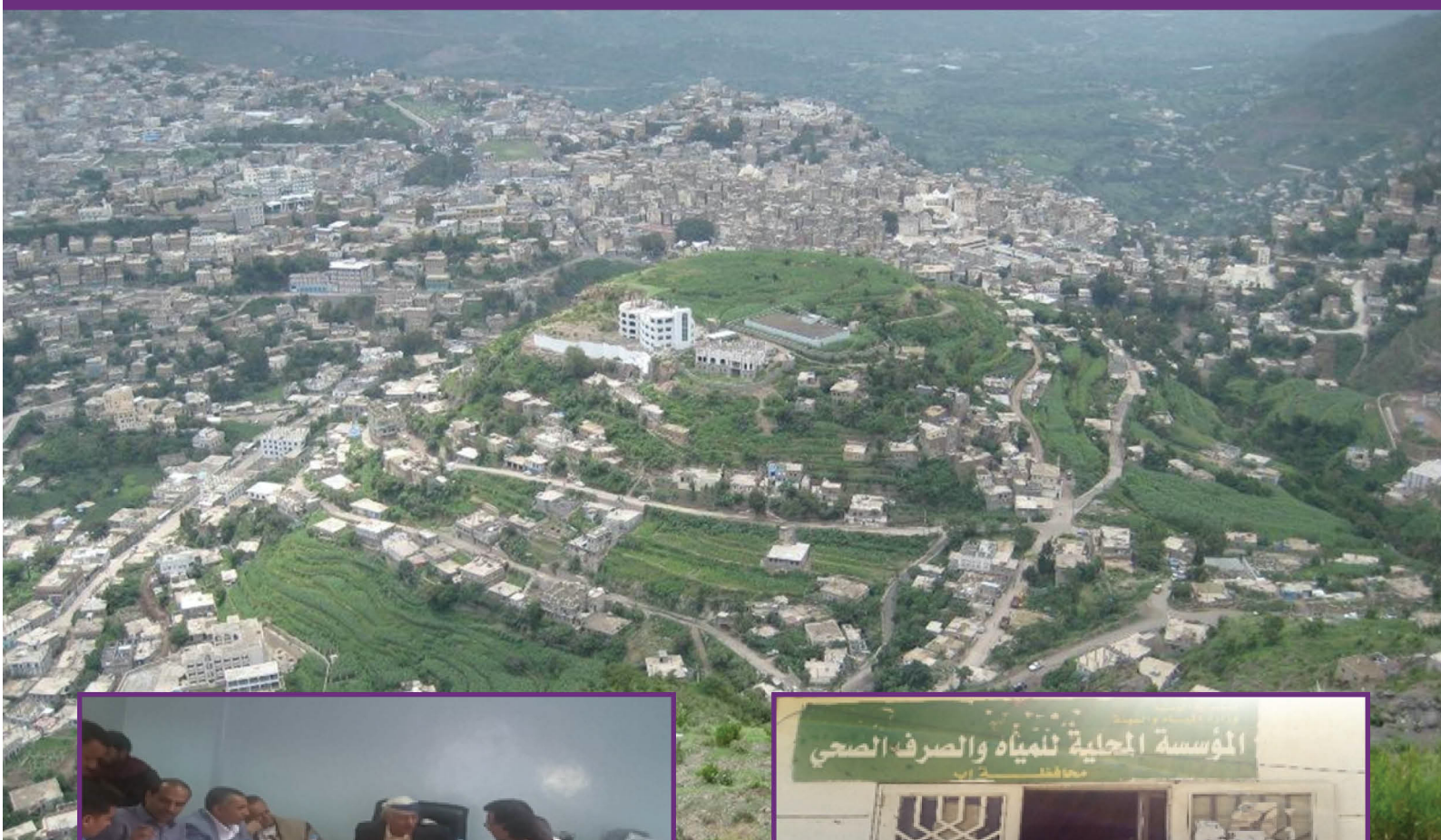


Trust and Necessity

Water Security Case Study:

Ibb Water and Sanitation Local Corporation (Yemen)

Resilience in Providing Urban Water Services During Severe Conflict



September 2018



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ABBREVIATIONS

| | |
|-------|---|
| BoD | Board of Directors |
| CBO | Community Based Organization |
| COCA | Central Organization for Control and Auditing |
| IWSLC | Ibb Local Corporation for Water Supply and Sanitation |
| GIZ | Gesellschaft für Internationale Zusammenarbeit GmbH |
| HR | Human Resources |
| INGO | International Non-Governmental Organisation |
| ICRC | International Committee of the Red Cross |

| | |
|-----------|--|
| IDP | Internally Displaced People |
| IT | Information Technology |
| KfW | Kreditanstalt für Wiederaufbau |
| MWE | Ministry of Water and Environment |
| NRW | Non revenue water |
| NWRA | National Water Resource Authority |
| NWSSIP | National Water Sector Strategy and Investment Plan |
| OMS | Operation Management Support |
| O&M | Operation and Maintenance |
| PIIS | Performance Indicator Information System |
| UN | United Nations |
| USD, US\$ | American Dollar |
| WASH | Water, Sanitation and Hygiene |
| WFP | World Food Programme |
| WSP | Water Sector Programme in the Republic of Yemen |
| WWTP | Wastewater Treatment Plant |
| YER, YR | Yemen Rial |

Units

| | |
|-------------------|--------------------------|
| Mio | million |
| masl | meter above sea level |
| mg/l | Milligram per litre |
| m ³ /d | Cubic meters per day |
| lpcd | litre per capita per day |

EXECUTIVE SUMMARY

Any water utility in a developing country would be content with the following results: nearly full recovery on customer bills, expanding the volume of water produced. From 2015 to 2018 water volume provided increased with 12% and a 21% and 17% increase in customer connections for water supply and sanitation, respectively. This is the recent history of the Water Supply and Sanitation Local Company (IWSLC) of Ibb, a city with an official population of 383,113 people in South West Yemen. Unlike other utilities, however, the Ibb LC presents a remarkable case of resilience, because of all of this was achieved during a time of unprecedented war, which began in Yemen in 2014.

To date, Ibb has been spared the worst of fighting, but the war nevertheless made itself felt in many unusually challenging circumstances: unpaid salary of civil servant staff, eroded customers' ability to pay, no spare parts, suspended power supplies, fluctuating fuel prices and a heavy influx of internally displaced persons. In spite of this, the IWSLC increased rather than decreased its level of services. Its performance on key performance indicators are as follows:

- 80% of the population in its coverage zone was connected to the public water supply system in 2018 – a total of 29,961 connections, up from 70% in 2014 when it had 24,775 connections in 2014, an increase of 21%.
- The nominal water production capacity increased significantly, from 19,869 m³/day on average in 2014 to 21,340 m³/day in 2018. The total volume of water produced in 2017 was 5,998,931 m³¹, an increase of 12% over the volume produced in 2015. Average water consumption was 40 litres per capita per day in 2017 – exactly the current norm.

At the same time, Ibb has enjoyed sound management performance:

- With the consent of the Board, IWSLC has taken some bold steps to adjusting service tariffs during the crisis period. First, when the government stopped subsidies for fuel derivatives in late 2014, an adjustment to the water tariff was agreed to overcome the impact of this cost increase on IWSLC's financial burden. It was decided to gradually increase the tariff by 20% every month up to a maximum of 45%.
- IWSLC employs a total staff of 240 people, a number that has been constant since 2015 due to a freeze on new recruitment, one of several austerity measures taken during the war.
- In the last four years, the bill collection rate was 87% on average, varying between 78% (in 2017) and 101% in 2016 (including arrears from previous years). For domestic and commercial users, the collection rate has even reached 100% during the entire crisis period. On the other hand, the average collection rate has been weighed down by low collections from governmental organizations (45%) and the non-payment of a special mark-up.
- According to IWSLC, 100% of customers have water meters installed and all of them are functional.
- NRW (non revenue water) stands at 28% with some minor fluctuations.
- Excluding depreciation, IWSLC was able to cover its operating expenses and generate savings of about 219 million YR in 2015, 46 million YR in 2016 and 231 million YR² in 2017, if all bills to customers would be paid.

¹ IWSLC keeps regular records on water production, consumption and losses. Twenty-seven water meters are installed at the wells and the reservoir.

² Equivalent to USD 525,000 in 2017.

Just as IWSLC has been able to extend the coverage of its water supply services, it has done the same for its sanitation and sewerage services. The number of connections increased by 17% but this was on an already overstretched urban sanitation system. The wastewater treatment plant became more and more of a bottleneck as it is extremely overloaded. The design capacity is 3,200 m³/day but the inflow is estimated at 11,322 m³/day or even more. In sanitation, the performance overall has been less and Ibb has not been spared the high incidence of cholera.

There are several explanations for IWSLC's ability to expand coverage in the years of conflict. First, being spared the worst of the war damage, the infrastructure of IWSLC was robust enough to serve an ever-growing customer base, in spite of the lack of asset replacement or major investment. This physical asset base was matched by IWSLC's intangible assets in the form of transparent procedures: for instance in the way water is delivered and billed (random checks of water meters to ensure accuracy of meter readers; insistence on customers to pay to ensure sustainability of services, providing option to pay in instalments), in the way connections are made (transparent and clear methods for new customer connections, meter installation and change in customer names) and customer complaints are addressed (with proper complaint handling procedure using Maintenance Management System ensuring follow up and reporting). This has all contributed to building customers' confidence.

The Customer Service Center applies the following procedures for the various processes of customer management through GIS applications:

- Application for new customer connection;
- Meter installation and adjustment;
- Change of customer name;
- Meter reading and bill distribution;
- Revenue collection;
- Inspection of works and follow up.

Water losses are investigated systematically through random field checks of meters to ensure the accuracy of the meter readers. This step is conducted before issuing the water bill to make sure that there are no mistakes in the amounts charged.

On the other hand, there is also insistence on the consumer to pay the due amount, with an option offered for payment in instalments as IWSLC's perspective is that the customer is equally responsible for the sustainability of the utility. The consequence of this policy is to systematically apply sanctions on customers who do not pay to in order to enforce payment discipline. In addition, errant behaviour by customers (e.g. manipulation of water meters, overdue bills) is systematically followed up via calls or visits.

A structured complaints procedure is in place. IWSLC uses the Maintenance Management System (MMS) application for customer complaint procedure. Any complaint from customers is filed and addressed individually until finally solved and closed.

A second reason underlying IWSLC's sound performance is its financial autonomy. Its ability to collect its own revenues and adjust the prices for services has allowed IWSLC to generate sufficient revenue to pay for all essential running costs and ensure timely payment of staff, even in hard times. This has boosted staff morale. Had IWSLC been dependent on public finances, it would have been much more exposed to the financial trouble that came with the Yemen war, such as the cessation of government payments.

These two points combined created a high spirit – for customers it is the only route to affordable and relatively reliable water supplies; for staff it was the only way to secure a job and income. The war

interestingly galvanized IWSLC's performance. In short, the customers needed IWLSL for its affordable water services, and the staff needed IWSLC for their jobs. There was simply no alternative to this beneficial mutual dependence.

A third reason was that IWSLC managed to avoid political interference that could have hampered its smooth response to the severe crisis. IWSLC retained its board and senior management – taking some difficult decisions on raising and changing tariffs and undertaking austerity measures, including need-based employment and recovery of all operational expenses.

Fourth, well-targeted support from humanitarian agencies helped to strengthen IWSLC and helped it to continue functioning by resolving vital constraints, such as the exposure to high fuel prices or the provision of necessary equipment. In other cities, parallel emergency water supply systems were created under humanitarian aid.

IWSLC's performance during war time is also a story of trust and necessity: for customers, IWSLC has become a secure and affordable source of water that should never be able to fail. For staff, the continuity of management and invisible social infrastructure led to high motivation and practical transparent procedures.

The Ibb water security case brings two generic lessons. It shows the importance of public utilities keeping functioning during crisis. With crisis emphasis is often on emergency aid or post-disaster recovery, but there is a third priority of ensuring vital services keep continued services by water utilities in a time of severe crisis is essential to reduce civilian casualties. It is hence important in the repertoire of conflict measures to not only focus on relief and rehabilitation but also to find ways to support utilities in providing their lifelines services during crisis, be it hospitals, energy providers or water utilities. This will sustain services in the most critical period and allow effective re-engagement during post conflict.

The second lesson concerns the importance of creating resilient organizations. There were several elements that made IWSLC a showpiece of resilience: financial autonomy, robust infrastructure, sufficient spare parts and fuel reserves; strong systems for billing, customer management and complaint handling and a relative safe distance from political interference through multi-stakeholder board and strict rules. The same provisions existed for other Local Corporation but the good reputation it had even before war, and the large management attention for customer care and the uninterrupted and solid leadership combined to the special performance in Ibb.

1. BACKGROUND

Since June 2014, Yemen has been battered by armed conflict, which escalated in early 2015 and has caused major loss of life, economic disruption, internal population displacement and damage to infrastructure and service delivery throughout the country. The water and sanitation sector has been both a victim of the war – through damage to infrastructure and disruption of services – and a catalyst of an unprecedented cholera epidemic that had 1,112,671 suspected cases and 2307 associated deaths between April 2017 and June 2018³. While efforts from public officials and development partners helped to stem the tide of the cholera outbreak, clean and affordable drinking water remain elusive, and if local sanitary conditions continue to deteriorate, there will continue to be adverse health and economic impacts.

The role of water and sanitation service providers is crucial to reducing the fatalities from the war. In Yemen, as part of the water sector reforms in the past, responsibility for urban water supply was placed with administratively and financially autonomous Water and Sanitation Local Corporations (LCs).

During the current war period, LCs have been operating under enormous strain. They are confronted by serious challenges such as damage to infrastructure, factionalist pressure and increased demand for services due to the influx of internally displaced persons (IDPs). The outage of the national electricity network since April 2015 and the shortage of oil derivatives to run standby generators has undermined the operations of water and sewerage facilities. Prices for diesel and other fuels are volatile. The war has also caused widespread financial hardship, thereby constraining customers' ability to pay. Most private businesses have closed and the Government has had difficulty to pay salaries. The Yemeni currency has depreciated⁴. According to the World Food Program (2017), the cost of living increased by 47% compared to the pre-crisis situation⁵. Fuel prices in particular have fluctuated considerably during the crisis. In December 2017, the prices for petrol, diesel, and cooking gas increased by 218%, 235%, and 207% respectively compared to the pre-crisis situation⁶.

Water and sanitation LCs have been struggling to deliver their services under these challenges. In several areas, private water trucks have taken over from the piped networks, but their prices are between two and four times more expensive, they are often unable to access certain conflict zones and water quality provided by private tankers is questionable.

This case study discusses the Ibb Water and Sanitation Local Corporation (IWSLC) that serves the capital of Ibb Governorate, which contains two districts namely Al Mashannah and Al Zahar. IWSLC is remarkable as it stands out among water service providers in Yemen (and other countries in conflict probably) for the level of water services it is delivering and its resilience in times of severe armed conflict. The case study is prepared to document and understand the reasons behind this performance and to inform the approach towards urban water supply in Yemen now and in an expected recovery period in the future.

The study is based on research undertaken between April and June 2018. An assessment of the utility's governance, financial and technical performance was undertaken. Data on key performance indicators (KPIs) were collected such as current service coverage, water production and consumption,

³ Based on the Weekly Epidemiological Bulletin

⁴ The exchange rate of Yemeni Rial (YR) to US Dollar rose in December 2017 to 441 YR per 1 USD (exchange rate at Yemen banks), which is more than double from the pre-crisis rate (215 YR per USD).

⁵ Yemen Market Watch Report, December 2017 by World Food Programme

⁶ Yemen Market Watch Report, December 2017 by World Food Programme

non-revenue water, billings and revenue collection. The assessment also covered current utility capacity to deliver services i.e. technical assets, operational issues, finances, human resources and customer relations. In addition to this assessment, 61 household users were interviewed to gain an understanding of the adequacy of water services and the costs of water. In the second part of the study, the resilience of IWSLC was investigated – looking at the role of main players (entrepreneurs, labor organizations, community leaders, private water providers and other actors). The findings of the first part of the research were discussed, including the impact of IWSLC's role in continuing to provide services during the conflict. Specific attention was paid to the importance of community awareness and involvement, and the role of community actors in IWSLC's performance.

Following this introduction, Section 2 of this case study provides an overview of IWSLC's performance on a number of parameters and then Section 3 discusses the underlying management structure of water supply and sanitation services. Section 4 analyses the different factors that explain IWSLC's remarkable performance. Finally, section 5 presents a number of lessons and recommendations on supporting the operation of urban water utilities during conflict and in the post-conflict era in Yemen, which it is hoped could happen quite soon.

2. PERFORMANCE OF THE IWSLC DURING THE ONGOING CONFLICTS

Ibb, a medium-sized city in South-Western Yemen, is an important market town and administrative center. The city is situated at an altitude of 1880 meters above sea level and has a population of 383,113. IWSLC was established by Republican Decree No. (21) of 2001 as the official provider of water supply and sanitation services in the urban areas of Ibb governorate.

During the crisis, IWSLC's water supply and sanitation services have been a lifeline for the population in dire economic straits, as the main alternative - water supplied from private water tankers - is two to four times costlier. Ibb Governorate, including Ibb City, also accommodated a large proportion of the Internally Displaced Persons (IDPs) in Yemen – by one estimate 25% of all IDPs in Yemen⁷.

Throughout the conflict period, IWSLC has continued to provide services, despite challenges such as lack of fuel, unavailability of electricity and spare parts and reduced consumer ability to pay. In fact, IWSLC has succeeded to:

- Keep its infrastructure operational;
- Maintain weekly water services;
- Achieve 78% to- 101% collection on bills issued;
- Maintain a reasonable percentage of non-revenue water (NRW).
- Increase water production, expand coverage and increase the customer base.

Similarly, IWSLC has continued providing sanitation services, in particular the operation of the wastewater treatment plant. Doing so has been challenging, as the plant was already operating above its capacity before the crisis started, whereas demand for sewerage services have increased. This section first discusses the water supply services and next sewerage provision.

⁷ Source: https://www.humanitarianlogistics.org/reliefweb_posts/displaced-people-in-ibb-yemen-devastated-by-hunger-and-disease-for-three-years/

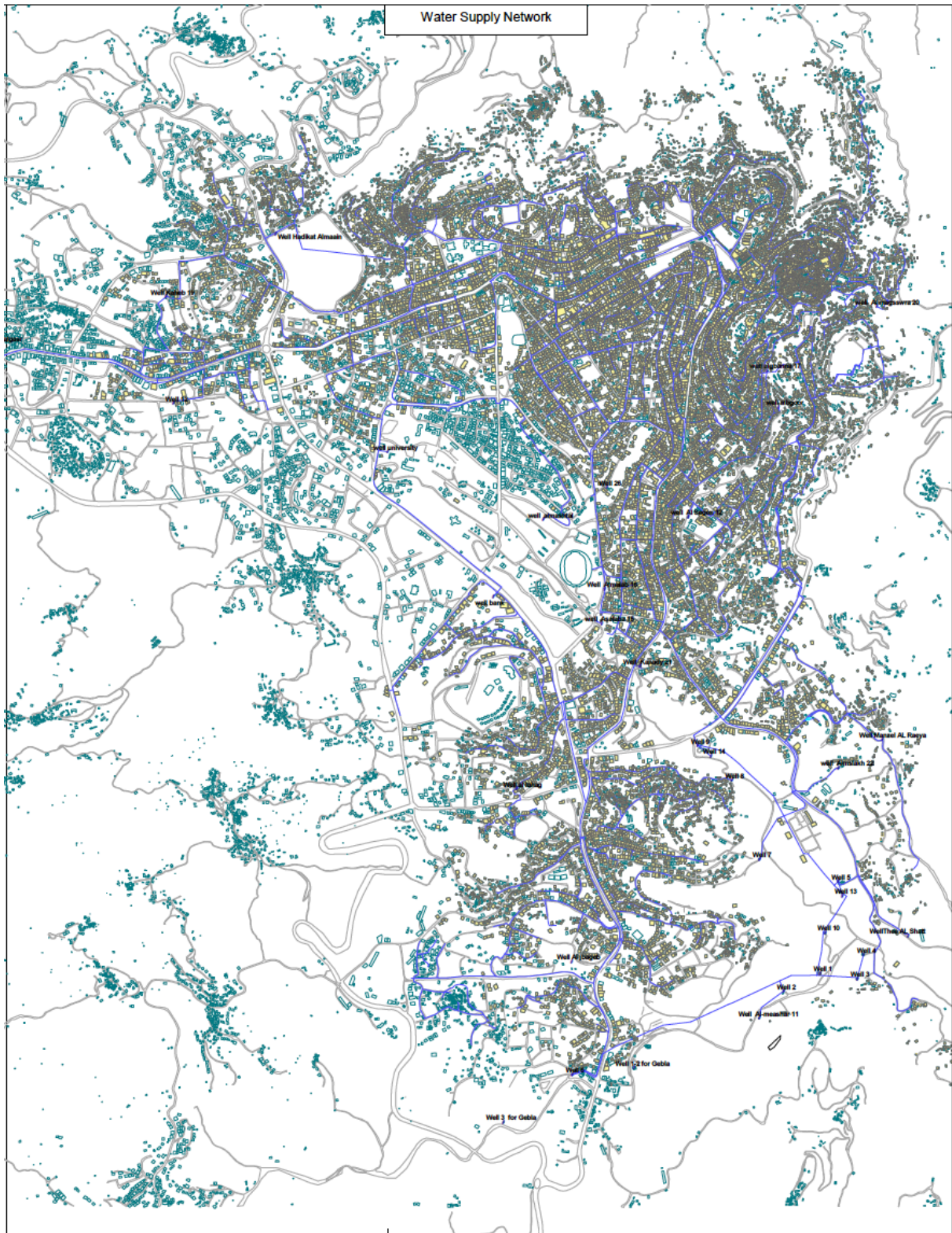


Figure 1: IWSLC Water supply network

2.1 WATER SUPPLY SERVICES

Coverage

IWSLC is the main water service provider in Ibb and its already high coverage has been increasing. It is currently serving a catchment area of about 383,113 people⁸. As of December 2017, 80% of this population was connected to the public water supply system – a total of 29,961 connections compared to 70% in 2014. During the crisis period, IWSLC has managed to increase its customer base by 21% from 24,775 connections in 2014.

IWSLC's increased customer base is partly the result of normal population increase. There has also been an inflow of IDPs from conflict-affected cities in Yemen, who found relative welcome in Ibb city. Many of these new settlers are relatively affluent and can afford water supply and sanitation services. In addition to absorbing IDPs, IWSLC has increased its coverage by taking over the costlier service areas previously covered by private water tankers.⁹

Today, whereas IWSLC covers 80% of the population, the other inhabitants are served either by private water supply networks (15%) or by water tankers (5%), according to IWSLC.¹⁰ As figure 2 illustrates this constitutes a shift towards water delivery by IWSLC compared to the pre-war situation, when IWSLC was responsible for 70% of the coverage only.

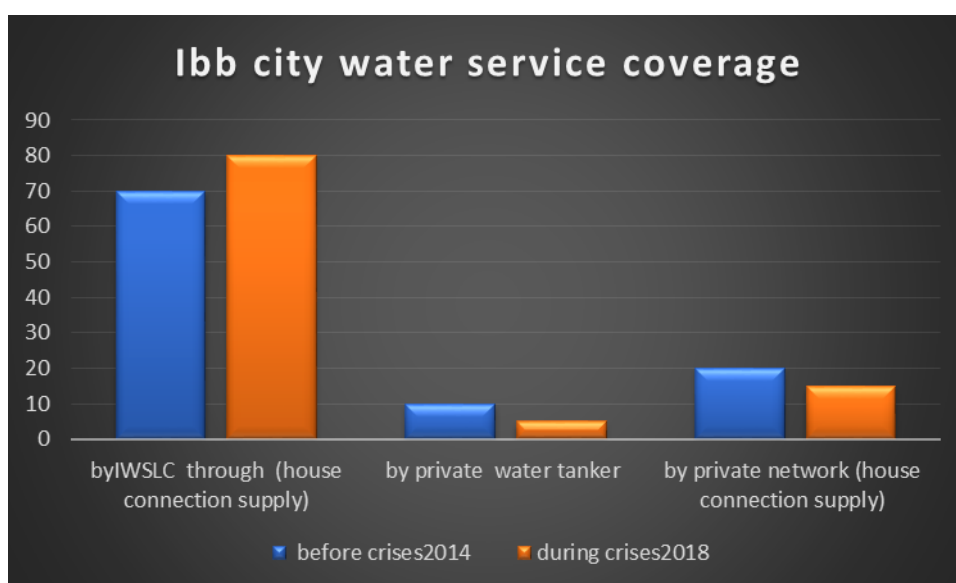


Figure 2: Ibb city water service coverage

Water production

The increased customer base has been complemented by increased water production. As of early 2018, 26 of the 29 existing water wells were operational. In the last four years, IWSLC increased its capacity to pump water by bringing two more wells on stream. Besides the wells, IWSLC's asset

⁸ The number of persons served per connection is more than the ten, due to the IWSLC policy to serve more than one family per connection

⁹ This came out in the interviews and household interviews and was confirmed during site visits of the research team. A detailed discussion of the private tanker supply was beyond the scope of the current study.

¹⁰ This is a remarkable difference between IWSLC and other LCs in which public water institutions almost collapsed and the private water providers are now playing an increased role on water provision

base consists of a reservoir receiving water from seven wells and 282 km of main line and distribution lines for water supply (see also annex 1).

The nominal water production capacity in fact increased significantly, from 19,869 m³/day of average nominal water production capacity in 2014 to 21,340 m³/day in 2018. The total volume of water produced in that year was 5,998,931 m³¹¹, an increase of 12% over the volume produced in 2015.

Good foresight and planning also served IWSLC well. When the crisis hit in 2015, it was able to absorb much of the uncertainty, especially over energy supply, as it had saved a stock of diesel. This had developed into a practice ever since the beginning of the political crisis in 2011, and it allowed IWSLC to keep providing services in the tensest of times. It initially reduced water production by 8% in 2015, but from 2016 the situation normalized. As demand increased, IWSLC also raised water production from 2016 onwards.

Table 1: Water production and consumption

| Description | 2014 | 2015 | 2016 | 2017 |
|---|-----------|-----------|-----------|-----------|
| Water production (m ³) | 5,347,606 | 4,940,540 | 5,219,242 | 5,998,931 |
| Water consumption (billing) (m ³) | 3,750,513 | 3,617,310 | 3,849,066 | 4,332,034 |
| No of connections | 24,775 | 26,537 | 28,100 | 29,961 |
| Population served | 247,750 | 265,370 | 281,000 | 299,610 |
| Water consumption liters per capita | 42 | 38 | 38 | 40 |
| NRW m ³ /year ¹² | 1,597,093 | 1,323,230 | 1,370,176 | 1,666,897 |
| % of total NRW losses | 30% | 27% | 26% | 28% |

The average daily water consumption was 40 litres per capita in 2017. This is within the emergency supply required by the National Water Sector Strategy and Investment Programme (NWSSIP)¹³ during the crisis. Consumption per capita slightly decreased, especially in 2015 and 2016, due to the large number of new customers that were additionally served.

Water production is closely monitored by IWSLC. The records of water produced and billed also makes it possible to assess the proportion of NRW (non-revenue water). This proportion – which may be caused by leakage losses or unmetered delivery – has fluctuated around 28%.

¹¹ IWSLC keeps regular records on water production, consumption and losses. Twenty-seven water meters are installed at the wells and the reservoir.

¹² Non revenue water (NRW) is the difference between the water officially billed and the water produced. The difference is caused by physical leakage and the non recovery of bills on water that is delivered.

¹³ The NWSSIP comes from 2005, predating the war.

Reliability of services

IWSLC maintains 36 water supply zones in the city and applies a distribution schedule, as follows:

- 15% of the customers are supplied with water 24 hours a day, 7 days a week (customers located near main waterlines)
- 40% of the customers are supplied with water two days a week
- 45% of the customers are supplied with water 24 hours a week.

The supply is either through gravity from the reservoir or directly from the well pump. Figure 1 illustrates the supply zones and type of supply by IWSLC.

From the survey, 61 household users were interviewed – distributed over different parts of the city. Of the interviewed household water users, 42 (i.e. 69 percent in the sample) used water from IWSLC's distribution network whereas 18 (i.e. 30 percent in the sample¹⁴) mainly relied on water tankers and private suppliers. One family received most of its water from roof top harvesting. The families receiving water from IWSLC were nearly all satisfied with the cost and quality of the water, but those taking water from the tankers were unhappy in most of the cases due to the high cost and poor quality. With regards the quantity of the water supplies, however, not all users find the water supply to be sufficient. In fact, 100% of private tanker customers indicated their dissatisfaction with the water quantity, compared to 51% of IWSLC's water users. The shortfall was because of insufficient delivery during the water turns: with individual water storages often not filling up. Families made up the shortfall with additional water purchases or deliveries from mosques or charities.

As for storage, most households use elevated water tanks and keep large numbers of bottles or other reservoirs at hand. These are filled during service disruption by IWSLC or private water tankers. The average household storage lasts for 7.9 days, which is in line with the water delivery cycles. However, 11% of interviewees had water storage of 4 days or less. On the other hand, 25% of all interviewed families had storage in excess of 10 days.

Water quality

IWSLC operates a drinking water laboratory that collects water samples from the reservoir and from 29 points including 26 wells and the distribution network (Figure 3). The laboratory analyses the most common physical, chemical and microbiological parameters from the source. The test results from the IWSLC indicate that water has been of good quality and within the Yemen drinking water standards (see Annex 2 for the location of the water quality stations). Additionally, all samples appear to indicate that the water supplied over the last three years is free from faecal coliform. It needs to be noted that the samples are taken at both, source and distribution network, but the quality may deteriorate as the water is stored at the house hold tank.

¹⁴ In the entire town 80% of the population is served the IWSLC – the sample was a bit biased towards the unconnected.



Figure 3: IWSLC's water lab

The LC had a gas chlorination system in the reservoir – dating from the period before the conflict. This is currently not operating but replaced with calcium hypochlorite solution (Figure 4), while the waters from the wells with direct supply to the network is not disinfected. The exceptions are seven boreholes, which were supported by the Red Cross (ICRC), that provided a chlorination unit for each of these wells.



Figure 4: Calcium hypochlorite unit at main reservoir

A significant portion of the population (according to the household survey) use tap water. Only 8 out of 61 (13%) households treat their water using filters or chlorine. Several other families use bottled water for their drinking water needs (18 out of 61 or 30%). The bottled water moreover is not free from problems. The NWRA branch has conducted an inventory of private water treatment stations. According to the biological analysis of water samples, the water from only 9 out of 19 treatment plant was completely safe. In 2 out of 19 cases the coliform was too high (see annex 2).

2.2 SANITATION AND SEWERAGE SERVICES

Asset base

Besides water supply, IWSLC is also responsible for urban sanitation. It has a wastewater treatment plant (WWTP), based in the Maitam area (Figure 5), that operates with an activated sludge system. It consists of an inlet (flow meter, coarse and fine screens, two canal grit chambers and a distribution chamber), a secondary treatment facility (two aeration tanks and two sedimentation tanks), a thickener, drying bed and a chlorination unit. The total sewer network consists of 171 km of transmission and collection lines.



Figure 5: The wastewater treatment plant

Coverage

Just as IWSLC has been able to extend the coverage of its water supply services, it has done the same for its sanitation and sewerage services (table 2). In so doing, however, the wastewater treatment plant has become more and more of a bottleneck as it is extremely overloaded. The design capacity is 3,200 m³/day but ground staff estimate that the flow is probably about 11,322 m³/day, but it could be even more. This means that the capacity of the WWTP is only 28% of the wastewater it receives for treatment. There are no figures available regarding the inflow to the WWTP because the installed flow meter is damaged. From 2014 to 2017, the number of connections increased from 20,983 to 24,480, a 17% rise for an already overstretched system. Figure 6 shows the sewerage collection network in Ibb city.

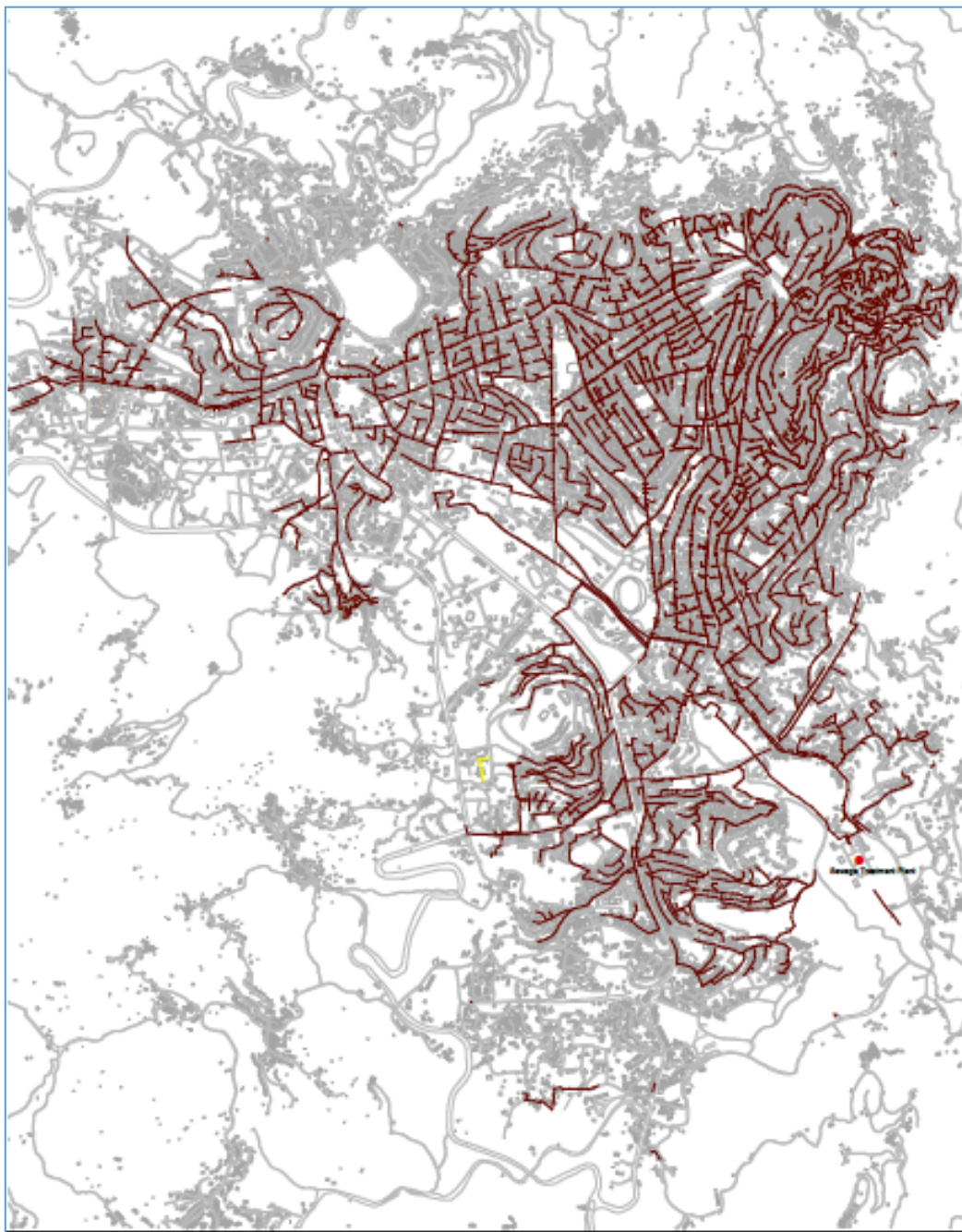


Figure 6: Sewerage collection network at Ibb city

Wastewater treatment and quality

There have also been concerns about groundwater pollution in Ibb, even prior to the conflict. A study undertaken by Al Sahabi et al (2015)¹⁵ analysed the chemical and physical composition of borehole samples. It established that in some boreholes, salinity levels and the concentration of total dissolved solids, ammonia and copper exceeded norms of safe water supply. The study hypothesized that this

¹⁵ Al Sahabi, Esmail; Fadhl Ali Al Nozaily and Sameer Abdulhafez (2015), Evaluation of ground water quality for drinking water by using physico-chemical analysis in the city of Ibb Yemen. *British Journal of Applied Science and Technology* 5(5), 425-435.

pollution was the result of excess flow from the lbb wastewater treatment plant, which is situated in the recharge zone of some of the boreholes and has not able to process all the wastewater delivered to it. Moreover, given that 34% of lbb residents are not connected to the sewerage network and they usually discharge untreated wastewater locally, this is an additional source of pollution. There is no quality supervision of the water supplied by private suppliers. The earlier system of control by IWSLC has been suspended.

Impact on public health

The mismatch between capacity and inflow affects the efficiency of the plant, but also presents health hazards. The unpleasant odour of the wastewater is strong and can be detected from far away. Results from BOD5 and COD analyses undertaken by the wastewater laboratory indicates that the efficiency of the treatment plant is decreasing tremendously. Moreover, lbb was one of many cities throughout Yemen that was affected by the cholera epidemic. In December 2017, the World Health Organization (WHO) reported 9,380 suspected cases of cholera with 9 deaths in Al Mashanah and Al Zahar. The continued dire state of sanitation in lbb raises concerns about whether it could continue to be a risk for public health.

Table 2: Sewerage coverage

| Sewerage Connections | 2014 | 2015 | 2016 | 2017 |
|----------------------------------|---------------|---------------|---------------|---------------|
| Number of domestic connections | 20,260 | 21,382 | 22,345 | 23,637 |
| Number of government connections | 208 | 212 | 256 | 265 |
| No of commercial connections | 515 | 499 | 547 | 578 |
| Number of industrial connections | - | - | - | - |
| Number of other connections | - | - | - | - |
| Total | 20,983 | 22,093 | 23,148 | 24,480 |

3. BEYOND PERFORMANCE: GOVERNANCE AND MANAGEMENT OF WSS

IWSLC's commendable performance in delivering WSS under stressful conditions is rooted in the strong governance structure and procedures in place. This section discusses the various elements underlying the performance of IWSLC: governance, management and staffing, customer relations and financial management.

3.1 GOVERNANCE

As part of the Water Supply and Sanitation Sector Reforms that aimed at larger performance and more autonomous service providersⁱ, clear state-of-the-art management and governance systems were set in place from the time IWSLC was established in 2001. Part of the reforms was to create autonomous service providers¹⁶. These systems have helped carry IWSLC through the challenges that have come with the conflict.

The decree that established IWSLC identified the tasks and responsibilities of all involved parties including the Ministry of Water and Environment (MWE), Board of Directors of the Local Corporation and its management. The Board is the supreme administrative authority of the Corporation. Its eight-member composition represents different stakeholders – local community, customers, private business – and comprises public interest, finance and regulatory roles (box 1). The task of the Board is to discuss and approve plans prepared by the executive management and approve tariff changes.

In the last four years, the Board has met six times – three times in 2014, once in 2015 and twice in 2016. In 2017, the Board could not convene. Despite the low number of meetings due to the security situation, the Board managed to take key decisions. The meetings in 2016 were very important in this regard. The first meeting was held on 26th July 2016 to discuss the impact of the increasing cost of diesel on IWSLC activities. The outcome of this meeting was that the Board agreed on a 20 to 45 percent tariff increase. The Board also agreed to austerity measures, such as a ban on new hiring and steps towards cost rationalization. A second meeting was held on 27th of August 2016 to discuss the decision by the Governor of the Central Bank to stop all payments except salaries. On this occasion, the Board authorized the IWSLC management to apply any measure necessary to ensure the continuity of services. At the same time, a mechanism was established to follow up systematically on decisions through the Secretariat of the Board of Directors. This new arrangement gave the IWSLC management more freedom to take decisions to deal with the numerous challenges and prioritize the sustainable provision of services.

The relevant procedures of the general laws, bylaws, and regulations that govern the IWSLC's management are given in Annex 3.

Box 1: Composition of the Board of the IWSLC

¹⁶ Service providers that would be autonomous in terms of management (with their own board) and in terms of finance (all recurrent costs generated from users fees).

Local citizens and private business participate in the decision-making process by outlining policies and monitoring functions. This is reflected in the membership of the board of local corporations, which is comprised of the following:

- The Governor (the chair);
- A member representing the private sector, nominated by the Chamber of Commerce;
- A member representing the local community;
- A member representing the National Water Resources Authority (NWRA), the sector regulator;
- A member from the office of the Ministry of Planning and Development in the Governorate;
- A member from the office of the Ministry of Finance in the Governorate;
- A member representing customers;
- A member representing the Ministry of Water and Environment.

3.2 MANAGEMENT

Several issues stand out in the management and staffing of IWSLC. First, there has been no change in the management positions for the last five years, which has ensured continuity. IWSLC has also been relatively free of political interference. It has operated a special contingency plan to deal with requests for political favours. Moreover, due to the presence and position of the Board, management and staffing have been geared towards ensuring the continuity of services. Since 2009 the IWSLC obtained an organizational structure and tasks description for the main departments, which was legally approved. The organizational structure, as presented in Annex 4, consists of seven main departments that are able to address IWSLC activities appropriately. The IWSLC Director General answers directly to the Minister and the Board of Directors concerning the conduct of daily financial, administrative and technical matters as well as implementation of new projects. The Director General also decides on the allocation of responsibilities to the different departments.

IWSLC has been able to retain its competent staff through timely payment of monthly salaries. In addition, a financial incentive was given to staff based on performance. In the current context of uncertain employment conditions in the country, regular salary payments are a considerable bonus. As a corporation with its own revenues, IWSLC has been able to grant these incentives to its staff, which has also helped to make it immune to the uncertainties of government finance. Staff motivation and performance have improved through monthly assessments and motivational guidance from senior management.

3.3 ORGANISATION AND STAFFING

IWSLC follows the general procedure of public civil law and national schemes for employment and salary payments. With the conflict and economic instability, there has been more emphasis on motivating staff through timely payments and incentives rather than by strictly honouring established rights. As part of the cost saving measures instituted by the Board in 2016, the system of annual salary increments and the standard transportation allowance were suspended, whereas an upper limit was introduced on overtime work and on in-kind incentives (e.g. petrol for cars). Capacity building programs were stopped. On the other hand, as mentioned, IWSLC applies an incentive scheme where incentives are awarded according to the monthly assessment of staff performance by each department manager.

IWSLC employs a total staff of 240 people, a number that has been constant since 2015. As part of the cost saving measures introduced in 2016, there has been a freeze on new recruitment. At present 19% of the employees has a university degree, 33% of staff has a technical degree and 48% have a secondary high school degree or lower qualification. The distribution of staff per department is in balance with the tasks and responsibilities (Fig. 7).

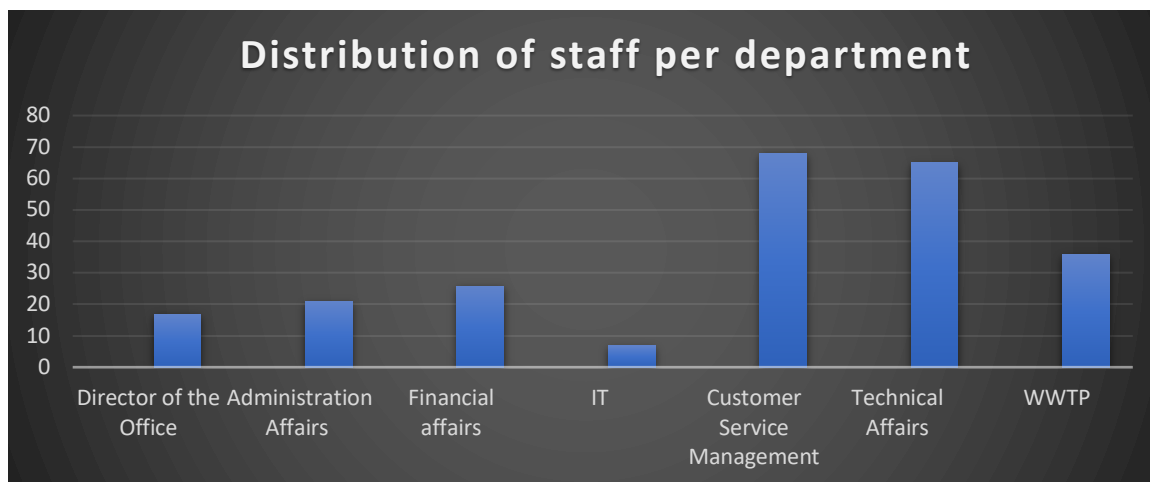


Figure 7: Distribution of staff per department

IWSLC has had a policy of keeping the number of non-productive staff low: the proportion of administrators and management employees is 17%. The Water Supply, Sanitation, and Customer Relations Departments are considered the utility's three main departments. Combined, their staff make up 68% of all personnel: hence a large proportion of staff is engaged in the core functions.

3.4 CUSTOMER RELATIONS

IWSLC has paid attention to building its relations with customers through systematic and transparent procedures, an efficient billing system and open communication. It operates a customer services center that provides services for new customer connections, meter placement, meter reading and bill distribution. IWSLC has been applying an Operation Management Support System (OMS), which was introduced through a GIZ program in 2003. Under this program, IWSLC has established a GIS department, which frequently updates network and customer data. The Customer Service Center applies the following procedures for the various processes of customer management through GIS applications:

- Application for new customer connection;
- Meter installation and adjustment;
- Change of customer name;
- Meter reading and bill distribution;
- Revenue collection;
- Inspection of works and follow up.

Water losses are investigated systematically through random field checks of meters to ensure the accuracy of the meter readers. This step is conducted before issuing the water bill to make sure that there are no mistakes in the amounts charged.

On the other hand, there is also insistence on the consumer to pay the due amount, with an option offered for payment in instalments as IWSC's perspective is that the customer is equally responsible for the sustainability of the utility. The consequence of this policy is to systematically apply sanctions on customers who do not pay to in order to enforce payment discipline. In addition, errant behaviour by customers (e.g. manipulation of water meters, overdue bills) is systematically followed up via calls or visits.

A structured complaints procedure is in place. IWSC uses the Maintenance Management System (MMS) application for customer complaint procedure. Any complaint from customers is filed and addressed individually until finally solved and closed.

3.5 BILLING AND COLLECTION

IWSC has a striking record in bill recovery, considering its unstable operating environment due to the conflict, which has boosted its financial capacity to deliver its services. In the last four years, the collection rate was 87% on average, varying between 78% (in 2017) and 101% in 2016 (including arrears of previous years). For domestic and commercial users, the collection rate has even been 100% during the entire crisis period. The excellent commitment and support of the domestic and commercial users needs to be acknowledged. The average collection rate has been weighed down by low collections from governmental organizations¹⁷ (45%) and the non-payment of a special mark-up.

Table 3: Billing and collection BY different consumer categories

| Consumer category | description | Year 2014 | Year 2015 | Year 2016 | Year 2017 | Total | Average collection rate |
|-------------------|---------------|-------------|-------------|-------------|---------------|---------------|-------------------------|
| Residential | Billing (YER) | 663,248,977 | 668,272,143 | 730,887,836 | 1,010,865,938 | 3,073,274,894 | |
| | Collection | 702,915,245 | 702,160,502 | 776,468,018 | 943,144,930 | 3,124,688,695 | 101% |
| Governmental | Billing | 116,919,792 | 115,650,911 | 119,885,380 | 164,133,583 | 516,589,666 | |
| | Collection | 88,421,978 | 60,515,869 | 77,223,757 | 4,251,343 | 230,412,947 | 45% |
| Commercial | Billing | 49,221,166 | 51,011,482 | 69,136,465 | 109,844,775 | 279,213,888 | |
| | Collection | 49,641,594 | 51,012,620 | 73,718.657 | 105,347,739 | 279,720,610 | 100% |
| Special mark-up | Billing | 127,278,486 | 127,909,306 | 992,432 | 68,644,712 | 324,824,936 | |
| | Collection | 0 | 0 | 0 | 0 | 0 | 0% |

¹⁷ Interestingly the rate charged to government organizations was higher (255%!) than other customers – so even with the low payment costs even from public clients may have been recovered/

IWSLC takes monthly water readings and issues bills each month. The domestic sector has the largest share of water sales, with a total of 75% of sales, i.e. 1.01 Billion YR¹⁸. The government sector has the second biggest share, with 12% (164 million YR) in 2017 and a general service fee that applies to all (10%). IWSLC also collects fees for local councils.

IWSLC has put efforts in building a strong relationship with the customers. Care is taken to create trust between customers and IWSLC through diligent meter reading. Monthly water meter readings and bill distribution is done through GIS based 'Reading Routes', which are prepared by dividing Ibb city into 206 routes, with each route serving 200 customers. It takes 1 to 10 days to distribute water bills and read the water meters. This period depends on the experience of the reader. There is one meter-reader/ bill distributor for every 1500-1600 customers. The customers pay either directly at the IWSLC customer service centre, to the IWSLC account at the post office or to the IWSLC staff when they visit their houses in which case, the customer gets a receipt from the staff member. As described before, when there are complaints about the bill or the meter, investigations tend to be quick and systematic. Promotional activities are done through dedicated teams that raise awareness and urge customers to pay their monthly bills. Teams also follow up on defaults and suggest service cuts in case of protracted delays of payment.

Table 4: Tariff structure and customer application, 2014-2017

| Customer type | Consumption Amount | Water & Sewerage Tariff (YER/m ³) | | |
|--------------------|--------------------|---|------|------|
| | in m ³ | 2014 | 2016 | 2017 |
| Domestic | (0 -5) | 123 | 168 | 220 |
| | (6 - 10) | 150 | 203 | 238 |
| | (11 - 15) | 183 | 248 | 289 |
| | (16-20) | 214 | 289 | 338 |
| | (21 - 25) | 279 | 378 | 443 |
| | (26- 30) | 298 | 404 | 474 |
| | (over 30) | 342 | 463 | 544 |
| Government, | (0 - 5) | 580 | 926 | 1039 |
| | (Over 5) | 580 | 926 | 1039 |
| Commercial & Other | (0 - 5) | 398 | 538 | 591 |
| | (Over 5) | 398 | 538 | 632 |

¹⁸ The average exchange rate for 2017 was 1 USD to YER 250 but amounts are given in Yemeni Rial, as the USD exchange rate has fluctuated too widely to make a USD conversion meaningful.

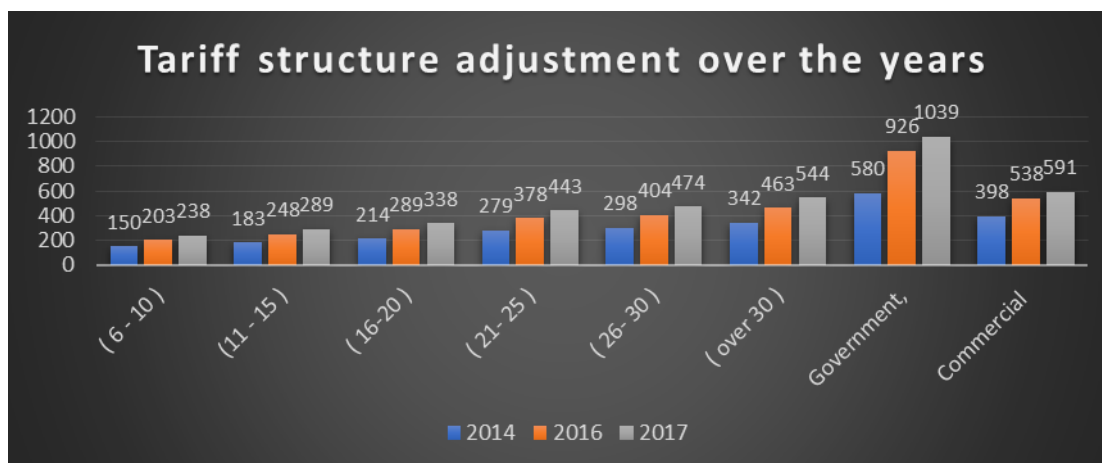


Figure 8: Tariff structure adjustment over the years

With the consent of the Board, IWSLC has taken some bold steps to adjusting service tariffs during the crisis period. First, when the government stopped subsidies for fuel derivatives in late 2014, an adjustment to the water tariff was agreed to overcome the impact of this cost increase on IWSLC's financial burden. It was decided to gradually increase the tariff by 20% every month up to a maximum of 45%. IWSLC used a tariff simulation model to calculate precise price increases, taking into consideration customer sub-categories, consumed quantities and billed revenue. Consumers with low consumption pay less per volume of water used for instance. IWSLC further adjusted tariffs to cope with the ongoing changes in operation and maintenance costs, but made provision for poor and low-income groups. There is a graded tariff system with small consumers paying less per volume consumed. The fees for the first 5 m³ (life line) are kept affordable for the poor, an idea applied from NWSSIP.

The tariff changes were introduced gradually to cover full operational, maintenance and depreciation costs. Care was taken to soften the impact of the cost increases. As domestic users are the bulk of the income base (91%), tariff adjustment was accompanied by other measures, such as educating and winning over local community leaders to avoid a public backlash.

Another change effected in light of a tighter budget was combining the water service fee with the sanitation fee. Before 2016, these fees were separate, but the payment of the sanitation fee was often problematic. On the decision of the Board, ISWLC now charges sanitation fees costs as part of the overall water bill. Therefore, due to the afore-mentioned phases of tariff adjustments, a good cost recovery was achieved. Billing and collection was simplified by combining both water and sanitation fees, thus reducing resistance to pay for sanitation only and simplifying bill collection,

Depending on the customer category, tariffs increased by 55% and 80% between 2014 and 2017, against an increase of fuel (diesel) price hike of 235%, which is still relatively modest. Compared to different water suppliers, IWSLC is still the cheapest with average water tariff in the domestic category of 266 YR/m³ while tankers are the most costly with 1250 YR/m³. Private network supply is in the middle with 350YR/m³¹⁹.

To assess the extent to which water tariffs cover production costs, the weighted average of the tariff per cubic meter sold was compared to both the average cost of production per cubic meter of water

¹⁹ Bottled water supply of course is considerably higher still but is an overall altogether different product.

with depreciation as well as the average cost of billing per cubic meter with depreciation. Table 5 presents the analysis of the average production costs of water versus the average tariff charged for customers.

Table 5: Analysis of average production cost against tariff

| Water production cost and tariff | 2015 | 2016 | 2017 |
|---|-------|-------|-------|
| Average water production cost YR/m ³ | 205 | 209 | 237 |
| Average water tariff billed - domestic | 223.2 | 235.4 | 266.5 |
| Average water tariff billed - governmental | 712.7 | 729.8 | 802.6 |
| Average water tariff billed - commercial | 576.7 | 561.1 | 630.6 |
| Weighted average tariff YR/m ³ | 280 | 284 | 329 |

NB: over the years, the average tariff has covered the production cost with depreciation also, average tariff covers the cost of each billed cubic meter with depreciation.

3.6 FINANCIAL MANAGEMENT AND PERFORMANCE

The Unified Accounting System procedure is applied in agreement with Financial Law No. 8 of 1990 on preparing public budgets. IWSLC is subject to the auditing and inspection of its accounts by the Central Organization for Control and Auditing (COCA).

Despite the crisis, the financial department continues its regular activities and continues to conduct an annual inventory of assets, stocks, and cash. Since 2001, IWSLC's financial department has been using an asset and inventory accounting software (Annex 1).

The last recurrent budget approval was in 2014. Since then, the Ministry of Finance failed to adopt any recurrent budget, not only for IWSLC but also for the entire governmental sector.

The Financial Law states that the latest budget approval shall bind institutions in their financial actions. However, due to the considerable change in prices and conditions during the conflict, the recurrent budget cannot be used as a control tool to identify deviations in expenses and revenues.

IWSLC finances itself from its revenues as recurrent budget. Table 6 provides an overview IWSLC's main sources of finance over the years.

IWSLC has not received any subsidy for recurrent budget from the Ministry of Finance before or during the conflict while for the investment budget, IWSLC used to have support from the government till 2011. This is important information, as it suggests that IWSLC had to learn to be financially autonomous even before the crisis because it was not receiving any form of governmental financial support. This is one of the explanatory factors for IWSLC's resilience now that the conflict has erupted.

As table 6 shows, IWSLC's main sources of finance are the proceeds from water sales (67%) and wastewater services (21%). Part of the gap in fuel expenses was covered by UNICEF, to the tune of YR 4.5 Million in 2015; 32.7 Million IN 2016; 51.4 Million in 2017, which represent 0.47%, 3.43%, 3.66%, respectively of recurrent budget over the years. Though modest, this financial support was

received in the proper time, thus helping IWSLC to stay afloat and in particular, to cope with the steep rise in diesel prices before adjusting the water tariff.

Figure 9 presents the overview of the annual amount of IWSLC's operation and maintenance costs (without depreciation) according to different categories for the past four years. The years 2015 to 2017 represented the crisis period while 2014 is considered as a pre-crisis period.

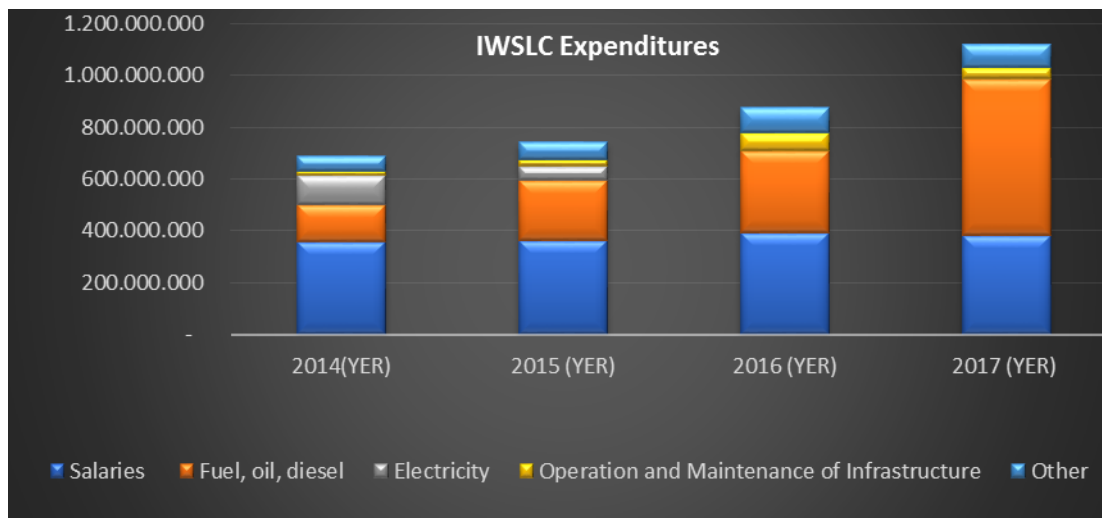


Figure 9: IWSLC expenditures

The changing economic situation is reflected in IWSLC's expenses – in particular its energy costs. Electricity delivery stopped in 2015 and since then, IWSLC's facilities have been run entirely on diesel and other fuels. The energy cost represents the highest percentage of total expenses in the last three years. It increased steeply from 37% in 2014 to the current 54% of total expenses. Salaries are another major cost factor but they have remained constant, another result of the austerity measures adopted. As a proportion of total expenses, salary costs have decreased from 52% in 2014 to 34% in 2017.

IWSLC has been able to counter the rising operating costs by increasing revenues, even in hard times. Compared to 2014, revenue in 2017 increased by 396 million YR or 41%. As a result, IWSLC is still able to meet its obligations (table 6).

Table 6: IWSLC Source of Finance

| | 2014 (YR) | 2015 (YR) | 2016 (YR) | 2017 (YR) | Total |
|---|--------------------|--------------------|--------------------|----------------------|----------------------|
| Water sales | 582,642,130 | 668,383,617 | 692,725,041 | 989,952,553 | 2,933,703,341 |
| Waste water fees | 246,747,805 | 166,550,919 | 227,184,641 | 294,891,744 | 935,375,109 |
| Support from Humanitarian Relief Organisations) | - | 4,506,500 | 32,709,600 | 51,428,840 | 88,654,940 |
| Other revenues | 127,278,486 | 127,909,306 | 992,432 | 68,644,712 | 324,824,936 |
| | 956,668,421 | 971,856,842 | 986,321,314 | 1,456,366,689 | 4,371,213,266 |

IWSLC's financial balance shows that it is able in principle to provide its vital services largely from its own revenue. If all bills are collected and if depreciation costs are not included in the overall tally, IWSLC is operating with a positive result. However, when depreciation costs are part of the sum total, the financial loss was about 51 million YR in 2015, 171 million YR in 2016 and 66 million YR in 2017. Yet depreciation expense is an accounting figure and no deposit was made in the depreciation bank account in 2015- 2017. It makes sense to waive this provision during times of hardship. Without depreciation, IWSLC was able to cover its operating expenses and generate savings of about 219 million YR in 2015, 46 million YR in 2016 and 231 million YR in 2017, if all bills to customers would be paid.

Table 7: Financial balance of the IWSLC

| Description | Year 2014 | Year 2015 | Year 2016 | Year 2017 |
|-------------------------------------|-------------|---------------|---------------|---------------|
| Total revenue charged | 956,668,421 | 962,843,842 | 920,902,113 | 1,353,489,008 |
| Total expenses without depreciation | 689,472,904 | 743,472,020 | 875,215,305 | 1,122,892,255 |
| Depreciation | 210,505,770 | 270,407,008 | 217,329,093 | 296,770,234 |
| Total expenses with depreciation | 899,978,674 | 1,013,879,028 | 1,092,544,398 | 1,419,662,489 |
| Balance <u>with</u> depreciation | 56,689,747 | - 51,035,186 | - 171,642,285 | -6,173,481 |
| Balance <u>without</u> depreciation | 267,195,517 | 219,371,822 | 45,686,808 | 230,596,753 |

Table 8: Cost coverage overview

| Description | Year 2014 | Year 2015 | Year 2016 | Year 2017 |
|---|--------------|--------------|-------------|---------------|
| Total revenue charged | 956,668,421 | 962,843,842 | 920,902,113 | 1,353,489,008 |
| Total revenue collected | 840,978,817 | 813,688,991 | 927,410,432 | 1,052,744,012 |
| Support by humanitarian organizations | | 4,506,500 | 32,709,600 | 51,438,840 |
| Total expenditures (without depreciation) | 689,472,904 | 743,472,020 | 875,215,305 | 1,122,892,255 |
| Balance (without depreciation) | 267,195,517 | 219,371,822 | 45,686,808 | 230,596,753 |
| Provision/write-off for non-collected revenue | -117,689,604 | -149,154,852 | 6,508,319 | -300,744,996 |
| Balance (without depreciation and with write-off) | 149,505,913 | 70,216,970 | 52,195,127 | -70,148,243 |

As explained above, although revenue collection is impressive given the current political situation, it is not 100% - largely due to non-payment by public sector customers. As Table 8 shows, IWSLC includes a provision for writing off non-paid revenue. The table also shows that IWSLC could still cover all operating expenses from the collection of revenues with this write-off, excluding depreciation, for the years 2014 to 2016 but a deficit of about 70 Million YR in 2017 is expected.

Although IWSLC's annual financial situation was stable, there has been fluctuation on a monthly basis, which can create cash flow problems. One reason driving such shortages is the unavailability of fuel in the local market, followed by strong fluctuations due to a sudden increase in fuel prices in 2017. These difficulties forced IWSLC to call for support from international relief organizations. Organizations such as ICRC and UNICEF, have supported IWSLC with fuel to overcome temporary difficulties needed for operation and maintenance of its water and wastewater facilities. From 2015 to 2017, IWSLC received fuel supplies from international relief agencies. In 2017, although UNICEF supported IWSLC with fuel supplies, IWSLC had a deficit of YR 19 Million due to the exorbitant increase in prices. Moreover, ICRC helped with some specific investments. It provided IWSLC with a submersible pump and two diesel generators in addition to chlorine dosing units for seven wells. Nevertheless, GIZ, ICRC and UNICEF have held short courses in awareness, O&M in Diesel Generator as well in chlorination.

4. CONCLUSION

The performance of IWSLC has been extraordinary by many measures given its operating environment. IWSLC managed to sustain its achievements in cost recovery and water delivery, which were already quite solid before the conflict, throughout the upheaval and stress of the conflict period. IWSC's experience, including both its challenges and its triumphs, contains many lessons on resilience and service delivery in extreme adverse circumstances.

The most important strengths and weakness as well as opportunities and threats for the IWSLC are summarized in table 8. Some factors that explain IWSLC's performance are:

First, IWSLC has been endowed with a good asset basis, particularly in the drinking water component, where IWSLC's wells are sufficient and functional. Luckily, there has been no damage from fighting or war attacks on the infrastructure and as such, IWSLC was spared the difficult process of rehabilitation whilst the war is still going on. The main damage has come from wear and tear and inability to do repairs requiring imported spare parts. The assets developed in the past also served to provide services, even to a growing customer base, even without replacement and major additional investment. There is also the intangible asset base of transparent procedures under which water is delivered and billed, which has contributed to building customers' confidence. IWSLC has also been relatively 'lean and mean', notably through a functional staffing policy and recruitment freeze aimed at managing costs and bolstering staff responsibility. It has safeguarded staff morale by ensuring the regular payment of salaries and has followed the prevailing rules and regulations. All these measures have helped to retain worker loyalty and customer confidence. IWSLC's experience has gone a long way to showing the importance and value of these intangible assets.

Second, the financial autonomy of the Corporation has provided the basis for its sustained functioning throughout the period of turmoil. Its ability to collect its own revenues and adjust the prices for its services has allowed IWSLC to generate sufficient revenue to pay for all essential running costs and ensure timely payment of staff. This helped to retain high staff morale, especially as other organizations were unable to provide such job security in times of hardship. Had the IWSLC been dependent on public finance, it would have been much more exposed to the financial turmoil that came with the Yemen war, such as the movement of the Treasury to Aden and the cessation of government payments.

Third, the war created high trust and goodwill for IWSLC – for customers it is the only route to affordable and relatively reliable water supplies; for staff it was the only way to secure a job and income. In short, the customers needed the IWSLC for its affordable water services, and the staff needed the IWSLC for their jobs. There was simply no alternative to this beneficial mutual dependence.

Fourth, IWSLC managed to avoid political interference that could have hampered its smooth response to the severe crisis. In other institutions in Yemen, the competition between rival powers played havoc with public organizations. Instead, IWSLC retained its board and senior management – validating some difficult decisions on raising and changing tariffs and undertaking austerity measures, including the need-based employment and recovery of all operational expenses. Decentralization also played a vital role.

Fifth, well-targeted support from humanitarian agencies helped to strengthen IWSLC and helped it to continue functioning by resolving vital constraints, such as the exposure to high fuel prices or the provision of necessary equipment. In other cities, parallel emergency water supply systems were created under humanitarian aid. Though useful at the time, such emergency provisions have come with a hidden cost. These emergency water supply systems were hard to sustain and partly undermined the functioning of the water supply by the LCs. The experience of Ibb compared to other

LCs suggests that even in humanitarian situations, the wiser strategy where possible is to support these primary service providers, especially by removing bottlenecks²⁰. The support given to IWSLC in fuel and spare parts by UNICEF and ICRC was modest, but important. It constituted not more than 5% of the overall budget yet it served to prop up IWSLC and helped it achieve an even larger coverage, accommodating also an extra population of IDPs.

Table 9: Summary of IWSLC's Strengths and Weaknesses

| | |
|--|---|
| <p>Strengths:</p> <ul style="list-style-type: none"> • Decentralization and financial autonomy provided IWSLC's financial and administration autonomy; • In spite of the conflict, IWSLC is still committed to abiding by laws and regulations; • The Board of Directors' members are still available and active; • The professional leadership of LC management • Adjustable tariff approved by Board; • Operates according to the principle of recovering operation and maintenance costs; • Functional office facilities (IT, equipment, networks, databases); • Intact and operational infrastructure; • Back up diesel generator facility including ample storage capacity; • Increased confidence between IWSLC and its customers due to continuing provision of WASH services; • High institutional loyalty and morale of IWSLC staff due to continuous salary payments compared to similar organizations that stopped doing so; • The administration managed to provide enabling environment to staff to continue doing their tasks in a professional technical manner, kept them away from political interferences • Staff engaging in public awareness to entice customers to pay their water service fees and recognise the importance of IWSLC's services; • Applying the OMS management system, thus enabling IWSLC staff to quickly respond to customer complaints; | <p>Weaknesses:</p> <ul style="list-style-type: none"> • Poor performance of sewerage systems and waste water treatment; • Health hazard created by inadequate capacity of WWTP; • Further increase in sewage connections but overstretched capacity; • Insufficient water quantities delivered in some areas; • Lack of spare parts affecting maintenance programs; • Depreciation of electrical and mechanical equipment and water and sanitation network without replacement; • No updates of IT and office equipment, resulting in inefficient work processes and delays; • Increase in percentage of non-revenue water; • Suspension of staff capacity building programs; • Large proportion of consumers not treating drinking water; |
|--|---|

²⁰ This is critical and raise concerns about sustainability of service delivery as well as sustaining of the capacity of institutions. Please explain this point in more detail. The world Bank support for Yemen water sector through UNICEF, WHO, UNOPS were to mainly to restore water and sanitation services, rehabilitate damaged assets and to support local institutions and sustain their capacities. Other organizations instead invested more on water tankers and emergency storage.

| | |
|---|--|
| <ul style="list-style-type: none"> • Adapting and applying reliable organization structure and job description; • Applying the principle of employment based on need only; • IWSLC management applies Board decisions; • Continuity of key management; • Management experience gained from the 2011 crisis, when the government withdrew subsidies to IWSLC; • Ibb LC managed to establish coordination with the international organization and win their trust | |
| <p>Opportunities:</p> <ul style="list-style-type: none"> • Peaceful urban community encouraged the IDPs from other escalated conflict cities to stay and invest which slightly increased Ibb city economic development; • Support from humanitarian organizations continues throughout the crisis aimed at strengthening IWSLC, not creating parallel systems; • The rapid development of technology and the presence of many systems and applications that can help improve performance, such as automatic reading and mobile devices for bill collection; • The huge increase in water services by private providers, which makes IWSLC more attractive in comparison; | <p>Threats:</p> <ul style="list-style-type: none"> • Increasing demand, especially for sewerage services, that cannot be met; • Unstable economic situation; • Fluctuating prices of fuel or non-availability of fuel on the market; • Unstable political and security situation; • Threat of conflict related infrastructure damage; • Further rising prices; • Rising water charges due to fuel prices – partly bailed out by humanitarian organization. |

While IWSLC maintained and even expanded its water supply services, the weakest link has been sanitation services. Its only treatment plant, which was already overstretched before the war, had no means to increase capacity. Despite the impressive operation of drinking water services, the performance in sanitation was poorer. IWSLC was essentially faced with a Catch-22 situation: the growing population (the result of an influx of IDPs) demanded more connections. At the same time the WWTP was already stretched beyond its capacity and part of its facilities were not functioning well. The alternative was uncontrolled sewerage disposal. Faced with this dire situation and limited options, IWSLC chose to connect even more persons.

In the end, Ibb was not spared the effects of the cholera outbreak and the city suffered more than 9,000 suspected cases according to WHO. The precise causes for the cholera outbreaks still remain to be settled but several factors in Ibb must have played a role: the untreated wastewater gathered around the WWTP causing public health problems and groundwater pollution; the lack of chlorination in part of IWSLC's water supply network (including the area served by the high water tank); the absence of governance role / control of NWRA on the water quality of tankers; the still widespread practice of consuming tap water without treatment and finally water quality problems even among some of the bottled water providers.

5. LESSONS AND RECOMMENDATIONS

Continued services by local water utilities as well as sustaining their capacity in a time of severe crisis and war is essential to reduce civilian casualties. It is hence important in the repertoire of conflict measures to focus not only on relief and rehabilitation but also to find ways to support utilities in providing their lifelines services during crisis, be it hospitals, energy providers or water utilities.

Part of the answer is in creating organizations that are resilient – that can absorb shocks and keep functioning under stress, and maybe even perform better than before, as circumstances demand. IWSLC is a prime example: it increased its services and enlarged its customer base over the last four years of severe conflict. The Ibb case study has many important lessons on resilience. One is that even in crisis, vital services do not need to collapse and that the crisis can indeed be an opportunity to improve, even in a context of extra demand from displaced persons. The second lesson concerns the various systemic elements that made IWSLC resilient.

- Its financial autonomy, particularly the ability to charge higher tariffs to meet increased operating costs, and its independence from public funding;
- Its tangible assets – infrastructure that is relatively robust, can deal with overload (in the case of water treatment); enough spare parts in stock and the ability to change energy source – as energy supply during crisis is a major liability;
- Its intangible assets – effective and transparent billing systems, customer management, staff motivation and complaints' handling;
- Its distance from political interference – helped also by the multi-stakeholder board under which IWSLC operated.

IWSLC's experience is also a story of trust and necessity: water users needed IWSLC to provide water in the most reliable and affordable way; its staff needed the organization to work well as this would provide them with secure job in otherwise uncertain times. What made these two drivers work towards resilience was good management and a whole set of good procedures and motivational actions. In this way, IWSLC has been able to perform and inspire confidence in its billing and service delivery.

The second part of the answer to keeping utilities functioning during crisis and conflict is to channel the right kind of support. One part of this approach is not to focus exclusively on short-term emergency measures, which can undermine the long-term development of the utility, but instead to bolster continued service. This can be done by facilitating the acquisition of critical inputs, such as fuel, spare parts, and chemicals and by giving such items protected status. IWSLC's daily operations have not been easy – the huge uncertainties over energy supply, the damage to the network due to high water pressure in certain sections, the risk of vandalism and theft and the risk of running out of spare parts – but it has managed to find stopgap measures that ensured that service continued to its customers.

The case study also has some lessons for the post conflict recovery period in Yemen, which will probably only be a matter of time. Reinforcing the strengths of utilities such as IWSLC and avoiding discontinuity in management and operations are key to establishing the basis for IWSLC's future growth.

Another important aspect is to catch up on investment that has been delayed or suspended in Ibb and other water utilities. An important priority is wastewater treatment, which has been underfunded for a long time. In new sanitation investments, there may also be opportunities for 'building back better' – looking at waste-energy optimisation and the systematic use of treated wastewater for certain types of agriculture. Similarly, in water supply, investment is overdue – to repair what was

broken and has worn out in the many years without new investment. The following would be investment priorities for IWSLC in the future. These actions would help ensure continued service performance, help accommodate the increased demand for water supply services (by developing new sources) and address the overcapacity and large demand for sanitation services. Investment priorities would be:

- Increase the capacity of the Waste Water Treatment Plant;
- Restore defunct equipment such as flow meter on WWTP;
- Extend the sewerage collection network;
- Keep investing in customer relations by well-targeted awareness campaigns
- Replace the main line to accommodate more customers and decrease the number of distribution zones;
- Provide each well with a chlorination unit;
- Support IWSLC to update the customer and financial applications;
- Update the study of rainwater harvesting for the sake of recharge of lbb groundwater aquifer;
- Explore other water sources outside the lbb city groundwater aquifers.

ANNEX 1: ASSET BASE OF IWSLC

Table 10: Water infrastructure

| No. | Descriptions | Unit | 2014 | 2015 | 2016 | 2017 |
|-----|--|--------------------|--------------|-----------|-----------|-----------|
| 1 | Total population | No | 345,748 | 361,836 | 370,158 | 383,113 |
| 2 | Total number of water connections | No | 24,775 | 26,537 | 28,100 | 29,961 |
| 3 | Total number of waste water connections | No | 20,973 | 22,093 | 23,148 | 22,480 |
| 4 | Average number of persons per house connection | P/C | 10 | 10 | 10 | 10 |
| 5 | Water service coverage | % | 70 | 74 | 76 | 79 |
| 6 | Public water distribution points | No | - | - | - | - |
| 7 | Main source of water supply (SW or GW) | | GW | GW | GW | GW |
| 8 | Distinctive water supply zones | No | attached | attached | attached | attached |
| 9 | Number of served areas currently | No | 36 | 36 | 36 | 36 |
| 10 | Water supply pumping stations | No | - | - | - | - |
| 11 | Low pressure pumps | No | - | - | - | - |
| 12 | High pressure pumps | No | - | - | - | - |
| 13 | Total number of boreholes | No | 27 | 29 | 29 | 29 |
| 14 | Boreholes in operation (=borehole pump no) | No | 25 | 26 | 26 | 26 |
| 15 | Ground reservoirs | No | 1 | 1 | 1 | 1 |
| 16 | Elevated tanks | No | ??? | ??? | ??? | ??? |
| 17 | Water sterilisation facilities | No | ??? | ??? | ??? | ??? |
| 18 | Nominal water production capacity | m ³ /yr | 7,382,668.00 | 7,682,688 | 7,682,688 | 7,682,688 |

| | | | | | | |
|----|--|--------------------|--------------|--------------|--------------|--------------|
| 19 | Current water production capacity | m ³ /yr | 5,347,606.00 | 4,940,540.00 | 5,219,242.00 | 5,997,931.00 |
| 20 | Losses Percentage (NRW%) | NRW% | 24 | 24 | 23 | 26 |
| 21 | Total no. of domestic water meters installed | No | 24,775 | 26,537 | 28,100 | 29,961 |
| 22 | Total no. of functioning domestic water meters | m | 24,775 | 26,537 | 28,100 | 29,961 |
| 23 | Nos. of new/functional water meters in stock | No | 11,479 | 8,826 | 6,192 | 9,151 |
| 24 | Length of the water supply network | m | 236,254 | 256,300 | 277,683 | 281,511 |
| 25 | Total no. of bulk water meter | No | 27 | 27 | 27 | 27 |
| 26 | Water tankers | No | 0 | 0 | 0 | 0 |
| 27 | O&M vehicles | No | 3 | 3 | 3 | 3 |
| 28 | Water laboratory | No | 1 | 1 | 1 | 1 |

Table 11: Waste water infrastructure

| No. | Descriptions | Unit | 2014 | 2015 | 2016 | 2017 |
|-----|---|---------------------|---------|---------|---------|---------|
| 1 | Total population | No | 345,748 | 361,836 | 370,158 | 383,113 |
| 2 | Total number of waste water connections | No | 20,973 | 22,093 | 23,148 | 22,480 |
| 3 | Average number of persons per house connection | P/C | 10 | 10 | 10 | 10 |
| 4 | Waste water service coverage | % | 62 | 63 | 65 | 66 |
| 5 | Length of waste water collection network (by gravity) | m | ??? | ??? | ??? | ??? |
| 6 | Length of mainforce lines (pressure lines) | m | 165,884 | 170,358 | 170,896 | 171,074 |
| 7 | Waste water treatment plants | No | 1 | 1 | 1 | 1 |
| 8 | Nominal WWTP capacity | m ³ /day | 5,300 | 5,300 | 5,300 | 5,300 |
| 9 | Current waste water treatment | m ³ /day | 11,700 | 12,418 | 12,960 | 13,623 |
| 10 | Sewage pumping stations | No | 2 | 2 | 2 | 2 |
| 11 | Nominal capacity of sewage pumping stations | m ³ /day | 3,456 | 3,456 | 3,456 | 3,456 |
| 12 | Current capacity of sewage pumping stations | m ³ /day | Stop | Stop | Stop | Stop |
| 13 | Sewage trucks (vacuum/flushing) | No | 3 | 3 | 3 | 3 |
| 14 | O&M vehicles | No | 4 | 4 | 2 | 2 |
| 15 | Mobile sewage pumps | No | 0 | 0 | 0 | 0 |
| 16 | Sanitation laboratory | No | 1 | 1 | 1 | 1 |

Table 12: IWSLC software

| Activity | Software name |
|-------------------------------|---------------|
| Billing, collection & revenue | Billing |
| Cash disbursement & expenses | Acc |
| Material management & stores | INVNT |
| Fixed assets management | Asset |

ANNEX 2: QUALITY OF WATER FROM PRIVATE TREATMENT PLANTS

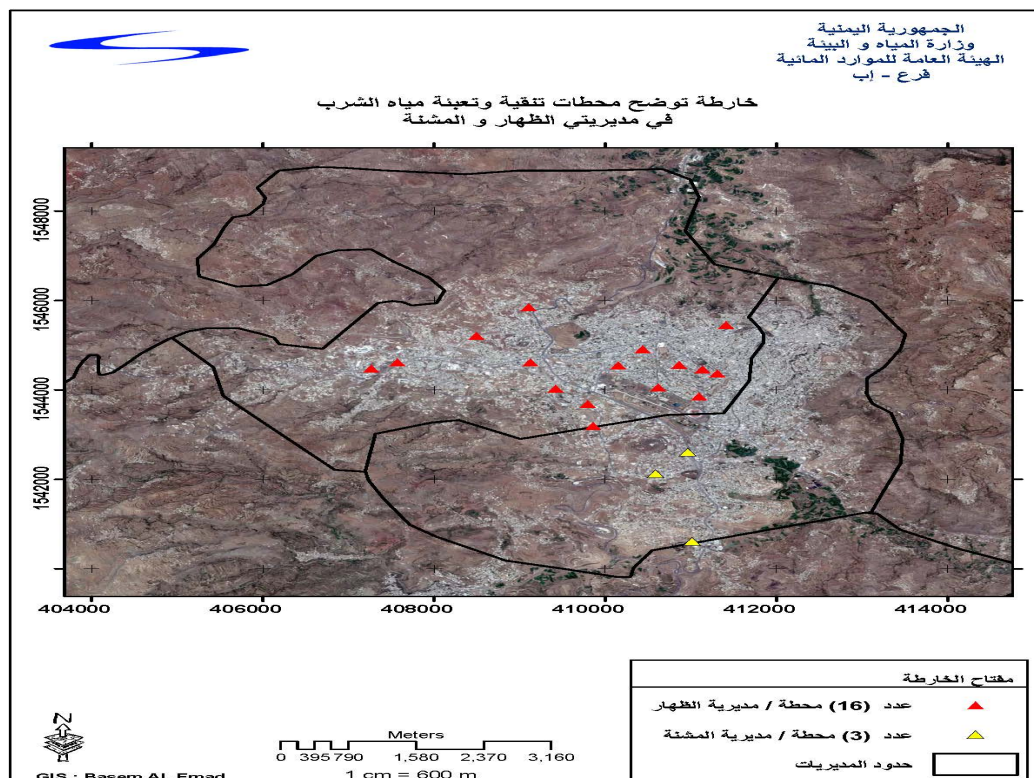


Figure 10: Locations

Table 13: Biological water quality of treatment stations²¹

| Directorate | No. of water treatment stations | Results of biological analysis for the water treatment stations produced water | | |
|--------------|---------------------------------|--|----|----|
| | | Nil | ≤5 | >5 |
| Al-Zahar | 16 | 8 | 7 | 1 |
| Al-Mashannah | 3 | 1 | 1 | 1 |

²¹ Source: Ibb NWRA branch

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| Sample Source | Unit | WHO standard | Reservoir | Well no 1 | Sample source 1 | Sample source 2) | Sample source 3 | Sample source 4) | Sample source 5 | Sample source 6 | Sample source 7(oid network) | Sample source 8 | Sample source 9 | Sample source 10 | Sample source 11 | Sample source 12 | Sample source 13 | Sample source 14 | Sample source 15 | Sample source 16 | Sample source 17(WELL NO (2)) | Sample source 18 (WELLNO (4)) | Sample source 19 (WELLNO (6)) | Sample source 20 | Sample source 21 | Sample source 22 | Sample source 23 |
|-------------------|------------|--------------|-----------|-----------|-----------------|------------------|-----------------|------------------|-----------------|-----------------|------------------------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-------------------------------|-------------------------------|--------------------------------|------------------|------------------|------------------|------------------|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chlorine | Mg/L | 0.2-0.5 | 0.9 | 0.017 | 0.013 | 0.017 | 0.013 | 0.01 | 0.015 | 0.017 | 0.005 | 0.021 | 0.011 | 0.01 | 0.014 | 0.029 | - | 0.015 | 0.011 | 0.012 | Nil | 0.014 | 0.016 | 0.018 | 0.013 | 0.012 | 0.004 |
| Total chlorine | Mg/L | 0.1-0.2 | 0.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| Residual chlorine | Mg/L | 0.5 | 0.002 | 0.017 | 0.013 | 0.017 | 0.013 | 0.01 | 0.015 | 0.017 | 0.005 | 0.021 | 0.011 | 0.01 | 0.014 | 0.029 | - | 0.015 | 0.011 | 0.012 | Nil | 0.014 | 0.016 | 0.018 | 0.013 | 0.012 | 0.004 |
| Ammonia | Mg/L | 50 | 16 | 10 | 12 | 6 | 11 | 9 | 12 | 8.8 | 15 | 11 | 14 | 6 | 12 | 13 | 6 | 15 | 6 | 20.00 | 11 | 19 | 18 | 8 | 17 | 8 | 12 |
| Nitrates | Mg/L | 0.1 | 0.01 | 0.017 | 0.019 | 0.019 | 0.102 | 0.014 | 0.012 | 0.032 | 0.017 | 0.048 | 0.013 | 0.012 | 0.014 | 0.012 | 0.02 | 0.013 | 0.016 | 0.02 | 0.017 | 0.02 | 0.012 | 0.021 | 0.027 | 0.013 | 0.012 |
| Nitrites | Mg/L | 400 | 59.8 | 44.8 | 30 | 41 | 53.6 | 52 | 50 | 36 | 59.4 | 61.5 | 55 | 26 | 49.1 | 11.5 | 48 | 105 | 43.1 | 61.2 | 50 | 62.1 | 58.5 | 44 | 62.9 | 32 | 48.8 |
| Sulfate | Mg/L | 0.3 | 0.077 | 0.1 | 0.052 | 0.043 | 0.104 | 0.064 | 0.115 | 0.21 | 0.085 | 0.034 | 0.068 | 0.04 | 0.101 | 0.012 | 0.071 | 0.045 | 0.065 | 0.1 | 0.15 | 0.101 | 0.087 | 0.093 | 0.122 | 0.087 | 0.105 |
| Iron | Mg/L | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coliform | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Coliform | Coli/100ml | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |
| Residual Coliform | Coli/100ml | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |

Table 14: Report of water analysis 2017

ANNEX 3: APPLICABLE RULES AND REGULATIONS FOR THE IWSLC

- Cabinet Decree no.237: Issued in 1997 concerning the reform policies program for water and sanitation
- Local Administration Law no. 4 issued in 2000. It dictates the system of local administration.
- Water Law No. 33 issued in 2002.
- Presidential Decree No. 218: Issued in 2004 regarding the regulatory framework of the MWE.
- Water Law no. 41: Issued in 2006 to amend a number of articles of Law 33 of 2002.
- The Law of Public Institution and Companies No. (35) 1991
- Civil Service Law number (19) of 1991 sets rules for public employees.
- Financial Law No. (8) of 1990 concerning by the public budget of the state.
- Procurement Law No. (23) of 2007 and its bylaw No. (53) of 2009 formulates the regulations, rules and procedures for the public tendering process.

ANNEX 4: ORGANISATIONAL STRUCTURE OF THE IWSLC

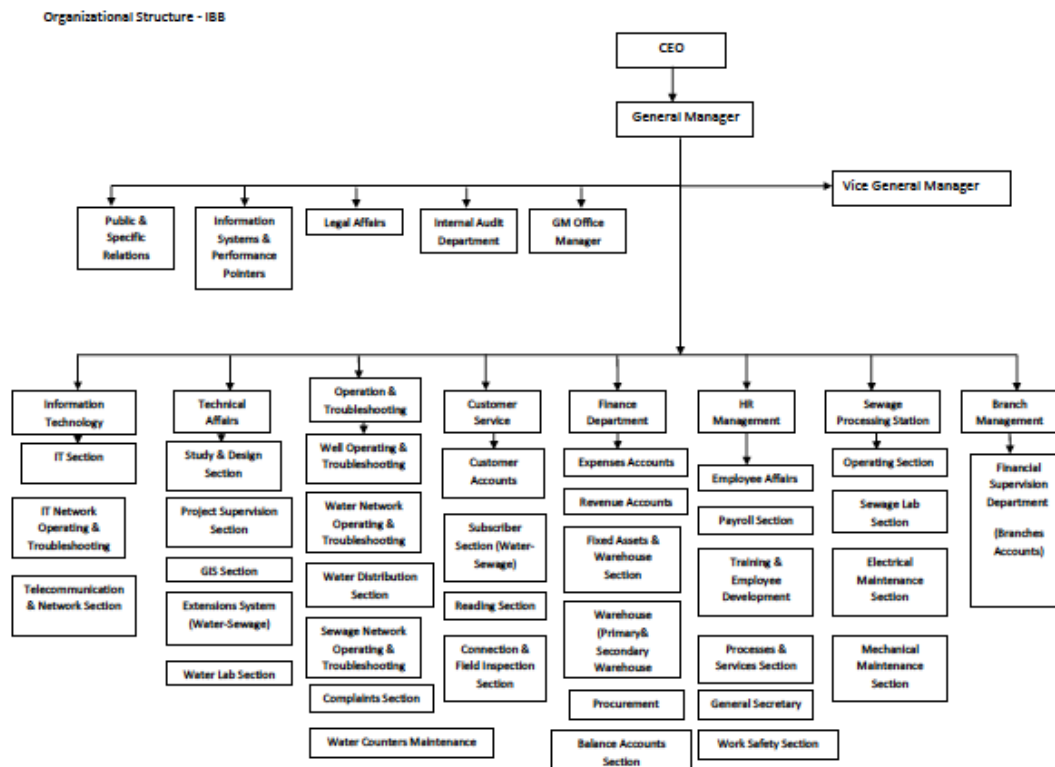
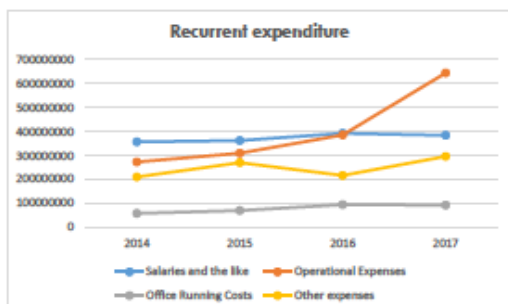


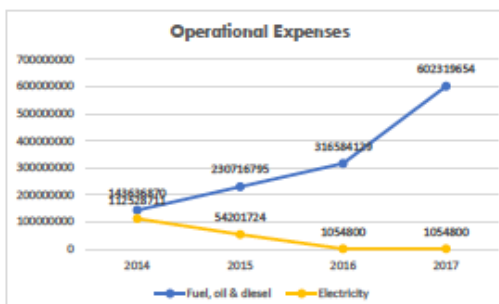
Figure 11: Organisational chart

ANNEX 5: FINANCIAL RESOURCES

Recurrent expenditure (YER) 2014 - 2017



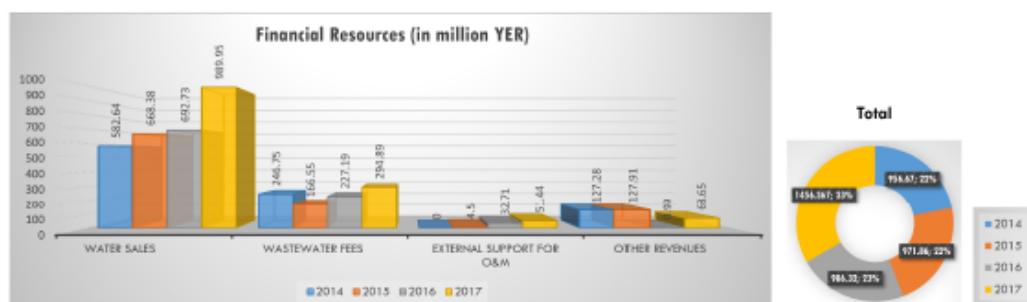
Operational Expenses (YER) 2014 - 2017



Expenditures

| No. | Description | 2014(YER) | 2015 (YER) | 2016 (YER) | 2017 (YER) |
|-----|---|--------------------|--------------------|--------------------|--------------------|
| 1. | Operational Expenses | | | | |
| 1.1 | Operation and Maintenance of Infrastructure | | | | |
| 1.2 | Spare parts and replacements water | 13,188,361 | 21,073,197 | 65,004,708 | 39,211,944 |
| 1.3 | Spare parts and replacements wastewater | | | | |
| 1.4 | Raw materials water | 3,795,000 | 3,857,000 | 3,803,602 | 2,414,736 |
| 1.5 | Raw materials wastewater | | | | |
| 1.6 | Fuel, oil, diesel | 143,636,870 | 230,716,795 | 316,584,129 | 602,319,654 |
| 1.7 | Electricity | 112,528,711 | 54,201,724 | 1,054,800 | 1,054,800 |
| | Total | 273,148,942 | 309,848,716 | 386,447,239 | 645,001,134 |

Financial Resources from 2014 to 2017 (in million YER)

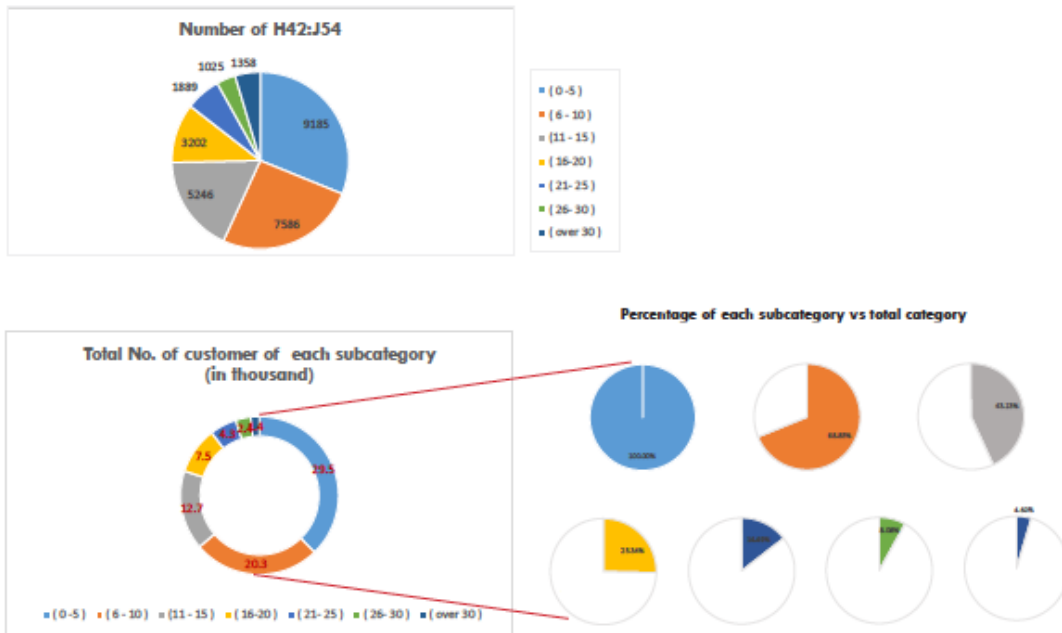


Financial Resources

| No. | Source of Finance | 2014(million YER) | 2015 (million YER) | 2016 (million YER) | 2017 (million YER) |
|-----|--------------------------|-------------------|--------------------|--------------------|--------------------|
| 1 | Water sales | 582.64 | 668.38 | 692.73 | 989.95 |
| 2 | Wastewater fees | 246.75 | 166.55 | 227.19 | 294.89 |
| 3 | External support for O&M | - | 4.5 | 32.71 | 51.44 |
| 4 | Other revenues | 127.28 | 127.91 | 0.99 | 68.65 |
| | TOTAL | 956.67 | 971.86 | 986.32 | 1456.367 |

Average water tariff a. Domestic customers; b. Government customers; c. Commercial & Other

a. Domestic customers



ⁱ According to the Cabinet Decree No. 237 for the year 1997 for Urban water sector reform and decentralization