

Resilience - Oriented Indicators Overview

Yemen Water Sector Performance Indicators
of The Water and Sanitation Local Corporations in
Aden, Sana'a, Ibb, Taiz and Hodeidah



2nd Quarter

April – June 2020



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List of Abbreviation

BOD	Biological Oxygen Demand
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GIZ-IDWS	GIZ project 'Institutional Development of the Water Sector'
LCs	Water Supply and Sanitation Local Corporations
MWE	Ministry of Water and Environment
NWRA	National Water Resource Authority
PDA	Personal Digital Assistant
WASH	Water, Sanitation and Hygiene
WWTPs	Wastewater Treatment Plant

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Overview

The urban population in Yemen is supplied with drinking water through a large number of water supply systems. Most systems are public and managed through the Water and Sanitation Local Corporations (LCs) and their affiliated water utilities and branches, and others are private like water tanker suppliers. Sewerage networks are available and cover only a certain percentage of the population.

Since the situation in Yemen has been greatly exacerbated by the conflict and its repercussion in 2015. The LCs are operating under different institutional, administrative, operational, and financial conditions. They are encountering several challenges to secure an enabling environment that allows for service quality improvement, cost recovery and financial sustainability. Network rehabilitation and extension projects funded by government and/or donor organizations, due to the prolonged conflict, have been suspended or completely terminated.

Given the significant impact of water and wastewater services on life and public health of the population, ensuring financial sustainability and good service quality is crucial. Hence, the ability of the LCs to provide acceptable services depends on a wide range of factors, such as adequate infrastructure, access to energy and consumables, qualified personnel, efficient financial and performance-oriented management. Likewise, The current situation confirmed that conflict and fragility can be extremely disruptive to these interrelated elements, and how the quality of service delivery could be degraded to a point of no return or perpetuating the “vicious cycle” of managerial, financial and operational deficiencies, and in due course, leads to customers’ dissatisfaction with the

services they receive, and low revenue collection due to their unwillingness to pay for those services, which sooner or later, undermines the resilience of the service delivery and providers.

One of the utmost consequences of poor sanitation and low access to clean drinking water has had catastrophic hygiene and health effects by forcing the vast majority of the urban population to rely on unsecured alternative water supplies, making them susceptible to water-borne diseases. The outbreak of cholera, on the other hand, has placed a burden on the social responsibility and mandate of the LCs. Yemen has also reported its first case of COVID-19 in April 2020 and the severity of the current response to COVID-19 posed grave detrimental impacts on WASH service provision and sustainability, which are vital to disease prevention, core to survival and protection. To confront and mitigate further severity of pandemics, the WASH Cluster and the other Humanitarian Societies have mobilized the possible resources to support the resilience of the LCs with urgent operational measures to secure the continuity of safe drinking water supply and wastewater treatment.

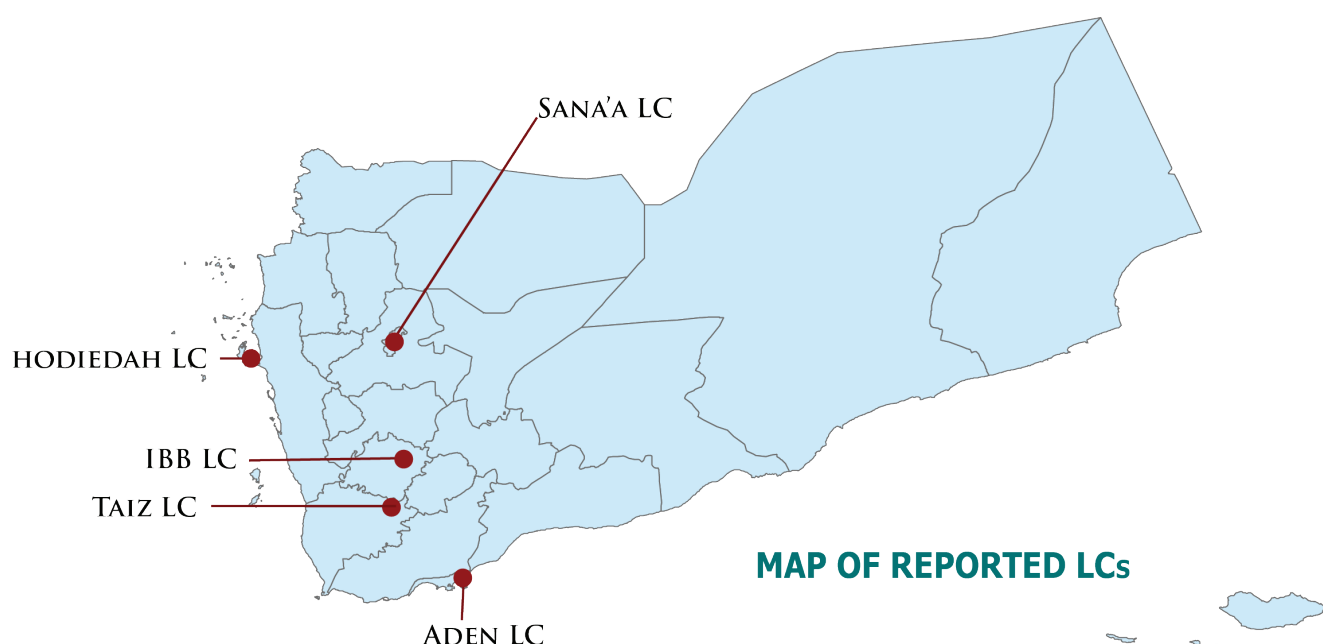
Improving the performance of LCs is challenging because the problems they face are multidimensional. Problems associated with dysfunctional and intricate business processes, cannot be overcome solely by short-term emergency measures. Achieving resilient and sustained service delivery requires a framework that integrates institutional measures with short/mid/long term investments to increase the efficiency and to reverse the dysfunctional equilibria in which the LCs operate.

2 Performance Monitoring Methodology

Since the conflict broke out in late March 2015, the Ministry of Water and Environment 'MWE' with the assistance of the GIZ Water Sector Program 'GIZ IDWS', has initiated a process to monitor and report key performance indicators of selected LCs serving in metropolitan cities of Sana'a, Aden, Taiz, Hodeidah and Ibb. These performance monitoring reports are based on financial, technical and operational performance indicators that are commonly used for the urban water sector. In addition, further reviews were integrated in 2019, summing up from 23 to 39 resilience-oriented performance indicators adapted to fit with the contextual situation, monitoring purposes and constitutes a valuable reference for effective evaluation of the impact of relevant sector interventions.

This report covers the period from April to June 2020, together with a brief technical analysis of key indicators

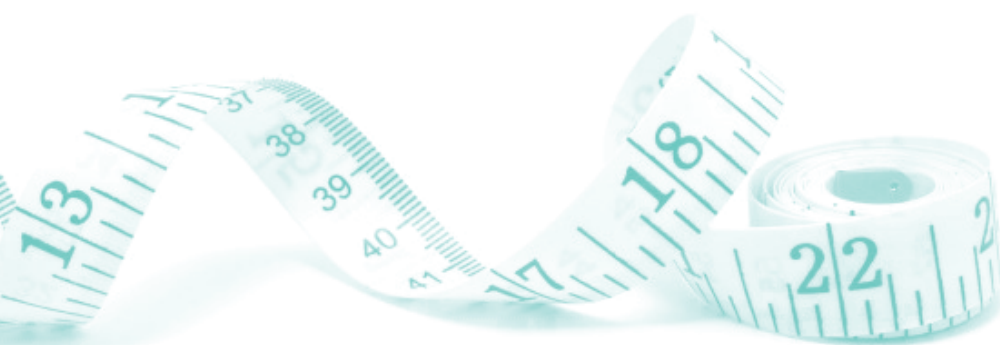
on different ranges of performance of each reported LC. The reporting exercise should not be perceived only as unilateral monitoring by GIZ IDWS, the process was carried out with data submitted and signed by the LCs' management through appointed focal points. Many clarifications were sought on the data provided especially for consistency and reliability of data and indicators. In some instances, estimates were given by the LCs in the absence or lack of systematic information. Nevertheless, GIZ IDWS team made every effort to improve data quality by means of validation, analysis and subsequently, reviewing the results, if necessary, with the LCs for further quality assurance; thus, the data finally presented are the best that could be obtained in the circumstances.



3 Emergency Water Sector Performance Indicators

This report measures the resilience of the LCs in terms of the following category of key resilience-oriented performance indicators:

	a. Service Coverage, Service Levels and Quality - Piped Water Supply	<ol style="list-style-type: none"> 1. Total population in service area (capita) 2. Number of IDPs in service area (capita) 3. Number of water connections (No.) 4. Number of population served through water supply network (capita) 5. Water supply service coverage = population served through water supply network vs total population in service area (%) 6. Number of service days of piped water supply per month (day/month) 	<ol style="list-style-type: none"> 7. Number of residual chlorine samples taken (No./month) 8. Number of residual chlorine samples according to standards (No./month) 9. Proportion of bacteriological quality samples of distributed water according to standards = Number of residual chlorine samples according to standards per total number of samples taken (%)
	b. Service Coverage and Quality - Sewerage	<ol style="list-style-type: none"> 10. Number of population served with sewerage connections (capita) 11. Number of sewerage connections (No.) 12. Sewerage connection coverage = population served through sewerage network vs total population in service area (%) 13. Number of BOD-samples of effluent of WWTP taken per month (No./month) 14. Number of BOD-samples of effluent of WWTP according to standards per month (No./month) 	<ol style="list-style-type: none"> 15. Proportion of effluent quality samples of wastewater treatment plants according to standards = Number of BOD samples according to standards per total number of samples taken (%) 16. Average BOD value of raw influent at WWTP (mg BOD₅/l) 17. Average BOD value of treated effluent at WWTP (mg BOD₅/l) 18. Treatment efficiency of WWTP regarding BOD (%)
	c. Production and consumption	<ol style="list-style-type: none"> 19. Total quantity of water produced (m³/month) 20. Per capita quantity of water produced (l/cap/day) 21. Storage capacity (m³) 22. Storage capacity share per capita (l/cap) 	<ol style="list-style-type: none"> 23. Energy costs per m³ water produced (YER/m³) 24. Effluent produced (m³/month) 25. Effluent produced (l/cap/day) 26. Effluent treated in wastewater treatment plant (m³/month)
	d. Performance of Pumps and Generators	<ol style="list-style-type: none"> 27. Total number of main pumps for the water supply system (No.) 28. Number of functional pumps in service (No.) 29. Number of working hours of all operating pumps of the water supply system (h/month) 30. Number of main functional pumps failures due to technical reasons (No./month) 	<ol style="list-style-type: none"> 31. Number of working generators in the operation of pumps (No.) 32. Number of working hours of all operating generators used to run the functional pumps of the water supply system (h/month)
	e. Financial Sustainability	<ol style="list-style-type: none"> 33. Total collected operational revenues (YER/month) 34. Total billed operational revenues (YER/month) 35. Total operational costs (YER/month) 36. Collection efficiency = Collected revenues vs. Billed revenues (%) 	<ol style="list-style-type: none"> 37. Actual operational cost coverage (%) 38. Monthly governmental subsidies (YER/month) 39. Percentage of basic monthly salaries paid (%)



4 Technical Analysis

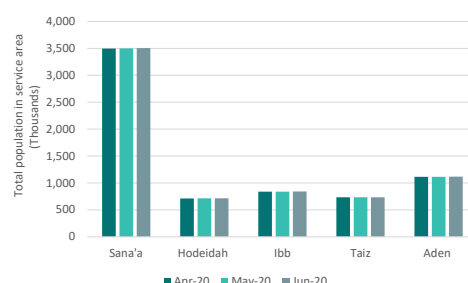
a. Service Coverage, Service Levels and Quality - Piped Water Supply

The service coverage indicator aims for demonstrating the physical accessibility of households that are connected to the distribution system expressed as a percentage of total number of populations in the served area. While access to infrastructure has advanced slowly in some areas; access to reliable and sustainable water supply remains challenging in general.

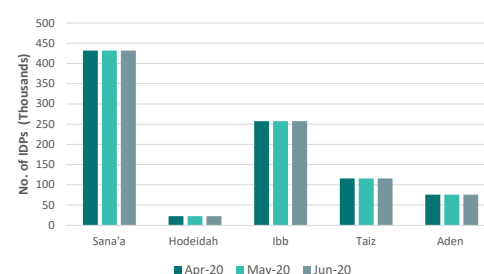
In the service area of the reported LCs, an average of 50% of the total urban population is connected to the public water supply system. Water coverage varies from LC to LC given the urban expansion accompanied by rapid population growth - keeping the LCs barely able to keep pace with adequate service coverage.

The massive influx of IDPs seeking safe areas and shelters had to a large extent aggravated the burden of the LCs to adequately comply with humanitarian aid efforts. However, the unresolved crisis situation in Hodeidah and other hot areas has kept large segment of people who have displaced to Sana'a and Ibb to resettle for an indefinite term, exacerbating the potentials of these LCs to augment the water service domain and connections to keep pace with the prevailing population growth and IDPs. Taiz LC has reported 76% of coverage claiming to serve additional households surrounding the water sources and vast areas equipped with water distribution points for humanitarian purposes. In this quarter, Aden LC was able to maintain 87% of service coverage as a logical consequence of financial support by the government and others to improve public services.

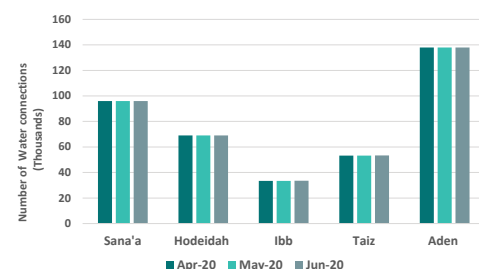
1. Total population in service area (capita)¹



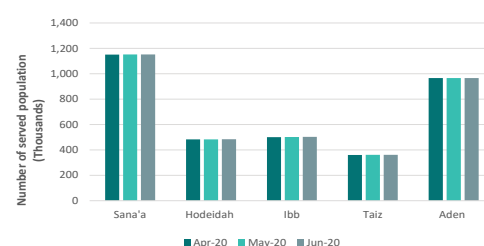
2. Number of IDPs in service area (capita)²



3. Number of water connections (No.)



4. Number of population served through water supply network (capita)



5. Water supply service coverage = population served through water supply network vs total population in service area (%)



1. The LCs do not have a reliable monthly population growth rate projection and were therefore estimated on the basis of an average of 2.5% of annual growth rate.

2. Source: WASH Cluster Response Coverage Jan-Dec 2020 (except IDPs data in Ibb is provided by the LC).

Number of service days of piped water supply

The scarcity of water resources in Sana'a, Taiz and Ibb has kept the supply of water susceptible to poorly fulfill the pressing demands of the served customers. Sana'a LC, hereby, has a lower water supply frequency maintained on average by 3 times a month. The shortage of water supply in Sana'a city could be due to the low volume of water production compared to Aden and Hodeidah with average supply 30 and 25 days consecutively per month. As a consequence of the massive drop in the water level of wells, Ibb LC has been struggling to optimize water sources despite the significant interruption in the water supply with an average of one day per month across all areas served by the LC. As was the case in the 1st quarter of 2020, no progress improvement has been observed in water supply services by Taiz LC with an average of once a month only.

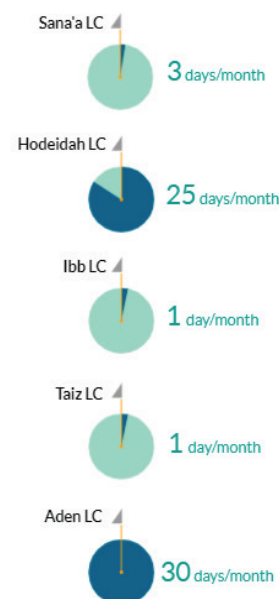
Customers served by intermittent systems are generally not satisfied with the amount of water they receive. Consequently, they try to maximize the amount they draw from the system during supply periods. The amount customers are able to collect depends on their localized pressure conditions. This puts those who are located far away from the main pipelines or at higher altitudes in the service area at a disadvantage. Customers collect and store water when the supply is on to meet their demand through the off-hours. When the supply cycle is short, the majority of customers pursue to draw their entire water demand within this very short period. This results in larger than expected flows in the pipes, causing high pressure losses, which result in low pressures at customers' end connections.

In order to respond as best they can to satisfy their needs. Customers incur a range of so-called coping costs to deal with interrupting water supply. These costs can relate to the purchase of facilities such as additional tanks to store water, domestic pumps because of low pressures, or the need to purchase alternative water supplies (e.g. private sector). Since the poorest customers can least afford such facilities, they are likely to be disproportionately affected by poor access to the public network.

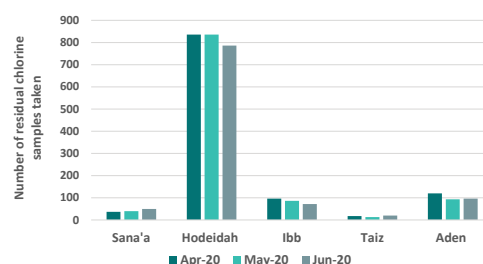
Bacteriological quality samples of distributed water

Alongside the obvious implications for water quantity, it brings concerns about water quality. In particular, interruption of water supply leads to zero pressure during non-supply periods, allowing contaminants to enter through broken or cracked pipes. These contaminants, which are in close proximity to the water network – are the result of poor or inadequate sanitation and drainage, raising the prospect of contamination. Hence, the water supply sourced by the LCs has been addressed as a suspicious causality of water-borne diseases if not treated, and the LCs were urged as preventive measures to carry out regular chlorination and tests for residual chlorine in the network to meet the required standards. Accordingly, LCs of Sana'a, Hodeidah, Ibb and Aden have shown compliance with bacteriological quality standards above 90% but remain doubtful unless the specific procedures and availability of measuring equipment and resources are verified. As for Taiz LC, the water quality treatment facilities (Labs & equipment) were entirely demolished during the armed clashes in the city. Alternatively, the LC has managed to conduct water sample tests either in the labs owned by the National Authority of Water Resources (NWRA Taiz branch) or in Ibb LC.

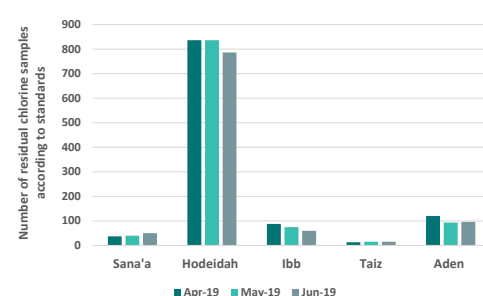
6. Number of service days of piped water supply per month (day/month)



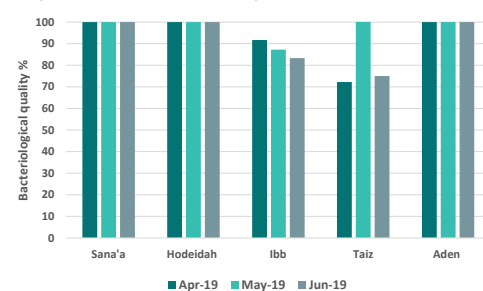
7. Number of residual chlorine samples taken (No./month)



8. Number of residual chlorine samples according to standards (No./month)



9. Proportion of bacteriological quality samples of distributed water according to standards = Number of residual chlorine samples according to standards per total number of samples taken %



b. Service Coverage and Quality - Sewerage

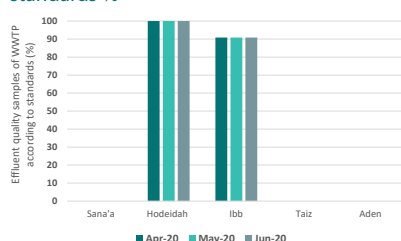
Most of the reported LCs have conventional sewer systems where about 43% of the population are served by the sewer networks. The remaining population discards their wastewater in privately owned cesspits where wastewaters are filtered and absorbed by the soil or pumped out with vacuum trucks either by the LC or by the private sector, given also that the concerned local authorities do not maintain any records of the properties with on-site sanitation.

In this quarter, most LCs are lagging behind adequate sewerage coverage in view of high urbanization rates, lack of investment for sewer networks expansion and infrastructure rehabilitation, etc. All are representing critical factors that constraints the LCs to effectively collect, treat, dispose and/or reuse of wastewater. It is also evident that the amount of sewage that is collected by some Wastewater Treatment Plans 'WWTPs' is higher and beyond the design capacity; therefore, WWTPs failures effectively mean that sewage effluent is being discharged without proper treatment into open areas, waterways, and onto irrigation areas, constituting obvious health risks to residents and huge affected areas.

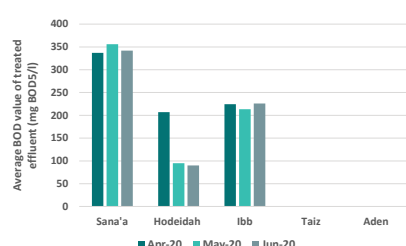
The surrounding poor conditions of insufficient power supply, lack of maintenance and the high volume of wastewater flows that have exceeded the capacity of the WWTPs have imposed poor quality of wastewater treatment to comply with the national standards. However, this report depended on the BOD₅ (a measure of organic pollution) of wastewater since the majority of the WWTPs' laboratories are either not equipped or dysfunctional to measure all test parameters. Additionally, the increase in BOD₅ concentrations could also be attributed to water scarcity and low production and supply frequency.

To demonstrate the wastewater treatment efficiency of the WWTPs by means of BOD₅. The treatment efficiency of effluent by Sana'a WWTP is 74% on average and the BOD₅ samples according to standards is 0%. The BOD₅ concentrations in the incoming wastewater are higher (1,329 mg/l average) than the BOD₅ design load (500 mg/l). The average treatment efficiency of effluent by WWTPs of Hodeidah and Ibb is 80% and the BOD₅ samples according to standards is 100% and 91% respectively. As for the WWTPs of Aden and Taiz, there have long been no tests for BOD₅ since the laboratories are damaged and out of operation, lacking the requisite equipment and materials; both appealing likewise for prompt and expanded assistance for the WWTPs facilities restoration.

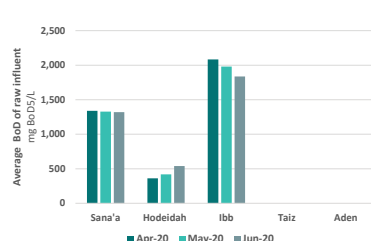
15. Proportion of effluent quality samples of wastewater treatment plants according to standards %



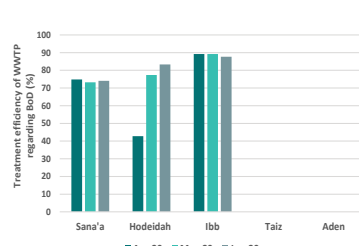
17. Average BOD value of treated effluent at WWTP (mg BOD₅/l)



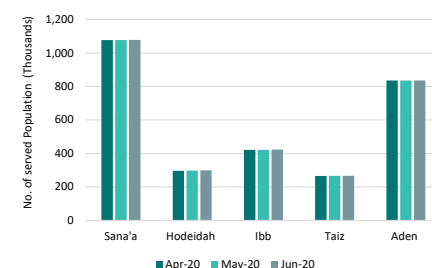
16. Average BOD value of raw influent at WWTP (mg BOD₅/l)



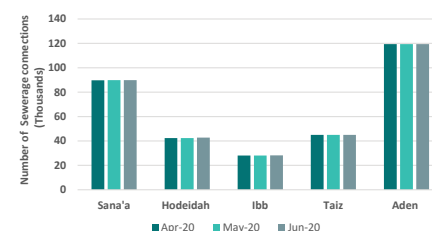
18. Treatment efficiency of WWTP regarding BOD₅ (%)



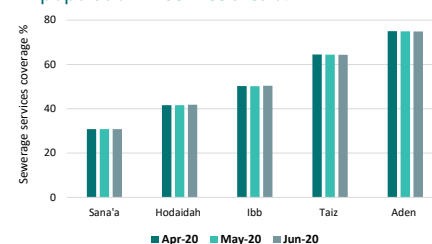
10. Number of population served with sewerage connections (capita)



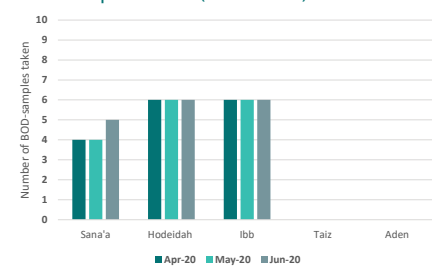
11. Number of sewerage connections (No.)



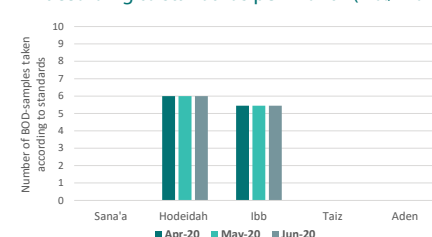
12. Sewerage connection coverage = population served through sewerage network vs total population in service area %



13. Number of BOD-samples of effluent of WWTP taken per month (No./month)



14. Number of BOD-samples of effluent of WWTP according to standards per month (No./month)



c. Production and Consumption

The storage capacity shares per capita by the LCs of Sana'a, Hodeidah, Ibb, Taiz and Aden are respectively 32, 52, 8, 88 and 98 l/capita. In this regard, the LCs must plan for extending the storage facilities to secure storage and production capacity, frequent demand for water supply and to respond effectively to urgent circumstances.

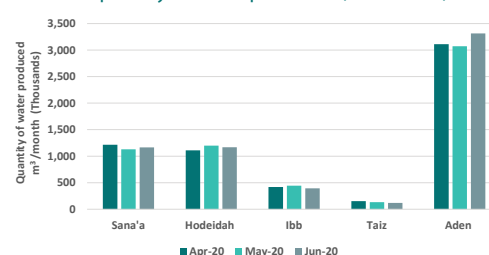
Average daily per capita of water production varies significantly among the LCs. For instance, LCs of Aden and Hodeidah have posted the highest average share at 106 and 77 l/c/d respectively. Whereas other LCs have quite low water production values per capita reaching an average of 33 l/c/d, as is the case in Sana'a LC, 27 l/c/d in Ibb LC, and 8 l/c/d in Taiz LC. These results may undoubtedly be considered due to lack in the local water resources, inadequate operating and production capabilities.

Energy costs per m³ water produced

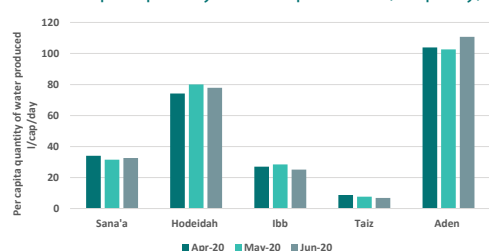
The frequent/entire cut-off of the National Electrical Grid posed a genuine challenge for the LCs to rely on and obtain an adequate amount of fuel for the operation of electric power generators. In addition, strong interactions with the energy system lie not only in the inherent need for energy for water pumping and wastewater treatment but even more so with important implications for operational costs.

For a thorough assessment of financial performance, the analysis of the energy costs (diesel and electricity) in this report was based on distinguishing the actual costs incurred by the LCs from those subsidized by the Humanitarian Organizations. The LCs were, therefore, requested to split and report their energy costs accounts without computing the costs of subsidized fuel as operating costs. For instance, energy costs account for 0% of the total operating costs in LCs of Sana'a, Taiz and Hodeidah LCs, since fuel is regularly supplied on a monthly basis and paid via the UNICEF, exempting these LCs from massive burdens of running costs and preserving their performance to meet other financial obligations. Though Ibb LC is one of the recipients of external fuel subsidies albeit on an intermittent basis, it remains largely self-reliant in obtaining fuel to fulfil the needs of power generation with an average cost 333 YER/m³. In this quarter, Aden LC reimbursed altogether the costs of the public electricity and fuel at an average price of 71 YER/m³, which roughly accounts for 30-35% of the total operating costs.

19. Total quantity of water produced (m³/ month)³



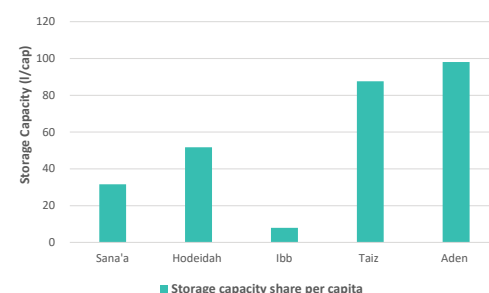
20. Per capita quantity of water produced (l/cap/day)⁴



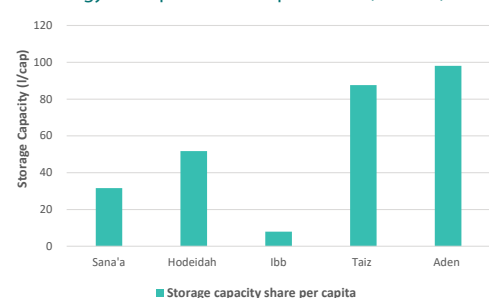
21. Storage capacity m³



22. Storage capacity share per capita (l/cap)



23. Energy costs per m³ water produced (YER/m³)⁵



3. The water quantity represents the production, not the billed water.

4. The calculation of per capita share of the water produced is based on LCs figures. The water supply provided by the private sector and/or humanitarian agencies was not monitored by the LCs and hence was not calculated in this report.

5. 1 Euro € ≈ 639 YER

1 US \$ ≈ 580 YER (June, 2020)

Source: InfoEuro (<http://ec.europa.eu/budget/graphs/infoeuro.html>)

Effluent treated in the WWTPS

The treatment efficiency of generated effluent varies among the LCs and depends on the WWTPs types and various stages of treatment for processing wastewater before disposal. Additionally, the available figures regarding the inflowing wastewater were estimated by the LCs since all the installed flow meters are either damaged or dysfunctional.

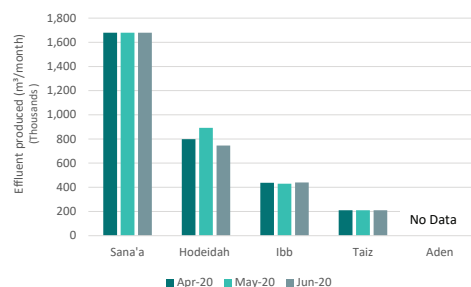
In this quarter, Sana'a WWTP has processed effluent on average 1,680,000 m³/month (52 l/cap/day), which constitutes almost 100% of the produced effluent. The design capacity (17,000 m³/day) of Taiz WWTP is underutilized, and currently receiving only on an average estimation of inflow 7000 m³/day representing only 40% of the nominal capacity of the treatment plant. This explains the implications of many attacks by the farmers drilling holes in manholes and the main transmission line in order to install pumps to use wastewater for agriculture crops and irrigation.

The average treatment of effluent by Hodeidah WWTP is 100% (88 l/cap/day), finding its way into the sea waters. The existing capacity of Ibb WWTP is 5,300 m³/day of sewage collection with average effluent generation 14,500 m³/day, presenting 63% overload of the plant. The WWTP lab of Aden LC was damaged as referred to the armed conflict in 2015, causing entire termination of regular measurement of treated wastewater and quality. Anyhow, mapping of existing WWTP operations and particular processes is crucial to outline the current performance and to identify the appropriate rehabilitation measures.

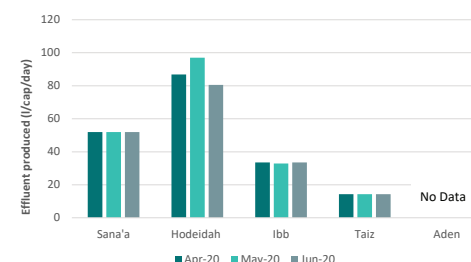
Treatment systems and capacity of the WWTPs

	WWTP	No. of WWTP	Nominal WWTP capacity m ³ /day	Effluent produced m ³ /day (Q2 2020)	Treatment system
1	Sana'a WWTP	2	50,500	56,000	Activated sludge
2	Ibb WWTP	1	5,300	14,534	Activated sludge
3	Hodeidah WWTP	1	54,000	27,087	Stabilization pond
4	Taiz WWTP	1	17,000	7,000	Oxidation pond
5	Aden WWTP	3	110,000	NA	Stabilization pond

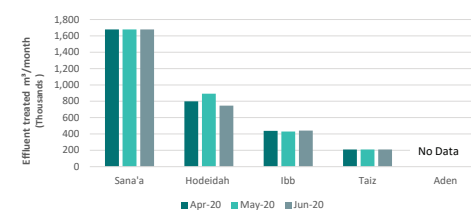
24. Effluent produced (m³/month)



25. Effluent produced (l/cap/day)



26. Effluent treated in wastewater treatment plant (m³/month)



d. Performance of pumps and generators

Most LCs have attempted with external fuel subsidies to overcome the power shortage by deploying additional electric generators to maintain the water supply. At the same time, full dependence on standby power has taxed excessive operating expenses beyond the LCs' financial capabilities. However, the solar water pumping system was a paradigm shift, introduced effectively in some areas to relieve stressful operational costs despite raising arguments about the future implications of renewable energy use on the local water resources.

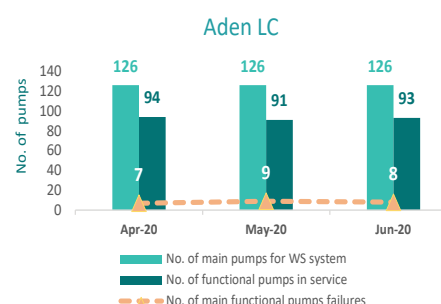
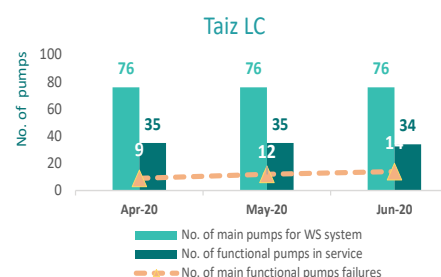
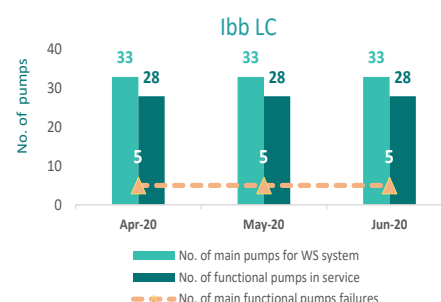
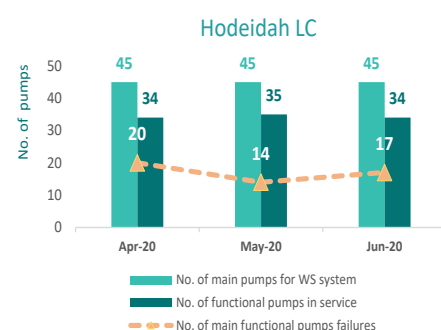
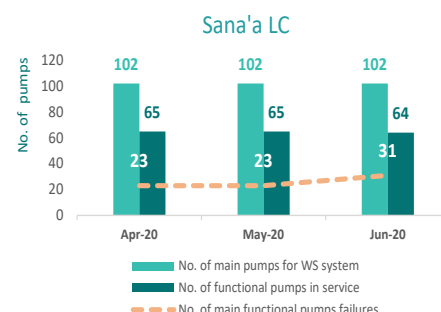
Generally, LC Sana'a has been supported, in addition to electric generators, with solar water pumping systems to reduce power failures and operate 63% of the main pumps running for 14 hours a day on average. In the meantime, Hodeidah LC has managed to operate up to 34 out of 45 main pumps. Both LCs of Sana'a and Hodeidah have suffered from a remarkable recurrence of pumps failures records. This can be viewed as adverse effects of long pumping hours and excess loads of electric generators.

In an attempt to cope with the water resource scarcity, Ibb LC was able to run 85% of the main pumps with 17% pumps damage caused by a decline in water wells level. Likewise, Taiz LC was barely efficient to enhance water production by running only 46% of the main pumps, owing to the limited availability of fuel to switch on the electric generators. Compared to other LCs, Aden LC operated about 93 of the 126 water pumps for water production on average 19 hours a day.

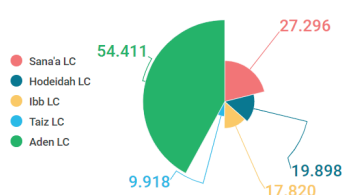
27. Total number of main pumps for the water supply system (No.)⁶

28. Number of functional water pumps in service (No.)

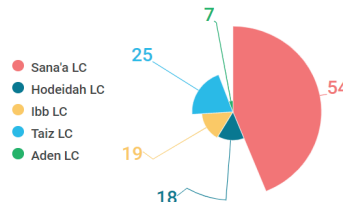
29. Number of main functional pump failures due to technical reasons (No./month)



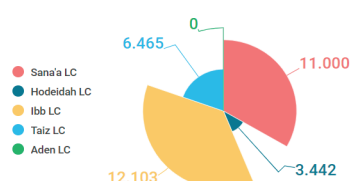
30. Number of working hours of all operating pumps of the water supply system (h/month)



31. Number of working generators in the operation of pumps (No.)



32. Number of working hours of all operating generators used to run the functional pumps of the water supply system (h/month)



6. The number of pumps represent the pumps in well fields and in pumping station in network.

e. Financial Viability

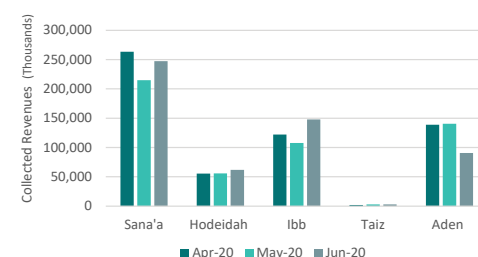
The financial viability varies significantly among the LCs due to differences in operating contexts, some of them do not reach cost recovery as a result of inadequate services or low tariffs. This becomes more challenging when coupled with a decline in revenue collection rates, causing an increase in receivables from customers and thus a shortage of liquidity.

As a result of ongoing efforts to improve their financial resources, service charges were effectively billed by Sana'a LC since the beginning of 2018. In addition, with the support of GIZ Water Program, Sana'a LC has employed the on-site 'Personal Digital Assistants (PDAs)' devices as an innovative approach to improve the quality of billing collection from the customers who ultimately realized the affordable costs of services obtained compared with the private water market. However, the upward patterns in financial recovery for Sana'a LC were attributed to collection efficiency improvement by 72%, seeming proportionate to cover operating costs (excluding fuel) as averaged in this quarter by 118%. Ibb LC was capable to stabilize monthly collection efficiency 79% along with a drop in cost coverage indeed by 63% on average. Although Hodeidah LC being striving to boost its financial standing, it had reported a performance decline in comparison with Q1st quarter 2020 both in collection efficiency and cost coverage.

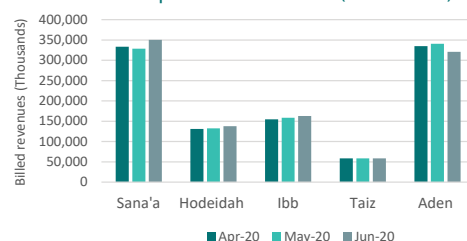
Owing to the fact that energy and wages were largely subsidized, Taiz LC did not rely on water sales and revenues to cover the operating expenses. As reported for this quarter, the steady scenario of low collection efficiency (5%) clearly proving inactive reading and billing processes. Such circumstances dictate the crucial mobilization of resources for network rehabilitation and the installation of new connections. In return, the LC must dynamically assume back business processes, inter alia, effective billing and collection management.

Though LC of Aden is striving to enhance the financial situation against the acceptable level of service provided to their customers. Poor customer management is the main culprit behind low collection efficiency 37% and operating costs coverage 18% in this quarter. For important considerations, the LC must gradually attempt to recover the state of underperformance and pursue to robust their financial footage to align with unexpected future tragedies such as discontinuity of external support.

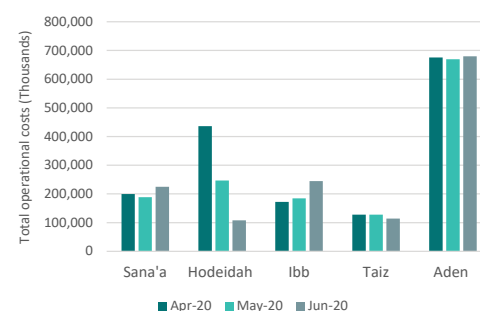
33. Total collected operational revenues (YER/month)⁷



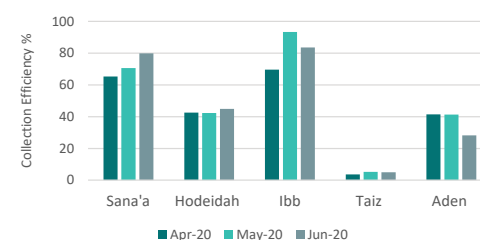
34. Total billed operational revenues (YER/month)



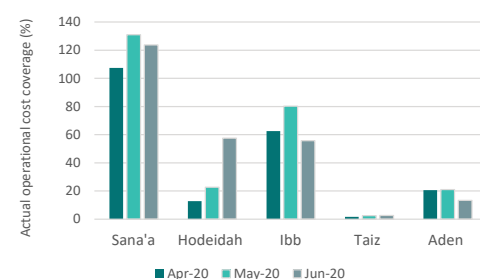
35. Total operational costs (YER/month)



36. Collection efficiency = Collected revenues vs. Billed revenues (%)



37. Actual operational cost coverage (%)



7. Revenues including domestic, commercial & governmental collection

Monthly governmental subsidies

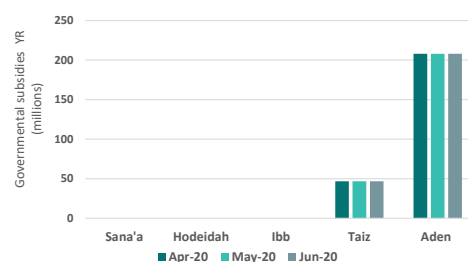
Given the fact that investment support from the government has dropped dramatically since 2015 due to deteriorating economic and financial conditions. In exclusive form, the LCs of Aden and Taiz were among fewer public institutions regularly receiving monthly allocations in kind of financial subsidies from the Ministry of Finance in Aden to pay basic staff salaries, while other LCs depend merely on water sales.

Percentage of basic monthly salaries paid

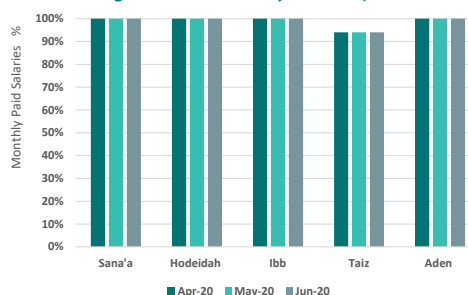
The eventual impact of external support and subsidies has gradually empowered the LCs in managing the salary expenses of employees. It should be noted that payroll is reported for the actual payments received monthly by the employees, regardless of the fact that some LCs reimburse late payments of the basic salaries retroactively.

Though most of the LCs were capable of paying 100% of the base salaries in this quarter, they are frequently in profound distress and vulnerable to secure the salaries and other heavy entitlements under volatile conditions and unpredictable continuity of external assistance.

38. Monthly governmental subsidies (YER/month)



39. Percentage of basic monthly salaries paid (%)



5 Resilience factors⁸

Disruptions of water supply and sanitation services can be caused by adverse effects on any one of the components that make up the service: people (e.g. skilled staff), hardware (e.g. infrastructure, equipment) and consumables (e.g. fuel, equipment, spare parts). Neither of these components is sufficient on its own. It is pointless having the spare parts required to repair electric generators, for instance, if the only technical staff able to install them are lacking the pertaining capacities and skills.

The LCs must increasingly strive to become more resilient and maintain services during/post-conflict. They must, therefore, address long-standing vulnerabilities in order to mitigate the cumulative effects of the conflict and gradually reduce their dependence on external short-term assistance.

At present, external assistance programmes, instead of sporadic crisis interventions, must seek to intervene in technical and investment measures. While these interventions may be essential during relief efforts, the resumption and strengthening of the LCs' capacity are equally synonymous with building resilience. It is the resilience that allows the LCs to maintain the reliable delivery of services in the short, medium and long-term. The table beside presents the identified resilience factors with their expected impact after the implementation of related activities.

RESILIENCE MEASURES AND IMPACT

Main Activity	Resilience Factor	Impact
Technical Assistance – Capacity building	Improve governance and management skills on top level.	<ul style="list-style-type: none"> • Support and guide the LC management during the crisis in the decision making of required actions and measures. • Enable managers and key staff to prepare and introduce customized policies and procedures to increase the performance of the utility. • Enhance the coordination and cooperation among the different stakeholders (donors). • Enhance monitoring, evaluation and accountability of the LC to increase the performance.
Technical Assistance – Capacity building, Financial support, Consultancy support, equipment support	Enhance the work capacity and skills of the employees. Human resource development	<ul style="list-style-type: none"> • Operate the utility more efficient and organized. • Improve coordination and cooperation among different departments. • Improve and increase the service for customers. • Manage professionally the exceptional work. Environment and the new technologies. • Reduce administrative water losses and increase revenue collection.
Technical Assistance – Financial support, Awareness building; Coaching, Investments	Strengthen the financial capacity of the utility.	<ul style="list-style-type: none"> • Ensure financial means at least to cover the minimum needs for operation of the utility. • Enable urgently needed repair and maintenance of the infrastructure. • Initiate pro-poor projects. • Keep motivated staff. • Enhance financial sustainability.
Technical Assistance – Awareness building, Operation Management Support	Improve customer management and customer relation.	<ul style="list-style-type: none"> • Increase service coverage and numbers of customers. • Enhance billing and collection procedures. • Increase collection efficiency and revenues. • Establish good customer relation to improve payment moral.
Investment – Rehabilitation, Maintenance, Extension	Increase water service coverage and supplied quantities.	<ul style="list-style-type: none"> • Increase water availability for urban residents. • Improve water supply condition. • Reduce physical water losses. • Increase number of customers. • Improve water quality.
Investment – Rehabilitation, Maintenance, Extension	Improve and extend sewer system.	<ul style="list-style-type: none"> • Improve hygiene and health situation for urban residents. • Protect environment and water sources. • Increase number of customers.
Investment	Provide renewable energy system (Photovoltaic).	<ul style="list-style-type: none"> • Operate water and sanitation facilities sufficiently. • Operate LC offices during working hours. • Reduce operation and maintenance costs.

8. GIZ IDWS/Damage Assessment Study DAS Stage 3 – Part 1: Resilience Strategy Report – Enhancing the Resilience of the LCs during Conflict and in Post-conflict Scenario - 2018

Annex 1 Resilience Emergency Indicators Sheet April -June 2020

Urban Water Sector - Sana'a LC, Aden LC, Hodeidah LC, Ibb LC & Taiz LC

No.	Data / Indicator	LC	Unit	1 st Q			2 nd Q		
				Jan-20	Feb-20	Mar-20	April-20	May-20	June-20
1	عدد السكان في المراكز الحضرية المخدومة من قبل مزود الخدمة (شهري في نهاية الشهر) Total population in service area	Sana'a	Cap	3,485,825	3,489,311	3,492,801	3,496,293	3,499,790	3,503,289
		Hodeidah		711,283	711,994	712,706	713,419	714,132	714,846
		Ibb		836,670	837,507	838,344	839,183	840,022	840,862
		Taiz		730,360	731,090	731,821	732,553	733,285	734,019
		Aden		1,111,019	1,112,130	1,113,242	1,114,355	1,115,469	1,116,585
2	عدد النازحين الى مناطق امتياز مزود الخدمة (شهري في نهاية الشهر) Number of IDPs in service area	Sana'a	Cap	431,896	431,896	431,896	431,896	431,896	431,896
		Hodeidah		22,536	22,536	22,536	22,536	22,536	22,536
		Ibb		257,500	257,500	257,500	257,500	257,500	257,500
		Taiz		115,678	115,678	115,678	115,678	115,678	115,678
		Aden		75,827	75,827	75,827	75,827	75,827	75,827
3	إجمالي عدد توصيلات المياه في نهاية الشهر - يشمل المنزلي، التجاري، والحكومي وغيره Number of water connections	Sana'a	No.	95,443	95,570	95,748	95,955	96,053	96,055
		Hodeidah		68,862	68,895	68,926	69,007	69,051	69,091
		Ibb		33,227	33,313	33,374	33,399	33,415	33,543
		Taiz		53,171	53,203	53,268	53,275	53,299	53,361
		Aden		136,891	137,374	137,625	137,967	137,967	137,967
4	عدد السكان المخدومين بالمياه من قبل مزود الخدمة (شهري في نهاية الشهر) Number of population served through water supply network	Sana'a	Cap	1,145,316	1,146,840	1,148,976	1,151,460	1,152,636	1,152,660
		Hodeidah		482,034	482,265	482,482	483,049	483,357	483,637
		Ibb		498,405	499,695	500,610	500,985	501,225	503,145
		Taiz		359,189	359,872	359,945	360,197	360,848	361,142
		Aden		958,237	961,618	963,375	965,769	965,769	965,769
5	نسبة عدد السكان المخدومين بالمياه من قبل مزود الخدمة من إجمالي السكان (شهري في نهاية الشهر) Water supply service coverage = population served through water supply network vs. total population in service area	Sana'a	%	33	33	33	33	33	33
		Hodeidah		68	68	68	68	68	68
		Ibb		60	60	60	60	60	60
		Taiz		76	76	76	76	76	76
		Aden		86	86	87	87	87	86
6	عدد أيام تزويد الخدمة خلال الشهر (تزويد المياه من خلال شبكة التوزيع) Number of service days of piped water supply per month	Sana'a	day/month	2.50	2.50	2.50	3	3	3
		Hodeidah		25	25	25	25	25	25
		Ibb		1	1	1	1	1	1
		Taiz		1	1	1	1	1	1
		Aden		30	30	30	30	30	30
7	إجمالي عدد عينات الكلور المأخوذة من شبكة المياه خلال الشهر Number of residual chlorine samples taken	Sana'a	No./month	62	64	42	37	40	50
		Hodeidah		846	789	853	836	836	786
		Ibb		118	112	120	96	86	72
		Taiz		12	10	16	18	13	20
		Aden		72	74	175	120	93	96

No.	Data / Indicator	City	Unit	1 st Q			2 nd Q		
				Jan-20	Feb-20	Mar-20	April-20	May-20	June-20
8	إجمالي عدد عينات الكلور الإيجابية المأخوذة من شبكة المياه والتي تتوافق مع المعايير Number of residual chlorine samples according to standards	Sana'a	No./ month	62	64	42	37	40	50
		Hodeidah		846	789	853	836	836	786
		Ibb		103	105	100	88	75	60
		Taiz		12	10	16	13	15	15
		Aden		72	74	175	120	93	96
9	درجة نقاوة المياه المزودة بكتورولوجيا Proportion of bacteriological quality samples of distributed water according to standards = Number of residual chlorine samples according to standards per total number of samples taken	Sana'a	%	100	100	100	100	100	100
		Hodeidah		100	100	100	100	100	100
		Ibb		87	94	83	92	87	83
		Taiz		100	100	100	72	115	75
		Aden		100	100	100	100	100	100
10	عدد السكان المخدومين بشبكات الصرف الصحي من قبل مزود الخدمة (شهري في نهاية الشهر) Number of population served with sewerage connections	Sana'a	Cap	1,070,976	1,072,428	1,074,564	1,076,928	1,077,912	1,078,500
		Hodeidah		296,233	296,352	296,450	296,709	296,821	299,019
		Ibb		418,455	419,535	420,465	421,200	421,410	423,255
		Taiz		265,144	265,406	265,648	265,700	265,931	266,141
		Aden		830,620	832,762	834,057	835,695	835,695	835,702
11	إجمالي عدد توصيلات الصرف الصحي - يشمل المنزلي، التجاري، والحكومي وغيره Number of sewerage connections	Sana'a	No.	89,248	89,369	89,547	89,744	89,826	89,875
		Hodeidah		42,319	42,336	42,350	42,387	42,403	42,717
		Ibb		27,897	27,969	28,031	28,080	28,094	28,217
		Taiz		44,912	44,935	44,940	44,962	44,982	44,983
		Aden		118,660	118,966	119,151	119,385	119,385	119,386
12	نسبة عدد السكان المخدومين بشبكات الصرف الصحي من قبل مزود الخدمة (شهري في نهاية الشهر) Sewerage connection coverage	Sana'a	%	31	31	31	31	31	31
		Hodeidah		42	42	42	42	42	42
		Ibb		50	50	50	50	50	50
		Taiz		65	65	64	64	64	64
		Aden		75	75	75	75	75	75
13	عدد عينات الـ (بي أو دي) المجمعة من محطات المعالجة خلال الشهر Number of BOD-samples of effluent of WWTP taken per month	Sana'a	No.	6	5	4	4	4	5
		Hodeidah		2	–	2	6	6	6
		Ibb		5	6	6	6	6	6
		Taiz		–	–	–	–	–	–
		Aden		–	–	–	–	–	–
14	عدد عينات الـ (بي أو دي) المجمعة من محطات المعالجة المطابقة لمعيار التدفق خلال الشهر Number of BOD-samples of effluent of WWTP according to standards per month	Sana'a	No.	0	0	0	0	0	0
		Hodeidah		2	–	2	6	6	6
		Ibb		4	5	5	5	5	5
		Taiz		–	–	–	–	–	–
		Aden		–	–	–	–	–	–
15	كفاءة المعالجة في محطات معالجة الصرف الصحي Proportion of effluent quality samples of wastewater treatment plants according to standards = Number of BOD samples according to standards per total number of samples taken	Sana'a	%	0	0	0	0	0	0
		Hodeidah		100	–	100	100	100	100
		Ibb		89	75	75	91	91	91
		Taiz		–	–	–	–	–	–
		Aden		–	–	–	–	–	–

No.	Data / Indicator	City	Unit	1 st Q			2 nd Q		
				Jan-20	Feb-20	Mar-20	April-20	May-20	June-20
16	متوسط قيمة ال (بي أو دي) للمياه المتدفقة (الخام) الى محطة معالجة مياه الصرف الصحي Average BOD value of raw influent at WWTP	Sana'a	mg BOD ₅ /L	1,520	1,292	1,268	1,340	1,328	1,320
		Hodeidah		535	—	450	362	420	540
		Ibb		2,085	2,180	2,099	2,084	1,981	1,836
		Taiz		—	—	—	—	—	—
		Aden		—	—	—	—	—	—
17	متوسط قيمة ال (بي أو دي) من المياه المعالجة (الخارجة) من محطة معالجة مياه الصرف الصحي Average BOD value of treated effluent at WWTP	Sana'a	mg BOD ₅ /L	611	345	330	337	356	342
		Hodeidah		81	—	84	207	95	90
		Ibb		225	235	226	224	213	226
		Taiz		—	—	—	—	—	—
		Aden		—	—	—	—	—	—
18	كفاءة المعالجة لمحطة مياه الصرف الصحي فيما يخص ال (بي أو دي) Treatment efficiency of WWTP regarding BOD	Sana'a	%	60	73	74	75	73	74
		Hodeidah		85	—	81	43	77	83
		Ibb		89	89	89	89	89	88
		Taiz		—	—	—	—	—	—
		Aden		—	—	—	—	—	—
19	إجمالي كمية المياه المنتجة Total quantity of water produced	Sana'a	m ³ /month	1,098,936	1,051,786	1,193,185	1,216,162	1,128,250	1,165,038
		Hodeidah		1,189,959	1,094,403	1,122,242	1,110,556	1,198,930	1,168,189
		Ibb		422,809	410,000	398,793	419,461	442,481	392,322
		Taiz		142,791	139,474	152,634	151,655	133,979	119,408
		Aden		3,267,100	3,253,328	3,376,256	3,111,407	3,073,060	3,314,826
20	نصيب الفرد من المياه المنتجة Per capita quantity of water produced	Sana'a	l/cap/day	31	30	33	34	32	33
		Hodeidah		80	73	75	74	80	78
		Ibb		27	26	26	27	28	25
		Taiz		8	8	9	9	8	7
		Aden		110	109	113	104	103	111
21	الطاقة التخزينية الشهرية المتاحة Storage capacity	Sana'a	m ³	36,450	36,450	36,450	36,450	36,450	36,450
		Hodeidah		25,000	25,000	25,000	25,000	25,000	25,000
		Ibb		4,000	4,000	4,000	4,000	4,000	4,000
		Taiz		49,000	49,000	49,000	49,000	49,000	49,000
		Aden		94,700	94,700	94,700	94,700	94,700	94,700
22	نصيب الفرد من الطاقة التخزينية المتاحة Storage capacity share per capita	Sana'a	l/cap	32	32	32	32	32	32
		Hodeidah		52	52	52	52	52	52
		Ibb		8	8	8	8	8	8
		Taiz		88	88	88	88	88	87
		Aden		99	98	98	98	98	98
23	تكلفة الطاقة لكل متر مكعب منتج من المياه خلال الشهر Energy costs per m ³ water produced	Sana'a	YER/m ³	0	0	0	0	0	0
		Hodeidah		0	0	0	0	0	0
		Ibb		300	334	376	344	366	291
		Taiz		0	0	0	0	0	0
		Aden		68	66	62	72	72	67
24	كمية المياه المنتجة - المعالجة أو غير المعالجة - التي تتدفق من محطة معالجة الصرف الصحي Effluent produced	Sana'a	m ³ /month	1,488,000	1,392,000	1,488,000	1,680,000	1,680,000	1,680,000
		Hodeidah		684,250	747,150	781,150	799,000	892,500	746,300
		Ibb		452,435	442,483	455,433	437,663	429,835	440,591
		Taiz		210,000	210,000	210,000	210,000	210,000	210,000
		Aden		—	—	—	—	—	—

No.	Data / Indicator	City	Unit	1 st Q			2 nd Q		
				Jan-20	Feb-20	Mar-20	April-20	May-20	June-20
25	كمية المياه المنتجة - المعالجة أو غير المعالجة - التي تتدفق من محطة معالجة الصرف الصحي Effluent produced	Sana'a	l/cap/day	46	43	46	52	52	52
		Hodeidah		75	81	85	87	97	81
		Ibb		35	34	35	34	33	34
		Taiz		14	14	14	14	14	14
		Aden		–	–	–	–	–	–
26	كمية مياه الصرف الصحي المعالجة التي تتدفق من محطة المعالجة Effluent treated in wastewater treatment plant	Sana'a	m ³ /month	1,488,000	1,392,000	1,488,000	1,680,000	1,680,000	1,680,000
		Hodeidah		684,250	747,150	781,150	799,000	892,500	746,300
		Ibb		452,435	442,483	455,433	437,663	429,835	440,591
		Taiz		210,000	210,000	210,000	210,000	210,000	210,000
		Aden		–	–	–	–	–	–
27	إجمالي عدد المضخات الرئيسية Total number of main pumps for the water supply system	Sana'a	No.	102	102	102	102	102	102
		Hodeidah		45	45	45	45	45	45
		Ibb		31	32	32	33	33	33
		Taiz		76	76	76	76	76	76
		Aden		126	126	126	126	126	126
28	عدد المضخات الرئيسية العاملة والتي تضخ المياه خلال الشهر Number of functional pumps in service	Sana'a	No./month	61	64	67	65	65	64
		Hodeidah		35	34	33	34	35	34
		Ibb		27	28	27	28	28	28
		Taiz		36	36	38	35	35	34
		Aden		96	98	97	94	91	93
29	عدد ساعات عمل (تشغيل) المضخات (كل المضخات العاملة والتي تضخ المياه) في الشهر Number of working hours of all operating pumps of the water supply system	Sana'a	h/month	25,865	25,038	28,991	28,415	26,237	27,296
		Hodeidah		19,896	18,687	20,522	18,938	22,368	19,898
		Ibb		18,414	17,248	18,414	17,820	18,414	14,580
		Taiz		10,522	10,227	11,042	10,756	9,918	8,082
		Aden		56,072	55,192	56,882	54,971	54,411	54,056
30	عدد الأعطال الناتجة عن أسباب فنية خلال الشهر للمضخات الرئيسية العاملة في ضخ المياه Number of main functional pumps failures due to technical reasons	Sana'a	No./month	4	21	26	23	23	31
		Hodeidah		15	17	20	20	14	17
		Ibb		4	4	5	5	5	5
		Taiz		5	12	7	9	12	14
		Aden		5	4	3	7	9	8
31	عدد المولدات العاملة في تشغيل المضخات Number of working generators in the operation of pumps	Sana'a	No.	52	54	59	56	56	51
		Hodeidah		17	18	18	17	18	18
		Ibb		17	18	18	19	19	19
		Taiz		31	32	29	25	25	24
		Aden		7	7	7	7	7	7
32	عدد ساعات عمل (تشغيل) المولدات (كل المولدات العاملة المستخدمة في تشغيل المضخات لضخ المياه) خلال الشهر Number of working hours of all operating generators used to run the functional pumps of the water supply system	Sana'a	h/month	10,051	10,776	12,560	11,966	9,937	11,097
		Hodeidah		3,953	3,232	4,096	3,834	3,467	3,026
		Ibb		11,594	11,088	12,276	11,970	12,369	11,970
		Taiz		7,755	7,956	7,758	7,328	6,829	5,238
		Aden		–	–	–	–	–	–
33	قيمة الإيرادات الشهرية المحصلة Total collected operational revenues	Sana'a	YER/month	279,778,052	271,855,470	263,425,357	214,755,532	247,312,221	278,339,254
		Hodeidah		62,685,786	68,265,317	72,544,237	55,681,676	55,995,572	61,982,857
		Ibb		121,789,124	136,355,581	134,095,608	122,010,885	107,623,597	148,005,490
		Taiz		2,574,634	3,025,700	3,053,230	2,098,536	3,085,601	2,904,230
		Aden		149,122,423	138,997,097	140,651,059	138,997,097	140,651,059	90,664,355

No.	Data / Indicator	City	Unit	1 st Q			2 nd Q		
				Jan-20	Feb-20	Mar-20	April-20	May-20	June-20
34	قيمة الإيرادات الشهرية المفوترة (قيمة مبيعات المياه الشهرية المفوترة) Total billed operational revenues	Sana'a	YER/ month	250,525,158	279,778,052	271,855,470	263,425,357	214,755,532	247,312,221
		Hodeidah		136,277,298	131,477,500	127,706,007	130,868,670	132,360,379	138,003,777
		Ibb		151,390,035	159,664,558	144,703,575	154,462,867	158,427,464	163,138,132
		Taiz		58,619,550	58,619,550	58,619,550	58,619,550	58,619,550	58,619,550
		Aden		344,859,483	334,880,861	340,684,867	334,880,861	340,684,867	320,750,115
35	إجمالي التكاليف التشغيلية Total operational costs	Sana'a	YER/ month	350,044,974	315,675,128	344,062,362	333,177,437	328,546,997	350,044,974
		Hodeidah		160,121,432	175,285,720	179,936,960	436,169,970	247,059,519	107,846,416
		Ibb		165,322,725	163,496,062	170,314,523	171,908,406	184,551,952	244,932,911
		Taiz		127,569,040	129,078,100	130,153,720	127,443,460	127,984,420	113,769,940
		Aden		683,900,568	675,328,587	669,804,540	675,328,587	669,804,540	679,736,635
36	نسبة التحصيل Collection efficiency = Collected revenues vs.. billed revenues	Sana'a	%	89	79	79	65	71	80
		Hodeidah		46	52	57	43	42	45
		Ibb		85	85	84	70	93	84
		Taiz		4	5	5	4	5	5
		Aden		43	42	41	42	41	28
37	التغطية التشغيلية المحصلة للكلفة Actual operational cost coverage	Sana'a	%	160	133	109	107	131	124
		Hodeidah		39	39	40	13	23	57
		Ibb		78	83	72	63	80	56
		Taiz		2	2	2	2	2	3
		Aden		22	21	21	21	21	13
38	قيمة الإعانات (المعونات) الحكومية الشهرية لمزود الخدمة Monthly governmental subsidies	Sana'a	YER/ month	0	0	0	0	0	0
		Hodaidah		0	0	0	0	0	0
		Ibb		0	0	0	0	0	0
		Taiz		46,828,589	46,828,589	46,828,589	46,828,589	46,828,589	46,828,589
		Aden		208,026,312	208,026,312	208,026,312	208,026,312	208,026,312	208,026,312
39	نسبة الرواتب الأساسية الشهرية المدفوعة للموظفين Percentage of basic monthly salaries paid	Sana'a	%	100%	100%	100%	100%	100%	100%
		Hodaidah		100%	100%	100%	100%	100%	100%
		Ibb		100%	100%	100%	100%	100%	100%
		Taiz		94%	94%	94%	94%	94%	94%
		Aden		100%	100%	100%	100%	100%	100%

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Published by

- Sana'a Water Local Corporation

T +967 1 250162, E swslc@y.net.ye

- Aden Water Local Corporation

T +967 2 254272-260171,2,3, E water-aden@y.net.ye

- Ibb Water Local Corporation

T +967 4 412034, E ibbwslc@gmail.com

- Hodeidah Water Local Corporation

T +967 3 204546,5-220494, E hswslc@y.net.ye

- Taiz Water Local Corporation

T +967 777209300, E twslc@yemen.net.ye

In cooperation with

Deutsche Gesellschaft für

Internationale Zusammenarbeit (GIZ) GmbH

Institutional Development of the Water Sector

GIZ Office

Hadda area, Str. 21

Sana'a, Yemen

T +967 1 434 429 - Ext. 404

F +967 1 412 387

E christine.werner@giz.de

W www.giz.de/yemen

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