption.
- Pressure reducing valve (PRV) will be used to control the pressure level in the water network to minimize the physical losses during supply time.
- Smart bulk meter to monitor the exact water supplied to the pilot area, establish the baseline of the losses and the reduction levels along the pilot implementation.
- Pressure loggers will be installed before and after the PRV and on three critical pressure points in the pilot site to provide the needed information for the PRV to function.
- Leak detection equipment will be used to identify the invisible leakages to help the maintenance team fix them.

Figure 19: Combined control valve and smart meter

Challenges to Scale up

Scaling up such a pilot project is accompanied with many challenges that should be carefully addressed. These key challenges are summarized under four categories as below:

1. Utilities:

a. Overcome reluctance to change.
b. Convince utilities of the many advantages.
c. Prove technical viability of DSC.
d. Develop required skills and knowledge.

2. Customers:

a. Cooperate in applying DSC.
b. Incentivize efficient water use.
c. Improve plumbing installations.

3. Technology:

a. Incentivize the industry to develop DSC technologies.
b. Efficient battery use/ battery recharge solutions.
c. Integration with smart meters.
d. Software solutions for effective management over large deployment.

3. Funding:

a. Private sector investment through the commercialization of paid services to customers.
b. Conducting feasibility studies for governments and donors, which address the total cost under IWS vs. 24X+7 DSC.

Expected Results

The application of these technologies will not only benefit the NRW reduction through reducing water losses, but it will also increase the revenues and save the network through managing properly the water distribution system, activating the leak detection approach, and allowing to monitor and control the valves installed in the field to be able to define the optimum operational pressure, as well as reducing the risk of microbial contamination through converting an intermittent supply to a continuous supply that has the potential for improving the quality of water delivered to consumers.

Non-Revenue Water Reduction Master Plan for Jordan

Tamer Al-Assa'd, Water Sector Governance Advisor, WMI
Bambos Charalambous, WMI Consultant
Mohammed Shafie, WMI Consultant

The goal of the non-revenue reduction master plan is to establish a unified framework and road map for improving the reliability and sustainability of Jordan's water supply systems in an accountable and holistic approach. The implementation of a national NRW master plan requires targeted implementation of capital-intensive interventions, through the establishment of improved utility management practices and the implementation of targeted technical assistance and institutional capacity building, especially those related to non-revenue water reduction.

The NRW master plan sets a road map towards effective NRW management in Jordanian utilities in a phased approach that allows the transition from current conditions, through reliable and accountable solutions that will be established and sustained in a high-priority water supply system, and progressively in the entire utilities. The transition begins with the establishment of sector-wide policies and standards, then with the establishment of utility institutional capacity by gearing the business process and information systems towards NRW control. This central capacity will focus on transitioning one supply system at a time to meet the established policies and standards. It will also provide the operational support to sustain those transitioned supply systems. The investment in further supply systems will be linked to that sustained effort that will be continuously audited by a reference authority.

Background

Water utilities in Jordan are facing a large challenge in managing Non-Revenue Water (NRW). Although many projects and initiatives have been implemented to reduce NRW, the actual improvement has not been seen yet. Among the various challenges that the water sector in Jordan is facing are the limited water resources and the unpredicted increase in population, due to the political situation in the neighboring countries. That situation put huge pressure on the already overloaded infrastructure services and limited resources, including financial and human resources. The key challenges facing the water sector in managing NRW in Jordan are summarized in the following table:

Physical Losses	Commercial Losses
• **Pressure Management:** difficulty in stabilizing pressure. • **ALC:** extreme difficulty; and no minimum-night-flow monitoring. • **Speed of Repairs:** hard to locate leakages. • **Asset Management:** high deterioration rate; uncontrolled cross-connections; and unpredictable asset conditions.	• **Metering Accuracy:** meter deterioration rate; and air registration. • **Control of Unauthorized Consumption: hard to locate illegal connections;** high dissatisfaction rates; and increase the number of cases.

Table 5: Key challenges facing NRW management

Therefore, the Water Authority of Jordan (WAJ), Ministry of Water and Irrigation (MWI) and water utilities, along with Water Management Initiative (WMI) project (funded by USAID), worked on developing the Jordan NRW reduction master plan.

Approach and Methodology

With an aim of developing a wide NRW strategy and a NRW master work plan that addresses the needs of the water sector in Jordan in a reliable and sustainable way, the intervention will identify priority areas in each utility to achieve NRW targets and to chart the way forward. The systematic approach used is based on the following:

- International IWA experience.
- Experience in developing the NRW diagnostic tool.
- The responsible impact approach developed regionally by ACWUA and the participation of the international NRW expert Mr. Bambos Charalambous, the first chairman and current management committee member of the IWA Water Loss Specialist Group and the founder and chairman of the Intermittent Water Supply (IWA) Specialist Group.
- The participation of Mr. Mohammed Shafei, the current management committee member of the IWA Water Loss Specialist Group and regional NRW expert.

The methodology can be summarized in the following steps:

1. Adaptation of the ACWUA responsible impact and NRW diagnostic tool for conducting relevant and efficient assessment.
2. Establishing a taskforce of counterparts, WAJ and water utilities, to assist with the assessment and data collection process.
3. Conducting utility assessments that include field visits, data gathering, and a holistic evaluation of the factors affecting progress in NRW management.
4. Highlighting the gaps found in each utility.
5. Developing the vision and objectives based on proven and reliable solutions.
6. Categorizing Jordanian water supply systems and prioritizing future actions based on the prevailing conditions.
7. Developing a strategic road map for NRW management in Jordan.
8. Defining the specific priority actions needed at each stage.
9. Estimating the implementation cost needed for each utility.
10. Advising on the implementation tactics needed to support the outlined strategy.
11. Conducting a workshop for a clear dissemination plan and knowledge sharing.
12. Implementing targeted capacity improvements and certification training.

Key Values

When approaching a national NRW reduction master plan for Jordan, the key values adopted were:

- Reliability: focused on increasing the reliability of water supply systems in Jordan. This includes reliable asset management through continuous water supply and maintenance capacity, as well as reliable data and dependable staff.
- Accountability: focused on delivering the impact sought from the investment by establishing the groundwork for an accountability system. This includes clear responsibilities, accurate KPIs, targets, benchmarks, and continuous auditing.
- Sustainability: focused on sustainable performance and maximizing the benefit of infrastructure investments. This includes the right policies, standards, procedures, and timely and accurate reporting systems.
- A holistic approach: focused on maximizing impact and applicability by addressing the multiple aspects of the NRW problem. This includes addressing local needs, conditions, applicable solutions, and sector responsibilities.

Figure 20: Key values

NRW Strategy

The strategy is based on dividing the challenges facing the water supply systems into the following components:

- Primary systems.
- Distribution systems.
- Customer metering and billing.

The NRW reduction master plan therefore implements a novel definition that divides water systems into four categories, as indicated in the table below. Each water utility can be operating water systems at different categories. To simplify the identification of categories in water systems, the categorization is based on the current conditions of the areas illustrated in the table below, which also summarizes the existing conditions under each category and area.

Area	Category A	Category B	Category C	Category D
Supply Continuity	Problematic IWS conditions	Improved IWS conditions	Continuous supply conditions	
Management of Primary Systems	Incomplete monitoring and control of the primary system	Resources and the primary system monitored and controlled by SCADA		
Management of Distribution Networks	No or incomplete monitoring and control of distribution zones	Distribution zone monitoring and pressure control	DMA monitoring and pressure control	Lowest feasible pressure
Management of Customer Metering and Billing	Incomplete monitoring and control of metering and billing	Robust monitoring and control over metering and billing	Big smart static customer meters	Smart static customer meters

Table 6: Prioritization of actions for each category of water systems

Sustainability

To highlight the aspect of sustainability, the NRW reduction master plan includes two types of components: establish and sustain.

Establish

One-time or intermittent efforts that lay a solid ground for managing the system in such a way that enables the life cycle of NRW management. Examples include the establishment of policies, infrastructure works, and information systems. The establishing activities are reflected in the capital cost needed for the activities below.

For each utility, improvements are needed at the central level to support and align with what is established in each water supply system. That includes:

- Sector-wide policies and standards needed for NRW management.
- Central NRW monitoring and reporting systems to cover primary systems, distribution zones and DMAs, loss of customers, commercial loss, work orders, MMS, and smart meters.

At the supply system level, infrastructure activities include:

- Primary system hydraulic reinforcement and SCADA.
- DZ hydraulic reinforcement, GIS update, and flow and pressure monitoring and control.
- DMA hydraulic reinforcement, GIS update, and flow and pressure monitoring and control.
- DMA rehabilitation using ALC and transition into 7/24.
- Comprehensive customer survey.
- Customer meter rehabilitation.
- Smart meters.

Sustain

Ongoing efforts that are necessary to actualize and yield continued benefits from the established efforts. Examples include daily maintenance, operating procedures, and reporting activities.

Sustaining activities are reflected in both the capital maintenance cost and the operational costs that cover the following aspects:

- Core NRW unit to perform assessment, monitoring, prevention planning, and classification.
- Leak inspection teams.
- Unauthorized consumption teams.
- Support for field billing staff to perform inspection.
- Customer meter teams.
- Operational GIS field staff.
- Primary system monitoring and control maintenance teams.
- Distribution zone and DMA monitoring and control maintenance teams.
- Smart meter maintenance teams.

Likely Pitfalls in Calculating NRW and its Constituent Components

Tamer Al-Assa'd, Water Sector Governance Advisor, WMI
Bambos Charalambous, WMI Consultant

The International Water Association (IWA) water balance is the established tool that is widely used today to calculate non-revenue water (NRW) and its constituent components by many of the world's water utilities. However, it is common to express water losses as a percentage of the total system input volume and/or net water supply and to compare these values among utilities, disregarding the fact that each water utility has different operating conditions, customer consumption profiles, and infrastructure systems.

It is argued by some that it is easy to calculate percentages which are understood by nontechnical people, although using percentages in expressing water losses is totally misleading. On the other hand, the Infrastructure Leakage Index (ILI) is the best indicator for technical performance comparison of physical losses for different systems. However, the excuse for lacking the necessary information to estimate the ILI and the difficulty in understanding such an index by the management team of the water utilities and others lead to ignoring or avoiding using this indicator and investigating the other components of the IWA water balance.

This paper aims to highlight the pitfalls of calculating key performance indicators for NRW and its constituent components, when non-standardized methodologies are adopted. It also aims to showcase the concept of "normalizing" the NRW values, taking into account the different factors which need to be considered to represent the actual performance of the water utilities. These factors include the different supply times, consumption levels, pressure levels, served customers per number of connections, number of connections per network length, frequency of breaks, and complaints of customers. The "radar chart" concept is utilized to visualize the NRW level against the other factors stated above, which can be used to compare the utility performance over time or to compare its performance against that of other utilities.

Background

Although the International Water Association (IWA) water balance is a widely used tool to calculate Non-Revenue Water (NRW) and its constituent components by many of the world's water utilities today, as already mentioned (see Figure 21), many of these concepts are misused. There are many issues starting from the different definitions and absence of standard accounting "tools", terminology, indicators, etc., and a key challenge of agreeing on one standardized set of definitions for Water Balance components to:

- Define the common terminology and indicators.
- Allow performance improvement and target setting within the utility (formerly process benchmarking).
- Allow performance assessment among utilities (formerly metric benchmarking).

The water balance is an important tool for understanding inflow, consumption, and losses. However, there are problems:

- Most utilities lack the needed information.
- No information on the nature and location of leakage.

There is always the possibility of improving the water balance with two other methods:

- Real loss component analysis.
- Leakage measurements in the system.

<table>
<tr><td rowspan="7">System input Volume (SIV)</td><td rowspan="3">Authorized Consumption</td><td colspan="2">Water Exported</td><td rowspan="3">Revenue water (RW)</td><td rowspan="7">Water Supplied (WS)</td></tr>
<tr><td rowspan="2">Billed authorized</td><td>Billed metered consumption</td></tr>
<tr><td>Billed unmetered consumption</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption</td><td>Unbilled metered consumption</td><td rowspan="6">Non revenue water (NRW)</td></tr>
<tr><td>Unbilled unmetered consumption</td></tr>
<tr><td rowspan="4">Water Losses</td><td rowspan="2">Apparent (Commercial) losses</td><td>Unauthorized consumption</td></tr>
<tr><td>Billing&customer meter inaccuracy</td></tr>
<tr><td rowspan="3">Real (physiical) losses</td><td>leakage/overflows at storage tank</td></tr>
<tr><td>leakage on trasmission and distribution mains</td></tr>
<tr><td>leakage on service connection up point of customer meter</td></tr>
</table>

Figure 21: IWA water balance

The Problem

In many cases, NRW is expressed as a percentage of the system input volume or as water supplied (WS), where the NRW ratio might be significantly reduced by exporting more water to other water systems, while keeping the same water delivered to end users, without changing the overall NRW quantity. This issue is illustrated in the figure below.

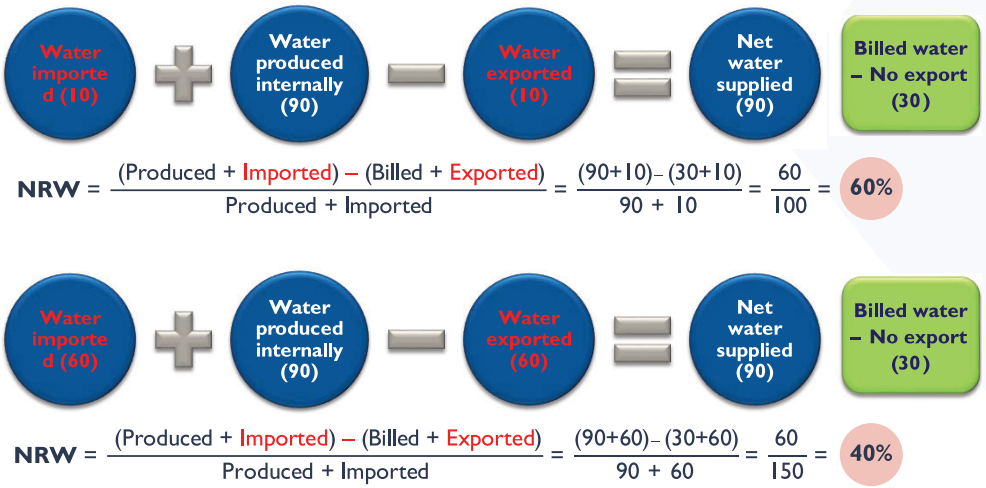


Figure 22: Supply time effect on the NRW %

Additionally, NRW expressed as a % of the system input volume or as water supplied (WS) does not work and might be misleading due to one or a combination of the following:

- Different supply times – see Figure 3.
- Different consumption levels – see Figure 4.
- Different pressure levels – see Figure 5.
- Etc.

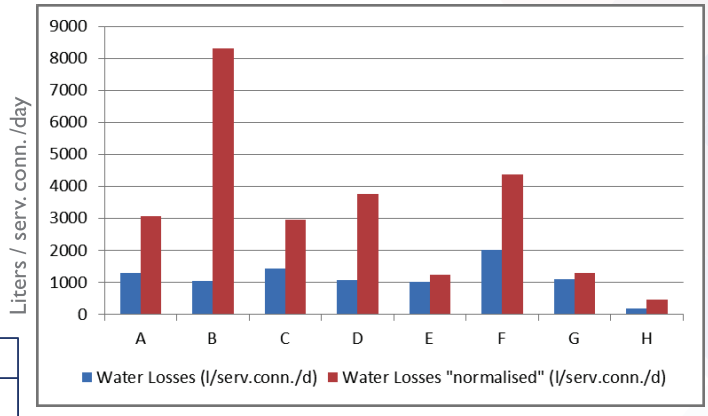


Figure 23:Two cases with the same billed and supplied water but different NRW %

Example 1	Example 2
Length of network: L **No of connections: 1,000** Customers: C Pressure: P **And Same NRW as % of SIV**	
• SIV: 100,000 m^3 • Consumption: 80,000 m^3 • NRW: 20,000 m^3 • NRW: **20%** of SIV	• SIV: 200,000 m3 • Consumption: 160,000 m3 • NRW: 40,000 m3 • NRW: **20%** of SIV
• Losses/connection/d = 20	• Losses/connection/d = 40
• Good	• Bad

Better NRW performance indicator (PI) → Losses/connection/day

Figure 24: Consumption effect on the NRW percentage

Example 1	Example 2
Length of network: L **No of connections: 1,000** Customers: C SIW: 100,000 m^3 Consumption: 80,000 m^3 NRW: 20,000 m^3 **And Same NRW as % of SIV = 20%** **Losses/connection/d = 20 m3** **But different average pressure (P)**	
• High pressure (30m)	• Low pressure (10m)
• L in l/connection/d/m P = 20/30	• L in l/connection/d/m P = 20/10
• Good	• Bad

Better NRW performance indicator (PI) → Losses/connection/day/m pressure

Figure 25: Pressure effect on the NRW percentage

Proposed Solutions and Recommendations

To overcome the issues addressed above, the following table summarizes the comparison between the different leakage performance indicators and their suitability to consider the water system conditions.

Performance Indicators for Real Losses	Continuity of Supply	Length of Mains	No. of Service Connections	Location of Customer Meters on Services	Average Operating Pressure
% of Volume Input	No	No	No	No	No
% of Water Supplied	No	No	No	No	No
Liters/Service Connection/Day	No	No	Yes	No	No
m3/km of system/day	No	Yes	Possibly	Yes	No
Infrastructure Leakage Index (ILI)	Yes	Yes	Yes	Yes	Yes

Table 7: Comparison of leakage performance indicators

It is also recommended to use the following indicators to monitor the operational performance of water systems to address the following areas of NRW:

1. Physical losses:

a. Litres/connection/day (w. s. p.).
b. Litres/connection/day per meter pressure (w. s. p.).
c. Infrastructure Leakage Index (ILI).

2. Commercial losses:

a. Percentage of authorized consumption.
b. Litres/connection/day.

3. NRW:

a. NOT % of the system input volume.
b. Litres/connection/day (w. s. p.).
c. Value of NRW as % of the operating cost.

The figure below illustrates a real example of how the NRW % varies according to the different operating conditions.

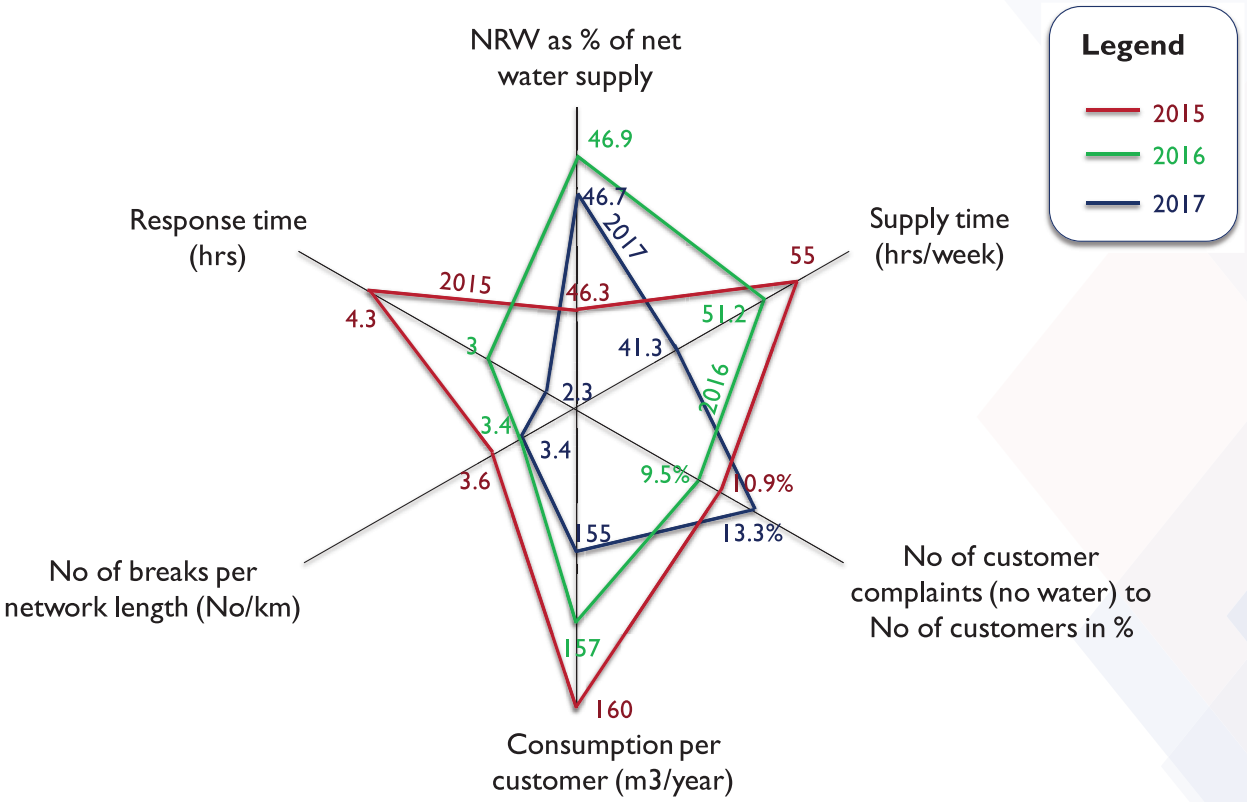


Figure 26: Radar chart to visualize other factors

WATER SAVING

Developing and Enhancing the Groundwater Basins Sector at the Water Authority of Jordan

Ahmad Abu Hijleh, Groundwater Management and Wastewater Reuse Specialist, WMI

Maha Al-Tarawneh, Water Resources Data, IKMS, and GIS Expert, WMI

Razan Roud, Head of Remote Sensing and GIS Department, MWI

Jawad Al-Bakri, Land Resources Management-GIS&RS Expert

Iman Al-Qaryouti, Intern, WMI

The objective of the USAID-funded Water Management Initiative (WMI) Project is to protect water resources in Jordan, in addition to improve the sustainability of Jordan's water supply systems, water governance systems, and water conservation.

Mindful of the importance of enhancing water supply systems and improving groundwater abstraction management, WMI is working on implementing a comprehensive management system for the private wells, leading to controlling the over-abstraction of groundwater resources, and in the meantime, increasing the generated income fees paid by the beneficiaries through establishing a new unit within WAJ to manage the private groundwater wells, both the agricultural and non-agricultural ones, in a way that will help reduce the abstraction from these wells.

Institutional and Administrative Reform

- **Restructuring the groundwater basins sector**

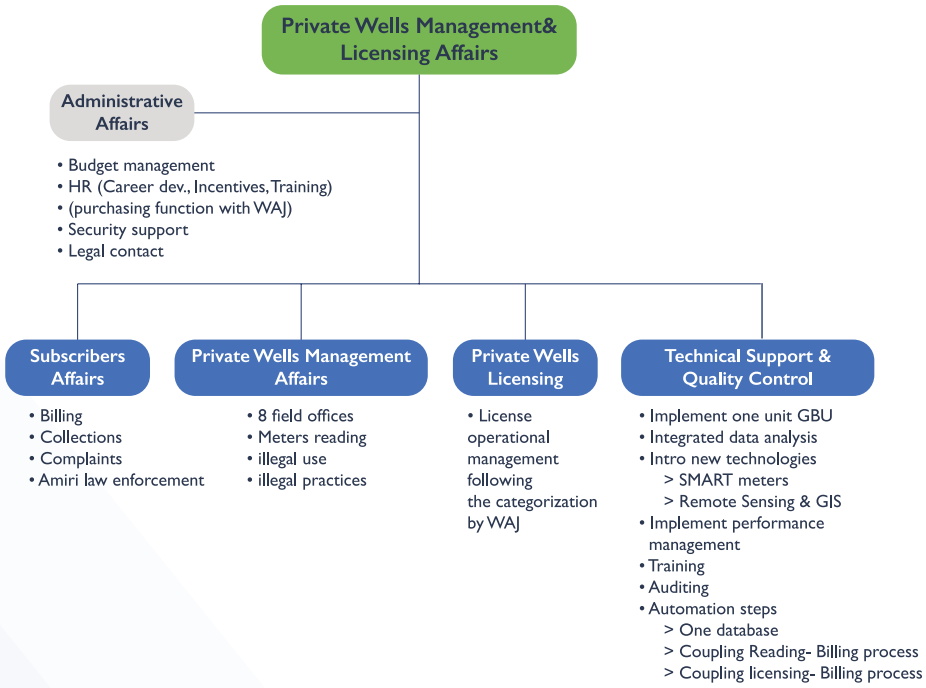


Figure 27: The organizational structure of the Private Wells Management and Licensing Affairs

The new unit will function as an independent business unit, to be able to focus on all improvements to be implemented. It is planned to locate all the staff of the new unit's headquarters in one working area to enhance cooperation and communication among its different departments.

The organizational structure (see Figure 27) of the new unit consists of the following existing operations departments: (1) Subscriber Affairs; (2) Private Wells Management Affairs; and (3) Private Wells Licensing. Additionally, two more departments will be established: the Technical Support and Quality Control Department and the Office of the Administrative Affairs.

- **Provide a modern work environment.**

With the approval of WAJ, the 7th and 8th floors at WAJ building will be renovated to host the above listed four main departments, in addition to the administrative affairs team (see Figure 28).

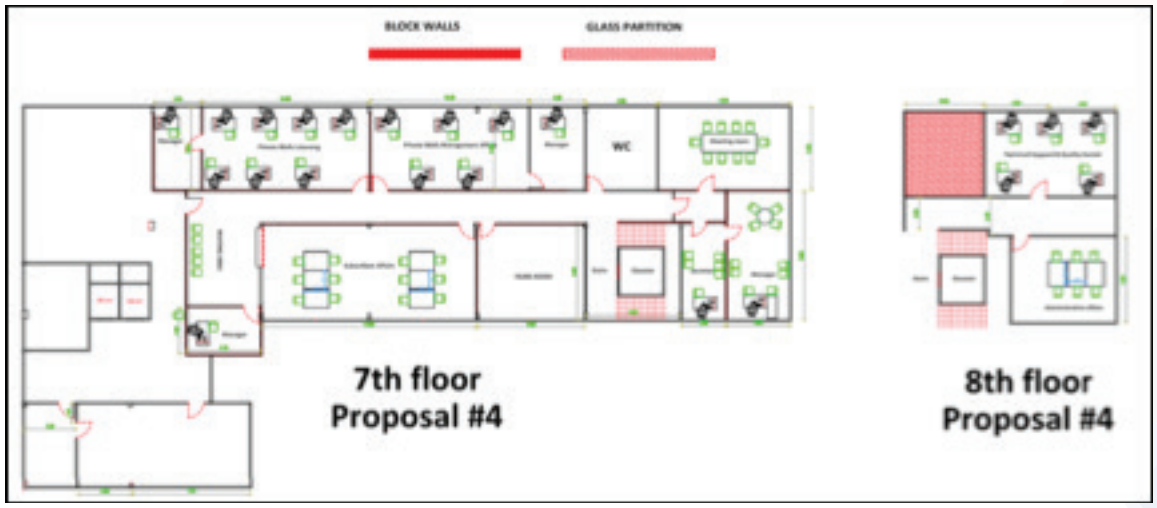


Figure 28: The proposed new structure of the New Groundwater Basins Unit

Technical Upgrading

A) Develop a GIS-based solution for the private wells: e-ground water management system (e-GWMS).

WMI project aims at supporting WAJ in developing an e-ground water management system (e-GWMS), a GIS-based system, to improve groundwater management practices as part of improving groundwater monitoring standards, procedures and capacity, through implementing a full-fledged, comprehensive system capable of documenting, monitoring, managing all office and field daily activities and business needs of Water Basins and Water Licensing Directorates in more effective and efficient way.

The e-GWMS will assist both WBD and WLD in registering all documents related to private water wells managed by WAJ and in managing these wells to monitor their water consumption and the billing process.

The proposed system should integrate with the existing systems adopted by WAJ and MWI to provide users and decision-makers with the following key tools and functionalities (see the figure below):

- Map visualization and GIS viewer web application.
- Basic and standard analysis tools.
- Reporting and charting tools to enhance the decision-making process.
- Operations dashboards.
- Capability to be integrated with NWIS, BMFO, SCADA and ERP systems in the future.

The figure below illustrates the proposed solution architecture of the e-GWMS.

B) Install a tracking system using GPS units in drinking water tankers.

In this regard, similar experiences can be gained from a project with similar mechanism implemented by the Ministry of Environment in association with the Ministry of Transportation and the Traffic Department: Monitoring dumping liquid waste through a GPS tracking system. Now, installing the GPS tracking device is a prerequisite for the annual relicensing of such tankers. Moreover, regulations for this purpose were issued in 2017 by the Ministry of Environment and approved by the cabinet. Figure 29 shows the tracking device installed in the wastewater collection tankers.

According to the records of WAJ, the annual consumption from the groundwater wells licensed to sell water is 4.2 mcm for the year 2017. According to a recent study conducted in 2019, a wide range between 3.1 mcm and 27 mcm with an average of 15.6 mcm/year of water is sold by tankers in Amman Governorate. Thus, such tracking system will help to:

- Define the location of the unlicensed wells for selling water (in case tankers buy water from them).
- Help determine the location of the unlicensed wells for selling water (agricultural and/or industrial wells).
- Assist the wells licensed to sell water in controlling the recorded extraction volumes by the well's meters.
- Can be used as a tool to modify the fees of the sold water from the private wells to tankers to include the fees for the wastewater services. The user of such type of water

Figure 29: Tracking device

To formulate the system, the following steps needs to be accomplished:

1. Get the approval of the top management at MWI and WAJ on the said idea.
2. Prepare the relevant instructions to manage the aforementioned tracking system.
3. Coordinate with the Traffic Department to ensure installation of the tracking device in each drinking water tankers.
4. Amend the current groundwater by-law accordingly.

C) Remote sensing for crop mapping and assessment for groundwater abstraction.

Within the activities of WMI, mapping of irrigated crops and their water consumption was carried out on five basins on the highlands of Jordan, using advanced technologies of remote sensing. The activities of crop mapping were designed to include the use of remote sensing data of Landsat 8 and SEBAL model, coupled with ground surveys and climatic records to derive maps of irrigation in the groundwater basins of Yarmouk, Amman-Zarqa, Azraq, Dead Sea and Al-Jafr.

Figure 30: Mapping of irrigated crops

In support to MWI and WAJ, WMI has completed a comprehensive program of analysis of illegal abstraction of underground water, identifying specific regions where these practices take place. Five basins were analyzed, and 27 hot spots were identified with a total estimated illegal abstraction and over-abstraction of 79 mcm.

Figure 31: Training on remote sensing to manage groundwater abstraction

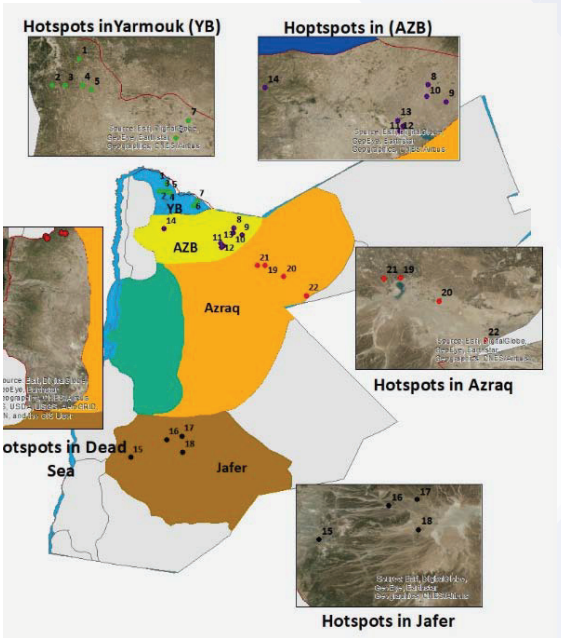


Figure 32: Hotspots located in Jordan

WMI offered training for 20 people on managing groundwater abstraction. MWI and WAJ started a campaign of notifications, began legal proceedings against the farms infringing the regulations of allowed abstractions, and started collecting the due amounts.

Main Objective:

The overall objective of the work was to develop aspects of groundwater monitoring at the Ministry of Water and Irrigation (MWI) and Water Authority of Jordan (WAJ) through building capacity in using remote sensing techniques for water management.

Status and Planned Activities: In collaboration with WAJ, WMI supervised implementing some recommended actions on groundwater violations such as illegal wells shutdown procedures and introducing better practices for changing cropping types to save water within the identified hotspots. WAJ provided distinctive support through the study conducted by the Assistant Secretary General, Eng. Awni Kloub and WB staff.

The Water Authority contributed to the effective implementation of the proposed actions by WMI through the direct support of the Assistant Secretary General for Water Basins Affairs, Eng. Awni Klopp and the technical staff of the five basins in the pilot project. The staff include: Mousa Al Khaldi, Ghanem Obeidat, Tawfeeq Rheimi, Fares Theinat, Ahmad Matar, and Mohammed Zeydanieen.

Figure 33: Applying recommended actions to groundwater illegal abstractions

WMI worked in close collaboration with MWI, WAJ, and MOA to establish a common technical team and build capacity in remote sensing techniques and GIS. A work plan was developed to monitor the identified hotspots within the 5 basins, as well as to detect changes within the entire basins for the hydrological 2019-2018 year.

WMI is working on a pilot project with the Water Basins Unit to install ultrasonic meters in selected farms, and it will propose the implementation of alternative systems to allocate amounts not extracted by farmers within their respective allocations to other farmers that require additional water beyond the limits, who are willing to pay a premium.

Results:

6.6 mcm is estimated to be saved as a result of implementing these techniques. Estimated completion is October 2019.

Effective Tools to Achieve Water Demand Management in Jordan

Noor Esoh, Water Demand Management Specialist, WMI
Fatin Shaban, Water Demand Management Engineer, MWI
Abdullah Al- Omari, Intern, WMI

Jordan has long relied on enhancing water supply to meet the increasing water demands. Additional factors which are beyond the control of the Government of Jordan such as climate change are now contributing to increased demands, and as such, the conventional approach to secure these demands will no longer suffice. Water demand management is an open field for study, as it is highly dependent on socioeconomic factors of a certain region and has site-specific features. For Jordan, even though different water demand management strategies have been adopted within the four main pillars of water demand management (legislative, technical, educational, and economic), significant potentials are not yet employed to further invest in this field.

Methodology

This paper summarizes the guiding principles of demand management with an emphasis on the role of compulsory legislative instruments as effective tools to better implement water demand management principles. The methodology adopted in this activity relies on the three main aspects of water demand management: legislative, technological, and educational/outreach-related activities.

Compulsory legislative instruments have been explored to demonstrate their capacity to absorb significant portions of the increasing demand, through adopting proper permitting procedures and the prohibition of incompatible water wasting fixtures that are abundantly available on the Jordanian market.

The rationale behind the selection of compulsory legislative instruments is summarized below:

- Water demand management under the current legislative framework is limited to voluntary procedures such as technical standards, plumbing codes, etc.
- Compliance with enforced technical regulations and administrative procedures undergoes strict monitoring and inspection mechanisms, through specialized government bodies and agencies such as the customs and JSMO.
- For the Jordanian setting, financial instruments under the current tariff structure have failed to prove effective reduction in water demands, since the majority of consumers fall within the lowest category in the tariff structure. Moreover, an increase in the water tariff on the lower category of consumers is not a favorable option for Jordanian decision-makers.
- Education and outreach programs are still necessary, but they will require time. Plus, they will not suffice to immediately meet the current deficit in water demand.

Legislative instruments can be seen as clear official guidance and commitment from the government to achieve water demand management on a national scale, which presents a sustainable option to secure future water demands.

Achievements

Along the implementation of the project activities, the following milestones have been achieved:

• WUE Action Plan:

A sector wide phased action plan for water use efficiency has been developed and approved by MWI. The objective of this action plan was to develop a set of objectives for water demand management with the actions required to achieve them. The action plan was developed against a timeline, based on consultation with the relevant stakeholders.

• Water Use Efficiency Capacity Building and Training:

Staff training on water efficiency best management practices was customized to government employees such as MWI, WAJ, JVA, GAM, JISMO and MPWH. The training targeted uses for both residential and non-residential sectors.

• National Water Use Efficiency Training for Schools and Hotels:

Around 4,500 students have been educated on best management practices for water efficiency, and staff members of 20 hotels have been trained on that, too. Redesign the existing certification program of the eco-school to include water use efficiency standards.

Figure 34: Water use efficiency training session at schools

Around 10,000 adoptions of water-efficient technologies and practices among school students and hotel staff members for hospitality, education and residential sectors have been achieved. Targeted trainings for the schools were designed to introduce water-efficient practices at the school facilities and households. The adoptions were calculated based on pre- and post-assessment surveys.

Over 100,000 cubic meters were saved over the course of a year, due to the above adoptions and as a result of retrofit programs targeting school lavatories and kitchen faucets.

• Support Enforcement of Local Standards

Two water efficiency related standards have been initiated for review by JISMO. WMI supported the review of the two standards during the technical committee review meetings and succeeded to gain approval to proceed with the adoption of the two standards as technical regulations.

WMI has investigated different scenarios for enforcing the two standards and conducted stakeholder consultations to select the appropriate approach without negatively impacting the local market.

• Rainwater Harvesting for Households

To ensure accurate sizing of rainwater harvesting when providing licensing for new buildings, a rainwater harvesting guide was developed for GAM. A one-day training session was organized to ensure optimum utilization of the guide. Moreover,

WMI worked with GAM to automate the licensing process of rainwater harvesting by embedding the fields for rainwater licensing in the existing system.Additionally,

along with MWI, WMI worked on amending the building regulations to clearly state the requirements to construct rainwater harvesting tanks.

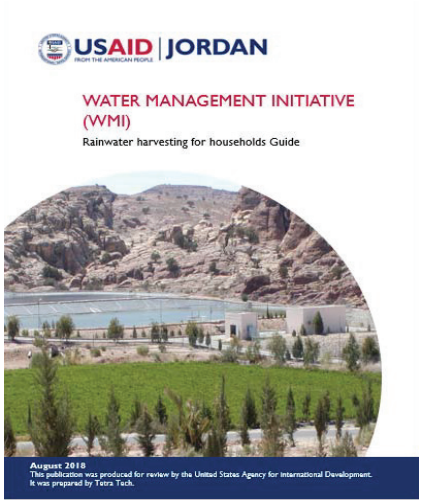


Figure 35: Rainwater harvesting for household guide

• Establishment of a Water Demand Management Unit at the Utility

WMI has succeeded in supporting Miyahuna in establishing a water demand management unit. In addition to its ongoing technical support, WMI has provided support in the recruitment of the unit staff, including the head of the unit and an intern.

• Retrofit Program for Large Consumers

WMI has conducted retrofit programs for school facilities from Irbid, Amman and Aqaba. Over 100,000 cubic meters were saved over the course of a year,

Due to the above adoptions and as a result of retrofit programs targeting school lavatories and kitchen faucets.

Figure 36: Retrofit program for school facilities

• Ma'an Campaign (Water Wise Homes Program)

The objective of the campaign is to introduce cutting edge water saving technologies to the public and encourage customers to purchase these products through the provision of an incentive package customized to the needs of customers. The campaign also aims to strengthen the role of the water utilities in water demand management and to enhance the existing relationship between the utility and customers. WMI consulted with relevant stakeholders about formulating and planning for the campaign.

معانا
maana

Figure 37: Ma'ana campaign logo

As a result, five main areas were identified:

• Technical: This includes the selection of the appropriate water saving technologies. One vendor was selected for this purpose.

• IT: An information website has been prepared and will be imbedded in the content of Miyahuna website. Additionally, an online system was developed to automate the entire implementation process of the program.

• Communication campaign: A campaign will be designed to inform the public of the program while utilizing the communication channels of the utility.

• Training: A comprehensive training package will be provided by WMI to relevant staff working in the field including utility staff and filed staff of plumbers.

• Provision of services: a local cooperative has been contracted to provide the incentive packages for the customers and will be receiving some training prior to implementation.

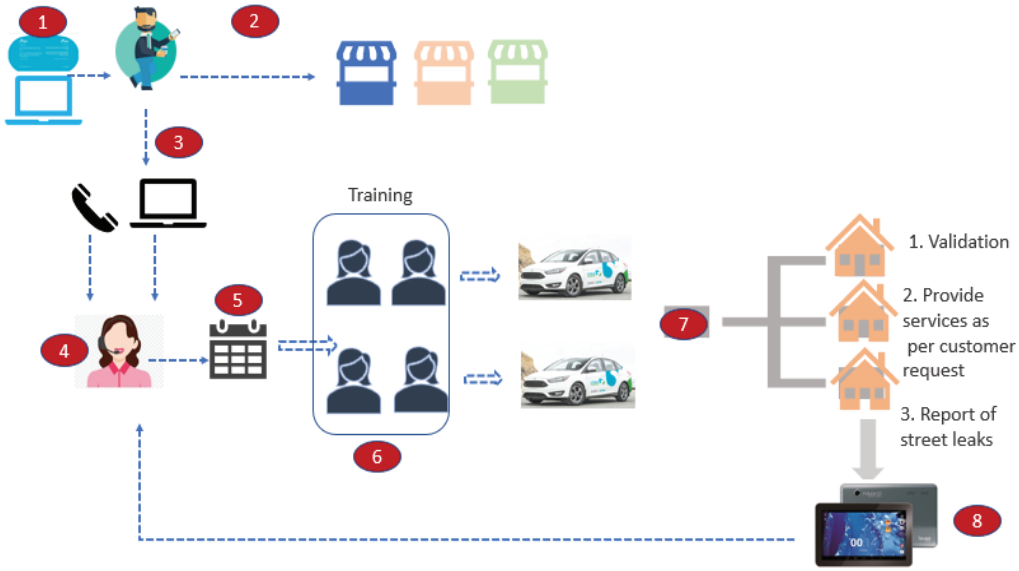


Figure 38: Ma'an campaign processes flow

Impact

The anticipated impact of these interventions are as follows:

- Increase adoptions of water-efficient practices and technologies.
- Achieve significant amounts of cubic meters saved due to adoption of water-saving technologies.
- Minimize and eliminate the number of water fixtures which do not comply with the Jordanian standards and codes.
- Enhance the public understanding of their water use and consumption.
- Enhance the public perception of water utilities.
- Strengthen the role of the utility in water demand management.

Determination of Water Losses in the King Abdullah Canal Conveyance System

Mohammad Shaban, Irrigation Management Specialist, WMI
Majid Khreisat, Water Management and Control Director, JVA
Mohammad Mufarih, Water Engineer, WMI

Background

The King Abdallah Canal (KAC) is 110 km long, concrete-lined open canal. It is considered the main conveyance system for irrigation in the Jordan Valley, in addition to its role in conveying a certain portion of drinking water to the citizens of Amman. KAC was built in phases from 1961 to 1987 with a total of 37 check gates, and discharge head capacity of 14.5 m3/s. KAC is divided into two main sections: (1) the northern part of the canal, 65km long, fed by fresh water and used for domestic and irrigation purposes; and (2) the southern part of the canal, 45km long, fed by blended water and used for irrigation purposes only.

Figure 39: King Abdullah Canal

To build a good and effective water resources management strategy, it is very important to have detailed quantitative knowledge of the available resources. To create such a strategy, detailed quantitative knowledge of the water losses in the KAC is needed. As such, reliable estimates of quantities of water losses from the KAC have contributed to increasing conveyance efficiency and reducing losses and physical and environmental damages that might occur.

Methodology

The primary goal of this activity was to measure the total water losses of the KAC and to determine the relative contribution of evaporation, seepage, and unmetered/illegal use to the total estimated loss. Illegal and unmonitored withdrawals from the KAC are important components of the losses in the canal that may count for a high percentage of administrative losses. -24hour measurements of the water flow in the canal are required to quantify these withdrawals and to refer to this quantity.

Towards this goal, WMI utilized two advanced Acoustic Doppler Current Profilers (ADCP) adapted for different objectives. The SonTek M9 is a boat-based, down-looking profiler that can make rapid and highly accurate current flow measurements in both parts of the canal and streams. The M9 system combines a Windows-based software package that can be used on a personal computer (PC) or mobile device. The SonTek-IQ is an ADCP that sits at the bottom of the canal and takes long-term measurements of flow.

The IQ is designed only for use in engineered structures whose geometry is known, and it has the advantage of being hidden under the water and is therefore able to make long-term measurements of the time series of currents.

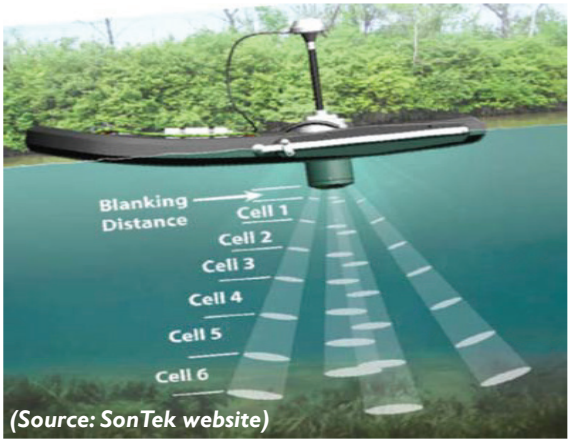
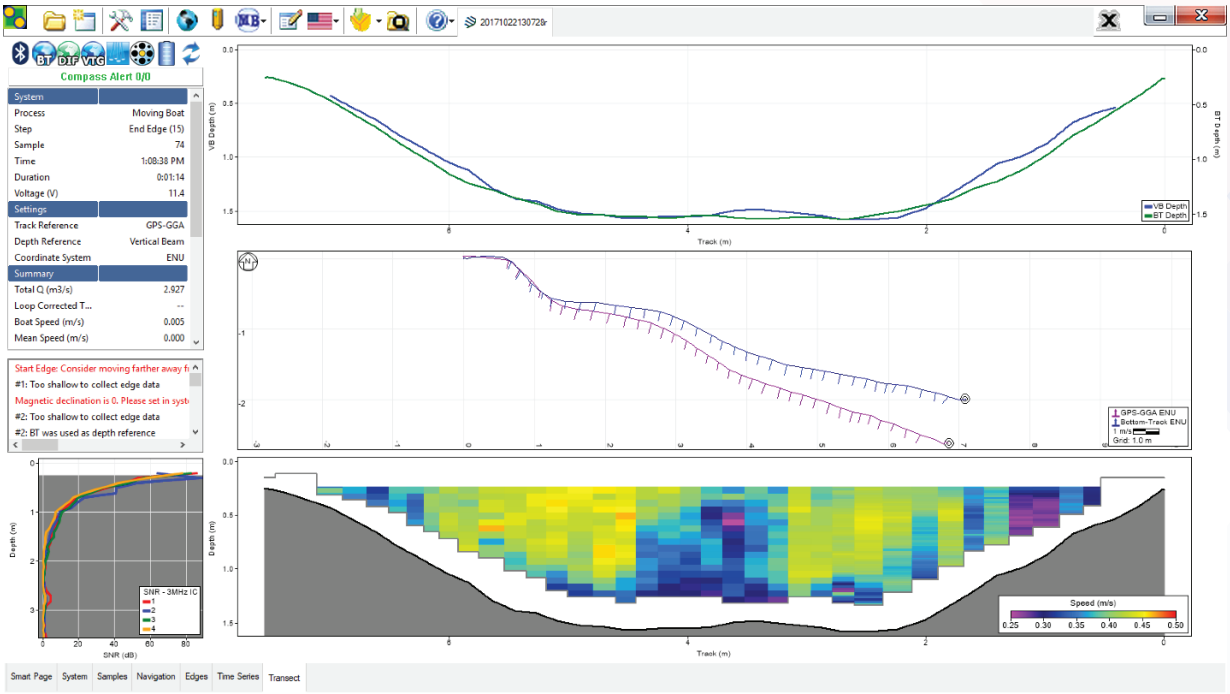


Figure 40: SonTek M9 Multiple Beam Acoustic Doppler Current Profiler

Figure 41:The SonTek M9 operating on the KAC in July 2017 (WMI Photo)



SonTek River Surveyor data display page. This data, dated 21 October 2017, is from the waterfall near the beginning of the KAC. The top graph is 2 different estimates of the channel depth. The middle plot is two different estimates of boat positions. The lower plot is a map of velocity. Note that the velocities are not estimated close to the channel bed. However, flow calculations are still performed. (Source: WMI)

Figure 42:The dashboard data of the SonTek

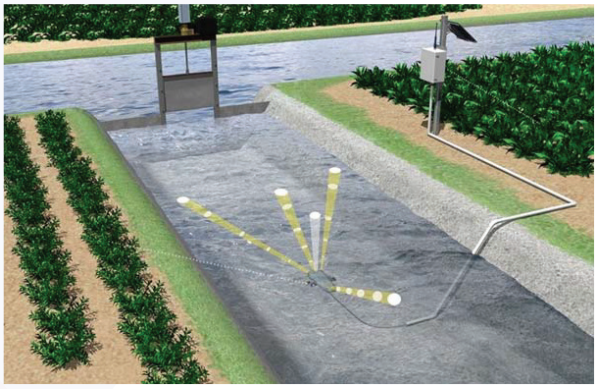


Figure 43: SonTek-IQ canal placement and acoustic beams (Source: SonTek website)

Figure 44: Preparing the SonTek-IQ for deployment in its custom-designed frame, October 2017 (Source:WMI)

Nearly 1,300 instantaneous discharge measurements were made using the SonTek M9 ADCP, and about 50 days of continuous -5minute SonTek-IQ ADCP measurements (over 14,000 discharge measurements) were collected in July and October 2017 and in April 2018. These observations were analyzed, combined and compared with observations made by the KAC-SCADA system to derive estimates of losses along 96 km of the KAC. On-job training was provided to JVA field technicians on using instruments and software and on data analysis.

Findings

Results show the total water losses in the northern part of the KAC are estimated to be %25.4 of the maximum flow (about 34 mcm/year), partitioned into three parts: %10.7 is caused by constant seepage; %13.7 is caused by unmetered or illegal uses; and %1 is caused by evaporation.3

The total water losses in the southern part of the KAC are estimated to be %38.1 of the maximum flow (about 27 mcm/year), partitioned into three parts: %14.5 is caused by constant seepage; %23 is due to unmetered or illegal uses; and %0.6 is caused by evaporation.

Illegal and unmonitored withdrawals from the KAC are one of the important components of the losses in the canal that count for a high percentage of the administrative losses (%60).

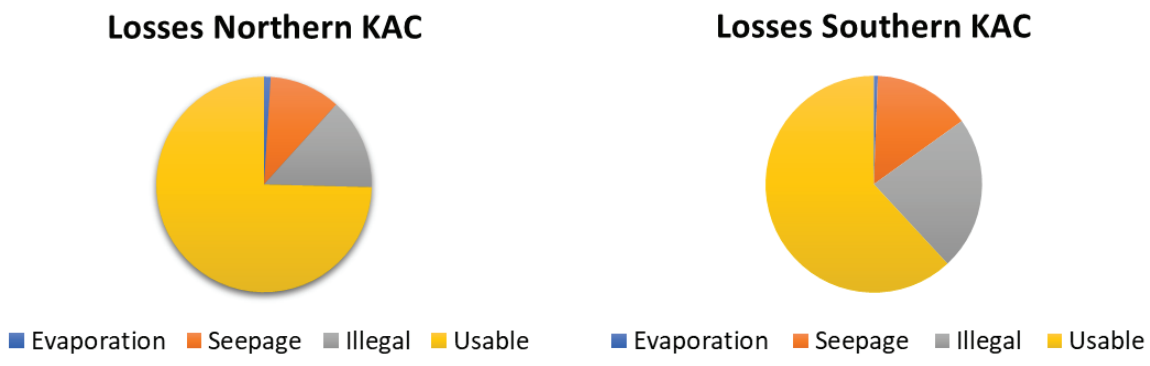


Figure 45: Losses in norther and southern parts of the canal

he figures show comparison of the different types of losses as per kilometer for the different reaches under investigation. This visualization clearly shows the reaches with the highest losses for each type and the reaches with potential for causing problems in the near future. Red and orange areas indicate the canal's reaches with higher losses according to different metrics.

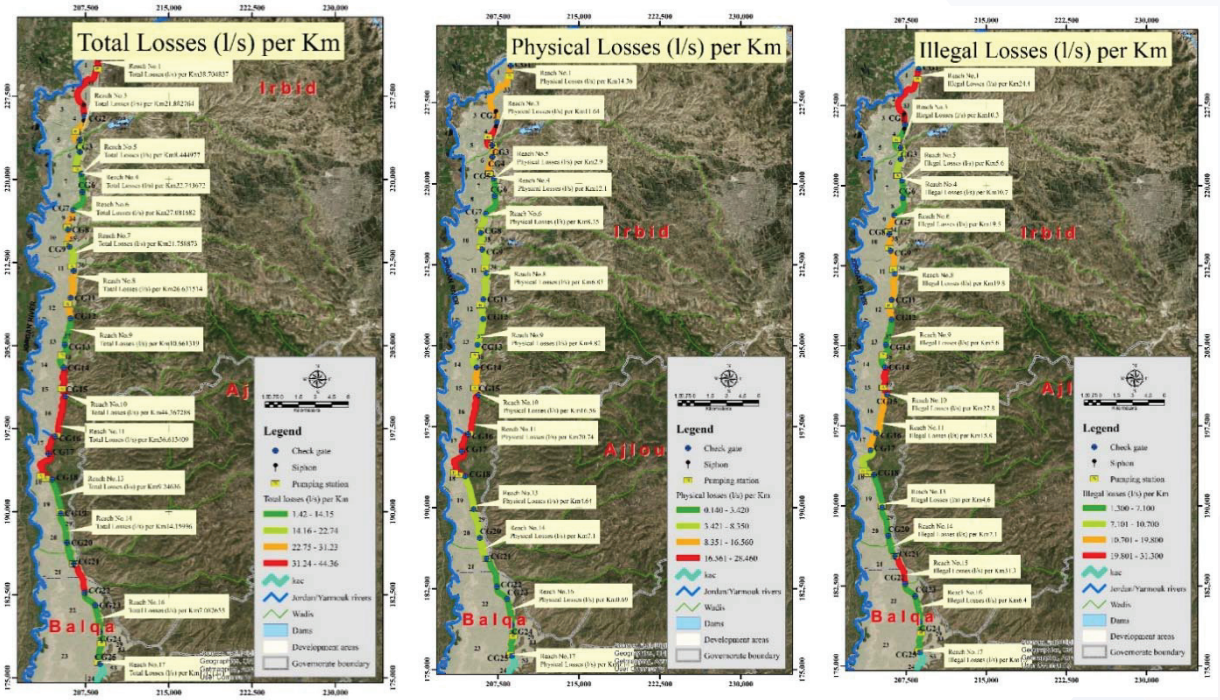


Figure 46: Total, physical, and illegal losses

- For the first time since the establishment of the KAC in 1961, the activity has been carried out.
- New technologies of flow measurement were introduced to Jordan.
- New measurement approach was followed for the first time in the world to measure the water losses in a canal under unsteady state conditions.
- The different KAC sections were classified based on their type of losses: physical and illegal.
- The shocking results pushed JVA to carry out a campaign to reduce the physical and illegal losses in the canal. The campaign achieved water savings of 11 mcm during 2018.

Figure 47: On job training to JVA field technicians on using the instruments and the software

WATER QUALITY PROTECTION

Protecting Water Resources Using Social Marketing Approach

Hamzah Al-Zoubi, Royal Department for Environment Protection Liaison Officer, MWI
Maha Dergham, Behavior Change Specialist, WMI
Abdul Razzaq Hyasat, Intern, WMI
Adnan Al-Zoubi, ASG for Media and Awareness, MWI
Ahmad Ulimat, ASG for Water Quality Affairs, WAJ

What is Social Marketing?

Social marketing is a planning approach that is used to influence people's behavior to provide benefits for individuals and society as a whole[3]. Social marketing depends on two main stages of behavior change: voluntary change through social influence and external environment change through policy change.

With the support of WMI, WAJ is using this approach to create sustainable protection activities for water springs in Jordan. Two springs were selected for the pilot phase and the intervention program was meant to cover eight springs at risk of water theft and pollution due to misuse and illegal practices. The pilot phase started in November 2018 with the springs of Wadi As-Seir in Amman and Al-Tanour in Ajloun.

Social marketing is proven to be a successful approach for sustainable change in health and environment sectors. USAID introduced this approach in the water sector in Jordan in 2010. It has been providing services to ensure smooth integration of this approach in the planning process of the water sector organizations[4].

Social Marketing Planning and Implementation Process

Social marketing takes into consideration the psychological, sociological, economic, and anthropological aspects of the target audience to fully understand them, and ultimately, provide an alternative to their exiting practices. This exchange includes products, services, and messages and takes place through the following process[5] :

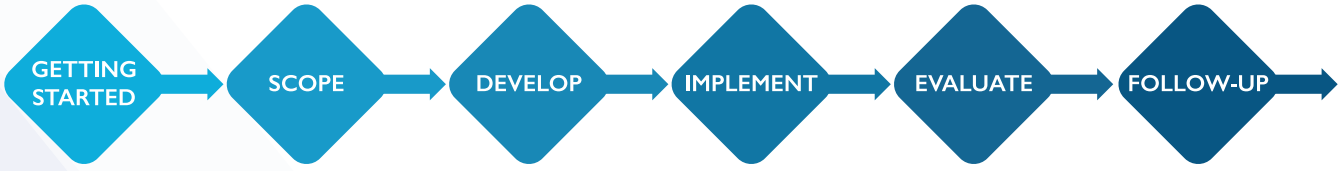


Figure 48: Social marketing planning and implementation process

(Image Source: National Social Marketing Centre)

3- National Social Marketing Centre

4- USAID Impact Assessment Report on the PAP Project

5- Social Marketing Behaviour, 2008

The "Getting Started" phase includes an assessment to understand what or who causes the problem and why the problem took place.

The "Scoping" phase involves understanding the audiences and their behaviors and focuses on creating the motivator for voluntary change among the target audiences.

The "Develop" phase is the design of the marketing mix, a combined activity that includes development of educational programs, technical support for the water utilities to enhance the water resource operations, infrastructure development for health and safety measures around Zone I of the source protection area, stakeholder engagement activities, and enforcement of laws and regulations.

The WMI Project is currently implementing the marketing mix "Developing Phase."

Background

Wadi As-Seir spring

It serves south of Amman with water. Wadi As-Seir stream originates from several springs in the area. Its water is drinkable after being treated in Wadi As-Seir treatment plant, which provides residents of the area with their water needs.

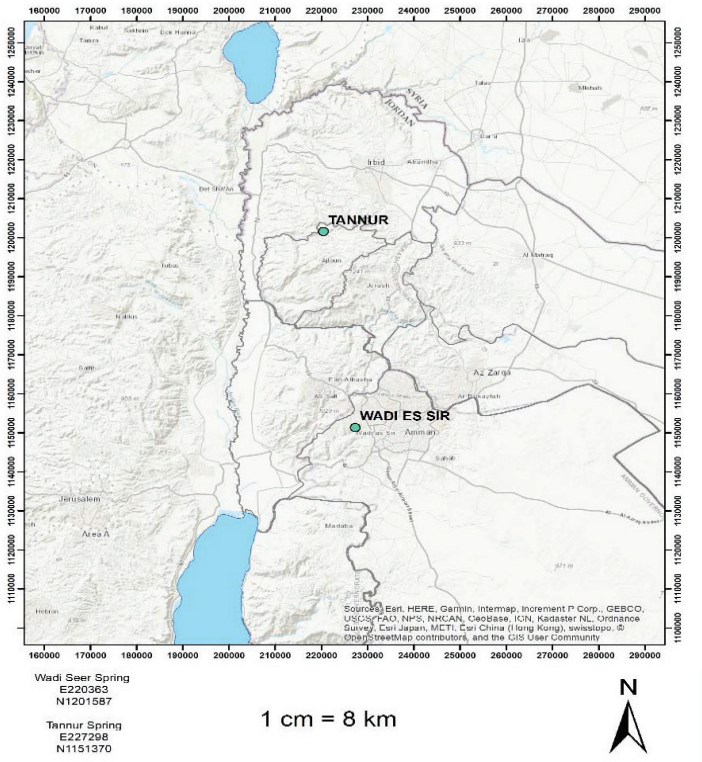


Figure 49: Geographical location of Wadi As-Seir and Al-Tanour springs

The stream is also a vital source of irrigation for farmers who grow fruits, such as pomegranate and figs.

Water sector authorities are repeatedly in action to remove illegal pipeline connections that are made to divert water from the water spring to the underground private reservoirs that are mostly unlicensed. Additionally, the water sector authorities are facing the challenge of preventing water theft by local violators who divert water from Wadi As-Seir stream to fill up tankers and sell water unfit for human consumption.

The control actions made by the water sector authorities to demolish illegal connections and seal the reservoirs with rubble and concrete were not enough, though. Additional actions were taken by the water sector authorities in cooperation with the Directorate of Public Security. Permanent patrols in different parts of west of Amman were deployed to prevent water tanker drivers from filling up their tankers from the stream and selling water. However, that was not enough either.

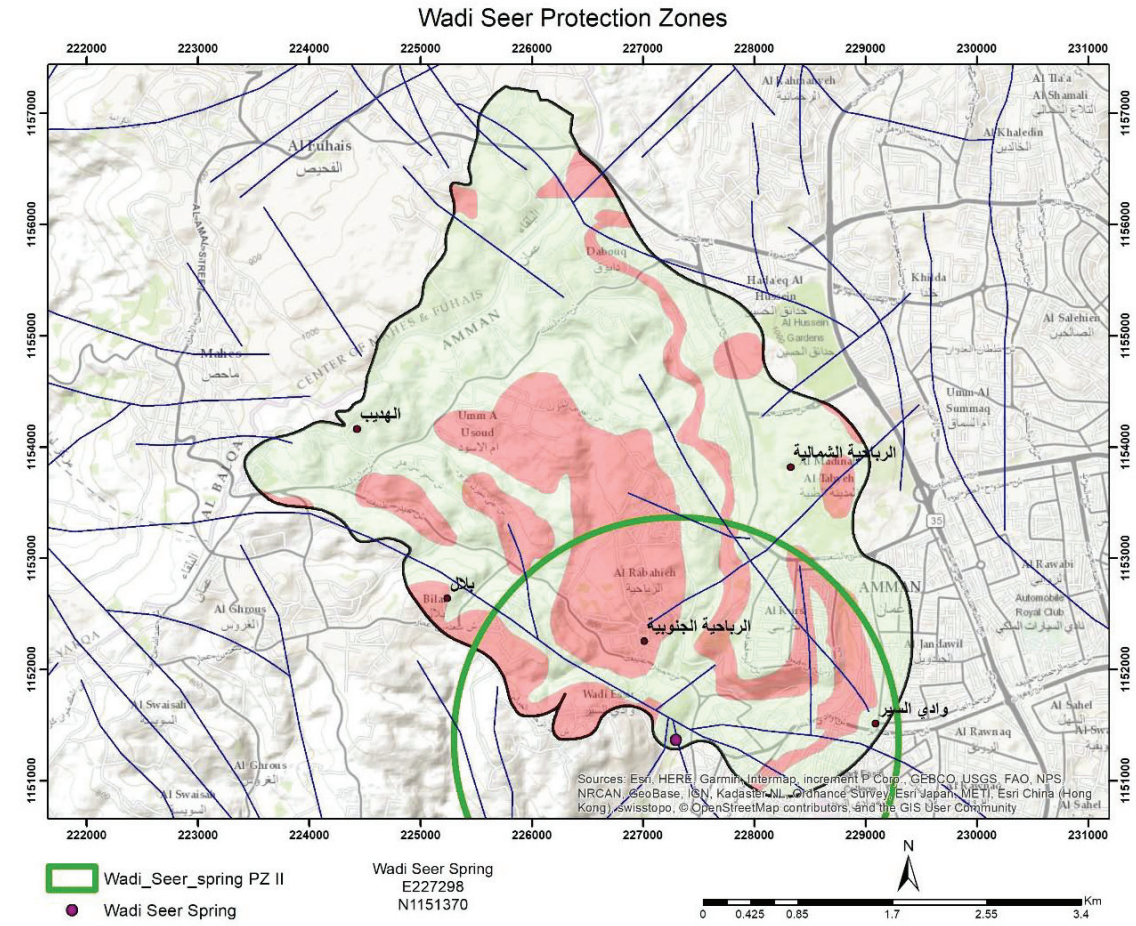


Figure 50: Wadi As-Seir protection zones

Al-Tanour Spring

Al-Tanour spring is one of the key water resources in Ajloun Governorate. This spring is surrounded by six olive mills, and around the spring farmers reside, living off of agriculture and livestock-raising. The activities associated with the olive mills during the olive harvesting season badly affect the quality of water of the Al-Tanour spring. However, the water sector authorities have controlled all activities related to dumping Zebar water in the valley around the spring. Since 2016, no cases of water pollution due to Zebar water have been reported. However, the Water Authority laboratories still find some water quality concerns that need to be followed up. The major problem is the absence of correct application in the protection zone and the lack of control over prohibited human practices within the protection zone around the spring.

The lack of public knowledge about the impact of human practices around the spring area on the quality of water remains a challenge. Additionally, the lack of the spring operators about the scientific knowledge to measure and control water quality is also still challenge.

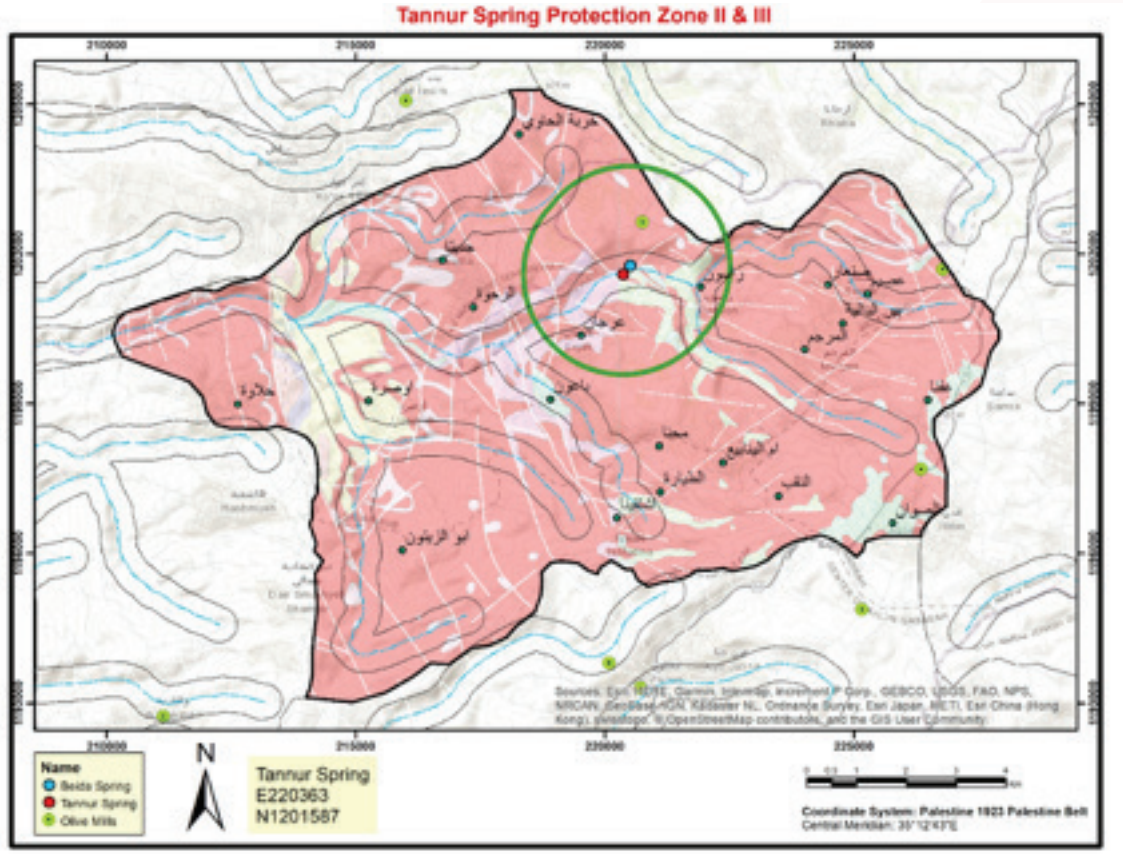


Figure 51: Al-Tanour spring protection zones

Approach and Methodology

Using the social marketing approach, the protection of the two springs from water thefts and illegal or prohibited practices was carried out or achieved through the following procedures:

1. Getting Started

A situational assessment and analysis were conducted through a field visit and interviews with key stakeholders to understand the problem and its causes.

a. Challenges and barriers were identified:

- Lack of public knowledge about how to react to stop illegal practices happening around water resources within local communities.
- Lack of public knowledge about the impact of illegal and prohibited practices, including water thefts, on the quality and quantity of drinking water.
- Reduction of water cost or interest in gaining more money are main drivers for illegal water thefts behaviors.
- The protection zone was identified on GIS applications with specific coordinates. This is not being reflected on the ground.
- Lack of public knowledge about prohibited practices within the protection zone around water springs, for instance, knowledge about the reason for prohibition, what people can do about that, and how they should report on certain issues.

Plan for stakeholder engagement: Water utilities, Ministry of Environment, and Ministry of Agriculture.

2. Scoping

Segmentation of audiences is based on their understanding of current practices and creation of motivators for voluntary change. The targeted segments are:

a. Students (grades 5 to 9).

b. Women CBOs.

c. Owners and operators of olive mills.

d. Operators of water pumping stations.

3. Develop

Using the commercial marketing approach, the intervention mix was developed to cover the four pillars of social marketing: support, design, inform/ educate and control. These four components equal the 4 Ps in marketing, which stands for product (core benefit); price (monetary cost and emotional effort); place (access to service); and promotion (communication timing, tools and channels)[6]. Nevertheless, social marketing involves more than the 4Ps of marketing. It also includes additional Ps in the mix. These include: people perspective; process, which involves service delivery and operating systems; and the physical appearance of staff and working environment.

6- Social Marketing Changing Behaviours for Good, Nancy Lee

The developed intervention mix, as explained in Figure 2, includes:

a. Customized educational programs.

b. Technical support and capacity building for the water utilities responsible for the water resource management, including training and delivery of necessary equipment to monitor water quality.

c. Infrastructure development for the protection zone around water resources, and application of health and safety measures.

d. Stakeholder engagement activities.

e. Development of standard operation procedures and enforcement of laws and regulations related to water thefts and illegal or prohibited practices.

Currently, the project is still in the implementation stage.

Activity	Target
The Reach of the Campaign	150,000
Awareness-Raising	6,000 individuals from targeted communities 2,500 students 1,000 rangers/ officers
Water Saved (Cubic Meters)	he protection of the two springs will save the production of (600 m3/hour) from Wadi As-Seir spring and up to (200m3/hour) from Al-Tanour spring

Table 8: Key achievements and expected results

Implementation of Water Safety Plans (WSPs) for Three Water Supplies in Jordan: Enablers, Lessons Learned, and Road Map

Eman Alhamdan, Senior Water and Wastewater Engineer, WMI
Muna Gharaybeh, Director of Desalination Department, WAJ
Haitham Kilani, Director of Operations, Miyahuna
Majida Al-Zoubi, Director of Quality, Miyahuna

Background

WMI works with the water sector in Jordan to overcome the various challenges that the sector is facing, including limited water resources and the unpredicted increase in population due to the political situation in the neighboring countries. That situation put huge pressure on the already overloaded infrastructure services. Through four components, WMI is providing the necessary technical support to improve efficiency and promote sustainability. In line with the National Water Strategy of Jordan, 2025-2016, one target of WMI is to improve water quality and risk management under water supply protection component.

In December 2016, WMI reviewed the water safety planning practices in Jordan and a report was submitted. The report discussed the current practices implemented by the Government of Jordan in relation to water safety planning, which had been initiated in 2006 through the World Health Organization (WHO).

In 2004, the World Health Organization (WHO) introduced the concept of Water Safety Planning (WSP) approach to conserve and monitor the water resources used for drinking purposes[7]. WSP is a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer.

In General, the objective of water safety planning is to ensure safe drinking-water supplies through proper water supply management practices. The water safety plan is an important component for a preventive management framework for safe drinking water[8]. Therefore, it comprises system assessment and design, operational monitoring and management planning (including documentation and communication),

which can be implemented through five major steps translated into 11 modules. WSP is important not only because of its valuable impact on water quality and the services it can provide, but also because it helps increase the confidence of the consumers in the safety of water supplies.

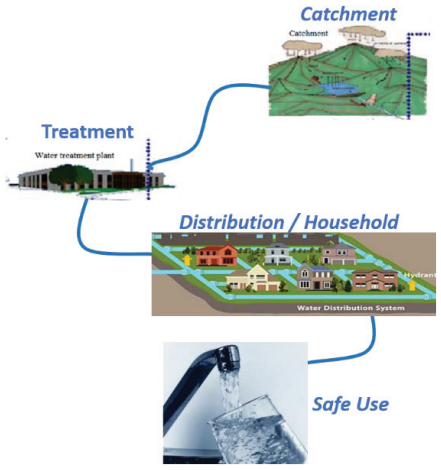


Figure 52: WSP concept covers the whole system

7- Annette Davison, et al. (2005). "Managing Drinking-Water Quality from Catchment to Consumer Report," Geneva, Switzerland.

8- Ibid.

provide, but also because it helps increase the confidence of the consumers in the safety of water supplies. In 2006, WHO introduced the concept in Jordan through direct implementation in cooperation with the Ministry of Water and Irrigation (MWI), Water Authority of Jordan (WAJ), Ministry of Health (MOH) and water companies in Jordan. After that, several efforts were made in this regard.

In the Year 2009, a joint program (JP) named "Adaptation to Climate Change to Sustain Jordan's MDG Achievements," was launched by four UN agencies working in Jordan, (namely UNDP, WHO-CEHA, FAO, and UNESCO), along with the Government of Jordan. The "WHO-JP" aims at protecting human health against water scarcity induced by climate change, through sustaining access to improved water supply sources, despite increased water scarcity induced by climate change, and strengthening adaptive capacity to climate change under water scarcity conditions for health protection and food security[9]. A major outcome of this project was formulating the following committees:

- The National Guiding Committee for Water Safety Planning Implementation.
- The Technical Committee (Task force teams and WSP teams).

Accordingly, during the period of 2012-2009, the WSP approach was tested in five demonstration areas selected by the steering committee, with the support of the project's technical committee, including Wadi Al-Arab, Zayy, Al-Karama, Lajoon and Aqaba water supply systems.

After the completion of the WHO-JP project (The period of 2016-2013) and based on the gained experience during the implementation of the aforementioned project, the Planning and Evaluation Directorate (PED) of WAJ Central labs, in association (to some extent) with the other relevant governmental agencies, has been undertaking the mandates of the WSP in the sector.

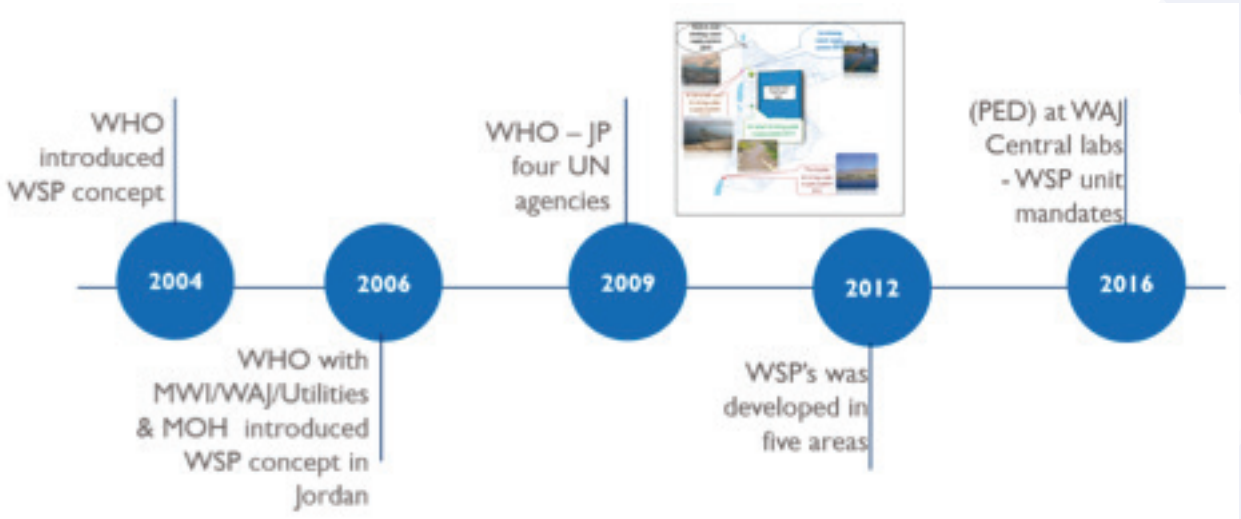


Figure 53: WSP timeline in Jordan

9- Based on the communication with Eng. Suzan Kailani.

After understating the situation and issuing the required recommendations (see WMI final report on "Review of Existing Water Safety Planning Practices in Jordan")[10] , WMI started working with MWI, WAJ and water utilities (stakeholders) to institutionalize WSP practices within the water sector in Jordan and developed an action plan for implementation of the national WSP.

Methodology

WMI approach was through re-activating the concept of water safety planning through working closely with all stakeholders to create a solid foundation for strong enabling environment by capacity building of the WSP teams and institutionalizing WSP practices in Jordan, in order to be able to scale up.

For this purpose, WMI has initiated the following activities:

- Re-triggering the National WSP Steering Committee.
- Enhancing it through engaging senior management representatives.
- Selecting five systems located in Amman, Jerash, and Karak governorates.
- Establishing an effective WSP core group (MWI, WAJ, Miyahuna, YWC and MOH).
- Formulating the technical teams in accordance with WSP needs (leader for each team).
- Managing the WSP action plans to launch workshops and develop processes.
- Supervising and directing the WSP implementation process.
- Improving the capacity of WSP teams.
- Water safety planning and auditing training.
- Monitoring and evaluating the progress of the teams.

Implementation

WMI has managed, supervised, and supported all WSP teams during the implementation process of the following WHO-WSP steps:

1. WSP Preparation (Module 1)

Module 1: Assemble WSP Team

2. Systems Assessment (Modules 5-2)

Module 2: Describe Water Supply System

Module 3: Identify Hazards and Assess Risks

Module 4: Determine and Validate Control Measures, Reassess and Prioritize Risk

Module 5: Develop, Implement and Maintain an Improvement Plan

Figure 54: Think big, start small, scale up (WHO approach)

10- WMI-USAID. (2016). "Review of Existing Water Safety Planning Practices in Jordan Final Report," Amman, Jordan

3. Monitoring (Modules 7-6)

Module 6: Define Operational Monitoring of Control Measures

Module 7: Verify the Effectiveness of the WSP

4. Management and Communication (Modules 9-8)

Module 8: Prepare Management Procedures

Module 9: Develop Supporting Programs

5. Feedback and Improvement (Modules 11-10)

Module 10: Plan and Conduct Periodic WSP Review

Module 11: Review and Revise the WSP Regularly and Follow an Incident

Figure 55: The WSP core team

WSP represents the work of water utilities. Five systems were selected during the planning phase and only three systems continued and finalized their WSPs, due to the following points:

- Some of the WSP teams were dealing with WSP as a volunteering work.
- Water safety planning was not clearly mentioned as a target within the mandates of the technical staff at the water utilities.
- Absence of fully active WSP units at the water utilities.
- Limited top management support during developing and implementation.

Based on these points and other many key lessons learned during the implementation journey, WMI prepared and submitted a concept paper towards a national water safety planning, which covered the required enabling environment to support sustainable WSP scale-up. Moreover, WMI will continue working on establishing the first-ever WSP audit teams and building their capacity in conducting informal-external WSP audits.

Enablers for Sustainable WSP

Although three systems have continued and finalized their WSPs so far, future management effort, support and follow up to create the following enabling environment are highly recommended to also achieve sustainable WSPs:

1. Advocacy:

a. Increase awareness amongst all stakeholders.
b. Share WSP benefits.
c. Develop materials.
d. Organize activities.
e. National "WSP champions."
f. Carry out WSP impact assessments.

2. WSP auditing:

a. Support the continuous improvement of WSPs.
b. Provide a system of ongoing support.
c. Provide accountability for WSP implementation.

3. Policy and regulatory instruments:

a. Integrate WSP into drinking-water policies and/or regulations.
b. Review and amend the relevant assignment agreements of water utilities.

4. Capacity building:

a. Scalable and sustainable WSP training programs.
b. Training of trainers (TOT) program.
c. Standardized training packages relevant to the national scale-up.

5. Institutionalized roles:

a. Mutual understanding of roles and responsibilities related to WSP training, implementation and auditing.

6. Sustainable financing:

a. Short- and long-term investments to:
- Improve water quality.
- Identify new infrastructure.
- Support WSP training, implementation oversight and auditing.

YOUTH AND GENDER PARTICIPATION

Internship Program

Shadia Nassar, Youth, Gender, and Vulnerable Population Specialist, WMI
Daren Abu Ghoush, Technical Coordinator Engineer, WMI
Mahmoud Al Alawneh, Junior irrigation Engineer, WMI

Through targeted technical assistance and capacity building, WMI supports implementation of improved water institutions/entities management practices, including capacity building with a special focus on gender mainstreaming and youth engagement.

One of the key expected results of the project is increasing the number of women and youth engaged in water sector planning and management. Therefore, WMI developed an internship program to serve youth aged 28-20 years in the water sector, taking into consideration the gender aspects in selecting the candidates. The program was developed to be in 3 phases: design, implementation, and evaluation.

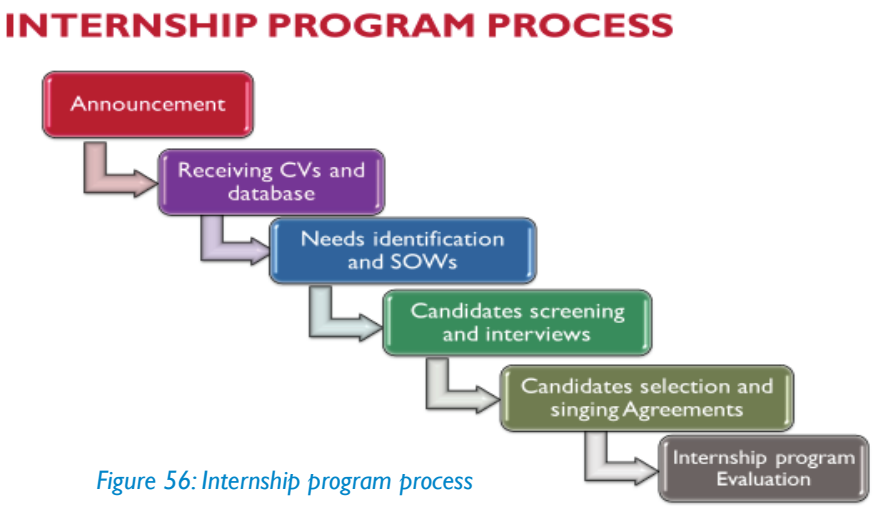


Figure 56: Internship program process

The internship program offers interns a hands-on opportunity to work in their desired field. They will learn how their course of study applies to the real world and build valuable experience that makes them stronger candidates for jobs after graduation.

Another significant advantage of the internship program is that, by providing internships, the water institutions/entities have the opportunity to select and develop their future talent through evaluating and screening potential employees prior to making full-time position offers. This leads to financial savings and raises the quality of services.

WMI established a strong partnership with Jordanian universities as one of the key elements of success of the internship program, to provide training and identify eligible students for the internship program, ensuring gender equal opportunities and benefits. WMI continues to explore potential partnerships with other institutions/ entities.

So far, the internship program has been in place for two years, having started in May 2017. The program will continue to run through 2021. Each intern participates in up to six months of internship training on a full-time basis, in which he or she will be trained on different topics based on his or her skills and the needs of the company.

Based on the increasing demands of the water sector, WMI updated the original internship program plan to increase the number of interns from 50 to 100 interns across the project life.

The program is managed by WMI management with full coordination with the Ministry of Water and Irrigation, the Water Authority of Jordan, the Jordan Valley Authority, and the water utilities.

Selection Criteria

Candidates can apply for an internship if they fall under any of the following:

The student is currently a senior; i.e., he or she is in the last year of an undergraduate or postgraduate program in any of the following fields:

- Sciences (lab technicians).
- Communication and information.
- Engineering.
- Finance.
- Human Resources.
- Management.
- Or any other field based on the needs of water utilities.

Internship Program Procedures

1. Conduct a needs assessment for the utilities departments to assess the gap between the current functions and staffing and between the desired functions and responsibilities based on the needs.
2. Develop a SOW for the needed fields and positions that the interns may be trained on.
3. Select the internship candidates based on selection criteria.
4. Conduct interviews and select the candidates.
5. Sign agreements for a six-month training period.
6. Develop a supervision system to track the intern's deliverables.
7. Assess the internship program after each training phase to detect gaps and constraints as a learning process to improve specific aspects of the program to achieve its goals.

Each intern participates in a maximum of six months of internship training on a full-time basis. This duration may be extended for another six months based on the needs of the water institutions/utilities.

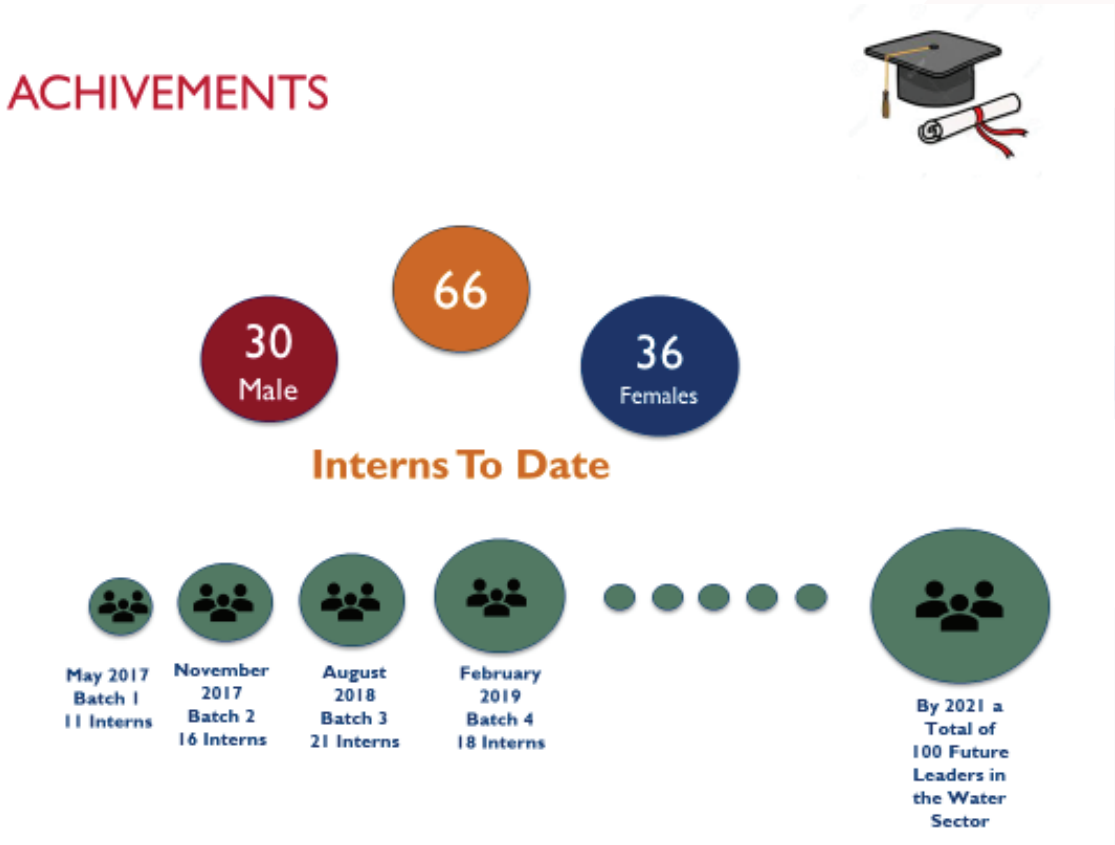


Figure 57: Interns to date

Sustainability

It is anticipated that WMI will support the YWP program for the life of the project with a total of ten candidates for the pilot phase. However, it is anticipated that utilities will allocate a yearly budget for this program and amend regulations to institutionalize the program under the HR department to ensure the sustainability of this initiative in the future. The internship agreement expires six months after its commencement, unless extended. Following the completion of the internship period, a graduation ceremony is held for the interns, at which they are awarded certificates of completion.

Young Water Professionals Program (Previously Internship Training)

WMI is working with the utilities to adopt and build this internal program, evolving to become "Young Water Professionals (YWP)." This program aims at creating a pool of young, fresh graduates, well trained and skilled to be future employees at the utilities serving the needs of the water sector. Additionally, this will reduce the financial burdens of the hiring process and would eventually motivate the workforce and improve performance and efficiency. This YWP internship will offer interns a hands-on opportunity to work in their desired field. They will learn how their course of study applies to the real world and build valuable experience that makes them stronger candidates for jobs after graduation.

Figure 58: Young Water Professionals Program management process

Gender Study on the Status of Women Working in the Water Sector

Shadia Nassar, Youth, Gender and Vulnerable Population Specialist, WMI

Ahmed Azzam, Assistant Secretary General for Financial and Administrative Affairs, MWI

Purpose

This gender study is in line with the governmental plans to empower women in the public sector, with the purpose of assessing the status of more than 1,200 women working in six water entities and companies governing and operating water supplies and services in Jordan. The study was conducted by the Women Studies Unit at the Ministry of Water and Irrigation (MWI), and supported by Water Management Initiative (WMI), a USAID funded project.

Methodology

A research-based methodology was adopted, comprised of qualitative (key informant interviews) and quantitative (face-to-face survey) techniques, applied to a sample of more than 260 male and female respondents working in the water sector entities, distributed all over the three regions. In addition, a desk study exercise was performed to analyze secondary data collected from human resources and financial management departments within the water sector entities.

SAMPLE

Distribution of the Key Informant Interviews and survey sample by entity

Entity	Female interviews	Male Interviews	Female Surveys	Total
MWI	6	6	5	17
Yarmouk	8	7	15	30
Aqaba	2	2	3	7
WAJ	31	31	62	124
JVA	8	7	15	30
Miyahuna	14	13	27	54
Total	69	66	127	262

Distribution of the Key Informant Interviews and survey sample by region

Data collection tool	Central	North	South	Total
Key informant interviews	70	25	40	135
Surveys	59	29	39	127
Total	129	54	79	262

Figure 59: Distribution of the interviews

Main findings

Gender Balance

Women employees constitute about %11 of the total employees in the water sector. By excluding the number of men working in the third job category, the percentage of women working in the water sector reaches %44.8, which is higher than %17, the national percentage of the working women in Jordan[11].

- Women hold %37 of leadership and supervision positions across water sector entities compared to other public sector entities.
- Compared to men who represent %15 of the total employees in the first job category, women represent %39 of the total employees in the same category, usually holding the first university degree and above. However, men represent %76 of the total employees in the third category, which can be related to the technical nature of the sector work. Employees in this category usually hold less than a secondary degree or vocational training.

Women and the External Factors Affecting their Working Environment

- More than %50 of women noted that the current working hours in the water sector are unsuitable for working women due to other family and social commitments.
- %33 of women think that the available facilities (e.g. prayer room, bathroom) are inadequate. Besides, the lack of nursery facilities is also a matter of concern for them.
- The majority of women (%72) believe that their career responsibilities are appropriate to their abilities and their academic and practical qualifications.
- The water sector entities are characterized by masculinity due to the nature of fieldwork and hard tasks that require certain physical efforts usually performed by men.

Training programs and capacity building

- %43.7 of females disagree that equality is achieved regarding the training opportunities, especially for the external training, which requires travel and accommodation outside Jordan.
- MWI offers numerous training programs to the employees. Therefore, working women need to take difficult decisions concerning family conditions every time they would like to join a training. In that case, women give priority to the family and lose many training opportunities.
- %45 of females believe that men develop in their professions faster than females due to different reasons, of which is the training and skill development opportunities given to them.

11- Global Gender Gap Index, 2018

Ability and Distribution of Job Duties from a Gender Perspective (Stereotypes)

- %49 of males have agreed that women have moderate ability to perform the same duties performed by men with the same degree of efficiency. Therefore, distribution of job tasks is affected by this fact.
- %53.6 of male interviewees, particularly in MWI, think that many women do not access leadership and supervisory positions because they need to develop their skills and abilities to be able to reach senior positions in the water sector.
- Women's leadership patterns are: (1) the emotional nature of women; and (2) the influence of external and personal factors on working women.

Conclusion

Women in the water sector generally enjoy acceptable status secured by the regulations and internal instructions, with minor differences among the several entities in the sector. Although positive indicators exist for women in the work environment, challenges of women's empowerment and gender equality still exist in the water sector such as:

- Ability of women to reach senior leadership and supervisory positions.
- Opportunities for women to develop their skill through external training.
- Ability of women to strike a balance between family responsibilities and job duties under long working hours and work pressure.
- Less women are recruited to work in the water sector due to the unconventional role of women in the fieldwork and technical jobs.
- Weak policies and practices to meet the needs of women such as women-friendly environment, day-care nurseries, and private facilities.

Recommendations

- **Human Resources Management System**

To have a more accurate and specific assessment of women status in the water sector, the entities should adopt a unified system for the management of the human resources data and a gender-sensitive record to be used in all water sector entities.

- **Gender Leadership Stereotypes and Supervision Positions**

To have a more accurate and specific assessment of women status in the water sector, the entities should facilitate the development and upgrading of women's experience in the sector, to ensure more women holding senior leadership and supervision positions will succeed in their careers as directors and general managers.

- **Training Programs**

Water entities are recommended to restructure the training and development mechanism within the water sector entities to avoid gender bias and to allow more women to access specialized/technical and external training programs.

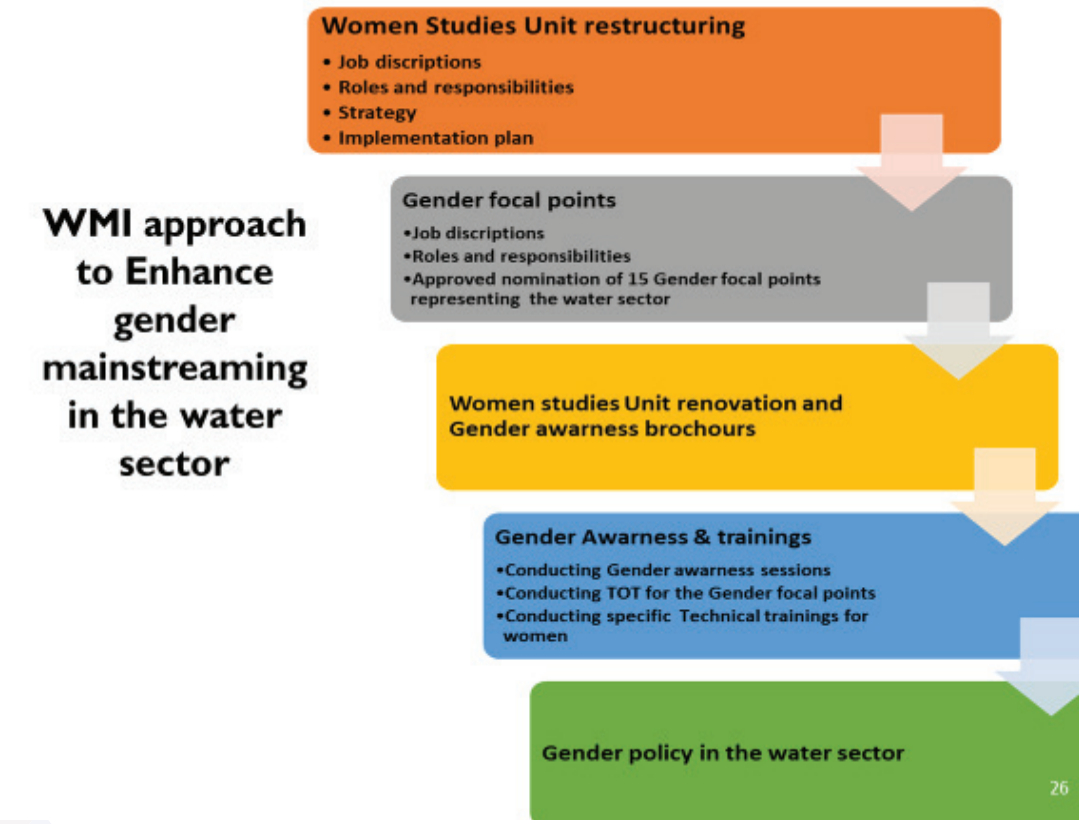


Figure 60: Approach to enhance gender mainstreaming

Impact on Supporting Sustainability

This study will help in developing the gender policy for the water sector based on the actual needs of women in the sector.

The gender policy serves as a framework for MWI and other stakeholders for mainstreaming gender in the water sector policies, programs, actions and investments. It provides stakeholders with support on actions and approaches that incorporate the diverse needs and concerns of women and men, and thereby lead to equitable access, use and management of water resources in Jordan.

The gender policy represents the official commitment by MWI, water utilities and partners to integrate gender equality into their activities at all levels of society and within the Water organizations. The policy is thus considered a guideline for the work of MWI, utilities and partners, but as every other policy in every other organization, it risks being forgotten if not adequately operationalized and institutionalized.

PLANNING, MONITORING AND EVALUATION

Capacity Building Evaluation: How Do We Know What Difference We are Making

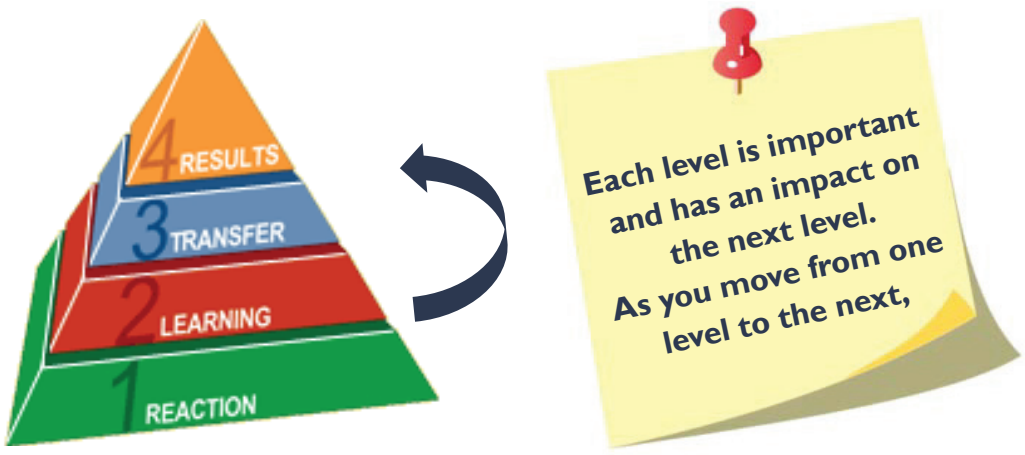
Maram Barqawi, Senior Performance, Monitoring, Evaluation, and Learning Specialist, WMI
Afaf Al-Sabbagh, Human Resources Manager, YWC
Nisreen Nabulsi, L&D Head-PHRi- HRCI, Miyahuna

What is Capacity Building via Training?

The transfer of knowledge, skills, or attitudes (KSAs), as well as ideas and sector context, through structured learning and follow-up activities to solve job performance problems or fill identified performance gaps[12].

Kirkpatrick's Four-Level Training Evaluation Model

If you deliver training, then you probably know how important it is to measure its effectiveness. After all, you do not want to spend time or money on training that does not provide a good return. The Kirkpatrick Evaluation Model helps us quantify effectiveness[13].



12- USAID ADS Chapter 253

13- 2012-2010 Kirkpatrick Partners, LLC.

Level 1: Reaction Measures:

- Customer Satisfaction: measures participants' satisfaction with the training.
  - Taking this program was worth my time.

1 = Strongly Disagree	2	3	4	5	6	7	8	9	10	= Strongly Agree

- Engagement: measures involvement and contribution of participants.
  - My learning was enhanced by the facilitator.

1 = Strongly Disagree	2	3	4	5	6	7	8	9	10	= Strongly Agree

- Relevance: measures participants' opportunity to apply what they learned in training on the job.
  - What I learned in this class will help me on the job.

1 = Strongly Disagree	2	3	4	5	6	7	8	9	10	= Strongly Agree

Level 2: Learning

At Level 2, you measure what your trainees have learned. How much has their knowledge increased as a result of the training?

• When?

After training is conducted.

• How?

By evaluating both before and after the training program.

- Before training commences, test trainees to determine their knowledge, skills and attitudes.
- After training is completed, test trainees for the second time to determine if any improvement has achieved.
- By comparing the results, it can be determined whether learning has been successful or not.

Level 2: Learning Measures:

- Knowledge "I know it.": measured primarily with formative exercises during the session or witha quiz towards the end.
- Skills "I can do it right now.": measured with activities and demonstrations during the session, which show that participants can perform the skill.
- Attitude "I believe this will be worthwhile to do on the job.": measured with rating scale questions.
- Confidence "I think I can do it on the job.": measured with rating scale questions.
- Commitment "I intend to do it on the job.": measured with rating scale questions.

Level 3: Behavior

At this level, you evaluate how far your trainees have changed their behavior, based on the training they received. Specifically, this looks at how trainees apply the information.

• How?

Use a control group if practical.
Evaluate both before and after the program.
Survey and/or interview one or more of the following:

- Trainees.
- Immediate supervisors.
- Others who often observe trainees' behavior.

Repeat the evaluation at appropriate times.
Consider costs versus benefits.

• Examples on Interview Questions:

Did the trainees use any of their learning?
Are trainees able to teach their new knowledge, skills, or attitudes to other people?
Are trainees aware that they have changed their behavior?

Level 4: Results

At this level, you analyze the final results of your training. This includes the outcomes that you or your organization have determined to be good for business or for the employees.

• When?

If your programs aim at tangible results rather than teaching management concepts, theories, and principles, then it is desirable to evaluate in terms of results.

• How?

Search for pieces of evidence.

• Examples for Interview questions:

What results have you seen since attending this training?
Please give an example of the success you have achieved since attending this training.

From a National Water Strategy towards Result-Oriented Planning

Rifqa Alameddin, Water Planning and Institutional Development Specialist, WMI
Adel Al-Obeiaat, Director of Policies and Strategic Planning, MWI
Saqer Al-Salem, Wastewater Processes, Biosolids, and Reuse Expert, WMI
Heba Al-Sallaq, Intern, WMI

> ***"Our Water situation forms a strategic challenge that cannot be ignored. We have to balance between drinking water needs and industrial and irrigation water requirements. Drinking water remains the most essential and the highest priority issue".***
> ***King Abdullah II***

The Ministry of Water and Irrigation (MWI) in Jordan has taken a closer analytical look at the water sector and published its National Water Strategy (NWS) 2025-2016. The strategy outlines the sector's future goals and priorities and focuses efforts and resources towards a common vision. It aims at strengthening operations, establishing an agreement around intended, sustainable results, and assessing and adjusting the sector's direction in response to the sector's scarce resources.

In line with this strategy, and in partnership with MWI's Directorate of Policies and Strategic Planning and the German Agency for International Cooperation (GIZ), and in a participatory, objective, and gender-sensitive manner, WMI produced a result-based action plan (RBAP) oriented towards achieving the goals of the National Water Strategy and its policies.

GOALS	Indicators	2014	2025
1) Financial Sustainability	Percentage of operation and maintenance coverage	%70	%127
	Government support (mil. JOD)	170	180
	Net debt (mil. JOD)	1170	1200
	Energy used per m3 billed (kwh/ m3/ billed)	4.31	3.66
2) Enhance Water and Wastewater Services	Percentage of water service coverage	%94	%95
	Percentage of wastewater service coverage	%63	%80
3) Supply of Water to Meet the Demand for all Uses	Water share per capita (l/c/d)	61	105
	Available water resources (m3/year)	832	1341
	Water share for all uses (m3/year)	90	114
	Storage capacity of dams (mcm)	325	400

4) Water Resources Sustainability and Protection	Percentage of NRW	%52	%30
	Percentage of over-abstraction	%160	%140
	Percentage of protected resources	%35	%60

Table 10: Goals and targets of the National Water Strategy 2025 - 2016

The result-based action plan (RBAP) is a disciplined framework that outlines the sector's fundamental goals and objectives and illustrates what outcomes need to be achieved before meeting the strategic goals (see Figure 39). It is supportive of the implementation of the recommendations of the International Monetary Fund (IMF) and Sustainable Development Goal 6 and is also in line with the objectives of some national initiatives and global resolutions.

About the Intervention

This intervention represents a three-fold approach: (1) institutional development and restructuring of the strategic planning modality; (2) orienting the sector towards common goals, harmonizing the sector's operational processes, and streamlining the data flow; and (3) capacity building and institutionalization, introducing a MEL framework, and sustaining the action.

Methodology

The result-based management (RBM) model was utilized as a tool, ensuring that the sum of the interventions of executing entities is sufficient to achieve the expected results. A three-phase work plan for building, formalizing and implementing the RBAP (see Figure 41) was jointly prepared by MWI, WMI and the GIZ as follows:

Phase I – Preparatory (Completed)

- Work plan development.
- Assignment of roles.
- Assignment of the sector's technical focal points.
- Conduction of a sector-wide orientation workshop.
- Formation of eight sector-wide, technically specialized sub-working groups (57 persons).

Phase II – Development (Completed)

- Conduction of 30 technical sub-working group meetings, brain-storming, sharing experiences and agreeing on common sub-objectives, methodologies and indicators.
- Formation of a sector-wide strategic planning team (19 persons).
- Conduction of strategic planning meetings.
- Data collection (baselines and targets).
- Finalization.
- Formalization.

Phase III – Institutionalization (Q-3Q2019 4)

This phase constitutes of multiple interventions, as follows:

- **Capacity Assessment and Strategic Planning Team Empowerment**
  a. Assessment of anticipated workload.
  b. Capacity assessment of the existing and potential strategic planning teams.
  c. Identification of training needs.
  d. Capacity enhancement.

- **Development of Entities' Plans**
  a. Business plans (5-2 years).
  b. Annual action plans that are based on the result-based budgeting model.

- **Establishment of a Monitoring, Evaluation and Learning (MEL) Framework, that considers:**
  a. Progress in target-achievement.
  b. Challenges hindering progress (if any).
  c. Performance and resource management (human and financial).

- **Assignment of Roles and Responsibilities**
  a. Supervision (objective focal points).
  b. Monitoring and evaluation (at different levels).
  c. Data provision (sources, channels and frequency).
  d. Reporting (format, channels and frequency).

- **Implementation and Learning (at all levels) through:**
  a. Analyzing data and reviewing reports.
  b. Sharing and building on success.
  c. Addressing challenges (entity and/or sectoral).
  d. Guiding and decision-making process.
  e. Identifying opportunities (for future projects).
  f. Periodic re-planning.

Additionally, the RBAP supports global resolutions and national initiatives, as follows:

1. Supporting the Global Resolution (SDGS): "Transforming our World: the 2030 Agenda for Sustainable Development."

a. The RBAP guides the achievement of SDG6 "ensure availability and sustainable management of water and sanitation for all" as follows:

- **SDG 6.3.2 has been covered under the following:**
  - Water substitution and reuse policy.
  - Groundwater sustainability policy.
  - Surface water utilization policy.
  - SDG 6.4.1 has been covered under the water reallocation and water demand management policies.
  - SDG 6.4.2 has been covered under the water reallocation policy.
  - SDG 6.5.2 has been covered under the National Water Strategy.

2. Supporting the National-Level Initiatives

a. The RBAP empowers the water sector to compete for the King Abdullah II Award for Excellence in Government Performance and Transparency.
b. The RBAP facilitates monitoring of progress in achieving SDG6.
c. The RBAP is supportive of the implementation of the IMF recommendations.

SUSTAINABILITY

Sustaining the intervention has been carefully considered through the following dimensions, also illustrated in Figure 40:

- Participation and engagement of the whole sector.
- Buy-in and support of decision-makers.
- Unification and structuring of goals in a clear time-bound plan.
- Assignment of roles and responsibilities.
- Agreement on relevant data, its sources, flow channels, quality and frequency.
- Formalization and institutionalization give the water sector the ownership of the RBAP.
- Capacity enhancement and staff empowerment.
- Introduction of a Monitoring, Evaluation and Learning (MEL) mechanism.

Impact

The completion of phases I and II engaged the sector in rich discussions, whereby experiences were shared, different work processes followed in achieving similar targets were illustrated, best practices were selected, gaps were identified, and common challenges were brought to the surface.

The participatory approach in building the RBAP gave ownership to the sector, as final indicators and targets were jointly set, based on actual capacity and available resources (human and financial). It was one of the largest actions that brought the sector together, from the north of Jordan to the center and ending with the south. The buy-in from top management and from decision-makers grew gradually as benefits were becoming clearer with time.

The initiative came on time, and with the completion of the final phase, impactful results will be evident, as follows:

- RBAP is a tool that has harmonized the sector's operational approaches and unified the goal. Therefore, tracking and assessing performance and progress in achievements of preset targets has become possible.
- Exploring and sharing achievements and success stories and learning from good examples.
- Exploring challenges, overall or entity-based, for interference, decision-making, and re-planning, as necessary.
- Exploring the common sectoral needs and demands and identifying future project concepts.
- Continuous learning and development that lead the strategic re-planning and decision-making processes.

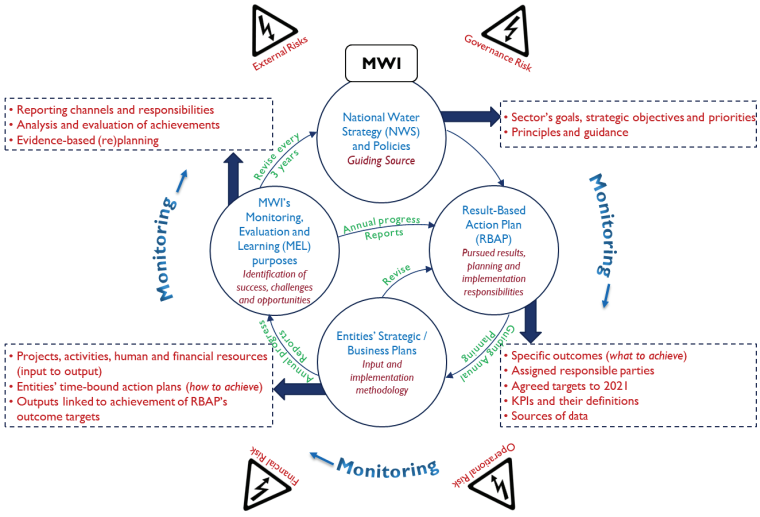


Figure 62: The RBAP sustainability cycle

WMI Approach for Self-Reliance and Sustainability

Maram Barqawi, Senior Performance, Monitoring, and Evaluation Specialist, WMI
Helena Hlavaty, Research, Monitoring and Evaluation Coordinator, WMI

What is Self-Reliance?

"To end the need for foreign assistance, we must focus on building self-reliance -- defined as the ability of a country, including the government, civil society, and the private sector, to plan, finance, and implement solutions to solve its own development challenges. This approach must be the cornerstone for how we orient USAID country partnerships[14]."

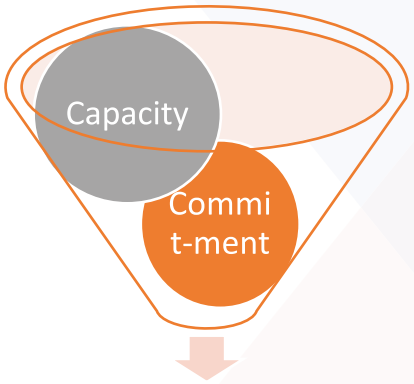


Figure 63: Self-reliance is driven by two closely-related elements

Sustainability and USAID's Methodology

Sustainability is defined as "the ability of a local system to produce desired outcomes over time. Programs contribute to sustainability when they strengthen the system's ability to produce valued results and to be both resilient and adaptive in the face of changing circumstances[15].

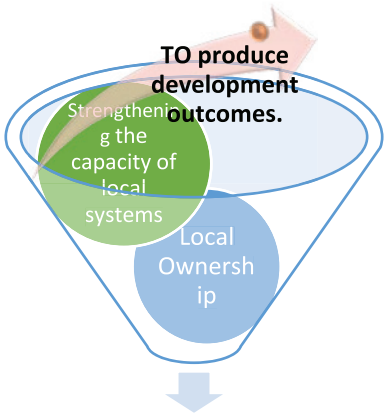


Figure 64: USAID promote sustainability through local empowerment

14- https://www.usaid.gov/sites/default/files/documents/1870/J2SR_Fact_Sheet.pdf

15- Local Systems : A Framework for Supporting Sustained Development

Program Sustainability Assessment Tool (PSAT)

In order to showcase these ideas in action, WMI's M&E team opted to highlight a tool that enables a broad range of practitioners to measure sustainability. Although numerous approaches to measuring self-reliance and sustainability exist, WMI's M&E team chose to highlight one particular tool called the Program Sustainability Assessment Tool (PSAT)[16]. This tool was developed by the Washington University in St. Louis and has been used by more than 1,000 individuals from over 320 unique programs. The tool consists of 40 Likert scale questions that enable practitioners to gauge an organization's sustainability across eight so-called "domains." WMI made the decision to highlight this tool in its presentation due to its versatility and applicability across a wide range of sectors and organizations.

The PSAT process will cover the following steps:

1. Understand
Understand the factors that influence a program's

3. Review
View results from your assessment as a

2. Assess
Use the program sustainability assessment tool to assess your program's capacity for sustainability

4. Plan
Develop an action plan to increase the likelihood of sustainability

In particular, WMI's presentation of the PSAT focused on the eight sustainability "domains" outlined by the tool. These eight domains are as follows[17]:

- Environmental support: having a supportive internal and external climate for one's program.
- Funding: establishing a consistent financial base for one's program.
- Partnerships: cultivating connections between one's program and its stakeholders.
- Organizational capacity: having the necessary internal support and resources.
- Program evaluation: assessing one's program to inform planning and document results.
- Program adaptation: taking actions to adapt one's program to ensure ongoing effectiveness.
- Communications: ensuring strategic communications with stakeholders and the public about one's program.
- Strategic planning: using processes that guide one's program's directions, goals, and strategies.

16- https://sustaintool.org/

17- https://sustaintool.org/

Each of the domains reflects factors that WMI makes a concerted effort to consider throughout its work. To illustrate this, WMI presented three examples of sustainability in our work. These included applying sector-wide gender reform, improving operational performance and service delivery in Ma'an, and implementing the Enterprise Resource Planning (ERP) system at Yarmouk Water Company (YWC).

Highlights: Sustainability at WMI

A) Gender Reform in the Water Sector

Supporting gender reform in the water sector in Jordan is a cross-cutting focus of WMI's project. As with all of its interventions and activities, WMI has made a concerted effort to ensure that these reforms are sustainable in the long-run. As part of its support to the Women Studies Unit at the Ministry of Water and Irrigation (MWI), WMI hired a consultant to conduct a gender study for the water sector. WMI will support developing the gender policy for the water sector based on the study results. Identifying needs and adapting accordingly ensures long-term sustainability. Furthermore, developing a gender policy helps to institutionalize changes, thus establishing the environmental support necessary for long-term sustainability.

In collaboration with the ministry, WMI has also worked on a training of trainers (TOT) program for gender mainstreaming in the sector. For this, WMI conducted a training needs assessment, prepared a training plan, and supported the water utilities to train a group of 15 gender focal points, who will then conduct further trainings on gender mainstreaming in the sector. For long-term sustainability, the MWI has ownership of this activity, as the focal points refer not to WMI, but to the Ministry. Across the board, WMI's work on gender reform in the water sector encapsulates many pillars of sustainability (as defined by the PSAT), including assessing, adapting, establishing partnerships, building capacity, and establishing environmental support.

B) Operational Performance and Service Delivery in Ma'an

In addition to WMI's support on gender in the water sector, WMI has also made sustainable improvements to operational performance and service delivery in Ma'an. Since their introduction in 2017 by WMI, meter reading and door-step billing have been completely automated at Ma'an Water Administration. These operational upgrades were possible because of a combination of efforts: a series of campaigns engaged stakeholders and the community, while the distribution of advanced technology such as handheld units and barcodes, along with the necessary training, boosted capacity. Now trained and provided with the necessary tools, administrators at Ma'an Water Administration are able to ensure that they will continue to improve performance for years to come.

C) Enterprise Resource Planning at Yarmouk Water Company

In a final example of WMI ensuring sustainability of its interventions, WMI's team has taken extensive measures to ensure that the implementation of the Enterprise Resource Planning system at YWC will be sustainable. The Board of Directors at YWC were involved from the very beginning of the intervention, and WMI's consultants were kept informed throughout implementation.

These factors ensured successful strategic planning and partnerships were in place. Most critically, the intervention has consistently emphasized the importance of capacity building. In partnership with YWC, WMI's intervention has championed the utility's human capital. To date, nearly 300 staff members at YWC have been trained as part of ERP implementation. This includes a group of eight "super users," who receive extensive training. All trainings are followed by consistent follow-up, in order to ensure that staff are fully prepared to use the ERP system optimally. In the long-term, YWC will help in establishing a Support Solution Center (SSC) to take over the responsibilities of managing the ERP system, giving YWC ownership of intervention and ensuring a sustainable outcome.

Concluding Thoughts

In conclusion, WMI's approach to sustainability embodies many of the domains outlined by the PSAT. For partnership and environmental support, we champion close collaboration with counterparts at all phases—indeed, the participatory approach is an integral component of our work. We also emphasize updates to policies and procedures over short-term changes, in order to ensure a suitable environment and institutionalization of changes. With regards to program evaluation and adaptation, conducting needs assessments and feasibility studies is a cornerstone of our work, and helps to ensure that the long-term perspective is always at the forefront of our work. To that end, conducting pilots helps ensure effectiveness and applicability of interventions. We work closely on strategic planning with counterparts, and, above all, emphasize the importance of capacity building for achieving sustainable change. To date, more than 2,500 individuals have been trained on various topics by WMI's team, and this number will only continue to grow. In the end, not only does WMI make sustainable changes, but we also build off of the strengths of its stakeholders. With these efforts, WMI seeks to achieve measurable improvement in water sector management and governance, working towards a sector that is self-reliant and sustainable.