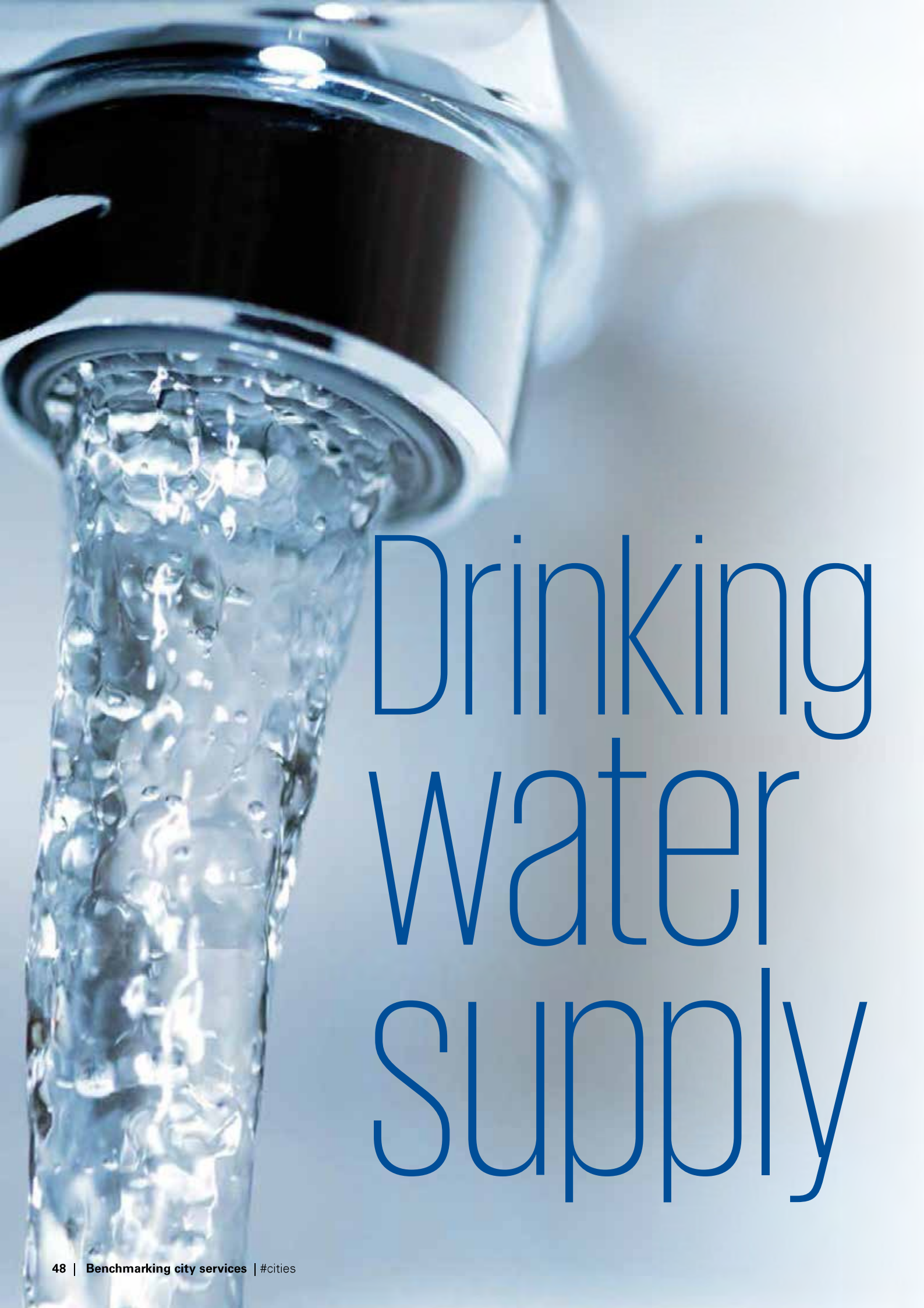


Drinking water supply

Access to safe drinking water may be a recognized human right, but that doesn't make it easy or cost efficient to deliver. It is a capital intensive sector with many parts of the world finding it costly to get water from the source to end users. At the same time, quality standards and expectations are rising. Urbanization and development are creating new demand. And, all the while, assets are aging. The need for efficiency has never been stronger.

Defining the service

Drinking water supply services encompass the design, construction, maintenance, repair and operation of water treatment and water distribution systems, regardless of the source — lake, river, well or salt water. This may also include customer billing, internal support services and management costs.

Topline findings

- A cubic meter of water costs the average city US$1.14 to treat and deliver.
- Cities report spending anywhere from US$0.08 to US$5.97 per cubic meter of water.
- The average city loses between 10 to 13 percent of water to leakage and other non-revenue sources.

Efficiency

Operating and capital cost per cubic meter of water supplied. This measure combines the total drinking water supply operating costs with the total capital costs and divides the sum by the number of reported cubic meters of water supplied.

Points to consider

Most cities spend the bulk of their operating budgets on the energy required for transmission and distribution, which is directly influenced by the size, density and topography of the service area.

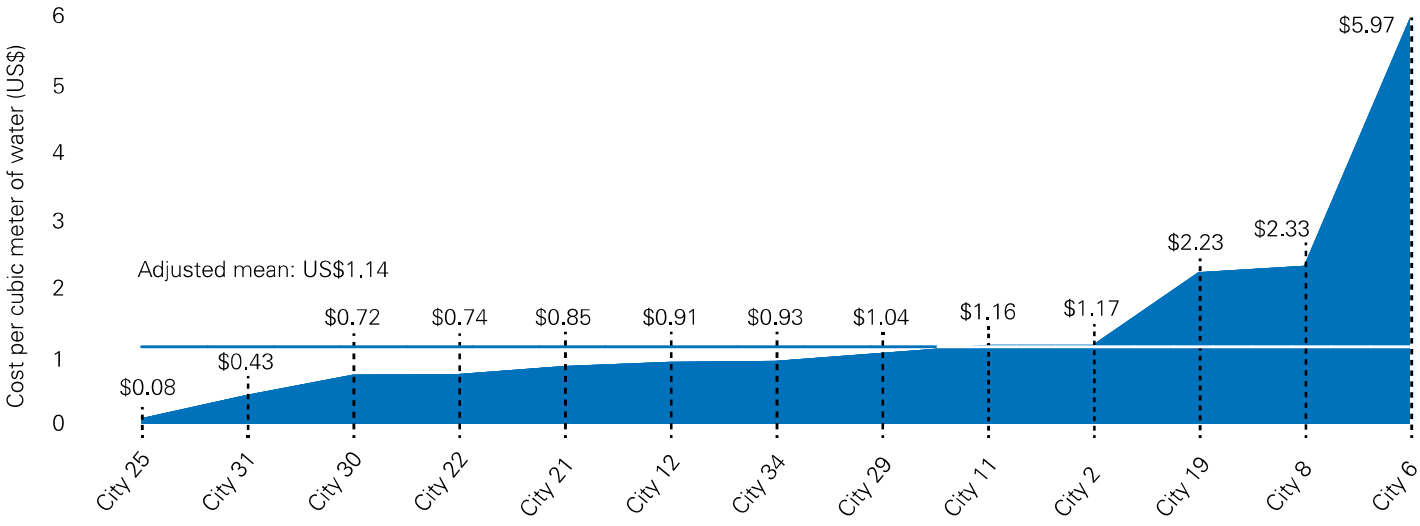
With a range of US$0.08–$5.97 per cubic meter to supply water, such a range begs further clarification. When we review this range with the adjusted mean of US$1.14 we might speculate that the high cost could have been influenced by a city that spent a considerable amount upgrading their water treatment plant or their distribution infrastructure. On the low side, it is difficult to imagine a city that only spends $0.08 per cubic meter, particularly when this includes operating and capital expenditures.

One of the factors that clearly contributes to the cost of water supply is the source of water. There are various sources that cities use including lake based, river based, ocean/sea based and well/aquifer based supply. Each of these different sources requires different treatment techniques where ocean/sea based water supply requires desalination plants that are extremely expensive to operate. Clearly subsequent studies should consider the source of water supply as an important consideration in cost.

An additional factor that can influence cost might include the terrain of a city. A city with an undulating landscape will have to pump water over the hills to its customers. Given that energy costs are the single most expensive ingredient to water supply, then a city that has to pump water over its uphill terrain will experience higher costs.

Drinking water meets one of our basic physiological needs. Fortunately today the cost and price of drinking water are still reasonable but the future demand for water may change this equation — something that cities need to watch closely.

Figure 15: Operating and capital cost per cubic meter of water supplied (US$)



Adjusted mean = Average of indicators excluding lowest and highest values

Effectiveness

Water leakage as a percent of water supplied. This measure calculates the difference between the amount of drinking water treated and the amount supplied to identify how much water is being lost during transmission.

Points to consider

One of the more profound discoveries occurred when we collected the percent of water loss through leakage. While the majority of cities lose less that 15 percent of their water, one city loses 65 percent of its water through either a combination of leakage or theft. Not too far behind this city is another city that loses 45 percent. Finally one northern city loses 38 percent. Clearly the focus of these three cities must be how to stop the leakage/theft.

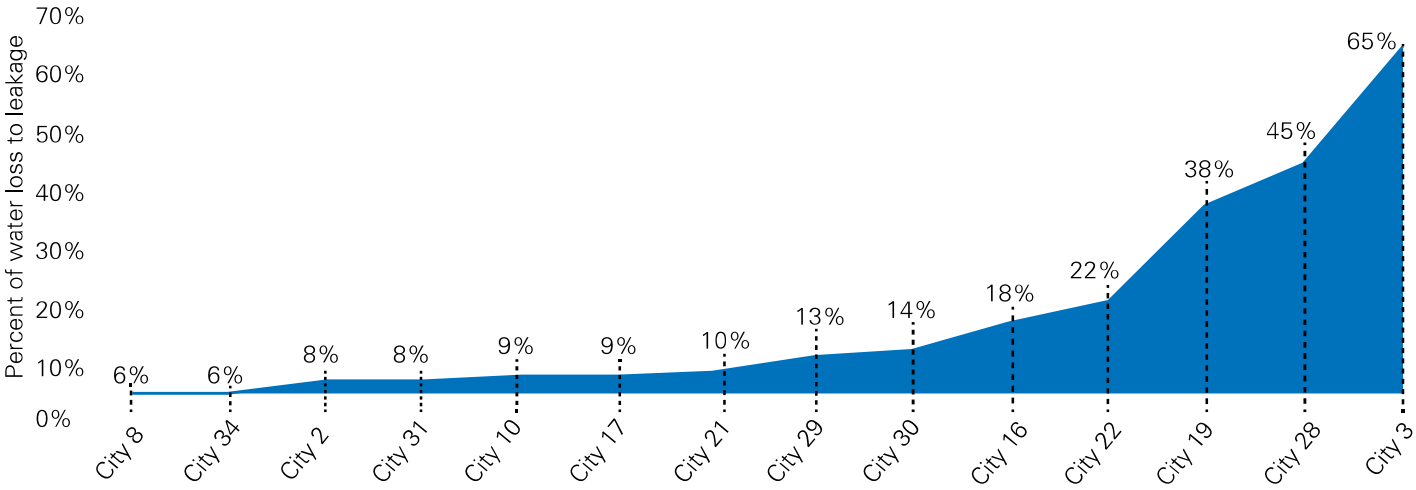
Reasons for water loss may vary from a simple explanation of not enough investment in aging infrastructure to severe weather causing water main breaks, to the struggling poor population who can't afford to purchase water. In discussions with one Indian city (not a participant in this study) they identified "non-revenue water

loss" as a key focus for their attention. As water becomes more and more scarce, water theft will increase. Not providing affordable water supply is definitely not an option.

Tariff prices also influence consumption and behavior (for instance, it is easier to waste water when it is more abundant at low cost).

Sitting back and examining cities with high water loss is easy. For cities facing this challenge, how do they get funding for a service that is invisible because its buried in the ground? This is true for a number of infrastructure services. How do we convince elected officials to make the investment when councilors are more inclined to pay attention to ratepayer complaints than systemic issues in basic services?

Figure 16: Water leakage as a percent of water supplied



Persistent problems

- Managing peak demand
- Maintaining aging pipes and infrastructure
- Meeting treatment standards and environmental regulation
- Reducing leakage and water loss
- Ensuring universal access

Common cost factors

- Source location, type and quality (river, lake or ocean)
- Energy for transmission and distribution
- Maintenance and repairs of underground assets
- Capital investment and renewal requirements
- Topography and rainfall trends

Innovative ideas

- In **Kazan**, authorities have undertaken a major plant reconstruction and implemented new electrolytic sodium hypochlorite production facilities, thereby enabling elimination of liquid chlorine improving overall organoleptic characteristics.
- **Philadelphia's** Water Department has just started a new project to fully replace customer-owned lead service lines that still exist between the main and the property's water meter.
- New automated and connected water meters are being rolled out in cities around the world, including in **Toronto** where authorities are engaged in a program to replace all outdated water meters and install new meters where flat rates had existed before.
- Following a five-year capital investment program co-financed by the EU, the City of **Warsaw** has seen significant improvements in the quality of water and the reliability of the overall system.

Transformative trends

- *Rising standards:* In many regions, regulators and authorities are tightening the base drinking water standards, testing and reporting requirements.
- *Prioritizing replacement:* More established cities are working to replace and upgrade their aging underground infrastructure and assets.
- *Seeking innovation:* Rather than tearing up city streets, many water authorities are exploring new approaches for strengthening and expanding the capability of their current assets.
- *Declining customer complaints:* As water meters become more sophisticated, many water authorities are seeing their rates of meter-related customer complaints fall.
- *Growing policy issue:* In many regions, disagreements over water rights and ownership will lead to growing political tensions and potential security challenges as populations migrate to find more reliable sources of potable water.

What else did we measure?

For our benchmarking exercise, we collected a wide variety of data on the effectiveness and efficiency of this service area. The following indicators lacked sufficient data or respondents to illustrate in this report:

- Kilometers of water distribution network
- Cost per km of water distribution network
- Number of boil water advisories
- Percent of properties served by water supply of total properties.

Combined efficiency and effectiveness analysis

Points to consider

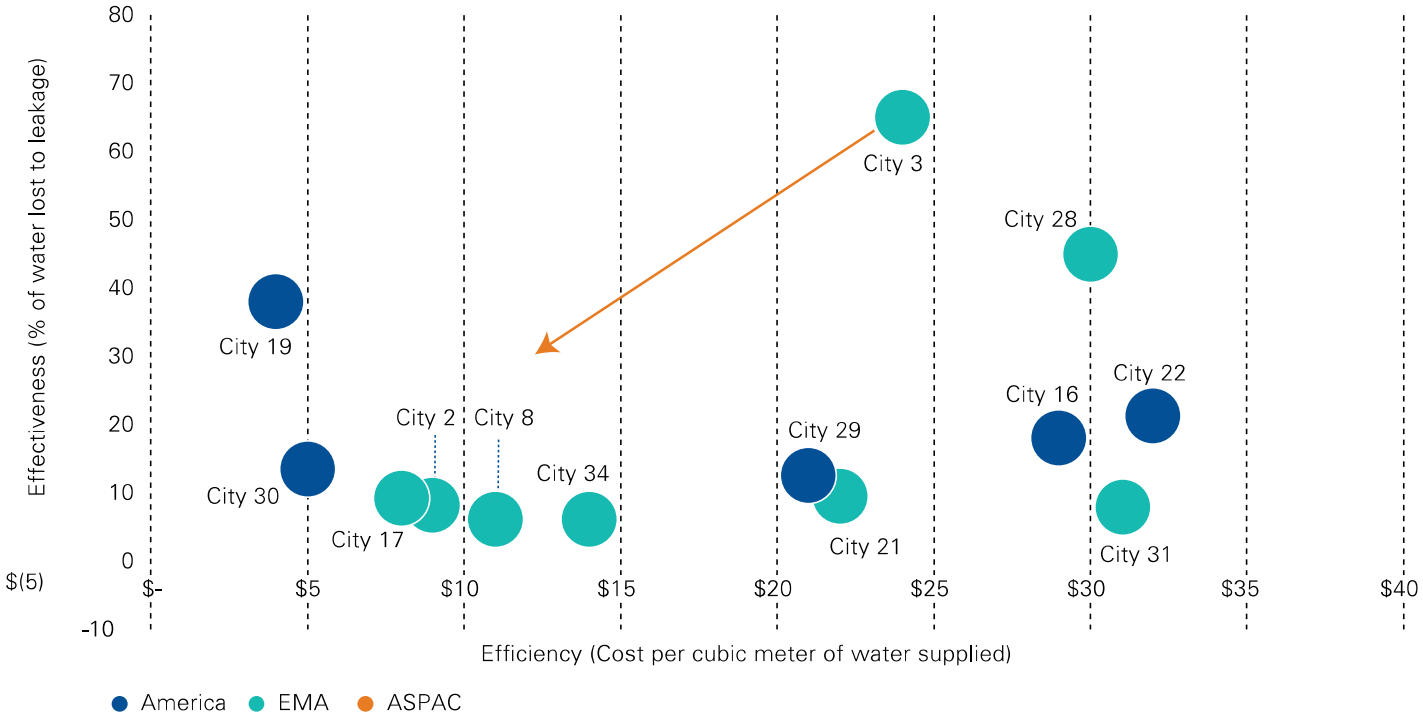
Combining efficiency and effectiveness in one graph provides an altogether new and exciting perspective to performance measures for the drinking water supply service. In this graph, the desired quadrant is the lower left quadrant where water leakage is at a minimum and so are costs. An ideal position is illustrated by Cities 30, 17, 2 and 8.

City 3 is clearly having serious problems with water leakage but not enough money is being spent to address water leakage even though it has a fairly high cost per cubic meter. We expect that its higher costs than most can be attributed to dealing with water loss and the damage this may cause. Leakage may be caused by the city growing faster than the capacity of the transmission and distribution system, by watermain breaks in an aging system and/or by water theft. Regardless of the cause, more capital expenditures are required to reduce leakage. In the longer term this may reduce the cost but not before costs will increase to overcome the water loss failures.

A cluster of cities are found in a sweet spot that can be described as relatively low leakage rates for reasonable cost per cubic meter of water supplied (approximately US$5–15 per cubic meter). They are lower than another cluster that spends US$20–30 per cubic meter, leading us to believe they may not be spending the right amount of money on sustainable lifecycle management.

No city can achieve 0 percent water leakage; it's practically impossible. Achieving next to 0 percent water leakage also comes with a price that few cities are prepared to pay.

Figure 17: Drinking water supply — combined efficiency and effectiveness



Q&A with Bastien Simeon, Global Infrastructure Sector Lead, Water, KPMG International

Bastien is a seasoned water specialist with more than 15 years of experience covering potable water production and distribution, desalination plants, wastewater collection, treatment and reuse, and irrigation. He has worked with most of the largest players in the industry — developers, operators and investors — with his main focus on public-private partnerships and merger and acquisition transactions.

Q: Were you surprised by the range of costs cities reported for drinking water?

A: Clearly, there are some outliers that suggest there may be problems in a few cities. Either their costs are severely out of line with the averages, or their measurement and reporting is faulty. Neither are a good sign. The remaining variation is simply a factor of environment: the quality of the source water, the terrain of the city, rainfall levels and so on. I think this shows that there is actually a significant amount of benefit that could be achieved through benchmarking cities in this service area.

Q: What other factors should cities be measuring in order to benchmark their drinking water services?

A: Quality is a big one. Cities with a higher standard of quality will likely spend more on treatment assets and consumables than those with lower standards. I think you also need to look at the service level that is being delivered, possibly by measuring supply shortages or outages. Data on rates of urbanization and population density can also provide very important insights when comparing cities and service levels.

Q: How has technology helped improve overall network efficiency and effectiveness?

A: By now, most large cities have implemented fairly sophisticated supervisory control and data acquisition (SCADA) solutions that have allowed them to automate many of their processes and remotely monitor their assets. And they've seen great benefits from that, particularly in the cost of labor. But I think we are rapidly moving towards a '2.0' control environment that will combine IoT, sensor technologies and algorithms to achieve a whole new level of automation and efficiency. And I suspect that newer and greenfield cities will have a real opportunity to leapfrog their more established peers when it comes to the efficiency and effectiveness of their drinking water service.

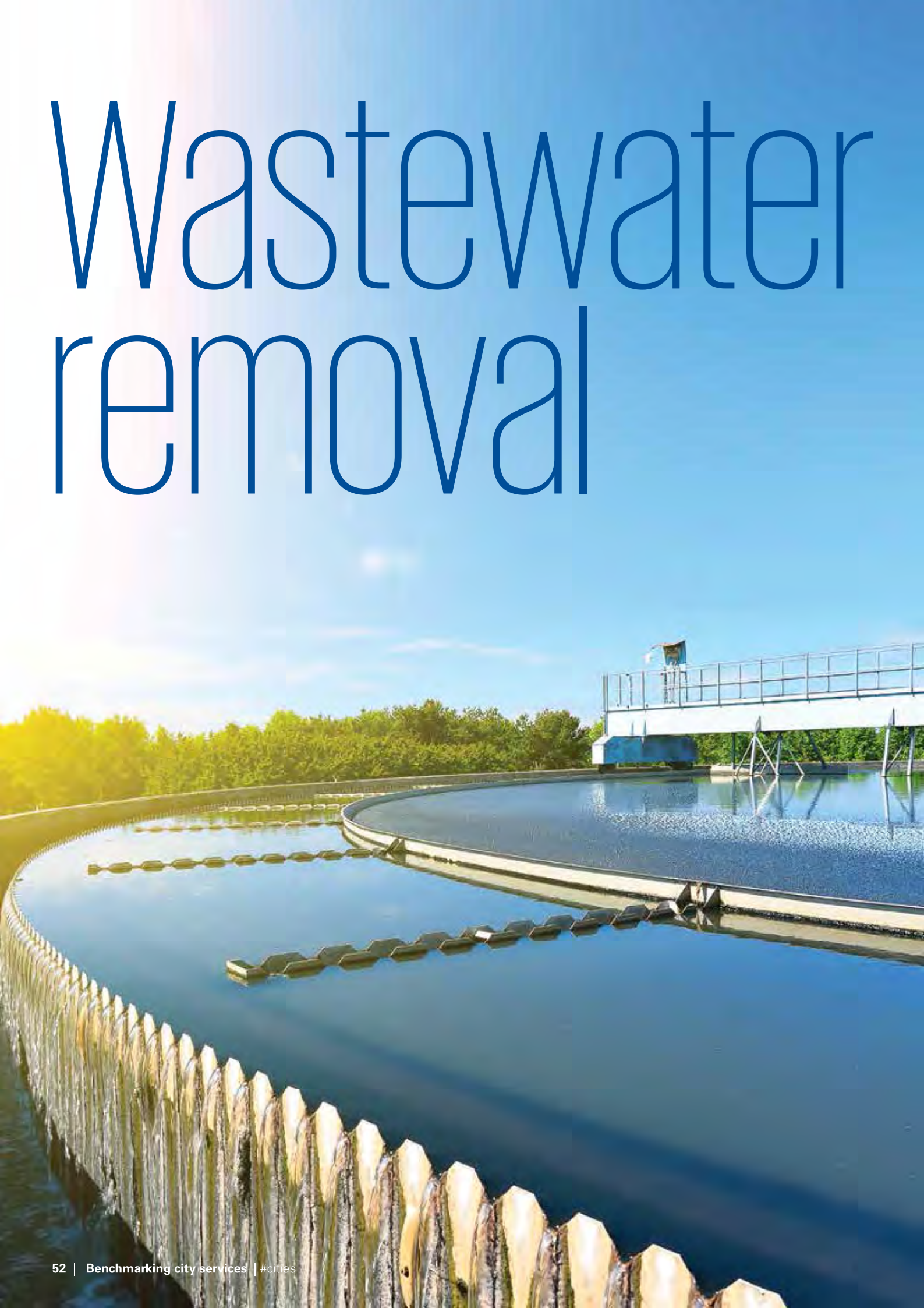
Q: Some water leakage is inevitable in a large city system, but why might some cities report significantly higher rates than others?

A: A lot of the leakage comes down to problems with the existing infrastructure and assets. In some cases, it's simply a matter of age. But in other cities, growth rates have outstripped capacity, forcing authorities to add more pressure into the system which, in turn, depletes the life of the assets and creates breaks and leakages. At the same time, there are many non-operational factors that can contribute to water loss. In some developing markets, for example, lack of access or high water rates have led to major issues with water theft.

Q: Can cities raise rates in order to improve cost recovery?

A: When it comes to drinking water, rates are a very sensitive topic. And water authorities and policy makers want to walk a fine line between creating an incentive for consumers to reduce their use and providing universal access. For many cities, however, I think the smarter move would be to focus on capturing the lost revenue that drips out of their system through leakage and theft. The data suggests most cities could see a 15 to 20 percent revenue lift just by closing leaky taps. The problem, of course, is that this requires significant capital investment and few cities have that type of flexibility in their budget today. As a result, we expect to see the need for continued subsidies and grants in this area, particularly from higher levels of government. ■

Wastewater removal



Governments spend billions of dollars on wastewater collection around the world. Yet, every year, more than 3.4 million people die as a result of water-related diseases. No wonder city leaders are particularly concerned about the efficiency and effectiveness of their wastewater collection and treatment services.

Defining the service

Wastewater removal services include the design, construction, maintenance, repair and operation of wastewater collection and treatment systems. This may include industrial, commercial and residential wastewater removal, as well as the disposal of bio-solids, backflow prevention and sewer systems.

Topline findings

- The average city spends US$1.21 and receives US$0.94 per cubic meter of wastewater collected and treated.
- Cities report spending anywhere from US$0.37 to US$2.92 per cubic meter of water.
- Only one city reported 100 percent coverage for wastewater removal services.

Efficiency

Total cost per cubic meter of wastewater collected and treated. This measure reflects the combined operating and capital costs for wastewater removal, divided by the total reported number of cubic meters of wastewater removed.

Total cost per km of wastewater network. This measure reflects the combined operating and capital cost for wastewater collection and treatment divided by the total number of km of network.

Points to consider

Total cost per cubic meter of wastewater collected and treated

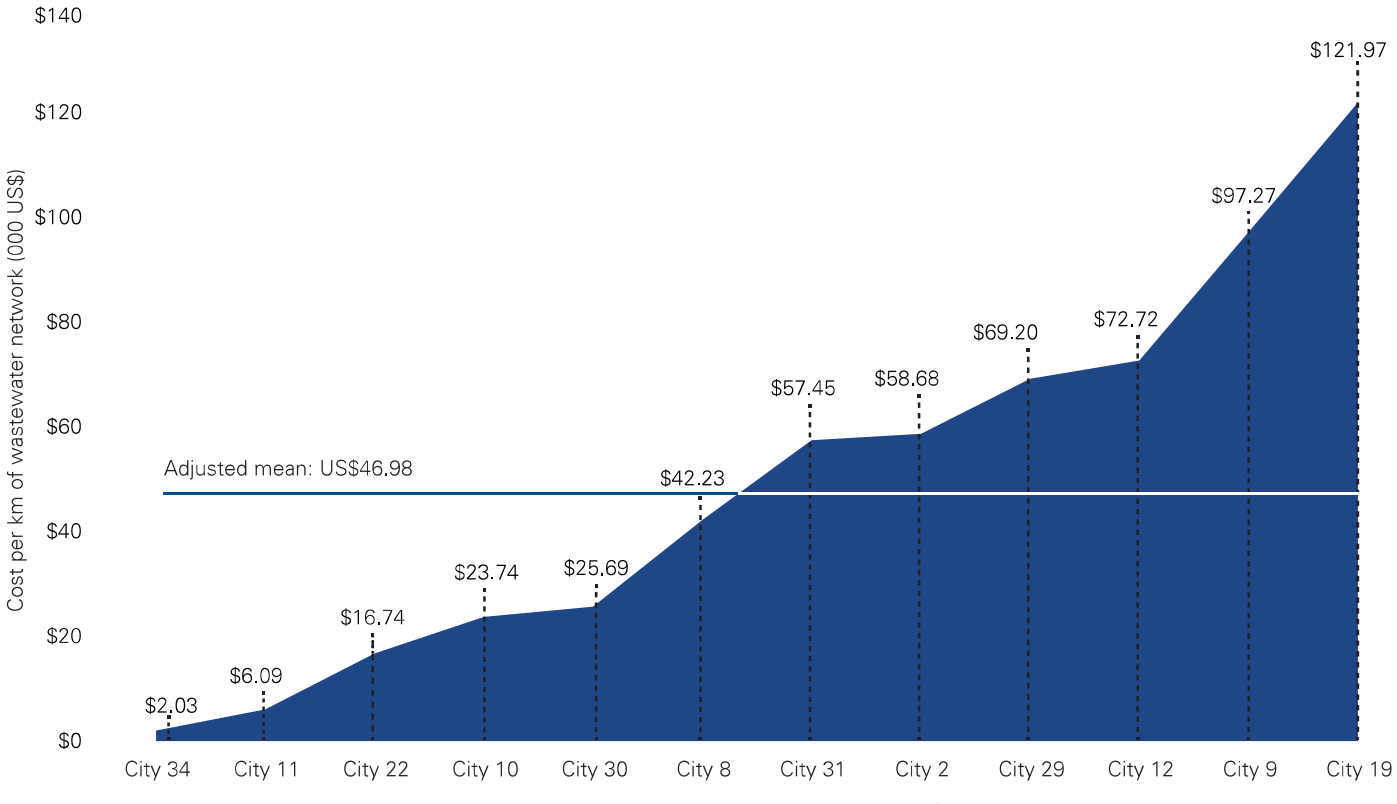
Perhaps the most consistent of all of the indicators in this study relates to the wastewater removal service where the cost per cubic meter ranges from US$0.37 to US$2.92 per cubic meter. The adjusted mean is calculated at US$1.20 per cubic meter. Cities below the mean may be spending too little on the reconstruction and replacement plans, while cities greater than the mean are taking care to make those investments but incurring higher costs.

Revenue information was also collected for this benchmarking exercise. While not provided in this graph, the adjusted mean calculation for revenue is calculated at US$0.94 per cubic meter. The difference between cost and revenue equates to US$0.26 per cubic meter. that must be picked up by general revenue sources within the city. One city in Europe actually generates more revenue than its costs and may be an excellent candidate for further study.

Additional factors that may influence cost may include:

- Higher than average energy costs in the city where the cost of pumping wastewater is a large component of a city's cost.
- Similar to drinking water supply, the terrain of a city can have a huge impact on cost, particularly if the city needs to compensate by more pumping that gravitational forces.
- Aging infrastructure may result in a higher than normal cost for repair or reactive maintenance, not to mention the capital costs to replace or reconstruct the network.
- The amount of wastewater production can also be reduced by cities that are seeking reuse of wastewater, such as the growing trend to reuse gray water for non-consumptive purposes.
- Wastewater removal can be more neglected than other underground infrastructure-based services when it comes time for capital investments, simply because it is not glamorous. Greater effort is required by wastewater service providers to convince elected officials of the risks associated with not making appropriate investments, especially investments that may span more than the term of an elected official.

Figure 18: Cost per km of wastewater network (000 US$)



Adjusted mean = Average of indicators excluding lowest and highest values

Total cost per km of wastewater network.
To demonstrate how certain services may have two important cost efficiency indicators, we also requested the cost per km of wastewater network. Although different from the customer oriented "cost per cubic meter of wastewater removed", this cost indicator focuses on the extent to which a city needs to draw wastewater from across its domain.

The adjusted mean of US$47,000 per km is useful should the department accountable for this service wish to predict future costs based on the expansion of their network, although a good portion of the cost of delivering this service would be attributed to the treatment plants and not the network. In future, separating the cost of collection from treatment would overcome this challenge and again provide a useful tool to gauge future costs.

One might ask why the cost per km ranges from US$2,000–US$122,000. Factors may include the degree to which a city is reconstructing or replacing its assets according to full lifecycle costs, or not. Clearly those cities on the low end of the range may be foregoing the costs, but this will catch up to them eventually and present additional, often more costly ramifications.

Other reasons may include:
— One time capital cost incurred in the reporting year that may have skewed the capital costs, such as a new wastewater treatment plant:
— The geographic coverage of a city where some cities are low density but span thousands of square miles and the wastewater network becomes quite extensive
— Age of infrastructure where older infrastructure may require more reactive maintenance than might normally be expected in a relatively newer network.

Effectiveness

Percent of properties served by wastewater removal service. This measure indicates how many properties are directly connected to the wastewater collection network as a percentage of total city properties.

Points to consider

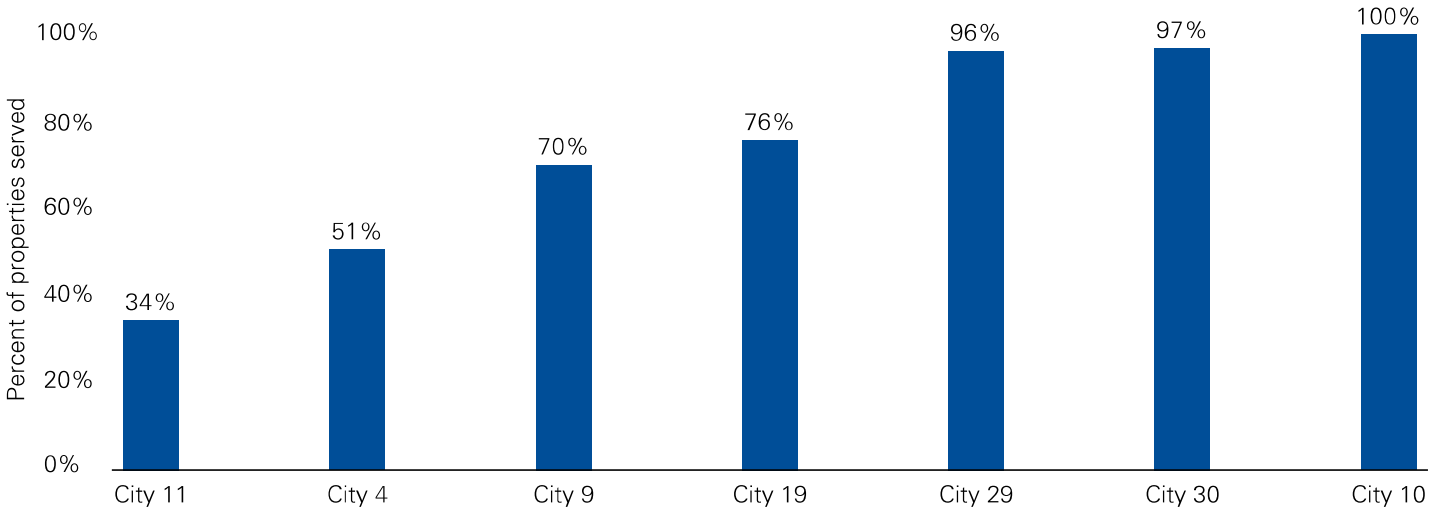
Regarding the appropriate effectiveness metric for the wastewater removal service, there are several. Information on the outflow quality of wastewater treated was not requested because there may be different standards in different countries. We agree that this quality of wastewater outflow is an important indicator of effectiveness. Other indicators we asked for included the number of wastewater main breaks, also known as sewer main breaks. We did receive some information back from cities but not a sufficient sample size to report any meaningful statistics.

One effectiveness indicator that was provided relates to the percent of properties that are covered within a city by the wastewater removal service. In some developing countries, this is a very significant indicator of how well the city is performing in hooking households up to the wastewater collection and treatment network.

While not all cities could provide the percentage of properties served, for those that did report this information, we noted that one community serves only 34 percent of its properties — perhaps due to septic systems offering an alternative to public wastewater treatment. Only one city reported that it served 100 percent of its properties, and this city is located in a developed country.

One of the emerging challenges relates to the intensification of development in cities where greater concentrations of residents poses pressure on the collection and treatment capacities of sewer systems. How does an established city with increasing road congestion replace and upgrade its underground wastewater network, especially when most of this network is located within the road allowance?

Figure 19: Percent of properties served by wastewater removal service



Persistent problems
— Tightening environmental regulations
— Decoupling combined storm and wastewater assets
— Maintaining investment and development targets
— Attracting new talent
— Protecting the hydrological network and watersheds.

Common cost factors
— Treatment chemicals and consumables
— Collection and pumping costs
— Maintenance and repairs of underground assets
— Capital investment, renewal and separation requirements
— Level of pre-collection treatment for industrial and commercial wastewater.

Innovative ideas
— **Moscow** has seen significant investment into its water treatment facilities with the construction of one of the world's largest UV radiation disinfection facilities that boasts enough capacity to treat around 80 percent of the city's current sewage and waste water.
— In **Dresden**, a newly installed fouling complex has helped the wastewater network achieve a high degree of power self-sustainability.

— Last year, the **Philadelphia** Water Department met the first milestones of their 25-year Green City Clean Waters plan which aims to reduce the amount of storm water entering the city's combined sewer system through the use of green infrastructure.
— In **Toronto**, authorities are taking aggressive action to fill the looming talent gap by creating focused talent and development plans for key staff and their future workforce.

Transformative trends

— *Treatment innovation:* Many cities are exploring new approaches for treating wastewater and managing biomass that reduce treatment costs, improve efficiency and better manage unwanted byproducts and odors.
— *Wastewater reuse:* Changing attitudes now see the reuse of treated wastewater as an untapped resource
— *Upgrading the network:* From new treatment plants and reservoirs through to upgraded collection assets and infrastructure, cities are investing significant capital to expand and modernize their wastewater network.
— *Decreasing volumes:* While overall volumes may be increasing, some cities note the per-capita volume is decreasing as people adopt more conservationist approaches.
— *Building the future workforce:* Recognizing the growing challenge of attracting new talent to the wastewater sector, a growing number of cities are now thinking about how they might entice millennials into the workforce.

What else did we measure?

For our benchmarking exercise, we collected a wide variety of data on the effectiveness and efficiency of this service area. The following indicators lacked sufficient data or respondents to illustrate in this report:

— Kilometers of wastewater collection and treatment network
— Cost per km of wastewater collection and treatment network
— Revenue collected from wastewater collection and treatment
— Number of sewer main breaks or collapses.

Q&A with Bastien Simeon, Global Infrastructure Sector Lead, Water, KPMG International

Bastien leads KPMG's Global Water Sector where he is responsible for assisting water and wastewater authorities around the world on addressing investment decisions for major infrastructure restructuring and construction projects.

Q: What factors influence cost efficiency in the wastewater sector?

A: I think the biggest consideration is the outflow water quality. Every region has somewhat different standards for the quality of the treated water that can be returned into the hydrological network and that has a tremendous impact on the operational costs that would be involved. One city in Namibia injects its treated wastewater directly into the potable water network. Other variations in operational and capital costs depending on the city's terrain. Those that enjoy natural hydraulics and drainage will spend less on pumping waste than those dealing with undulating terrain. At the other end of the spectrum, cities are facing very different capital investment programs, depending on their asset mix and age. So there are a lot of factors that could influence cost efficiency on a cost for volume basis.

Q: Why might wastewater authorities be struggling with large capital requirements today?

A: There are three main reasons. The first is that many cities, particularly the more established ones, are facing large asset renewal and replacement requirements. The second reason has more to do with the growing desire to separate wastewater assets from storm water, in part to better manage capacity but also to improve treatment costs. And the third reason relates to the constantly changing quality standards that wastewater must conform to; retrofitting a treatment plant to meet a higher standard can be a costly proposition. Let's face it, making investments in a sewer system are not all that glamorous compared with other more visible infrastructure investments.

Q: Should cities be striving for 100 percent service coverage?

A: It all depends on the city and its ability to absorb wastewater in other ways. In many older cities, septic systems are common and industry and commercial properties are required to — at the very least — treat their wastewater prior to city collection. Mandating septic systems is clearly not a realistic response, but it does suggest that there are other ways that a city can reduce their reliance on centralized wastewater assets. At the same time, however, we are seeing many 'greenfield' cities developing very innovative approaches that would suggest that 100 percent coverage is not only possible, but that it may prove the most efficient approach in some cases.

Q: Has technology helped improve efficiency in the wastewater sector?

A: Much like similar operations in drinking water and storm water, many of the more established cities have implemented SCADA-type systems that have helped to bring a higher level of automation to wastewater collection and treatment. And now, as the technology environment evolves, we are also seeing operators move towards the adoption of sensor technologies and remote monitoring systems to support operations, as well as more predictive analytics to support forecasting and risk assessment. And, as a result, they are able to use their SCADA systems as a proactive tool to help identify problems and risks before they become service interruptions or compliance issues.

Q: What advice would you offer wastewater authorities?

A: I think it all comes down to robust planning. If you are aggressive about your planning and are able to predict demand, you will know how much capacity you need to build and where your maintenance budgets would be best spent. My experience suggests that the cities that are aggressive in their planning are the ones that are ahead of the game, from both an effectiveness and an efficiency perspective.

Finally, we need to change our attitude towards wastewater where treated wastewater is seen as a resource that can be reused — for irrigation, industry, or even aquifer recharge. ■

Storm water drainage

Flooding can devastate a city by compromising city services and destroying property and city assets. So while flooding events might be unpredictable, city leaders recognize the growing number of such extreme weather events and are now turning their attention to storm water drainage as an investment into the sustainability, resilience and livability of their city.

Defining the service

Storm water drainage services include the design, construction, maintenance, repair and operations of storm water collection and treatment systems, including everything from culverts and ditches through to sophisticated storm water treatment plants and reservoir systems.

Topline findings

- On average, cities spend US$0.65 per cubic meter of storm water drained.
- The average city spends US$11,283 per km of storm water network.
- The vast majority of cities provide storm water drainage services to 100 percent of their properties.

Efficiency

Operating and capital cost per cubic meter of storm water drained. This measure combines the total storm water drainage operating costs with the total capital costs and divides the sum by the number of reported cubic meters of storm water drained.

Points to consider

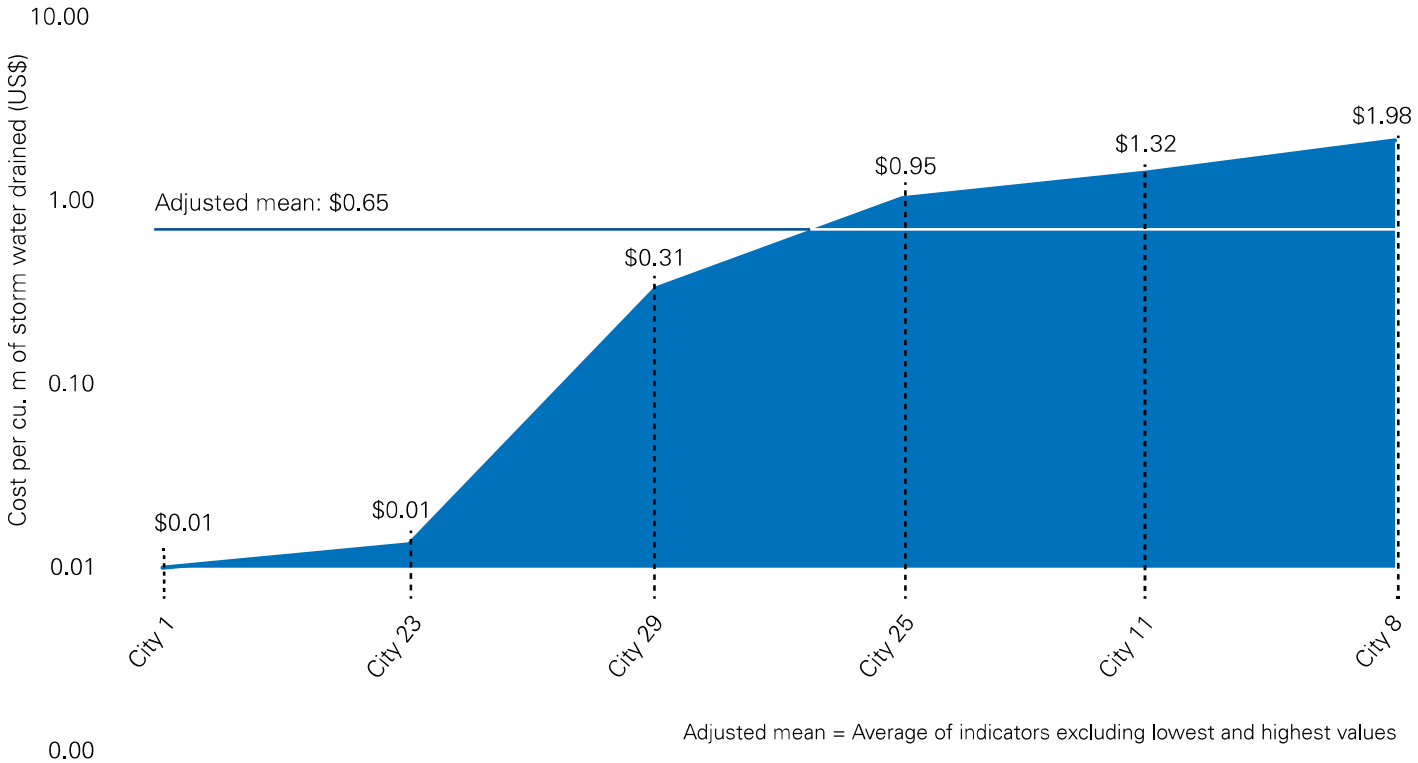
Storm water drainage, as a service is still emerging in many cities, largely because storm water was considered more of a nuisance than something deserving specific attention, creative solutions and financial commitment. Little wonder when we reached out to cities to see what services they might want to benchmark that this service popped up on our radar. Unfortunately when we asked for specific information necessary to calculate efficiency and effectiveness indicators, only six cities were able to respond.

There are two cities that appear to be outliers because of their low cost per cubic meter of storm water drained. City 1 and 23 show the cost per cubic meter of storm water drained at pennies on the dollar compared with US$1.98 for City 8. When we reviewed the outliers, we expect that the amount of storm water drained is the major reason for the low cost cities. We believe that these cities reported large quantities of storm water (denominator) and relatively small operating and capital costs. In other words, these are valid observations but certainly point to a concern that perhaps cities need to invest more and more in storm water drainage networks than they do today.

We experienced challenges in capturing the volume of storm water drained. Few cities actually measure the volume of storm water they collect. In part this is due to the fact that only recently are cities beginning to handle storm water in a manner similar to drinking water and wastewater. Recently cities have been introducing storm water drainage fees where the calculation may be either a flat rate charge or one that is determined by the percentage of a property that is non-permeable.

As cities experience more extreme weather events, regardless of their cause, they need to spend more on storm water drainage and seriously consider innovative ways in which to divert water, protect property, and prevent damage to valuable environmental features.

Figure 20: Operating and capital cost per cubic meter of storm water drained (US$)



Adjusted mean = Average of indicators excluding lowest and highest values

Effectiveness

Percent of properties served by storm water drainage service. This measure divides the number of properties directly connected to the storm water drainage network by the total number of properties that can be connected.

Points to consider

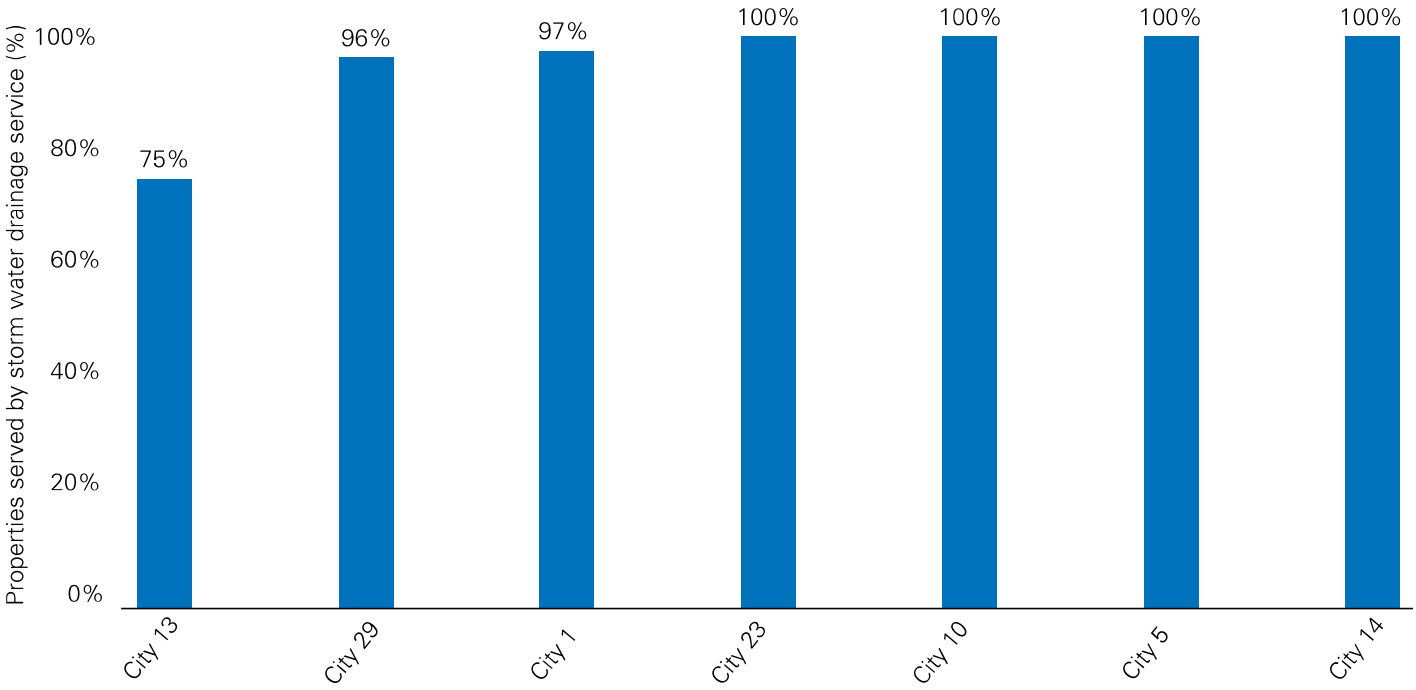
Seven cities provided sufficient information to calculate this metric. With the exception of one city, all cities are effectively providing storm water drainage to properties in their city. The one city that only supports 75 percent of the properties with this service may well be in the process of developing its storm water drainage network as a newer, more modern suburban municipality.

As cities begin to charge storm water drainage fees/charges, the likelihood of greater coverage and reduced storm water damage will improve.

Some cities are providing development credits or storm water drainage charge reductions when developers build special storm water holding tanks that mitigate large surface areas from contributing to large quantities of storm water, such as parking lots around shopping malls or multi-residential properties. Other credits deal with property owners that control the storm water quality so that "deleterious substances" do not make it into natural water courses. Residential property owners can use a variety of different techniques to control storm water flow, including: rain barrels, cisterns and infiltration galleries.

Future studies of storm water drainage may also include different techniques for calculating storm water drainage fees and/or rebates on fees. Because this service aims to prevent flooding, future studies should examine the number of flooding incidents and/or the damage caused by floods. This information may need to be supplied by insurance companies who may/may not cover the costs of flood damage.

Figure 21: Percent of properties served by storm water drainage service



Persistent problems

- Planning for rising severity and frequency of storm events
- Meeting storm water treatment requirements
- Maintaining aging pipes and infrastructure
- Improving asset management discipline
- Aligning to future city development plans

Common cost factors

- Frequency and severity of storm events
- Capital requirements for maintenance and upgrades
- Treatment and discharge requirements
- Topography and ground cover/land use
- More stringent regulatory requirements
- New development costs

Innovative ideas

- Supported by rebates from city council, more than 90,000 new domestic rainwater tanks were installed by **Brisbane** residents during the Millennium Drought event.
- Authorities in **Dresden** have optimized their sewer system control to help better manage storm water during storm events.
- In **Mornington Peninsula**, storm water authorities have implemented the Local Integrated Drainage Scheme (LIDS) to enhance and deliver flood mitigation works, and to reduce the risk of flooding to the population.
- **Toronto** is considering a new storm water charge policy that would separate storm water services from water consumption in order to provide customers with greater fee transparency.

— In neighboring **Mississauga**, authorities have introduced a credit program that provides financial recognition for private, on-site storm water measures that deliver direct benefits to the city's storm water system.

Transformative trends

— *Increasing risk:* The frequency and severity of storm events is rising causing many cities to rethink their 'design storm' scenarios.
— *Rising regulation:* Environmental regulators, planners and policy makers are increasingly focused on ensuring that storm water discharge is treated and managed in a way that preserves the local environment and reduces the risk of flooding.
— *Splitting services:* Cities that have historically relied upon shared storm water and waste water infrastructure are now working to separate the two in order to improve efficiency and ensure proper treatment guidelines are being followed.
— *Changing funding models:* Many cities are exploring new ways to shift the cost of storm water services away from the public budget through user fees and other charges.

What else did we measure?

For our benchmarking exercise, we collected a wide variety of data on the effectiveness and efficiency of this service area. The following indicators lacked sufficient data or respondents to illustrate in this report:

— Kilometers of storm water drainage network
— Number of storm water overflows
— Number of storm sewer breaks
— Revenue collected for storm water drainage.

Q&A with Ross Homeniuk, Director, Global Infrastructure advisory practice, KPMG International

Working with governments, utilities and private sector organizations, Ross leads KPMG's Canadian asset management practice where he integrates his deep business and technical expertise with best practice and supporting technologies to help strengthen municipal asset management.

Q: How is storm water drainage changing?

A: As the rate of urbanization increases and people become more focused on protecting the natural environment, we have seen cities become much more sophisticated in their approach to storm water drainage and treatment. Older cities are now working to separate their waste water and storm water systems. Other cities are working to introduce new technologies into the network. We're also seeing lots of different treatment options being implemented — from end-of-pipe oil and grit separators through to centrally treated systems.

Q: Many cities are shifting towards fees for storm water drainage. What are some of the challenges with implementing fees?

A: The reality is that, in most cities, storm water drainage has traditionally been a public work and therefore funded by the general tax base. More recently, many cities have been working with their local water utilities to collect storm water drainage fees as part of their customer billing which, essentially, shifts the costs off the tax base and onto users. So the big challenge is really around public perception. But in my experience, people are not opposed to paying more for a service, as long as they understand why they are paying more and what they are getting in return.

Q: How can cities improve the efficiency and effectiveness of their storm water systems?

A: There are many ways to improve, depending on your current asset mix, investment levels and demand volume. But one of the bigger problems we see are systems that focus too much on the 'build' and not enough on the 'maintain' part of the asset lifecycle. There are many storm water pipes in older cities that have not been cleared in decades. I know of cities that still have 100-year old wooden pipes as part of their network. You need to put as much focus on maintaining and optimizing your network as you do on building out new capacity.

Q: Are there other players that can help drive improvements?

A: Certainly. At the city level, I think executives need to recognize that storm water interacts with a wide variety of different city services — everything from the way roads and parks are designed through to the way a city plans development influences the volume of storm water and therefore the efficiency of the network. Businesses and individuals can also play vital roles by investing into storm water capture approaches and reducing the amount of impervious land on their properties. We need to think clearly about how our current decisions will impact our ability to manage storm water in the future.

Q: What advice would you offer city managers and storm water drainage leaders?

A: I think everyone now recognizes that storm water is going to become a much bigger problem as weather events become more unpredictable and more severe. In this environment, city leaders need to reassess their drivers for investment into storm water drainage and then identify the best solution for the city's future needs and environmental realities. But remember, what worked in the past will not necessarily work in the future. This isn't about building more, but rather about being smarter. ■