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Water and Environment Support in the ENI Southern Neighbourhood region

WES INFO BULLETIN

NATIONAL ACTIVITY EGYPT
"STRENGTHEN THE WATER UTILITIES CAPACITIES TO MANAGE/REDUCE NON-REVENUE WATER AND DETECT LEAKAGE"

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Overview

From September 2020 to March 2023, the EU funded 'Water and Environment Support (WES) in the ENI Southern Neighborhood region' Project, following the request of the Ministry of Water Resources and Irrigation in Egypt, implemented a National Activity "Strengthen the water utilities capacities to manage/reduce Non-Revenue Water (NRW) and detect leakage" (N-W-EG-1), with the aim to assist the Asyut Water and Wastewater Company (AWWC) to target the reduction of NRW and to continue its efforts to improve NRW management.
The activity supported the Real Loss Reduction Strategy (2017) prepared with the support of the second phase of the EU Water Sector Reform Program, which promotes an integrated NRW Reduction Strategy and its alignment with the real Loss Reduction Strategy.

Methodology and Implementation

The activity was implemented in Asyut city water network, which is an extended water supply system of more than 200 km and multiple water sources served by the AWWC. Asyut City is customarily divided into two sub-zones: West Asyut (AlGharb) and East Asyut (AlSharq); the two zones constituted the study area of this project.

The objectives of the activity were to:

- Investigate the situation of non-revenue water management in a pilot city served by AWWC and prepare its network, as part of rational planning aimed at NRW reduction, to the next stage of implementation of distribution zones/sectors and their subsequent division into District Metered Areas (DMAs).
- Implement and calibrate a hydraulic model for the network of the pilot city as a tool to provide valid support to move into the design stage and establishment of DMAs.
- Introduce internationally recognised best practices for improving NRW (including the design of Distribution Zones and the use of Geographic Information System (GIS) to enable an analysis of the geographical distribution of leakage).
- Build the capacity of the utility staff involved in the pilot area on the implementation of best practices for the management of non-revenue water through on-the-job training and direct involvement in the implementation of the tasks with the support of non-key experts (field data analysis, water balancing, model calibration, and fixing anomalies between the results of the model calculations and the field data).
- Develop a manual documenting the proposed procedures for reducing NRW in AWWC.

The WES team of water experts implemented accordingly the following tasks and events:

☐ Task 1: Inception Phase

The task included an initial data assessment, an evaluation of the availability and reliability of network and customers' data and the establishment of the partner teams (NRW and GIS) who were to be involved in the activity throughout its implementation to ensure the transfer of know-how, training and learning by doing. During this phase, the sequence of actions necessary to carry out the activity was also determined.
The inception phase ended with an inception Report and with a **one-day online Workshop with the participation of key 12 stakeholders (30/11/2020).**

☐ Task 2: Verification of GIS Maps and Customers' Database (DB)

This task included:

1. Checking information on existing background maps (aerial photography, vector cartography, etc.), existing network maps (primary, distribution, service connections) and infrastructures (water intakes, water treatment plants, tanks/reservoirs, pumping stations, etc.)
2. Verification of the existing customers' database.

The WES team conducted a database design analysis of the GIS and the customer database in use in AWWC to identify improvements to be proposed to the existing AWWC Water Supply System (WSS) DB structure. The Conclusions were presented in the WSS GIS database Design Report.
AWWC also provided the consumer database, which was used for the construction of the hydraulic model. However, Unfortunately the DB provided by AWWC for the geographical positions of the meters, had incomplete information and could not be used for the next stage of the project but it was helpful as it included the positions of the large consumers that were used for demand allocation of the hydraulic model.

☐ Task 3: Calibration of the hydraulic model

This task involved the implementation of the network hydraulic model for the study area, using the network and facilities data to be imported from the GIS database as well as the data to be imported from the customers' database. The list of sites where monitoring points – both flowmeters and pressure gauges – were to be installed was proposed to AWWC to perform the field work needed for model calibration.
Based on the monitoring data, the total amount of water fed into the water supply system was determined and calibration could be performed. The network layout and allocated demand that were developed using data provided by AWWC and the flow distribution resulting from the calculations were used to select the initial proposal for the overall network zoning and the corresponding identification of the locations of flowmeters to be installed and valves to be closed.

☐ Task 4: Preliminary division of the network system into distribution zones (DZ)

Under this task, control areas i.e., Distribution Zones (DZs) and District Metering Areas (DMAs) were identified along with the positions of the Zones' inflow sites (Q&P Monitoring sites).
The available data did not allow the water balance to be prepared with the required accuracy as (i) the demand data is only an estimate based on the volume transiting in the system and the number of nodes in each urban area, (ii) the amount of water lost is also a pure estimate based on the length of the network in the area and an estimated coefficient with no reference to the real situation, (iii) no information on pressure is available from the field.
To provide an indication of what to do in the immediate future, an exercise was carried out to compare the estimated volume entering into the WSS (domestic + commercial demand, large consumers demand and leakage) with the estimated amount of water lost, DMA by DMA. This exercise allowed possible ranking of the DMAs from which NRW activities could start. The key performance indicator (KPI) adopted is defined by the ratio between the amount of water lost (in lps) and the total length of the network (in km) in each DMA.
The task ended with the preparation of the Hydraulic Model and Zone Design Report.

☐ Task 5: Elaboration of procedures to reduce NRW

This task involved the preparation of a manual with the required set of procedures to reduce NRW that are tailored to Asyut city water network and covering the following areas:

1. GIS data upload and maintenance;
2. Hydraulic Model data upload and maintenance;
3. Distribution Zone operation and maintenance, including Q-P monitoring procedures;
4. Water Balance calculation procedure;
5. Guidance on how to divide the Distribution zones further into District Metered Areas (DMAs).

The project ended with a **three-day Training of 32 key stakeholders (13-15/02/2023)** involving managers responsible for operation and maintenance (O&M), local non-revenue water staff, GIS specialists and the Commercial Department. The objective of the training was to build the capacity of Asyut Water and Wastewater Company (AWWC) in:

- Setting up the water supply zones and the District Metered Areas within the AWWC network and ensuring its tightness.
- Calculation of the water balance.
- Implementation of the proposed NRW reduction procedures in AWWC elaborated in the manual of procedures to reduce NRW.

Main Results

- ✓ Diagnosis of existing assets in the pilot zone and a review of available data and gaps.
- ✓ Geo-location of around 85% of the customers by AWWC staff based on the gaps.
- ✓ Proposals for improvements and changes to the existing DB structure based on the analysis of the AWWC Water Supply System (WSS) GIS DB, which enable improved NRW management in AWWC and the construction of the network hydraulic model.
- ✓ Implementation and calibration of the WSS network hydraulic model.
- ✓ Initial segmentation of the study area into zones and then provisional segregation into DMAs.
- ✓ Proposals for the necessary equipment to be purchased for the implementation of the zones and DMAs.
- ✓ Preliminary list of priority areas in which to address the first NRW reduction measures.
- ✓ Manual with a set of procedures to reduce NRW, tailored to the AWWC water network.
- ✓ Two-day on-job training which discussed all the steps undertaken and the results of the calibration.

Recommendations

The WES team recommended to the AWWC staff to initiate the following actions:

- Integrate the existing AWWC WSS GIS DB structure with the attributes and entities necessary to make it suitable as a tool for an NRW reduction analysis. The Logical data model and the conceptual analysis delivered under task 2 will help in this job.
- Upgrade and update the existing AWWC WSS GIS DB with the new structure and make the AWWC GIS department the “official” repository of the AWWC WSS GIS DB.
- Conduct a monitoring campaign to determine the real characteristics of the pumps at all the pump stations in the WTPs. It is necessary to monitor for each pump the real head and flow.

- Once the real data of the pumps is determined, it is necessary to carry out a second field test monitoring Q and P data, which will be used for a second run of the hydraulic model.
- The AWWC teams need to finish the localization of the customers and update their data in the GIS DB for further analysis. This data will be used to re-elaborate the demand allocation necessary for the second run of the hydraulic model.
- The hydraulic model developed by the WES team can be used to compare the field data and the calculated data. Alternatively, the AWWC team can develop their own hydraulic model on Water GEMS using the AWWC WSS GIS DB data.
- If the hydraulic model will confirm the assumptions made to size and locate the flowmeters to segregate the overall WSS network in Zones and DMAs, the AWWC team can proceed with the phase of acquisition of the equipment. The procedures and the reports provided will help organize and implement the DMAs.

National Meeting in Egypt

☐ **This WES water activity was presented at the WES National Meeting held on the side of Cairo Water Week (CWW) 2023, (01/11/2023) and at an EU Press Conference that was organised by the EU Delegation to Egypt, during the CWW 2023, (02/11/2023).**
Key stakeholders and media had the opportunity to learn about the methodology, implementation followed and the activity's results but also about the **second WES water activity "Assisting Egypt in developing financial mechanisms for the management of water resources at on-farm level"** that was prepared and Implemented in the country, between June 2021 and December 2023.

Useful Links

https://www.wes-med.eu/activities_type/n-w-eg-1-strengthen-the-water-utilities-capacities-to-manage-reduce-non-revenu-water-and-detect-leakage/
https://www.wes-med.eu/activities_type/national-meeting-in-egypt/

WES Project

The Water and Environment Support (WES) is an EU funded regional project designed to contribute to the implementation of an integrated approach to pollution reduction and prevention, in line with the Union for the Mediterranean agendas and the Barcelona Convention. WES is also meant to contribute to a more efficient management of scarce water resources in the ENI Southern Neighbourhood region.
The project aims to do so by increasing the capacity of stakeholders that are involved in pollution reduction and water management and support them in formulating and implementing the environmental and water policies.
WES supports the shift to a more sustainable consumption and production model, promotes an integrated and efficient management of water, combats plastic pollution and marine litter and fosters dialogue on key environmental and sustainable development issues. In this way, WES also supports mutual understanding, cooperation, and peace in the region.

For any further information on WES project, please visit: www.wes-med.eu

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