التعاون الألماني
DEUTSCHE ZUSAMMENARBEIT

Published by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Resilience - Oriented Indicators Overview

Yemen Water Sector Performance Indicators

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

1st Quarter

January – March 2020

IBB-WSLC

SWSLC

Contents

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

1 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 providers.

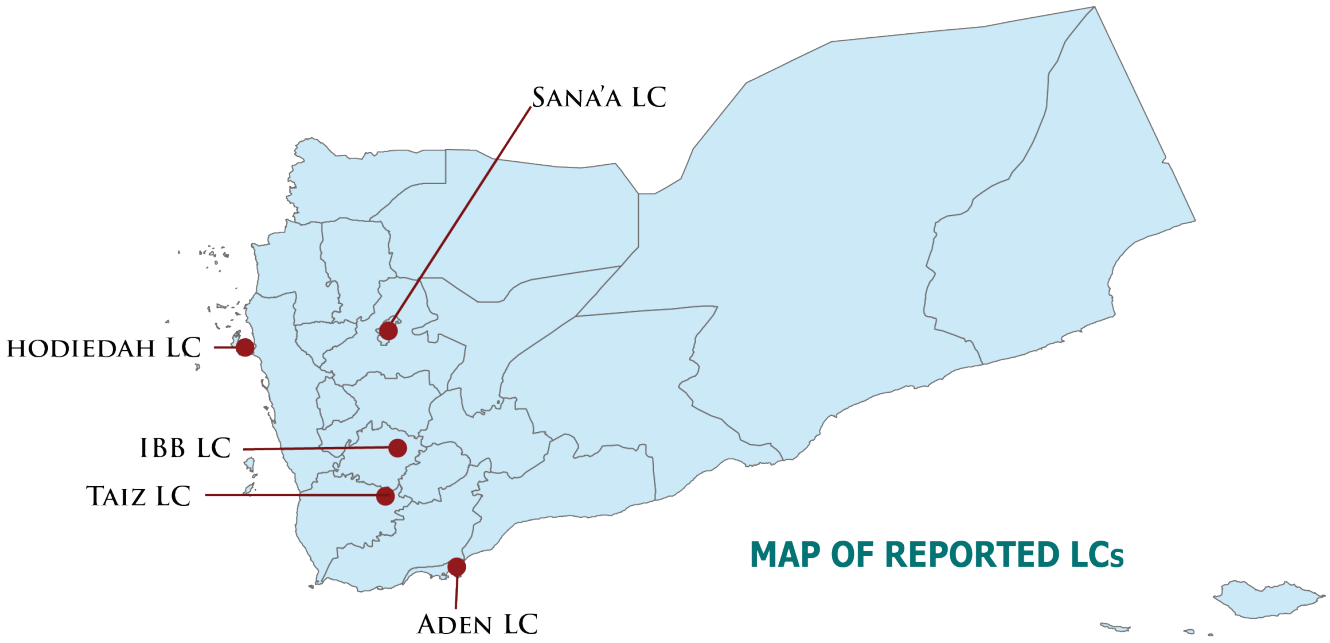
One of the utmost consequences of poor sanitation and low access to clean drinking water has had catastrophic hygiene and health effects by forcing the vast majority of the urban population to rely on unsecured alternative water supplies, making them susceptible to water-borne diseases. The outbreak of cholera, on the other hand, has placed a burden on the social responsibility and mandate of the LCs. To confront and mitigate further severity of Cholera epidemic, 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 intricated 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 January to March 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.



MAP OF REPORTED LCs

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

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)
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

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)
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

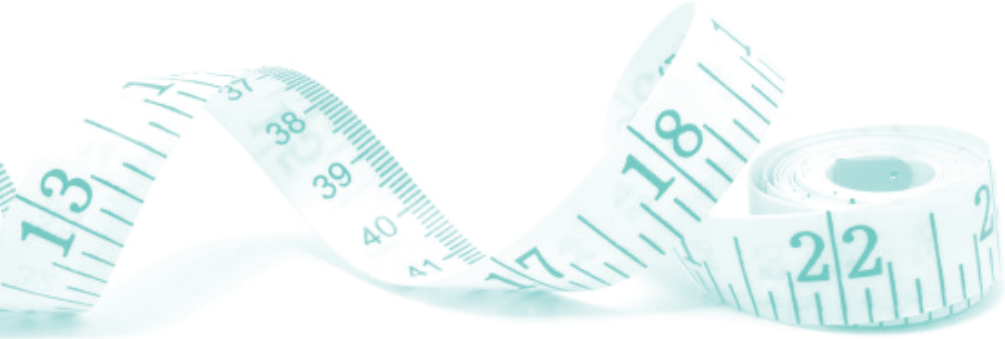
19. Total quantity of water produced (m^3/month)
20. Per capita quantity of water produced (l/cap/day)
21. Storage capacity (m^3)
22. Storage capacity share per capita (l/cap)
23. Energy costs per m^3 water produced (YER/m^3)
24. Effluent produced (m^3/month)
25. Effluent produced (l/cap/day)
26. Effluent treated in wastewater treatment plant (m^3/month)

d. Performance of Pumps and Generators

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)
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

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 (%)
37. Actual operational cost coverage (%)
38. Monthly governmental subsidies (YER/month)
39. Percentage of basic monthly salaries paid (%)



4 Technical Analysis

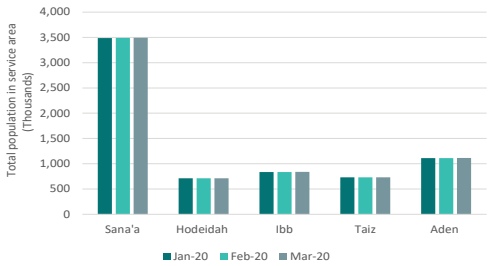
a. Service Coverage, Service Levels and Quality - Piped Water Supply

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.

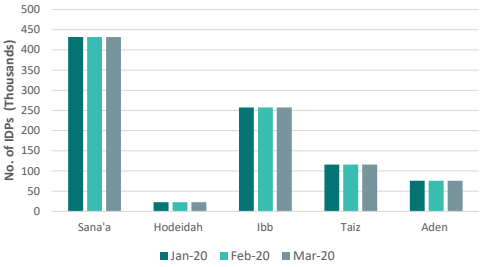
In the service area of the reported LCs, an average of 50% of the total urban population is connected to the public water supply system. Water coverage varies from LC to LC given the urban expansion accompanied by rapid population growth - keeping the LCs barely able to keep pace with adequate service 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 86% of service coverage as a logical consequence of financial support by the government and others to improve public services.

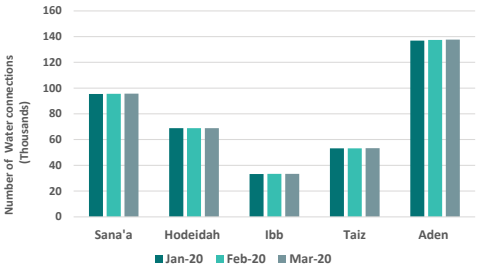
1. Total population in service area (capita)[1]



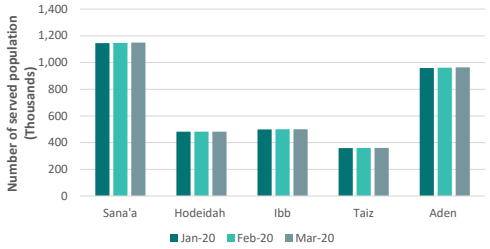
2. Number of IDPs in service area (capita)[2]



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 e (%)

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).

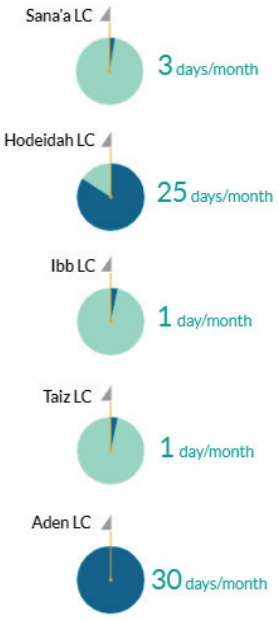
Number of service days of piped water supply

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 2-3 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 an average supply of 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. Unlike the performance of 2019, water supply services by Taiz LC have been declined in this quarter from an average of 5 days to once a month.

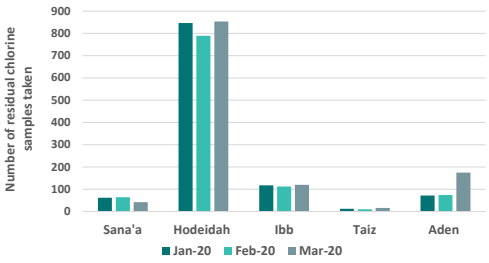
Customers served by intermittent systems are generally not satisfied with the amount of water they receive. Consequently, they try to maximize the amount they draw from the system during supply periods. The amount customers are able to collect depends on their localized pressure conditions. This puts 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.

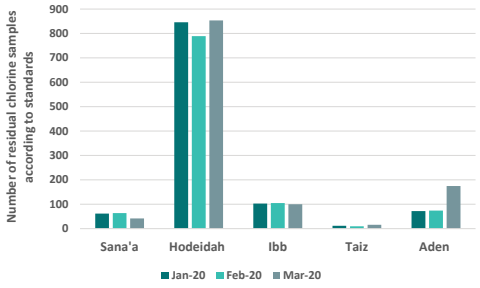
6. Number of service days of piped water supply per month (day/month)



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



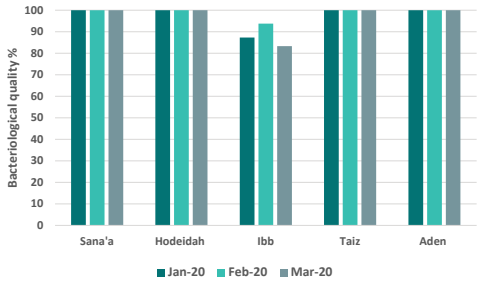
8. Number of residual chlorine samples according to standards (No./month)



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 our 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.

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 42% 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.

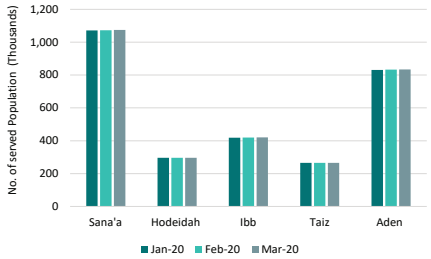
In this quarter, most LCs are lagging behind adequate sewerage coverage in view of high urbanization rates, lack of investment for sewer networks expansion and infrastructure rehabilitation, etc. All are representing critical factors that constraints the LCs to effectively collect, treat, dispose and/or 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 BOD_5 (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.

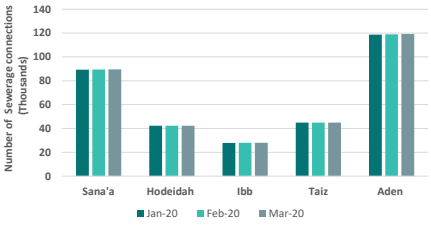
To demonstrate the wastewater treatment efficiency of the WWTPs by means of BOD_5. The average treatment efficiency of effluent by WWTPs of Sana'a, Hodeidah and Ibb is 80% and the BOD_5 samples according to standards is 0%, 100% and 80% respectively. As for the WWTPs of Aden and Taiz, there have long been no tests for BOD_5 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.

Given limited funding and resources, affordable 'assistance' projects could be adopted for addressing the challenges of sewerage treatment. Decisions on such smaller-scale treatment technologies including conventional and non-conventional models (e.g. constructed wetlands, biogas treatment plants, reed-bed systems, etc.) will be context-specific and require consideration of various selection criteria.

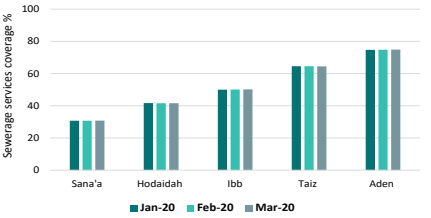
10. Number of population served with sewerage connections (capita)



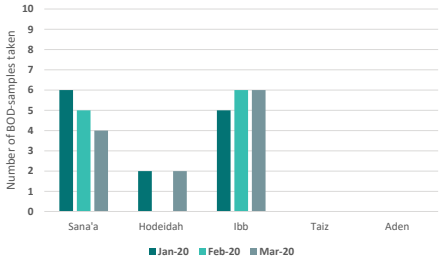
11. Number of sewerage connections (No.)



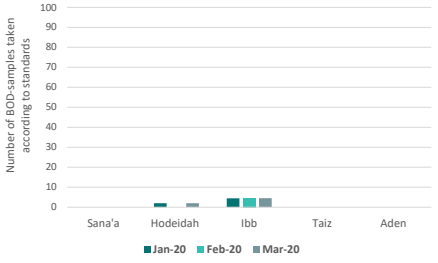
12. Sewerage connection coverage = population served through sewerage network vs total population in service area %



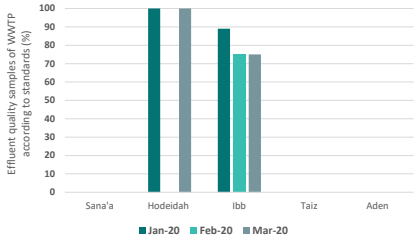
13. Number of BOD-samples of effluent of WWTP taken per month (No./month)



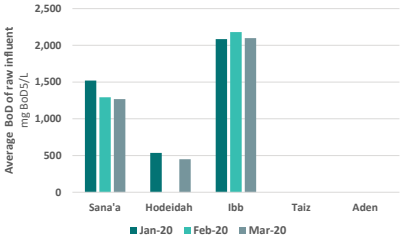
14. Number of BOD-samples of effluent of WWTP according to standards per month (No./month)



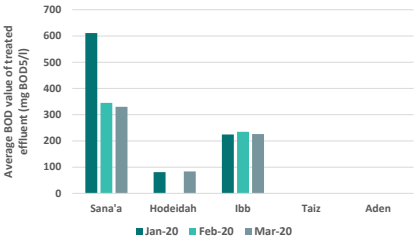
15. Proportion of effluent quality samples of wastewater treatment plants according to standards %



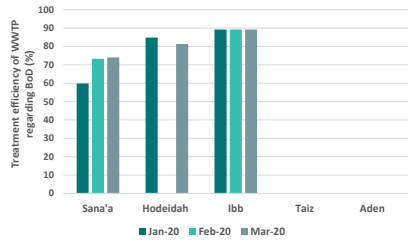
16. Average BOD value of raw influent at WWTP (mg BOD_5/l)



17. Average BOD value of treated effluent at WWTP (mg BOD_5/l)



18. Treatment efficiency of WWTP regarding BOD_5 (%)



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 99 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.

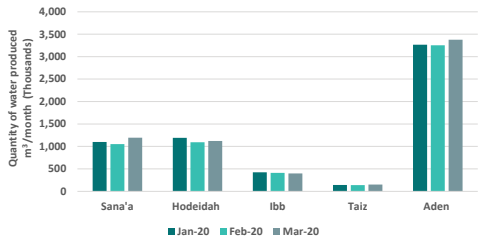
This quarter varies significantly in average daily per capita of water production among the LCs. For instance, LCs of Aden and Hodeidah have posted the highest average share at 111 and 76 l/c/d respectively. Whereas other LCs have quite low water production values per capita reaching an average of 31 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

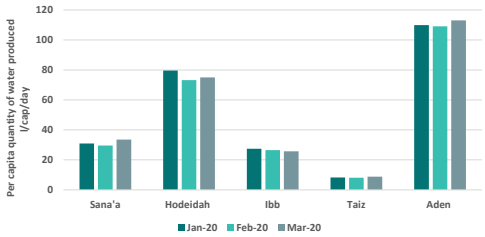
The frequent/entire cut-off of the National Electrical Grid posed a genuine challenge for the LCs to rely on and obtain an adequate amount of fuel for the operation of electric power generators. In addition, strong interactions with the energy system lie not only in the inherent need for energy for water 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 337 YER/m³. In this quarter, Aden LC reimbursed altogether the costs of the public electricity and fuel at an average price of 65 YER/m³, which roughly accounts for 30-40% of the total operating costs.

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

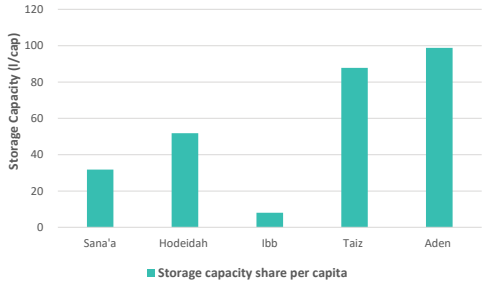


20. Per capita quantity of water produced (l/cap/day)[4]

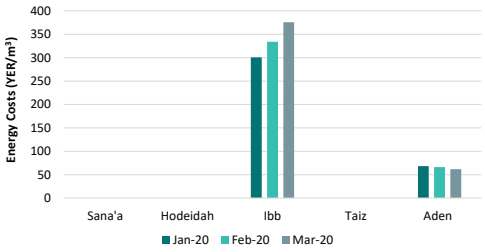


21. Storage capacity m³

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 € ≈ 628 YER
1 US $ ≈ 573 YER (March, 2020)
Source: InfoEuro (http://ec.europa.eu/budget/graphs/inforeuro.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.

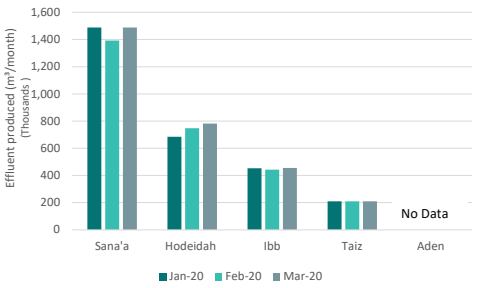
In this quarter, Sana'a WWTP has processed effluent on average 1,456,000 m^3/month (45 l/cap/day), which constitutes almost 100% of the produced effluent. The design capacity (17,000 m^3/day) of Taiz WWTP is underutilized, and currently receiving only on an average estimation of inflow 7000 m^3/day representing 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% (80 l/cap/day), finding its way into the sea waters. The existing capacity of Ibb WWTP is 5,300 m^3/day of sewage collection with average effluent generation 15,000 m^3/day, presenting 65% 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.

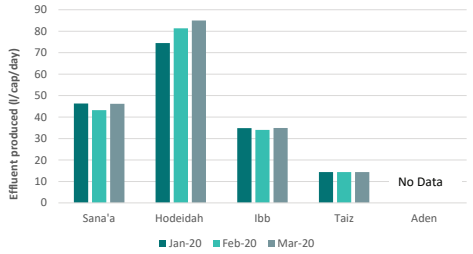
Treatement systems and capacity of the WWTPs

	WWTP	No. of WWTP	Nominal WWTP capacity m^3/day	Effluent produced m^3/day (Q1 2020)	Treatment system
1	Sana'a WWTP	2	50,500	48,533	Activated sludge
2	Ibb WWTP	1	5,300	15,004	Activated sludge
3	Hodeidah WWTP	1	54,000	24,584	Stabilization pond
4	Taiz WWTP	1	17,000	7,000	Oxidation pond
5	Aden WWTP	3	110,000	NA	Stabilization pond

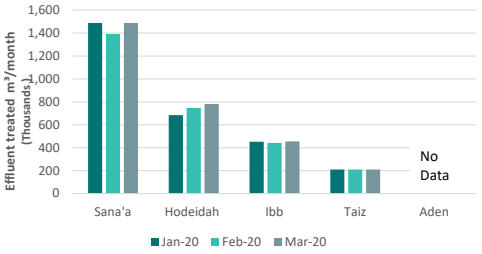
24. Effluent produced (m^3/month)



25. Effluent produced (l/cap/day)



26. Effluent treated in wastewater treatment plant (m^3/month)



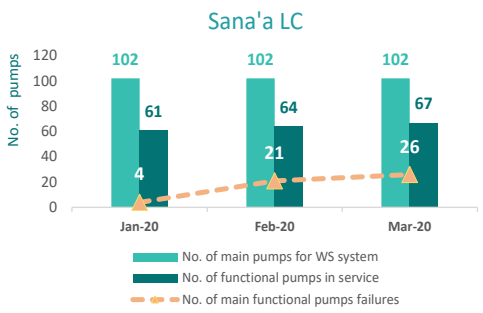
d. Performance of pumps and generators

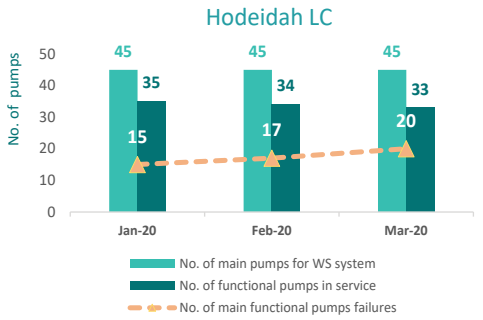
Most LCs have attempted with external fuel subsidies to overcome the power shortage by deploying additional electric generators to maintain the water supply. At the same time, full dependence on standby power has taxed excessive operating expenses beyond the LCs' financial capabilities. However, the 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.

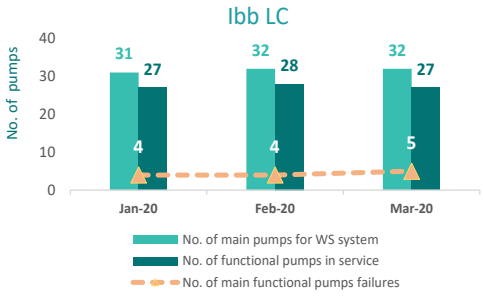
Generally, LC Sana'a has been supported, in addition to electric generators, with solar water pumping systems to reduce power failures and operate 63% of the main pumps running for 13 hours a day on average. In the meantime, Hodeidah LC has managed to operate up to 34 of functional pumps in service, with remarkable recurrence of failures records. This can be assumed as a backlash of long-term pumping hours and overloads of electric generators in severe temperatures.

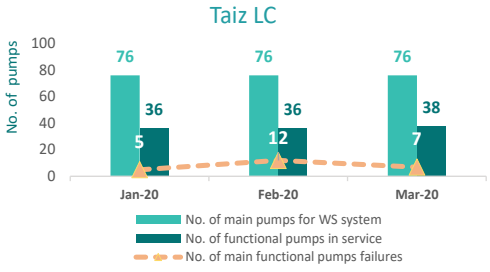
In an effort to cope with the water resource challenges, Ibb LC was able to run 86% of the main pumps to maintain water distribution for most of the city population. Likewise, Taiz LC was barely efficient to enhance water production (9 hours per day) by running 37 operational pumps. Compared to other LCs, Aden LC operated about 97 of the 126 water pumps for water production on average 19 hours a day.

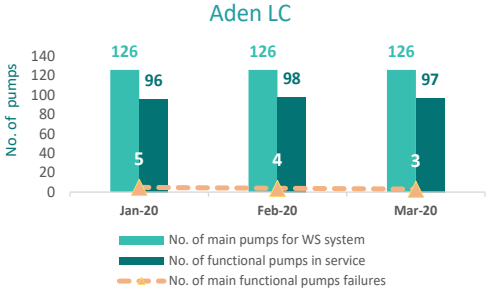
27.Total number of main pumps for the water supply system (No.)[6]
28. Number of functional water pumps in service (No.)
29. Number of main functional pump failures due to technical reasons (No./month)



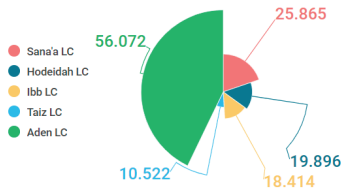




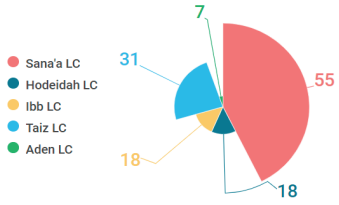




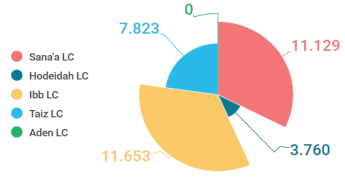
30. Number of working hours of all operating pumps of the water supply system (h/month))



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

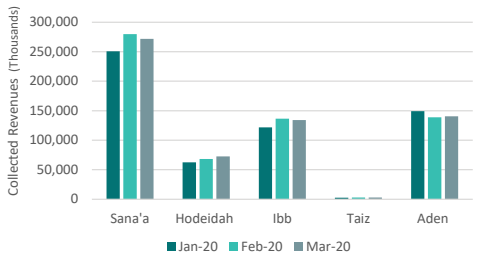
The financial viability varies significantly among the LCs due to differences in operating contexts, some of them do not reach cost recovery as a result of inadequate services or low tariffs. This becomes more challenging when coupled with a decline in revenue collection rates, causing an increase in 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. This improvement was further expressed by 79% of collection efficiency and relative to 128% average of cost recovery. Ibb LC was capable to stabilize monthly collection efficiency 86% along with cost coverage indeed by 79% on average. Hodeidah LC registered a slight incline compared with Q4 2019 both in collection efficiency 51% and cost coverage 39% on average.

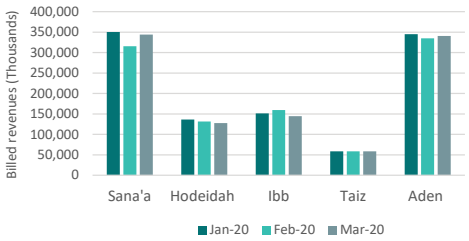
Since energy and wages were largely subsidized, Taiz LC did not rely on water sales and revenues to cover the operating expenses. As reported for this quarter, the low collection efficiency of 5% clearly expressing inactive reading and billing processes. Such circumstances dictate the crucial mobilization 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 42% and operating costs coverage 21% 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.

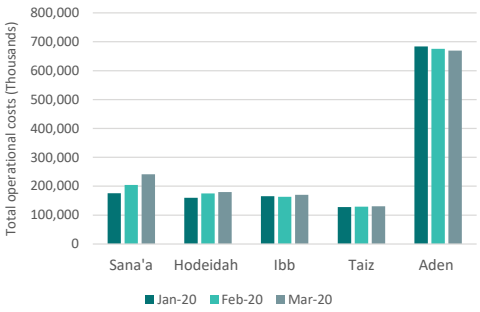
33. Total collected operational revenues (YER/month)[7]



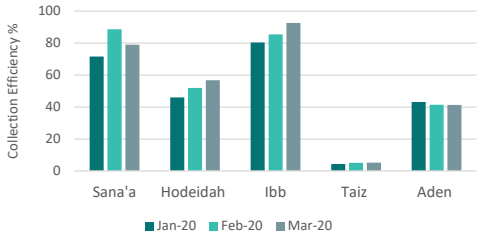
34. Total billed operational revenues (YER/month)



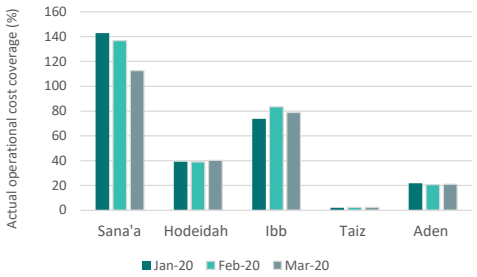
35. Total operational costs (YER/month)



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



37. Actual operational cost coverage (%)

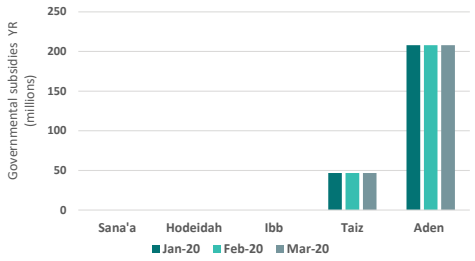


7. Revenues including domestic, commercial & governmental collection

Monthly governmental subsidies

Given the fact that investment support from the government has dropped dramatically 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 staff salaries and other operating expenses, while other LCs depend merely on water sales.

38. Monthly governmental subsidies (YER/month)

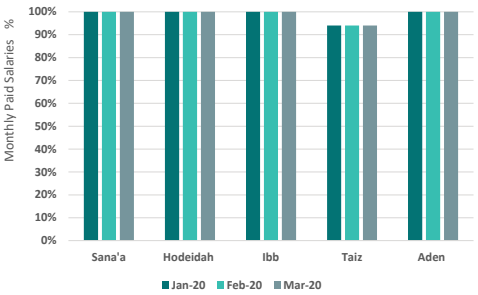


Percentage of basic monthly salaries paid

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 as in the case of Taiz LC (no salary subsidies received during the last 6 months of 2019).

39. Percentage of basic monthly salaries paid (%)



5 Resilience factors[8]

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.	• 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	• 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.	• 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.	• 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.	• 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.	• Improve hygiene and health situation for urban residents. • Protect environment and water sources. • Increase number of customers.
Investment	Provide renewable energy system (Photovoltaic).	• 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 Jan-Mar 2020

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

No.	Data / Indicator	LC	Unit	1st Q		
				Jan-20	Feb-20	Mar-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
		Hodeidah		711,283	711,994	712,706
		Ibb		836,670	837,507	838,344
		Taiz		730,360	731,090	731,821
		Aden		1,111,019	1,112,130	1,113,242
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
		Hodeidah		22,536	22,536	22,536
		Ibb		257,500	257,500	257,500
		Taiz		115,678	115,678	115,678
		Aden		75,827	75,827	75,827
3	إجمالي عدد توصيلات المياه فى نهاية الشهر - يشمل المنزلي، التجاري، والحكومي وغيره Number of water connections	Sana'a	No.	95,443	95,570	95,748
		Hodeidah		68,862	68,895	68,926
		Ibb		33,227	33,313	33,374
		Taiz		53,171	53,203	53,268
		Aden		136,891	137,374	137,625
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
		Hodeidah		482,034	482,265	482,482
		Ibb		498,405	499,695	500,610
		Taiz		265,144	265,406	265,648
		Aden		958,237	961,618	963,375
5	نسبة عدد السكان المخدومين بالمياه من قبل مزود الخدمة من اجمالي 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
		Hodaidah		68	68	68
		Ibb		60	60	60
		Taiz		76	76	76
		Aden		86	86	87
6	عدد ايام تزويد الخدمة خلال الشهر (تزويد المياه من خلال شبكة التوزيع) Number of service days of piped water supply per month	Sana'a	day/ month	3	3	3
		Hodeidah		25	25	25
		Ibb		1	1	1
		Taiz		1	1	1
		Aden		30	30	30
7	إجمالي عدد عينات الكلور المأخوذة من شبكة المياة خلال الشهر Number of residual chlorine samples taken	Sana'a	No./ month	62	64	42
		Hodeidah		846	789	853
		Ibb		118	112	120
		Taiz		12	10	16
		Aden		72	74	175

No.	Data / Indicator	City	Unit	1st Q		
				Jan-20	Feb-20	Mar-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
		Hodeidah		846	789	853
		Ibb		103	105	100
		Taiz		12	10	16
		Aden		72	74	175
9	درجة نقاوة المياة 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
		Hodeidah		100	100	100
		Ibb		87	94	83
		Taiz		100	100	100
		Aden		100	100	100
10	عدد السكان المخدومين بشبكات الصرف الصحى 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
		Hodeidah		296,233	296,352	296,450
		Ibb		418,455	419,535	420,465
		Taiz		265,144	265,406	265,648
		Aden		830620	832762	834057
11	نسبة عدد السكان المخدومين بشبكات الصرف الصحى من قبل مزود الخدمة (شهري في نهاية الشهر) Sewerage connection coverage	Sana'a	%	89,248	89,369	89,547
		Hodeidah		42,319	42,336	42,350
		Ibb		27,897	27,969	28,031
		Taiz		44,912	44,935	44,940
		Aden		118,660	118,966	119,151
12	إجمالي عدد توصيلات الصرف الصحي - يشمل المنزلي، التجاري، والحكومي وغيره Number of sewerage connections	Sana'a	No.	31	31	31
		Hodeidah		42	42	42
		Ibb		50	50	50
		Taiz		65	65	64
		Aden		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
		Hodeidah		2	–	2
		Ibb		5	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
		Hodeidah		2	–	2
		Ibb		4	5	5
		Taiz		–	–	–
		Aden		–	–	–

No.	Data / Indicator	City	Unit	1st Q		
				Jan-20	Feb-20	Mar-20
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
		Hodeidah		100	–	100
		Ibb		89	75	75
		Taiz		–	–	–
		Aden		–	–	–
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
		Hodeidah		535	–	450
		Ibb		2,085	2,180	2,099
		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
		Hodeidah		81	–	84
		Ibb		225	235	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
		Hodeidah		85	–	81
		Ibb		89	89	89
		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
		Hodeidah		1,189,959	1,094,403	1,122,242
		Ibb		422,809	410,000	398,793
		Taiz		142,791	139,474	152,634
		Aden		3,267,100	3,253,328	3,376,256
20	نصيب الفرد من المياه المنتجة Per capita quantity of water produced	Sana'a	l/cap/ day	31	30	33
		Hodeidah		80	73	75
		Ibb		27	26	26
		Taiz		8	8	9
		Aden		110	109	113
21	الطاقة التخزينية الشهرية المتاحة Storage capacity	Sana'a	m^3	36,450	36,450	36,450
		Hodeidah		25,000	25,000	25,000
		Ibb		4,000	4,000	4,000
		Taiz		49,000	49,000	49,000
		Aden		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
		Hodaidah		52	52	52
		Ibb		8	8	8
		Taiz		88	88	88
		Aden		99	98	98

No.	Data / Indicator	City	Unit	1st Q		
				Jan-20	Feb-20	Mar-20
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
		Hodaidah		0	0	0
		Ibb		300	334	376
		Taiz		0	0	0
		Aden		68	66	62
24	كمية المياه المنتجة - المعالجة أو غير المعالجة - التي تتدفق من محطة معالجة الصرف الصحى Effluent produced	Sana'a	m^3/ month	1,488,000	1,392,000	1,488,000
		Hodeidah		684,250	747,150	781,150
		Ibb		452,435	442,483	455,433
		Taiz		210,000	210,000	210,000
		Aden		–	–	–
25	كمية المياه المنتجة - المعالجة أو غير المعالجة - التي تتدفق من محطة معالجة الصرف الصحى Effluent produced	Sana'a	l/cap/ day	46	43	46
		Hodeidah		75	81	85
		Ibb		35	34	35
		Taiz		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
		Hodeidah		684,250	747,150	781,150
		Ibb		452,435	442,483	455,433
		Taiz		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
		Hodeidah		45	45	45
		Ibb		31	32	32
		Taiz		76	76	76
		Aden		126	126	126
28	عدد المضخات الرئيسية العاملة والتي تضخ المياه خلال الشهر Number of functional pumps in service	Sana'a	No.	61	64	67
		Hodeidah		35	34	33
		Ibb		27	28	27
		Taiz		36	36	38
		Aden		96	98	97
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
		Hodeidah		19,896	18,687	20,522
		Ibb		18,414	17,248	18,414
		Taiz		10,522	10,227	11,042
		Aden		56,072	55,192	56,882
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
		Hodaidah		15	17	20
		Ibb		4	4	5
		Taiz		5	12	7
		Aden		5	4	3

No.	Data / Indicator	City	Unit	1st Q		
				Jan-20	Feb-20	Mar-20
31	عدد المولدات العاملة في تشغيل المضخات Number of working generators in the operation of pumps	Sana'a	No.	52	54	59
		Hodaidah		17	18	18
		Ibb		17	18	18
		Taiz		31	32	29
		Aden		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
		Hodeidah		3,953	3,232	4,096
		Ibb		11,594	11,088	12,276
		Taiz		7,755	7,956	7,758
		Aden		–	–	–
33	قيمة الإيرادات الشهرية المحصلة Total collected operational revenues	Sana'a	YER/ month	250,525,158	279,778,052	271,855,470
		Hodeidah		62,685,786	68,265,317	72,544,237
		Ibb		121,789,124	136,355,581	134,095,608
		Taiz		2,574,634	3,025,700	3,053,230
		Aden		149,122,423	138,997,097	140,651,059
34	قيمة الإيرادات الشهرية المفوترة (قيمة مبيعات المياه الشهرية المفوترة) Total billed operational revenues	Sana'a	YER/ month	350,044,974	315,675,128	344,062,362
		Hodeidah		136,277,298	131,477,500	127,706,007
		Ibb		151,390,035	159,664,558	144,703,575
		Taiz		58,619,550	58,619,550	58,619,550
		Aden		344,859,483	334,880,861	340,684,867
35	إجمالي التكاليف التشغيلية Total operational costs	Sana'a	YER/ month	175,302,297	204,469,708	241,500,800
		Hodeidah		160,121,432	175,285,720	179,936,960
		Ibb		165,322,725	163,496,062	170,314,523
		Taiz		127,569,040	129,078,100	130,153,720
		Aden		683,900,568	675,328,587	669,804,540
36	نسبة التحصيل Collection efficiency = Collected revenues vs. billed revenues	Sana'a	%	89	79	79
		Hodeidah		46	52	57
		Ibb		80	85	93
		Taiz		4	5	5
		Aden		43	42	41
37	التغطية التشغيلية المحصلة للكلفة Actual operational cost coverage	Sana'a	%	160	133	109
		Hodeidah		39	39	40
		Ibb		74	83	79
		Taiz		2	2	2
		Aden		22	21	21

No.	Data / Indicator	City	Unit	1st Q		
				Jan-20	Feb-20	Mar-20
38	قيمة الإعانات (المعونات) الحكومية الشهرية لمزود الخدمة Monthly governmental subsidies	Sana'a	YER/ month	0	0	0
		Hodaidah		0	0	0
		Ibb		0	0	0
		Taiz		46,828,589	46,828,589	46,828,589
		Aden		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%
		Hodaidah		100%	100%	100%
		Ibb		100%	100%	100%
		Taiz		94%	94%	94%
		Aden		100%	100%	100%

Imprint

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As at
March 2021

Design and layout
GIZ IDWS

Photo credits
Cover page ©Photographer Ali Sunidar

Text
Aden LC, Hodeidah LC, Ibb LC, Sana'a LC, Taiz LC are responsible for the content of this publication.


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