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STAGE FOUR

Yemen Water Sector

Yemen Water Sector - Damage Assessment Report of the Urban Water Supply and Sanitation Situation in Yemen – Stage IV

Part 2: Situational Assessment Report

Annex 12 Technical Assessment Report for Taiz

Imprint

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Table of Content

Figures

Tables

Abbreviations

ABR	Anaerobic Baffled Reactor
BMZ	German Ministry of Economic Cooperation and Development
BoD	Board of Directors
BoQ	Bills of Quantities
CAC	Cooperative Agricultural Credit (Bank)
CBO	Community Based Organization
COCA	Central Organization for Control and Auditing
DAS	Damage Assessment Study
DCI	Ductile Cast Iron
DI	Ductile Iron
EM	Electro-mechanical
USD	US Dollar
FC	Financial Cooperation
GI	Galvanized Iron
GDP	Gross Domestic Product
GIZ	Gesellschaft für Internationale Zusammenarbeit GmbH
GoY	Government of Yemen
HR	Human Resources
HRDU	Human Resource Development Unit
INGO	International Non-Governmental Organisation
ICRC	International Committee of the Red Cross
IDP	Internally Displaced People
IT	Information Technology
JAR	Joint Annual Review
KfW	Kreditanstalt für Wiederaufbau
LAC	Local Advisory Committee
Utility	Local Corporations
MoCS	Ministry of Civil Service
MoF	Ministry of Finance
MoM	Minutes of Meeting
MWE	Ministry of Water and Environment
NRC	Norwegian Refugee Council
NRW	Non revenue water
NWRA	National Water Resource Authority
NWSA	National Water and Sanitation Authority
NWSSIP	National Water Sector Strategy and Investment Plan
OMS	Operation Management Support
O&M	Operation and Maintenance
PIIS	Performance Indicator Information System
PVC	Polyvinylchloride
QF	Questionnaire forms (DAS Stage III)
St, ST	Steel
TA	Technical Assistance
TFPM	Task Force on Population Movement
UN	United Nations
USD, U$	American Dollar
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme
WSP	Water Sector Programme in the Republic of Yemen

WSLC	Water and Sanitation Local Corporation
WU	Water Utilities
WWTP	Wastewater Treatment Plant
YER, YR	Yemen Rial

Units

LS	lump sum
m	meter
Mio	million
masl	meter above sea level
mg/l	Milligram per litre
m^3/d	Cubic meters per day
lpcd	litre per capita per day

no, nosnumber (numerical figure)

Appendices

Executive Summary for LC Ta'izz

From the 775,048 residents in LC Ta›izz in 2022, about 46 % respective Ta›izz people are supplied through 11 supply zones with 10 hours per month of water supply, 24 of the 131 existing water wells are operational and nominal water production capacity of 9,936 m3/d. There are about 20 % whom served by the institution/branch through water tankers by 51 distribution points, and 6 % are served by private sectors (water tankers). The rest are served through direct purchase of water from private wells.

A. Institutional Assessment and Recommended Technical

Assistance Measures (TA Plan) for LC Ta›izz

The LC Ta›izz, established in 2001. The utility employs in its 11 departments plus auxiliary unit in total 756 staff members The institution has an approved organizational structure. Currently, it operates with an old structure but significant portions of it are currently inactive due to war-induced challenges.

The identified shortcomings and respective recommendation for urgent and non-urgent measures can be summarized in the following table. A Technical assistance plan based on the identified measures showing the amounts needed for the urgent, high, medium and low priorities is attached in Appendix A-3.

Department	Obstacles	Recommendations	Implementation
Governance/ Management/ Organizational structure/ Resilience	There are acknowledged differences between the approved and current structures The institution operates with an old structure Significant portions of departments are currently inactive Commercial management, along with its associated departments and tasks, is nearly halted The main buildings of the institution and its affiliated facilities have been subjected to shelling, attacks, vandalism, looting, and destruction The contents of facilities, including furniture, equipment, office supplies, documents, assets, systems, programs, and databases, suffered extensive damage. Lack of automation and use of modern technology for the flow of administrative procedures and operations	■ A need for a comprehensive evaluation of the institution›s organizational aspects amid challenging circumstances ■ The committee should address immediate institutional needs, particularly related to war-induced challenges, through collaboration with external organizations and donor entities. ■ The institution›s immediate needs involve supervision, review, and providing opinions on plans and work programs ■ Developing information systems and technologies to support the safety of planning and administrative decision-making ■ Establishing a comprehensive and unified documentation system for information and data related to the organization›s activities ■ Internal integration of automated systems implemented in the organization while continuing to develop the enterprise information database ■ Enhancing the computer network to connect the public institution›s buildings equipped with data control and protection systems	■ Urgent ■ High ■ Urgent ■ High ■ Medium ■ High ■ Urgent

Human resource and capacity building management	The inability to pay employee salaries and wages More than 50% of the institution›s workforce has been displaced or leaked to other cities outside Ta›izz during the war years Financial constraints prevent the disbursement of salaries and incentives and employee entitlements. Shortage of offices, computers, printers, chairs, occupational safety tools, cars, and motorcycles in the transportation department.	■ Staff return ■ Offering regular training courses and promoting experience exchange ■ Improving internet services and establishing an internal network for the institution ■ Seeking funding for debts overcome	■ Urgent ■ High ■ High ■ Urgent
Finance management	Subscribers completely refraining from paying water bills and outstanding debts since the beginning of the war events in March 2015 The institution›s financial revenues have completely stopped Low staff qualification	■ Need for extensive repairs and equipment provision ■ Provide a qualified academic staff. ■ Conduct training courses for financial employees. ■ Provide computers, office tools, and other necessary supplies for work execution.	■ Urgent ■ High ■ High ■ Urgent
Customer service and relation management	Subscribers completely refraining from paying water bills and outstanding debts since the beginning of the war events in March 2015 Operating primarily as a humanitarian service provider during the war Evaluation and improvement of the entire billing process, including meter reading, data entry, review, invoice issuance, and distribution. Need for enhancements in the collection process and effective monitoring of various types of debts. Medium priority for enhancing planning and monitoring mechanisms to ensure efficient performance. Urgent need for implementing automation and modern technology in management operations and procedures.	■ Tariff adjustments ■ Network Connection between Centers and Collection Offices ■ Raise the community awareness of the importance of paying the bills for water consumption. ■ Policies and strategies of developing and strengthening the relationship between the LC/AU/Branch and the Consumers ■ Developing automated programs for taking readings. ■ Adding an input program for transfer transactions in the connection department, and training and qualifying department employees on it.	■ High ■ High ■ High ■ High ■ High ■ Medium
Water and Sanitation Service management	Status: department is in operation with partial and intermittent work Significant number of household meters were damaged or missing due to shrapnel and gunfire Complete lack of support for essential resources like diesel, reliance on alternative energy sources Shortage of equipment, emergency vehicles and assembly parts	■ Field surveys to assess damages and develop a clear action plan for rehabilitation	■ Urgent
IT infrastructure	Power sustainability Internet access limitations Vulnerabilities in antivirus protection, power regulation, and data backup practices Lack of the required number of laptops, computers and printers for the IT department and its sections: Programming and Database Section, Maintenance and Networks Section, GIS Section Lack of the required number of chairs and desks for the IT department Lack of network maintenance tools, maintenance and repair toolkit	■ Providing a permanent power source to operate devices and accessories ■ Training courses in the following areas: Oracle Database Management, Oracle Developer 11G, Computer Network Management and Maintenance, Computer Hardware Management and Maintenance, ArcView, ArcMap, AutoCAD. ■ Need for establishing comprehensive antivirus solutions, implementing power stabilization measures ■ Formulating disaster recovery plans to enhance data security and IT system resilience ■ Rehabilitation of the local and external network connecting the institution›s buildings and providing all the requirements for repair and maintenance.	■ Urgent ■ High ■ High ■ High ■ Urgent

Gender perspective	Women›s and Public Relations and Awareness Departments are not operational since 2015 There are no regular meetings between women›s management and employees in other departments Women›s management is not involved in planning and updating strategic policies There is no specific budget allocated to women›s management in the institution/branch. No specific complaints office for women beneficiaries No existing mechanisms to ensure women›s participation in leadership positions within the organization	Resumed work after recovering main workplaces and initiating repairs Establish an office for the management of women that accommodates its departments, sections, and committees Create partnerships between women›s departments in water institutions nationally and internationally for exchanging experiences and developing work for the benefit of women, the institution, and connecting them to international organizations. Courses in Administrative Development Accounting & Secretarial Courses Technical Courses in (Laboratory - Safety and Occupational Health - Sanitary Engineering) Courses in Gender Studies	Urgent Medium Medium High High High Low

Table 0.1: Obstacles and recommendations for institutional measures

To enable the implementation of the above proposed recommendations the following Technical Assistance interventions grouped into six packages with related cost estimates have been identified:

Package	TA intervention	Estimated TA cost in USD			
		Urgent	High priority	Medium priority	Low priority
		(0-6 months)	(1 -2 year)	(3-5 years)	(>5 years)
TA1	Financial Support	1,100,000	2,000,000	1,000,000	0
TA2	Training Courses	265,000	235,000	140,000	0
TA3	Office equipment and IT	122,750	0	0	0
TA4	Coaching and Consultancy services	90,000	225,000	100,000	0
TA5	Operation Management Support	90,000	160,000	60,000	0
TA6	Public Relation and Awareness	0	70,000	50,000	15,000
Total TA cost:		1,667,750	2,690,000	1,350,000	15,000

Table 0.2: Cost estimates on TA intervention

The total required amount for the technical assistance measures has been estimated to around USD 1,667,750 for critical priority intervention, USD 2,690,000 for high priority intervention, 1,350,000 for medium priority intervention and USD 15,000 for low priority interventions.

B. Infrastructure Assessment and Recommended Rehabilitation Measures (Investment Plan) for LC Ta›izz

The buildings and reservoirs are facing full and partial damages through age deterioration and war-induced damages. The LC faced indirect damage, mostly through the diesel price rise, economic crisis, and displaced people.

Water supply system

The water infrastructure comprises 131 wells, only 24 of them operational, 18 ground reservoirs with total capacity of 45,600 m3, 1 elevated tank, 20 water sterilization facilities, 1 water laboratory and 823 km of water supply network. According to the LC, from the 49,437 house water connections, with no information on water meters installed which was highly affected by war. The water production increased since 2017 by 38 % to currently 9,936 m3/day in average. The customers are supplied by the 11 distribution zone through the pumping station interconnected with the ground and elevated reservoirs. The water supply is 10 hours per month considering the provided amount of only 9.6 lpcd.

There is lack of equipment and spare parts for the O&M of the water network. The LC is therefore not able to perform the regular maintenance of the facilities and equipment. The result is failure of generators, wells and pumping equipment. Due to the high content of dissolved salts the pipes are regularly blocked and need to be cleaned.

The required materials comprise submersible and centrifugal pumps for the water supply, new generators, water meters and various small materials for the maintenance of the network and facilities. Besides transformers for well operation and laboratory equipment is needed. The LC requested also vehicles for operation and maintenance water and sewage systems.

Sanitation system

In 2022, from the 775,048 residents in LC Ta›izz, about 81 % respective Ta›izz people are served through the public sewer network and the institution do not have available data for whom served by other providers.

The station is located in the Al-Burayhi Area on Street 60 (outside the city and under Houthi control). Unfortunately, specific details such as available land area, construction date, total construction cost, funding entity, and operation start date are not available in the provided data.

The station comprises three treatment stages, utilizing the main technology of biological treatment. Information regarding the efficiency upgrade date is also not provided. Average daily flow is 9,000 m3/day, specific values are not available for many parameters, including organic load, population served, and various water quality parameters at both the inlet and outlet of the station.

There is absence of information regarding the design criteria for oxygen demand, chemical oxygen demand, suspended solids, ammonia content, nitrogen compounds, and phosphorus content. Additionally, details such as seasonal temperature design, water disinfection method, and national/international standards for treated sewage water are also lacking.

Investment needs

The identified measures have been prioritized according to feasibility and urgency in urgent measures, high priority, medium and low term measures grouped into 9 investment packages as shown in Table 4. The period indicates the proposed commencement of the investments, starting from 2024.

The required estimated budget has been calculated for:

- Urgent measures: 41,105,748 USD
- High-priority measures: 25,833,710 USD
- Medium- priority measures: 33,760,800 USD
- Low- priority measure: 656,000 USD

The total needed amount for the rehabilitation, restoration and extension of the water and sanitation system, provision of solar systems and supply of required operation and maintenance materials has been estimated to about 101,356,258 USD for the next 5 years.

Domains	Obstacles	Investment measures			
		Urgent (0-6 months)	High priority (1-2 years)	Medium priority (3-5 years)	High priority (>5 years)
Building and Reservoirs	▪ Destruction in the building›s ceiling due to the impact of falling shells + damage to windows and doors + complete looting of all furniture in the building, including desks, chairs, computers, documents, and files ▪ Cease of finishing work on the floors due to the outbreak of war and deterioration of the floor ▪ Looting and destruction of all furniture, appliances, and equipment by 100% ▪ . Shelling on the building, causing damage to windows, doors, and walls ▪ . Occupation of the building for five years and its evacuation by a military brigade ▪ Completely destroyed building due to the impact of a missile hitting the building directly, leading to its total destruction along with all its contents, including devices, furniture, documents, and records	▪ Continuation of the restoration, finishing, and furnishing of the third-floor building for the General Administration. ▪ Furnishing the building of the General Administration for the institution (basement + first floor + second floor ▪ Rehabilitation of the technical workshop building	▪ Rehabilitation of building walls, tile work, windows, doors, concrete ceilings, painting, electrical work + furnishing the building with furniture, devices, and office equipment, rehabilitation of information systems and networks, connecting them to the buildings and systems + a solar power system to operate the building	▪ Rehabilitation of station walls, pump buildings, control and security buildings, gates, windows, tiles, concrete ceilings, concrete tank, yard, electrical work, plumbing work, horizontal pumps - Installation of a solar power system ▪ -Rehabilitation of the generator rooms and security rooms for the fog field, a total of 9 rooms ▪ -Replacing deteriorating iron tanks with a new concrete tank with a capacity of 6000 cubic meters	

Water Resource, use and balance	▪ Shortage in water supply ▪ Low yield of the wells ▪ Safety problems related to wells ▪ Insufficient information coming from wells	▪ Drilling a replacement well for the Hussainiya well due to its low production caused by specific issues, and the submersion of large portions of it due to the absence of casing installation to the final depth of the well ▪ Cleaning and reactivating (rehabilitating) the wells of the city of Al-Noor and around Al-Shajarah to restore their well-being and resume their previous production capabilities ▪ Implementation of projects to connect wells to centralized main storage tanks within the city and changing the pumping system. ▪ Preparing the necessary studies to change the course of the water transmission line as part of the seawater desalination project through the Kudhah area	▪ Rehabilitation and implementation of projects for cleaning and reactivating the mentioned wells, including the supply, installation, and replacement of all necessary electromechanical equipment to restore the operation of the wells and integrate them into the production lines	▪ Rehabilitation and implementation of projects for cleaning and reactivating the mentioned wells, including the supply, installation, and replacement of all necessary electromechanical equipment to restore the operation of the wells and integrate them into the production lines	
Water pipelines	▪ Dilapidated water distribution network. ▪ Uncompleted rehabilitation of distribution networks	▪ Supplying maintenance tools and equipment for the network ▪ Expanding and implementing new water networks for several regions ▪ Supply and installation of new meters, valves and replacement of existing ones ▪ Rehabilitation of the corroded Ductile water line	▪ Construction Project of a 6000 m3 Concrete Water Collection Tank for Fog and Taloq - China Area ▪ Water Network Project - Al Arbaeen Area Implementation of main and sub water lines with different diameters ▪ Supply of 10,000 Residential Water Meters	▪ Galvanized Pipes for Home Connections ▪ Supply of 10,000 Residential Water Meters	▪ -
Water Pumping/ lifting Stations	▪ Insufficient pumping capacity	▪ Supply and installation of several Centrifugal pump with different specifications ▪ Submersible electric motor Pumps ▪ Electrical transformers ▪ Copper connection properties 240mm ▪ Ductile Welding Pack	▪ -		▪ -

Water sterilization facilities	▪ Lack of water sterilization equipment ▪ Lack of measuring kits for residual chlorine.	▪ Supply and installation of new units ▪ Replacement of chlorine units with new ones ▪ Supply of residual chlorine test devices ▪ Supply of necessary safety tools for chlorine disinfection process		▪ -	▪ -
Power generating/ auditing for water & wastewater system	▪ Diesel power generator pumping station out of service and needs rehabilitation. ▪ Raise of Diesel prices.	▪ Implementing Integrated system for energy generation (solar energy system) ▪ Supply and installation of generators, Diesel Engine Oil, Batteries and inverters with different specifications	▪ Supply of necessary spare parts for overhauling each generator, including pistons, nozzles, bearings, rings, water pumps, oil pumps, sensors, and batteries for the generators ▪ Supply and installation of a solar energy system	▪ Supply and installation of a solar energy system to operate the pumping station	▪ Overhaul of the Electrical System
Operation and maintenance process of water infrastructures	▪ Lack of transport vehicles. ▪ Lack of repair and maintenance tools for pipe works pump and motor works. ▪ Lack of tools and instruments for electrical works. ▪ -Lack of trench excavation equipment. ▪ -Lack of water meter maintenance workshop.	▪ Supply and delivery of diesel truck with different volumes ▪ Supply of Medium Bobcat Loader ▪ Supply of small Carry Pickup Trucks for water network maintenance teams ▪ Supply of mobile maintenance workshops (Boxer Panel Van) for wells and water network maintenance ▪ Supply of mobile maintenance workshops (Double-cabin) for wells and production fields	▪ Supply and delivery of a mobile crane/hiab crane on a 7-10 ton truck for well maintenance ▪ Supply of Medium Bobcat Loader	▪ Supply and delivery of diesel truck with different volumes ▪ Supply and delivery of a portable crane/winch on a 50-ton truck for well maintenance	▪ Supply and delivery of diesel truck with different volumes
Wastewater collection/ transportation pipelines	▪ Lack of repair and maintenance tools for pipe works, pump and motor works	▪ Main Sewer Project - Set of mechanical seal ▪ Project/Replacement of Main Sewer Line ▪ construct of Septic Tank Analysis	▪ Sanitary Sewer Network - Western Area- phase Two ▪ Supply of Double Socket Swept Tees ▪ Maintenance of sewage networks	▪ Sanitary Sewer Network - Western Area - Phase Three	▪ -
Wastewater treatment facilities	▪ No information as the station is located outside the city under the control of the rebels	▪			▪ -
Operation and maintenance process of wastewater facilities	▪ Poor logistics for operation & maintenance	▪ Supply of Sewage Flushing Trucks (Jetting & Vacuum Tank mounted on Trucks) 10 m3 ▪ Supply of 10,000 Capacity Sewage Suckers ▪ Supply of Sewerage Rods (Sewer Cleaning) ▪ Supply of Heavy & Medium-duty Manholes Covers	▪ Supply of 15,000 Capacity Sewage Suckers ▪ Supply of 4-inch &8-inch Sewage Dewatering Pumps	▪ Supply of Sewage Flushing Trucks (Jetting & Vacuum Tank mounted on Trucks) 10 m3 ▪ Supply of Sewerage Rods (Sewer Cleaning)	▪ -

Water & wastewater Laboratories	▪ Poor logistics for operation and limitations in consumables and chemicals ▪ Need for solar energy systems	▪ Buying DR3900 vis spectrometers with Accessories &Reagent ▪ Economical flam photometry ▪ Botanical Vacuum oven with 6 shelves ▪ Fume Hood 48 Dish work surface/vp light/ Blower ▪ DRB 200 Digital Reactor Block For TNT Plus ▪ General Electric Countertop Microwave Oven ▪ Non-electric Steam Sterilizer 41.5at	▪ Buying Ultrasonic Cleaner Heater/Digital Timer ▪ Digital Titrator ▪ HQ-portable multi-meter PH Rod -Cond-T-OD ▪ Digital Stirring Hot Plat ▪ Refrigerator ▪ Drummond Pipet Aid portable ▪ Ultrasonic Cleaner Heater/Digital Timer	▪ -	

Table 0.3: Brief description of recommended rehabilitation measures for water and sanitation infrastructures

Package	Measures	Urgent (0-6mths) (USD)	High priority (1-2 years) (USD)	Short-term (3-5 years) (USD)	Long-term (>5 years) (USD)	Total (USD)
		2024	2024-2025	2025-2027	>2027	
Package 1	Civil Works on buildings and structures	2,089,700	350,200	1,516,800	0	3,956,700
Package 2	Well rehabilitation and new construction	7,189,000	1,620,000	801,000	0	9,610,000
Package 3	Water pumping station	1,148,400	0	0	0	1,148,400
Package 4	Water network rehabilitation and extension	14,516,664	13,197,850	22,853,000	0	50,567,514
Package 5	Wastewater collection, disposal and Treatment	9,154,239	7,311,060	4,000,000	0	20,465,299
Package 6	Generators and spares, Electric materials and solar systems	2,879,100	1,735,000	1,140,000	200,000	5,954,100
Package 7	Vehicles, machines, tools	3,970,000	1,561,000	3,450,000	456,000	9,437,000
Package 8	Laboratory equipment	129,225	58,600	0	0	187,825
Package 9	Water sterilization facilities	29,420	0	0	0	29,420
Total investment		41,105,748	25,833,710	33,760,800	656,000	101,356,258

Table 0.4: Cost estimation on investment measures[1]

[1] Details on Investment measures with cost estimation are given in Appendix A-4

1. Background

1.1 Ta›izz Governorate

Ta›izz is a city in southwestern Yemen. It is located in the Yemeni highlands, near the port city of Mocha on the Red Sea, at an elevation of about 1,400 meters (4,600 ft) above sea level. It is the capital of Ta›izz Governorate. As of 2023, the city has an estimated population of approximately 940,600 residents making it the third largest city in Yemen.

In 2019, due to the ongoing campaign as part of Yemen›s civil war, Ta›izz was a battleground and a war zone. Once known as the «cultural capital of Yemen», the war has bestowed a new name on Ta›izz: «city of snipers».

Ta›izz has a hot semi-arid climate . The average daily temperature high during August is 32.5 °C (90.5 °F). Annual rainfall of Ta›izz is around 600 mm (24 in), but on Jabal Sabir it is probably around 1,000 mm (39.4 in) per year.

Historically, the mountainous city of Ta›izz was known for coffee production. The Mocha coffee produced in Ta›izz was considered some of the finest in the region in the early 20th century. Today, coffee remains a major part of the economy but mango, pomegranate, citrus, banana, papai, vegetables, cereals, onions, and qat are also grown in the surrounding landscapes.

1.2 General information of the LC Ta›izz

The utility/branches under the management of (the LC/NWSA).	Name of the utility/branch
National Water and Sanitation Authority - Ta›izz Governorate	Al-Mocha Branch
National Water and Sanitation Authority - Ta›izz Governorate	Al-Turba Branch
National Water and Sanitation Authority - Ta›izz Governorate	Dhubhan Branch
National Water and Sanitation Authority - Ta›izz Governorate	Al-Ma›afir Branch
National Water and Sanitation Authority - Ta›izz Governorate	Damnat Khudair

Table 1.1: List of affiliated utilities and branches to NWSA/LC serving in the same geographical area (governorate)

The population growth through period from 2017 to 2022 in LC Ta›izz with the displaced people is shown in Table 1.2.

Notes	2022	2021	2020	2019	2018	2017	Year
Only in urban centers served by the service provider (Mudhaffar Directorate + Cairo Directorate + part of Sala Directorate)	775,048	759,397	744,062	729,037	714,315	698,594	Population
Based on statistics from the governorate›s statistics office	2.06	2.06	2.06	2.06	2.06	2.25	Population growth rate (%)
Data not available	Data not available	Data not available	Data not available	Data not available	Data not available	Data not available	Cumulative displaced persons

Table 1.2: Population Growth in LC Ta›izz

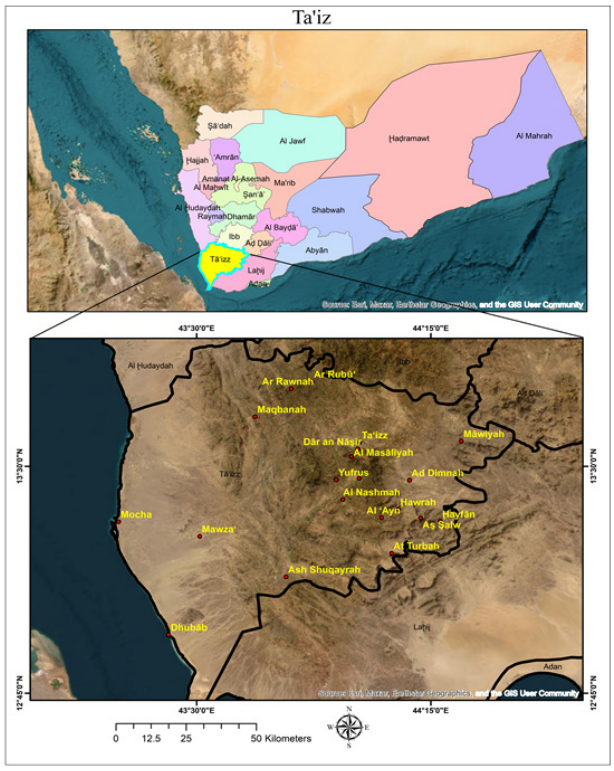


Figure 1.1: Ta›izz Location Map

1.3 Methodology of assessment

The water and sanitation authority NWSA is responsible on the water and sanitation services in LC Ta›izz, and administratively belongs to the general water and sanitation corporation. The main objectives of the situational assessment report for NWSA in Ta›izz are as follows;

Assessment of the current water and sanitation services; this covers both technical (water and sanitation infrastructure) and institutional (offices, staffing and equipment) aspects.

Prepare list of actions to improve the water and sanitation services with cost estimate

Prepare investment plan for GIZ and other donors

For this purpose, two questionnaires were prepared based on DAS IV list of required information; Questionnaire A for institutional issues while questionnaire B for technical issues. In addition, the field team prepared checklist for the problems and challenges faced the LC.

The questionnaires were prepared with close coordination with GIZ and the NWSA representatives through carried out the workshops in Yemen. The questionnaires were distributed to LC's and NWSA for filling the requested data and the consultant field team was working with LC and NWSA representatives on filling gaps and getting the LC and NWSA certification for collected data.

Part A is covering all institutional subjects: management, governance, human resources, customer management, financial management, and IT management while Part B covers water supply, water and wastewater infrastructure, and managements. The questionnaires were distributed in March 2023. Interviews were conducted with the General Manager, Deputy General Manager for technical affairs, the Financial Manager, the Human Resource Manager, the Technical Manager, the Customer Manager and IT Manager. The field team verified and certified the questionnaires from LC and NWSA in June 2023.

In addition, the field team held several telephone conferences with the responsible members of the LC and NWSA respectively to ask for clarification of data. All provided data were analyzed and respective results incorporated in this report

The sections below summaries the assessment outcomes of the water and sanitation services of LC and NWSA management capacity. The outcomes are summarized into technical assistant measures and an investment plan which include actions and measures to improve the services with cost estimate.

2. Assessment of LC Organization and Management

(Note: Any missing data is due that some departments resumed operations, others are in the process of reactivation as a direct effect of war-induced damages, staff displacement, and the need for extensive repairs and equipment provision)

The LC'S in Yemen were established based on Republican Decree no. (02) for the year 2001. The legal procedures and laws are still in operation during the conflict; the LC is following the financial and civil service laws, law for procurement and water law.

2.1 Organizational Structure

The institution has an approved organizational structure. Currently, it operates with an old structure but significant portions of it are currently inactive due to various reasons, including the following:

- Commercial management, along with its associated departments and tasks, is nearly halted. This is due to subscribers completely refraining from paying water bills and outstanding debts since the beginning of the war events in March 2015. Consequently, the institution›s financial revenues have completely stopped, rendering it unable to cover even basic operational expenses, including the inability to pay employee salaries and wages.
- The main buildings of the institution and its affiliated facilities have been subjected to shelling, attacks, vandalism, looting, and destruction. These locations were used as military barracks by armed groups between 2016 and 2020. The contents of these facilities, including furniture, equipment, office supplies, documents, assets, systems, programs, and databases, suffered extensive damage.
- More than 50% of the institution›s workforce has been displaced or leaked to other cities outside Ta›izz during the war years. Some were forced to leave due to their homes being near conflict lines and war-affected areas, while others protested the non-receipt of their monthly salaries for over three years.
- The phenomenon of theft of household meters is widespread in most areas, with a significant number damaged or missing due to shrapnel and gunfire, approximately 36,720 meters, either damaged or absent from their original locations.

Despite efforts to reactivate the commercial management, challenges persist. There are acknowledged differences between the approved and current structures, with detailed explanations provided. The institution possesses executive regulations for internal procedures. The document indicates a need for a comprehensive evaluation of the institution›s organizational aspects amid challenging circumstances.

2.1.1 Board of Directors/Advisory Committee

The committee includes representatives from various entities, such as the governor, local council head, and institutional management council head, among others. Notably, there is representation for women from the Ministry of Water and Environment.

The Board/Advisory Committee conducts regular meetings, with four held between 2019 and 2022. The committee addresses immediate institutional needs, particularly related to war-induced challenges, through collaboration with external organizations and donor entities.

The institution›s immediate needs, as approved by the committee, involve supervision, review, and providing opinions on plans and work programs. This includes reviewing studies related to the reconstruction and rehabilitation of infrastructure affected by the war.

The committee is actively involved in strategic planning, with attached plans for 2020, 2021, and 2022, as well as

a strategic plan for 2021-2025. Women participate in auxiliary committees, contributing to areas like awareness, field visits, report preparation, information technology, and accounts.

The committee takes on responsibilities for reviewing and updating policies and decisions related to institutional operations regularly. Financial reports and performance indicators are submitted regularly to the committee, and there is a mechanism in place for monitoring and implementing the decisions and directives of the Board/ Advisory Committee. The institution is committed to ethical and financial accountability, despite facing challenges due to war.

2.1.2 Organization Structure and Governance

The operational status of various departments within an institution from 2017 to 2022 is as follows:

- Administrative Department:
  - Status: Operational since the end of 2019.
  - Details: Work resumed after the recovery of main workplaces, enabling administrative stability and a return to normal activities.
- Financial Department:
  - Status: Operational since the end of 2019.
  - Details: Similar to the administrative department, work in finance started to resume after reclaiming main workplaces.
- Water Management Department:
  - Status: Operational with partial and intermittent work.
  - Details: Worked from various locations, including temporary setups, starting to resume more effectively since 2019.
- Sewage Management Department:
  - Status: Operational with partial and intermittent work.
  - Details: Similar to the water management department, it operated from various locations, gradually resuming more effectively from 2019.
- Commercial Management Department:
  - Status: Not Operational.
  - Details: Efforts ongoing since 2022 to reactivate, but significant requirements include staff return, field surveys, equipment provision, tariff adjustments, and support for administrative restoration.
- Projects, Planning, and Statistics Department:
  - Status: Operational.
- Purchasing and Stores Department:
  - Status: Operational since 2020.
  - Details: Work resumed after recovering main store sites and workplaces, initiating repairs to damaged and looted areas.
- Internal Audit Department:
  - Status: Operational since the end of 2019.
  - Details: Similar to other departments, work resumed after reclaiming main workplaces.
- Legal Affairs Department:
  - Status: Not Operational.
  - Details: All staff evacuated since the war›s beginning. Reactivation initiated in 2022 with one lawyer currently working.
- Women›s Department:
  - Status: Not Operational.
  - Details: All staff evacuated since the war›s beginning. Reactivation initiated in 2022 with two women currently working.
- IT Department:
  - Status: Operational since the end of 2019.
  - Details: Resumed work after recovering main workplaces and initiating repairs.
- Other Departments:
  - Status: Not Operational.
  - Details: Includes Regional and Branch Management, Board Secretariat, Public Relations and Awareness, and Technical Maintenance and General Workshop.

In summary, while some departments resumed operations, others are in the process of reactivation. Challenges include war-induced damages, staff displacement, and the need for extensive repairs and equipment provision. The institution is actively working to address these challenges and restore normalcy across all departments.

2.1.3 Most important problems related to governance and organizational structure

Lack of automation and the use of modern technology for the flow of administrative procedures and operations. The following should be done:

- Developing information systems and technologies to support the safety of planning and administrative decision-making:
- Establishing a comprehensive and unified documentation system for information and data related to the organization›s activities, which is relied upon in developing strategies, plans, future programs, evaluating performance levels, and disseminating the organization›s electronic archiving system, linking it to the ministry›s electronic archiving system.
- Internal integration of automated systems implemented in the organization while continuing to develop the enterprise information database in terms of content, accuracy, report quality, ease of information retrieval, and unifying system data, etc.
- Enhancing the computer network to connect the public institution›s buildings equipped with data control and protection systems, linking the main headquarters to production and pumping facilities, and enabling remote control and monitoring systems.»

2.1.4 Interaction of authorities with institution/ branch

The Ministry of Water and Environment actively engages by providing support, coordinating with organizations and donors, and securing funding for rehabilitation and infrastructure projects. This involvement aims to mitigate the impact on affected components. However, the Board of Directors/Advisory Committee demonstrates limited interaction in alleviating challenges. On the other hand, local authorities actively interact with the institution/ branch, contributing to the efforts in overcoming challenges associated with water and sanitation services during crises.

This collaboration reflects a multifaceted approach involving various levels of governance to ensure effective responses and solutions.

2.1.5 Governance criteria

The institution/branch undergoes audits and inspections by relevant authorities, with attached responses to reports from the central control and auditing body, detailing the impact of conflict on their facilities and the challenges faced in restoring documentation and archives. The institution/branch has mechanisms for stakeholder consultation, accountability through complaints and reports, and a documented strategic plan for the years 2020-2022. There are policies and procedures in place for transparency, disclosure, and conflict of interest with service providers, and the institution operates with clear policies to address conflicts of interest. However, challenges include the destruction of facilities and the unavailability of certain data due to the war›s impact, affecting the precision and availability of information.

The institution, despite facing significant challenges, demonstrates a commitment to governance standards and transparency. It undergoes regular financial audits by relevant authorities, with attached responses to reports from the central control and auditing body. However, the aftermath of armed conflict has taken a toll on its infrastructure, hindering administrative processes and document retrieval. The institution complies with accountability measures, offering reliable information, though challenges in obtaining historical war-related data persist. Governance frameworks include strategic plans, codes of conduct, and performance evaluation systems, albeit some currently inactive. The institution engages in community consultation through various channels and upholds the right to access information. Despite operational challenges, it remains dedicated to environmental compliance and seeks partnerships with the private sector for diverse contractual arrangements. While operating primarily as a humanitarian service provider during the war, it acknowledges a deviation from initial business-oriented principles in its current context.

2.1.6 Resilience Strategy

The institution demonstrates a commitment to meeting the urgent and future needs of the population, particularly in the provision of water and sanitation services. Strategic plans and programs prioritize key indicators, including the percentage of the population served by water and sewage networks, satisfaction levels, physical and administrative losses, and cost recovery ratios. The institution faces severe challenges in the current crisis, such as a complete lack of support for essential resources like diesel, reliance on alternative energy sources, and the extensive destruction of water-related infrastructure. Financial constraints due to non-payment of fees, lack of budgetary support, and war-related damages impede its operational capacity. Despite these challenges, the institution conducts risk assessments and implements plans to address potential crises. Attached plans include infrastructure needs, early recovery, rehabilitation, and emergency response plans. The impact of the current crises is evident in reduced well productivity, water production, longer water cycle intervals, increased unit production costs, and significantly decreased financial revenues, resulting in a decline in the percentage of the population benefiting from water services.

Despite challenges such as limited funding, political complexities, and difficulties in marketing strategic projects, the institution has implemented various measures to address the impact of the ongoing war. These include rehabilitation and reconstruction projects for water facilities, drilling new wells, seeking funding for geophysical studies, and engaging humanitarian organizations to coordinate conflict-neutralizing efforts. The paragraph also highlights the need for external support, emphasizing the importance of sustaining fuel supplies and implementing strategic projects like seawater desalination to fundamentally resolve Ta›izz›s water crisis. The institution›s plans for post-conflict recovery, as reflected in its infrastructure and recovery plans, demonstrate a comprehensive approach to rebuilding and restoring essential services in the aftermath of conflicts.

2.2 Assessment of human resource management

2.2.1 Staff Situation and Salary

The LC employs the same total staff of 756 in the entire investigated period (2017-2022) with no contracting staff and day (temporary) workers, with 14.32 employees per 1,000 water connections. The percentage of female staff amounts 4.1 of total staff.

The table below summarizes the staff according to gender, working condition and in relation to the number of water connections. Comprehensive details on the assessment of staffing situation of the LC are given in Table 2.1.

Staff situation	2017	2018	2019	2020	2021	2022
Total no. of permanent staff	756	756	756	756	756	756
Total nos. of contracting staff	0	0	0	0	0	0
Total nos. of day workers (temporary worker)	0	0	0	0	0	0
Total no. of staff	756	756	756	756	756	756
Total nos. of male staff actual working	725	725	725	725	725	725
Total nos. of male staff not actual working	0	0	0	0	0	0
Total nos. of staff female actual working	31	31	31	31	31	31
Total nos. of staff female not actual working	0	0	0	0	0	0
% of female to total	4.1	4.1	4.1	4.1	4.1	4.1
Nos. of water connections	52,308	52,367	52,629	52,660	52,697	52,789
Nos. of staff per 1,000 connections	14.45	14.44	14.36	14.36	14.35	14.32
Number of employees who have reached retirement age and are still working, receiving their salaries from the institution	39	7	11	29	18	26

Table 2.1: Staff number and attendance

Not all the departments of the LC are in operation due to challenges include war-induced damages, staff displacement, and the need for extensive repairs and equipment provision; below figure presents the distribution of staff for the different positions which they occupy.

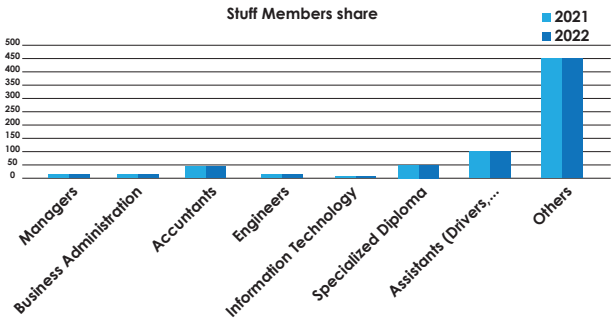


Figure 2.1: Share of staff members (in No.) according to positions

In 2022, the number of managers is 16 represents 2.1 % of total staff, which is acceptable for the size of the LC.

From the figures above it can be further concluded that the number of staff per department is appropriate. The staff of technical departments (Engineering, finance, planning, IT, diploma) represents only 18 % of total staff while the" others" represent 65% which clarify a problem in staff share among departments.

2.2.2 HR general information, procedures and reporting

NA

2.2.3 Staff qualification, training needs, and capacity development

NA

2.3 Capacity Building Plan

NA

3. Financial Capacity

3.1 Financial management

3.1.1 General data on financial management

- The general financial management practices of the institution or branch are as follows:
- The management prepares audited annual financial reports, incorporating profit and loss data.
- Periodic financial reports, such as monthly, quarterly, and semi-annual, are generated and a copy of the latest reports is provided.
- There are no formal audit reports on financial and accounting activities. Instead, there are notes that receive prompt responses.
- Details regarding a detailed record for fixed assets are pending.
- Financial and accounting computer programs are employed, and they are confirmed to be in current use with regular data updates.

The summary underscores the institution/branch›s commitment to financial transparency, periodic reporting, and the utilization of computer programs for efficient financial and accounting management.

Implemented technical assistance needs related to financial management

Measures have been taken to enhance financial management from 2017 to the present, addressing issues such as staff shortages, outstanding payments, insufficient computers, and a shortage of office supplies. Current efforts include staff training for accounting tasks and activating necessary documentation processes. Moreover, the institution is actively seeking sources to procure computers and office supplies, demonstrating a commitment to improving financial management capabilities.

Planned technical assistance needs related to financial management

- Provide a qualified academic staff.
- Conduct training courses for financial employees.

- Equip a suitable work environment.
- Provide computers, office tools, and other necessary supplies for work execution.

Here are the key points regarding budget management and expenditures for institution or branch:

- Operational Budget: The institution/branch does not currently have an operational budget in place.
- Capital Costs in Budget: The current budget does not include expected capital or investment costs.
- Revenue Coverage: There are currently no revenues, as the institution lacks water availability, and therefore, they do not cover current and future service delivery costs.
- Tariff Adjustments: The tariff has been adjusted once over the past ten years but has not been implemented yet.
- Liquidity for Monthly Expenses: The institution has insufficient liquidity to cover monthly expenses, leading to a cessation of operations during the war period.
- Financial Reserves: There are no financial reserves to cover the most expensive component of operation and maintenance.
- Savings for Short-lived Assets: The institution lacks sufficient savings to cover expected costs over the next two years for short-lived assets.
- Funding Sources for Long-Term Development: In the long term, the primary funding sources for developing and expanding water and sanitation systems include loans, government grants, and assistance.
- Long-Term Capital Plan: There is no existing plan specifying projects and funding for improving long-term capital.

3.2 Budget (Recurrent, Revenues, Expenses, Aid and Liabilities)

3.2.1 Recurrent Budget

NA

3.2.2 Revenues, Expenses and Liabilities

The table below presents an overview of the annual amount of operation and maintenance cost for the LC according to different categories for the years (2017-2022).

Revenues / Expenses	2017	2018	2019	2020	2021	2022
Total revenue in YER	-	-76,865,463	-290,726,973	-49,541,023	-40,192,872	-254,444,082
Total cost without depreciation in YER	-	640,639,215	766,097,558	941,716,364	1,086,097,640	1,556,721,457
Total cost in YER	-	640,639,215	766,097,558	1,002,006,364	1,226,358,806	1,715,672,847
Salaries, allowances, incentives and others in YER	-	638,986,524	724,802,279	723,954,475	723,121,067	722,737,867
% Salaries, etc. of total revenue	-	-	-	-	-	-
% Salaries, etc. of total cost	-	99.74	94.61	72.25	58.96	42.13
Fuel, oil in YER	-	235,560.00	2,689,095	181,392,870	343,712,520	809,955,100
% Fuel, oil, of total revenue	-	-	-	-	-	-
% Fuel, oil, of total cost	-	0.04	0.35	18.10	28.03	47.21
Electricity in YER	-	0.00	0.00	0.00	0.00	0.00
% Electricity total revenue	-	-	-	-	-	-
% Electricity of total cost	-	-	-	-	-	-
Maintenance, spare parts, other O&M expenses in YER	-	1,417,131	36,972,274	34,996,119	17,922,643	22,386,070
% Maintenance, other O&M of total revenue	-	-	-	-	-	-
% Maintenance, other O&M of total cost	-	0.22	4.83	3.49	1.46	1.30
Other expenses in YER	-	0.00	1,633,910	1,372,900	1,341,410	1,642,420
% Other expenses of total revenue	-	-	-	-	-	-
% Other expenses of total cost	-	0.00	0.21	0.14	0.11	0.10
Depreciation in YER	-	0.00	0.00	60,290,000	140,261,166	158,951,390
% Depreciation of total revenue	-	-	-	-	-	-
% Depreciation of total cost	-	0.00	6.02	11.44	9.26	0.00

Table 3.2: Revenues, recurrent costs

Revenues

- The total expenses are more than total income for all the specified period, so that LC did not achieve any profit.

Revenues versus Expenses

- The salaries represent the highest percentage of the total expenses. It represents almost all the expenses in 2018 and 2019 of the total expenses. While in 2020 to 2022, salaries with fuel cost represent the main portion of expenses

Regarding the liability, LC has the biggest accumulated salaries debts. It amounted to 1,336,033,457 YER (81 % of the total debts) as showed in Table 3.3.

3.2.3 Financial Liability (Payable amount)

To identify the financial liabilities of the LC, the debts during the period (2017-2022) have been assessed and are presented in the table below.

Financial liability	2017(YER)	2018 (YER)	2019 (YER)	2020 (YER)	2021 (YER)	2022 (YER)	Details
Salaries and wages	875,726,905	73,588,748	215,918,344	1,560,145	75,455,886	93,783,429	
Other dues for employee	0.00	1,500,000	3,177,960	1,274,330	2,128,086	4,205,359	
Indebtedness of electricity	0.00	0.00	0.00	0.00	0.00	0.00	Power outage
Fuel and oil	0.00	0.00	0.00	0.00	0.00	0.00	Support from organizations
Insurance	98,252,305	9,251,459	24,496,260	0.00	1,687,111	1,685,468	
Taxes	112,304,160	11,397,566	28,927,839	784,075	2,580,591	2,047,522	
Local councils	0.00	0.00	0.00	0.00	0.00	0.00	Because invoices are not being issued
Other financial obligation	23,337	10,062	1,060	982,372	79,504	311,512	
Total	1,086,306,707	95,747,835	272,521,463	4,600,922	81,931,178	102,033,290	

Table 3.3: Financial Liability

3.3 Financial Data

3.3.1 Financial Efficiency and Support

Funding Sources	2017 (YER)	2018 (YER)	2019 (YER)	2020 (YER)	2021 (YER)	2022 (YER)	Details
Revenues from Entity/Branch Activity	0.00	1,120,400	18,005,724	6,437,817	28,192,900	45,535,583	Current and miscellaneous activity
Current Budget Support Deficit	0.00	543,153,352	457,364,861	722,385,124	686,565,868	590,849,840	Salary support
Support for Expenses from Donors	0.00	0.00	0.00	223,642,400	467,118,350	824,843,342	Support from organizations
Local Authority or Other Sources	0.00	19,500,000	0.00	-	4,288,816	0.00	-
Total	0.00	563,773,752	475,370,585	952,465,341	1,186,165,934	1,461,228,765	-

Table 3.4: Financial resources (revenues) and support (2017-2022)

3.3.2 Bank Account Data and Cash Flow

The table below presents an overview of the accounts for LC Ta›izz.

Account Type	Connections Account	Income Account	Expenditure Account	Depreciation Account	
2017	first period balance (YER)	0.00	0.00	0.00	0.00
	Total Deposits (YER)	0.00	0.00	0.00	0.00
	Total withdrawals and transfers (YER)	0.00	0.00	0.00	0.00
	end period balance (YER)	0.00	0.00	0.00	0.00

2018	Total Deposits (YER)	3,930,297	88,939	98,755,153	-
	Total withdrawals and transfers (YER)	3,612,159	0.00	98,755,153	-
	end period balance (YER)	318,137	88,939	0.00	-
2019	Total Deposits (YER)	22,008,400	0.00	432,495,801	-
	Total withdrawals and transfers (YER)	22,244,308	0.00	431,113,441	-
	end period balance (YER)	79,229	88,939	138,359	-
2020	Total Deposits (YER)	8,675,800	0.00	724,879,060	-
	Total withdrawals and transfers (YER)	8,413,700	0.00	724,648,738	-
	end period balance (YER)	341,329	88,939	1,612,680	-
2021	Total Deposits (YER)	15,039,466	0.00	68,854,012	-
	Total withdrawals and transfers (YER)	15,277,821	0.00	987,157,263	-
	end period balance (YER)	102,973	88,939	2,995,429	-
2022	Total Deposits (YER)	122,106,868	0.00	592,636,245	-
	Total withdrawals and transfers (YER)	103,119,940	0.00	595,580,433	-
	end period balance (YER)	19,089,901	88,939	51,241	-

Table 3.5: Bank account details

3.3.3 Financial sources, subsidies and support

The table below presents an overview of the received funding subsidies in the past six years.

Project Name	Targeted Areas	Number of Beneficiaries	Support Details	Supporting Entity	Project Start	Support Amount (USD)	Project Status (Completed, Under Implementation)
Sewage Network Replacement and Rehabilitation Project	Jamal Street, Qarshi Alley, Al-Mankh, Nasiriya, Asaifra, 7 July, Jidari	25,000	Plastic pipelines, concrete manholes, iron covers, and accessories	Himmah Shabab Organization	2017	78,000	Completed
Rehabilitation and Cleaning of Sewage Lines and Manholes - Asayfrah	Asayfrah	10,000	Plastic pipelines, concrete manholes, iron covers, and accessories	Mercy Corps Organization	2017	9,000	Completed
Rehabilitation and Cleaning of Sewage Lines and Manholes - Al-Ajainat	Al-Ajainat	35,000	Plastic pipelines, concrete manholes, iron covers, and accessories	Red Cross Organization	2017	15,000	Completed
Rehabilitation Project for the Water Pumping Station - Al-Muassasa	Al-Muassasa Station	20,000	Pumps, drums, valves, and meters	Red Cross Organization	2017	84,000	Completed
Rehabilitation, Sterilization, and Painting of Water Tanks	Al-Mazhar, Al-Qahira, Salih	450,000	Cleaning, painting, and sterilization	UNICEF Organization	2018	60,000	Completed
Rehabilitation Project for Al-Noor City Well	Al-Ba›arah	20,000	Room, generator, pumps, cables, and pipes	UAE Red Crescent	2018	100,000	Completed
Supply of 597,000 Liters of Diesel to Operate Well Generators and Pump Water to Residential Areas in Al-Mazhar, Al-Qahira, Salih	Al-Mazhar, Al-Qahira, Salih	450,000	Diesel	UNICEF, WFP	2018	271,000	Completed
Sewer Line Replacement Project - Joulah Sanan Area - Al-Qahira	Joulah Sanan	1,500	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2018	1,500	Completed
Sewer Line Replacement Project - Wadi Al-Qadi Area - Al-Qahira	Wadi Al-Qadi	1,500	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2018	5,000	Completed

Sewer Line Replacement Project - 7 July Area - Al-Qahira	7 July	2,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2018	5,500	Completed
Sewer Line Project - Al-Zenqal Area - Al-Mazhar	Al-Zenqal	12,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2018	17,000	Completed
Sewer Line Replacement Project - Sayinah Behind the Department Area - Al-Mazhar	Sayinah	1,500	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2019	3,500	Completed
Sewer Line Project - Al-Mahrousa Area - Birbasha - Al-Mazhar	Birbasha	12,000	Plastic pipelines, concrete manholes, iron covers, and accessories	Mercy Corps Organization	2019	14,000	Completed
Sewer Line Replacement Project - Near the Water Foundation	Near the Foundation - Al-Kamab	20,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2019	8,000	Completed
Rehabilitation Project for the University Water Pumping Station	University Station	150,000	Paints, concrete, cladding, gates, and windows	Red Cross Organization	2019	27,000	Completed
Rehabilitation Project for the Republican Bridge Well	Sa›lat al-Qamṭa	15,000	Pumps, drums, valves, and meters	CARE Organization	2019	18,000	Completed
Rehabilitation Project for the Shu›ab Sileet Well	Wadi al-Qadi	15,000	Valves and cleaning	Wisdom Association	2019	1,000	Completed
Main Sewer Line and Sanitation Network Project - Umd Area - Baer Basha - Al-Mazafar	East Umd	45,000	Plastic pipelines, concrete manholes, iron covers, and accessories	Social Development Fund	2020	950,000	Completed
Sewer Line Replacement Project - Old City Site for Areas (Al-Mutawakkil, Al-Mu›atabiah, Al-Naseeriya around Shajarah) - Al-Mazafar	Old City Area	40,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2020	70,000	Completed
Sewer Lines Project - (Al-Darbah Near Al-Zaghrawi›s House, Near Bayt Hail Rest House, Al-Waqsh, Near Al-Wahda School) - Cairo	Next to the Zaghrouri›s house, next to Beit Hael rest area, Al-Waqsh, next to Al-Wahda School - Cairo.	35,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2020	58,000	Completed
Sewer Lines Project - Al-Mazafar and Cairo (Al-Manakh, Al-Jumhuri Near Nasser School, Al-Daboua Al-Kasara)	Al-Mnakh, Al-Jumhuri, next to Nasser School, Al-Daboua, Al-Kasara.	15,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2020	65,000	Completed
Sewer Line Replacement Project - Al-Mazafar and Cairo (Al-Qubba Al-Masrour, Near Al-Mukhtar Hotel, Martyrs Cemetery)	Al-Quba Al-Maasur, next to Al-Mukhtar Hotel, Martyrs Cemetery	25,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2020	60,000	Completed
Sewer Line Replacement Project - (Cairo Directorate Al-Daboua, Near Bilal School)	Al-Daboua, next to Bilal School - Wadi Al-Salami	2,500	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2020	95,000	Completed
Sewer Lines Project - Area (Wadi Al-Salami) - Al-Mazafar Directorate	Wadi Al-Salami	20,000	Plastic pipelines, concrete manholes, iron covers, and accessories	CARE Organization	2020	110,000	Completed
Sewerage Lines Project - Wadi Al-Salami Area	Wadi Al-Salami	20,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	2020	110,000	Completed

Sewer Line Replacement - Cairo	Near Al-Hindi Mosque, Amar bin Yasir Alley, and Wadi Al-Madam	35,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	2020	59,000	Completed
Sewer Line Replacement - Ashbat Area, Sala	Ashbat	80,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	2020	70,000	Completed
Replacement of Manhole Covers and Inspection Rooms - Muzaffar and Cairo	Muzaffar and Cairo	150,000	Iron covers for manholes and concrete ceilings	CARE	2020	40,000	Completed
Well Rehabilitation Project - Shub Salit, Hul Atiya, Jamal Street	Three Directorates	75,000	Pumps, control panels, manifolds, and counters	CARE	2020	126,000	Completed
Water Network Project - Wadi Al-Qadi, Shub Salman - Cairo	Wadi Al-Qadi, Shub Salman	12,000	Polyethylene pipes, valves, and manifolds	CARE	2020	48,000	Completed
Sewer Lines Project - Muzaffar and Cairo	(Near Al-Fath Mosque, School Alley, Near Balqis Cinema)	20,000	Plastic pipes, concrete manholes, iron covers, and accessories	Mercy Corps	2020	71,000	Completed
Sewer Lines Project - Cairo	(Asifra Al-Sharmani, Al-Saeed above the liquid, Al-Daboua below the health center, Near the National Institute, Near Jameh Shaheen Mosque)	30,000	Plastic pipes, concrete manholes, iron covers, and accessories	Mercy Corps	2020	61,500	Completed
Sewer Lines Project - Sala	(Al-Jahmaliya, Haret Al-Tawhid, Near Al-Jumhuriya Newspaper)	15,000	Plastic pipes, concrete manholes, iron covers, and accessories	Mercy Corps	2020	18,000	Completed
Well Filtration Project for Seven Wells - Muzaffar and Cairo	(East Umad + Al-Janat + West Sina + Hul Atiya + Jamal Street + Republican Bridge + Shub Salit)	150,000	Well filtration and depth increase	Mercy Corps	2020	42,000	Completed
Main Water Network Rehabilitation Project by Replacing Main Valves - Muzaffar, Cairo, and Sala	Muzaffar, Cairo, and Sala	350,000	Polyethylene pipes, valves, and manifolds	Red Cross	2020	160,000	Completed
Rehabilitation Project for Sewage Pumping Station - Wadi Al-Qadi - Muzaffar	Wadi Al-Qadi and Al-Manakh	110,000	Generator, pumps, building and fence paints, and electricity	Binaa Association	2020	110,000	Completed
Sewage Network Project - Al-Harazia Area - Sala	Al-Harazia	15,000	Plastic pipes, concrete manholes, iron covers, and accessories	Binaa Association	2020	15,000	Completed
Sewer Line Replacement Project for Al-Khayatin Street - Muzaffar	Al-Khayatin Street and Upper Liberation Street	35,000	Plastic pipes, concrete manholes, iron covers, and accessories	Binaa Association	2020	35,000	Completed
Water Network Rehabilitation Project for Al-Harazia Area - Sala	Al-Harazia	10,000	Polyethylene pipes, valves, and manifolds	Binaa Association	2020	12,000	Completed
Solar Energy System for Wells - Shub Salit and Dar Al-Nahla - Muzaffar and Cairo	Wadi Al-Qadi, Al-Masbah, and Old City	45,000	Panels, jamla bases, panels, and control boxes	Binaa Association	2020	140,000	Completed
Supply of Two Generators for Wells - Tha›bat and Al-Muassasa - Sala	Tha›bat, Al-Jahmaliya, Al-Kambo, Al-Hud, and Al-Shamasie	60,000	Generators	Hikma Association	2020	50,000	Completed
Well Maintenance Project for Ba›ara, West Umad, and Tha›bat - Muzaffar and Sala	Ba›ara, Madinat Al-Nour, Umad, and Tha›bat	45,000	Cleaning, valves, and others	Maakum Foundation	2020	12,000	Completed

Training Course in Planning for 20 Employees of the Organization	Organization Employees	20	Strategic Planning	CARE International	2020	3,000	Completed
Training Course in Water Treatment and Sewage - for 18 Employees	Organization Employees	18	Well chlorination, water and sewage network maintenance	Mercy Corps	2020	4,000	Completed
Rehabilitation Project for Al-Majliah Station - Cairo	Al-Majliah, Al-Swani, and Tha›bat	120,000	Generators, building paints, windows, gates, valves, and horizontal pumps	French Organization	2021	120,000	Completed
Rehabilitation Project for Tha›bat Station - Muzaffar	Tha›bat, Al-Jahmaliya, Al-Kambo, Al-Hud, and Al-Shamasie	150,000	Generators, building paints, windows, gates, valves, and horizontal pumps	French Organization	2021	130,000	Completed
Drilling 6 Wells Project - Muzaffar and Cairo	Muzaffar and Cairo	450,000	Drilling wells with a depth of 350 meters	Response Foundation	2021	450,000	Completed
Well Drilling Project Inside the Republic Hospital - Cairo	Cairo	50,000	Drilling a well with a depth of 350 meters	Yanabee Al-Khair Foundation	Yanabee Al-Khair Foundation	2021	56,000
Rehabilitation Project for East Umad Well	East Umad, Muzaffar	10,000	Cleaning, valves, and pipes	French Organization	French Organization	2021	15,000
Rehabilitation Project for East Sina Well	Sina and Al-Manakh	10,000	Cleaning, valves, building rehabilitation, and protective fence	French Organization	French Organization	2021	10,000
Rehabilitation of Sewer Lines - Al-Hadba, Wadi Al-Madam Area	Wadi Al-Madam	2,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2021	15,000
Sewer Lines Project - Sina Area, Near Badr School - Upper Sina	Sina	6,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2021	30,000
Replacement of Sewer Manhole Covers - Cairo and Muzaffar	Muzaffar and Cairo	150,000	Concrete ceilings, iron covers, and room cleaning	CARE	CARE	2021	80,000
Rehabilitation Project for Water Network - Umad Area, Muzaffar	Umad	3,000	Polyethylene pipes, valves, and meters	Shabab Saba Foundation	Shabab Saba Foundation	2021	3,000
Sewage Line Project - Al-Sharaf Area, Sala	Sala	500	Plastic pipes, concrete manholes, iron covers, and accessories	Shabab Saba Foundation	Shabab Saba Foundation	2021	4,000
Connection of New Wells to the Public Network - 3 Wells - Al-Hajrawi, Dar Al-Nahla, Wadi Al-Madam	Old City and Wadi Al-Qadi	80,000	Polyethylene pipes, valves, meters, and rooms	Response Foundation	Response Foundation	2021	250,000
Rehabilitation of Sewer Network - Muzaffar	Ba›ara, Al-Damina, Al-Salami, Al-Ba›arah	30,000	Plastic pipes, concrete manholes, iron covers, and accessories	French Organization	French Organization	2021	80,000
Sewer Lines Project - Al-Hasab and Souq Al-Sameel	Al-Hasab and Souq Al-Sameel	25,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2021	120,000
Sewage Line Project - Al-Haqr, Muzaffar	Al-Haqr Al-Dairi	1,000	Plastic pipes, concrete manholes, iron covers, and accessories	Shabab Saba Foundation	Shabab Saba Foundation	2021	3,500
Supply of Diesel 597,000 Liters to Operate Well Generators and Pump Water to Residential Areas in the City - Muzaffar, Cairo, Sala	Three Directorates	350,000	Diesel	UNICEF, WFP	UNICEF, WFP	2021	271,000
Connection Project for Swani, Al-Salami, and Al-Daboua Wells - Cairo and Muzaffar	Ba›ara, Al-Hasab, Al-Daboua, Liberation Lower, Swani, and Wadi Al-Madam	60,000	Polyethylene pipes, valves, meters, and rooms	Response Foundation	Response Foundation	2022	245,000

Sewer Line Replacement Project - Street 26	Sala, Al-Jahmaliya, Al-Jumhuriya	120,000	Plastic pipes, concrete manholes, iron covers, and accessories	Beit Hael, Cairo Directorate	Beit Hael, Cairo Directorate	2022	55,000
Rehabilitation of Sewer Network - Republic and Swani	Republic and Swani	8,500	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	60,000
Rehabilitation of Sewer Network - Near Aqaba School	Tha›bat	2,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	12,000
Rehabilitation of Sewer Network - Al-Ba›arah	Old Al-Ba›arah	10,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	31,000
Sewer Line Project - Al-Karama Area, Mist Road	Wadi Hattab, Al-Dhahra, Industrial Area	35,000	Plastic pipes, concrete manholes, iron covers, and accessories	Muzaffar Residents, Muzaffar Directorate	Muzaff		
Rehabilitation of Sewer Network - Sina and Nasiriya Area - Phase 1	Sina Upper	25,000	Plastic pipes, concrete manholes, iron covers, and accessories	UNBIS	UNBIS	2022	188,880
Rehabilitation of Sewer Network - Sina and Nasiriya Area - Phase 2	Nasiriya	25,000	Plastic pipes, concrete manholes, iron covers, and accessories	UNBIS	UNBIS	2022	200,014
Rehabilitation of Sewer Network - Wadi Al-Madam Area - Phase 1	Wadi Al-Madam	25,000	Plastic pipes, concrete manholes, iron covers, and accessories	UNBIS	UNBIS	2022	200,000
Rehabilitation of Sewer Network - Wadi Al-Madam Area - Phase 2	Al-Jumhuriya	60,000	Plastic pipes, concrete manholes, iron covers, and accessories	UNBIS	UNBIS	2022	200,000
Sewer Line Project - Falcon Roundabout Towards University Entrance	Falcon Area	2,500	Plastic pipes, concrete manholes, iron covers, and accessories	Governorate	Governorate	2022	33,000
Rehabilitation of Sewer Lines - Near Water Foundation and Fourth Roundabout	Fourth Roundabout, West Water Foundation	18,500	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	73,000
Rehabilitation of Sewer Lines - Climate Area	East Climate	12,000	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	55,000
Sewer Line and Branches from Falcon Roundabout to Ba›ara Roundabout	Falcon Square Street	14,200	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	74,000
Rehabilitation of Sewer Lines - Sala, Near Al-Najah School	Tha›bat	16,500	Plastic pipes, concrete manholes, iron covers, and accessories	CARE	CARE	2022	20,000

Table 3.6: Investment support for infrastructure projects from 2017 to 2022

4. Customer Services

4.1 Customers Data and Reporting

4.1.1Customer and Connection Data

The table below summarizes the number of connections per customer category for the water and sewer system. The total number of water connections in 2022 is 52,789 connections, with a slight increase of 481 connections over the year 2017, most of which are in the domestic sector (49,437) connections.

The total number of sewerage connections in 2022 is 44,388 with an increase of 247 connections over the year 2017.

Connections	Domestic connections	Government connections	Commercial connections	Total connections
No. of Water connections	49,437	298	3,054	52,789
No. of installed water meters	49,437	298	3,054	52,788
% installed water meter to total connection	100	100	100	100
No. of functional water meters	49,437	297	3,054	52,788
% of functional water meter to total	92.6	76	N/A	91.3
No of zero Reading	4,109	163	N/A	7,834
No of Sewer connections	41,295	254	2,839	44,388

Table 4.1: Water and Sewer connections per customer category in 2022

The total number of installed water meters amounts to 52,788 meters with 100 % functioning water meters.

4.2. Billing, Collection, and Complaint Procedures:

- Customer Database Maintenance:
  - The customer database is maintained and updated.
  - Invoices are printed for areas with monthly consumption, excluding government departments.
  - Differentiation between actual readings and fixed consumption is made.
- External Collection Centers:
  - There are no external collection and customer service centers.
  - Collection is managed by Commercial Department employees, area readers, and amounts are submitted to the Finance Department.
  - Collection lists are sent to the computer department for data entry.
- Field Operations:
  - There are 57 field meter readers and 8 field revenue collectors.
- Digital Collection Assistant Devices:
  - No digital collection assistant devices are used for revenue collection.
- Incentive System:
  - There is an incentive system for field customer service and revenue relations employees.
  - 10% of the total collection is distributed to eligible employees.
- Service Connection Guidelines:
  - Guidelines for service connection procedures are available.
- Procedure Implementation:
  - The documented procedures for billing and collection are implemented in 2022.
- Documentation:
  - Electronic and printed copies of billing and collection procedures are available.
- Handling Customer Complaints:
  - Special procedures are in place for handling customer complaints and grievances.

Overall, the organization demonstrates a structured approach to billing, collection, and customer service with clear guidelines, effective field operations, and an incentive system to motivate employees.

4.2.1 Billing and Collection Procedures

- Meter Reading Cycle and Recording:
  - Current cycle readings are issued, delivered to area readers, filled with actual readings, and submitted to the computer department.
  - After inputting the readings, fixed and estimated readings are processed, and invoices are printed only after resolving any irregularities in readings.
- Billing Cycle and Distribution:
  - Monthly billing cycle involves entering all data, including readings, collections, charges, and settlements.
  - After completing all operations, invoices are issued, and data for the current cycle is transferred. Invoices are printed only after the successful completion of all operations. The cycle is closed, and the next cycle is initiated.
- Payment Methods and Collection Centers:
  - Invoices are paid through the institution›s collection offices. Previously, payments were accepted at the institution›s collection offices, post offices, and Karami centers.

4.2.2 The key steps and responsibilities involved in service interruption or disconnection procedures:

No information

4.2.3 Problems and Development Needs in Customer Management Procedures

NA

4.2.4 Planned Technical Assistance Needs Related to Customer Services and Relations:

No information

2.2.5 Proposed Technical Assistance and investment Measures Related to Improving Procedures and Operations of Customer Management

NA

2.2.6 *Billing & Collection data*

The LC takes monthly water readings and issues bills each month according to the procedure described above.

In 2022, the domestic sector is the largest sector in water sales, with 58 %, of the total water sales, then become the government sector which represents 35 % of total water sales with only 0.5 % of connections, while the commercial sector represents 7 % of total water sales with 6 % of connections.

This indicates that the LC should relies on the governmental sector and domestic sector in increasing the collection efficiency

The LC total income from water billing was approximately 1,085,341,649 YER in 2022 and increased by 69 % over the year 2017.

Details for the billing and collection for the last six years and depending on the customer type is illustrated in the table below.

As a general overview on the collection efficiency, the values was too low, which refers to challenges include war-induced damages.

(Note: what was obtained in the years 2018 and 2019 was monitored through the debt statements, not the printing of LC invoices, as in the years 2021 and 2022, as a general)

Customer category	2017			2018			2019			2020			2021			2022		
	Number of bills	Water and wastewater	coll. Eff.	Number of bills	Water and wastewater	coll. Eff.	Number of bills	Water and wastewater	coll.Eff.	Number of bills	Water and wastewater	coll. Eff.	Number of bills	Water and wastewater	coll. Eff.	Number of bills	Water and wastewater	coll. Eff.
	No	YER	%	No	YER	%	No	YER	%	No	YER	%	No	YER	%	No	YER	%
Domestic billing	0	269,446,572	0	0	269,910,261	0	0	268,456,428	0.013	0	267,034,326	0	0	280,200,396	0	15,000	941,720,664	0.18
Domestic collection	0	0		0	0		6	34,464		0	0		0	0		375	1,707,249	
Governmental billing	0	200,127,600	0	0	200,127,600	0	0	210,482,420	1.6	0	177,267,880	0	0	42,163,440	0	0	597,355,930	0.55
Governmental coll.	0	0		0	0		3	3,402,561		0	0		0	0		1	3,269,520	
Commercial billing	0	26,054,880	0	0	26,054,880	0.53	0	26,063,930	4.92	0	25,663,290	0	8,544	25,561,440	1.8	8,544	76,265,840	3.76
Commercial collection	0	0		2	138,392		36	1,281,178		0	0		55	459,235.00		106	2,870,441	
Total billing	0	333,017,184	0	0	333,447,072	0.04	0	339,399,442	1.4	0	315,710,792	0		230,887,872	0.2		1,085,341,649	0.72
Total collection	0	0		2	138,392		45	4,718,203		0	0		55	459,235		482	7,847,210	

Table 4.4: Billing and collection amount per customer category

The accumulated debts of the three main categories are as follows:

- Domestic: 19,719,142,687 YER, corresponds to 72 months
- Governmental: 9,082,392,119 YER, corresponds to 72 months
- Commercial: 3,569,312,041 YER, corresponds to 72 months

4.3 Tariff structure according to customer type and consumption

No data

5. Assessment of IT infrastructure and management

5.1 IT and Office Resources

The Information Technology network status is as follows:

The organization›s Information Technology network faces significant challenges, with internal and inter-building networks in urgent need of maintenance and complete rehabilitation. The internal network within the main building is available but requires attention. The distribution across multiple buildings at the main administration site has suffered due to severed connections, necessitating comprehensive repairs.

There is currently no external network link to remote sites. The history of the local network indicates that it was previously available but ceased in early 2015 due to war-related circumstances, resulting in looting, theft of equipment, and extensive damage. Both the local and inter-building networks require substantial efforts for maintenance and rehabilitation. Addressing these issues is crucial for restoring effective communication and connectivity within the organization.

- Status of communications networks is as follows:
  - Available Communication Networks:
  - Primary Network: YemenNet.
  - Quality and Coverage Leader: Yemen Mobile.
  - Mobile Networks with 4G Internet:
  - Yemen Mobile is the service provider for 4G Internet.
  - Internet Services:
  - Both wired and wireless internet services are available.
  - Internet Accessibility Quality:
  - The quality of communication does not support participation in online meetings and training courses.
  - Power Supply:
  - Power source: Private generator.
  - Reliability: Depends on fuel availability.
  - Daily Electricity Supply: Dependent on generator runtime.
  - Impact on Communication Networks:
  - Frequent generator shutdowns due to fuel shortages negatively impact communication networks.
  - Internet Accessibility Restrictions:
  - Internet access is limited for specific departments, services, and employees.

These insights reveal challenges in power sustainability and internet access limitations, highlighting the need for addressing fuel availability and enhancing communication infrastructure for efficient operations.

Information Technology Applications and Software

Category	System	Invoicing	Accounting	Payroll	Inventory	Fixed Assets	Performance Indicators	Geographic Information System (GIS)
Ownership	System owned by institution	System owned by institution	System owned by institution	System owned by institution	System owned by institution	System owned by institution	System owned by institution	ArcMap 10 ArcView 3
Operating System	Windows	Windows	Windows	Windows	Windows	Windows	Windows	Windows
Source Code Availability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
License Cost	$0	$0	$0	$0	$0	$0	$0	$0 (Except GIS)
Regular License Payment	No	No	No	No	No	No	No	Yes (GIS only)

Table 5.1: Samples of Information technology applications and software

5.2 Data security and management

5.2.1 Antivirus Protection:

No original antivirus software; current protection from downloaded software, lacking comprehensive device coverage.

5.2.2 Antivirus Usage:

Antivirus not used by all users; no original version available.

5.2.3 Power Regulation:

No use of voltage regulators or power stabilizers.

5.2.4 Backup Procedures:

- One authorized person for backup tasks.
- Two locations for storing backups.
- Manual backup procedures in place.

5.2.5 Backup Frequency:

Last data restoration from backup was in July 2022.

5.2.6 User Management:

Specific person assigned for user management tasks.

5.2.7 User Permissions Management:

Specific person assigned for user permissions management.

5.2.8 Disaster Recovery Plans:

No specific plans for IT system recovery during emergencies or disasters.

The assessment reveals vulnerabilities in antivirus protection, power regulation, and data backup practices. It underscores the need for establishing comprehensive antivirus solutions, implementing power stabilization measures, and formulating disaster recovery plans to enhance data security and IT system resilience.

5.3 Needs for IT and related office equipment

Item	Request Reasons	Description/Specifications	Quantity	Priority
Furniture and Office Equipment				
Desks	Lack of the required number of desks for the IT department and its sections: Programming and Database Section, Maintenance and Networks Section, GIS Section	Wooden desk with drawers and a side table. Drawer dimensions: 40 cm width × 48 cm depth × 65 cm height. Desk dimensions: 200 cm width × 90 cm depth × 76 cm height. Side table dimensions: 88 cm width × 76 cm height × 40 cm depth.	5	Urgent
Chairs	Lack of the required number of chairs for the IT department and its sections: Programming and Database Section, Maintenance and Networks Section, GIS Section	Medical mesh back and mid-movable chair	5	Urgent
Air Conditioner	For servers	1-ton, 1200 BTU, Energy-efficient control (40%, 60%, 80%), Dual Tropical Inverter Compressor, Fast cooling and energy-saving, Plasmaster™ IonizerPLUS, Smart ThinQ™ (Wi-Fi), Ten years warranty on the dual inverter compressor	1	Urgent
Devices and Networks				
Desktop Computer	Lack of the required number of desktop computers for the IT department and its sections: Programming and Database Section, Maintenance and Networks Section, GIS Section	Specifications: Intel Core i7 Quad Core, 8GB RAM, 1TB HDD, 2GB Graphics Card, 19» LED Monitor, DVD+/-RW, Windows 7 or above.	5	Urgent
Laptop Computer	Lack of the required number of laptops for the IT department and its sections: Programming and Database Section, Maintenance and Networks Section, GIS Section	Specifications: Intel Core i7-8850H, 32GB RAM, 1-2TB HDD, 4GB Graphics Card, 15.6» FHD LED Monitor, DVD+/-RW, Windows Server.	2	Urgent
Servers				Urgent
Invoice Printer	Only one invoice printer is available and needs periodic maintenance to function properly	Sedco Magna L3200 C Line Matrix Printer. P8000/P7000 Standard life cartridge ribbon.	3	Urgent
Voltage Regulator	Lack of a voltage regulator to ensure the safety of devices from high and low voltage that can damage them	20KVA / 16KW UPS, Input: 220-240V, Output: 220-240V, Three years warranty, Including maintenance.	1	Urgent
Backup Battery	Lack of backup batteries to ensure device operation during sudden power outages	Capacity: 100 Ampere, Type: Deep Cycle Gel	7	Urgent
Electric Charger	To ensure battery charging	Three-stage charger, 10 Ampere	7	Urgent
Routers for Branch and Main Centers	The local and external network between the institution›s buildings is disrupted and needs maintenance and rehabilitation due to theft and damage		4	Urgent
Local Network Switches in the Branch	The local and external network between the institution›s buildings is disrupted and needs maintenance and rehabilitation due to theft and damage	Cisco network switch 48 10/100/1000 Ports, Gigabit Ethernet Smart Switch, 2 Combo Mini-GBIC Ports, With Fiber Port	5	Urgent
Internal Wireless Modems	The local and external network between the institution›s buildings is disrupted and needs maintenance and rehabilitation due to theft and damage	Tp-link TD-W8961N 500Mbps Wireless N ADSL2+ Modem Router	3	Urgent
Software				
Network Firewall	To protect the network from hacking	Real-time antivirus, online payment protection, performance improvement, unlimited high-speed VPN connection, data leak detection tool, identity protection features, virus scanning and removal by an expert	3	Urgent
Software Updates	Update ArcMap10	ArcMap10	1	Urgent
New or Replacement Software	Antivirus, Windows 11, Office 2020, ArcView	Anti- virus :10 original copies, Windows 11:5 original copies, Microsoft- office :5 original copies,	5, 5, 5	Urgent
Equipment and Other Devices				

Other IT Infrastructure and Tools	Lack of network maintenance tools, maintenance and repair toolkit	1. Ethernet Cable Network Cat6 – 350 meters. 2. RG45 - 100 units, and RG11 - 100 units. 3. PETECH EZ-RJ45 Crimp Tool for RJ-11, RJ-12 - 2 units. 4. Network Wire Punch Down Impact Tool with Two Blades - 2 units. 5. Ethernet Network Tool Cable Tester RG45, RG11 - 2 units. 6. Repair tool bag	-	Urgent

Table 5.2: Information technology and office needs for devices and equipment

5.4 Proposed TA and investment measures for improving IT management

Technical Support Needs	Priority Level	Target Categories and Details
Training courses in the following areas: Oracle Database Management, Oracle Developer 11G, Computer Network Management and Maintenance, Computer Hardware Management and Maintenance, ArcView, ArcMap, AutoCAD.	Urgent	IT Management and its Departments: Programming and Database Department, Maintenance and Networks Department, Geographic Information Systems (GIS) Department.
Rehabilitation of the local and external network connecting the institution›s buildings and providing all the requirements for repair and maintenance.	Urgent	All departments of the institution.
Providing a permanent power source to operate devices and accessories.	Urgent	All departments of the institution.
Connecting the internet to the institution.	Urgent	All departments of the institution.
Rehabilitation of the server room and providing all the requirements for repair and maintenance.	Urgent	All departments of the institution associated with the institution›s databases.
Rehabilitation of the offices of the IT management and all its departments.	Urgent	IT Management and its Departments: Programming and Database Department, Maintenance and Networks Department, Geographic Information Systems (GIS) Department.

Table 5.3: Proposed TA and investment measures

6. Gender Cross Cutting Issues

6.1 Gender Issues within the Institution/ Branch

6.1.1 Administrative and organizational status of gender

- The organizational structure includes women›s management.
- Job descriptions are available for women›s management positions.
- Women›s management is currently inactive due to the institution›s current situation.
- Women›s management is not involved in planning and updating strategic policies.
- Female employees and managers participate in water and environmental meetings and networks.
- There are no regular meetings between women›s management and employees in other departments.
- Women›s management does not prepare a specific action plan.
- The manager of women›s management works in other departments in addition to her position.
- The manager of women›s management has not left for other departments.
- There is a categorized database based on gender.
- There is no specific budget allocated to women›s management in the institution/branch.

6.1.2 Presence of Women in Decision-Making Positions in the Institution/Branch

Question	Answer
What is the percentage of women to men in decision-making positions in the institution/branch?	3
How many leadership positions do women hold in the institution/ branch?	5
General Manager	0
Department Manager	1
Department Head	6
Accountant	8
Secretary	3

Table 6.1: Women in Decision-Making Positions

6.1.3 Special Services and Facilities for Women within the Institution/Branch

- No dedicated bathrooms for female employees, and their specific needs are not considered.
- No bathrooms designed for people with special needs, lacking special facilities.
- No designated prayer area for female employees due to technical and managerial neglect.
- No daycare facilities for employees› children during working hours due to a lack of serious consideration by the management.
- No specific complaints office for women beneficiaries; complaints are directed to the relevant authority or the employee committee for review.

6.1.4 Women›s Participation Procedures in Decision-Making

No specific conditions or criteria for appointing female employees; relies on job requirements, qualifications, and experience.

- No special conditions or criteria for appointing female employees in decision-making positions.
- No existing mechanisms to ensure women›s participation in leadership positions within the organization.
- No published procedures considering gender perspectives.
- No identified reasons or obstacles hindering women from reaching leadership positions; employees only lack opportunities.
- Policies and suggestions in place to enhance women›s participation, including training, active involvement in conferences, and preparation of studies and plans.
- Technical assistance needs for improving and addressing the gender issues

Technical Support Needs	Priority Level	Target Categories and Details
Courses in Administrative Development: Preparation of lectures and reports. Planning and preparation of projects. In tenders and auctions. Conducting research and analyses addressing gender-specific needs.	Urgent	Women employees of the institution
Accounting Courses	Urgent	Women employees of the institution
Secretarial Courses	Urgent	Women employees of the institution
Technical Courses in (Laboratory - Safety and Occupational Health - Sanitary Engineering)	Urgent	Women employees of the institution
Courses in Gender Studies	Urgent	Women employees of the institution

Table 6.2: Technical assistance needs for gender issues

7. Assessment of Water and Sanitation

(Note: Any missing data is due that some departments resumed operations, others are in the process of reactivation as a direct effect of war-induced damages, staff displacement, and the need for extensive repairs and equipment provision)

7.1 Water Supply and Infrastructure System

General Situation

There are many indirect negative impacts caused by the crisis: power cuts, financial constraints (decrease in revenues), increase of the operation and maintenance cost and lack of materials due to the lack of an investment program granted from the national budget (Ministry of Finance) since 2015.

The methodology for the data collection and assessment has been presented already in Chapter 1.3 in this report. The questionnaire forms for Part B, comprised questions regarding the technical condition, availability, parameters and physical status of the utilities infrastructure. The assessment focused on the following topics:

- Water Supply and Infrastructure System
  - Water Production and Distribution
  - Infrastructure
  - Water Quality
  - Non-Revenue Water
- Sanitation System
  - Wastewater Collection
  - Wastewater Treatment
- Operation and Maintenance
- Energy Supply

Based on the provided data from the LCs, the site visit, direct discussions with the LC managers and through the feedback from the managers all the available information had been assessed and respective results are presented in the below Chapters 7.1 to 7.4. The subsequent requirements and investment needs for rehabilitation and restoration of services have been identified by the LC and were verified and completed by the Consultant. The comments from the LC on the draft investment plan were taken into consideration for the preparation of the final version as summarized in Chapter 8.

7.1.1 Water production, distribution, supply system

As of 2022, 24 of the 131 existing water wells are operational. Among 131 wells, 38 wells were drilled and ceased operation in previous years. Production data overall was consistent in the way it was provided in part B of the questionnaire forms. It does not reflect any effect caused by the crisis. On the contrary, the water produced quantity increased in 2022 by 38 % compared to 2017.

Additionally, the nominal water production capacity ranged from 6,120 m3/d in 2017 to 9,936 m3/d in 2022. The average nominal water production capacity provided by the LC is 7,176 m3/d in the six evaluated years.

The chart below demonstrates the increase in the actual/ current water production over the years.

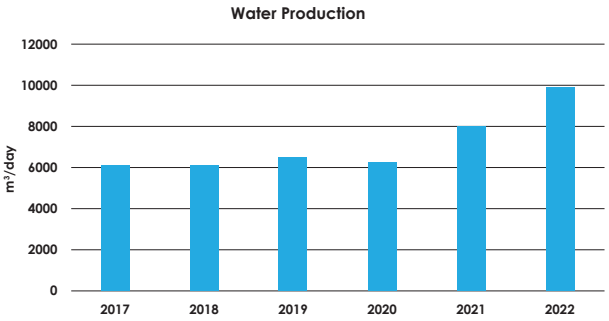


Figure 7.1: Average water production in m3/day for the years (2017 - 2022)

There is one water laboratory available for the testing and control of water. However, the consumables/chemicals are available, but they will expire if not activated due to the absence of furnishings.

There are 11 pumping station in Ta›izz with average capacity of water system pumping stations (pumping and booster stations) of 9,572 m3/day.

7.1.2 Infrastructure

Buildings, administrative and technical facilities

Building Purpose/ Description	Location/ Address	Ownership/ Rental	Building Materials	Area (m2)	Number of Floors	Number of Offices	Operational Status (2)	Current Status (3)	Brief Explanation of Completely/ Partially Destroyed Elements	Note
Administrative Building for Cairo Directorate	Ta›izz Governorate - Ashraf Basin (Inside the main compound of the institution)	Institution-owned	Block Buildings + Concrete	582	1	19	Not Used	Partially Damaged	Severe damage to the building›s ceiling from shells + Destruction of windows and doors + Complete looting of all furniture, offices, chairs, computers, documents, etc.	Execution Date: 1965
Administrative Building for Network and Distribution	Ta›izz Governorate - Ashraf Basin (Inside the main compound of the institution)	Institution-owned	Block Buildings + Concrete	582	1	20	Not Used	Partially Damaged	Severe damage to the building›s ceiling from shells + Destruction of windows and doors + Complete looting of all furniture, offices, chairs, computers, documents, etc.	Execution Date: 1965
Stores Management Office	Ta›izz Governorate - Ashraf Basin (Inside the main compound of the institution)	Institution-owned	Block Buildings + Concrete	18	1	1	Regularly Used	Intact but requires maintenance and restoration	Partial damage to the ceiling and walls of the room + Damage to windows and doors + Tampering with the contents of the stores management office and the loss and destruction of many documents and furniture	
Main Building for the General Administration of the Institution	Ta›izz Governorate - Ashraf Basin (Inside the main compound of the institution)	Institution-owned	Stone + Block + Concrete	500	4	49	Partially Used	Partially Damaged	Work on finishing the fourth floor stopped due to the outbreak of war and deterioration of the floor + Complete looting and destruction of all furniture, equipment, and documents + Shelling damage to windows, doors, and walls + Building occupied for five years and vacated by a military unit	Execution Date: 2005
Stores Hangar 1	Ta›izz Governorate - Ashraf Basin (Inside the main compound of the institution)	Institution-owned	Concrete + Metal Structure	300	1	1	Regularly Used	Intact but requires maintenance and restoration	Partial damage to the ceiling and walls of the hangar due to shells + Hangar occupied for five years by a military unit + Tampering with the contents of the stores and looting 50% of its contents	
Stores Hangar 2	Ta›izz Governorate - Ashraf Basin (Inside the main compound of the institution)	Institution-owned	Concrete + Metal Structure	300	1	1	Regularly Used	Intact but requires maintenance and restoration	Partial damage to the ceiling and walls of the hangar due to shells + Hangar occupied for five years by a military unit + Tampering with the contents of the stores and looting 50% of its contents	
Stores Hangar Claba Station Square	Ta›izz Governorate - Claba Al-Softel Area	Institution-owned	Concrete + Metal Structure	386	1	1	Not Used	Not Known	Located inside the Claba station fence, which is currently in conflict zones + Many shells and bullets are undoubtedly falling on the station, destroying its contents	Execution Date: 2004

Table 7.1: Sample data on administrative buildings

Investment requirements for buildings, administrative and technical facilities

A series of critical construction and rehabilitation projects have been outlined, targeting diverse facilities within Ta›izz Governorate. The primary focus is on the completion of the third-floor administrative building, involving the installation of partitions, gates, windows, tiling, painting, electrical work, and the furnishing of office spaces and training rooms, along with the implementation of a solar energy system. Additionally, there are projects encompassing the furnishing of the general administration building, the rebuilding and rehabilitation of a hall in Al-Jahmaliya, the restoration of a sewage pumping station, the revitalization of a technical workshop, and the rehabilitation of a university water pump station. These endeavors cover a wide spectrum, including infrastructure repair, furniture and equipment procurement, and the integration of solar energy systems to enhance operational efficiency. The estimated costs associated with each project highlight the substantial financial commitment required for these vital initiatives, underscoring their importance in addressing crucial infrastructure needs.

More details about these investments are founded in Appendix A-4

Water supply infrastructure and management

The following table is an overview of the available water infrastructure and facilities as of 2017 compared to 2022.

Description / Facility	Unit	2017	2022
Public water distribution points	No	17	51
Main source of water supply (SW or GW)		GW	GW
Number of distinct supply zones	No	11	11
Total number of boreholes	No	121	131
Boreholes in operation (=borehole pump no)	No	20	24
Ground Reservoirs	No. /m3	18/45,600	18/45,600
Elevated Tanks	No. /m3	1/500	1/500
Nominal water production capacity	m3/d	27,800	30,392
Water sterilization facilities	No.	N/A	20
Current water production capacity	m3/d	6,120	9,936
Total no. of domestic water meters installed	No	N/A	N/A
Total no. of functioning domestic water meters	m	NA	NA
Length of the water supply network	km	823	823
Total nos. of bulk water meter	No	N/A	N/A
Water Laboratory	No	N/A	1

Table 7.2: Overview of available water infrastructure

Ground and elevated water reservoirs

Notable reservoirs include those at the TWSLC main center, Al-Managh, Political Security, Thaabat Station, Al-Mojalih Station, Jarah mountain, Al-Maslakh Pumping station, Al-Gameaa Pumping station, Al-Hwjalah Pumping station, Kalabah Pumping station, Altaff mountain, Salah mountain, and Wadi Gorap mountain. The construction years range from 1965 to 2010, with varying capacities, such as 6,000 cubic meters for Reservoir No. 3 at TWSLC main center. The reservoirs are primarily of concrete or iron construction, with most being ground tanks. The purposes vary from collective to distribution, with different operational statuses and current conditions. For instance, Reservoir No. 1 at Al-Hwjalah Pumping station is in a damaged state with partial destruction, and its operational status indicating partial use.

Operation and maintenance of reservoirs

Operation and maintenance of reservoirs include the use of chlorine stations in some reservoirs for water treatment, annual cleaning and maintenance routines, appropriate water level management to ensure sufficient distribution pressure, the addition of extra booster pumps to overcome water supply challenges in distant areas, and the presence of manual water level measurement devices and control systems. Additionally, there are flow meters in place, albeit some needing replacement.

Water Distribution

From the 775,048 residents in LC Ta›izz in 2022, about 46 % respective Ta›izz people are supplied through 11 supply zones with 10 hours per month of water supply, besides there are about 20 % whom served by the institution/ branch through water tankers through 51 distribution points, and 6 % are served by private sectors (water tankers). The rest are served through direct purchase of water from private wells and from sources not under the authority of the institution plus through surface water harvesting from rainfall.

Water supply network

The water supply network at LC Ta›izz is 823 Km (transmission and distribution) long with diameters of 25 to 600, and comprises 52,789 water house connections for distribution lines.

The network is suffering from the repeated blockages because the pipes are partially worn. The following table represent samples of water supply network details:

Distribution area	Water Network Components	«Pumping Lines/ Distribution Lines»	Installation Date	Diameter	Material	Unit	Quantity	Operational Status	Physical Condition
Within the city boundary	Pipes with accessories	Distribution lines	Not available	100	HDPE	m	195,246	Partially Operational	Partially Worn
Within the city boundary	Pipes with accessories	Distribution lines	Not available	110	HDPE	m	10,028	Partially Operational	Partially Worn
Within the city boundary	Pipes with accessories	Pumping lines	Not available	150	DI	m	37,370	Partially Operational	Partially Worn
Within the city boundary	Pipes with accessories	Pumping lines	Not available	200	DI	m	22,793	Partially Operational	Unknown
Within the city boundary	Pipes with accessories	Pumping lines	Not available	250	DI	m	5,289	Partially Operational	Unknown
Within the city boundary	Pipes with accessories	Pumping lines	Not available	300	DI	m	23,253	Partially Operational	Unknown
Within the city boundary	Pipes with accessories	Pumping lines	Not available	400	DI	m	15,131	Partially Operational	Unknown
Within the city boundary	Pipes with accessories	Pumping lines	Not available	500	DI	m	3,141	Partially Operational	Unknown
Within the city boundary	Pipes with accessories	Pumping lines	Not available	600	DI	m	344	Partially Operational	Unknown
Within the city boundary	Pipes with accessories	Distribution lines	Not available	80	HDPE	m	16,777	Partially Operational	Partially Worn
Within the city boundary	Pipes with accessories	Distribution lines	Not available	90	HDPE	m	4,480	Partially Operational	Partially Worn
Within the city boundary	Home Connections	Distribution lines	Not available	25	HDPE & GI	m	209,188	Partially Operational	Worn
Within the city boundary	Home Connections	Distribution lines	Not available	32	HDPE & GI	m	125,494	Partially Operational	Worn
Within the city boundary	Home Connections	Distribution lines	Not available	64	HDPE & GI	m	25,072	Partially Operational	Worn

Table 7.3: Details of existing water supply network

Data for Water Pumping/Lifting/Boosting Stations for the Water System

Station Name	Location	Purpose of Station	Establishment Date	Number of Pumps	Station Capacity (m3/day)	Power Source
Old Main Pumping Station at the Corporation	Ta›izz Governorate - Ashraf Basin (Inside the main courtyard of the corporation)	Pumping/ Boosting Station	1965	4	13,824	Diesel generator
New Main Pumping Station at the Corporation	Ta›izz Governorate - Ashraf Basin (Inside the main courtyard of the corporation)	Pumping/ Boosting Station	2006/2007	3	14,400	Diesel generator
Main Pumping Station - Tha3abat	Ta›izz Governorate - Juhmaliyah Area (Tha3abat Tanks Dialogue)	Pumping/ Boosting Station	1965	3	4,920	Diesel generator
Main Pumping Station - Al-Mojalia	Ta›izz Governorate - Al-Mojalia Area - Cairo Directorate	Water Distribution Station	1965	2	3,600	Diesel generator
Second Pumping Station for Al-Dabab Field - University Station	Ta›izz Governorate - Habeel Salman Area - Al-Muzaffar Directorate	Pumping Station	2005/2006	3	9,792	Diesel generator
Main Pumping Station - Senah	Ta›izz Governorate - Senah Traffic Area - Al-Muzaffar Directorate	Water Distribution Station	1981	3	5,184	Diesel generator
Main Pumping Station - Al-Godiry	Ta›izz Governorate - Al-Ajinat Area - Al-Muzaffar Directorate	Boosting Station	1995	2	5,184	Diesel generator

First Pumping Station for Al-Dabab Field - Al-Maslakh Station	Taʿizz Governorate - Hazran Al-Dabab Area - Sabir Al-Mawadem Directorate	Pumping Station	2005/2006	4	13,824	Diesel generator
First Pumping Station for Al-Hwjalah Field - Al-Hwjalah Station	Taʿizz Governorate - Asaifrah Area - Al-Taeziah Directorate	Pumping Station	2005/2006	4	13,824	Diesel generator
Second Pumping Station for Al-Hwjalah Field - Kalabah Station	Taʿizz Governorate - Kamb Al-Rus Area - Cairo Directorate	Pumping Station	2005/2006	4	13,824	Diesel generator
Hayma - Al-Qarif Station	Taʿizz Governorate - Al-Hoban Area - Al-Taeziah Directorate	Pumping Station	1965	2	6,912	Diesel generator

Table 7.4: Water pumping/Lifting/boosting stations for the Water System

Electro-mechanical (EM) facilities for the water supply system (water resources and pumping station)

The summary of multiple boreholes situated in regions marked by war-related challenges, particularly emphasizing the adverse impact on water supply systems. Boreholes such as Al-Amerah and Al Hawban exhibit a complete cessation of water pumping for more than eight years, resulting in diminished pump efficiency exacerbated by the prolonged inactivity and increased salinity in the well water. Similarly, Wadi Gadid Boreholes echo these challenges, underscoring the critical consequences of wartime conditions on water infrastructure. Additionally, the Habir and Al-Hyma boreholes illustrate a common theme of halted pumping activities, further impacting pump efficiency and overall functionality. Collectively, these summaries stress the urgent need for intervention and support to restore these essential water sources, highlighting the broader humanitarian concerns associated with water scarcity in conflict-affected areas.

Control and measurement systems in water production units and pumping stations

Here is a summary of the key points:

- Control Systems for Electric Motors:
  - The system in use is conventional (relay-based).
  - There is a need for improvement and the implementation of monitoring systems.
- Automation:
  - Equipment can be operated automatically.
- Remote Monitoring and Control:
  - Wells, water sources, and pumping stations can be monitored and controlled remotely using intelligent controllers.
  - Remote control programs are suggested for further enhancement.
- Backup Systems:
  - Backup solar generators/energy sources are available and operate for 5 to 8 hours.
- Current Control System Maintenance:
  - Control systems are maintained regularly, with a recommendation for periodic development.
- Measurement Device Systems:
  - The current measurement device systems are considered sufficient but require some development.
- Maintenance of Measurement Devices:
  - Measurement device systems are regularly maintained, with a monthly examination of cable ends and verification of readings.
- Team Understanding and Training:
  - The working team has a basic understanding, but there is a need for additional training and qualification, particularly regarding maintenance and calibration of measuring devices.
- Reading Procedures:
  - Readings from measuring devices are taken manually via the operator.
- Documentation of Readings:
  - Readings from measuring devices are documented and stored, with a preference for regular maintenance and calibration.
- Suggestions for Improvement:
  - Recommendations include implementing remote control programs, supplying filters for electrical wave purity, and ensuring proper maintenance of motors with the use of sine wave filters.

Water disinfection and treatment units

In terms of chemical treatment, there is no indication of treating water for excess chemical elements, and similarly, there is no physical treatment for issues such as excess salts or impurities. The data reveals that water is distributed without undergoing any form of treatment. The tables also show that there are no specific areas supplied with treated water, and the quantity of water treated is consistently reported as zero. Laboratory tests for both chemical and physical parameters are reported as nonexistent, with no adherence to Yemeni standards.

In the broader context of water disinfection and treatment, the tables indicate that there are treatment units in place, but their sufficiency is noted to some extent. Monitoring and quality control procedures are reported as adequate to some extent. The periodic monitoring of water quality in distribution lines is noted, occurring on a monthly basis. Monitoring is also reported for each water source on a monthly schedule. The data suggests that the water treatment and disinfection operations have experienced interruptions due to military confrontations. Chlorine residual testing, safety procedures, and control systems are reported to be in place but with varying

degrees of adequacy. The need for maintenance in control systems is highlighted. Periodic maintenance of disinfection and treatment units is reported but is subject to the availability of resources.

Overall, the data paints a picture of a water distribution system where treatment is minimal, facing challenges such as interruptions due to conflict and a need for enhanced safety measures and maintenance. Periodic monitoring efforts are present but constrained, reflecting broader operational challenges in the context of water treatment and distribution.

Operational Data on Water Disinfection

Biologically treated drinking water is confirmed, with a focus on addressing cholera and disease-causing bacteria. The coverage of sanitized drinking water areas has progressively increased from 10% in 2017 to 65% in 2022. The quantity of disinfected water has been consistently monitored and reported in cubic meters. Bacteriological examinations conducted in the laboratory indicate a substantial number of tests performed, with 360 bacterial tests conducted overall. Compliance with Yemeni drinking water standards is evident through bacteriological tests, with 290 tests meeting the specified standards. Additionally, the assessment of residual chlorine concentration in the water network is reflected in the sampling of 220 chlorine residual samples, ensuring adherence to water quality standards. The summary underscores the commitment to maintaining water safety through biological treatment and rigorous testing procedures, contributing to the overall improvement and expansion of sanitized water distribution networks over the years.

Water disinfection and treatment practices explores the existence of sufficient procedures for monitoring and examining water quality, periodic monitoring of water quality in distribution lines, and regular examination of water quality for individual sources. It also delves into potential interruptions in disinfection processes, testing of chlorine residuals, adherence to safety procedures when handling disinfection materials, and the functionality of control systems for treatment units. Maintenance practices for disinfection and treatment units are also considered, with responses indicating the current status and available capabilities. Additionally, It investigates the biological and chemical elements negatively impacting water quality and seeks details on strategies to improve water quality both biologically and physically/chemically.

Laboratories

Water laboratories information and operational capacity

The institution or branch confirms the presence of a water laboratory with suitable space and some equipment for conducting qualitative and quantitative tests. Consumables are partially available, nearing expiration. The laboratory operates on both 6V and 220V systems and is staffed by three chemistry specialists. However, there is a lack of occupational safety tools and emergency provisions. Calibration of devices is performed periodically for those with available calibration solutions. While biological and chemical tests are conducted, specific details about the tests are not provided.

Sanitation laboratories information and operational capacity

The institution confirms the existence of a sewage laboratory with suitable space and specialized staff. However, the laboratory lacks necessary equipment, consumables, and a sufficient power source. Occupational safety tools and emergency provisions are also unavailable. Details about waste disposal, device calibration, and specific biological and chemical tests conducted in the sewage laboratory are not provided. Detailed investment requirements for water and sewage laboratories can be found in Appendix A-4.

7.1.3 Quality and management

Water Production Monitoring

Water production is measured using mechanical meters installed in wells, pump stations, and reservoirs. However, 80% of the meters need replacement due to aging and war-related damages, impacting the accuracy of water quantity measurement. The documentation of water production involves meter readings, diesel distributor records, and daily logs maintained by well operators. The current water sources are deemed inefficient, prompting the institution to coordinate with authorities for rehabilitation efforts, explore new water sources, and consider seawater desalination. The institution addresses water scarcity through projects like well revitalization, terrain improvements, and rainwater harvesting. The table also highlights the need for additional water sources in the future, emphasizing projects to reactivate wells and enhance hydrogeological conditions. However, insufficient information about groundwater status hampers effective water resource planning and development. The institution is actively engaged in projects to mitigate water scarcity, seeking cooperation with humanitarian organizations and exploring various strategies to secure sustainable water supplies for the city of Ta›izz.

Water source quality and monitoring

The wells and water sources supplying the city of Ta›izz lack designated water reserve areas due to the absence of necessary laws and regulations. While most well fields are situated far from sources of pollution, emergency wells within the city, especially in Al-Mazra›a directorate, may be at risk of contamination due to the lack of sewage network services.

The water quality, particularly in terms of suitability for drinking, is generally reported as unsatisfactory (with an 85% rate of non-suitability). However, for domestic use, the water is considered suitable. There is no current plan to address the decline in water quality, and some well sites face exposure to floods, albeit at a low rate (4%). Regular maintenance of wells occurs, dependent on support from donor organizations, as the institution lacks the necessary equipment due to the impacts of the ongoing war.

Water resource management

Key findings include conflicts over wells due to military and non-lawful entities, the absence of a regulatory body, lack of legally binding allocation procedures, robust coordination with the General Authority for Water Resources, no community participation in basin management, private wells as water sources for service providers, and no other sectors benefiting from current water sources. This snapshot provides insights into the challenges and opportunities in water resources management in the region.

7.1.4 Non-Revenue Water

Water consumption service areas data

There was considerable change in the water production during the assessed years which increased by 70 %, but the impact of crisis is not considerable on the consumption per capita per day which increase from 4.9 to 9.6 lpcd, which is too low compared to the average consumption in Yemen with 49 lpcd, the supply situation in Ta›izz is relatively acceptable.

However, the table below shows water balance for the years (2017-2022).

Description	2017	2018	2019	2020	2021	2022
water production(/year)	307,839	539,771	764,341	653,495	692,695	1,052,602
water supplied by distribution points or cisterns m3	0	0	43,063	134,710	141,822	163,400
Water supplied by water transport trucks (operated by the private sector.»	61,200	70,430	75,360	89,000	100,800	100,800
water consumption (m^3/ year) (billing)	N/A	N/A	N/A	N/A	N/A	N/A
Nos of connection	52,308	52,367	52,629	52,660	52,697	52,789
Nos. of supplied population	173,820	185,320	387,281	422,499	349,300	505,987
water consumption lpcd	4.9	8.1	8.0	7.1	8.9	9.6
NRW in m^3/year	N/A	N/A	N/A	N/A	N/A	N/A
% of total water losses	N/A	N/A	N/A	N/A	N/A	N/A

Table 7.5: Water balance for the years (2017-2022)

7.2 Sanitation system

7.2.1 General data of the wastewater system, sewer network

In 2022, from the 775,048 residents in LC Ta›izz, about 81 % respective Ta›izz people are served through the public sewer network and the institution do not have available data for whom served by other providers. More details are provided in Table 7.8-

Description / Facility	unit	2017	2018	2019	2020	2021	2022
Total Population	No.	698,594	714,315	729,037	744,062	759,397	775,048
Population served by the institution/ branch	No.	252,520	368,320	410,920	488,920	557,560	630,210
Total area covered by the services provided by the institution/branch	Km^2	480	480	480	480	480	480
Total area served by the institution/ branch	Km^2	80	120	150	170	200	230
Average number of people in water connections	No.	10.5	10.5	10.5	10.5	10.5	10.5
Total population served by other service providers	No.	N/A	N/A	N/A	N/A	N/A	N/A
Area served by other service providers	Km^2	18	18	19	10	21	22
Number of connections served by the institution/branch through the sewage network	No.	42,752	42,752	44,752	45,650	46,750	48,750
Number of connections served by the institution/branch through septic tank trucks (whitats)	No.	N/A	N/A	N/A	N/A	N/A	N/A

Number of connections served by the institution/branch through digestion tanks (septic tanks)	No.	8,220	8,220	8,220	9,560	9,930	9,930
Type of Sewer Collection and Transport System	System	oxidation basins	oxidation basins	oxidation basins	oxidation basins	oxidation basins	oxidation basins
Total Length of Sewer Network	m	241,000	241,000	254,000	269,000	279,000	290,000
Length of Gravity Sewer Network	m	238,000	238,000	251,000	266,000	276,000	287,000
Length of Main Sewer Pipes (Pressurized Pipes)	m	N/A	N/A	N/A	N/A	N/A	N/A
Total Number of Sewage Treatment Plants	count	1	1	1	1	1	1
Total Number of Sewage Pumping Stations	count	1	1	1	1	1	1
Number of Main Flow Meter Installed in Sewer Network and Treatment Plants	count	NA	NA	NA	NA	NA	NA
Nominal Capacity of Sewage Pumping Stations	m^3/day	2,000	2,000	2,000	2,000	2,000	2,000
Current Capacity of Sewage Pumping Stations	m^3/day	2,000	2,000	2,000	2,000	2,000	2,000
Number of Manholes in Sewer Collection and Transport System	count						
Total Design Flow Capacity for Daily Wastewater Entering All Sewage Treatment Plants	m^3/day	17,000	17,000	17,000	17,000	17,000	17,000
Quantity of Current Wastewater (Actual) at the Inlet of All Sewage Treatment Plants	m^3/day	NA	NA	NA	NA	NA	NA
Number of Analysis Tanks (Anaerobic), Inspection Tanks, etc. per Area if Available	count	NA	NA	NA	NA	NA	NA
Quantity of Wastewater and Sludge from Other Systems at Sewage Treatment Plants	m^3/day	NA	NA	NA	NA	NA	NA
Number of Primary Treatment Tanks (in Hospitals, Slaughterhouses, Factories, Laboratories, etc.), if Available	count	NA	NA	NA	NA	NA	NA
If There Are No Safe Systems for Disposal and Treatment of Wastewater, How Is Wastewater Collected and Disposed?	Not Applicable	NA	NA	NA	NA	NA	NA
Total Number of Requests for Pumping and Emptying Sewage from Other Systems, e.g., Pits and Anaerobic Tanks	count	NA	NA	NA	NA	NA	NA
Percentage of Wastewater Treated Properly from the Total Treated Wastewater Quantity	%	NA	NA	NA	NA	NA	NA

Table 7.6: General data of the sewerage system

Here is the sewer collection and transmission network information in LC Ta›izz:

Components of Sewage Network	Sewage System	Collection Lines / Transmission Lines	Installation Date	Installation Area	Diameter	Material	Quantity	Operational Status	Current Status
Concrete pipes and stone manholes and chambers	Separate	Collection/ Transmission Lines	1970	Old City, Jamal Street, Al-Musalla, Republican, Jahmaliyah, Al-Harish, Al-Ajinnat	600, 500, 400, 300, 250, 200, 160	Reinforced Concrete		Partially Operational	Deteriorated
Stone manholes and stone chambers	Separate	Collection/ Transmission Lines	1970	Old City, Jamal Street, Al-Musalla, Republican, Jahmaliyah	500, 600, 800	Stones		Partially Operational	Deteriorated
Ductile iron pipes, concrete manholes, and block inspection chambers	Separate	Collection/ Transmission Lines	1987	Al-Thawra, Al-Jahmaliyah, Al-Kawthar, Al-Darb, Joulah Sinnan	300, 400	Cement-lined Ductile Iron		Operational	Intact
Plastic pipes, concrete manholes, block inspection chambers, and concrete inspection chambers	Separate	Collection/ Transmission Lines	1995	All remaining neighborhoods in the Muzaffar and Cairo directorates	600, 500, 400, 300, 250, 200, 160	UPVC Plastic		Operational	Intact

Table 7.7: Sewer network components

Components of sewage treatment plant

Statement	Current Status	Operational Status	Operational Problems/ Failures	Reasons for Stoppage/Damage
Sewage Discharge Unit from Suction Pipes	5	4	Destroyed due to war	Components malfunctioning
Balance Tank	5	4	Destroyed due to war	Components malfunctioning
Inlet Pump Station	5	4	Destroyed due to war	Components malfunctioning
Intermediate Pump Station	5	4	Destroyed due to war	Components malfunctioning
Coarse Screens (Large Openings)	5	4	Destroyed due to war	Components malfunctioning
Fine Screens (Small Openings)	5	4	Destroyed due to war	Components malfunctioning
Sand Trap Channel	5	4	Destroyed due to war	Components malfunctioning
Flow Measurement Unit	5	4	Destroyed due to war	Components malfunctioning
Primary Sedimentation Tanks	5	4	Destroyed due to war	Components malfunctioning
Distribution and Mixing Chambers between Treatment Stages	5	4	Destroyed due to war	Components malfunctioning
Aeration Tanks	5	4	Destroyed due to war	Components malfunctioning
Secondary Sedimentation Tanks	5	4	Destroyed due to war	Components malfunctioning
Return Sludge Pump Station	5	4	Destroyed due to war	Components malfunctioning
Excess Sludge Pump Station	5	4	Destroyed due to war	Components malfunctioning
Sludge Storage Tanks	5	4	Destroyed due to war	Components malfunctioning
Sludge Thickening and Dewatering Unit	5	4	Destroyed due to war	Components malfunctioning
Anaerobic Sludge Digesters	5	4	Destroyed due to war	Components malfunctioning
Digested Sludge Pump Station	5	4	Destroyed due to war	Components malfunctioning
Water Separation from Sludge Unit	5	4	Destroyed due to war	Components malfunctioning
Biological Gas Treatment Units	5	4	Destroyed due to war	Components malfunctioning
Biogas Storage Units	5	4	Destroyed due to war	Components malfunctioning
Biogas Flaring	5	4	Destroyed due to war	Components malfunctioning
Sludge Drying Beds	5	4	Destroyed due to war	Components malfunctioning

Sterilization Unit	5	4	Destroyed due to war	Components malfunctioning
Preparation and Chemical Dosing Equipment	5	4	Destroyed due to war	Components malfunctioning
Final Treatment for Reuse of Plant Outputs (Note the type of treatment in the Notes column)	5	4	Destroyed due to war	Components malfunctioning
Extensions and Side Drainage Attachments outside the Station	5	4	Destroyed due to war	Components malfunctioning
Pipeline Extensions at the Station›s Inlet and Outlet, Between Distribution Rooms, Tanks, and Basins	5	4	Destroyed due to war	Components malfunctioning
Odor Treatment Unit	5	4	Destroyed due to war	Components malfunctioning
Other (Please add additional lines for any other components)	5	4	Destroyed due to war	Components malfunctioning

Table 7.8: Sewage treatment plant components

7.2.2 Sewage treatment plants and design standards

The station is located in the Al-Burayhi Area on Street 60 (outside the city and under Houthi control). Unfortunately, specific details such as available land area, construction date, total construction cost, funding entity, and operation start date are not available in the provided data.

The station comprises three treatment stages, utilizing the main technology of biological treatment. Information regarding the efficiency upgrade date is also not provided. Average daily flow is 9,000 m3/day, specific values are not available for many parameters, including organic load, population served, and various water quality parameters at both the inlet and outlet of the station.

There is absence of information regarding the design criteria for oxygen demand, chemical oxygen demand, suspended solids, ammonia content, nitrogen compounds, and phosphorus content. Additionally, details such as seasonal temperature design, water disinfection method, and national/international standards for treated sewage water are also lacking.

Concerning the disposal of treated sewage water, the data indicates that it is not discharged into the sea, springs or water ponds, basins or tanks, wetlands, or soil. However, it is noted that the treated sewage water is utilized for agricultural purposes and is not used for burial or disposed of in waste dumps.

Electro-Mechanical Units/Facilities for the Sewage System

The sewage pumping station is located in Wadi Al-Qadi - Al-Hajari, is a lifting station, established in the year 2000, equipped with 2 pumps, a capacity of 2000 cubic meters per day, and powered by diesel generator.

The sewage pumping station, featuring a pump identified as «ZUG OC100F 45/2AW 230.» The pump is of submersible type, with a model manufactured in 2018 by ZENIT. It has been in service since 2021, demonstrating a current productivity of 150.9 m^3/h and operating at a total lift of 25 meters. The pump is reported to be in good condition and is performing excellently.

Operation management of a sewage treatment station

No information as the station is located outside the city under the control of the rebels.

7.3 Operation and Maintenance

7.3.1 Operation and Maintenance (O&M) management

Water Supply Operations Management:

- Production Plan:
  - A production plan based on demand management policy and actual needs is in place.
- Plan Adherence:
  - The specified procedure in the water production plan is followed.
- Control and Monitoring:
  - Procedures exist for controlling and monitoring the operation of the water production and distribution system based on the prepared plan.
- Documentation System:
  - There is a documentation system for the operation of machines and equipment.
  - Documentation is done through both manual records and an automated system.
- Automated Systems:
  - While there are no automated systems (e.g., SCADA), historical operation records exist for all important equipment.
- Qualified Staff:
  - There is a need for additional qualified staff to cover various sites and facilities for water production and distribution.
- Challenges Faced by Operations Team:
  - Aging assets, equipment, and machines requiring replacement.
  - Shortage of water sources due to stoppage in conflict areas.

- High water losses from fractures, leaks, and meter theft.
- Emptying of institution›s warehouses due to attacks and looting.
- Urgent need to recover distribution zone systems and reconsider network pressures.

- Recommendations for Improvement:
  - Neutralize sites and facilities from conflict locations.
  - Provide more intensive training programs, especially in technical aspects and modern technologies.
  - Support the institution with required operational expenses for maintenance and continuous operation.
- Overall Status:
  - Despite challenges, the system is operational with adherence to the production plan, manual and automated documentation, and an acknowledgment of the need for improvements and support.

Water Supply Maintenance Management:

- Maintenance Plan:
  - A documented and comprehensive maintenance plan for all electro-mechanical equipment and assets used in water production and distribution is available.
  - The latest plan is attached as B.5.2-1.
- Qualified Maintenance Staff:
  - Adequate qualified staff is available for executing various maintenance operations required for equipment and machines used in water production and distribution.
- Maintenance Workshop:
  - There is no dedicated maintenance workshop for the water system due to looting and destruction of technical workshop components.
- Workshop Equipment:
  - The workshop lacks all necessary tools, devices for inspection and measurement, and materials for maintenance due to looting and destruction.
- Documentation and Archives:
  - Maintenance archives contain technical drawings, operation and maintenance documents, and equipment manuals in both paper and electronic formats.
- Manufacturer Recommendations:
  - Preventive maintenance recommendations from manufacturers are implemented for at least the main equipment in the water system.
- Coding and Numbering System:
  - There is a coding and numbering system for machines and equipment.
  - Each machine or equipment has a dedicated card with all its basic data, and there is a daily record of updates on these machines.
- Maintenance Archives:
  - There is a system for archiving various maintenance operations (emergency and preventive) for machines and equipment used in water production and distribution.
  - Daily records are maintained for all updates on these machines and their operational history.
- Emergency Maintenance Timeframe:
  - The average time to fulfill requirements for emergency maintenance related to the water system is 1 to 6 months.
  - Challenges include financial constraints, lack of operational revenue, and dependence on external organizations for funding.
- Preventive Maintenance Timing:
  - Preventive maintenance related to the water system is not carried out on schedule.
  - Recommendations include the need for spare parts, rehabilitation of the technical workshop, and the establishment of mobile field maintenance workshops.
- Quality and Efficiency:
  - Maintenance operations in the water system adhere to quality, efficiency, and effectiveness standards.
- Safety Measures:
  - Materials, equipment, and safety tools are not available for workers in the water system.
  - Detailed quantities and specifications for required safety tools are provided for external support.
- Adherence to Safety Rules:
  - Safety rules and instructions are partially considered during maintenance due to inadequate availability of safety requirements.
- Challenges for Maintenance Team:
  - Challenges faced by the maintenance team include the need for spare parts, rehabilitation of the technical workshop, provision of mobile field maintenance workshops, supply of safety tools, and cash incentive programs for work.

Overall Status:

- Despite challenges such as the lack of a dedicated maintenance workshop and missing equipment, the maintenance plan is being followed. The availability of qualified staff and adherence to preventive maintenance recommendations contributes to the overall operational status. Continuous improvement can be achieved by rebuilding the workshop, restocking necessary tools, and enhancing preventive maintenance practices.

Sewage System Operation Management:

- Sewage Collection and Transport Plan:
  - There is a plan for collecting and transporting sewage based on a practical assessment.
- Adherence to Collection and Transport Plan:
  - The procedures outlined in the sewage collection and transport plan are followed.
  - No issues were reported regarding compliance.
- Monitoring and Control Procedures:

- There are procedures for monitoring and controlling the operation of the sewage collection and transport system.
- No issues were reported, and operational shortcomings are addressed.

- Documentation of Operation Processes:
  - There is a documentation system for the operation of machines and equipment used in sewage collection and transport.
  - Both manual records and automated systems are available.
- Automated Control Systems:
  - Automated systems, such as SCADA, are not utilized for controlling sewage collection and transport machinery.
- Qualified Staff for Operation:
  - Sufficiently qualified staff is available for the operation and management of sewage collection and transport machinery.
- Challenges for Operations Team:
  - Challenges faced by the operations team include the need for:
  - Sewer suction equipment (suction and discharge).
  - Manhole covers (heavy, medium, light) as per specifications.
  - Drain cleaning tools and opening sewer lines.
  - Transportation for workers and maintenance equipment.
  - Training programs on modern systems and equipment used in sewage networks.

Sewage System Maintenance Management:

- Documented Maintenance Plan:
  - There is a documented and comprehensive maintenance plan for all equipment and machinery in the sewage collection and transport network.
- Qualified Maintenance Staff:
  - There is a sufficiently qualified staff to execute various maintenance operations for the equipment and machinery used in the sewage system.
- Dedicated Maintenance Workshop:
  - There is a partially dedicated maintenance workshop for the sewage collection and transport network.
- Equipment and Tools in Maintenance Workshop:
  - The workshop is not fully equipped with all necessary tools, equipment, inspection devices, and materials for sewage system maintenance.
  - The organization needs support in providing various items, including sewer suction equipment, manhole covers, UPVC pipes, drain cleaning tools, transportation, and training programs.
- Technical Drawings and Documentation:
  - Technical drawings, operation manuals, and maintenance guides for equipment and machinery in the sewage system are available in both paper and electronic formats.
- Manufacturer Recommendations:
  - Manufacturer recommendations related to preventive maintenance are implemented for major equipment in the sewage collection and transport system.
- Coding and Numbering System:
  - There is a coding and numbering system for machinery and equipment in the sewage system.
  - Each piece of equipment has a dedicated card with all relevant data.
- Maintenance Archive:
  - An archive system exists for various maintenance operations (emergency and preventive), utilizing both manual records and automated systems.
- Emergency Maintenance Timeframe:
  - The average time to provide requirements for emergency maintenance operations related to sewage collection and transport is 1-3 days.
- Adherence to Preventive Maintenance:
  - Preventive maintenance for sewage collection and transport operations is partially implemented.
- Quality Standards Adherence:
  - Quality, effectiveness, and efficiency standards are considered during sewage system maintenance operations.
- Safety Equipment Availability:
  - Safety equipment is not fully available for workers in sewage collection and transport operations, primarily due to a lack of support from most organizations.
- Adherence to Safety Regulations:
  - Adherence to occupational safety rules during maintenance work is partially implemented due to insufficient availability of necessary items.
- Challenges for Maintenance Team:
  - Challenges faced by the maintenance team include the need for spare parts, additional mobile maintenance workshops, safety tools, cash programs for work, and transportation for workers and maintenance equipment.

Operation and Maintenance Management - Stormwater Drainage System

The institution faces significant challenges in managing rainwater within its sewage system. Without a shared network for sewage and rainwater drainage, there is a lack of structures capable of handling rainwater flow and no design consideration for the capacity of the sewage treatment plant to accommodate rainwater. Consequently, heavy rainfall during seasons is deemed disastrous for the water and sewage infrastructure. Challenges include blockages in sewage lines due to debris carried by rainwater, leading to increased overflow rates post-rainfall. Unfortunately, the organization lacks effective mechanisms and procedures to address the impact of rainwater flooding on the sewage system, and the negative effects extend to sewage treatment operations, causing

blockages and frequent collapses in older cement and narrow sewage lines. Additionally, there are no efforts to participate in solving flood-related issues resulting from heavy rainfall in urban areas, and the absence of regulations or guidelines for rainwater management further compounds the challenges. The responsibility for managing and maintaining rainwater drainage infrastructure falls on governmental entities, such as the Public Works and Roads Office, Municipal Office, and Local Authority Departments, introducing complexities in collaboration. Overall, the organization grapples with multifaceted difficulties in effectively managing rainwater within its sewage system.

An Inventory of heavy machinery, transportation, and logistic support for the operation and maintenance of water supplies and sewage systems requirements is provided in Appendix A-4.

7.4 Energy Supply

7.4.1 General information and data on energy sources for water supply system

Statement	Unit	2017	2018	2019	2020	2021	2022
Number of pumps installed for the water supply system (groundwater and surface wells, water sources from springs, pumping stations, water treatment and disinfection units).	Number	22	22	22	23	28	28
Total power of electric pumps installed for the water supply system (groundwater and surface wells, water sources from springs, pumping stations, water treatment and disinfection units).	Kilowatts	2127	2127	2127	2127	2162	2162
Total electricity consumption for the water supply system (groundwater and surface wells, water sources from springs, pumping stations, water treatment and disinfection units).	Kilowatt-hours	NA	NA	NA	NA	605	716
Total number of generators installed for the water supply system (groundwater and surface wells, water sources from springs, pumping stations, water treatment and disinfection units).	Number	22	22	22	23	28	28
Total capacity of generators installed for the water supply system (groundwater and surface wells, water sources from springs, pumping stations, water treatment and disinfection units).	Kilovolt-Amperes	2260	2260	2710	2710	3730	3630
Number of generators operating for the water supply system (groundwater and surface wells, water sources from springs, pumping stations, water treatment and disinfection units).	Number	22	22	22	23	28	28
Compound capacity of operational generators for the water supply system (wells, surface sources, springs, lifting stations, water disinfection and treatment units)	Kilo Volt-Ampere	2260	2260	2710	2710	3730	3630
Number of hours the operational generators for the water supply system run	Hours	16547	29628	49172	45352	40339	51740
Total electrical energy produced by the institution/branch›s generators for the water supply system	Kilo Watt-Hours	No data	No data	No data	No data	No data	No data
Quantity of diesel consumed by the operational generators for the water supply system	Liters	147,142	353,356	525,009	520,152	556,820	743,920
Total cost of diesel consumed for generators for the water supply system	Riyals	60,328,220	144,875,960	162,752,635	161,247,120	295,671,420	737,968,640
Number of solar energy systems for the water supply system (wells, surface sources, springs, lifting stations, water disinfection and treatment units)	Number	0	0	3	3	4	7
Total capacity of solar energy systems for the water supply system (wells, surface sources, springs, lifting stations, water disinfection and treatment units)	Kilo Watts	0	0	133	133	178	242
Number of hours the solar energy systems for the water supply system run	Hours	0	0	8640	8640	11520	20160
Total electrical energy produced by solar energy systems for the institution/ branch for the water supply system	Kilo Watt-Hours	0	0	20667	20667	30553	41333
Total number of electrical transformers for the water supply system	Number	1	1	1	1	1	1
Total electrical energy supplied from the general grid to operate the water supply system	Kilo Watt-Hours	0	0	0	0	0	0
Cost of electrical energy supplied from the general grid to operate the water supply system	Riyals	0	0	0	0	0	0
Electrical energy purchased from the private sector for the water supply system	Kilo Watt-Hours	0	0	0	0	0	0
Cost of electrical energy purchased from the private sector for the water supply system	Riyals	0	0	0	0	0	0

Table 7.9: Electrical power of water supply system

7.4.3 General information and data on energy sources for sanitation system

Statement	Unit	2017	2018	2019	2020	2021	2022
Number of Electric Motors and Pumps Installed in the Sewage Collection and Treatment System	Number	NA	NA	NA	NA	NA	NA
Total Power of Electric Motors Installed in the Sewage Collection and Treatment System	Kilowatts	NA	NA	NA	NA	NA	NA
Total Electric Power Requirement for All Sewage Collection and Treatment Systems	Kilowatt-hours	NA	NA	NA	NA	NA	NA
Total Number of Generators Installed in the Sewage Collection and Treatment System	Number	NA	NA	NA	NA	NA	NA
Total Capacity of Generators Installed in the Sewage Collection and Treatment System	Kilovolt Amperes	NA	NA	NA	NA	NA	NA
Number of Operating Generators in the Sewage Collection and Treatment System	Number	NA	NA	NA	NA	NA	NA
Capacity of Operating Generators Installed in the Sewage Collection and Treatment System	Kilovolt Amperes	NA	NA	NA	NA	NA	NA
Number of Operating Hours of Generators in the Sewage Collection and Treatment System	Hours	NA	NA	NA	NA	NA	NA
Total Electric Power Produced by Generators for Sewage Collection and Treatment System	Kilowatt-hours	NA	NA	NA	NA	NA	NA
Quantity of Diesel Consumed by Operating Generators for Sewage Collection and Treatment System	Liters	NA	NA	NA	NA	NA	NA
Total Cost of Diesel Consumed by Generators for Sewage Collection and Treatment System	Riyals	NA	NA	NA	NA	NA	NA
Number of Solar Power Systems for Sewage Collection and Treatment System	Number	NA	NA	NA	NA	NA	NA

Table 7.10: Electrical power of sanitation system

Energy Sources for Water and Sanitation Systems - Electrical Transformers

Facility Name/Entity or Unit Name	Facility Type (Water/ Sanitation)	Electrical Transformer Code/Number	Input Voltage (Volts)	Output Voltage (Volts)	Transformer Capacity (Kilovolt-Amperes)	Total Equipment Load Capacity through Transformer (Kilowatts)	Current Status	Performance Level	Reasons for Out-of-Service Equipment
Electrical Transformer 500 kVA	Main Pumping Station	OIL2353036	11kV	400V	500kVA	396	Partially destroyed/ Faulty	Weak with frequent malfunctions	Transformer damage due to falling shells

Table 7.11: Electrical transformers data

Diesel generators

Facility Name/Entity or Unit Name	Facility Type (Water/Sanitation)	Generator Code/Number	Generator Type (Main/Backup)	Service Duration/Operating Date	Model	Manufacturer	Generator Capacity (Kilovolt-Amperes)	Equipment or Units Loaded on Generator	Total Equipment Load Capacity through Generator (Kilowatts)	Current Status	Performance Level	Reasons for Out-of-Service Equipment
Algeser Borehole	1	Perkins, U621533A, EUROPE	Main	Since 2016, worked for over 17,200 hours	Perkins, U621533A, EUROPE	Perkins	100	Submersible electric pump with motor + Operation room lighting	30	Deteriorated	Frequently Malfunctioning	Generator needs replacement or complete refurbishment as it has exceeded the expected operating hours, and the borehole is recently stopped due to diesel support cessation
Gamal Street Borehole	1	Perkins, U618346A, EUROPE	Main	Since 2016, worked for over 17,500 hours	Perkins, U618346A, EUROPE	Perkins	100	Submersible electric pump with motor + Operation room lighting	30	Deteriorated	Frequently Malfunctioning	Generator needs replacement or complete refurbishment as it has exceeded the expected operating hours, and the borehole is recently stopped due to diesel support cessation
Al-Montazah Borehole	1	Perkins, U607228Y, EUROPE	Main	Since 2016, worked for over 22,725 hours	Perkins, U607228Y, EUROPE	Perkins	80	Submersible electric pump with motor + Operation room lighting	15	Deteriorated	Frequently Malfunctioning	Generator needs replacement or complete refurbishment as it has exceeded the expected operating hours, and the borehole is recently stopped due to diesel support cessation
Shab-Saleet Borehole	1	Perkins, U498744C, EUROPE	Main	Since 2020, worked for over 7,070 hours	Perkins, U498744C, EUROPE	Perkins	100	Submersible electric pump with motor + Operation room lighting	18	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Shagarah Borehole	1	Perkins, U521352D, China	Main	Since 2020, worked for over 4,000 hours	Perkins, U521352D, China	Perkins	60	Submersible electric pump with motor + Operation room lighting	20	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Hosseinieh Borehole	1	Perkins, U453742A, EUROPE	Main	Since 2016, worked for over 17,550 hours	Perkins, U453742A, EUROPE	Perkins	60	Submersible electric pump with motor + Operation room lighting	20	Deteriorated	Frequently Malfunctioning	Generator needs replacement or complete refurbishment as it has exceeded the expected operating hours, and the borehole is recently stopped due to diesel support cessation
Al-Berarh Borehole	1	Perkins, U619176A, EUROPE	Main	Since 2020, worked for over 3,550 hours	Perkins, U619176A, EUROPE	Perkins	100	Submersible electric pump with motor + Operation room lighting	30	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation

Al-Dohrah Borehole	1	Perkins, U652208C, EUROPE	Main	Since 2018, worked for over 11,320 hours	Perkins, U652208C, EUROPE	Perkins	90	Submersible electric pump with motor + Operation room lighting	25	Deteriorated	Good	Generator needs replacement or complete refurbishment as it has exceeded the expected operating hours, and the borehole is recently stopped due to diesel support cessation
East of Amed Borehole	1	Perkins, U607558Y, EUROPE	Main	Since 2020, worked for over 6,700 hours	Perkins, U607558Y, EUROPE	Perkins	100	Submersible electric pump with motor + Operation room lighting	30	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
West Amed Borehole	1	Perkins, U618968A, EUROPE	Main	Since 2018, worked for over 12,120 hours	Perkins, U618968A, EUROPE	Perkins	100	Submersible electric pump with motor + Operation room lighting	30	Deteriorated	Frequently Malfunctioning	Generator needs replacement or complete refurbishment as it has exceeded the expected operating hours, and the borehole is recently stopped due to diesel support cessation
Al-Goshash Borehole	1	Volvo, TAD 531 GE, EUROPE	Main	Since 2019, worked for over 8,160 hours	Volvo, TAD 531 GE, EUROPE	Volvo	90	Submersible electric pump with motor + Operation room lighting	25	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Corporation Borehole	1	Perkins, U697028F, EUROPE	Main	Since 2020, worked for over 2,250 hours	Perkins, U697028F, EUROPE	Perkins	88	Submersible electric pump with motor + Operation room lighting	25	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Thabaat Borehole	1	Perkins, U685487E, EUROPE2	Main	Since 2020, worked for over 6,350 hours	Perkins, U685487E, EUROPE2	Perkins	100	Submersible electric pump with motor	30	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Alharazia Borehole	1	Perkins, U610105A, EUROPE2	Main	Since 2020, worked for over 5,780 hours	Perkins, U610105A, EUROPE2	Perkins	80	Submersible electric pump with motor	15	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Generator of Sinah Boreholes	1	Volvo, TAD 734 GE, EUROPE2	Main	Since 2020, worked for over 4,860 hours	Volvo, TAD 734 GE, EUROPE2	Volvo	312.5	Submersible electric pump with motor	45	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Atiya & Al-Moasel	1	DOOSAN, P158LE-2, Korea	Main	Since 2018, worked for over 9,400 hours	DOOSAN, P158LE-2, Korea	DOOSAN	200	Submersible electric pump with motor	40	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation

Algomhory Hospital Borehole	1	Volvo, TAD 531GE, EUROPE	Main	Since 2021, worked for over 1,400 hours	Volvo, TAD 531GE, EUROPE	Volvo	90	Submersible electric pump with motor	18	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Wadi El Madam Borehole	1	MASONS (Perkins) RJ51175*U720519H Spain	Main	Since 2022, worked for over 540 hours	MASONS (Perkins) RJ51175*U720519H Spain	MASONS	110	Submersible electric pump with motor	30	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Dar Al Nakhlah Borehole	1	MASONS (Perkins) RJ51175*U720521H Spain	Main	Since 2022, worked for over 230 hours	MASONS (Perkins) RJ51175*U720521H Spain	MASONS	110	Submersible electric pump with motor	18	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Hajree Borehole	1	MASONS (Perkins) RJ51175*U720525H Spain	Main	Since 2021, worked for over 560 hours	MASONS (Perkins) RJ51175*U720525H Spain	MASONS	110	Submersible electric pump with motor	30	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Daboaa Borehole	1	JP (Perkins) RJ51175*U716368H UAE	Main	Since 2022, worked for over 130 hours	JP (Perkins) RJ51175*U716368H UAE	Perkins	100	Submersible electric pump with motor	30	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Jodiry Borehole	1	Perkins, U595712Y, EUROPE	Main	Since 2022, worked for over 91 hours	Perkins, U595712Y, EUROPE	Perkins	80	Submersible electric pump with motor	25	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Swani Borehole	1	JP (Perkins) RJ51175*U72551H UAE	Main	Since 2022, worked for over 340 hours	JP (Perkins) RJ51175*U72551H UAE	Perkins	100	Submersible electric pump with motor	30	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Salamy Borehole	1	MASONS (Perkins) RJ51175*U719018H Spain	Main	Since 2022, worked for over 215 hours	MASONS (Perkins) RJ51175*U719018H Spain	Perkins	110	Submersible electric pump with motor	30	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Noor City Borehole	1	Perkins, U6559396, EUROPE	Main	Since 2019, worked for over 380 hours	Perkins, U6559396, EUROPE	Perkins	100	Submersible electric pump with motor	30	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation

Al-Dabab Boreholes Generator	1	Perkins, Zwart, 104270, EUROPE	Main	Since 2022, worked for over 205 hours	Perkins, Zwart, 104270, EUROPE	Perkins	312.5	Submersible electric pump with motor	75	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
TWSLC Main Yard Pumping Station	4	Perkins, JGB063002 U5698P, EUROPE	Main	Since 2018, worked for over 3,710 hours	Perkins, JGB063002 U5698P, EUROPE	Perkins	562.5	Centrifugal pumps, 4 pumps + Lighting for operation buildings + Administration buildings	686	Good	Good	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
University Pumping Station	4	Volvo, TAD1342GE, EUROPE	Main	Since 2021, worked for over 790 hours	Volvo, TAD1342GE, EUROPE	Volvo	400	Centrifugal pumps, 3 pumps + Lighting for operation buildings + Administration buildings	462	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Thabaat Pumping Station	4	Perkins, MGAF8030N13587F, EUROPE	Main	Since 2021, worked for over 280 hours	Perkins, MGAF8030N13587F, EUROPE	Perkins	450	Centrifugal pumps, 2 pumps + Lighting for operation buildings + Administration buildings	396	Excellent	Excellent	Generator needs support with spare parts for filters, oils, batteries, etc., and the borehole is recently stopped due to diesel support cessation
Al-Mojalia Pump Station	4	Perkins, U003886F, EUROPE	Main	Since 2022, worked for over 60 hours	Perkins, U003886F, EUROPE	Perkins	250	Centrifugal pumps, 2 pumps + Lighting for operation buildings + Administration buildings	200	Excellent	Excellent	
Sewer Re-pumping Station	6	Perkins, U070916E, EUROPE	Main	Since 2020, worked for over 2,890 hours	Perkins, U070916E, EUROPE	Perkins	150	Sewer lifting pumps, 2 pumps + Lighting for operation buildings	90	Excellent	Excellent	

Table 7.12: Diesel generators data

Solar system

Facility/Unit Name	Facility Type (Water/ Sanitation)	Solar Energy System Code	Solar Energy System Type (Single Source/ Works with Another Source)	Service Duration/ Operation Date	Total Solar Energy System Capacity (kW)	Total Equipment Load Capacity Using Solar Energy (kW)	Number of Broken Panels	Current Condition	Performance Level
Shuɯb Salit Well	Ground Wells	1	Works with solar system in the morning and a generator in the evening	2019	51	18.5	8	Good	Good
Al-Muntazah Well	Ground Wells	2	Works with solar system in the morning and a generator in the evening	2019	33	22	16	Good	Good
Dar Al-Nakhla Well	Ground Wells	3	Works with solar system in the morning and a generator in the evening	2019	49	37	12	Good	Good
West Sina and Al-Janat Wells	Ground Wells	4	Works with solar system in the morning and a generator in the evening	2022	35	15	9	Good	Good
Republican Hospital Well	Ground Wells	5	Works with solar system in the morning and a generator in the evening	2021	45	37	0	Good	Good

Al-Harazia Well	Ground Wells	6	Works with solar system in the morning and a generator in the evening	2023	15	11	3	Good	Good
Al-Hajri School Well	Ground Wells	7	Works with solar system in the morning and a generator in the evening	2023	55.5	37	0	Good	Good
Wadi Al-Salami Well	Ground Wells	8	Works with solar system in the morning and a generator in the evening	2023	40	30	0	Good	Good

Table 7.13: Solar system data

7.4.4 Operational data of the LC energy generation station

The operational data for diesel generators linked to water and sanitation facilities reveals notable points:

- The operational data for diesel generators at various water and sanitation facilities spans the years 2020, 2021, and 2022.
- Generators, such as those at Algeser Borehole, Gamal Street Borehole, and Al-Montazah Borehole, show variations in operating hours, water pumped quantity, and diesel consumption. For example, Algeser Borehole›s generator (Perkins, U621533A, EUROPE) had 3,521 operating hours in 2020, pumping 32,896 cubic meters of water and consuming 33,515 liters of diesel.
- Thabaat Borehole›s generator (Perkins, U685487E, EUROPE2) experienced 4,326 operating hours in 2020, pumping 45,327 cubic meters of water, and consuming 36,548 liters of diesel.
- There are a diverse range of equipment models (e.g., Perkins, Volvo, DOOSAN) deployed across different boreholes, pumping stations, and water-related facilities.
- There is a contractor station for diesel storage and distribution and water distribution via tanks, with associated quantities like 20,600 liters of diesel and 134,710 cubic meters of water in 2020.

7.4.5 Operational Data for Solar Energy Systems

- The facilities covered include Shab Saleet Well, Al-Montazah Well, Dar Al Nakhlah Well, and West Sinah and Al-Janat Wells, among others.
- Shab Saleet Well had 2,880 operating hours in each of the three years, producing 4,933 kilowatt-hours of energy annually, and pumping 55,987 cubic meters of water each year using solar energy.
- Similarly, other wells like Al-Montazah Well and Dar Al Nakhlah Well show corresponding data for the specified parameters.
- Some wells, like West Sinah and Al-Janat Wells, started operations in 2022, indicating zero values for 2020 and 2021.

7.4.6 Energy consumption data

The table below summarizes the electricity and Diesel consumption for 2022 compared to 2017 situation:

Energy Source	Description	Unit	2017 Quantity	2022 Quantity	Change (%)
Public Electricity Supply	Water Pumped or Treated	m^3	0	0	0
	Total Electricity Consumed	kWh	0	0	0
	Cost of Electricity Consumption	YER	0	0	0
Diesel Generators	Water Pumped or Treated	m^3	307,839	1,216,002	75
	Diesel Consumption	Liters	166,270	796,430	79
	Diesel Cost	YER	68,170,889	790,058,560	91
Private Sector Electricity	Water Pumped or Treated	m^3	0	0	-

Table 7.14: Energy consumption for 2017 and 2022

7.4.6 Quantities of diesel supplied to and consumed from the storage facilities

Description	Unit	2017	2018	2019	2020	2021	2022
Total Diesel Supplied to Storage	Liters	0	0	0	0	0	0
Total Cost of Diesel Supplied to Storage	Riyals	0	0	0	0	0	0
Diesel Purchased from Internal Revenues	Liters	0	0	0	0	0	0
Cost of Self-Purchased Diesel	Riyals	0	0	0	0	0	0
Diesel Supplied with Humanitarian Aid	Liters	0	0	2,956,768	2,850,000	4,909,983	1,750,000
Cost of Humanitarian-Aid Supplied Diesel	Riyals	68,171,110	163,709,720	178,279,140	161,247,120	295,671,420	806,496,000
Fuel withdrawn for water production and distribution	Liters	147,142	353,356	525,009	520,152	556,820	743,920
Diesel withdrawn for sewage transport and treatment	Liters			20,000		9,400	30,510
Diesel expended for the operation and maintenance logistical support equipment and assets		19,128	45,936	30,086	20,600	33,973	22,000

Table 7.15: Quantities of diesel supplied to and consumed from the storage facilities for the years 2017 to 2022

The requirements for improvement and expansion of the needed energy sources for both the water and sanitation systems are illustrated in Appendix A-4.

8. Technical Assessment (TA) and Investment Plans

8.1 Recommendations and Costs for TA Measures (TA Plan)

8.1.1 Methodology and Structure of TA Plan

The assessment on the institutional situation of LC Ta›izz with the water and sanitation condition of selected public institutions led to the conclusions and recommendations summarized in the tables below and the Technical Assistance Plan. The "Shortcomings" in the tables below provide an overview of the identified problems the LC is facing. The "Recommendations" next to the "Shortcomings" explain the proposed measures in order to remedy the problems. For those recommendations where external support is required, reference is made to the respective TA package. The period for the realization of the respective recommended activities is in the "Implementation" column which refers to the urgency criteria outlined in the questionnaires as follows:

- Urgent: no time frame; measures to be implemented as soon as possible
- High: to be implemented within 1-2 years
- Medium: to be implemented within 3-5 years
- Low: to be implemented as long-term planning more than 5 years for development.

The estimated costs for the proposed six TA packages are presented in Table 8.2.

8.1.2 TA measures.

Institutional Assessment and Recommended Technical Assistance Measures (TA Plan) for LC Ta›izz

The identified shortcomings and respective recommendations for post crisis scenario can be summarized as follows.

Department	Obstacles	Recommendations	Implementation
Governance/Management/ Organizational structure/ Resilience	■ There are acknowledged differences between the approved and current structures ■ The institution operates with an old structure ■ Significant portions of departments are currently inactive ■ Commercial management, along with its associated departments and tasks, is nearly halted ■ The main buildings of the institution and its affiliated facilities have been subjected to shelling, attacks, vandalism, looting, and destruction ■ The contents of facilities, including furniture, equipment, office supplies, documents, assets, systems, programs, and databases, suffered extensive damage. ■ Lack of automation and use of modern technology for the flow of administrative procedures and operations	■ A need for a comprehensive evaluation of the institution›s organizational aspects amid challenging circumstances ■ The committee should address immediate institutional needs, particularly related to war-induced challenges, through collaboration with external organizations and donor entities. ■ The institution›s immediate needs involve supervision, review, and providing opinions on plans and work programs ■ Developing information systems and technologies to support the safety of planning and administrative decision-making ■ Establishing a comprehensive and unified documentation system for information and data related to the organization›s activities ■ Internal integration of automated systems implemented in the organization while continuing to develop the enterprise information database ■ Enhancing the computer network to connect the public institution›s buildings equipped with data control and protection systems	■ Urgent ■ High ■ Urgent ■ High ■ Medium ■ High ■ Urgent
Human resource and capacity building management	■ The inability to pay employee salaries and wages ■ More than 50% of the institution›s workforce has been displaced or leaked to other cities outside Ta›izz during the war years ■ Financial constraints prevent the disbursement of salaries and incentives and employee entitlements. ■ Shortage of offices, computers, printers, chairs, occupational safety tools, cars, and motorcycles in the transportation department.	■ Staff return ■ Offering regular training courses and promoting experience exchange ■ Improving internet services and establishing an internal network for the institution ■ Seeking funding for debts overcome	■ Urgent ■ High ■ High ■ Urgent

Finance management	Subscribers completely refraining from paying water bills and outstanding debts since the beginning of the war events in March 2015 The institution›s financial revenues have completely stopped Low staff qualification	Need for extensive repairs and equipment provision Provide a qualified academic staff. Conduct training courses for financial employees. Provide computers, office tools, and other necessary supplies for work execution.	Urgent High High Urgent
Customer service and relation management	■ Subscribers completely refraining from paying water bills and outstanding debts since the beginning of the war events in March 2015 ■ Operating primarily as a humanitarian service provider during the war ■ Evaluation and improvement of the entire billing process, including meter reading, data entry, review, invoice issuance, and distribution. ■ Need for enhancements in the collection process and effective monitoring of various types of debts. ■ Medium priority for enhancing planning and monitoring mechanisms to ensure efficient performance. ■ Urgent need for implementing automation and modern technology in management operations and procedures.	■ Tariff adjustments ■ Network Connection between Centers and Collection Offices ■ Raise the community awareness of the importance of paying the bills for water consumption. ■ Policies and strategies of developing and strengthening the relationship between the LC/AU/Branch and the Consumers ■ Developing automated programs for taking readings. ■ Adding an input program for transfer transactions in the connection department, and training and qualifying department employees on it.	■ High ■ High ■ High ■ High ■ High ■ Medium
Water and Sanitation Service management	■ Status: department is in operation with partial and intermittent work ■ significant number of household meters were damaged or missing due to shrapnel and gunfire ■ Complete lack of support for essential resources like diesel, reliance on alternative energy sources ■ Shortage of equipment, emergency vehicles and assembly parts	■ Field surveys to assess damages and develop a clear action plan for rehabilitation	■ Urgent
IT infrastructure	■ Power sustainability ■ Internet access limitations ■ Vulnerabilities in antivirus protection, power regulation, and data backup practices ■ Lack of the required number of laptops, computers and printers for the IT department and its sections: Programming and Database Section, Maintenance and Networks Section, GIS Section ■ Lack of the required number of chairs and desks for the IT department ■ Lack of network maintenance tools, maintenance and repair toolkit	■ Providing a permanent power source to operate devices and accessories ■ Training courses in the following areas: Oracle Database Management, Oracle Developer 11G, Computer Network Management and Maintenance, Computer Hardware Management and Maintenance, ArcView, ArcMap, AutoCAD. ■ Need for establishing comprehensive antivirus solutions, implementing power stabilization measures ■ Formulating disaster recovery plans to enhance data security and IT system resilience ■ Rehabilitation of the local and external network connecting the institution›s buildings and providing all the requirements for repair and maintenance.	■ Urgent ■ High ■ High ■ High ■ Urgent
Gender perspective	■ Women›s and Public Relations and Awareness Departments are not operational since 2015 ■ There are no regular meetings between women›s management and employees in other departments ■ Women›s management is not involved in planning and updating strategic policies ■ There is no specific budget allocated to women›s management in the institution/branch. ■ No specific complaints office for women beneficiaries ■ No existing mechanisms to ensure women›s participation in leadership positions within the organization	■ Resumed work after recovering main workplaces and initiating repairs ■ Establish an office for the management of women that accommodates its departments, sections, and committees ■ Create partnerships between women›s departments in water institutions nationally and internationally for exchanging experiences and developing work for the benefit of women, the institution, and connecting them to international organizations. ■ Courses in Administrative Development ■ Accounting & Secretarial Courses ■ Technical Courses in (Laboratory - Safety and Occupational Health - Sanitary Engineering) ■ Courses in Gender Studies	■ Urgent ■ Medium ■ Medium ■ High ■ High ■ High ■ Low

Table 8.1: Obstacles and recommendations for institutional measures

8.1.3 Awareness Building

Due to the ongoing crisis, the international donor organizations suspended their support on awareness campaigns. In order to resume the training and education activities on water and sanitation issues, it is important to establish awareness committees. The committee should be formed of a selected group of 15 members to be trained by specialized Consultant who is experience in the preparation of awareness plans and holding of campaigns. The awareness interventions shall be discussed with the LC, the local council and possibly donor organizations involved in such activities.

The campaigns shall be in form of media announcement / publication, distribution of brochures and leaflets and workshop meetings at public institutions. The training and information brochures should cover the following subjects:

- Importance of rain water harvesting
- Water saving in households.
- Considered use of sanitation facilities regarding water saving and pollution.
- Personal hygiene, food and household hygiene, health issues.
- Education of children (for mothers) with regards to hygiene, considered water use, sanitation.
- Safe waste and wastewater disposal.
- Importance of water and sanitation service and related subjects

Individual campaigns shall be held for schools, women and marginalized families with respective visits to inform them on above themes. The committee shall consult the attendees obtain their opinion about the quality of water and sanitation services and how improvements can be achieved. The feedback of such campaigns has to be compiled and discussed with the LC and donor organization.

The performance of this committee shall be observed and evaluated by the Consultant. The impact of the awareness campaigns should be assessed according to the goals set to enable the identification of further additional or amended awareness measures.

8.1.4 Technical Assistance Plan

The required TA support for the LC Ta›izz has been determined based on the outlined recommendations in above section. The respective needs for the improvement of the resilience of the LC have been grouped into the following four individual Technical Assistance Packages:

TA Package 1: Financial Support
TA Package 2: Training Courses
TA Package 3: Office Equipment and IT
TA Package 4: Coaching and Consultancy Services
TA Package 5: Operation Management Support (OMS)
TA Package 6: Public Relation and Awareness

Most of the recommended measures are proposed to be implemented as an integrated package and in parallel to strengthen the LC and increase their resilience within the next one to two years. Less pressing measures, as additional training courses, office/ IT equipment, further coaching and consultancy support, OMS and additional awareness campaigns, can be implemented within the next three to five years. These measures are less urgent but still important for the long-term development of the LC.

The following table summarizes the estimated cost for the TA packages:

Package	TA intervention	Estimated TA cost in USD			
		Urgent	High priority	Medium priority	Low priority
		(0-6 months)	(1 -2 year)	(3-5 years)	(>5 years)
TA1	Financial Support	1,100,000	2,000,000	1,000,000	0
TA2	Training Courses	265,000	235,000	140,000	0
TA3	Office equipment and IT	122,750	0	0	0
TA4	Coaching and Consultancy services	90,000	225,000	100,000	0
TA5	Operation Management Support	90,000	160,000	60,000	0
TA6	Public Relation and Awareness	0	70,000	50,000	15,000
Total TA cost:		1,667,750	2,690,000	1,350,000	15,000

Table 8.2: Cost estimates on TA interventions

The total required amount for the technical assistance measures has been estimated to around USD 1,667,750 for critical priority intervention, USD 2,690,000 for high priority intervention, 1,350,000 for medium priority intervention and USD 15,000 for low priority interventions.

8.2 Prioritized Investment Plan

Infrastructure assessment and recommended rehabilitation measures (Investment Plan) for LC Ta'izz

Domains	Obstacles	Investment measures			
		Urgent (0-6 months)	High priority (1-2 years)	Medium priority (3-5 years)	High priority (>5 years)
Building and Reservoirs	Destruction in the buildings ceiling due to the impact of falling shells + damage to windows and doors + complete looting of all furniture in the building, including desks, chairs, computers, documents, and files Cease of finishing work on the floors due to the outbreak of war and deterioration of the floor Looting and destruction of all furniture, appliances, and equipment by 100% Shelling on the building, causing damage to windows, doors, and walls Occupation of the building for five years and its evacuation by a military brigade Completely destroyed building due to the impact of a missile hitting the building directly, leading to its total destruction along with all its contents, including devices, furniture, documents, and records	Continuation of the restoration, finishing, and furnishing of the third-floor building for the General Administration. Furnishing the building of the General Administration for the institution (basement + first floor + second floor Rehabilitation of the technical workshop building	Rehabilitation of building walls, tile work, windows, doors, concrete ceilings, painting, electrical work + furnishing the building with furniture, devices, and office equipment, rehabilitation of information systems and networks, connecting them to the buildings and systems + a solar power system to operate the building	Rehabilitation of station walls, pump buildings, control and security buildings, gates, windows, tiles, concrete ceilings, concrete tank, yard, electrical work, plumbing work, horizontal pumps - Installation of a solar power system Rehabilitation of the generator rooms and security rooms for the fog field, a total of 9 rooms Replacing deteriorating iron tanks with a new concrete tank with a capacity of 6000 cubic meters	
Water Resource, use and balance	Shortage in water supply Low yield of the wells Safety problems related to wells Insufficient information coming from wells	Drilling a replacement well for the Hussainiya well due to its low production caused by specific issues, and the submersion of large portions of it due to the absence of casing installation to the final depth of the well Cleaning and reactivating (rehabilitating) the wells of the city of Al-Noor and around Al-Shajarah to restore their well-being and resume their previous production capabilities Implementation of projects to connect wells to centralized main storage tanks within the city and changing the pumping system. Preparing the necessary studies to change the course of the water transmission line as part of the seawater desalination project through the Kudhah area	Rehabilitation and implementation of projects for cleaning and reactivating the mentioned wells, including the supply, installation, and replacement of all necessary electromechanical equipment to restore the operation of the wells and integrate them into the production lines	Rehabilitation and implementation of projects for cleaning and reactivating the mentioned wells, including the supply, installation, and replacement of all necessary electromechanical equipment to restore the operation of the wells and integrate them into the production lines	
Water pipelines	Dilapidated water distribution network. Uncompleted rehabilitation of distribution networks	Supplying maintenance tools and equipment for the network Expanding and implementing new water networks for several regions Supply and installation of new meters, valves and replacement of existing ones Rehabilitation of the corroded Ductile water line	Construction Project of a 6000 m3 Concrete Water Collection Tank for Fog and Taloq - China Area Water Network Project - Al Arbaeen Area Implementation of main and sub water lines with different diameters Supply of 10,000 Residential Water Meters	Galvanized Pipes for Home Connections Supply of 10,000 Residential Water Meters	

Water Pumping/ lifting Stations	Insufficient pumping capacity	Supply and installation of several Centrifugal pump with different specifications Submersible electric motor Pumps Electrical transformers Copper connection properties 240mm Ductile Welding Pack	-		
Water sterilization facilities	Lack of water sterilization equipment Lack of measuring kits for residual chlorine.	Supply and installation of new units Replacement of chlorine units with new ones Supply of residual chlorine test devices Supply of necessary safety tools for chlorine disinfection process			
Power generating/ auditing for water & wastewater system	Diesel power generator pumping station out of service and needs rehabilitation. Raise of Diesel prices.	Implementing Integrated system for energy generation (solar energy system) Supply and installation of generators, Diesel Engine Oil, Batteries and inverters with different specifications	Supply of necessary spare parts for overhauling each generator, including pistons, nozzles, bearings, rings, water pumps, oil pumps, sensors, and batteries for the generators Supply and installation of a solar energy system	Supply and installation of a solar energy system to operate the pumping station	Overhaul of the Electrical System
Operation and maintenance process of water infrastructures	Lack of transport vehicles. Lack of repair and maintenance tools for pipe works pump and motor works. Lack of tools and instruments for electrical works. Lack of trench excavation equipment. Lack of water meter maintenance workshop.	Supply and delivery of diesel truck with different volumes Supply of Medium Bobcat Loader Supply of small Carry Pickup Trucks for water network maintenance teams Supply of mobile maintenance workshops (Boxer Panel Van) for wells and water network maintenance Supply of mobile maintenance workshops (Double-cabin) for wells and production fields	Supply and delivery of a mobile crane/hiab crane on a 7-10 ton truck for well maintenance Supply of Medium Bobcat Loader	Supply and delivery of diesel truck with different volumes Supply and delivery of a portable crane/winch on a 50-ton truck for well maintenance	Supply and delivery of diesel truck with different volumes
Wastewater collection/ transportation pipelines	Lack of repair and maintenance tools for pipe works, pump and motor works	Main Sewer Project - Set of mechanical seal Project/Replacement of Main Sewer Line Construct of Septic Tank Analysis	Sanitary Sewer Network - Western Area- phase Two Supply of Double Socket Swept Tees Maintenance of sewage networks	Sanitary Sewer Network - Western Area - Phase Three	
Wastewater treatment facilities	No information as the station is located outside the city under the control of the rebels				
Operation and maintenance process of wastewater facilities	Poor logistics for operation & maintenance	Supply of Sewage Flushing Trucks (Jetting & Vacuum Tank mounted on Trucks) 10 m3 Supply of 10,000 Capacity Sewage Suckers Supply of Sewerage Rods (Sewer Cleaning) Supply of Heavy & Medium-duty Manholes Covers	Supply of 15,000 Capacity Sewage Suckers Supply of 4-inch &8-inch Sewage Dewatering Pumps	Supply of Sewage Flushing Trucks (Jetting & Vacuum Tank mounted on Trucks) 10 m3 Supply of Sewerage Rods (Sewer Cleaning)	

Water & wastewater Laboratories	Poor logistics for operation and limitations in consumables and chemicals Need for solar energy systems	Buying DR3900 vis spectrometers with Accessories &Reagent Economical flam photometry Botanical Vacuum oven with 6 shelves Fume Hood 48 Dish work surface/vp light/Blower DRB 200 Digital Reactor Block For TNT Plus General Electric Countertop Microwave Oven Non-electric Steam Sterilizer 41.5at	Buying Ultrasonic Cleaner Heater/Digital Timer Digital Titrator HQ-portable multi-meter PH Rod -Cond-T-OD Digital Stirring Hot Plat Refrigerator Drummond Pipet Aid portable Ultrasonic Cleaner Heater/ Digital Timer		

Table 8.3: Obstacles and recommendations for Infrastructure Assessment and Rehabilitation Measures

Investment needs

The identified measures have been prioritized according to feasibility and urgency in urgent measures, high priority, medium and low term measures grouped into 9 investment packages as shown in Table 4. The period indicates the proposed commencement of the investments, starting from 2024.

Package	Measures	Urgent (0-6mths) (USD)	High priority (1-2 years) (USD)	Short-term (3-5 years) (USD)	Long-term (>5 years) (USD)	Total (USD)
		2024	2024-2025	2025-2027	>2027	
Package 1	Civil Works on buildings and structures	2,089,700	350,200	1,516,800	0	3,956,700
Package 2	Well rehabilitation and new construction	7,189,000	1,620,000	801,000	0	9,610,000
Package 3	Water pumping station	1,148,400	0	0	0	1,148,400
Package 4	Water network rehabilitation and extension	14,516,664	13,197,850	22,853,000	0	50,567,514
Package 5	Wastewater collection, disposal and Treatment	9,154,239	7,311,060	4,000,000	0	20,465,299
Package 6	Generators and spares, Electric materials and solar systems	2,879,100	1,735,000	1,140,000	200,000	5,954,100
Package 7	Vehicles, machines, tools	3,970,000	1,561,000	3,450,000	456,000	9,437,000
Package 8	Laboratory equipment	129,225	58,600	0	0	187,825
Package 9	Water sterilization facilities	29,420	0	0	0	29,420
Total investment		41,105,748	25,833,710	33,760,800	656,000	101,356,258

Table 8.4: Cost estimation on investment measures

The required estimated budget has been calculated for:

- Urgent measures: 41,105,748 USD
- High-priority measures: 25,833,710 USD
- Medium- priority measures: 33,760,800 USD
- Low- priority measure: 656,000 USD

The total needed amount for the rehabilitation, restoration and extension of the water and sanitation system, provision of solar systems and supply of required operation and maintenance materials has been estimated to about 101,356,258 USD for the next 5 years.

Appendices to Annex 12

Assessment Report of Taiz Utility

Appendix A-1
Pictures of Infrastructure

Administrative Building


Administrative Building


Water and Wastewater Laboratory


Water and Wastewater Laboratory


Pumping Stations


Pumping Stations

Pumping Stations

Pumping Stations

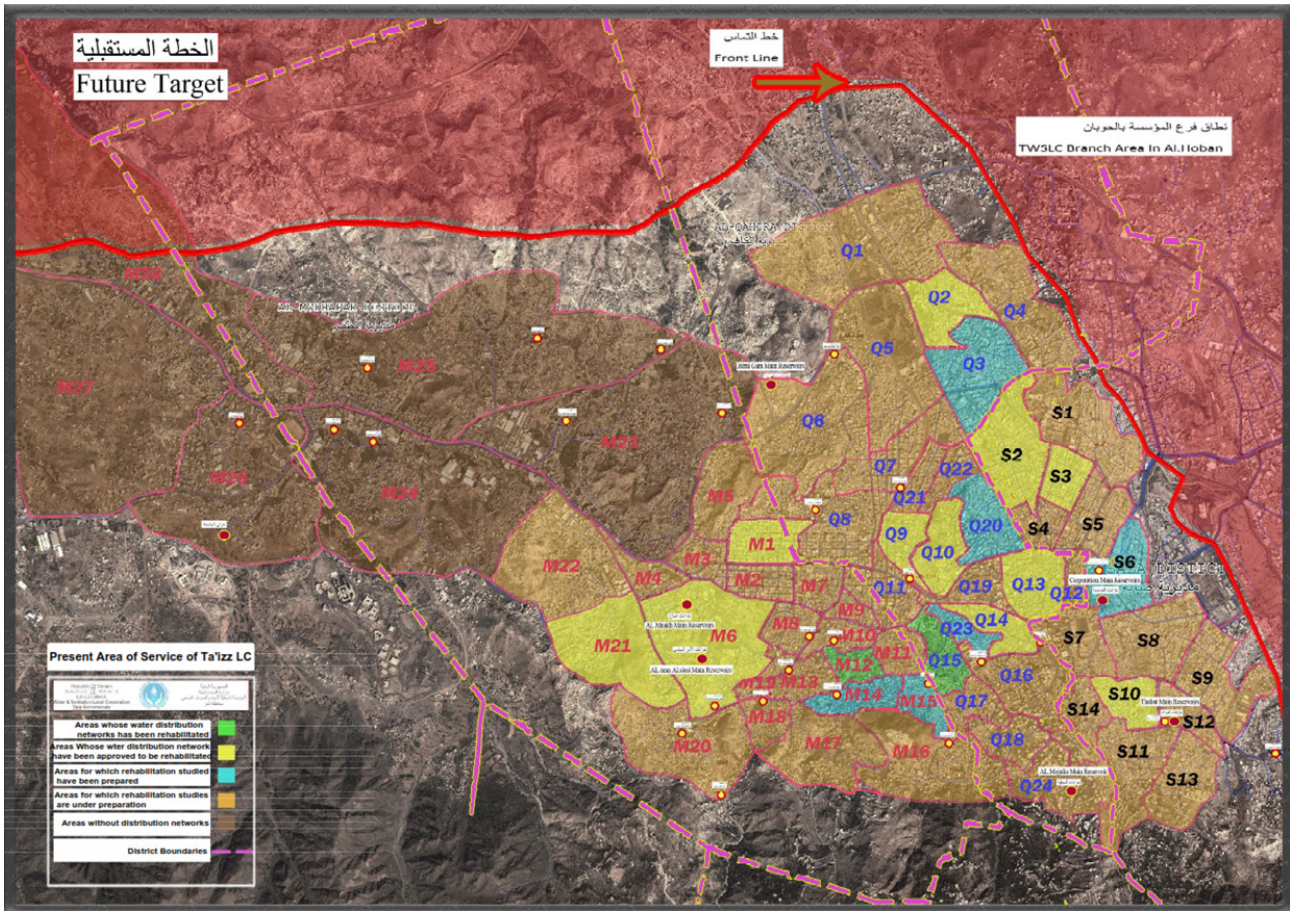
Water Storage Reservoirs

Water Storage Reservoirs

Water Storage Reservoirs

Water Storage Reservoirs

Appendix A-2
Current Limits of the LC's Area of Service



Appendix B:
Questionnaire Forms

Appendix A-3:
Technical Assistance Plan for LC Taiz

Package	TA intervention	Estimated TA cost in USD			
		Urgent	High priority	Medium priority	Low priority
		(0-6 months)	(1 -2 years)	(3-5 years)	(>5 years)
TA1	Financial Support	1,100,000	2,000,000	1,000,000	0
TA2	Training Courses	265,000	235,000	140,000	0
TA3	Office equipment and IT	122,750	0	0	0
TA4	Coaching and Consultancy services	90,000	225,000	100,000	0
TA5	Operation Management Support	90,000	160,000	60,000	0
TA6	Public Relation and Awareness	0	70,000	50,000	15,000
Total TA cost:		1,667,750	2,690,000	1,350,000	15,000

TA Package 1: Financial Support

ID	Financial support	Requirements	Urgent - total cost (USD)	High priority total cost (USD)	Medium priority - total cost (USD)	Low priority - total cost (USD)
1.1	Energy supply and consumables	Financial support	100,000		0	0
	Debt support (salaries & wages)		1,000,000	2,000,000	1,000,000	
Total TA Package 1:			1,100,000	2,000,000	1,000,000	

TA Package 2: Training Courses

ID	Training Subject	Target Staff	Urgent - total cost (USD)	High priority - total cost (USD)	Medium priority - total cost (USD)	Low priority - total cost (USD)
2.1	Board of Directors Program	Board of Directors, Secretary of BoD	10,000	45,,000	15,000	0
2.2	Management & HR subjects	General Directors, Deputies, Planning and Project Manager, Financial Manager, HR Manager	50,000	40,000	40,000	0
2.3	Technical subjects	Deputy, Director of main departments, Key staff, engineers	60,000	30,000	30,000	0
2.4	Finance subjects	Finance department staff, Procurement department, Supervision & Inspection	50,000	20,000	0	0
2.5	Customer Relations and Services subjects	General director, director of main departments	45,000	50,000	25,000	0
2.6	IT, PIIS	IT manager, Finance, Planning department key staff	35,000	20,000	20,000	0
2.7	On-Job training	HR & IT department, Audit Section and Accounting Sections, Warhouse and procurement management staff	15,000	30,000	10,000	0
Total TA Package 2:			265,000	235,000	140,000	0

TA Package 3: Office Equipment and IT

ID	Item	Description/Specifications	Quantity	Urgent total cost (USD)	High Priority total cost (USD)	Medium Priority - total cost (USD)	Low Priority total cost (USD)
3.1	Furniture						
3.1.1	Desks	Wooden desk with drawers and a side table. Drawer dimensions: 40 cm width × 48 cm depth × 65 cm height. Desk dimensions: 200 cm width × 90 cm depth × 76 cm height. Side table dimensions: 88 cm width × 76 cm height × 40 cm depth.	5	1,500			
3.1.2	Chairs	Medical mesh back and mid-movable chair	5	250			
3.1.3	Air Conditioner	1-ton, 1200 BTU, Energy-efficient control (40%, 60%, 80%), Dual Tropical Inverter Compressor, Fast cooling and energy-saving, Plasmaster™ IonizerPLUS, Smart ThinQ™ (Wi-Fi), Ten years warranty on the dual inverter compressor	1	300			
	Sub- total	2,050					
3.2	IT Equipment						
3.2.1	Desktop Computer	Specifications: Intel Core i7 Quad Core, 8GB RAM, 1TB HDD, 2GB Graphics Card, 19» LED Monitor, DVD+/-RW, Windows 7 or above.	5	4,500			
3.2.2	Laptop Computer	Specifications: Intel Core i7-8850H, 32GB RAM, 1-2TB HDD, 4GB Graphics Card, 15.6» FHD LED Monitor, DVD+/-RW, Windows Server.	2	3,000			
3.2.3	Server		1	7,000			
3.2.4	Invoice Printer	Sedco Magna L3200 C Line Matrix Printer. P8000/ P7000 Standard life cartridge ribbon.	3	45,000			
3.2.5	Network Firewall	Real-time antivirus, online payment protection, performance improvement, unlimited high-speed VPN connection, data leak detection tool, identity protection features, virus scanning and removal by an expert	3	12,000			
	Sub- total	71,500					
3.3	Software						
3.3.1	Software Updates	ArcMap10	6	3,000			
3.3.2	New or Replacement Software	Anti- virus :10 original copies, Windows 11:5 original copies, Microsoft- office :5 original copies,		600 800 600			
	Sub- total	5,000					
3.4	Electric equipment						
3.4.1	Routers for Branch and Main Centers		4	8,000			
3.4.2	Voltage Regulator	20KVA / 16KW UPS, Input: 220-240V, Output: 220-240V, Three years warranty, Including maintenance.	1	2,000			
3.4.3	Backup Battery	Capacity: 100 Ampere, Type: Deep Cycle Gel	7	3,500			
3.4.4	Electric Charger	Three-stage charger, 10 Ampere	7	21,000			
3.4.5	Local Network Switches in the Branch	Cisco network switch 48 10/100/1000 Ports, Gigabit Ethernet Smart Switch, 2 Combo Mini-GBIC Ports, With Fiber Port	5	1,250			
3.4.6	Internal Wireless Modems	Tp-link TD-W8961N 500Mbps Wireless N ADSL2+ Modem Router	3	1,500			

3.4.7	Other IT Infrastructure and Tools	1. Ethernet Cable Network Cat6 – 350 meters. 2. RG45 - 100 units, and RG11 - 100 units. 3. PETECH EZ-RJ45 Crimp Tool for RJ-11, RJ-12 - 2 units 4. Network Wire Punch Down Impact Tool with Two Blades - 2 units. 5. Ethernet Network Tool Cable Tester RG45, RG11 - 2 units. 6. Repair tool bag	-	■ 100 ■ 6,500 ■ 100 ■ 50 ■ 150 ■ 50			
	Sub- total			44,200			
	Total TA Package 3:			122,750			

TA Package 4: Coaching and Consultancy services

ID	Intervention	Requirement	Urgent - total cost (USD)	High priority - total cost (USD)	Medium priority - total cost (USD)	Low priority - total cost (USD)
4.1	Coaching support	Institutional development support	15,000	75,000	0	0
4.2	Consultancy services	Update design, Feasibility study	75,000	100,000	50,000	0
4.3	External Auditor	Re-evaluation of audits and accounts	0	50,000	50,000	0
Total TA Package 4:			90,000	225,000	100,000	0

TA Package 5: Operation Management Support /GIS

ID	Intervention	Requirement	Urgent - total cost (USD)	High priority - total cost (USD)	Medium priority - total cost (USD)	Low priority - total cost (USD)
5.1	Establish pre-conditions	Satellite images, GIS software, customer survey, Customer Service Centre	90,000	60,000	60,000	0
5.2	Consultancy services	Team leader, experts, draughtsman	0	100,000	0	0
Total TA Package 5:			90,000	160,000	60,000	0

TA Package 6: Public Relation and Awareness

ID	Intervention	Requirement	Urgent - total cost (USD)	High priority - total cost (USD)	Medium priority - total cost (USD)	Low priority - total cost (USD)
6.1	Consultancy and committee support	Engage consultant, establish and maintain awareness committee	0	40,000	30,000	0
6.2	Public awareness campaign	Workshops, meetings, publications, media	0	20,000	20,000	15,000
6.3	Gender related awareness	Workshops for women, visit of marginalized, school visits	0	10,000	0	0
Total TA Package 7:			0	70,000	50,000	15,000

Total TA measures in USD:	1,667,750	2,690,000	1,350,000	15,000

Appendix A-4:

Investment Plan for LC Taiz

Overview of required investment packages for LC Taiz

Package	Measures	Urgent (0- 6 months) (USD)	High priority (1- 2 years) (USD)	Medium (3-5 years) (USD)	Low (>5 years) (USD)	Total (USD)
		2024	2024-2025	2025-2027	>2027	
1	Civil works on buildings and structures	1,847,700	914,000	1,195,000	0	3,956,700
2	Well rehabilitation and new construction	9,240,000	270,000	100,000	0	9,610,000
3	Water pumping station	1,148,400	0	0	0	1,148,400
4	Water network rehabilitation and extension	26,525,514	4,691,000	19,351,000	0	50,567,514
5	WWTP and sewage pumps	9,862,439	6,602,860	4,000,000	0	20,465,299
6	Sewer network rehabilitation and extension	1,854,100	2,460,000	1,440,000	200,000	5,954,100
7	Vehicles, machines, tools	5,805,000	1,812,000	1,600,000	220,000	9,437,000
8	Electric materials and solar systems	129,225	58,600	0	0	187,825
9	Laboratory equipment	29,420	0	0	0	29,420
Total (USD)		56,441,798	16,808,460	27,686,000	420,000	101,356,258

Package 1: Civil Works on buildings and structures

ID	Purpose/Building Description	Location	Brief Explanation of Needs/Materials/ Equipment	Unit	Quantity	Estimated Total Cost (USD)	Priority
1.1	Buildings						
1.1.1	Completion of Renovation and Furnishing of the Third-Floor Administrative Building	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Installation of block and aluminum partitions, gates, and windows + Tiling, painting, electrical work + Furniture, office equipment, and training room setup + Solar energy system for building operation (All project documents ready)	m2	550	180,000	1
1.1.2	Furnishing of the General Administration Building (Basement + First + Second Floors)	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Furnishing of the entire building, including furniture, office equipment, and meeting room setup + Solar energy system for building operation (All project documents ready)	Itemized	1	250,000	1
1.1.3	Rebuilding and Rehabilitation of the Third Area Hall (Destroyed Building)	Taiz Governorate - Al-Jahmaliya Area - Tha›bat	Reconstruction of a destroyed building, including debris removal, new construction, concrete work, doors, windows, painting, electrical work, plumbing + External wall rehabilitation + Furniture, office equipment, and information network setup + Solar energy system for building operation (Project documents draft ready)	m2	200	120,500	1
1.1.4	Rehabilitation of Sewage Pumping Station	Wadi Al-Qadi Area - Near Al-Hajari School	Painting of walls, installation of barbed wires and main gates + Solar energy system for station operation and diesel consumption reduction (Project documents draft ready)	m2	478	191,200	1
1.1.5	Rehabilitation of the Administrative Building for Cairo Directorate	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Rehabilitation of building walls, tiling, windows, doors, concrete ceilings, painting, electrical work + Furniture, office equipment setup + Rehabilitation of information systems and networks, connecting them to buildings and systems + Solar energy system for building operation (Project documents draft ready)	m2	550	84,600	2

1.1.6	Rehabilitation of University Water Pump Station Building	Taiz Governorate - University Area Industrial Zone - Sabr Al-Mawadem Directorate	Various rehabilitation works, including raising station walls, refurbishing windows, doors, generator building, chlorination facility, electro-mechanical operation building + Electrical work for the yard + Construction of underground diesel tanks (200,000-liter capacity) + Concrete tank for water storage (1,000 m3 capacity) + Solar energy system installation for centrifugal pumps + Shading for pipes + Warehouse construction for materials and equipment (All project documents ready)	m2	2,640	678,000	1
1.1.7	Rehabilitation of Generator Building + Maintenance and Meter Inspection Building + Storage Shading	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Rehabilitation of building walls, tiling, windows, doors, concrete ceilings, painting, electrical work + Equipment setup for pump workshop, electrical workshop, mechanical workshop, and service area (Project documents draft ready)	m2	717	265,000	1
1.1.8	Rehabilitation of the Administrative Building for Network and Distribution	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Rehabilitation of building walls, tiling, windows, doors, concrete ceilings, painting, electrical work + Furniture, office equipment setup + Rehabilitation of information systems and networks, connecting them to buildings and systems + Solar energy system for building operation (Project documents draft ready)	m2	550	78,400	2
1.1.9	Rehabilitation of Jadir Water Pump Station Buildings	Taiz Governorate - Jadir Area - Al-Muzaffar Directorate	Elevation of station walls with block buildings and cladding, painting, barbed wire, electrical and plumbing works + Internal and external painting of station buildings + Windows and doors for buildings + Electrical and plumbing works + Replacement of damaged centrifugal pumps + Installation of a solar energy system + Construction of an underground diesel tank with a capacity of 100,000 liters (Project documents draft ready)	m2	1,310	187,200	2
1.1.10	Rehabilitation of Pump Station 1 for the Dhabab Field (Pump, Operation and Dashboard Building + Generators Building + Guard Room + Chlorination Building + Walls + Water Collection Tank)	Taiz Governorate - Dhabab Hazran Area - Sabr Al-Mawadem Directorate	Rehabilitation of station walls and pump, control, guard, and chlorination buildings + Gates, windows, tiling, concrete ceilings, concrete tank, yard, electrical works, plumbing works, horizontal pumps + Installation of a solar energy system (All project documents ready)	m2	3,050	671,000	3
1.1.11	Rehabilitation of Generators and Guard Rooms for Dhabab Field (9 Rooms)	Taiz Governorate - Dhabab Hazran Area - Sabr Al-Mawadem Directorate	Rehabilitation of buildings, doors, windows, tiling, painting, diesel tanks, electrical works, plumbing works (All project documents ready)	m2	360	55,800	3
1.1.12	Rehabilitation of Pump Station 1 for the Hawjalah Field (Pump, Operation and Dashboard Building + Generators Building + Guard Room + Chlorination Building + Walls + Water Collection Tank)	Taiz Governorate - Hawjalah Behind the Power Generation Station - Al-Ta›izzah Directorate	Rehabilitation of station walls and pump, control, guard, and chlorination buildings + Gates, windows, tiling, concrete ceilings, concrete tank, yard, electrical works, plumbing works, horizontal pumps + Installation of a solar energy system (All project documents ready)	m2	2,100	703,000	3
1.1.13	Rehabilitation of Generators and Guard Rooms for Hawjalah Field (9 Rooms)	Taiz Governorate - Hawjalah Behind the Power Generation Station - Al-Ta›izzah Directorate	Rehabilitation of buildings, doors, windows, tiling, painting, diesel tanks, electrical works, plumbing works (All project documents ready)	m2	251	87,000	3
1.2	Warehouses						
1.2.1	Rehabilitation of Storage Hangars + Containers	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Rehabilitation of walls and roofs of hangars + Installation of partitions and shelves + Winches + Complete replacement of damaged containers + Windows and doors, painting, electrical work (Project documents draft ready)	m2	2,360	140,000	1

1.3	Workshops						
1.3.1	Rehabilitation of Technical Workshop Building	Taiz Governorate - Supervision Basin (within the main courtyard of the institution)	Rehabilitation of building walls, tiling, windows, doors, concrete ceilings, painting, electrical work + Equipment setup for pump workshop, electrical workshop, mechanical workshop, and service area (Project documents draft ready)	m2	717	265,000	1
Sub-total Priority 1 - Urgent (0-6 months)						1,847,700	
Sub-total Priority 2 - High (1-2 years)						914,000	
Sub-total Priority 3 - Medium (3-5 years)						1,195,000	
Sub-total Priority 4 - Low (>5 years)						0	
Total Package 1:						3,956,700	

Package 2: Well rehabilitation

ID	Well Location/ Field	Well Name or Number	Brief Description of Need	Unit	Quantity	Estimated Total Cost (USD)	Priority	Notes
1	City Wells / Emergency Wells	Al-Husainiya Well	Drilling a replacement well for Al-Husainiya Well due to its low production and the submersion of a large part of it. The submersion is a result of not installing casings to the final depth of the well.	Meter	400	95,000	1	-
2	City Wells / Emergency Wells	24 Wells + 5 Pump Stations	Providing necessary petroleum products to operate the functioning wells. Ensuring the required water production to aid the city›s residents.	Liter	124,000	4,464,000	1	Needs support for three years until the implementation of the diesel usage strategy and exit plan. (Daily operational rate = 16 hours)
3	City Wells / Emergency Wells	Noor City Well and Joul Al-Shajara Well	Cleaning and rehabilitating (reactivating) Noor City and Joul Al-Shajara wells to restore their efficiency and previous production capabilities.	Well	2	30,000	1	-
4	City Wells / Emergency Wells	Various Wells (e.g., Al-Muntaza, Al-Dubua, Jamal Street, Al-Husainiya, Joul Al-Shajara, Dar Al-Nakhlah, Hawl Atiya, Wadi Al-Ma›sal, Al-Salami, Ghurb Umdah, etc.)	Implementing projects to connect the wells to main collective storage tanks within the city. Changing the pumping system to be through central tanks instead of direct pumping from the wells to the network. Aiming to expand distribution areas and reduce water return time.	Well	11	820,000	1	-
5	City Wells / Emergency Wells	Various Wells (e.g., Wadi Ghurab, Sallah, Bir Pasha)	Rehabilitating and implementing projects to clean and reactivate the mentioned wells, including supplying, installing, and replacing all necessary electromechanical equipment to restore their operation and integrate them into production lines.	Well	3	480,000	1	-
6	City Wells / Emergency Wells	Sala Surface Water Field	Enhancing water sources by drilling 5 manual surface wells.	Well	5	125,000	1	-

7	City Wells / Emergency Wells	-	Rehabilitating Noor City Well using a drilling rig and deepening it to its previous depth.	Well	1	40,000	1	-
8	City Wells / Emergency Wells	Various Wells (e.g., Al-Husainiya, Joul Al-Shajara, Hawl Atiya, Wadi Al-Ma›sal, Al-Salami, Ghurb Umdah, Shara Jamal, Al-Husainiya, Hawl Shajara, Dar Al-Nakhlah, Joul Al-Shajara, Ghassh, Al-Ba›arah, etc.)	Implementing projects to drill replacement wells for the mentioned wells due to their low production. This is a result of specific objectives and a significant part of them being submerged due to not installing casings to the final depth of those wells.	Well	4	320,000	1	-
10	City Wells / Emergency Wells	Various Wells (e.g., Shara Jamal, Al-Husainiya, Hawl Shajara, Hawl Atiya, Wadi Al-Ma›sal, Al-Salami, Ghurb Umdah, Shara Jamal, Al-Husainiya, Dar Al-Nakhlah, Shara Jamal, Dar Al-Nakhlah, Noor City Well)	Implementing projects to clean and reactivate the mentioned wells to restore their efficiency and previous production capabilities.	-	-	180,000	1	-
11	Fog Field Wells	Fog Wells (9 wells)	Rehabilitating and implementing projects to clean and reactivate the mentioned wells. Supplying, installing, and replacing all necessary electromechanical equipment to restore their operation and integrating them into production lines.	-	-	540,000	2	Refer to Annex B.2.2.6.a-1
12	Hawjla and ‹Amra Field Wells	Hawjla and ‹Amra Wells (18 wells)	Rehabilitating and implementing projects to clean and reactivate the mentioned wells. Supplying, installing, and replacing all necessary electromechanical equipment to restore their operation and integrating them into production lines.	-	-	1,080,000	2	Refer to Annex B.2.2.6.a-2
13	Haima and Habir Field Wells	Haima and Habir Wells (8 wells)	Rehabilitating and implementing projects to clean and reactivate the mentioned wells. Supplying, installing, and replacing all necessary electromechanical equipment to restore their operation and integrating them into production lines.	-	-	801,000	3	Refer to Annex B.2.2.6.a-3

14	Jabal Habshi Intersection, Wadi Al-Burqani	-	Conducting geophysical and hydrological studies to explore new water sources to cover the water deficit and enhance the production capacity of wells in the valleys surrounding Taiz city in the western direction from the city (Jabal Habshi Intersection, Wadi Al-Burqani).	-	-	25,000	1	-
15	Water Fields in Taiz City	-	Supplying a communication unit, including a fixed station and mobile devices, for emergency and maintenance teams for the new well fields.	-	-	40,000	1	-
16	City of Taiz based on the defined geographical boundaries for the Rainwater Harvesting Project	-	Updating the study of the Rainwater Harvesting Project and preparing the final designs for areas within the city to establish surface and subsurface water dams and barriers to reserve and provide water, in addition to treatment and delivery to the city.	-	-	200,000	1	-
17	Seawater Desalination		Conducting necessary studies to change the path of the water transmission line as part of the Seawater Desalination Project through the Kadhah region (as a strategic and sustainable solution to solve the water crisis in Taiz fundamentally).	-	-	200,000	1	.
18	Water Basin for the City of Taiz	- Water Resources Development	Conducting geological and hydrological studies for the groundwater basins supplying Taiz city with a feasibility study for the artificial well drilling project in the city field (to feed the groundwater reservoir) + other fields - Phase 1.	-	-	70,000	1	
19	Study of the prohibition of basins and fields.	Water Resources Development	Determining the boundaries of water basins, studying the volume of groundwater reservoirs and the type of water-bearing layers, studying the volume of water extracted from the basin, and studying soil protection from erosion and building water barriers.	-	-	100,000	1	
Sub-total Priority 1 - Urgent (0-6 months)						9,240,000		
Sub-total Priority 2 - High (1-2 years)						270,000		
Sub-total Priority 3 - Medium (3-5 years)						100,000		
Sub-total Priority 4 - Low (>5 years)						0		
Total Package 2:						9,610,000		

Package 3: Water Pumping Stations

ID	Requirements	Type of Water Supply Facility/Unit	Name/Number/ Code of Water Supply Facility/Unit	Technical Specifications (Brief)	Unit	Quantity	Estimated Total Cost (USD)	Priority
3.1	Iron pipes diameter 3» treated rough thickness not less than 0.5mm SCH40 Omani or Saudi Arabia with sockets	Well	1	Iron pipes diameter 3» treated rough thickness not less than 0.5mm	Number	1,000	150,000	1
3.2	Nipples for pumps Abu ½2 - 3»	Well	1	Iron nipples Abu ½2 - 3»	Number	50	3,000	1
3.3	Nipples for pumps Abu 2 - 3»	Well	1	Iron nipples Abu 2 - 3»	Number	30	1,800	1
3.4	Nipples for pumps Abu ½1 - 3»	Well	1	Iron nipples Abu ½1 - 3»	Number	10	300	1
3.5	Nipples for pumps Abu 3 - 3»	Well	1	Iron nipples Abu 3 - 3»	Number	20	1,000	1
3.6	Iron clamps Abu 3»	Well	1	Iron clamps Abu 3»	Number	10	500	1
3.7	Plastic pipes ¾ for well levels with a length of 3 meters	Well	1	Plastic pipes ¾ inch with a length of 3 meters	Pipe	1,000	2,000	1
3.8	Centrifugal pump 45 kW with a capacity of 40 l/s and head 100m	Pumping Station	2	Power 45 kW, Capacity 40 l/s, Head 100m	Pump	2	14,000	1
3.9	Centrifugal pump 110 kW with a capacity of 40 l/s and head 160m	Pumping Station	2	Power 110 kW, Capacity 40 l/s, Head 160m	Pump	2	20,000	1
3.10	Centrifugal pump 45 kW with a capacity of 40 l/s and head 100m	Pumping Station	2	Power 45 kW, Capacity 40 l/s, Head 100m	Pump	2	14,000	1
3.11	Centrifugal pump 132 kW with a capacity of 200 l/min and head 160m	Pumping Station	2	Power 132 kW, Capacity 200 l/min, Head 160m	Pump	2	24,000	1
3.12	Centrifugal pump 45 kW with a capacity of 60 l/s and head 150m	Pumping Station	2	Power 150 kW, Capacity 60 l/s, Head 150m	Pump	2	14,000	1
3.13	Centrifugal pump 45 kW with a capacity of 60 l/s and head 100m	Pumping Station	2	Power 45 kW, Capacity 60 l/s, Head 100m	Number	2	14,000	1
3.14	Regular shlishen	Well	1	High-quality plastic	Number	2,000	2,000	1
3.15	Thermal 3m shlishen	Well	1	High-quality thermal	Number	2,000	12,000	1
3.16	Copper connection properties 240mm	Well	1	Copper 240mm	Properties	1,000	5,000	1
3.17	Copper connection properties 120mm	Well	1	Copper 120mm	Properties	500	1,500	1
3.18	Copper connection properties 50mm	Well	1	Copper 50mm	Properties	1,000	2,000	1
3.19	Copper connection properties 35mm	Well	1	Copper 35mm	Properties	2,000	4,000	1
3.20	Copper connection properties 25mm	Well	1	Copper 25mm	Properties	2,000	2,000	1
3.21	Copper connection properties 16mm	Well	1	Copper 16mm	Properties	1,000	1,000	1

3.22	Copper connection properties 95mm	Well	1	Copper 95mm	Properties	1,000	5,000	1
3.23	Copper connection properties 70mm	Well	1	Copper 70mm	Properties	1,000	4,000	1
3.24	End properties copper 50mm	Well	1	Copper 50mm	Properties	1,000	2,000	1
3.25	End properties copper 70mm	Well	1	Copper 70mm	Properties	1,000	4,000	1
3.26	End properties copper 35mm	Well	1	Copper 35mm	Properties	1,000	2,000	1
3.27	End properties copper 16mm	Well	1	Copper 16mm	Properties	1,000	1,000	1
3.28	End properties copper 25mm	Well	1	Copper 25mm	Properties	1,000	1,000	1
3.29	Double-insulated 3x35 HO7RN-F copper cable	Well	1	Double-insulated 3x35 HO7RN-F copper cable	Meter	10,000	200,000	1
3.30	Double-insulated 3x25 HO7RN-F copper cable	Well	1	Double-insulated 3x25 HO7RN-F copper cable	Meter	500	7,500	1
3.31	Double-insulated 3x16 HO7RN-F copper cable	Well	1	Double-insulated 3x16 HO7RN-F copper cable	Meter	2,000	22,000	1
3.32	Double-insulated 3x50 HO7RN-F copper cable	Well	1	Double-insulated 3x50 HO7RN-F copper cable	Meter	2,000	60,000	1
3.33	Double-insulated 3x70 HO7RN-F copper cable	Well	1	Double-insulated 3x70 HO7RN-F copper cable	Meter	2,000	70,000	1
3.34	Nokia Aluminum Cable 70+3x70mm	Well	1	Nokia Aluminum Cable 70+3x70mm	Meter	3,000	9,000	1
3.35	Nokia Aluminum Cable 50+3x50mm	Well	1	Nokia Aluminum Cable 50+3x50mm	Meter	3,000	9,000	1
3.36	Submersible Electric Motor 18.5kw	Well	1	Submersible Electric Motor 18.5kw	Motor	10	20,000	1
3.37	Submersible Electric Motor 22kw	Well	1	Submersible Electric Motor 22kw	Motor	10	25,000	1
3.38	Submersible Electric Motor 30kw	Well	1	Submersible Electric Motor 30kw	Motor	10	30,000	1
3.39	Submersible Electric Motor 37kw	Well	1	Submersible Electric Motor 37kw	Motor	10	35,000	1
3.40	Submersible Pump Diameter 6 Hinch Z616/42	Well	1	Submersible Pump Diameter 6 Hinch Z616/42	Pump	10	30,000	1
3.41	Submersible Pump Diameter 6 Hinch Z616/23	Well	1	Submersible Pump Diameter 6 Hinch Z616/23	Pump	6	21,000	1
3.42	Submersible Pump Diameter 6 Hinch Z616/26	Well	1	Submersible Pump Diameter 6 Hinch Z616/26	Pump	6	24,000	1
3.43	Submersible Pump Diameter 6 Hinch Z616/30	Well	1	Submersible Pump Diameter 6 Hinch Z616/30	Pump	8	36,000	1
3.44	Weight for lowering into wells to measure depths with a 500m metric tape	Well	1	Iron weight equipped with a meter for depth measurement	Weight	2	6,000	1
3.45	Electric drill, one medium and the other heavy-duty with a charger	Maintenance Workshop	4	Electric drill, one medium, and the other heavy-duty with a charger	Number	4	1,200	1

3.46	Electric grinder 220 volts with blades and 20 volts charging grinder with spare battery and charger	Maintenance Workshop	4	Electric grinder 220 volts with blades and 20 volts charging grinder with spare battery and charger	Number	8	2,400	1
3.47	Thermal grease for pumps 6 barrels Abu 25 and Abu kilo	Maintenance Workshop	4	Thermal grease for pumps 6 barrels Abu 25 and Abu kilo	Barrel	6	3,600	1
3.48	Desktop computers for departments (Electromechanical - Pumps - Welding) with a printer	Maintenance Workshop	4	Core i7, SSD 1TB	Device	3	3,600	1
3.49	Welding pack Iron Abu 12 for welding workshop	Maintenance Workshop	4	Welding pack Iron Abu 12 for welding workshop	Pack	100	500	1
3.50	Ductile Welding Pack	Maintenance Workshop	4	Ductile Welding Pack	Pack	50	2,000	1
3.51	Welding pack for flexible cables such as Ceplack or others for welding cables and a new 2m date	Maintenance Workshop	4	Welding pack for flexible cables such as Ceplack or others for welding cables and a new 2m date	Pack	100	2,000	1
3.52	JCB excavator for maintenance of water and sewage networks	Emergency and Maintenance Department	5	According to the attached specifications	Number	1	150,000	1
3.53	Level survey device for surveys related to the maintenance of water and sewage networks	Emergency and Maintenance Department	5	According to the attached specifications	Number	1	1,500	1
3.54	Supplying 3-ton jack for maintenance of water and sewage networks	Emergency and Maintenance Department	5	According to the attached specifications	Number	2	15,000	1
3.55	Rehabilitation and maintenance of the old device, including the purchase of plates, compression, pump, and the dashboard for the inspection device	Emergency and Maintenance Department	5	According to the attached specifications	Lump sum	1	15,000	1
3.56	Supplying a 5-ton dump truck for maintenance of water and sewage networks	Emergency and Maintenance Department	5	According to the attached specifications	Number	1	40,000	1
Sub-total Priority 1 - Urgent (0-6 months)							1,148,400	
Sub-total Priority 2 - High (1-2 years)							0	
Sub-total Priority 3 - Medium (3-5 years)							0	
Sub-total Priority 4 - Low (>5 years)							0	
Total Package 3:							1,148,400	

Package 4: Water network rehabilitation and extension

ID	Installation Location/ Distribution Area	Brief Explanation of Required Needs	Diameter	Material	Operating Pressure (Bar)	Unit	Quantity	Estimated Total Cost (USD)	Priority
4.1	Al Mudhaffar	Water Network Project - Wadi Al Salam Area - Haret Al Hadeeqa (Implementation of main and sub water lines with different diameters, manifolds, and water meters)	Various Diameters	HDPE	16	Project	1	195,000	2
4.2	Al Mudhaffar	Water Network Project - Industrial Area - Near the University Station (Implementation of main and sub water lines with different diameters, manifolds, and water meters)	Various Diameters	HDPE	16	Project	1	150,000	2
4.3	Al Mudhaffar	Water Network Project - Al Duha Area - Near Al Shibani Factory (Implementation of main and sub water lines with different diameters, manifolds, and water meters)	Various Diameters	HDPE	16	Project	1	330,000	2
4.4	Al Mudhaffar	Water Network Project - Al Baarah Area (Implementation of main and sub water lines with different diameters, manifolds, and water meters)	Various Diameters	HDPE	16	Project	1	375,000	2
4.5	Al Mudhaffar	Water Main Line Replacement Project (Main Water Line Replacement from the University Station to China Tanks)	Various Diameters	HDPE	25	Project	1	1,100,000	1
4.6	Cairo	Water Distribution Line Project - Extends from Near the Wadi Station to the Electricity Roundabout in Wadi Al Qadi	Various Diameters	HDPE	16	Project	1	55,664	1
4.7	Cairo	Construction Project of a 6000 m3 Concrete Water Collection Tank - In the Postal Area - Inside the Conference Headquarters	6000 m3 Capacity	Concrete	N/A	Cubic Meter	6,000	1,460,000	2
4.8	Al Mudhaffar	Construction Project of a 6000 m3 Concrete Water Collection Tank for Fog and Taloq - China Area	6000 m3 Capacity	Concrete	N/A	Cubic Meter	6,000	1,460,000	2
4.9	Al Mudhaffar	Construction Project of a 4000 m3 Concrete Water Collection Tank - Al Hasab - Mount Fanduq Yuzan (Arail Hill)	4000 m3 Capacity	Concrete	N/A	Cubic Meter	4,000	1,200,000	3
4.10	Al Mudhaffar	Construction Project of a 4000 m3 Concrete Water Collection Tank - Al Duha - Mount Al Duha (University)	4000 m3 Capacity	Concrete	N/A	Project	1	1,200,000	3
4.11	Al Mudhaffar	Water Network Project - Al Arbaeen Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	727,110	2
4.12	Cairo	Water Network Project - Tahrir Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	634,900	2
4.13	Al Mudhaffar	Water Network Project - University Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	886,310	2
4.14	Al Mudhaffar	Water Network Project - Al Hasab Airport Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	723,190	2

4.15	Cairo	Water Network Project - Al Demina Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	742,010	2
4.16	Al Mudhaffar	Water Network Project - Al Dhahra Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	418,110	2
4.17	Salalah	Water Network Project - Al Majlia Area Implementation of main and sub water lines with different diameters	Various Diameters	DCI & HDPE	16	Project	1	209,610	2
4.18	Al Mudhaffar	Water Network Project - Wadi Al Qadi Area Implementation of a main water line	300 mm	DCI & HDPE	16	Project	1	483,610	2
4.19	Institution Stores	Supply of Polyethylene Sewer Pipes of Various Diameters + Manhole Covers + Sewer Opening Tools (Steel Picks, etc.)	300 mm - 800 mm	HDPE	6	M/T	30,000	1,000,000	2
4.20	Institution Stores	Supply of Polyethylene Water Pipes of Various Diameters with all Fittings	25 mm - 200 mm	HDPE	16	M/T	25,000	1,000,000	2
4.21	Institution Stores	Supply of 20,000 Residential Water Meters	15 mm	N/A	16	Meter	20,000	800,000	1
4.22	Institution Stores	Supply of 10,000 Residential Water Meters	15 mm	N/A	16	Meter	10,000	400,000	2
4.23	Institution Stores	Supply of 10,000 Residential Water Meters	15 mm	N/A	16	Meter	10,000	400,000	3
4.24	Home Connections	Galvanized Pipes for Home Connections	¾ inch	Galvanized Iron	16	M/T	6,000	12,000	1
4.25	Home Connections	Galvanized Pipes for Home Connections	¾ inch	Galvanized Iron	16	M/T	3,000	6,000	2
4.26	Home Connections	Galvanized Pipes for Home Connections	¾ inch	Galvanized Iron	16	M/T	3,000	6,000	3
4.27	Secondary Feed Lines (Mountainous Areas)	Galvanized Pipes	1 inch	Galvanized Iron	16	M/T	6,000	18,000	1
4.28	Secondary Feed Lines (Mountainous Areas)	Galvanized Pipes	1 inch	Galvanized Iron	16	M/T	3,000	9,000	2
4.29	Secondary Feed Lines (Mountainous Areas)	Galvanized Pipes	1 inch	Galvanized Iron	16	M/T	3,000	9,000	3
4.30	Feed Lines (Mountainous Areas)	Galvanized Pipes	1½ inch	Galvanized Iron	16	M/T	6,000	36,000	1
4.31	Feed Lines (Mountainous Areas)	Galvanized Pipes	1½ inch	Galvanized Iron	16	M/T	3,000	18,000	2
4.32	Feed Lines (Mountainous Areas)	Galvanized Pipes	1½ inch	Galvanized Iron	16	M/T	3,000	18,000	3
4.33	Feed Lines (Mountainous Areas)	Galvanized Pipes	2 inches	Galvanized Iron	16	M/T	10,000	80,000	1
4.34	Feed Lines (Mountainous Areas)	Galvanized Pipes	2 inches	Galvanized Iron	16	M/T	5,000	40,000	2
4.35	Feed Lines (Mountainous Areas)	Galvanized Pipes	2 inches	Galvanized Iron	16	M/T	5,000	40,000	3
4.36	Main Network Lines	Ductile Iron Pipes	150 mm	Ductile Iron	16	M/T	10,000	600,000	1
4.37	Main Network Lines	Ductile Iron Pipes	150 mm	Ductile Iron	16	M/T	5,000	300,000	2
4.38	Main Network Lines	Ductile Iron Pipes	150 mm	Ductile Iron	16	M/T	5,000	300,000	3
4.39	Main Network Lines	Ductile Iron Pipes	200 mm	Ductile Iron	16	M/T	10,000	670,000	1

4.40	Main Network Lines	Ductile Iron Pipes	200 mm	Ductile Iron	16	M/T	5,000	335,000	2
4.41	Main Network Lines	Ductile Iron Pipes	200 mm	Ductile Iron	16	M/T	5,000	335,000	3
4.42	Main Network Lines	Ductile Iron Pipes	250 mm	Ductile Iron	16	M/T	6,000	540,000	3
4.43	Main Network Lines	Ductile Iron Pipes	250 mm	Ductile Iron	16	M/T	3,000	270,000	3
4.44	Main Network Lines	Ductile Iron Pipes	250 mm	Ductile Iron	16	M/T	3,000	270,000	3
4.45	Main Network Lines	Ductile Iron Pipes	300 mm	Ductile Iron	16	M/T	10,000	1,170,000	1
4.46	Main Network Lines	Ductile Iron Pipes	300 mm	Ductile Iron	16	M/T	5,000	585,000	2
4.47	Main Network Lines	Ductile Iron Pipes	300 mm	Ductile Iron	16	M/T	5,000	585,000	3
4.48	Main Network Lines	Ductile Iron Pipes	400 mm	Ductile Iron	16	M/T	6,000	960,000	1
4.49	Main Network Lines	Ductile Iron Pipes	400 mm	Ductile Iron	16	M/T	3,000	480,000	2
4.50	Main Network Lines	Ductile Iron Pipes	400 mm	Ductile Iron	16	M/T	3,000	480,000	3
4.51	Secondary Water Network Lines	Plastic Pipes (PVS)	100 mm	Plastic	16	M/T	15,000	180,000	1
4.52	Secondary Water Network Lines	Plastic Pipes (PVS)	100 mm	Plastic	16	M/T	5,000	60,000	2
4.53	Secondary Water Network Lines	Plastic Pipes (PVS)	100 mm	Plastic	16	M/T	5,000	60,000	3
4.54	Secondary Water Network Lines	Plastic Pipes (PVS)	80 mm	Plastic	16	M/T	10,000	80,000	1
4.55	Secondary Water Network Lines	Plastic Pipes (PVS)	80 mm	Plastic	16	M/T	5,000	40,000	2
4.56	Secondary Water Network Lines	Plastic Pipes (PVS)	80 mm	Plastic	16	M/T	5,000	40,000	3
4.57	Secondary Distribution Lines	Main Valves and Taps (CATE VALVE)	80 mm	N/A	40	Number	1,500	225,000	1
4.58	Secondary Distribution Lines		100 mm	N/A	40	Number	2,000	500,000	1
4.59	Main Distribution Lines and Pumping Stations		150 mm	N/A	40	Number	1,500	450,000	1
4.60	Main Distribution Lines and Pumping Stations	N/A	200 mm	N/A	40	Number	800	480,000	1
4.61	Subsidiary Feed Lines	N/A	63 mm	N/A	40	Number	2,000	160,000	1
4.62		HDPE Pipes	¾ inch	HDPE	16	M/T	20,000	10,000	1
4.63	Replacement of Old Damaged Lines	HDPE Pipes	1 inch	HDPE	16	M/T	20,000	16,000	1
4.64		Plastic Links 63×63×32	63	Plastic	25	M/T	3,000	15,000	1
4.65		Plastic Links 63×25	63	Plastic	25	M/T	3,000	15,000	1
4.66		Plastic Links 50×25	50	Plastic	25	M/T	3,000	12,000	1
4.67	Near Main Tanks, Pressure Stations, and Main Rooms	Rotary Disc Valves	200		25	Number	150	60,000	1

			250		25	Number	100	40,000	1
			300		25	Number	150	60,000	1
			400		25	Number	150	60,000	1
4.68	Main and Sub-Main Pump Lines	Ductile Iron Flexible Coupling	100		25	Number	1,200	480,000	1
			80		25	Number	800	320,000	1
			150		25	Number	200	80,000	1
			200		25	Number	300	120,000	1
			300		25	Number	600	240,000	1
4.69	Main Tanks Pressure Relief Rooms	Air Discharge Valves	50	Italian	25	Number	300	45,000	1
			80	Italian	25	Number	300	50,000	1
			100	Italian	25	Number	600	120,000	1
			150	Italian	25	Number	150	60,000	1
			200	Italian	25	Number	100	75,000	1
			300	Italian	25	Number	100	120,000	1
4.70	New Connections in Pump and Lift Lines	Ductile Iron Flange Tees	80	Italian	25	Number	600	100,000	1
			100	Italian	25	Number	1,200	300,000	1
			150	Italian	25	Number	800	240,000	1
4.71	In Pump and Lift Lines	Ductile Iron Flange Elbows (11125-50-22-30-45-90)	80	Italian	40	Number	3,000	300,000	1
			100	Italian	40	Number	3,000	450,000	1
			150	Italian	40	Number	3,000	500,000	1
4.72	In Main and Sub-Main Pressure Relief Rooms and Main Pumping Stations	High-Pressure Iron Relief Valves with a minimum of 40 Bar, resistant to high temperatures and moisture	150	British	40	Number	300	120,000	1
			200	British	40	Number	300	150,000	1
			300	British	40	Number	300	300,000	1
4.73	Repair of Imbalances Occurring During Operation	Plastic Double Collar (D.V.S)	80	British	40	Number	1,500	15000	1
			100	British	40	Number	3,000	40000	1
4.74	Next to Main Storage Tanks, Pump Lines, and Pumping Stations	Bulk Water Meters of Flange Fitting Type	53		25	Number	300	51000	1
			80		25	Number	300	60000	1
			100		25	Number	300	75000	1
			150		25	Number	300	120000	1
			200		25	Number	300	180000	1
			300		25	Number	300	210000	1
			400		25	Number	300	300000	1
4.75	Main and Sub-Main Distribution Valves	Iron Surface Valves (256) DIN 4050, Service Box	¾ inch		16	Number	3,500	175000	1
4.76	Feeder Lines and Household Connections	Galvanized Iron Flange Elbows	1 inch, ,		16	Number	8,000	16000	1
			1½ inch		16	Number	6,000	12000	1
			2 inch		16	Number	4,000	8000	1

4.77	Repairing Breaks in Main and Sub-Main Lines	Ductile Iron Flange Adapters	80			Number	6,000	120000	1
			100			Number	6,000	180000	1
			150			Number	5,000	200000	1
			200			Number	4,000	200000	1
			250			Number	2,000	130000	1
			300			Number	3,000	240000	1
			400			Number	1,500	150000	1

ID	Tank Name or Location	Brief Description of Needs	Estimated Total Cost (USD)	Priority
4.78	Iron tanks No. 1, 2 at the institution›s site	Replacement of deteriorated iron tanks with a new concrete tank with a capacity of 6000 m3	5,200,000	3
4.79	Concrete tanks No. 1, 2 at the climate zone site	Replacement and substitution of the deteriorated installation system, valves, meters, and fittings of the pumping network and the dilapidated distribution	65,000	2
4.80	Concrete tanks No. 1, 2 inside the political security area yard	Replacement and substitution of the deteriorated installation system, valves, meters, and fittings of the pumping network and the dilapidated distribution	65,000	2
4.81	Implementation of a collection and distribution tank in the Jabal Al-Ikhwah area - Upper Dhuboa	Implementation of a main tank for collecting and distributing water to surrounding areas using hydraulic pressures (capacity: 3,000 cubic meters)	2,150,000	3
4.82	Implementation of a collection and distribution tank in the Jabal Ad-Darbah area - overlooking Wadi Al-Qadi	Implementation of a main tank for collecting and distributing water to surrounding areas using hydraulic pressures (capacity: 3,000 cubic meters)	2,150,000	3
4.83	Implementation of a collection and distribution tank in the Conference area - Upper Dhuboa	Implementation of a main tank for collecting and distributing water to surrounding areas using hydraulic pressures (capacity: 2,000 cubic meters)	1,650,000	3
4.84	Implementation of a collection and distribution tank in the Tha›bat area - Radio yard	Implementation of a main tank for collecting and distributing water to surrounding areas using hydraulic pressures (capacity: 3,000 cubic meters)	2,150,000	3
4.85	Implementation of a collection and distribution tank in the Circular Road area - Behind Cairo Castle	Implementation of a main tank for collecting and distributing water to surrounding areas using hydraulic pressures (capacity: 2,000 cubic meters)	1,650,000	3
4.86	Implementation of a collection and distribution tank in the Tiba Al-Arhanb area - Haret Al-Dar	Implementation of a main tank for collecting and distributing water to surrounding areas using hydraulic pressures (capacity: 3,000 cubic meters)	2,150,000	3

Sub-total Priority 1 - Urgent (0-6 months)			26,525,514	
Sub-total Priority 2 - High (1-2 years)			4,691,000	
Sub-total Priority 3 - Medium (3-5 years)			19,351,000	
Sub-total Priority 4 - Low (>5 years)			0	
Total Package 4:			50,567,514	

Package 5: Wastewater collection, disposal and Treatment

Sewer network rehabilitation and extension

ID	Sanitary Sewer Network Requirements	Installation Area	Diameter	Material	Operating Pressure (bar)	Brief Description of Requirements	Unit	Quantity	Total Estimated Cost (USD)	Priority
5.1	Main Sewer Project - Extends from Farim al-Kidm to Point Four - Supervision Basin - Al-Harish - Joulah Sannan	Sallah / Cairo	500,400,200,160	Plastic UPVC	10 Bar	Main sanitary sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	2434	730,560	2
5.2	Project/ Replacement of Main Sewer Line - Extends from Oqbat Street 26 to Upper Liberation - Lower Liberation	Cairo / Al-Muzaffar	500,200,160	Plastic UPVC	10 Bar	Replacement of old concrete main sewer lines with new larger diameter pipes and construction of new inspection chambers	m	2322	580,500	2
5.3	Project/Inner Sanitary Sewer Network - Dhahra Area - Phase Three	Al-Muzaffar	160,200,250	Plastic UPVC	10 Bar	Internal network lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	19964	2,395,680	1
5.4	Project/Septic Tank Analysis - Dhahra and Al-Jarajeer Area - 30th Street	Al-Muzaffar	160,200,250	Concrete	10 Bar	Construction of double concrete tanks each with a capacity of 250 m3. Number 12	Number	12	480,000	1
5.5	Main Sewer Line and Sanitary Sewer Network Project - Biʾara Area	Al-Muzaffar	160,200,250,315	Plastic UPVC	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	3250	382,184	1
5.6	Project/Internal Sanitary Sewer Network - Wadi Al-Salami - Harat Al-Hadiqah - Phase Three	Al-Muzaffar	160,200,250	Plastic UPVC	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	3397	305,730	1

5.7	Project/Sanitary Sewer Network - Al-Dar Al-Aliya Area - Phase Two	Al-Muzaffar	160,200,250	Plastic UPVC	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1587	190,450	1
5.8	Main Sewer Line Project - Extends from Vegetable Market to City Center - Bier Bash	Al-Muzaffar	315,200,160	Plastic UPVC	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	835	100,200	1
5.9	Project/ Replacement of Sewer Line - Asefra Power Station Area	Cairo	200, 160	Plastic UPVC	10 Bar	Replacement of damaged main sewer line - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	300	65,000	1
5.10	Project/ Replacement of Sanitary Sewer Lines - Daboua and Salakhana Area - Phase Two	Cairo	200, 160	Plastic UPVC	10 Bar	Replacement of concrete network lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1618	184,500	1
5.11	Main Sanitary Sewer Line and Internal Network Project - South and East of Taiz University - Habeel Salman	Cairo	160,200,250,315	Plastic UPVC	10 Bar	Main conveyance line, internal network - Concrete reinforced tanks - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	3500	340,000	1
5.12	Project/Sanitary Sewer Line - Al-Hisab from Joulah al-Mawar - Jame› al-Shibani - Wadi Issi	Al-Muzaffar	160,200,315	Plastic UPVC	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1190	176,990	1
5.13	Project/ Replacement of Main Sanitary Sewer Lines - Old City	Al-Muzaffar	160,200,315	Plastic UPVC	10 Bar	Replacement of deteriorated concrete network lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1615	179,751	1
5.14	Project/ Replacement of Deteriorated Sanitary Sewer Lines - Juhmalia Area Near Al-Thalaya School	Sallah	160,200,250	Plastic UPVC	10 Bar	Replacement of deteriorated concrete main line - New plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	3551	426,120	1
5.15	Project/Main Sanitary Sewer Line - Tha›abat Area - Southern Ring Road	Sallah	315,200,160	Plastic UPVC	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1720	206,400	1

5.16	Project/ Replacement of Deteriorated Concrete Sewer Line Extending from Di Lux to Al-Hajaz Al-Ramli in Aseefra	Cairo	800,600,500,315,200,160	Plastic UPVC	10 Bar	Replacement of old deteriorated concrete main sewer lines with new larger diameter pipes and construction of main manholes and sub-inspection chambers	m	2796	960,000	1
5.17	Project/Main Sanitary Sewer Line with Internal Network - Dahaya Area near Shibani Factory	Al-Muzaffar	315,200,160	Plastic UPVC	10 Bar	Main conveyance line and internal network lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	3551	450,000	1
5.18	Project/ Replacement of Sanitary Sewer Lines - Ajeenat Area	Al-Muzaffar	160,200,315	Plastic UPVC	10 Bar	Replacement of deteriorated main and branch sewer lines with new plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	2366	307,580	1
5.19	Project/ Replacement of Main Sewer Line - Jamal Street	Al-Muzaffar	400,200,160	Plastic UPVC	10 Bar	Replacement of deteriorated main and branch sewer lines with new plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1180	199,434	1
5.20	Project/ Replacement of Sanitary Sewer Lines for Internal Network - Al-Kawthar Al-Harish Area	Sallah	315,200,160	Plastic UPVC	10 Bar	Replacement of deteriorated main and branch sewer lines with new plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	2230	350,000	1
5.21	Project/ Replacement of Sanitary Sewer Lines - Shamas Area	Sallah	315,200,160	Plastic UPVC	10 Bar	Replacement of deteriorated main and branch sewer lines with new plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	3800	500,000	1
5.22	Project/ Replacement of Sanitary Sewer Lines - Al-Jumhuriya Area	Cairo	160,200,315	Plastic UPVC	10 Bar	Replacement of deteriorated main and branch sewer lines with new plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	2928	351,360	1
5.23	Project/ Replacement of Main Sanitary Sewer Line - From Al-Jumhuriya to Al-Majlia	Cairo	200, 315	Plastic UPVC	10 Bar	Replacement of old concrete main sewer lines with new larger diameter pipes and construction of new inspection chambers	m	2288	402,860	1

5.24	Project/ Replacement of Sanitary Sewer Lines for Deteriorated Network - Entire Souq Al-Sameel Area	Sallah	160,200,315	Plastic UPVC	10 Bar	Replacement of deteriorated main and branch sewer lines with new plastic pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling	m	1700	200,000	1
5.25	Project/Sanitary Sewer Network - Western Area - Phase One (CA-1)	Al-Muzaffar	500,400,315,200,160	Plastic UPVC & HDPE	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling - Protection layer	m	-	2,700,000	2
5.26	Project/Sanitary Sewer Network - Western Area - Phase Two (CA-2)	Al-Muzaffar	600,500,400,315,200,160	Plastic UPVC & HDPE	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling - Protection layer	m.	-	3,300,000	2
5.27	Project/Sanitary Sewer Network - Western Area - Phase Three (CA-3)	Al-Muzaffar	400,315,200,160	Plastic UPVC & HDPE	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling - Protection layer	m	-	1,600,000	3
5.28	Project/Sanitary Sewer Network - Western Area - Phase Four (CA-4)	Al-Muzaffar	500,400,315,200,160	Plastic UPVC & HDPE	10 Bar	Main and branch sewer lines - Pipes of various diameters - Manholes and inspection chambers of various diameters - Excavation and backfilling - Protection layer	m	-	2,400,000	3
Sub-total Priority 1 - Urgent (0-6 months)									9,862,439	
Sub-total Priority 2 - High (1-2 years)									6,602,860	
Sub-total Priority 3 - Medium (3-5 years)									4,000,000	
Sub-total Priority 4 - Low (>5 years)									0	
Total Package 5:									20,465,299	

Package 6: Electric Equipment and Solar System

ID	Requirements	Required For	Installation Location	Brief Technical Specifications	Unit	Quantity	Estimated Total Cost (USD)	Priority	
6.1	Proposed Requirements for Enhancing Energy Sources Efficiency								
6.1.1	Silent Generator 500KVA, 50Hz, 380-400V, Sea Level 1500	Water Supply System	Groundwater Wells	Silent Generator 500KVA, 50Hz, 380-400V, Sea Level 1500	Generator	2	120,000	1	
6.1.2	Silent Generator 350KVA, 50Hz, 380-400V, Sea Level 1500	Water Supply System	Groundwater Wells	Silent Generator 350KVA, 50Hz, 380-400V, Sea Level 1500	Generator	2	90,000	1	
6.1.3	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Generator	5	150,000	1	
6.1.4	15W40 Generator Oil, 15 barrels	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Barrel	15	15,000	1	
6.1.5	Diesel Engine Oil, 200 liters for vehicles and motorcycles	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Drum	200	4,000	1	
6.1.6	Batteries 50 Ampere-hour for generators	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Battery	30	15,000	1	
6.1.7	Batteries 70 Ampere-hour for generators	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Battery	30	2,100	1	
6.1.8	Batteries 100 Ampere-hour for generators	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Battery	50	6,000	1	
6.1.9	Batteries 120 Ampere-hour for generators	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Battery	50	7,500	1	
8.1.10	Batteries 150 Ampere-hour for generators	Water Supply System	Groundwater Wells	Silent Generator 120KVA, 50Hz, 380-400V, Sea Level 1500	Battery	20	3,000	1	
6.1.11	Batteries 200 Ampere-hour for generators	Water Supply System	Groundwater Wells	-	Battery	20	3,000	1	
6.1.12	Acid for 20-liter batteries	Water Supply System	Groundwater Wells	-	Drum	300	6,000	1	
6.1.13	Inverter (Converter), WEG, IP55, 15kW	Water Supply System	Pumping Stations	-	Inverter	5	11,000	1	
6.1.14	Inverter (Converter), WEG, IP55, 18.5kW	Water Supply System	Pumping Stations	-	Inverter	15	37,500	1	

6.1.15	Inverter (Converter), WEG, IP55, 22kW	Water Supply System	Pumping Stations	-	Inverter	6	18,000	1	
6.1.16	Inverter (Converter), WEG, IP55, 30kW	Water Supply System	Pumping Stations	-	Inverter	10	40,000	1	
6.1.17	Inverter (Converter), WEG, IP55, 37kW	Water Supply System	Groundwater Wells	-	Inverter	10	50,000	1	
6.1.18	Inverter (Converter), WEG, IP55, 45kW	Water Supply System	Groundwater Wells	-	Inverter	8	44,000	1	
6.1.19	Inverter (Converter), WEG, IP55, 55kW	Water Supply System	Groundwater Wells	-	Inverter	8	52,000	1	
6.1.20	Supply of air, oil, and diesel filters for generators in the institution›s wells as per the attached inventory	Water Supply System	Groundwater Wells	According to the attached inventory	Total	1	70,000	1	
6.1.21	Supply of necessary spare parts for overhauling each generator, including pistons, nozzles, bearings, rings, water pumps, oil pumps, sensors, and batteries for the generators mentioned in the previous item	Water Supply System	Groundwater Wells	According to the attached inventory	Total	1	100,000	2	
6.2	Required Needs for Expansion in Energy Sources Systems								
6.2.1	Supply and installation of a solar energy system to operate the East Ummad well with a capacity of (39) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	70,000	1	
6.2.2	Supply and installation of a solar energy system to operate the Republican Bridge well with a capacity of (27.75) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	60,000	1	
6.2.3	Supply and installation of a solar energy system to operate the Houl Atiya well with a capacity of (22.5) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	50,000	1	

6.2.4	Supply and installation of a solar energy system to operate the Ma›ssal/Al-Bun well with a capacity of (27.75) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	60,000	1	
6.2.5	Supply and installation of a solar energy system to operate the East Sina well with a capacity of (39) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	70,000	1	
6.2.6	Supply and installation of a solar energy system to operate the Husseinia well with a capacity of (27.75) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	60,000	1	
6.2.7	Supply and installation of a solar energy system to operate the Shajara well with a capacity of (33) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	70,000	1	
6.2.8	Supply and installation of a solar energy system to operate the Jadiriyah Station well with a capacity of (27) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	60,000	1	

6.2.9	Supply and installation of a solar energy system to operate the Bia›rra well with a capacity of (45) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	75,000	2	
6.2.10	Supply and installation of a solar energy system to operate the Jashash well with a capacity of (55.5) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	80,000	2	
6.2.11	Supply and installation of a solar energy system to operate the Medina al-Noor well with a capacity of (33) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	70,000	2	
6.2.12	Supply and installation of a solar energy system to operate the West Ummad well with a capacity of (27.75) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	60,000	2	
6.2.13	Supply and installation of a solar energy system to operate the Jamal Street well with a capacity of (45) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	75,000	2	

6.2.14	Supply and installation of a solar energy system to operate the Dahrat well with a capacity of (45) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	75,000	2	
6.2.15	Supply and installation of a solar energy system to operate the Thaبbat well with a capacity of (45) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	75,000	1	
6.2.16	Supply and installation of a solar energy system to operate the Dabbab Fog No. 1 well with a capacity of (82.5) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	100,000	2	
6.2.17	Supply and installation of a solar energy system to operate the Dabbab Fog No. 5 well with a capacity of (55.5) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	80,000	1	
6.2.18	Supply and installation of a solar energy system to operate the Dabbab Fog No. 9 well with a capacity of (55.5) kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	80,000	1	

6.2.19	Supply and installation of a solar energy system to operate the Tha›bat Station with a capacity of 360 kilowatts	Water Supply System	Pumping Station	Supply and installation of a solar energy system to operate the pumping station, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	520,000	1	To operate four pumps with a total capacity of 240 kilowatts.
6.2.20	Supply and installation of a solar energy system to operate the Jadiriyah well with a capacity of 135 kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	200,000	1	To operate one pump with a capacity of 90 kilowatts.
6.2.21	Supply and installation of a solar energy system to operate the Sina Station well with a capacity of 165 kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	240,000	1	To operate two pumps with a total capacity of 110 kilowatts.
6.2.22	Supply and installation of a solar energy system to operate the Majlia well with a capacity of 165 kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	240,000	1	To operate two pumps with a total capacity of 110 kilowatts.
6.2.23	Supply and installation of a solar energy system to operate the Wadi Al-Qadi Sewage Station with a capacity of 135 kilowatts	Sewage System	Pumping Station	Supply and installation of a solar energy system to operate the pumping station, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	200,000	1	To operate one pump with a capacity of 90 kilowatts.

6.2.24	Supply and installation of a solar energy system to operate the Dhabab Fog No. 1 well with a capacity of 270 kilowatts	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the well, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	400,000	3	To operate one pump with a capacity of 132 kilowatts
6.2.25	Supply and installation of a solar energy system to operate the first pumping station in the Hawjlah field with a capacity of 270 kilowatts	Water Supply System	Pumping Station	Supply and installation of a solar energy system to operate the pumping station, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	400,000	3	To operate one pump with a capacity of 132 kilowatts
6.2.26	Supply and installation of a solar energy system to operate the second pumping station in the Hawjlah field in Klaba with a capacity of 165 kilowatts	Water Supply System	Pumping Station	Supply and installation of a solar energy system to operate the pumping station, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	240,000	3	To operate one pump with a capacity of 110 kilowatts
6.2.27	Supply and installation of a solar energy system to operate the pumping station in the Hayma Al-Qaraf field with a capacity of 270 kilowatts	Water Supply System	Pumping Station	Supply and installation of a solar energy system to operate the pumping station, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	System	1	400,000	2	To operate one pump with a capacity of 132 kilowatts
6.2.28	Supply and installation of a solar energy system to operate the Taluq field wells	Water Supply System	Groundwater Wells	Supply and installation of a solar energy system to operate the wells, including solar panels, foundations, cables, inverter, and all necessary electrical work for well operation with solar energy.	Well	10	700,000	2	-
6.2.29	Wind Studies	-	-	Feasibility Study	Study	1	100,000	3	-
6.2.30	Overhaul of the Electrical System	-	Water Fields Electrical Networks Maintenance	Maintenance of electrical networks in water fields	Job	1	200,000	4	-

Sub-total Priority 1 - Urgent (0-6 months)					1,854,100				
Sub-total Priority 2 - High (1-2 years)					2,460,000				
Sub-total Priority 3 - Medium (3-5 years)					1,440,000				
Sub-total Priority 4 - Low (>5 years)					200,000				
Total Package 6:				5,954,100					

Package 7: Vehicles, Equipment and Tools

ID	Statement (1)	Technical Specifications	Unit	Quantity	Estimated Unit Cost (USD)	Total Estimated Cost (USD)	Priority (2)
	For water supply O&M						
7.1.1	Supply and delivery of a 5,000-liter diesel truck	As detailed in Annex no. B.5.5.a.1-1	Diesel truck	2	60,000	120,000	1
7.2.2	Supply and delivery of a 6,000-liter diesel truck	As detailed in Annex no. B.5.5.a.1-2	Diesel truck	2	70,000	140,000	3
7.1.3	Supply and delivery of a 10,000-liter diesel truck	As detailed in Annex no. B.5.5.a.1-3	Diesel truck	3	82,000	246,000	4
7.1.4	Supply and delivery of a 5,000-liter water tanker	As detailed in Annex no. B.5.5.a.2	Water tanker	6	35,000	210,000	4
7.1.5	Supply of a small dump tipper truck (3 tons)	Annex no. B.5.5.a.3-1	Dump tipper truck	2	50,000	100,000	1
7.1.6	Supply of a small dump tipper truck (6 tons)	Annex no. B.5.5.a.3-2	Dump tipper truck	3	70,000	210,000	3
7.1.7	Supply and delivery of a portable crane/winch on a 50-ton truck for well maintenance	Annex no. B.5.5.a.4	Winch	1	700,000	700,000	3
7.1.8	Supply and delivery of a mobile crane/ hiab crane on a 12-15 ton truck for well maintenance	Annex no. B.5.5.a.5	Hiab crane	1	170,000	170,000	1

7.1.9	Supply and delivery of a mobile crane/ hiab crane on a 7-10 ton truck for well maintenance	Annex no. B.5.5.a.5	Hiab crane	1	130,000	130,000	2
7.1.10	Supply of Medium Bobcat Loader	Annex no. B.5.5.a.6-1	Bobcat	3	80,000	240,000	1
7.1.11	Supply of Medium Bobcat Loader & Backhoe	Annex no. B.5.5.a.6-2	Bobcat	3	92,000	276,000	2
7.1.12	Supply of small Carry Pickup Trucks for water network maintenance teams	Annex no. B.5.5.a.7	Number	6	14,000	84,000	1
7.1.13	Supply of mobile maintenance workshops (Boxer Panel Van) for wells and water network maintenance	Annex no. B.5.5.a.8-1	Number	3	62,000	186,000	1
7.1.14	Supply of mobile maintenance workshops (Half-carriage Single cab) for wells and water network maintenance	Annex no. B.5.5.a.8-2	Number	3	70,000	210,000	1
7.1.15	Supply of mobile maintenance workshops (Double-cabin) for wells and production fields	Annex no. B.5.5.a.8-3	Number	6	70,000	420,000	3
7.1.16	Supply of small vehicles for project supervision, water distribution, emergencies, and sewage works	Annex no. B.5.5.a.9-1	Number	3	35,000	105,000	1
7.1.17	Supply of small vehicles for project supervision, water distribution, emergencies, and sewage works	Annex no. B.5.5.a.9-2	Number	7	35,000	245,000	2
7.1.18	Supply of 6 welding machines (large and medium)	Annex no. B.5.5.a.10	Number	6	-	32,000	1
7.1.19	Supply of 6 asphalt cutting machines (large and medium)	Annex no. B.5.5.a.11	Number	6	-	26,000	1
7.1.20	Supply of excavators for excavation works (5, 8, 10 tons)	Annex no. B.5.5.a.12	Number	6	-	30,000	1
7.1.21	Supply of 2 wheeled excavators for excavation works	Annex no. B.5.5.a.13-1	Number	2	140,000	280,000	1
7.1.22	Supply of 3 wheeled excavators for excavation works	Annex no. B.5.5.a.13-2	Number	3	140,000	420,000	3

7.1.23	Supply and delivery of 2 backhoe loaders for excavation works (STEER BACKHOE LOADER - Poclain)	Annex no. B.5.5.a.14-1	Number	2	160,000	320,000	1
7.1.24	Supply and delivery of 3 backhoe loaders for excavation works (STEER BACKHOE LOADER - Poclain)	Annex no. B.5.5.a.14-2	Number	3	160,000	480,000	3
7.1.25	Supply of 4 air compressors (2 medium + 2 large)	Annex no. B.5.5.a.15	Number	4	-	50,000	1
7.1.26	Supply of an integrated wireless communication unit	Annex no. B.5.5.a.16	Unit	1	-	95,000	1
7.1.27	Supply of a device for inspecting water meters of various diameters	Annex no. B.5.5.a.17	Number	1	180,000	180,000	2
7.1.28	Supply of professional safety tools	Annex no. B.5.5.a.18	Multiple	1	100,000	100,000	1
7.1.29	Supply of field devices for measuring elevations, electrical conductivity, pH, and borehole cameras	Annex no. B.5.5.a.19	Multiple	1	42,000	42,000	1
7.1.30	Rehabilitation of the maintenance workshop and supply of workshop equipment	Annex no. B.5.5.a.20	Multiple	1	120,000	120,000	1
7.1.31	Implementation of underground diesel storage tanks, total capacity 300,000 liters, number 3	Annex no. B.5.5.a.21	Number	3	70,000	210,000	1
7.1.32	Supply of leak detection and loss reduction devices	Annex no. B.5.5.a.22	Multiple	1	100,000	100,000	1
7.1.33	Supply of collection systems and field billing tools	Annex no. B.5.5.a.23	Multiple	1	40,000	40,000	1
7.2	For Operating and Maintaining the Sewage Collection, Transportation, and Treatment System						
7.2.1	Supply of Sewage Flushing Trucks (Jetting & Vacuum Tank mounted on Trucks) 10 m3	As detailed in Annex no. B.5.5.b.1-1	Number	2	240,000	480,000	1
7.2.2	Supply of Sewage Flushing Trucks (Jetting & Vacuum Tank mounted on Trucks) 10 m3	As detailed in Annex no. B.5.5.b.1-2	Number	2	240,000	480,000	3
7.2.3	Supply of 10,000 Capacity Sewage Suckers	As detailed in Annex no. B.5.5.b.2-1	Number	2	170,000	340,000	1

7.2.4	Supply of 15,000 Capacity Sewage Suckers	As detailed in Annex no. B.5.5.b.2-2	Number	2	195,000	390,000	2
7.2.5	Supply of Sewerage Rods (Sewer Cleaning)	As detailed in Annex no. B.5.5.b.3-1	Number	800	120	96,000	1
7.2.6	Supply of Sewerage Rods (Sewer Cleaning)	As detailed in Annex no. B.5.5.b.3-2	Number	1500	120	180,000	3
7.2.7	Supply of Heavy & Medium-duty Manholes Covers	As detailed in Annex no. B.5.5.b.4-1	Multiple	1000	-	138,000	1
7.2.8	Supply of Heavy & Medium-duty Manholes Covers	As detailed in Annex no. B.5.5.b.4-2	Multiple	3000	-	420,000	3
7.2.9	Supply of Small Transport Vehicles (Carry Pickup Trucks) for Sewer Network Maintenance, Emergency Teams, and Directorate Operations	As detailed in Annex no. B.5.5.b.5-1	Number	4	14,000	56,000	1
7.2.10	Supply of Vehicles for Supervision of Emergency Operations and Sewer Works	As detailed in Annex no. B.5.5.b.5-2	Number	4	35,000	140,000	2
7.2.11	Supply of Professional Safety Tools	As detailed in Annex no. B.5.5.b.6	Multiple	1	100,000	100,000	1
7.2.12	Supply of 4-inch Sewage Dewatering Pumps	As detailed in Annex no. B.5.5.b.7	Number	4	20,000	80,000	2
7.2.13	Supply of 6-inch Sewage Dewatering Pumps	As detailed in Annex no. B.5.5.b.7	Number	4	25,000	100,000	1
7.2.14	Supply of 8-inch Sewage Dewatering Pumps	As detailed in Annex no. B.5.5.b.7	Number	4	30,000	120,000	2
Sub-total Priority 1 - Urgent (0-6 months)						5,805,000	
Sub-total Priority 2 - High (1-2 years)						1,812,000	
Sub-total Priority 3 - Medium (3-5 years)						1,600,000	
Sub-total Priority 4 - Low (>5 years)						220,000	
Total Package 7:						9,437,000	

Package 8:Laboratory equipment

	Data	Installation Location	Technical Specifications	Unit	Quantity	Estimated Unit Cost (USD)	Total Estimated Cost (USD)	Priority
8.1	Water laboratories							

8.1.1	DR3900 vis spectrometers with Accessories &Reagent	Water Lab Section	As detailed in Annex no. B.6.2.a.1	Set	1	10,447	10,447	1
8.1.2	Economical flam photometry	Water Lab Section	As detailed in Annex no. B.6.2.a.2	Set	1	11,900	11,900	1
8.1.3	EuroMerit water still	Water Lab Section	As detailed in Annex no. B.6.2.a.3	PCs	2	8,920	17,840	1
8.1.4	Botanical Vacuum oven with 6 shelves	Water Lab Section	As detailed in Annex no. B.6.2.a.4	Set	1	3,450	3,450	1
8.1.5	Fume Hood 48 Dish work surface/vp light/Blower	Water Lab Section	As detailed in Annex no. B.6.2.a.5	Units	1	18,650	18,650	1
8.1.6	stereoZoom Microscope 2 mega pixel degital camera	Water Lab Section	As detailed in Annex no. B.6.2.a.6	Set	1	2,520	2,520	1
8.1.7	Titrettle Digital Bottletop Burette	Water Lab Section	As detailed in Annex no. B.6.2.a.7	Set	2	2,300	4,600	1
8.1.8	Digtal Incubator	Water Lab Section	As detailed in Annex no. B.6.2.a.8	PCs	2	4,355	8,710	1
8.1.9	Symmetry analytical Balance	Water Lab Section	As detailed in Annex no. B.6.2.a.9	PCs	1	2,100	2,100	2
8.1.10	Ultrasonic Cleaner Heater/Digital Timer	Water Lab Section	As detailed in Annex no. B.6.2.a.10	PCs	2	1,690	3,380	2
8.1.11	Digital Titrator	Water Lab Section	As detailed in Annex no. B.6.2.a.11	PCs	2	560	1,120	2
8.1.12	HQ-portable multi-meter PH Rod -Cond-T-OD	Water Lab Section	As detailed in Annex no. B.6.2.a.12	Set	1	8,318	8,318	2
8.1.13	Digital Stirring Hot Plat	Water Lab Section	As detailed in Annex no. B.6.2.a.13	PCs	2	2,000	4,000	2
8.1.14	Drummond Pipet Aid portable	Water Lab Section	As detailed in Annex no. B.6.2.a.14	PCs	3	980	2,940	2
8.1.15	HM-Heating Mantel	Water Lab Section	As detailed in Annex no. B.6.2.a.15	PCs	2	800	1,600	2
8.1.16	Refrigerator	Water Lab Section	As detailed in Annex no. B.6.2.a.16	PCs	3	700	2,100	2
8.2	Sewage Laboratories							
8.2.1	BOD-TRAK with accessories+Low Temperature -incubator	Sewage Lab Section	As detailed in Annex no. B.6.2.b.1	Set	1	8,000	8,000	1
8.2.2	Advantec Vacuum filtration manifold with vacuum pump 0.13 efm	Sewage Lab Section	As detailed in Annex no. B.6.2.b.2	PCs	1	6,000	6,000	1
8.2.3	Accuflame Bunsen Burner	Sewage Lab Section	As detailed in Annex no. B.6.2.b.3	Set	3	250	750	1
8.2.4	RTD General Purpose Digital Thermometer	Sewage Lab Section	As detailed in Annex no. B.6.2.b.4	PCs	3	200	600	1
8.2.5	DRB 200 Digital Reactor Block For TNT Plus	Sewage Lab Section	As detailed in Annex no. B.6.2.b.5	PCs	2	3,000	6,000	1
8.2.6	WB-200 Water Bath	Sewage Lab Section	As detailed in Annex no. B.6.2.b.6	Set	2	900	1,800	1

8.2.7	Stainless Steel Drying Rack	Sewage Lab Section	As detailed in Annex no. B.6.2.b.7	PCs	1	1,400	1,400	1
8.2.8	Filtering Flask Capacity 1000L	Sewage Lab Section	As detailed in Annex no. B.6.2.b.8	PCs	5	200	1,000	1
8.2.9	Compact Digital Lab Mixer	Sewage Lab Section	As detailed in Annex no. B.6.2.b.9	PCs	2	2,600	5,200	1
8.2.10	Non-electric Steam Sterilizer 41.5at	Sewage Lab Section	As detailed in Annex no. B.6.2.b.10	PCs	2	2,700	5,400	1
8.2.11	Essentials Buchner Funnel Porcelain 200ml	Sewage Lab Section	As detailed in Annex no. B.6.2.b.11	PCs	10	50	500	1
8.2.12	Handheld Colony Counter	Sewage Lab Section	As detailed in Annex no. B.6.2.b.12	Set	4	600	2,400	1
8.2.13	Volumetric Flask 50, 100, 250, 1000	Sewage Lab Section	As detailed in Annex no. B.6.2.b.13	PCs	12	17,300	17,300	1
8.2.14	Glass Beaker 10, 25, 50, 100, 500	Sewage Lab Section	As detailed in Annex no. B.6.2.b.13	PCs	12			1
8.2.15	Volumetric Pipettes 1, 2, 5, 10, 25	Sewage Lab Section	As detailed in Annex no. B.6.2.b.13	PCs	12			1
8.2.16	General Electric Countertop Microwave Oven, 700 Watts, 0.7 Cu. Ft., Black; 120V, 60 Hz	Sewage Lab Section	As detailed in Annex no. B.6.2.b.16	PCs	2	800	1,600	1
8.2.17	Cole-Parmer Digital Refractometer, 0 - 95% Brix, 1.3330 - 1.5400 RI	Sewage Lab Section	As detailed in Annex no. B.6.2.b.17	PCs	2	1,100	2,200	1
8.2.18	Chemical Reagents	Sewage Lab Section	As detailed in Annex no. B.6.2.b.14	PCs			24,000	1
Sub-total Priority 1 - Urgent (0-6 months)							129,225	
Sub-total Priority 2 - High (1-2 years)							58,600	
Sub-total Priority 3 - Medium (3-5 years)							0	
Sub-total Priority 4 - Low (>5 years)							0	
Total Package 8:							187,825	

Package 9: Water sterilization facilities

ID	Requirements	Installation Location	Technical Specifications	Unit	Quantity	Estimated Total Cost (USD)	Priority	Notes
9.1	Chlorination Plant equipment							
9.1.1	Supply and installation of new units	Republican Hospital Well 2, Daboua Well 3, Al-Hajari 4, Al-Durah 5, Al-Suwani	Dosing Pump: Pressure 16 bar, 7L/h, 40W-100~240v, Mixer 0.75 kw, Tank 200L	Set	5	2,650	1	
9.1.2		Sha›b Sait, Al-Muntazah, Al-Ba›arah, Al-Dahra, Al-Husseiniya, Houl Al-Shajarah	Dosing Pump: Pressure 18 bar, 4.5L/h, 40W-100~240v, Mixer 0.75 kw, Tank 200L	Set	6	4,030	1	
9.1.3	Supply and installation of new units	Jamal Street, Al-Salami, Madinat Al-Noor, Al-Judairi, Sallah well	Dosing Pump: Pressure 20 bar, 4L/h, 40W-100~240v, Mixer 0.75 kw, Tank 200L	Set	5	3,750	1	
9.1.4	Supply and installation of new chlorine units	Main Distribution Tanks	Pump max. flow rate: 15L/h, max working pressure: 5bar, pulse/minute: 130, injection volume per stroke: 2.1 ml, piston stroke length: 2.2mm, suction height: 2m, power supply 230v/50-60Hz.67w, Mixers: 0.12KW; 150rpm, polyethylene Tank 200l	Set	5	6,450	1	
9.1.5	Supply and installation of new chlorine units	Climate Distribution Tanks + University Station	Pump max. flow rate: 15L/h, max working pressure: 5bar, pulse/minute: 130, injection volume per stroke: 2.1 ml, piston stroke length: 2.2mm, Mixers: 0.12KW; 150rpm, polyethylene Tank 200l, suction height: 2m, power supply 230v/50-60Hz.67w	Set	5	6,750	1	
9.1.6	Supply of chlorine disinfection chemicals	MSDS Calcium Hypochlorite 70%	Appearance: white Granules, Chlorine 65-70%, sodium chloride max 15%, water insoluble max 3%	Drum	30x45kg	2,600	1	
9.1.7	Supply of residual chlorine test devices	F.R.C test Kit	F.R.C test Kit	Kit	16	640	1	
9.1.8	Supply of detectors and tools for monitoring the chlorine disinfection process	DPD1# + DPD3#	DPD1# + DPD3#	PKt/100	100	300	1	
9.1.9	Supply of multiple concentration chlorine tablets	PKT. chlorine tablet and polytester	PKT. chlorine tablet and polytester	PK	50x200	1,500	1	
9.1.10	Supply of necessary safety tools for chlorine disinfection process	Gloves + masks +...	Personal Use	PK	25xpk	750	1	
Sub-total Priority 1 - Urgent (0-6 months)						29,420		
Sub-total Priority 2 - High (1-2 years)						0		
Sub-total Priority 3 - Medium (3-5 years)						0		
Sub-total Priority 4 - Low (>5 years)						0		
Total Package 9:						29,420		