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Establishment-Led Service Improvement and Cost Recovery (EL-SICR) Modality

30th July 2024

Background

The **Establishment-Led Service Improvement and Cost Recovery approach** emerged from the multifaceted challenges that Water Establishments (WEs) persistently face in Lebanon, focusing on the enhancement of three main factors:

1. **Resources** in terms of *water sources, infrastructure, energy and liquidity*.

2. **Autonomy** in terms of *performance-based selection of staff, dynamic internal organization, flexible use of available finances and volumetric tariffing and fair settlement of arrears*.

3. **Accountability** in terms of *local communities and authorities lobbying for satisfactory and equitable services*, *subscription and payment campaigns for cost recovery*, and *transparency and compliance with environmentally sustainable uses of resources*.

Main Objectives

- **Enhance WEs' capacity** to timely and efficiently respond to troubleshooting needs and maintenance at the local level
- **Increase WEs' leadership** in conducting assessment, design and supervision of infrastructure improvement works
- **Improve WEs' visibility** towards users
- **Provide means and resources for the WEs' local staff** to plan and perform the expected expansion of capacities and effectiveness
- **Consolidate** procurement procedures, collection of evidence and lessons learned, benchmarks and cost-benefit analyses

EL-SICR Process

Three main steps were undertaken:

1. The Implementing Partner (IP) temporarily assigns staff, typically an engineer to the WE through a **secondment process**.

2. The IP/seconded engineer **assesses the local section** of the Water Establishment (WE) to identify its strengths and weaknesses.

3. A **tailored work plan** is jointly developed to focus on improving services in a specific number of areas.

The EL-SICR Manual

A Guidelines Manual is under preparation for EL-SICR approach and methodology.

The **purpose of the Manual** is to outline the EL-SICR methodology developed for providing effective and sustainable assistance to the Water sector in a Nexus context that bridges development and emergency. The Manual aims at guiding practitioners through the key components of the EL-SICR methodology, offering a comprehensive framework of activities that meet the multi-level needs of Lebanon's Water sector.

It details the following components:

- EL-SICR Methodology
- Monitoring and Accountability
- Replicability, Lessons learned and Recommendations

The EL-SICR Manual

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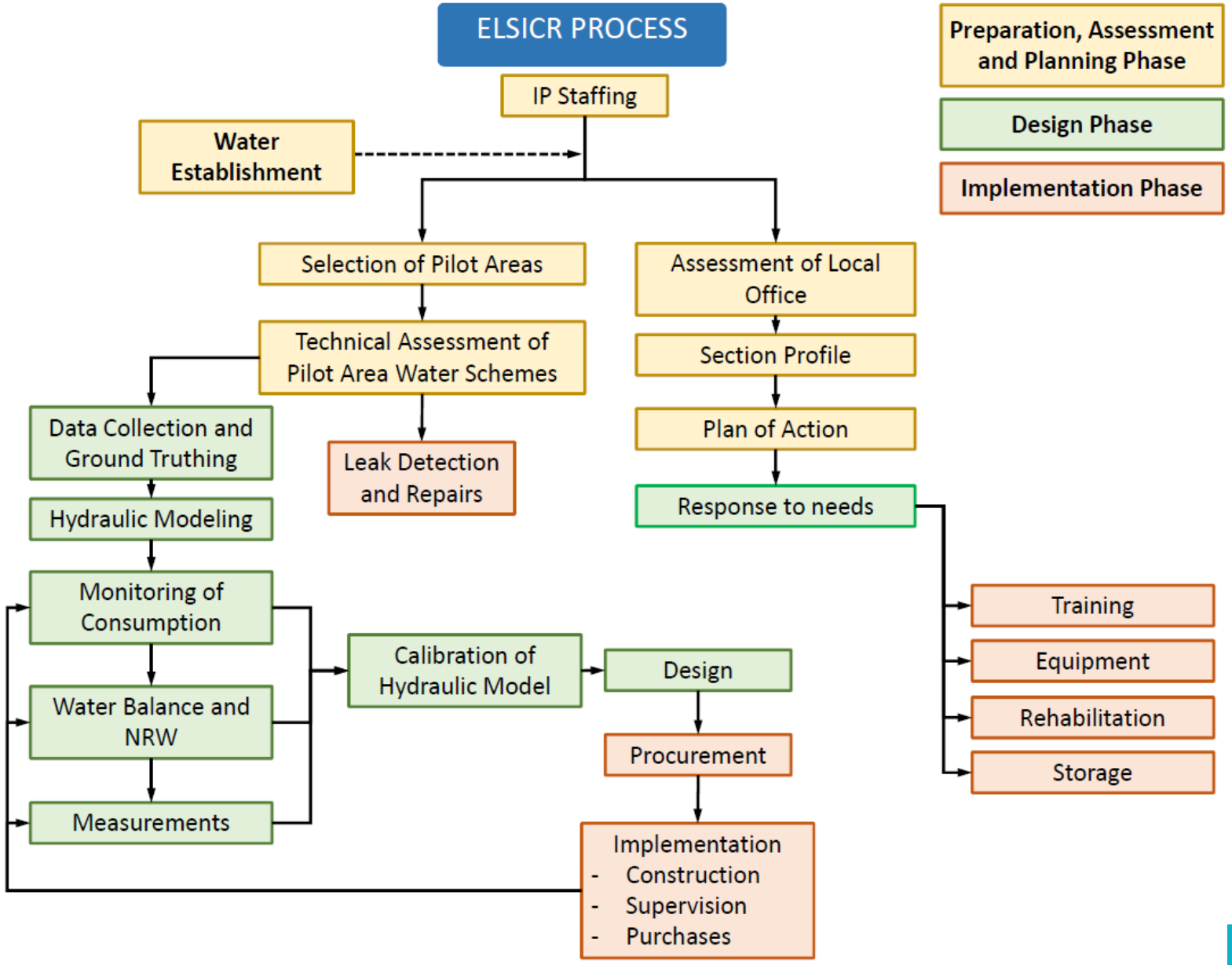

ELSICR PROCESS
Preparation, Assessment and Planning Phase
Design Phase
Implementation Phase
IP Staffing
Water Establishment
Selection of Pilot Areas
Technical Assessment of Pilot Area Water Schemes
Data Collection and Ground Truthing
Hydraulic Modeling
Monitoring of Consumption
Water Balance and NRW
Measurements
Leak Detection and Repairs
Assessment of Local Office
Section Profile
Plan of Action
Response to needs
Training
Equipment
Rehabilitation
Storage
Calibration of Hydraulic Model
Design
Procurement
Implementation
- Construction
- Supervision
- Purchases

Baalbek Local Section	Labweh Local Section	Riyak Local Section	Baabda Local Section	Qobayat Local Section	Saida Local Section
Douris Ain Bourday	Moqraq Nabi Osman Fakeha Ras Baalbek	Riyak Ali El Nahri	Ain el Remmaneh	Debabiyeh Emaret El Bayket Machta Hammoud Kfartoun Mounseh Qobayat, …	Qennarit Ghazieh

1 - Staffing

The successful implementation of the EL-SICR approach relies significantly on the capacities and coordination among various actors. The **key personnel** in this approach is mainly composed of two groups of staff:

Water Establishment Staff and Seconded Engineers

Local WE section teams, who execute maintenance, troubleshoot issues, and day-to-day operations, together with the Seconded Engineers that are responsible for overseeing technical assessments, design, and implementation of infrastructure improvements.

Implementing Partners' Staff and Senior Hydraulic Engineer

IPs' Project Managers, Coordinators, and Officers coordinate with the staff implementing EL-SICR: the Social Staff is responsible for community engagement and the Senior Hydraulic Engineer coordinates the work of the seconded engineers and provides technical support to the Engineering team.

2 - Assessment and enhancement of WE local offices

In-depth assessment is an exercise carried out by the engineering staff, in coordination with WE local section staff and the support of the Implementing Partner.

The assessment is composed of five main sections:

- **Personnel**: number, capacities and needs
- **Resources**:
  - **Offices**: current condition, available and needed furniture, necessary supplies, and any rehabilitation or repair work required to ensure better working conditions.
  - **Storage**: condition of local storage units, area, current capacity, condition and any rehabilitation or upgrade needs.
  - **Equipment**: maintenance and safety tools + specialized equipment for NRW and leak detection equipment.

2 - Assessment and enhancement of WE local offices

- **Finances**: financial standing of the local section.

- **Data**: including drawings, designs, bills of quantities, hydraulic models, GIS data, subscriptions and payments, and readings from bulk meters and domestic meters.

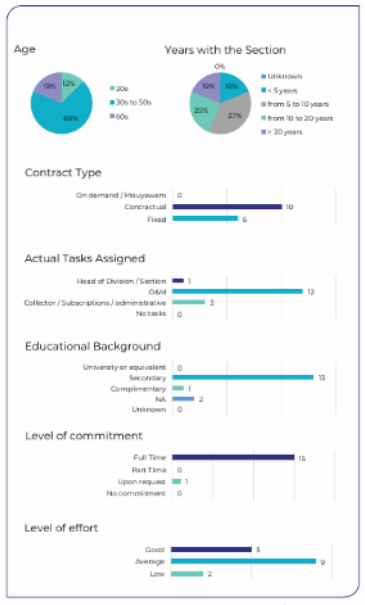
- **Processes**: operation, maintenance, subscriptions, collection, service improvement, cost recovery, processing and coordination processes.

2 - Assessment and enhancement of WE local offices

Sections Profiles and Plans of Action

LABWEH SECTION – February 2022
Bekaa Water Establishment (BWE)

Personnel



Operation

Operators	1 operator by village
Guidance	Head of division + seconded engineer
Evaluation	Based on received complaints

Maintenance

Identification of needs	Subscribers complaints + whatsapp group for maintenance staff
Guidance	Head of section assess the personnel + equipment and supplies needed
Supervision	Maintenance that require heavy machinery or extensions for house connections

Service Improvement

Studies on networks?	Only by the seconded engineer
Records of interventions	Unorganized and not documented
Evaluation of system performance?	Not documented

Head Office and Section

Processing and coordination can take from one week to months

LABWEH SECTION – February 2022
Bekaa Water Establishment (BWE)

Offices

Building	One office building + 1 Pumping stations building (200 m2)
Furniture	Good
Available equipment	Maintenance and leak detection equipment
Overall Condition	Offices are good but the entrance needs rehabilitation
Supplies needed	Maintenance tools (compressor), Electricity, PC
Rehabilitation Works Needed	Electricity, fence and entrance Rehabilitated by WW-GVC but the entrance needs rehabilitation No meeting room and no warehouse
General notes	

Storage

Available storage areas	The Section does not have any area available for storage of equipment, pipes or accessories
Condition	All equipment are stored inadequately in the office building
Rehabilitation needs	A storage area is needed in order to keep accessories, maintenance equipment as well as leak detection and specialized equipment

Equipment

Description of available equipment	The section has enough equipment and tools to execute usual maintenance. However, they can't perform excavation since the compressor they use is private property for one of the staff. In addition, a portable air compressor is not available. No excavator.
Needed maintenance equipment	- Portable generator, basic maintenance tools such as driller, wrenches, threading machine, electrical tools - Diesel Air compressor + pneumatic asphalt breaker - vehicle mounted light - welding equipment and pipe electrofusion welding machine - Safety equipment
Needed specialized equipment	Some are available, others are needed

Comment

Despite being rehabilitated in 2020 by WW-GVC, the Section entrance area was fully destroyed by a truck accident. The whole entrance needs restoration.

No meeting area and no storage area in the Section. It is recommended to provide additional space for a meeting room and a storage area.

The Section needs maintenance equipment and additional specialized equipment (leak detection equipment) to complete the available equipment.

LABWEH SECTION – February 2022
Bekaa Water Establishment (BWE)

Technical Data

Datasets	Availability	Accuracy	Accessibility
Design Drawings	Medium	Low	High
As-Built Drawings	Medium	Low	High
Bills of Quantities	Low	Low	Low
GIS Shapefiles	Low	Medium	Medium
Hydraulic Models	Low	High	Low
Subscribers	High	Medium	Medium
Payers	High	High	Medium
Bulk Meter Reading	Medium	High	Low
Domestic Meter Reading	Medium	Low	Low

Financial Data

Estimated numbers	Users	13,464	**Total Income (LBP)**	2021	
	Non-users	4,488		2020	196,375,000
	Subscribers on Record	6,361		2019	248,600,000
	Real Subscribers	4,898		2018	
Payment Rate	2021		**Total Expenses (LBP)**	2021	
	2020	12.7%		2020	
	2019	14.5%		2019	744,073,000 (only for salaries and electricity)
	2018	19.5%		2018	
			Total Arrears Except 2021 (LBP)		15,943,575,050

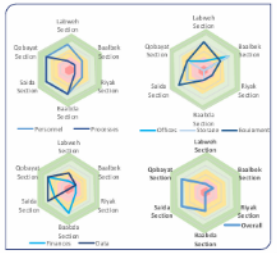
- Subscription employee available in the section office one day per week
- Subscription data available upon request
- Collection is done from households
- Information concerning payment or collection can be available upon request
- The section does not have record and available data on expenses
- The income was previously very low but was increased following Madad intervention in the area. Recently it was reduced due to the water shortage and financial crisis

LABWEH SECTION – February 2022
Bekaa Water Establishment (BWE)

Score card

Rating	Poor	Below Standard	Standard	Above Standard	Excellent	Score
Personnel	-4	-2	0	2	4	**2.0**
Offices	-2	-1	0	1	2	**-1.0**
Storage	-1	-0.5	0	0.5	1	**-1.0**
Equipment	-2	-1	0	1	2	**1.0**
Finances	-3	-1.5	0	1.5	3	**-1.5**
Data	-1	-0.5	0	0.5	1	**0.0**
Processes	-3	-1.5	0	1.5	3	**-1.5**
Total						**-2.0**

Sections Comparison



Comment

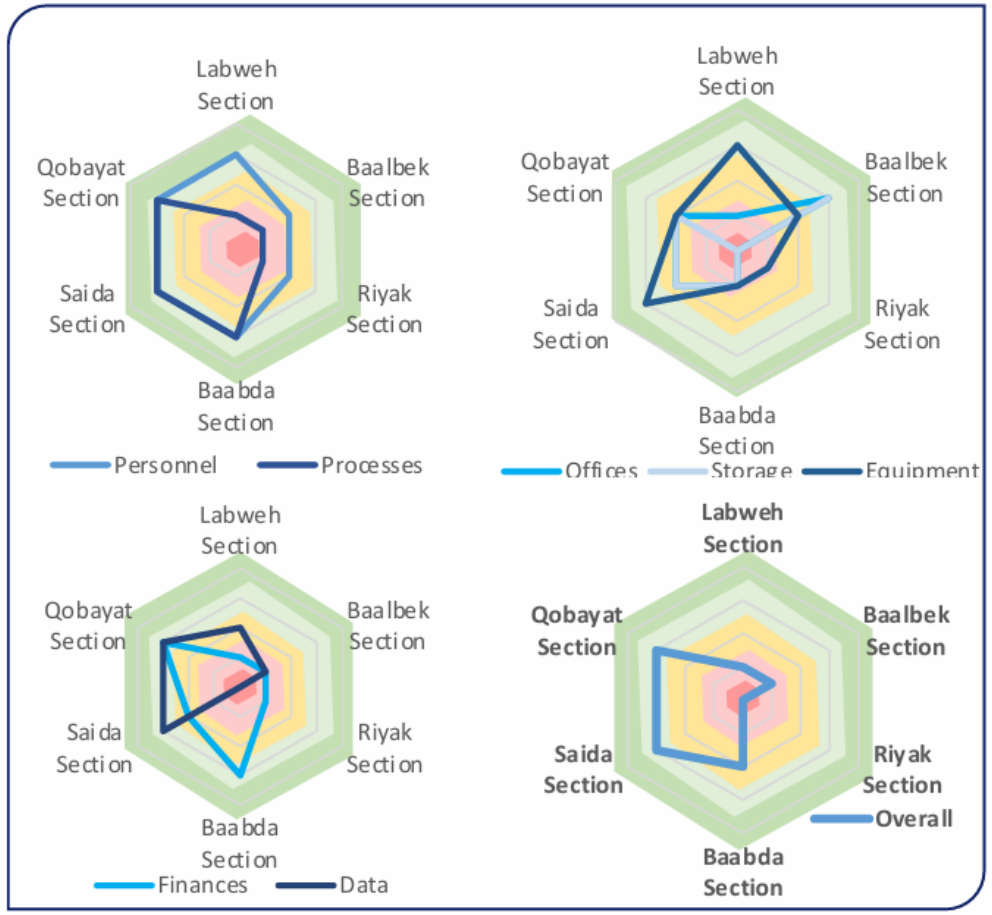
The total Section Score is negative while some improvement have been done in the last years for the networks, water sources, designs, and provision of equipment.

The Section can be improved by focusing on direct implementation of the following:

- Training of the personnel
- Rehabilitation of the Offices entrance
- Provision of meeting area and storage area
- Provision of additional equipment and specialized equipment
- Improvement of water system knowledge and well monitoring of operation
- It is highly recommended to keep record of each technical intervention on the network (leakage repairs, etc.).

2 - Assessment and enhancement of WE local offices

Sections Comparison



2 - Assessment and enhancement of WE local offices

Coaching, Training and Capacity Building

- **Technical training sessions**:
  - ✓ fundamentals of hydraulics,
  - ✓ hydraulic modeling,
  - ✓ calibration of hydraulic models,
  - ✓ non-revenue water,
  - ✓ identification and reduction of water losses
  - ✓ data collection, analysis, and visualization using GIS
- **Training on the proper use and maintenance of equipment** used in water management and distribution
- **Operation schedules**: scheduling and coordination of water distribution operations to ensure efficient and effective service delivery
- **Illegal connections campaigns**: identifying and addressing illegal water connections
- **Procurement department training**: procurement process, with a particular emphasis on compliance with the New Lebanese Public Procurement Law.

2 - Assessment and enhancement of WE local offices

Assessment of Equipment need / maintenance and provision of equipment

1	2		3
Item Nr	Description	Indicative Image of Item	Unit
100	Miscellaneous Equipment		
101	Portable self-priming dewatering pump, gasoline powered (or equivalent), 2" (50mm) Intake/Outlet 1HP minimum. Minimum flow rate of 5 l/s. With copper, brushless motor.		U
102	Portable generator (5Kva Diesel generator), runtime no less than 10hr at full load. ISO 8528 or equivalent, 220V rated voltage, operating noise level no higher than 70dB (with noise case), electric start with battery. The Coil of alternator must be copper. The supplier should guarantee that spare parts for the generator are readily available in the local market. Warranty no less than 2 years.		U
103	Portable circular metal saw with accessories (main use for DI pipes); minimum 200mm stainless steel disk, minimum 2,000W (240V AC) and 2,500 rpm motor (no load speed), with Bevel lever and depth guide. Warranty no less than 2 years.		U
104	Walk behind Asphalt cutter/saw, with bladeguard, pointer wheel, water system, minimum 10HP, diesel powered, cutting depth of 4in, (or equivalent), complete with all accessories. With minimum 400mm diameter Cured Concrete Diamond Blade, or equivalent. Warranty no less than 2 years.		U
114	Wrench Set made of heavy duty steel (chrome vanadium or better) fitting sizes between 3/8" to 1 1/2"		U
115	Carbon Steel Pincer/Plier Set Including at minimum: 8" Linesman, 6" long nose, 6" bent nose, 6" slip joint, 6" diagonal cutter, 8" tongue & groove, 6" end cutter, 7" curved jaw, 6" long nose locking, 8" adjustable (or equivalent)		U
116	Pipe wrench set, heavy duty steel, adjustable for fittings up to 18 inches (minimum of 4 wrenches of varying ascending sizes per set), with storage bag or case.		U
117	Adjustable wrench made of heavy duty steel (Chrome vanadium or better), up to 18 inches, heavy duty steel.		U
118	Socket wrench set made of heavy duty steel (Chrome vanadium or better) (including storage case), heavy duty, with adjustable heads 4 to 24mm range minimum; includes Ratchets set minimum 12pc with range 8 to 19mm, Extensions, Combination Wrenches set and Hex Keys set.		U

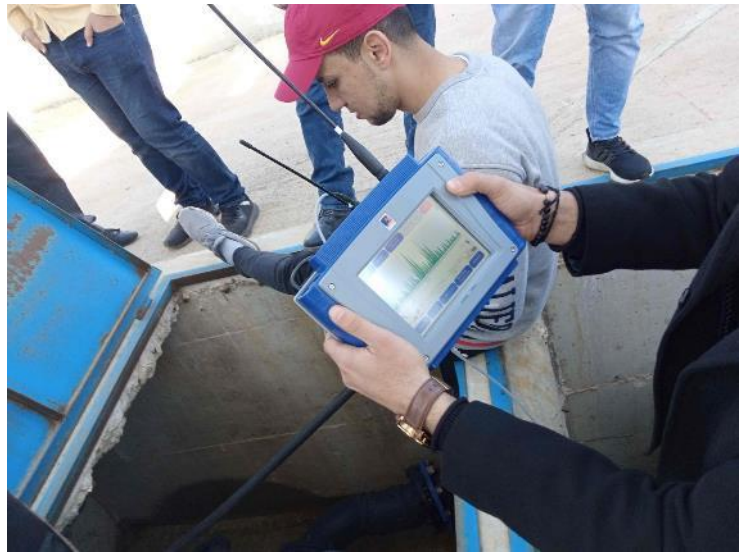
2 - Assessment and enhancement of WE local offices

Specialized / Leak Detection Equipment

100	**Specialized Equipment**		
101	Metal pipes and cables locator		U
102	Ultrasonic/Acoustic leak detection ground microphone and stick, with complete accessories. Warranty no less than 2 years.		U
103	Manual diaphragm leakage listening stick		U
104	Portable hand-held electronic digital water pressure gauge, for positive and negative pressures, minimum 0.2% accuracy, range up to 40Mpa. Complete with all cables, accessories and carrying case.		U
105	Electronic Digital Thermometer (Celsius) for use in hot and cold fluids and semisolid materials. For use in commercial/industrial environments with Easy-to-read screen. Battery Operated and Factory Calibrated.		U

2 - Assessment and enhancement of WE local offices

Specialized / Leak Detection Equipment



Training on the use of the Specialized Equipment

2 - Assessment and enhancement of WE local offices

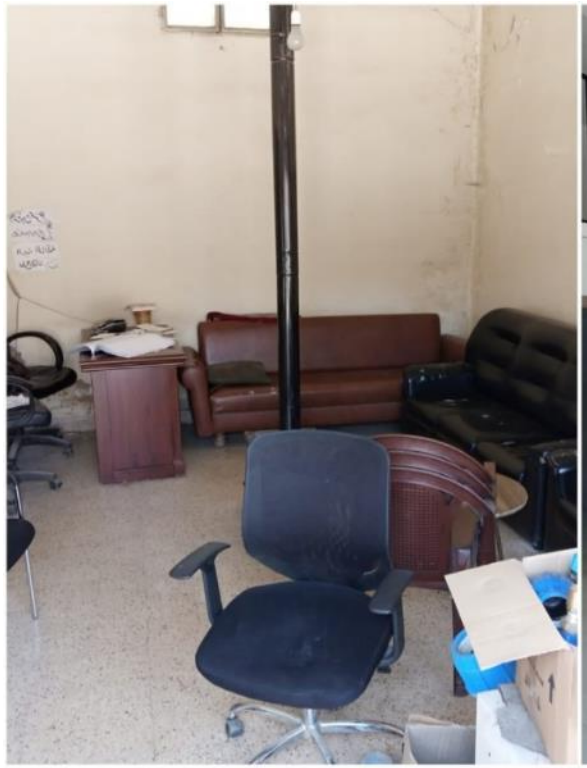
Rehabilitation Works

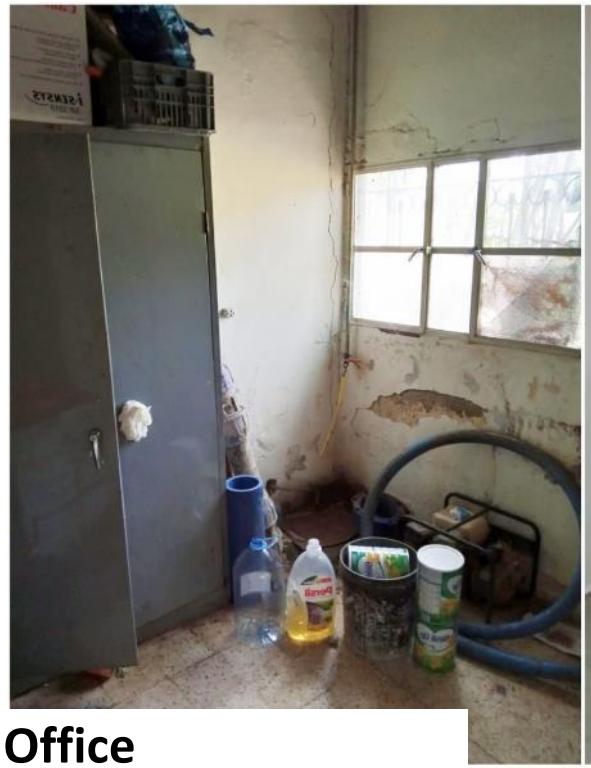
Labweh BWE Office

Before and After rehabilitation

2 - Assessment and enhancement of WE local offices

Rehabilitation Works






Riyak BWE Office

Before and After rehabilitation

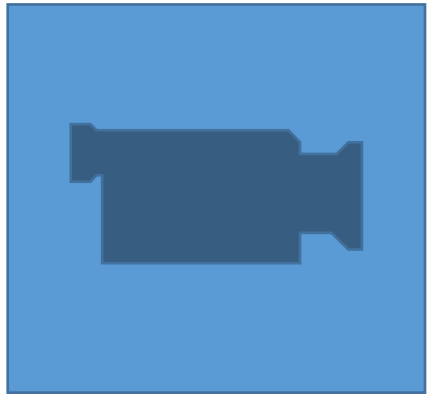
2 - Assessment and enhancement of WE local offices

Rehabilitation Works

EBML Baabda Office

2 - Assessment and enhancement of WE local offices

Rehabilitation Works



Rehabilitation of Qobayat NLWE Offices

2 - Assessment and enhancement of WE local offices

Rehabilitation Works

NLWE Qobayat Office

Before and After rehabilitation

2 - Assessment and enhancement of WE local offices

Rehabilitation Works

NLWE Qobayat Office

Before and After rehabilitation

2 - Assessment and enhancement of WE local offices

Creating Storage Areas

Constructed warehouse in Baalbek

2 - Assessment and enhancement of WE local offices

Installing Solar Systems for Offices Electricity supply

Solar System in Qobayat

Solar System in Labweh

3 - Assessment and upgrade of potable water schemes

STUDY PHASE

DOURIS AND AIN BOURDAY WATER SCHEMES

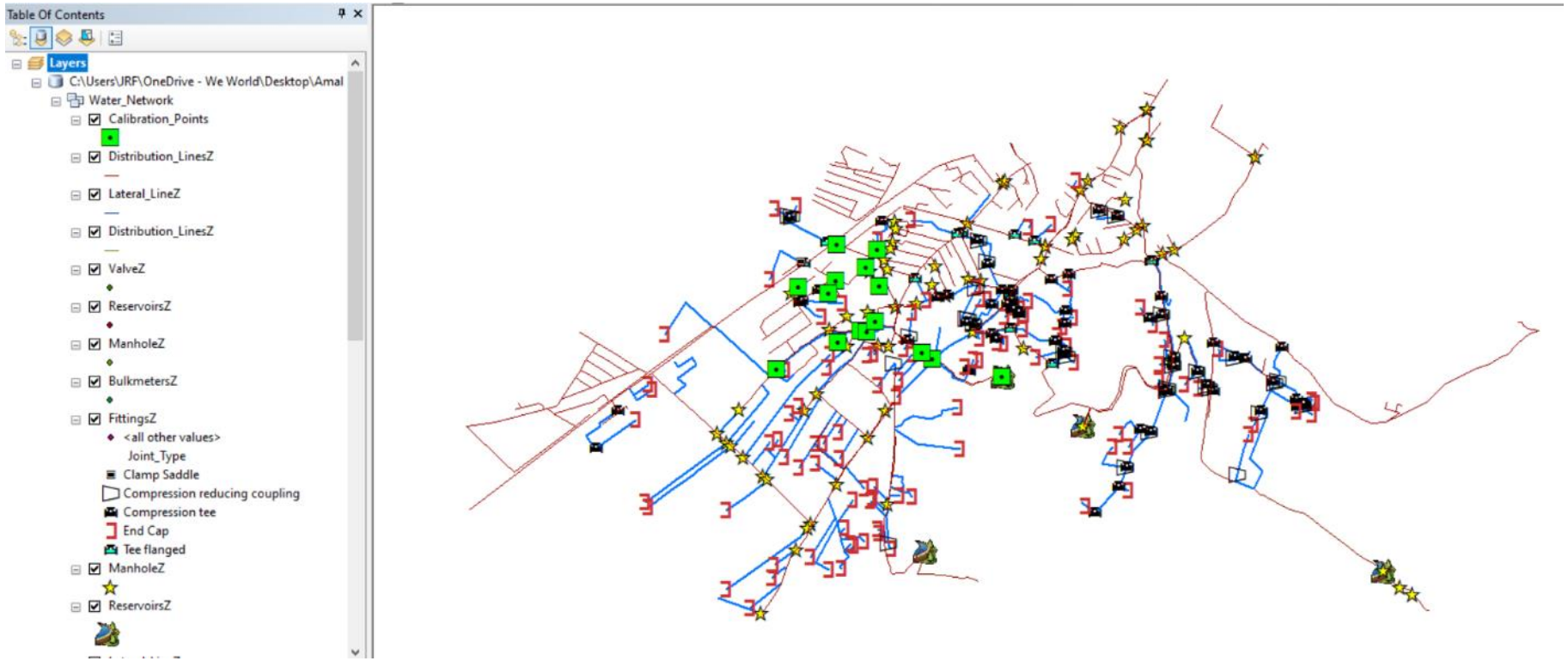
3 - Assessment and upgrade of potable water schemes

Data Collection and Ground Truthing

- The Hydraulic Engineer begins with gathering all available data and information about the targeted water scheme.
  - ✓ as-built drawings,
  - ✓ design drawings,
  - ✓ any relevant data from sources such as the Water Establishment, contractors, or consultants
- Ground truthing is the initial step in the assessment and evaluation phase of the existing water network.
- The objective of this activity is to gather accurate and comprehensive data about the current conditions of the water scheme.
- The engineer proceeds with verifying, validating, and updating the database.
- Field inspections by WE staff should be planned and supervised to "reverse map" uncertain components of the water networks.
- The collected information is then used to update the GIS database.

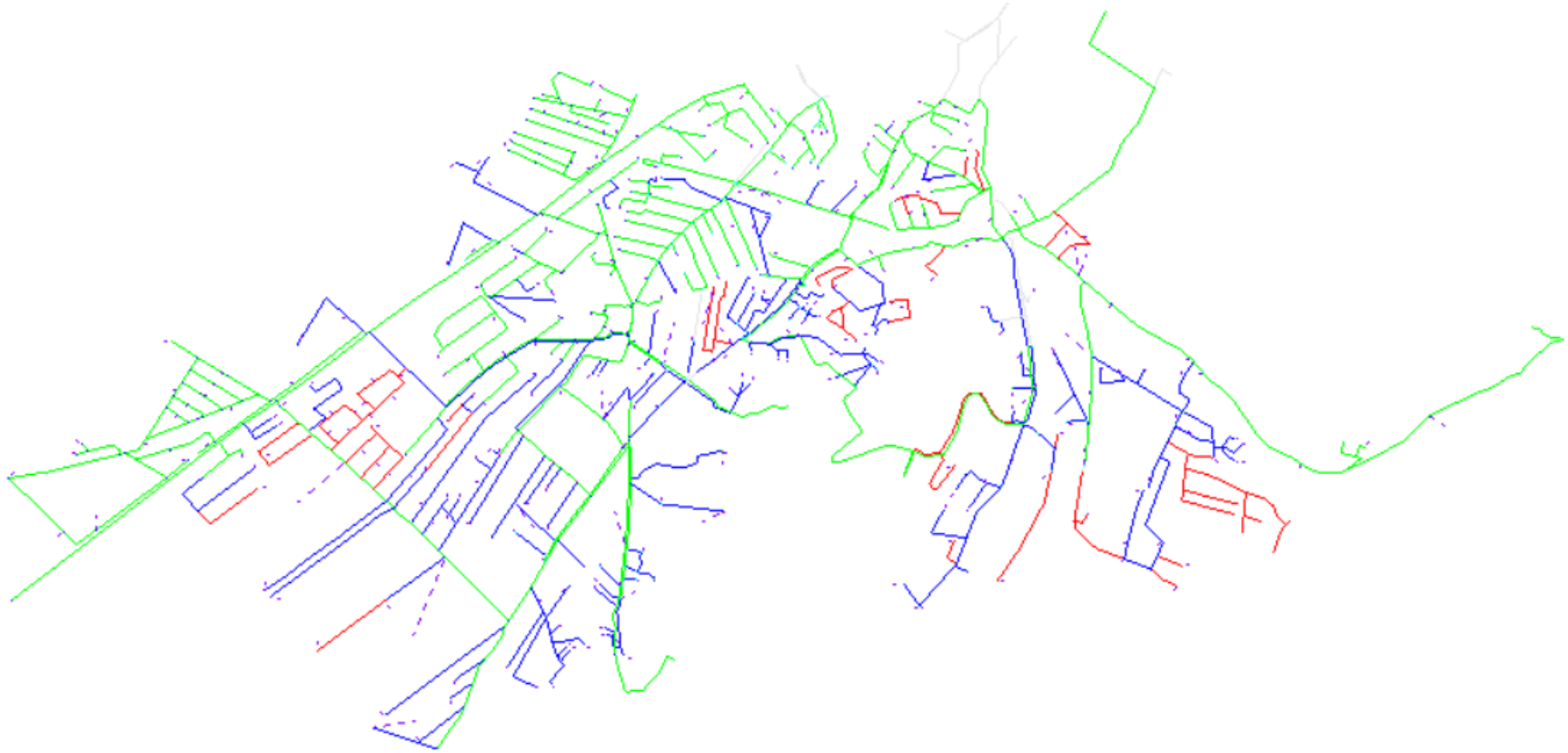
3 - Assessment and upgrade of potable water schemes

Data Collection and Ground Truthing



3 - Assessment and upgrade of potable water schemes

Hydraulic Modeling



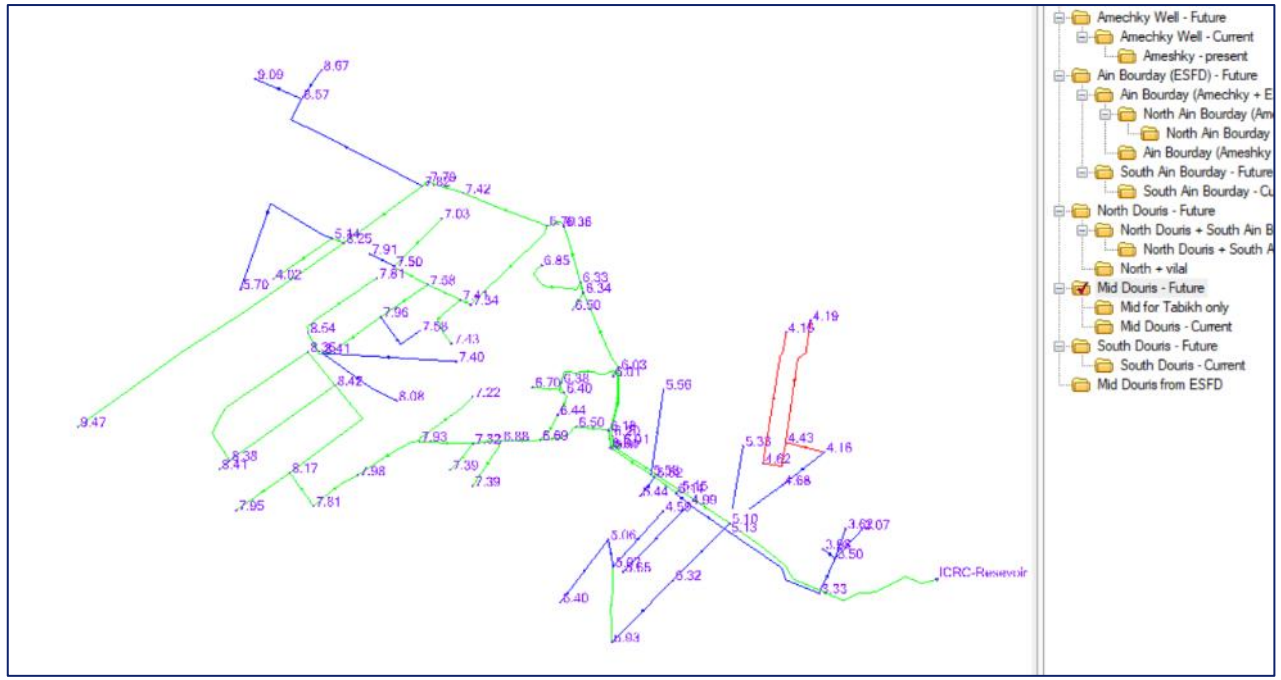
3 - Assessment and upgrade of potable water schemes

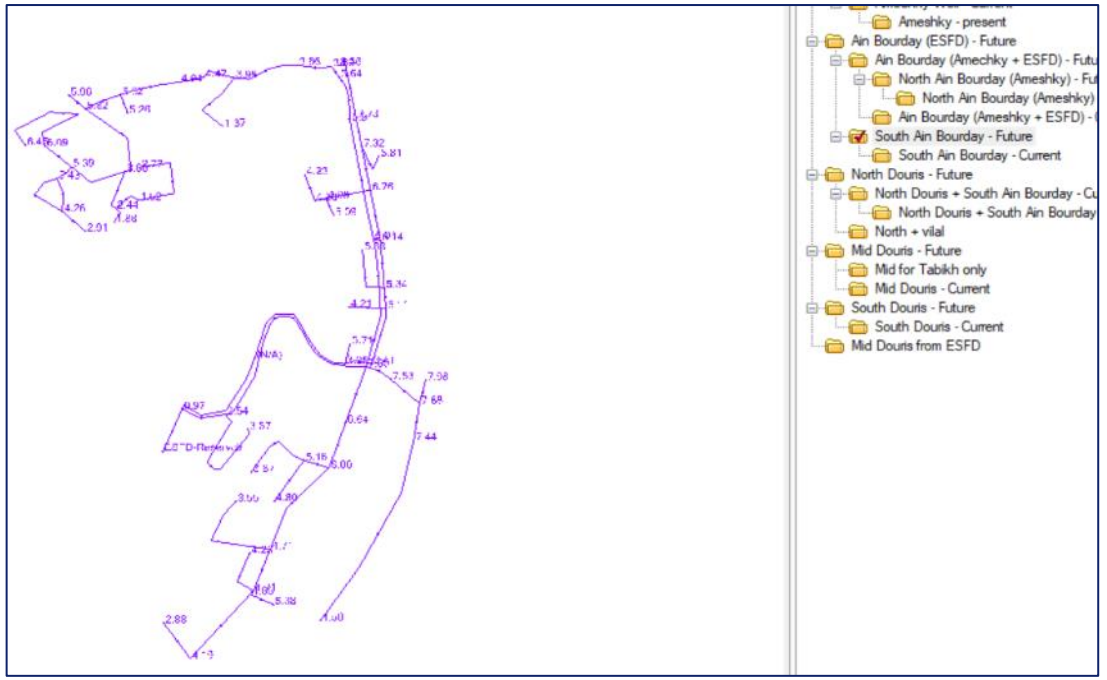
Hydraulic Modeling

- By exporting GIS data for pipelines, reservoirs, and other hydraulic elements into a hydraulic model, engineers create a digital twin of the physical system
- This hydraulic model is then used to simulate various scenarios, such as changes in demand, the addition of new infrastructure (e.g., pipe extensions to new neighborhoods)
- These simulations enable hydraulic engineers to assess the system's performance under different conditions and use this information to design and improve the water supply
- When designing new network extensions, engineers must adhere to the standards and guidelines set forth in the Lebanese National Water Strategy.

3 - Assessment and upgrade of potable water schemes

Hydraulic Modeling – Various Scenarios

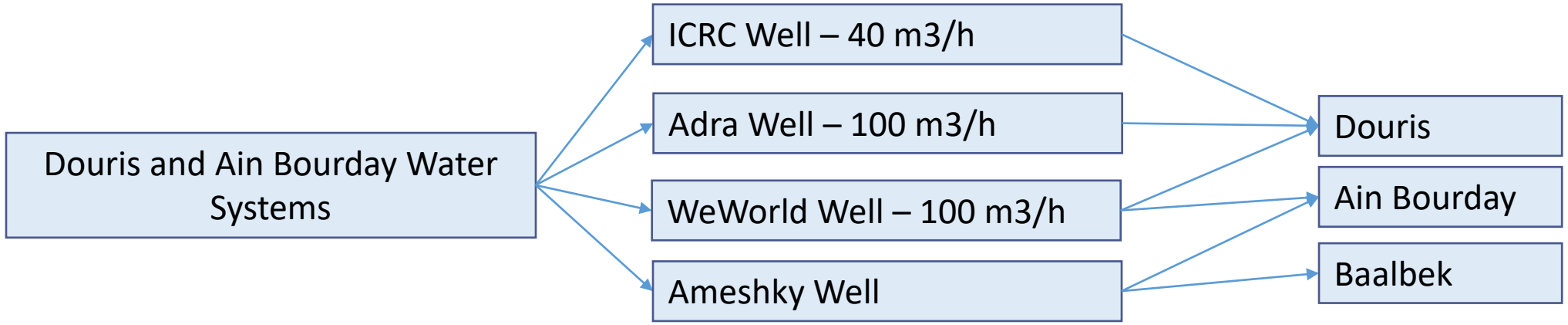




3 - Assessment and upgrade of potable water schemes

Data Collection and Ground Truthing

- All needed data in hand, the second step is to analyze the data and understand the operation system:
  - ✓ Available water sources and areas of supply
  - ✓ Daily water production from wells
  - ✓ Can the current operation schedule and DMA distribution be improved? How?
  - ✓ Is it possible to reach more population?



3 - Assessment and upgrade of potable water schemes

Design

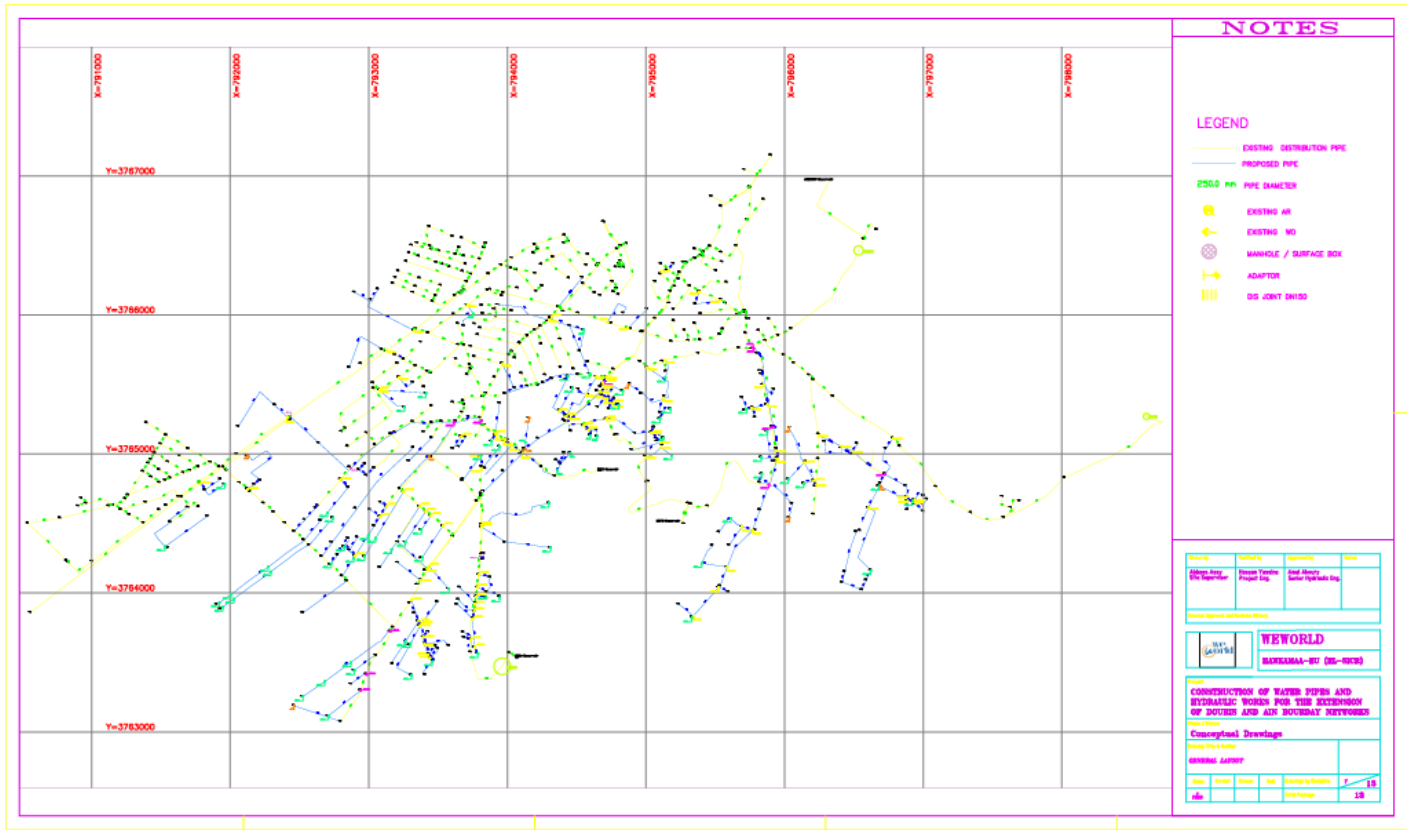
- Network extensions to supply new subscribers and/or connect existing unconnected subscribers;
- Performance-related works and interventions on the networks in order to improve their performance such as modifications of connections, creating or disconnecting loops, etc.;
- Installation of district meters or pressure loggers on specific points on the networks including all related civil construction and hydraulic works.

The design process includes:

- Hydraulic modeling and calculation notes
- creating design drawings and design reports,
- Estimating the quantities of work required and estimating the budget needed for each intervention.

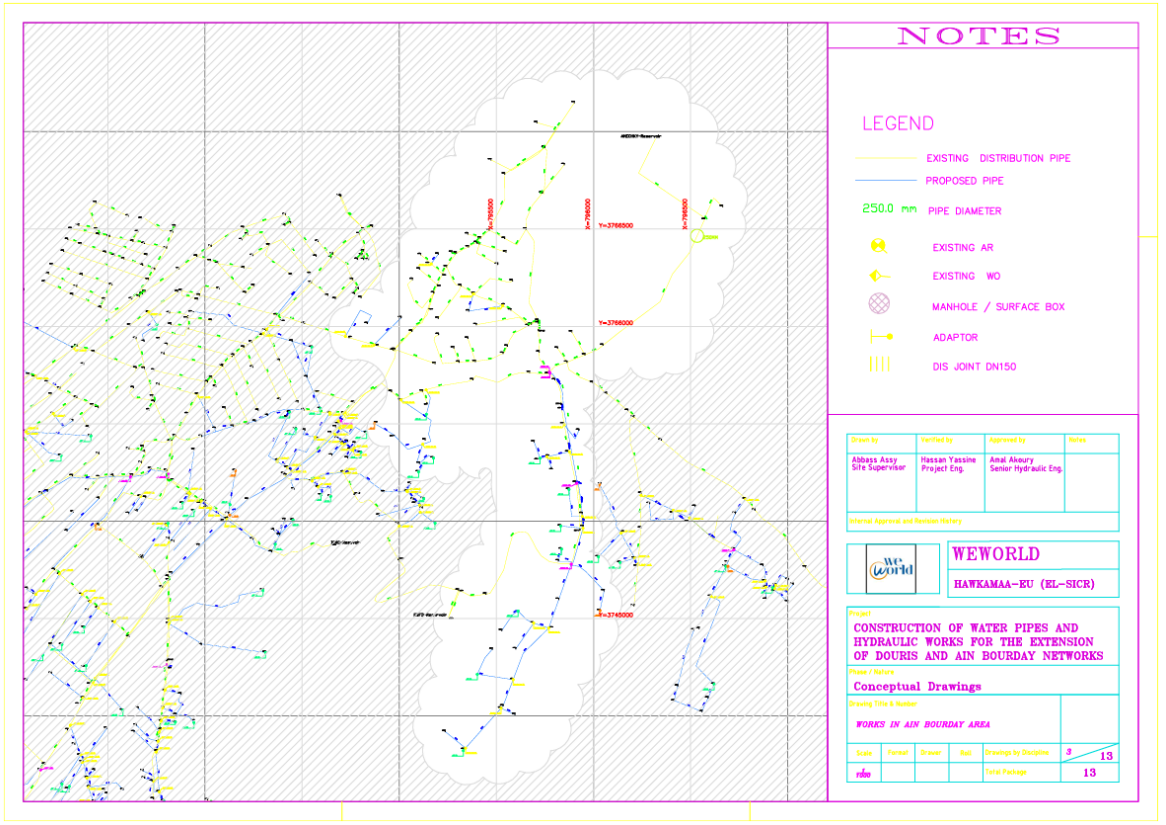
3 - Assessment and upgrade of potable water schemes

Design – Drawings Preparation



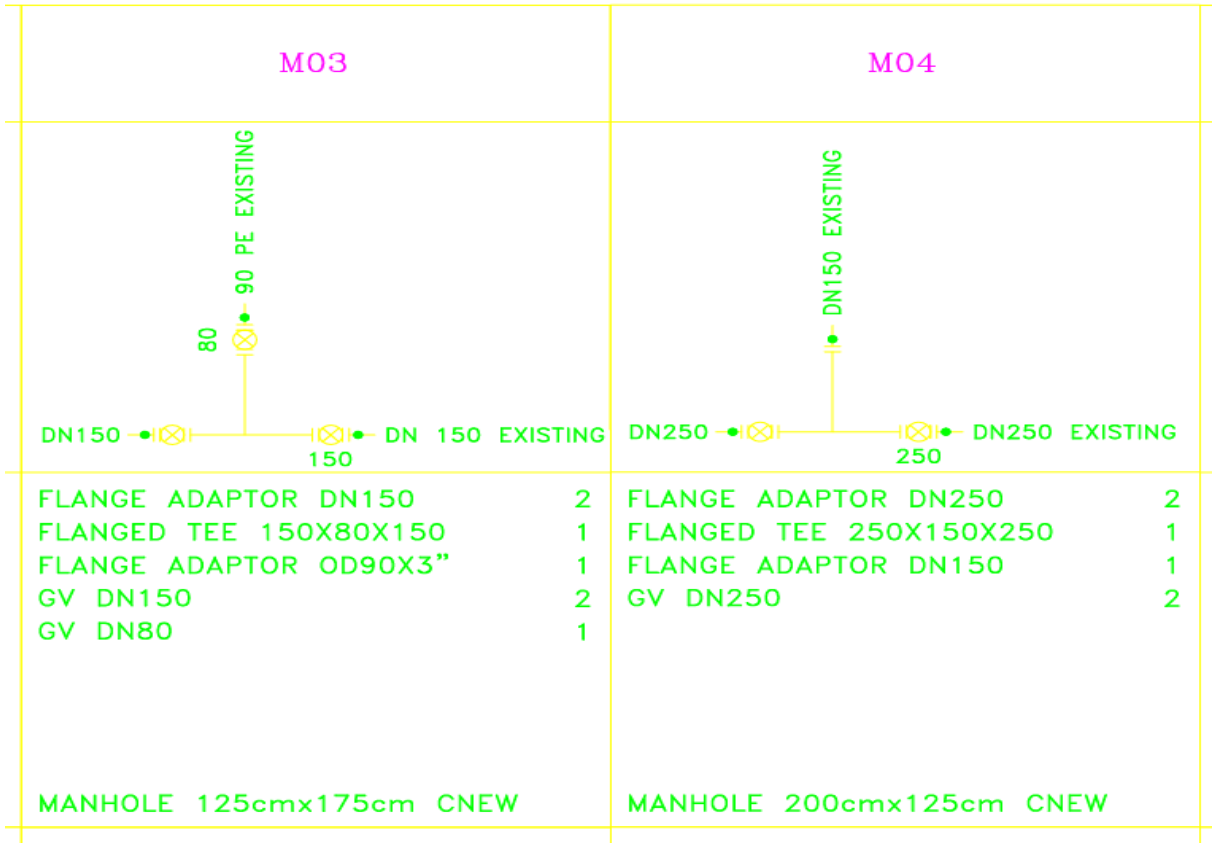
3 - Assessment and upgrade of potable water schemes

Design – Drawings Preparation



3 - Assessment and upgrade of potable water schemes

Design – Drawings Preparation



3 - Assessment and upgrade of potable water schemes

Procurement for Provision of Supplies and for Works Implementation

Works implementation can be carried out through several methods:

- **Trained Daily Workers**: paid by supporting partners and supervised by the Water Establishment (WE) and the supporting partners through the engineers.
- **Contractors through various modalities:**
  - **Direct Tenders**
  - **Framework Agreements**

3 - Assessment and upgrade of potable water schemes

QC/QA and Supervision of Works

The works implementation are supervised by **the Hydraulic/civil Engineers with the support of site engineers from the supporting partner:**

- Quality Assurance
- Compliance with laws and regulations including safety regulations and environmental standards
- Progress Monitoring
- Contractor Accountability

The engineers monitor the progress of the works, provide daily reports and maintain records of the quantity of work completed.

They prepare variation orders to ensure that contractual agreements accurately reflect the evolving needs of the project.

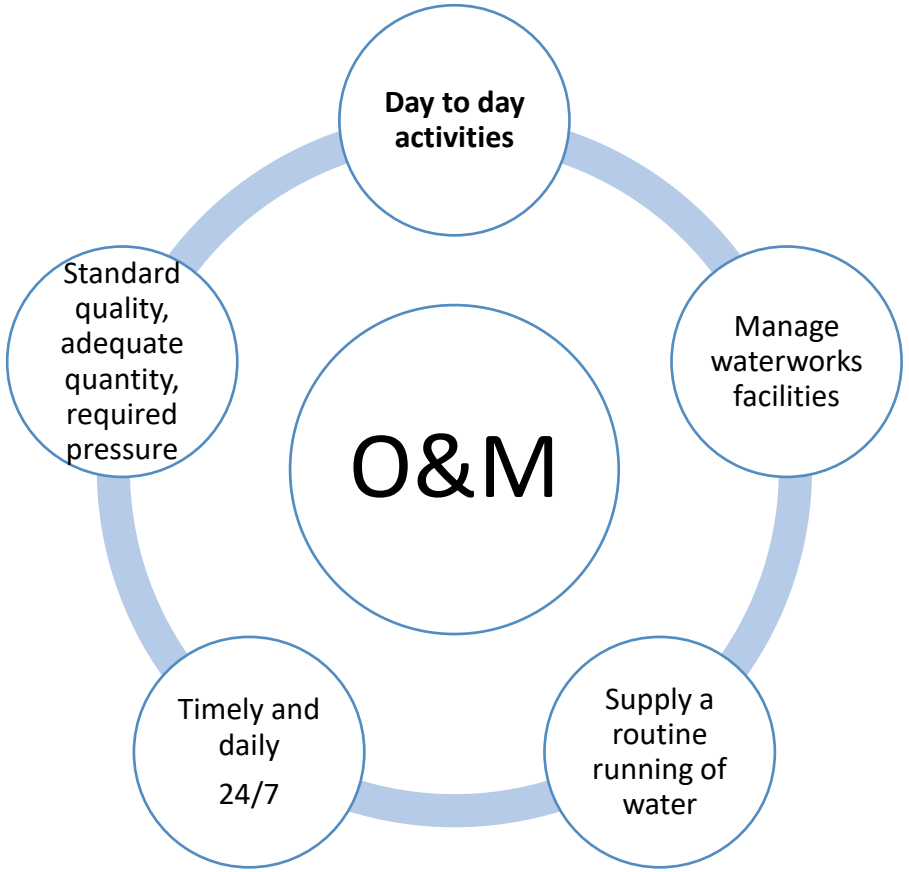
3 - Assessment and upgrade of potable water schemes

CALIBRATION OF HYDRAULIC MODEL, LEAK DETECTION CAMPAIGN AND MONITORING OF WATER CONSUMPTION

ALI EL NAHRI

OPERATION AND MAINTENANCE (O&M)

3 - Assessment and upgrade of potable water schemes



3 - Assessment and upgrade of potable water schemes

- To operate and maintain the facilities appropriately, the development of the technical capacities of staff was required.
- Despite empowering the Riyak section, the WE still lacks the ability of performing technical activities and to cover the cost of operation and maintenance
- The BWE – Riyak Section doesn’t have access to database related to the existing networks and monitoring of water consumption

3 - Assessment and upgrade of potable water schemes

Funding challenges	ELSICR contribution
Vehicle repairs	Maintaining fleet mobility for site inspections and repairs
Tools and equipment	Purchase of tools and equipment for onsite maintenance
Workers	Hiring additional workers (workers after following a training program

3 - Assessment and upgrade of potable water schemes

O&M activities start with the planning and design of a facility and continue through its life cycle.

Operations:

- Hydraulic integrity: ability of a distribution system to meet all user demands
- DMAs form the basis for the system water balance, and allows leakage, pipe bursts and illegal connections to be monitored in manageable areas of the system.

Maintenance:

- Physical: Ability to have correctly functioning components
- Repair networks, fittings and leakages

Status of Ali el Nahri Network:

All the existing pipes are very old and were installed in the early 2000's; Aging pipes, which can corrode over time, causing a lot of physical water loss.

3 - Assessment and upgrade of potable water schemes

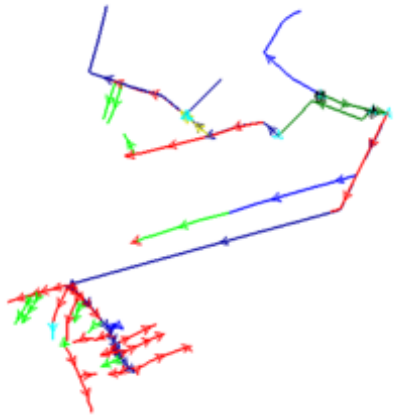
Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

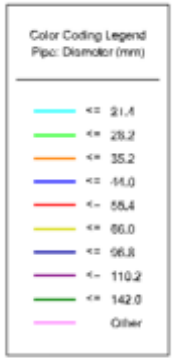
Leaks (visible or hidden) have a negative impact on network performance, acting as open demands and resulting in decreased pressure and inadequate service.

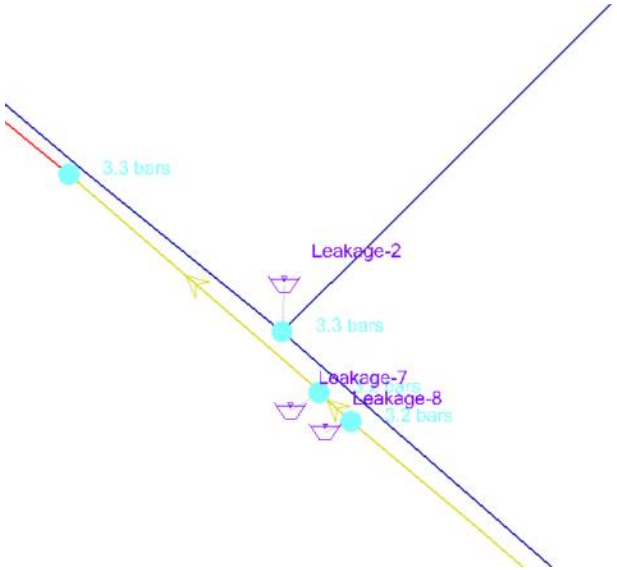
- Purchase of Leak Detection Equipment
- Training of staff on the efficient use of the equipment
- Conduct leak detection campaigns

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri







Leakage #	Water quantity (m3/h)
Leakage-1	12.4
Leakage-2	7.2
Leakage-4	6.8
Leakage-5	6.7
Leakage-6	0.4
Leakage-7	1.1
Leakage-8	1.3
Estimated Total physical loss (m3/h)	**35.9**

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

- When dealing with existing networks, it is essential to evaluate potential issues and design improvements. To achieve this, the hydraulic engineers must first calibrate the hydraulic model using on-site real information:

  - By taking measurements at various points in the network for pressure and flow
  - Incorporating this data into the hydraulic model

  The goal is to create a model that accurately reflects the real distribution scenarios as closely as possible.

Pressure Reading

Flow Reading

Tools:

- Use specialized equipment
- Take readings from house connections from water meters where available and by basic means (bottles and timers) → Electromagnetic / mechanical Water meters installed where found needed
- Take readings from district water meters at various locations on a regular basis to monitor the overall consumption of a specific District Metered Area (DMA) on the network
- Take readings from pressure loggers

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

Current Water Supply Status	Distribution Neighborhoods (DMAs)					TOTAL
	From BWE Well				From Jomaa Well	
	Saha	Bayader	Kroum	Toward High School	Jomaa	
Number of Residents	4,716	2,868	3,384	438	4,866	16,272
Number of subscriptions	**402**	**208**	**280**	**37**	**425**	**1,352**
Number of subscribed people	2,412	1,248	1,680	222	2,550	8,112
Estimated number of illegal connections	**298**	**217**	**222**	**28**	**297**	**1,062**
Distribution Pattern	**Every three days (between 1300 and 1500 m3 once every 3 days for each neighborhood)**			**Everyday**	**Everyday**	
Total volume of physical losses (m3/day)	301	358	330	49	100	1,138
Physical NRW (%)	**66.9%**	**79.6%**	**73.3%**	**70.3%**	**14.3%**	**53.7%**
Commercial NRW (%)	**6.4%**	**105.7%**	**52.8%**	**79.8%**	**56.6%**	**49.1%**
Average quantity received per apartment (m3/day)	0.21	0.22	0.24	0.32	0.83	0.41
Quantity of water received per person (l/day)	**35.50**	**36.04**	**39.84**	**53.36**	**138.54**	**67.79**

3 - Assessment and upgrade of potable water schemes

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Stages of Implementation	Proposed measures and solutions
Preparation and cleaning	Clean all the surface boxes (this is requested and can be done by BWE staff or daily workers before the intervention of any contractor)
First intervention for the network improvement	Repair visible leakages (Refer to Annex 3 for locations and description of needed works)
	Repair defected valves and rehabilitate the old manholes (Refer to Annex 3 for locations and description of needed works)
	Disconnect Municipality garden neighborhood when supplying El Saha and Kroum Neighborhoods and supply it together with El Bayader neighborhood being the smaller neighborhood with the lower demand
	Disconnect Kroum area when supplying Bayader Neighborhood
	Install district meters including manholes construction at various locations on the network in order to allow future control and monitoring of water consumption and losses.
Second step - short term solution	Conduct leak detection campaigns in order to detect additional invisible leakages
	Re-calibrate the network after first intervention in order to evaluate the obtained results and design further interventions
	Evaluate the first intervention outcome and re-evaluate the supply of Municipality garden neighborhood together with El Bayader
Long term strategy to be adopted by the BWE	Construct a new network for the whole locality with an adequate design taking into consideration the actual and future needs
	Disconnect illegal connection / subscribe all connected population
	Supply the Municipality neighborhood by The Municipality garden well following the equipping of The garden Well
	Improve the water quantity at source level in order to meet all population needs
	Install water meters at house connections in order to control and monitor the water consumption, leakages and illegal connections

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

The hydraulic engineer proceeded with the design and preparation of Bill of Quantities for the following:

- Repair of existing valves
- Existing manholes rehabilitation requirements
- Leakages repairs
- Separating the existing network into DMAs
- Installation of mechanical district flowmeters at **7** locations including fittings, accessories and manholes

Works have been implemented by a Contractor with the supervision of the Engineer and BWE staff and with the support from the Implementing Partner.

3 - Assessment and upgrade of potable water schemes

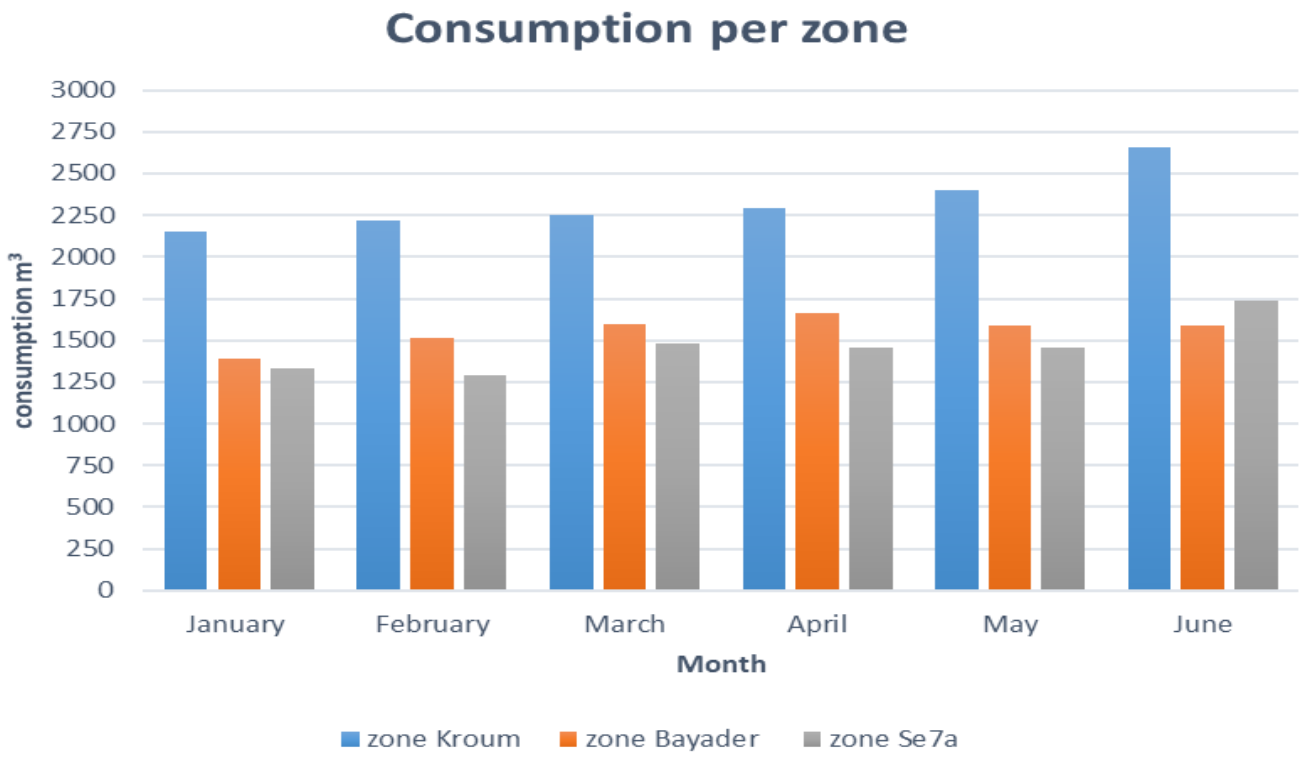
Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

Following the works implementation, the engineer proceeded with the monitoring and analysis of the water consumption:

		Consumption per zone						
Flow meters		**Zone 1 to 3**	**Zone 2 (Madrase)**	**Zone 4 (Seha)**	**Zone 5 (Bahsoun)**	**Zone 3 to 6 (Montazah)**	**Zone 6 to 7 (Kouroum)**	**Zone 7 (Bayader)**
30-10-23	30-10-23 13:30	-8	2	0	0	443	667	0
31-10-23	31-10-23 7:30	-57	0	0	0	262	708	430
01-11-23	01-11-23 7:43	-122	0	1138	325	17	3	0
02-11-23	02-11-23 7:52	53	851	3	0	460	790	0
03-11-23	03-11-23 7:46	-117	0	0	0	329	634	557
04-11-23	04-11-23 9:40	-75	667	923	242	-19	0	19
05-11-23	05-11-23 7:15	-11	0	0	0	601	929	0
06-11-23	06-11-23 7:14	-30	0	0	0	242	733	425
07-11-23	07-11-23 8:03	-84	921	1048	307	-9	9	0
08-11-23	08-11-23 7:28	654	0	0	0	-383	383	0
08-11-23	08-11-23 17:07	-669	0	0	0	1032	558	0
09-11-23	09-11-23 7:48	-24	0	0	0	237	722	401
10-11-23	10-11-23 7:22	-117	955	1144	305	10	-15	15

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri



3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

Ali Nahri								
Subscribers	**Zone**	**House counting scenario**	**House counting per zone**		**Average distribution (summer)**	**Distribution pattern**	**Distribution per day (m^3/day)**	**per household (m^3)**
1273	Saha , Bahsoun	1250	Saha	**1175**	1250	24 hrs each 3 days	**420**	**0.36**
			Bahsoun	**75**	315	24 hrs each 3 days	**105**	**1.40**
	Bayader, Montazah, Farms	720	Bayader	**600**	1050	24 hrs each 3 days	**350**	**0.58**
			Montazah	**85**	530	24 hrs each 2 days	**840**	**9.88**
			Farms	**35**	108	24 hrs each 3 days	**36**	**1.03**
	Kroum, Montazah School	1100	Kroum	**900**	1500	24 hrs each 2 days	**750**	**0.83**
			Montazah	**85**	620	24 hrs each 2 days	**840**	**9.88**
			School	**115**	980	24 hrs each 3 days	**327**	**2.84**
	Haush El Ghanam	930		930	N/A	Everyday		

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

Despite the technical intervention on the Ali en Nahri network where leakages have been reduced, people were still complaining for the following reasons:

- People in the same neighborhood receive water in different quantities
- Existing farms consuming a high quantity of water without being subscribed or with one standard subscription
- Illegal connections

A campaign for water conservation is needed in order to raise awareness about water consumption, calibrate house connections, remove illegal connections and aware people about subscription to BWE and payment.

3 - Assessment and upgrade of potable water schemes

Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

Community Engagement

Water campaigns are conducted jointly by Social, engineering staff and technicians.

- Illegal disconnection / subscriptions, removing violations
- Community Perception Research (CPR)
- Water conservation awareness campaigns
- WaterWise sessions (targeted audience, specific modules)
- Project Progress community meetings
- Subscription and Collection Campaigns
- Complaints Mechanism & Conflict Resolutions
- Communication & Visibility – Inaugurations, Events, etc.

3 - Assessment and upgrade of potable water schemes

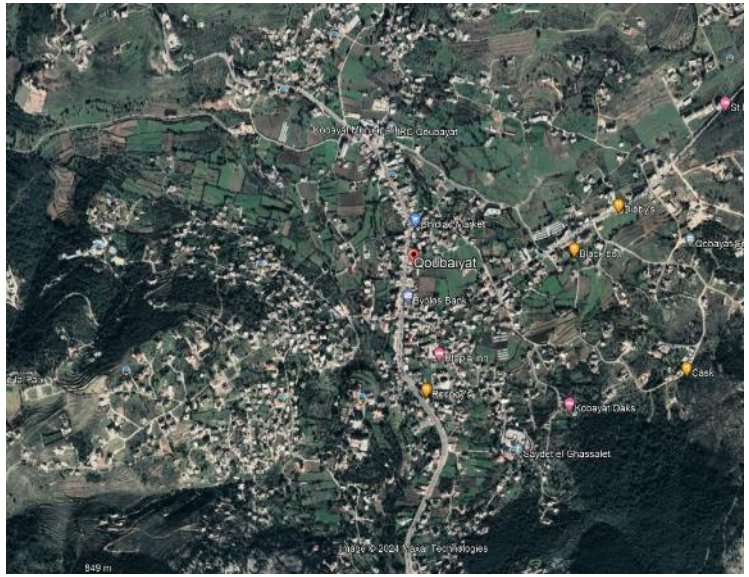
Calibration of Hydraulic Model, Leak detection campaign and Monitoring of water consumption – Ali el Nahri

3 - Assessment and upgrade of potable water schemes

EL-SICR IMPLEMENTATION IN QOBAYAT

CASE STUDIES

EMARET EL BAYKET, MACHTA HAMMOUD & QOBAYAT PUMPING STATIONS



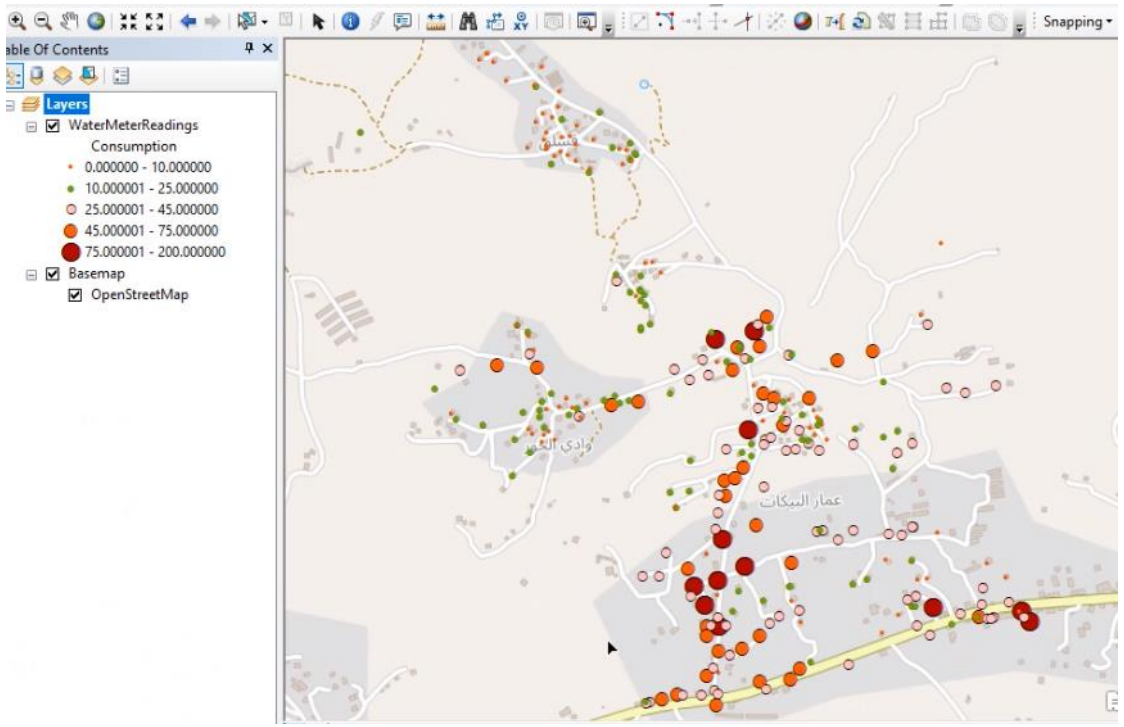
3 - Assessment and upgrade of potable water schemes

Design and Implementation for Service Improvement in Amaret el Bayket and Machta Hammoud

Water System in Amaret el Bayket vs Machta Hammoud

- Both localities have available water resources
- Both localities suffer from unfair water distribution
- There is water meters at Amaret el Bayket house connections while no water meters at Machta Hammoud house connections
- The main reasons for the unfair distribution are:
  - The geographical nature of the localities
  - Discontinued distribution pattern
  - The un-calibrated house connections allowing for high consumption in limited time

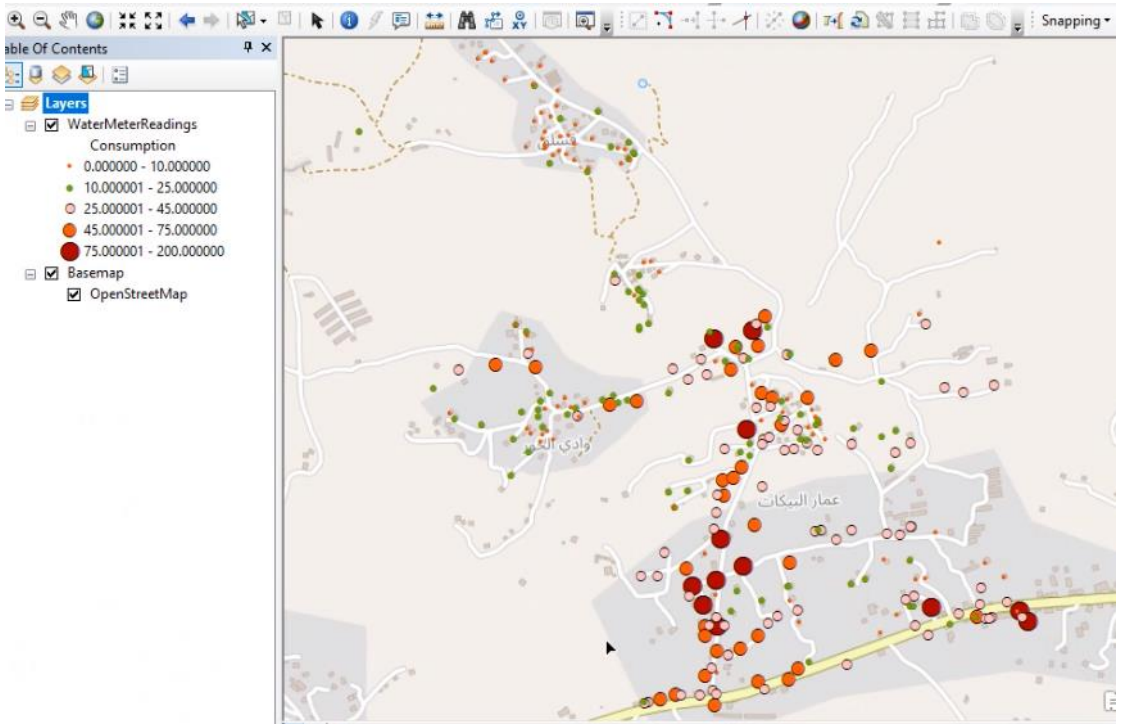
Water meter readings in Amaret El Bayket



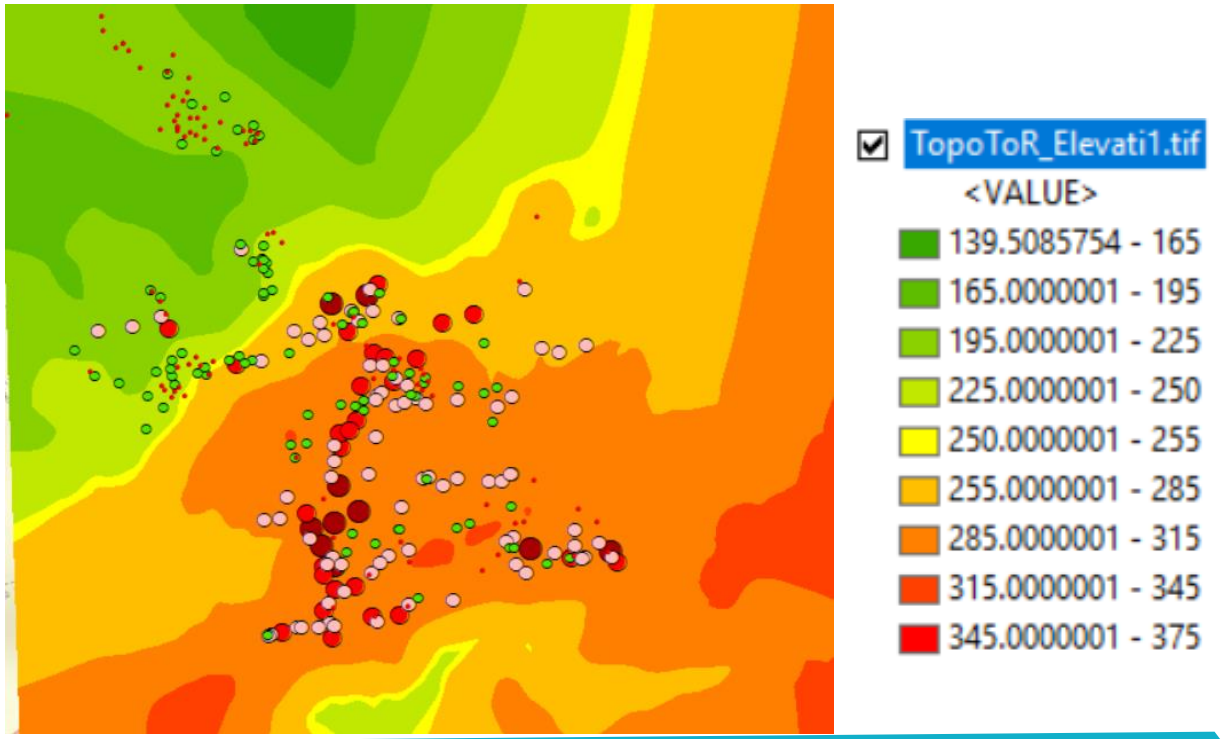
3 - Assessment and upgrade of potable water schemes

Design and Implementation for Service Improvement in Amaret el Bayket and Machta Hammoud

Water meter readings in Amaret El Bayket



Water meter readings in Amaret El Bayket and Elevation



3 - Assessment and upgrade of potable water schemes

Design and Implementation for Service Improvement in Amaret el Bayket and Machta Hammoud

Analysis of the Water System in Machta Hammoud

- The house connections were simulated as open demand reservoirs
- The result showed high consumption (high flow) draining the water source quickly and causing the pressure to drop at elevated locations
- The analysis of the situation clearly showed the importance of the calibration of the house connections in order to reduce the water consumption, allow for a better pressure and fair distribution to all the neighborhoods

3 - Assessment and upgrade of potable water schemes

Design and Implementation for Service Improvement for Qobayat PS

Qobayat Pumping Station suffers from:

- Continuous pumps defects causing interruption in the supply and repetitive interventions and urgent repairs with high costs
- The old-aged transmission pipelines from the PS to the reservoirs were subject to continuous leakages
- The **old pipelines were replaced** in order to reduce further defects
- The **installation of water hammer systems** and new transmission pipelines was found crucial for reducing defects and maintenance costs in both the short and long term. These measures also help protect the entire water system and enhance the quantity of water supplied.


Thank you.