DIRECTIONS IN DEVELOPMENT
Environment and Sustainable Development

The Future of Water in African Cities

Why Waste Water?

Diagnostics of Urban Water Management in 31 Cities in Africa: *Companion Volume*

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1. Introduction

By 2030, Africa's urban population will double, and the difficulties African cities currently face in providing sustainable water services will be exacerbated. "The Future of Water in African Cities: Why Waste Water?" (Jacobsen et al. 2012), argues that the traditional approach of one source, one system, and one discharge cannot close the water gap. A more integrated, sustainable, and flexible approach, which takes into account new concepts such as water fit to a purpose, is needed in African cities. The book provides examples of cities in Africa and beyond that have already implemented Integrated Urban Water Management (IUWM) approaches both in terms of technical and institutional solutions. Case studies explore the ways in which IUWM can help meet future water demand in African cities. Recent work carried out by Bahri (2012) on IUWM for the Global Water Partnership has also emphasized the necessity to examine the challenges posed by urban sprawl for urban planners and to recognize the need for coordinate, response, and sustainable resource management across sectors, sources, services and scales.

The World Bank has recognized a need for an integrated approach to urban water management. As part hereof the issue has come to the forefront: What is the specific character of the water challenge in African cities and how can we compare the severity of the challenge, the need for integrated approach and the local capacity to respond to these challenges? The study presented in this companion volume is an initial attempt to answer this question.

2. Objective and Aims

The objective of this study is to present the results of a comparative analysis of urban water management for 31 cities in Sub-Saharan Africa. This study is complementary to Jacobsen et al 2012. The present companion volume presents the methodology and general findings of the comparative analysis prepared as part of a wider diagnostic of urban water management in 31 cities in Africa.[1] Section 3 describes the methodology used to compare the 31 cities according to a selection of variables and indicators. Section 4 analyses the results of the comparative analysis following 6 individual categories selected for the study of urban water systems in those 31 cities (urbanization, solid waste management, water supply service, water resources availability, sanitation service, and flood hazard). Within each of those categories data have been collected for a number of indicators, see Annex 1. The result is considered as an index of how each city performs relative to the other 31 cities for that particular category, see annexes 2 and 3.

There are a number of challenges related to compare challenges and capacities across cities. Availability, validity and veracity of city level data are issues that may impact on the results. Ideally one would want city level data, with identical definitions and similarities in data collection verified by the responsible authorities. For this initial Africa IUWM index, we have relied on publicly available data, from global data bases to the extent possible as described in Section 3.2. The selection of data, categories and indicators

[1] Specific and detailed results for each of the cities is available at http://water.worldbank.org/AfricaIUWM

has been discussed with a number of experts within the fields of urban planning, environment and water (see Acknowledgements).

3. Methodology

A number of city level indicators exist. The most ambitious hereof is the Global City Indicators

Previous attempts to categorize and classify cities according to environmental indicators have resulted in the work produced by the Economist Intelligence Unit and Siemens for cities in Europe, Latin America, Asia and Africa. (i.e. the green city index used by The Economist (2011) for 15 cities in Africa). The work by Siemens and The Economist has focused on the categorization and classification of cities according to their environmental performance and presents an emphasis on the evaluation of each city in comparison to the rest. The specific regional focus for Africa of this index and its methodology was used as source and reference for developing the comparative analysis of 31 cities in Africa used by Jacobsen et al. (2012).

A methodology to characterize the different cities and to compare them was used based on the one followed by the Economist Intelligence Unit for the African Green City Index (The Economist Intelligence Unit 2011). This methodology was chosen for its simplicity and also due to the fact that it was able to limit the level of normalization and aggregation of the indicators by allowing a comparison of the data indicator by indicator. The choice of this methodology also avoided the ranking of the cities or their comparison against an established benchmark for it simply compares the values for each indicator for each city amongst themselves.

1.1 Selection of cities

The 31 cities selected for this comparative study (see Table 1) were chosen based on whether they fulfilled some or all of the following criteria:

- Rate of population growth (more than 3 percent growth rate)[2]
- Size of the cities (more than 2,000,000 inhabitants)[3]
- Presence of World Bank projects

Table 1. List of cities and selection criteria.

No.	Country	City	Population ('000 Inhabitants)	Population Growth Rate 1995–2010	Selection Criteria*
1	Angola	Luanda	4,775	5.87	P,G
2	Benin	Cotonou	841	2.82	WB

[2] According to data from (UNDESA, 2012), *World Population Prospects the 2011 Revision*.
[3] Op. cit.

No.	Country	City	Population ('000 Inhabitants)	Population Growth Rate 1995–2010	Selection Criteria*
3	Burkina Faso	Ouagadougou	1,324	7.02	WB
4	Cameroon	Douala	2,108	4.56	P,G,WB
5		Yaoundé	1,787	5.45	G,WB
6	Democratic Republic of the Congo	Kinshasa	9,052	4.18	P,G,WB
7		Lubumbashi	1,544	4.06	G,WB
8		Mbuji-Mayi	1,489	4.47	G,WB
9	Republic of Congo	Brazzaville	1,505	4.19	G,WB
10	Côte d'Ivoire	Abidjan	4,175	3.29	P,G
11	Ethiopia	Addis Ababa	3,453	2.06	P,WB
12	Ghana	Accra	2,332	3.27	P,G,WB
13		Kumasi	1,826	5.04	G
14	Guinea	Conakry	1,645	3.30	G,WB
15	Kenya	Nairobi	3,363	4.08	P,G,WB
16	Malawi	Blantyre	733	N/A	WB
17		Lilongwe	866	4.75	G,WB
18	Mozambique	Maputo	1,655	1.37	P,WB
19	Nigeria	Lagos	10,572	3.93	P,G,WB
20		Abuja	1,994	8.93	P,G
21		Ibadan	2,835	2.39	P
22		Kano	3,393	2.23	P
23	Senegal	Dakar	2,856	3.66	P,G
24	South Africa	Johannesburg	3,618	2.38	P
25		Cape Town	3,357	2.52	P
26		Durban	2,839	2.33	P
27	Sudan	Al-Khartum (Khartoum)	5,185	2.53	P
28	Tanzania	Dar es Salaam	2,498	4.77	P,G,WB
29	Uganda	Kampala	1,597	3.72	G
30	Zambia	Lusaka	1,421	4.30	G,WB
31	Zimbabwe	Harare	1,663	1.30	WB

Source: Authors.

**Note:* Selection criteria: P = population size (> 2 million); G = growth rate (>3% annual growth); WB = World Bank presence.

1.2 Selection of variables and indicators

The selection of variables included in the 31 cities comparative analysis is based on the understanding of IUWM as a holistic approach to all components of the urban water cycle within the context of the river basin. The variables chosen for the comparative analysis focus on the aspects of IUWM highlighted by Jacobsen et al. (2012) and present the main challenges and capacities for IUWM faced by major urban

areas in Africa. For the comparative analysis, six different variables were identified that would best represent the challenges and capacities of IUWM faced by cities in Africa: urbanization challenges, solid waste management, water resources availability, water supply services, sanitation services and flood hazards in river basins.[4] An internal and multi-disciplinary group of managers and experts at the World Bank provided important insights and feedback on the selection of indicators.

Out of the 6 variables selected, 16 indicators were identified as being relevant for the comparative analysis. All of the indicators are based on qualitative data collected from different types of sources. They aim to measure how each of the cities is faced by certain challenges or capacities associated with IUWM.[5] Data for the 16 indicators was gathered between January and March 2012 as part of a wider exercise to collect data for a 31 cities diagnostic that informed a World Bank publication (Jacobsen et al. 2012).

Characteristics of the selected indicators:

- **Representativeness:** the first objective with the selection of indicators was to represent and cover as many aspects of each variable as possible (in terms of completeness, causality, and complementariness)
- **Local data**: city-level indicators with specific local data were preferred so as to enable comparison between cities, and to present a more accurate description of the city-level situation. However, different proxies had to be used in some cases due to data constraints. Similarly, utility-level data varied depending on the utility's coverage; mostly, coverage was at city-level, but some utilities are national (for example, Senegal).
- **Consistency**: indicators are available consistently for all or most of the 31 cities were preferred.
- **Accessibility**: indicators were selected to be accessible and useful to the end-user due to the target audience being both internal to the World Bank and external (city leaders);
- **Availability of data**: indicator selection process was very much constrained by the availability, consistency, and reliability of the data for the 31 cities, which highlights the need to systematize such data for monitoring and planning purposes.

Table 2. Selection of variables and indicators for the comparative analysis of 31 cities in Africa.

Variables	Indicator
Urbanization challenge	City growth rate, 1995-2010

[4] In Jacobsen et al. (2012), the authors include "Economic and institutional strength" as a seventh variable in their 31 city diagnostic exercise. However, it is in this variable were most of the national proxies were used. For this reason, this seventh variable was excluded due to the fact that the main objective of the comparative study is to compare cities with city level data.

[5] See Annex for description of indicators and sources. A fully detailed list of sources for each indicator will be available at http://water.worldbank.org/AfricaIUWM

Variables	Indicator
	Percentage of city population living in informal areas
Solid waste management	Percentage of solid waste produced collected (public and private collection)
	Percentage of solid waste disposed of in controlled sites
Water resources availability	Average annual runoff
	Annual high flow (q10)
	Annual low flow (q90)
	Groundwater baseflow
	Basin yield
Water supply service	Percentage of city population with improved water coverage
	Residential water consumption in city or utility coverage area
	Percentage of collection rate from population billed
	Percentage of revenue water
Sanitation service	Percentage of population with access to improved sanitation
	Percentage of wastewater treated
Flood hazard in river basin	Frequency of flood events

Note: see annex for the definition and sources for each indicator.

1.3 Definition, calculation of intervals and aggregation of indicators

The data from the selected sub-set of indicators was then homogenized and the mean and standard deviation for each of the indicators was calculated. . The cities and their corresponding individual values for every sub-indicator have been assigned to one of 5 intervals depending on how much each of the individual values differed from the Mean plus or minus x-times the Standard Deviation. Each city value has been normalized then aggregated into one single indicator, giving equal weight to each of the sub-indicators. The values have been classified on a scale of 0 to 4 then matched with the interval they belong to according to their aggregated values.

The groups were classified based on different intervals calculated with the Mean score and Standard Deviation

- 0= Below Mean minus 1.5 times Standard Deviation
- 1= Between Mean minus 1.5 Standard Deviation and Mean minus 0.5 times Standard Deviation
- 2= Between Mean minus 0.5 times Standard Deviation and Mean plus 0.5 times Standard Deviation
- 3= Between Mean plus 0.5 times Standard Deviation and Mean plus 1.5 times Standard Deviation
- 4= Above Mean plus 1.5 times Standard Deviation

Table 3. Calculation, definition and codification of intervals

Calculation of intervals	Below Mean - 1.5xSD	Between Mean - 0.5xSD and Mean - 1.5xSD	Between Mean - 0.5xSD and Mean + 0.5xSD	Between Mean +0.5xSD and Mean +1.5xSD	Above Mean +1.5xSD
Codification for normalization of intervals	0	1	2	3	4
Values for intervals	Between 0 and 0.99	Between 1 and 1.99	2	Between 2.01 and 2.99	Between 3 and 4
Definition of intervals	Well below average	Below average	Average	Above average	Well above average

Note: SD = Standard Deviation.

1.4 Data limitations

Obtaining consistent and substantial data to effectuate the comparative analysis proved challenging due to the lack of substantial and consistent sources of data for IUWM at the city level. The data used in this comparative study of 31 cities reflects some general inconsistencies in definitions, measurements, and data collection methodologies. The inherent complexities of the sector, the difficulties in measuring institutional arrangements, and the validation of the data found, added limitations to the data set. The calculation of the mean values and standard deviation required the homogenization of the values for each indicator which presented some problems due to the fact that values from different sources and different methodologies as well as from different years had to be treated equally in order to calculate the values for the mean and standard deviation. The reliability of data and sources also affects the

quality of the data used in this study and the different types of analyses that can be derived from the data. Following is a list of several of the main limitations affecting the data set:

- The different methodologies used by the different data sources add uncertainty to the data set.
- Different metrics and different definitions used by the sources add precision problems, which make the homogenization and integration of the indicators difficult,
- The use of different sources for the same indicator and different years adds inconsistencies and complications when homogenizing and normalizing the data to compare the different indicators.
- In some instances, the data was self-reported, which limited its validity.

2. Results

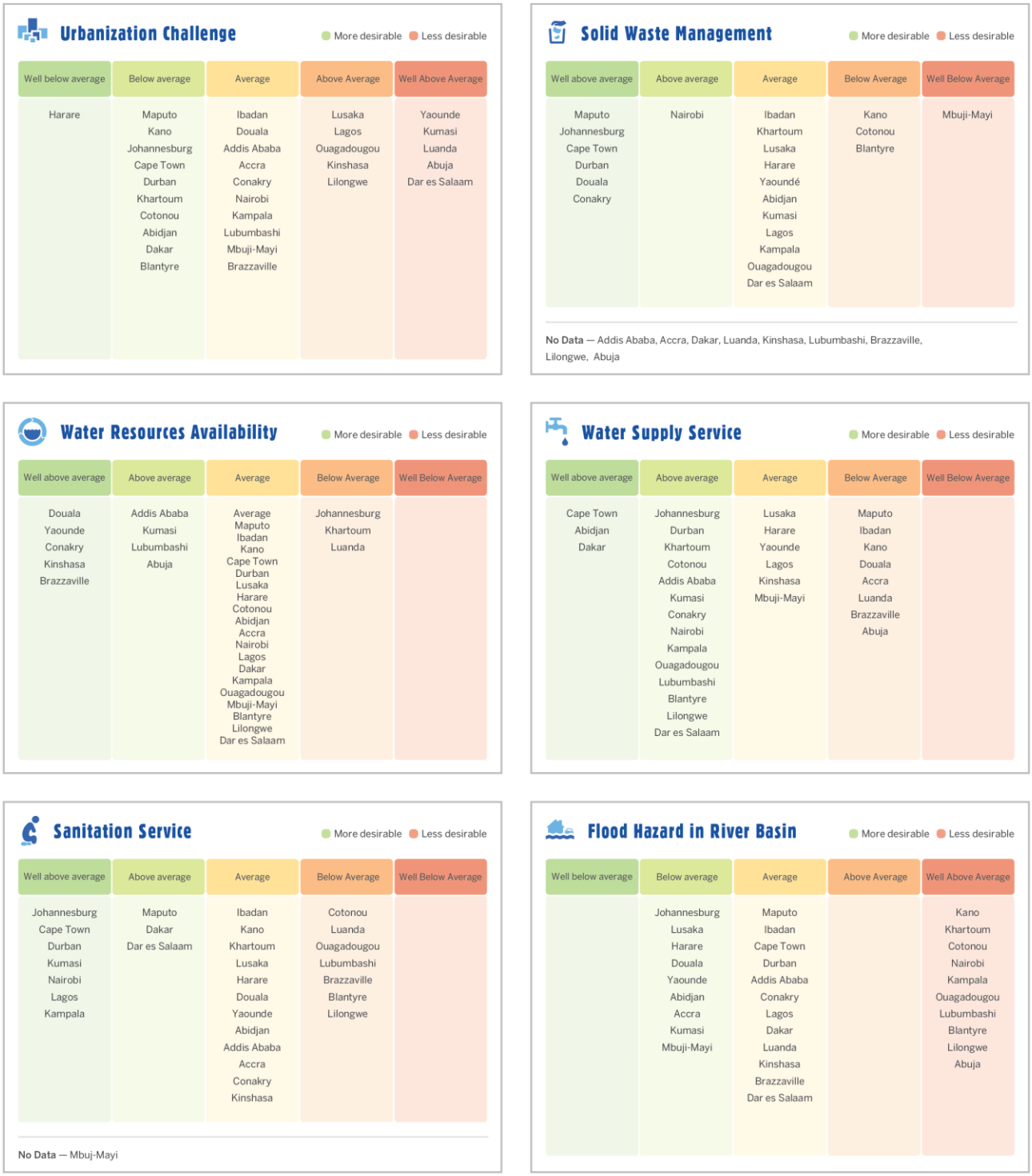
The results of the comparative study of IUWM for 31 cities in Africa are represented following 6 different variables. Each one of the variables illustrates one dimension associated with IUWM as defined by Jacobsen et al. (2012). The comparative study presents the different dimensions of IUWM by establishing different levels of desirability for the results for each variable. These results are based on the relative position above or below the average for each one of the values for the indicators selected for the 31 cities (see Annex 1).

According to Table 4. Categorization of variables according to level of desirabilityin the case of the variables “Urbanization challenge” and “Flood hazard in river basin”, the values for the 31 cities scoring below average will be more desirable. For the rest of the variables, values for the indicators above the average will be more desirable. A color gradation has been used to help clarify the degree of desirability for each variable (Green = more desirable; Red = less desirable). Figure 1 shows the overall position of the 31 cities of the study according to each one of the 6 variables studied. The columns in the tables contain the overall position above or below the average for each one of the variables.

Table 4. Categorization of variables according to level of desirability

Variable	More desirable	Less desirable
Urbanization challenge	Below average	Above average
Solid waste management	Above average	Below average
Water resources availability	Above average	Below average
Water supply service	Above average	Below average
Sanitation service	Above average	Below average
Flood hazard in river basin	Below average	Above average

Figure 1. Comparative analysis of IUWM for 31 cities in Africa.



4.1 Urbanization challenge

Urbanization growth of African cities presents a challenge for increasingly dense urban areas will require new planning tools to cope with the future demand of urban services and infrastructure. The results of the study on 31 cities in Africa show the variability and disparity of urban growth trends across the region. Overall however, they also corroborate the message that urbanization in Sub-Saharan Africa is happening, and fast: of the 31 cities, 20 are growing at an annual rate of more than 3 percent. Of these 20 cities, Yaoundé, Kumasi, Luanda and Abuja are way ahead with annual growth rates of more than 5 percent. The effects of this rapid urbanization will heighten the challenges associated with the provision of urban services experienced by local governments and other public and private stakeholders.

The results of the comparative analysis of the urbanization challenge for the 31 cities also compare the level of informal settlements in each of the cities. The need for improved access to urban services will also be challenged by large concentrations of populations living in informal areas and the lack of urban planning in these settlements. In this sample of 31 cities, 7 of them have more than 70 percent of their population living in informal areas while the average for all 31 is 54.8 percent. Cities well above average like Yaoundé or Luanda have respectively 75 and 80 percent of their population living in informal settlements while Cotonou and Abidjan have the lowest percentage of population living in informal areas (20 and 14 percent respectively).

4.2 Solid waste management

African cities in the study present varying levels of solid waste collection. The average solid waste collection rate for the 31 cities of this study is 51.7 percent, with 11 cities in the average category. Cities in Southern Africa are performing well relatively to the rest, showing rates higher than 70 percent (with Cape Town with 100 percent collection rate as the highest). The lowest collection rate is for two cities in Nigeria: Mbuji-Mayi (for which there is no formal collection system) and Kano, with 20 percent collection rate. For solid waste formally disposed of, the average for the 31 cities is 55 percent. However, waste collection and disposal figures vary widely across the sample of 31 cities from over 90 percent in the three South African cities of the study to 8 percent in Cotonou or 26 percent in Lusaka.

4.3 Water resources availability

The comparative study of 31 cities includes a series of indicators which portray the level of access to water resources within the river basin providing information about the hydrologic conditions in each of the cities' basins. The results of this comparative study for the variable on water resource availability within the basin show that the distribution of cities is concentrated around the average values for each of the 5 indicators used for this variable (20 of 31 cities). 5 cities are well below average in terms of water resources availability within their basin and no cities are well below average.

Baseline data used for the comparative study highlights that the average basin yield basins within which the 31 cities are located is 188 million cubic meters per year, which gives an indication of the amount of water reliably available in those basin in an average year. Based on this indicator, 12 cities are located in

basins that have an annual basin yield over the average, with the highest value being Douala (1010 million cubic meters per average year) and the lowest being Khartoum with 2.61 million cubic meters. This shows the clear limitation of this indicator. Khartoum ranks low, because the basin itself has a low yield although the Nile river runs across Khartoum, the basin yield value measures the availability of water generated within the basin, and does not reflect what might be available as a result of rivers flowing through the basin. Utmost care must be used in interpreting this indicator.

4.4 Water supply service

Results for the comparative analysis in water supply service highlight the variability in levels of water supply across the sample. Additionally, the need for basic water supply coverage for growing populations meets the reality of old and non-functioning infrastructures in many cities in Sub-Saharan Africa. The average individual residential water consumption for the 31 cities of the study is 65.7 liters per capita per day but for 13 of the 31 cities the daily residential water consumption is lower than 50 liters. As cities grow, future infrastructure projects will have to accommodate expected new water demands and the extension of service coverage. The average access to improved drinking water for the population of the 31 cities is 65.6 percent but 13 of the 31 cities in the sample are below the average, with the lowest coverage in Ibadan, Nigeria with 22 percent of the population with access to improved drinking water.

Levels of utility service and coverage also vary for the 31 cities. The average collection rate from the population billed by the water utility in the 31 cities is 42.2 percent. Of the 31 cities, 19 have a collection rate above the average and 12 are underperforming in comparison to the total sample. The lowest collection rate levels are to be found in Ibadan, Nigeria (13 percent), Abuja also in Nigeria (20 percent) and Luanda in Angola (23 percent). The level of revenue water, which is the percentage of water produced that reaches the costumer, is on average 57.8 percent, with the highest levels for Khartoum (95 percent) and Dakar (80.5 percent) and the lowest for Abuja (20.11 percent) and Kano (40 percent).

4.5 Sanitation service

In this study, sanitation services are depicted by the indicators of access to improved sanitation and percentage of wastewater treated. According to the comparative study, improvements in access to sanitation and wastewater treatment are needed in all of the 31 cities of the study. Access to improved sanitation averages 53.6 percent in the 31 cities but for 12 cities the levels of access to improved sanitation are lower. The cities of Brazzaville, Dar es Salaam and Lilongwe have the lowest access to improved sanitation, well below the average (10.5, 12.6 and 14 percent respectively). Moreover, levels of 41.7 percent and less of wastewater collected and treated by infrastructure for a sample of 8 cities amongst 13 (for the rest of the 31 cities data is missing) also illustrate the general environmental challenge caused by the pollution of water bodies and water supply sources around urban areas.

4.6 Flood hazard in river basin

In this study, the level of flood hazard in the river basin for each city is represented by the expected average number of flood events per 100 years. The calculation is based on a hydrological model of peak-flow magnitude for annual runoff exceeded by 10 percent for years 1961–1999 (Annual high flow q10, see Annex 1) and on observed flood events from 1999 to 2007 from the Dartmouth flood observatory (Jacobsen et al. 2012). Based on that frequency of flood events, 12 of the 31 cities have an average level of frequency of floods of 9.9 events over 100 years. The results of the comparative study also show that 10 cities are well above the average in terms of expected frequency of flood events, with cities like Kano or Khartoum with the highest level of expected exposure to flood events (with 25 and 21 expected flood events respectively over a period of 100 years). Of the 31 cities in the study, 9 cities have levels of expected flood events below the average, with cities like Johannesburg, Lusaka or Harare with 2 expected flood events and Cape Town, Lagos and Luanda with 7 expected flood events over 100 years.

3. Conclusions

The results of the comparative analysis of the different variables related with urban water management show varying levels of development for each of the 31 cities. Based on this comparative analysis and although general trends are difficult to establish and regional tendencies have to be taken into account, there is large room for improvement for all cities and for most of the indicators.

The results of the comparative analysis of 31 cities in Africa also show that there is no clear “winner”. Although some cities, mainly in southern Africa, perform better on average than some of the other cities, they also have challenges of their own that cannot be overestimated. The need to plan the city of the future while acknowledging and accounting for the urban challenges of today demonstrates that an effort is needed to understand the necessities and also capacities faced by urban areas in terms of increasing risks linked to population growth or climate change that will affect access and delivery of services, sustainable development of resources.

The development of this type of comparative study can be useful, provided that there is general and available data to be used. The preliminary work carried out for this report highlighted problems with data collection that need to be addressed if a wider and more detailed comparative exercise is to be undertaken. An emphasis on good quality city-level data needs to be pursued. Most often, data about urban water management generated at the local level is incomplete or inconsistent which presents problems for any type of comparative analysis. Sound management and planning decisions are based on rigorous information. The gaps and limitations of the data used in the study of 31 cities and the lack of consistent monitoring tools represent a serious hindrance to the understanding of current and future needs for basic urban services in Sub-Saharan Africa.

Additionally, the analysis and comparison of the institutional aspects of urban water management proved difficult based on the lack of specific and up-to-date information about local policies and institutions. The task at hand should be to gather information in order to compare at a local level the

effects of policies and institutions on the provision of urban services and the management of integrated urban water systems.

6. References

Bahri, A. (2012) *Integrated Urban Water Management*, TEC Background Papers, No.16, Global Water Partnership.

Jacobsen, M. et al. (2012) *The future of water in African Cities: why waste water?* , Water Paper, The World Bank.

The Economist Intelligence Unit (2011) *African Green City Index: Assessing the environmental performance of Africa's Major Cities*, Siemens: Germany.

Annex 1

Table 1. Selection of variables and indicators for the comparative analysis of 31 cities in Africa.

Variables	Indicator	Type	Units	Weight	Notes and sources
Urbanization challenge	City growth rate, 1995-2010	Quantitative	%	50%	UNDESA, 2012
	Percentage of city population living in informal areas	Quantitative	%	50%	Various sources
Solid waste management	Percentage of solid waste produced collected (public and private collection)	Quantitative	%	50%	Various sources
	Percentage of solid waste disposed of in controlled sites	Quantitative	%	50%	Various sources
Water resources availability	Average annual runoff	Quantitative	Million cubic meters (MCM)/year	20%	World Bank Data, Climate Change Knowledge Portal. For detailed methodology see Strzepek, et al., 2011. Average modeled runoff at basin scale for years 1961–1999.
	Annual high flow (q10)	Quantitative	MCM/year	20%	Annual runoff exceeded by 10 percent of the time for years 1961–1999. Source: World Bank Data, Climate Change Knowledge Portal. For detailed methodology see Strzepek et al., 2011.
	Annual low flow (q90)	Quantitative	MCM/year	20%	Annual runoff exceeded 90 percent of the time for years 1961–1999. Source: World Bank Data, Climate Change Knowledge Portal. For detailed methodology see Strzepek et al., 2011.
	Groundwater baseflow	Quantitative	MCM/year	20%	Sustained flow in a river resulting from groundwater. Source: World Bank Data, Climate Change Knowledge Portal. For detailed methodology see Strzepek et al., 2011.
	Basin yield	Quantitative	MCM/year	20%	World Bank Data, Climate Change Knowledge Portal. For detailed methodology see Strzepek et al., 2011. Maximum sustainable reservoir releases within the basin for years 1961–1999

Variables	Indicator	Type	Units	Weight	Notes and sources
Water supply service	Percentage of city population with improved water coverage	Quantitative	%	25%	Improved water coverage as per source's definition. Various sources
	Residential water consumption in city or utility coverage area	Quantitative	l/cap/day	25%	Total residential water consumption, in liters per capita per day. Relates to population served by utility or population living in city, depending on the source. Various sources
	Percentage of collection rate from population billed	Quantitative	%	25%	Various sources
	Percentage of revenue water	Quantitative	%	25%	Percentage of water produced that reaches the costumer. Calculated based on the percentage of nonrevenue water, which is the percentage of water produced and lost before reaching the customer, either through leaks, theft, or legal use for which no payment is made. Various sources.
Sanitation service	Percentage of population with access to improved sanitation	Quantitative	%	50%	Various sources
	Percentage of wastewater treated	Quantitative	%	50%	Percentage of wastewater treated by treatment plant system of percentage of wastewater collected. Various sources
Flood hazard in river basin	Frequency of flood events	Quantitative	Number of events/100 years	100%	Estimate of flood frequency as the expected average number of events per 100 years (hydrological model of peak-flow magnitude). Sources: UNEP/GRID-Europe PREVIEW flood data set, Strzepek et al., 2011; Dartmouth Flood Observatory, Dartmouth College.

Annex 2

This annex shows the individual tables for each of the 6 variables of the comparative study.

Table 1. Urbanization challenge.

More desirable → Less desirable

Well below average	*Below average*	*Average*	*Above average*	*Well above average*
Harare	Maputo Kano Johannesburg Cape Town Durban Khartoum Cotonou Abidjan Dakar Blantyre	Ibadan Douala Addis Ababa Accra Conakry Nairobi Kampala Lubumbashi Mbuji-Mayi Brazzaville	Lusaka Lagos Ouagadougou Kinshasa Lilongwe	Yaounde Kumasi Luanda Abuja Dar es Salaam

Table 2. Solid waste management.

More desirable → Less desirable

Well above average	*Above average*	*Average*	*Below average*	*Well below average*
Maputo Johannesburg Cape Town Durban Douala Conakry	Nairobi	Ibadan Khartoum Lusaka Harare Yaoundé Abidjan Kumasi Lagos Kampala Ouagadougou Dar es Salaam	Kano Cotonou Blantyre	Mbuji-Mayi

No data
Addis Ababa, Accra, Dakar, Luanda, Kinshasa, Lubumbashi, Brazzaville, Lilongwe, Abuja

Table 3. Water resources availability.

More desirable → Less desirable

Well above average	*Above average*	*Average*	*Below average*	*Well below average*
Douala	Addis Ababa	Maputo	Johannesburg	
Yaounde	Kumasi	Ibadan	Khartoum	
Conakry	Lubumbashi	Kano	Luanda	
Kinshasa	Abuja	Cape Town		
Brazzaville		Durban		
		Lusaka		
		Harare		
		Cotonou		
		Abidjan		
		Accra		
		Nairobi		
		Lagos		
		Dakar		
		Kampala		
		Ouagadougou		
		Mbuji-Mayi		
		Blantyre		
		Lilongwe		
		Dar es Salaam		

Table 4. Water supply service.

More desirable → Less desirable

Well above average	*Above average*	*Average*	*Below average*	*Well below average*
Cape Town	Johannesburg	Lusaka	Maputo	
Abidjan	Durban	Harare	Ibadan	
Dakar	Khartoum	Yaounde	Kano	
	Cotonou	Lagos	Douala	
	Addis Ababa	Kinshasa	Accra	
	Kumasi	Mbuji-Mayi	Luanda	
	Conakry		Brazzaville	
	Nairobi		Abuja	
	Kampala			
	Ouagadougou			
	Lubumbashi			

	Blantyre Lilongwe Dar es Salaam			

Table 5. Sanitation service.

More desirable				Less desirable
Well above average	***Above average***	***Average***	***Below average***	***Well below average***
Johannesburg Cape Town Durban Kumasi Nairobi Lagos Kampala	Maputo Dakar Dar es Salaam	Ibadan Kano Khartoum Lusaka Harare Douala Yaounde Abidjan Addis Ababa Accra Conakry Kinshasa	Cotonou Luanda Ouagadougou Lubumbashi Brazzaville Blantyre Lilongwe	
No data Mbuji-Mayi				

Table 6. Flood hazard in river basin.

More desirable				Less desirable
Well below average	***Below average***	***Average***	***Above average***	***Well above average***
	Johannesburg Lusaka Harare Douala Yaounde Abidjan Accra Kumasi Mbuji-Mayi	Maputo Ibadan Cape Town Durban Addis Ababa Conakry Lagos Dakar Luanda Kinshasa Brazzaville Dar es Salaam		Kano Khartoum Cotonou Nairobi Kampala Ouagadougou Lubumbashi Blantyre Lilongwe Abuja

Annex 3

This annex shows individual tables for each of the 31 cities.

Table 1. Luanda.

Urbanization Challenge					Well above average
Solid waste management system					
Water resources availability				Below average	
Water supply service				Below average	
Sanitation service				Below average	
Flood hazard in river basin			Average		

Table 2. Cotonou.

Urbanization Challenge		Below average			
Solid waste management system				Below average	
Water resources availability			Average		
Water supply service		Above average			
Sanitation service				Below average	
Flood hazard in river basin					Well above average

Table 3. Ouagadougou.

Urbanization Challenge				Above average	
Solid waste management system			Average		
Water resources availability			Average		
Water supply service		Above average			
Sanitation service				Below average	
Flood hazard in river basin					Well above average

Table 4. Douala.

Urbanization Challenge			Average		
Solid waste management system	Well above average				
Water resources availability	Well above average				
Water supply service				Below average	
Sanitation service			Average		
Flood hazard in river basin		Below average			

Table 5. Yaoundé

Urbanization Challenge					Well above average
Solid waste management system			Average		
Water resources availability	Well above average				
Water supply service			Average		
Sanitation service			Average		
Flood hazard in river basin		Below average			

Table 6. Brazzaville.

Urbanization Challenge			Average		
Solid waste management system					
Water resources availability	Well above average				
Water supply service				Below average	
Sanitation service				Below average	
Flood hazard in river basin			Average		

Table 7. Kinshasa.

Urbanization Challenge				Above average	
Solid waste management system					
Water resources availability	Well above average				
Water supply service			Average		
Sanitation service			Average		
Flood hazard in river basin			Average		

Table 8. Lubumbashi.

Urbanization Challenge			Average		
Solid waste management system					
Water resources availability		Above average			
Water supply service		Above average			
Sanitation service				Below average	
Flood hazard in river basin					Well above average

Table 9. Mbuji-Mayi.

Urbanization Challenge			Average		
Solid waste management system					Well below average
Water resources availability			Average		
Water supply service			Average		
Sanitation service					
Flood hazard in river basin		Below average			

Table 10. Abidjan.

Urbanization Challenge		Below average			
Solid waste management system			Average		
Water resources availability			Average		
Water supply service	Well above average				
Sanitation service			Average		
Flood hazard in river basin		Below average			

Table 11. Addis Ababa.

Urbanization Challenge			Average		
Solid waste management system					
Water resources availability		Above average			
Water supply service		Above average			
Sanitation service			Average		
Flood hazard in river basin			Average		

Table 12. Accra.

Urbanization Challenge			Average		
Solid waste management system					
Water resources availability			Average		
Water supply service				Below average	
Sanitation service			Average		
Flood hazard in river basin		Below average			

Table 13. Kumasi.

Urbanization Challenge					Well above average
Solid waste management system			Average		
Water resources availability		Above average			
Water supply service		Above average			
Sanitation service	Well above average				
Flood hazard in river basin		Below average			

Table 14. Conakry.

Urbanization Challenge			Average		
Solid waste management system			Average		
Water resources availability		Above average			
Water supply service		Above average			
Sanitation service			Average		
Flood hazard in river basin			Average		

Table 15. Nairobi.

Urbanization Challenge			Average		
Solid waste management system		Above average			
Water resources availability			Average		
Water supply service		Above average			
Sanitation service	Well above average				
Flood hazard in river basin					Well above average

Table 16. Blantyre.

Urbanization Challenge		Below average			
Solid waste management system				Below average	
Water resources availability			Average		
Water supply service		Above average			
Sanitation service				Below average	
Flood hazard in river basin					Wel above average

Table 17. Lilongwe.

Urbanization Challenge				Above average	
Solid waste management system					
Water resources availability			Average		
Water supply service		Above average			
Sanitation service				Below average	
Flood hazard in river basin					Well above average

Table 18. Maputo

Urbanization Challenge		Below average			
Solid waste management system		Above average			
Water resources availability			Average		
Water supply service				Below average	
Sanitation service		Above average			
Flood hazard in river basin			Average		

Table 19. Abuja.

Urbanization Challenge					Well above average
Solid waste management system					
Water resources availability		Above average			
Water supply service				Below average	
Sanitation service			Average		
Flood hazard in river basin					Well above average

Table 20. Ibadan

Urbanization Challenge			Average		
Solid waste management system			Average		
Water resources availability			Average		
Water supply service				Below average	
Sanitation service			Average		
Flood hazard in river basin			Average		

Table 21. Kano.

Urbanization Challenge		Below average			
Solid waste management system				Below average	
Water resources availability			Average		
Water supply service				Below average	
Sanitation service			Average		
Flood hazard in river basin				Above average	

Table 22. Lagos.

Urbanization Challenge				Above average	
Solid waste management system			Average		
Water resources availability			Average		
Water supply service			Average		
Sanitation service	Well above average				
Flood hazard in river basin			Average		

Table 23. Dakar.

Urbanization Challenge		Below average			
Solid waste management system					
Water resources availability			Average		
Water supply service	Well above average				
Sanitation service		Above average			
Flood hazard in river basin			Average		

Table 24. Cape Town.

Urbanization Challenge		Below average			
Solid waste management system	Well above average				
Water resources availability			Average		
Water supply service	Well above average				
Sanitation service	Well above average				
Flood hazard in river basin			Average		

Table 25. Durban.

Urbanization Challenge		Below average			
Solid waste management system	Well above average				
Water resources availability			Average		
Water supply service		Above average			
Sanitation service	Well above average				
Flood hazard in river basin			Average		

Table 26. Johannesburg.

Urbanization Challenge		Below average			
Solid waste management system	Well above average				
Water resources availability				Below average	
Water supply service		Above average			
Sanitation service	Well above average				
Flood hazard in river basin		Below average			

Table 27. Khartoum.

Urbanization Challenge		Below average			
Solid waste management system			Average		
Water resources availability				Below average	
Water supply service		Above average			
Sanitation service			Average		
Flood hazard in river basin					Well above average

Table 28. Dar es Salaam.

Urbanization Challenge					Well above average
Solid waste management system			Average		
Water resources availability			Average		
Water supply service		Above average			
Sanitation service		Above average			
Flood hazard in river basin			Average		

Table 29. Kampala.

Urbanization Challenge			Average		
Solid waste management system			Average		
Water resources availability			Average		
Water supply service		Above average			
Sanitation service	Well above average				
Flood hazard in river basin					Well above average

Table 30. Lusaka.

Urbanization Challenge				Above average	
Solid waste management system			Average		
Water resources availability			Average		
Water supply service			Average		
Sanitation service			Average		
Flood hazard in river basin		Below average			

Table 31. Harare.

Urbanization Challenge	Well below average				
Solid waste management system			Average		
Water resources availability			Average		
Water supply service			Average		
Sanitation service			Average		
Flood hazard in river basin		Below average			