



Food and Agriculture Organization  
of the United Nations

# Improved Water Resources Monitoring System/ Integrated Water Resources Management at regional level in Lebanon

In many regions of the world, including the Near East and North Africa (NENA) region and Lebanon, sustainable and reliable delivery of water for irrigation and municipal use has become increasingly complex and problematic. This issue also extends to affect the protection of the ecosystems from water pollution. Particularly, if the overall demand is outstripping supply, the delivery of water is often less about engineering, although it is still required. The issue is more often related to the governance of the resources, to manage and protect sources from pollution and over-abstraction, resolve conflicts about water, and ensure rights to water are respected. It is also about understanding water flow pathways in complex river basin systems. This is where water monitoring and accounting can play a crucial role to help water management institutions, such as the regional Water Establishments, in managing complexity in light of the challenges facing the water sector.

In this context, the Food and Agriculture Organization of the United Nations (FAO), in collaboration with the North Lebanon Water Establishment (NLWE), which represents the Ministry of Water and Energy, is implementing the project 'Improved Water Resources Monitoring System/Integrated Water Resources Management at regional level in Lebanon', funded by the Swiss Agency for Development and Cooperation (SDC).

The objective of the project is to improve the performance and enhance the capacity of regional water management institutions leading to more effective planning and management of water resources and better water outcomes to end-users. The project focuses on enhancing the monitoring of water resources in Minieh and Akkar, North Lebanon.

The project aims at strengthening Lebanon's water management institutions to improve their performance at regional level, thereby helping the sector to address the challenges for a sustainable use of water resources. More specifically, the holistic approach of the program focuses on six components:





Real-time monitoring at key locations: selection of a suitable watershed, installation of real-time monitoring equipment that generates water resources information, together with the calibrated monitoring system, assessment tool and training are provided to stakeholders.

Water quality monitoring at key locations within a pilot watershed: defining suitable water quality parameters and key locations for testing to support improved management of environmental priorities at Water Establishment/watershed level. While equipping the related laboratories (Tripoli Central Lab, Minyeh Lab, Halba Lab, and Sir Al Dineyeh Lab), staff is trained to enhance their capacity on irrigation water analysis, including water quality testing and monitoring.



Water Establishment/Watershed Prototype Monitoring System: developing integrated computer platform that links the various monitoring components into a comprehensive monitoring system for water for irrigation to empower management authorities to better-informed decisions.

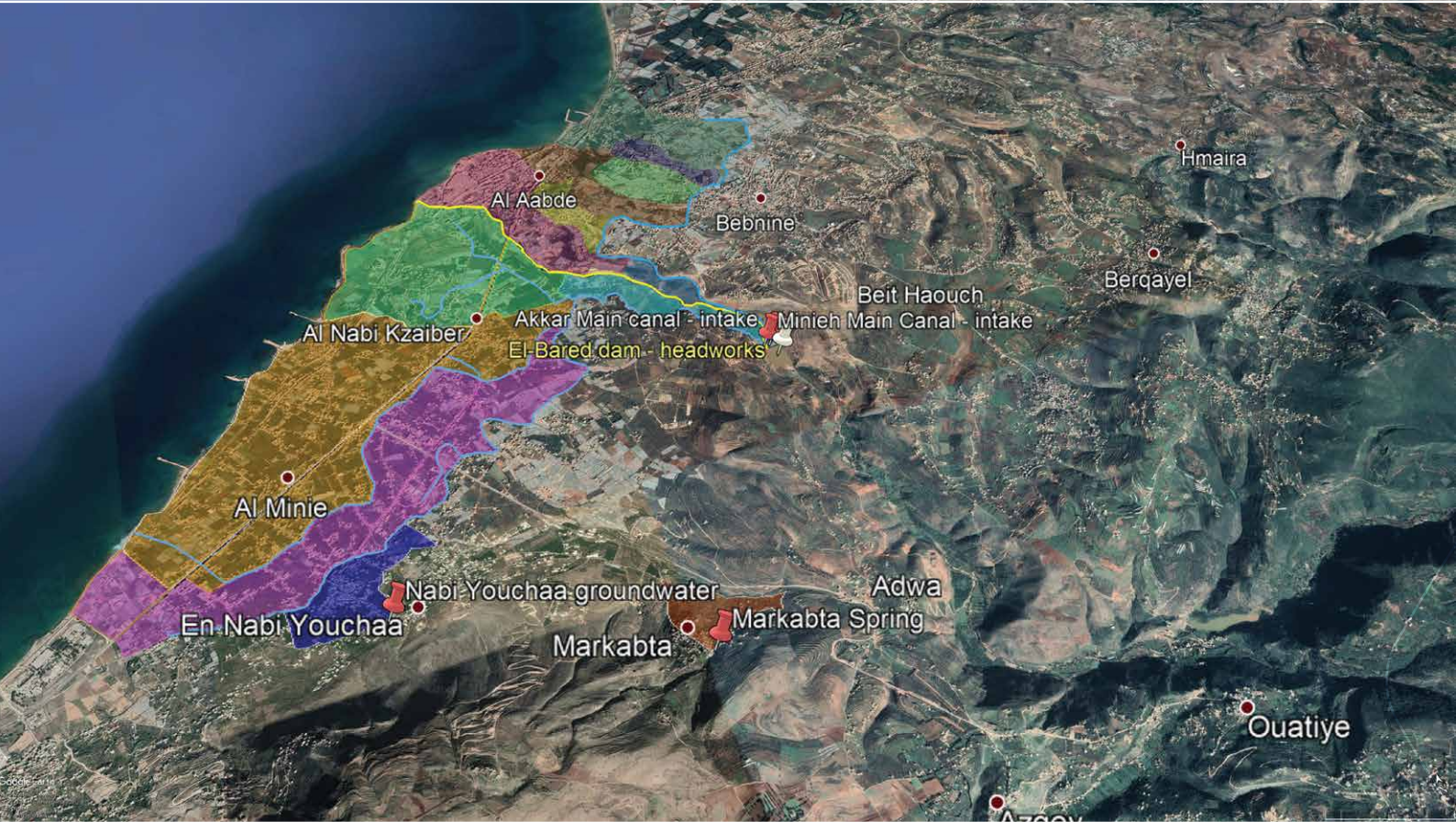
Water accounting tool: monitoring Land-cover/Land-use maps through remote sensing, and generating information regarding soil moisture, vegetation state, leaf area index, biomass production, ET mapping and scoring to support more effective decision-making at the regional level.

Informed decisions transferred to end-users to improve capacity for enhanced crop water productivity: selection, diagnosis and benchmarking of 15 pilot plots to improve agricultural practices at field level.

A scaled-up approach through stakeholder platforms and data-sharing: establishing a network of experts/stakeholders and set-up a platform/knowledge transfer process to ensure the dissemination of the project interventions and its scaling-out to other Water Establishments.



# The pilot Site – El Bared Watershed



## The project approach

The project approach is to work closely with the North Lebanon Water Establishment, relevant government officials, research institutions, and communities in the pilot area to develop and implement the water-monitoring system and develop water management tools informed by collected data.

### Activities

Monitoring

Tool Development

Decision-making

Piloting, Training & Learning

Dissemination

### Actors involved

NLWE

National & regional institutions

End-users



The project is implemented over a total period of 48 months in two phases:

## PHASE I – The development

Training	Application	Dissemination
Capacity building programme on operation and maintenance of discharge monitoring system	Identification, installation calibration and validation of discharge measurement system along the irrigation canal system	Field training for professional staff and decision-makers
Capacity building programme on irrigation water quality monitoring	Identification of water quality monitoring sites	Water quality guidelines
	Provision of required equipment to NLWE laboratories	Training for professional staff
Capacity building programme on water accounting tool/water productivity automated system	Production of land cover land use maps	Training for professional staff and decision-makers
	Definition of water productivity scores using remote sensing techniques	
	Construction of Automated Water Productivity Scoring System	
Capacity building program on FAO Model "AQUACROP" and optimal farming practices	Diagnosis and benchmarking of current water productivity levels	Optimal Practice Report of agricultural production for farmers and agricultural practitioners
	Calibration and validation of AquaCrop for selected sites	Field guide on Water Productivity for farmers and agricultural practitioners
	Piloting optimal farming practices in demonstration plots and monitoring their performance	Dissemination campaign on farming practices to enhance crop water productivity
Capacity building programme on water establishment-watershed Prototype Monitoring System focusing on system operation and generated data analysis	Development of a Prototype Monitoring System incorporating data and analytics related to agricultural water use, discharge and water quality	Prototype Monitoring System guidelines and training for professional staff and decision-makers
	Development of Asset Management module including condition and criticality scoring, and financial planning tools	

## PHASE II – Scaling-up Strategy

- Selection of pilot monitoring sites within the NLWE
- Pilot project implementation and development of tools and transfer to end-users

PILOT

Knowledge Transfer

- Lesson learnt/main findings
- Knowledge transfer through stakeholders' platforms

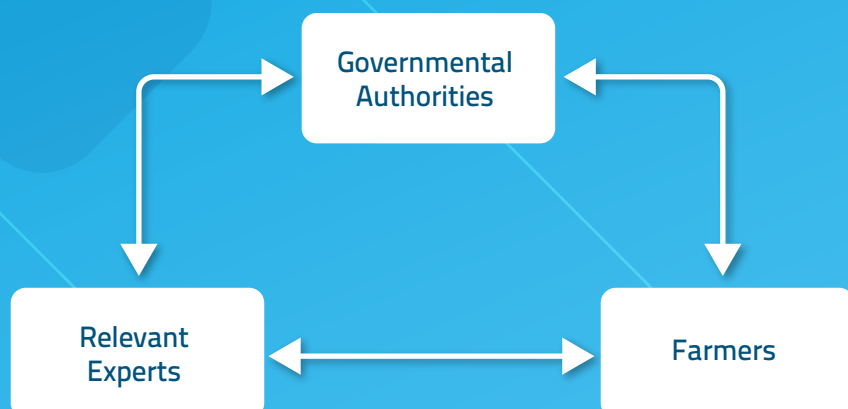
- Application in other water establishments

SCALING-OUT



Mainstreaming the water monitoring and informed decision-making approach into National Frameworks and Processes occurs through: 1) the establishment of dialogue platforms, 2) the establishment of expert networks and 3) the inclusion in national policies/strategies.

### Stakeholders and beneficiaries





## INVOLVED ACTORS:

Policymakers, decision-makers at relevant ministries are engaged in a dialogue platform on Integrated Water Management and the role of water monitoring data to support decision-making at the regional level. A framework for discussion at policy-level contributes to the ownership of systems, knowledge sharing and transfer of capacity for informed decision-making to end-users.

Technical experts' staff at the ministries, research institutions and universities take part into various training programs, to be delivered throughout project implementation, enhancing their knowledge and capacity. It also provides informative and technical material.

Indirect Beneficiaries include water users across all sectors and, in particular, farmers and those exposed to the environmental risk of unaccounted water quality problems. Moreover, the project aims to undertake information exchange with farmers in the pilot area to enable the application of tools to assess yield response to water such as AquaCrop – enabling improvements to water productivity and efficiency.

## THE TOOLS

### Supervisory Control and Data Acquisition (SCADA)

SCADA system is an Industrial Control System (ICS) used for site regulation and monitoring. The system at place gathers information from variously located sensors. It then transmits this data back to the central computer for processing, storing and allowing analytics. In the project context, SCADA system is used as basis of Prototype Monitoring System incorporating modules related to water supply data and analytics, water quality data and analytics, asset management within its three modules (Condition assessment, Criticality assessment, Financial planning). The system then produces various reports to inform decision-makers about necessary actions in any of the fields. The ultimate goal is to enhance water resource related decisions, thereby allowing NLWE a more effective management and appropriate allocation of available water resources.





## DISCHARGE

Discharge App is an innovative open-source computational tool for discharge data collection, based on surface structure imaging velocimetry (SSIV). It complements traditional water monitoring and management systems in decision-support processes and provides a direct connection between stakeholder and information sources. Through user-friendly mobile application, it allows crowd-sourced data collection and participatory observation, as well as synchronization with Cloud and data management on the website. It is employed to foster modernization in low-cost and people-centered monitoring procedures.

Further information on Discharge application:  
<https://discharge.ch/>



## AquaCrop

AquaCrop is the crop growth model developed by FAO to address food security and assess the effect of the environment and management on crop production. It simulates the yield response of herbaceous crops to water and is particularly well suited to conditions in which water is a key limiting factor in crop production. Capitalizing previous case studies and integrating new trials, the tool has been piloted in the program to aid in formulating possible changes in crop water management practices to improve crop water productivity levels.

Further information on AquaCrop:  
<http://www.fao.org/aquacrop>





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