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## Tariff increases threaten Kenyan supplies

**An increase in water and sewerage tariffs approved by the Water Services Regulatory Board (Wasreb) in Kenya is threatening to backfire on water sector reforms that were initiated in 2002, when the country's new Water Act came into force.**

Wasreb has warned of a possible collapse of water companies because of low revenue levels and inability to meet their water supply obligations. Wasreb therefore recently asked water companies to review their charges to reflect increases in energy costs and prices of water treatment chemicals. At least six of the leading water companies have increased their tariffs by 50-600% over recent months.

Simmering discontent among consumers and

mounting pressure from civil society and lobby groups for a reversal of the decision to approve the tariff increases has raised questions about the sustainability of the Water Act reforms that introduced commercialisation of water supply in the country.

'There is no explanation to consumers why the rate should go up by 100% or 150% and what formula is used to arrive at these figures,' says Stephen Mutoro, the Executive Secretary of the Kenya Water and Sanitation Network (Kewasnet), a water consumer lobby group.

'There is no guarantee that by effecting the massive increases these companies will ensure uninterrupted water supply to consumers,' he said. (See Analysis, p5) ● **Shem Oirere**

## Stimulus package boost for US water sector to drive efficiency

**US President Barack Obama's ambitious economic stimulus bill contains significant investments in water-related programmes that include \$3 billion for potable water and \$4 billion for wastewater projects.**

The US House and Senate reached a compromise on the American Recovery and Reinvestment Act of 2009 that will pump \$6 billion into local clean and drinking water infrastructure improvements. This is divided into \$4 billion to the Clean Water State Revolving Fund programme (which covers wastewater) and \$2 billion to the Safe Water State Revolving Fund programme (which covers potable water).

The plan states that 'not less than 20% of the appropriated funds shall be provided for projects that address green infrastructure, water or energy efficiency improvements, or other environmentally innovative activities.' The bill also indicates that no less than 50% of the capitalization grants received by states be used 'in the form of forgiveness of principal, negative interest loans or grants or any combination of these.' The bill stipulates that the funded projects must proceed within 12 months of enactment.

Also with potential implications for water are \$600 million for the cleanup of hazardous sites under the Superfund system and \$200 million for clean-up of petrol leaks from underground

storage tanks.

The American Water Works Association (AWWA) greeted the announcement with cautious optimism. Executive Director Gary Zimmerman said in a statement: 'For communities seeking to repair or replace critical water infrastructure, today's signing represents an important step forward in addressing a growing national challenge. The more than \$6 billion committed for water and wastewater needs will push forward projects critical to our nation's public health protection, fire protection, economic strength and our overall quality of life.'

However, he added: 'While the funds committed represent only a tiny fraction of the need, AWWA is optimistic that the investment in water will jump-start many critical projects and create hundreds of thousands of new jobs. From this perspective, the glass is certainly half full.'

AWWA applauded Congress's decision to waive requirements that states must provide matching funds, which could have been problematic. This waiver will undoubtedly speed distribution of the funds. Mr Zimmerman also noted: 'It also makes good sense to give priority to projects that can begin construction within a year, giving utilities necessary time to complete construction plans or obtain environmental permits.'

(See Analysis, page 4) ● **LS**

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Utility reform and achieving efficiency are central themes of the publication, encompassing topics such as benchmarking, investment planning, consolidation, public / private sector roles, leadership, IT, and human resources. Other regular themes include financing, regulation, charging policies, procurement, corporate governance and customer issues.

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## Assistance for Asian water and sanitation services

**The Asian Development Bank (ADB) has announced it is to manage a regional technical assistance project to help improve the delivery of water and sanitation services in Asia.**

The Partnership for Good Governance and Knowledge on Urban Water Management aims to improve the capacity of utilities to manage and provide quality services. It is being financed by a \$500,000 grant from the Republic of Korea's e-Asia and Knowledge partnership fund, which the ADB administers, along with a further \$100,000 in the form of training, venue and equipment from the Korea Water Resources Corporation (K-water).

The region is struggling to meet the increased demand for water and basic sanitation caused by the rapid growth in its urban populations. Despite many reform and development programmes across the region, service coverage is still patchy, non-revenue water is high and many utilities have weak financial performance and poor customer relations.

Past technical assistance to build the capacity of

utilities to provide better services has often fallen short of its goals, typically providing skills and knowledge to individual staff that has not been replicated in, or fully benefited, the whole utility.

The new programme aims to resolve this by designing a training programme to build up capacity and skills right across a utility. Two water and sanitation operators from different South Asian cities, where the need for improvement is considered to be greatest, will be chosen.

K-water, which has extensive experience in coaching water and sanitation staff, will develop and carry out the programme, with the aim of replicating it at other utilities in future.

Kyeong-Ae Choe, ADB's principal urban development specialist in its South Asia department, said: 'Achieving the Millennium Development Goal of halving the proportion of people without sustainable access to safe drinking water or basic sanitation by 2015 is getting more challenging in Asia's urban areas.' ●

## In Brief

### GLOBAL: World Bank warns that financial crisis could set back water utility development

The World Bank has warned that the global financial crisis could set back development in water utilities by a decade or more as investment falters and people become increasingly unable to pay their bills. As funding dries up, a vicious circle could re-emerge of poor services, low willingness to pay and low investment, according to World Bank director of energy, water and transport Jamal Saghir. Speaking at the World Water Forum, he said water utilities around the world would have to increase efficiency to convince cash-short governments that they are a sound investment, noting: 'We can do more with the same or even less.' New ventures are likely to be cancelled and cost pressures applied to existing infrastructure projects, he warned.

### OMAN: Ministerial water forum recommends self-sufficiency in water conservancy projects

Oman has hosted the Group of 77 (G77) ministerial forum on water, which discussed ways of boosting cooperation among countries in the water resources field. Participants agreed to exchange technical expertise, aided their scientific and technological cooperation in the field of water resource management, and discussed means of developing desalination and sanitation projects in the member countries. Recommendations were adopted to boost cooperation among the countries of the south for water conservancy. The attendees recommended adopting a policy of self-sufficiency in financing water conservancy projects such as dam construction and hydropower systems, canals and drainage system expansion.

### US: California drought gains emergency status

California's governor Arnold Schwarzenegger has declared a state-wide emergency due to the three-year drought. Governor Schwarzenegger asked urban water agencies to reduce water consumption by 20%. Mandatory rationing is an option if other measures are insufficient and at least 25 water agencies in the state have already introduced mandatory measures. Winter

rainfall and snowpack were below average again this year. The Los Angeles Department of Water and Power has voted to impose water restrictions in the city for the first time in 20 years. Under the plan, users would pay nearly double the normal price for any water used in excess of a monthly allowance. Lawn sprinkler use will be restricted to two days a week. The scheme will begin in May.

### BENIN: Minister warns that corruption has limited access to water

Benin's minister of Energy and Water has warned that corruption has limited access for more than half of the country's population to potable water. Over the past 20 years donors have contributed \$87 million for water sector reforms, more than half from the Japanese government, but much has vanished during the bidding process for projects. Transparency International estimates in its 2008 global report on corruption that in the water sectors of developing countries, corruption increases the price of domestic connections by 30% and represents, for industry, \$48 million in losses annually.

### US: EPA releases first state funding awards

The US EPA (Environmental Protection Agency) has begun to announce individual state awards of funding under the American Recovery and Reinvestment Act of 2009, which President Obama signed into law on February 17, 2009. The states of Idaho, Oregon, Washington and Alaska, as well as tribal governments, will receive more than \$297 million in total from the EPA for clean water projects to create jobs and protect communities and the environment. The federal money is the first tranche of EPA funding available to states and tribes under the Act. Meanwhile, the US Congress has passed the country's first major water works bill for 15 years, which includes \$19.4 billion over a five year period for wastewater treatment, Great Lakes clean-up support and other water quality measures. The Act will still have to pass the Senate to become law – in 2007 and 2008 the Senate rejected five separate water quality bills, upon which the new bill is based.

## Technical assistance for Nigerian reforms

**Consultancy Atkins, in a joint venture with UK-based ITAD and Abuja-based Enplan, has been awarded an €7.2 million (\$9.76 million) contract over two years to provide technical assistance to Nigeria's water supply and sanitation sector reform programme.**

The project is funded by the European Union (EU) in collaboration with the Nigerian government and will potentially benefit over three million people across six states – Cross River, Anambra and Osun in the south and Kano, Jigawa and Yobe in the north, with central co-ordination from the capital Abuja.

The main objective is to aid poverty eradication, sustainable development and achieving the Millennium Development Goals (MDGs). To make this happen, the water and sanitation sector reform process in each state will be facilitated by establishing State Technical Units manned by consultants. The teams will work closely with the state water ministries

to introduce the planned institutional and legislative reforms and provide improved water supply and sanitation delivery in 39 local government areas.

Nigerian professionals will be the main staff on the project, covering engineering, community development, procurement and finance and accounting. The work fits in with other work Atkins has been undertaking for the EU in Nigeria, notably the drafting of the National Water Resources Bill.

Although some progress has been made during the first phase of the project, a large amount remains to be done. Atkins project director, Ian Mathieson, said: 'The main challenge will be to introduce institutional change in a very short time frame. We look forward to working with our clients to ensure an effective implementation of the reforms which will ultimately improve water supply and sanitation for a significant proportion of the Nigerian population.' ●

### Business

#### **MALAYSIA: Johor water takeover finalised**

Pengurusan Aset Air Berhad (PABB) has confirmed its third water restructuring agreement, which will see it take over MR4.03 billion (\$1.09 billion) of water assets in the Malaysian state of Johor. This is the first of the three to involve a private concessionaire – the acquisitions from the states of Malacca and Negri Sembilan, completed at the turn of the year, involved taking over these services from state governments. The move is part of a major national water services industry restructuring initiative involving peninsular Malaysia and Labuan. The original owner of the Johor assets was SAJ Holdings, Syarikat Air Johor (a unit of Ranhill Utilities) and Johor's state government. SAJ will continue to manage water distribution and will lease water assets from PAAB for operations and maintenance for 30 years at an annual charge of around RM50 million (\$13.6 million). PAAB will now move on to Pahang and the state of Selangor, where delicate negotiations with the four concessionaires are taking place.

#### **DUBAI: DEWA announces tranche of water supply projects**

The Dubai Electricity and Water Authority (DEWA) has announced that it is to invest over Dh72 billion (\$19.7 billion) in projects to keep pace with rising demand in the city. Work is under way to carry out key electricity and water production, transmission and distribution projects. Of the funds, Dh15.5 billion (\$4.2 billion) has been allocated to projects that came into

service within the past two years, and Dh57 billion (\$15.5 billion) to new projects under way.

#### **US: Joint venture wins New York climate change study**

Consultancy Halcrow has been selected by the New York City Department of Environmental Protection (NYCDEP) to undertake a £2.4 million (\$3.4 million) climate change study project, as part of a joint venture with environmental engineering firm Hazen and Sawyer. The company will help the NYCDEP to identify and quantify the impacts of climate change and population growth on New York city's sewer, drainage and wastewater systems. Halcrow's climate change adaptation specialists will lead a team of international experts in devising adaptation strategies and processes to mitigate the anticipated risks. The team will also be collating data on local rainfall, sea level rise, and storm surge for use in simulation modelling. Work on the project is expected to begin in mid-2009 and last until 2011.

#### **ZAMBIA: Minister pledges extra water sector funding**

Zambia's finance and national planning minister, Situmbeko Musokotwene, has allocated extra funding to the water sector specifically to prevent the spread of waterborne diseases. He told the country's national assembly that \$42 million had been allocated to the national rural and urban water supply programme, to improve current infrastructure and extend services to under-served, particularly peri-urban areas.

### Loans and Tenders

#### **COLOMBIA: IADB agrees wastewater funds for Medellín river rehabilitation**

The City of Medellín in Colombia is to complete an ambitious programme to rehabilitate a vital river and improve the quality of life of local communities with up to \$450 million in financing approved by the board of the Inter-American Development Bank (IADB) as part of its water and sanitation initiative. The historic loan – the largest credit ever approved by the IADB for wastewater treatment – will help turn Medellín into one of the first large Latin American cities to adequately treat nearly 100% of the wastewater it collects. The Medellín river sanitation programme is being executed by Empresas Públicas de Medellín (EPM), a municipal public utility company that provides potable water, sewer, power, combustible gas distribution, telephone and refuse collection services to around three million people.

#### **BELGIUM: EIB and Aquafin agree next funding tranche**

The European Investment Bank (EIB) and Flemish wastewater operator Aquafin have agreed a new tranche of funding. The EIB's support, through six loans in total, has helped achieve several hundred projects constructing and renovating collector sewers, overflow basins, pumping stations and wastewater treatment plants throughout Flanders.

#### **INDONESIA: World Bank agrees water supply grant**

The Indonesian government and the World Bank, as administrator of the Global partnership on Output-Based Aid (GPOBA), have signed an

agreement on a grant worth \$2.4 million for expanding piped water supply to urban poor in the second largest city in Indonesia, Surabaya. The scheme in Surabaya aims to extend piped water connections to 15,500 low-income households comprising 77,500 people.

#### **GEORGIA: EBRD invites Borjomi tenders**

The European Bank for Reconstruction and Development has invited tenders for the second phase of a water supply system rehabilitation project for Borjomi, 160km east of Tbilisi in Georgia. Sealed tenders from contractors have been invited for the project, which will include rehabilitation of the water supply network including valves, manholes, fire hydrants, pressure regulating valves and fittings; rehabilitation of the wastewater network including inspection manholes; construction of water meter units and installation of consumer water meters; and arranging house connections.

#### **LAO: ADB support for small towns**

The Asian Development Bank (ADB) has approved a \$23 million grant for Lao PDR's small towns water supply and sanitation sector project, which should benefit women who currently spend up to two hours a day collecting and storing water. The project will provide piped water and sanitation services for around 137,000 residents in over 120 villages in the country. Australia is providing \$3 million in co-financing from the Gender and Development Fund. The project supports the Lao government's push to expand access to safe piped water to 80% of the urban population by 2020.

# Iraq brings business boost for Degrémont

Construction of a new water treatment plant for the Al-Rusafa area of Baghdad has given Degrémont the opportunity to deliver design, equipment supply and personnel training through its team in Egypt, Jordan and Lebanon, as well as in France. **LIS STEDMAN** reviews the contract.

**N**ow that the political temperature in Iraq appears to be cooling, projects intended to begin the long work of reconstructing the nation's shattered infrastructure are beginning to appear. One of these has seen Suez Environnement subsidiary Degrémont recently signing an agreement with Al Mabrook Construction and Trading and Issam al-Iraqi Construction Contractors to build a potable water treatment plant in Baghdad.

The Baghdad Water Authority awarded the contract, worth \$201 million and covering design, equipment supply and personnel training, for a 200MGD plant in the capital's Al-Rusafa area. Degrémont will be responsible for overall plant design, procurement and delivery of equipment as well as training the Iraqi engineers who will assemble and start up the plant. The project will supply over four million people in the Grand Baghdad area.

The plant, with its very high output capacity (910,000 m<sup>3</sup>/day), will complete the current drinking water production system in the city of Baghdad, which has two similar plants already. Joubrane Ouechec, Vice President Senior Development Middle East, says there are two main challenges to the project. 'First of all, [there is] a technical challenge to provide to the Baghdad citizen safe drinking water through reliable water treatment from the Tigris river. For Degrémont, it is to develop water infrastructures, with a very high output capacity of 910,000m<sup>3</sup>/d in the first phase. In the future, the capacity of the plant should be increased to reach 2,275,000m<sup>3</sup>/d in a second phase to be developed.'

The second challenge is project management, he adds. 'The challenge in the transfer of know-how to the Iraqi employees and in the coordination of this project during its conception and launch of the operation of the new plant. Degrémont will provide the overall design of the plant. The contract will be backed in totality by support from the countries in the Middle East where Iraqi employees will be trained on the equipment by Degrémont's team based in Egypt, Jordan and Lebanon – neighbouring countries – as well as in France.'

The company has committed to provide its expertise and know-how to design and build the plant's first phase as well as implementing robust and reliable equipment and technologies. These will include a 910,000m<sup>3</sup>/d raw water pumping station and a 2,275,000m<sup>3</sup>/d treated water pumping station; 16 Turbocirculator clarifiers at 40m in diameter, 28 Aquazur V sand filters with a unit surface area of 163m<sup>2</sup>, pre-ozonation, with a total capacity of 50kg of ozone per hour, disinfection via gaseous chlorine, and sludge treatment using four gravity thickeners and ten centrifuges. All of the technologies are either Degrémont proprietary technology or patented systems.

The Aquazur V system is a downflow open sand filter that retains suspended particulates in raw waters within a thick layer of sand. The homogeneity of the sand is said to increase filter run-time, while the thickness enables filtration at high speeds. The high water head (1.2m) prevents degasification.

In terms of specific issues, M Ouechec says power is an important consideration: 'Taking into consideration both the actual situation of the country's power grid, and the necessity of having constant production of water, the project includes an electrical generating emergency power plant.'

The contract is a good fit with Degrémont's expertise in the Middle East. The company has undertaken several projects in Iraq, in all fields of water treatment including drinking and wastewater services for the Baghdad municipality, as well as water treatment for metal producers and the chemical industry. In all, Degrémont has supervised more than 30 water treatment projects in Iraq, from the beginning of the 1960s. M Ouechec adds: 'Degrémont Group is currently supplying a series of drinking water compact units to the Baghdad Water Authority. Those units provide some parts of the city with drinking water. Degrémont Middle East, through its base in the UAE (United Arab Emirates), is managing the execution of projects in Qatar, Oman, Dubai and Bahrain.'

Among the company's other projects in the area, in Dubai, it is currently

building the biggest wastewater treatment and reuse plant in the region, using the biggest-yet MBR (membrane bioreactor) for the Jumeirah Golf Estates project. In Qatar, two wastewater treatment and reuse plants are being built for the city of Doha and the new city of Lusail.

In Barka, Oman, Degrémont is building a seawater desalination plant, coupled with a power plant built by GDF Suez Energy International. Degrémont and GDF Suez Energy International have also just won a power and desalination project in Bahrain, which will be the largest RO (reverse osmosis) plant in the region at a capacity of 220,000 m<sup>3</sup>/day.

The plant's main environmental targets focus on the sludge production and disposal element. M. Ouechec says: 'As the sludge production is greater than 80 tonnes of dry solids per day, we had to design a sludge treatment that would allow convenient disposal, which is why we proposed mechanical dewatering: the treated sludge volume will be approximately 400m<sup>3</sup>/d.'

Following a number of difficult years during which much of Baghdad's infrastructure was destroyed, the municipality is now making investments in development and upgrading of its drinking water production and distribution systems. 'Wastewater treatment is also an issue for the city,' M. Ouechec notes. Security 'is not a real issue', he stresses. 'However, we re-clarify that our contract's scope is limited to the engineering, procurement and training of manpower outside Iraq.'

He adds that Degrémont's long history of working in Iraq has been very helpful. 'Degrémont has undertaken numerous projects in Iraq, which implies a good knowledge of the country in terms of managing technological projects such as the Al-Rusafa drinking water treatment plant. Our partners in the consortium are also a part of this success. Al Mabrook and Essam Al-Iraqi are first-class civil works contractors, which have already been involved in several plants and other construction. They have a large stock of construction equipment and highly-qualified and dedicated staff in the areas of civil and electro-mechanical works.' ●

# Kenya's water sector reforms under threat

Increases in water and sewerage tariffs in Kenya are threatening performance improvements and water supplies as consumers are unable to pay. **SHEM OIRERE** reports.

**An ongoing review of water consumer prices by water service providers in Kenya is threatening to backfire on the water sector reforms that were initiated in 2002 when a new water Act came into force.**

Simmering discontent among consumers and mounting pressure from civil society and lobby groups for a reversal of the decision by the Water Services Regulatory Board (Wasreb) to approve water and sewerage tariff increases has raised questions over the sustainability of the reforms that introduced commercialization of water supply in the country.

The Water Act 2002 paved way for the formation of private companies to supply water and sewerage services taking over from local authorities. The companies were formed by local authorities under the supervision of the eight water service boards created under the new law to manage water services in the country in partnership with the local authorities.

At the start of this year, government body Wasreb asked the water companies to review their charges to reflect the recent increase in energy costs and prices of water treatment chemicals that have doubled over the past ten years since the last tariff review.

The Act envisaged a steady growth in performance by the water companies where the providers could raise adequate revenue from supplying water and sewerage services and build capacity to sustain the activities without relying on donor support. But now, Wasreb warns of a possible collapse of the companies because low revenue levels and inability to meet their water supply obligations.

'Right now, it is only a matter of time before the water providers come to a standstill. It is not something we like but if we are to have sustainable providers, we have to look at the prices again,' said Mr Robert Gakubia, Wasreb's CEO, when he announced the new tariff regime.

Increases by at least six of the leading water companies over recent months represent the first time the tariffs have been revised since the Act came into being, with the last such increase having been effected in 1999.

According to Gakubia, there has been a sharp increase in the cost of electricity for running water treatment plants as well as the price of water treatment chemicals, leaving the water companies with no profit or enough funds to sustain their operations.

The companies owe Kenya's sole electricity distributor, Kenya Power and Lighting Company (KPLC), close to £16 million (\$22.3 million), accrued over the past six years as the firms grappled with low revenue collections due to inability by some consumers to pay rates, and high defaulting rates by government institutions through corruption and mismanagement of funds allocated for water bills from the Central Government.

KPLC has now resorted to disconnecting electricity to water treatment plants owned by a number of the water companies, leading to acute water shortages in many towns. In fact there has been an outbreak of cholera due to water shortage in the towns of Homa Bay and Nyamira in western Kenya over recent months, exacerbating the weak financial status of the very poor in the affected communities.

Some of the water firms that have increased their tariffs inherited huge debts from the local authorities that were running the water and sewerage services before the operations were privatized at the promulgation of the 2002 Act. Nairobi Water and Sewerage Company for example, which supplies Kenya's capital city with water, inherited £80 million (\$111.5 million) from its forerunner, the Nairobi City Council Water Department.

The Director of Water Services in the Ministry of Water and Irrigation, Eng Lawrence Simitu, has said only three water companies – Nanyuki, Nairobi and Embu – were able to meet their financial obligations, while another 22 were piling up debts and facing water supply problems. For example, in Kenya's fifth largest city, Eldoret, the local water service provider, Eldoret Water and Sewerage Company, has asked consumers to pay £1.9 (\$2.6) for ten cubic metres of water, a 50% increase from the previous charges.

'This move is unrealistic since water flows by gravity from the Chebara Dam in Marakwet to Eldoret and so the company does not spend much on pumping,' a former local councillor Kipkorir Menjo was quoted saying after the new rates were announced by the company.

However, the tariff rise meant to support the water supply firms through increased revenue from consumers may end up strangling them, as water users look elsewhere for their supplies and the very poor find it impossible to afford the commodity.

According to Stephen Mutoro, the Executive Secretary of the Kenya Water and Sanitation Network (Kewasnet), a water consumer lobby group, a number of water companies in the country have been under-performing and 'think by raising the rates it would help them improve their efficiency.'

A number of the water companies have sustained high levels of unaccounted-for water, ranging between 23% for Malindi Water Company to per cent of 74% for Kisumu Water Company.

'Unaccounted-for water is a very tricky issue because we believe you can bring it to 40% and below with improvements in management but below that, you need to have massive investment. If you do not collect that revenue, we cannot have that investment,' Gakubia told a conference in Nairobi last December.

However, Mutoro has said Kewasnet is urging water consumers to reject the new rates 'until these water companies followed the due process and justified the increment.'

The dismal performance by Kenya's water service providers may not be improved by an increase in consumer charges, some officials in the Ministry of Water now believe. Instead of taxing the water consumer more to fund the operations of the financially starving utilities, the government is exploring the idea of merging them to maximize economies of scale.

According to Eng Simitu, 'less than 30% of the existing water service providers are financially sound.'

'If two or more providers are merged, we will have one corporate team and save operations and maintenance costs,' Simitu told journalists earlier this year.

He said the idea behind the proposed merger was a realization that the objectives of the country's water reforms were not being achieved, yet the 'the essence of commercializing water supply in the country was to improve efficiency and ensure water service providers' sustainability, profitability and growth.'

Kenya's economy, still reeling from the effects of the December 2007 debilitating post-election violence that led to the killing of over 1000 people and uprooting of another 350,000 from their homes, has complicated matters for the cash-hunting water companies. Consumers, suffering depleted pockets following sharp increases in foodstuff and electricity prices, may find it almost impossible to sustain the new tariff regime, hence throwing the water companies into a deeper financial crisis. ●

# World Bank support for Congo water reforms

Water and wastewater provision is in desperate need of improvement in the Democratic Republic of Congo.

**LIS STEDMAN** heard from the World Bank about plans to increase access to water and improve the efficiency of the state water utility.

**The World Bank is providing funds for a project in the Democratic Republic of Congo (DRC) that aims to both increase access to water and improve the efficiency of REGIDESO, the state water utility.**

The first element of the project will improve and expand water supply services in major urban centres. This will be achieved via investment and rehabilitation programmes tailored for the country's capital city Kinshasa, its second largest city, Lubumbashi, and the main seaport, Matadi. The work will mainly focus on improving water production capacity, modernising the distribution system and financing individual connections and collective distribution systems.

The second element of the project aims to support sector reform, capacity building and improved governance. This is designed to add to the sustainability of investments funded under the first part of the project, and will help REGIDESO to achieve what are considered to be key aims for the utility: operational and financial viability. The work will also help stabilise investments from other donors and enable it to spread rehabilitation to other areas of the country using cash from the profitable centres, bringing water to cities that are not within the scope of the first part of the project.

The background to the country's requirement for such help is complex: the resource-rich DRC has suffered widespread and well-publicised problems despite the abundance of raw materials such as gold and oil. DRC's formal economy virtually collapsed over the course of two decades of mismanagement and conflict, and the country's per-capita gross domestic product (GDP) is one of the lowest in the world, just \$139 in 2006.

The country's years of war have caused significant harm to its

infrastructure, which was neglected and in many instances destroyed, and the Bank describes many institutions as being 'in shambles'. An initial war in 1996 was followed by the second Congo war, which started in 1998 and formally ended in 2003, and is described as the largest conflict in modern African history. Since 2001, however, with support from the Bretton Woods Institutions (the World Bank and the International Monetary Fund), the country's government has instigated economic, financial and structural reforms to stabilise its macro-economic situation and create a climate conducive to private

***The World Bank says its analysis of REGIDESO's performance 'shows that a public sector solution is no longer suitable to transform the utility into a viable business service that can meet the needs of the unserved population.'***

sector-led development.

There are green shoots of recovery. As well as an improving economy, the DRC has abundant water resources: a river network that is one of the most extensive in the world, and largely-untapped and probably widespread groundwater resources. Despite this, the country still has major problems in providing a water supply to its people. Today, just 11.5 million people have access to a safe water supply, 22% of the total population, compared to around 60%, on average, across sub-Saharan Africa. Franck Bousquet, a senior financial specialist on water and urban issues for central and western Africa, notes: 'We have outlined the issues – underinvestment, a lack of management, technological and financial expertise. There is a need for outside expertise from a private operator.'

The World Bank calls the state of

DRC's urban water supply services 'particularly worrisome'. In the 1970s and 1980s, a Bank report noted that REGIDESO was one of the most effective public enterprises in DRC (then Zaire) and one of the best performing public water utilities in the sub-region. REGIDESO's remarkable growth was largely financed through external grants and loans, but since 1990 its operational performance has declined sharply. As a result, the rate of water supply services coverage in urban areas fell from 68% in 1990 to 35% in 2006. This means that in the urban sector, only 7.3 million out of 21 million urban inhabitants now have access to a water supply. Most of the REGIDESO systems serving secondary cities are no longer operational, due to the effects of war, lack of investment and maintenance, and the suspension of aid.

Between 1989 and 2006, despite the considerable growth of urban areas, the number of active connections decreased by 8% and the volume of water sold reduced by 10%. Over the same period, the number of connections per kilometre dropped from 36 to 18.

The very low level of coverage and access rates are the main obstacles to providing sufficient water for all urban residents. M. Bousquet notes: 'In terms of the access rate, 22 is one of the lowest in sub-Saharan Africa, where the average is 65%.' For this important indicator, he says, REGIDESO 'is on the top of the bottom'.

REGIDESO is supposed to produce and distribute water in 94 centres, including all major cities, administrative centres and towns. By the end of 2006, just 60 of the 94 were working. Twelve were out of order, 11 had insufficient equipment to operate, and 11 had had their production capacity crippled by the war. Part of the problem is that the three major

cities covered by the initial phase of the project represent 72% of the utility's turnover and 79% of its active customers.

The network's efficiency is 61% (comparing the amount of water produced to that being sold), in contrast to 80% in Senegal, 84% in Cote d'Ivoire, and 83% in Burkina Faso. Network losses are in the region of 20m<sup>3</sup>/day/km compared to 9m<sup>3</sup>/day/km in Senegal, 6m<sup>3</sup>/day/km in Cote d'Ivoire, and 7m<sup>3</sup>/day/km in Burkina Faso. Under a third of active connections have a working meter, and sales and billing data are said to be uncertain and unreliable.

### Revenue collection

REGIDESO also has a poor record in collecting money owed – the level of dues recouped is said by the World Bank to be 'by far the worst' in sub-Saharan Africa, with a collection rate of 49% of billed amounts (compared to 98% in Senegal and 95% in Burkina Faso in 2006).

The utility has faced particular problems in obtaining payment from public institutions, known as Instances Officielles (IOs) – particularly the country's decentralised public entities. As of 31 December 2006, 81 percent of IO's water bills were unpaid, equating to Fc116.6 billion (\$151.429 million) out of a total of Fc143 billion (\$185.714 million). The total deficit represents 1.5% of REGIDESO's operating costs, 43% of its turnover, which makes the utility's sustainability problematic. M. Bousquet says: 'An important objective of the project is that the state pays its water bills.'

Perhaps unsurprisingly, a World Bank review of the utility's accounts showed that its finances have steadily worsened over the past decade, and that it has a chronic operating deficit. REGIDESO also has a substantial debt burden, identified in 2006 as standing at \$131 million, which it is simply unable to service because of inadequate revenues. Operating costs represent 166% of turnover, mainly because staff expenses are very high at 35% of turnover in 2006, and provisions for the unpaid IO debts.

Water tariffs are similar to others in sister countries in the sub-region that tend to have financially self-sufficient utilities. The average tariffs in Côte d'Ivoire and Senegal are \$0.70/m<sup>3</sup> and \$0.79/m<sup>3</sup>. However, REGIDESO's average water tariff of Fc315/m<sup>3</sup> (\$0.41/m<sup>3</sup>) is below the cost price of Fc397/m<sup>3</sup> (\$0.52/m<sup>3</sup>) and (as indicated) the category that represents the highest percentage of turnover, the IOs, also has the lowest collection rate, which means its payments cannot subsidise other user groups as it ideally would.



**Rubbish and sewage on a street in Congo's capital, Kinshasa.**  
Credit: Reuters / David Lewis

### Staff costs

The proposed project intends to reduce staff costs (the utility is significantly over-staffed) and combat leakage to drive down the production cost, which is recognised as another of the major issues that REGIDESO faces.

The World Bank analysis of the utility found it had a weak internal decision-making process, budgetary and control system, inventory management and staff management system. While REGIDESO is theoretically autonomous, the Bank found that management decisions on such issues as procurement and staffing had 'not been immune to interferences from the line ministry and other political actors'.

The staffing problem is considered to be a significant factor in the utility's woes. As of October 31 2008, REGIDESO had 4803 staff and around 247,000 active connections. The World Bank document notes: 'Benchmarking it to other performing water utilities in the region and using any classic ratios (such as staff/connections, turnover/staff, and sales per m<sup>3</sup> per staff) clearly indicate that the utility is overstaffed. For example, the current ratio is 51 active connections per agent, versus 371 for the state water utility company in Cote d'Ivoire (SODECI), 120 for the state water utility in Mali (EDM), 116 for the state water utility in Burkina Faso (ONEA), and 309 for the state water utility in Senegal (SDE/SONES).'

This means REGIDESO's staff expenses are around 35% of turnover, rather than the expected 20 to 25%. Further Bank analysis of REGIDESO staff according to their professional category showed a clear distortion: field staff represent only 25% of total staff numbers, a percentage that would

normally be much higher – field staff in Mali and Cote d'Ivoire represent 42% and 62% of staff, respectively.

The utility's executive category, in contrast, makes up 29% of its numbers, compared to 4% in Cote d'Ivoire and 10% in Mali. The country's poverty reduction strategy paper and priority action plan stress the need to carry out water sector reform to sustainably improve the water access rate in the country.

Reforming REGIDESO is part of a broader public enterprise reform being undertaken in the DRC, which has speeded up since the 2006 presidential elections and the appointment of a new government in March 2007. Four laws that allow the state to disengage from public enterprises, and enable more private sector participation, were promulgated in July 2008.

The World Bank's analysis of REGIDESO's performance and its inability to turn around its worsening financial and commercial situation for the past decades, it says 'shows that a public sector solution is no longer suitable to transform the utility into a viable business service that can meet the needs of the unserved population.'

### Need for reform

A diagnostic study undertaken as part of the project confirmed this view. This work, prepared and endorsed by the key stakeholders agreed that, given the current state of the sector, feeding in more funds without reform was not a viable option.

A number of alternatives were investigated during project preparation, and their potential impact discussed with stakeholders. The recommended option, which was endorsed by the DRC government and has emerged

from in-depth preparatory studies, involves setting up a management contract with a private operator for a five-year period (a PSP).

This conclusion, adopted by the DRC government, chimes with a recent World Bank review of around 65 PPPs, which shows most have performed satisfactorily and have significantly improved access, service quality and operational efficiency.

The proposed PPP builds on lessons learned in previous projects in the region, taking a lower risk approach through use of a management contract, and taking careful consideration of important design issues such as staffing, contractual targets, direct management of investment funds by the operator, and an emphasis on capacity building.

M. Bousquet notes: 'The type of contract proposed is a management contract. The type of risk has nothing to do with the access rate. The company will not be providing finance so it is not an issue – the tariff is typically an issue.'

The DRC government has been working on a number of key initiatives over the past couple of years to address the challenges faced by the water sector, and with help from the World Bank, determining which risks simply could not be borne by the private sector. In 2006, through its Steering Committee for the Reform of State-owned Enterprises (COPIREP), it opted to explore various types of PPP arrangement for the urban water sector, in order to restore REGIDESO's financial stability and strengthen its commercial and management functions.

The resultant action plan, approved in February last year, had input from an in-depth consultation with key stakeholders including ministries, the utility's management and union representatives.

The government also moved to solve the problem of the non-paying state agencies in 2007, setting up a working group comprising representatives of REGIDESO and the country's Ministry of Budget to prepare an action plan aimed at ensuring these bodies pay their water bills regularly. The working group, with support from a consultant, prepared a detailed action plan presenting key actions to be funded to address the issue.

Acting to reduce bloated staffing levels, the government has also recommended that a severance programme to reduce the wage bill by about 15% should be prepared and implemented as part of the overall reform. An internal committee within the utility, gathering managers and unions, has been working since April 2008 on preparing this programme,

again supported by a consultant. This 'retrenchment' will be completed before the private operator takes over to avoid any negative associations.

On 4 August, 2008, the DRC government confirmed its commitment to carrying out the national water utility reforms, including tackling the retrenchment issues of redundant personnel.

On 5 November 2008, the government sent the Bank a Sector Policy Letter, which set out its sector strategy and confirmed its commitment to adopting a number of policies: an action plan that would ensure public agencies' water bills are controlled and paid on time; ensuring REGIDESO's balance sheet is restructured and cross debts cancelled; and reducing the number of personnel in REGIDESO. It also confirmed the decision to contract a professional operator to run REGIDESO for five years under a management contract and its transformation into a commercial company under the new legal framework for public enterprises.

Provincial self-government was re-introduced at the 2006 elections, and the country is currently divided into ten provinces and one city. However, decentralization has not yet reached local government level and key aspects of fiscal intergovernmental relations and administrative decentralization are not yet regulated, creating great uncertainty over the operation of decentralized institutions, which the Bank feels is unlikely to be resolved in the short term.

In January 2007, the DRC National Assembly adopted a decentralization law that will mean, instead of the current 11 provinces, the country will be split into 26 provinces, including the city-province and capital Kinshasa. Managing water services by a single utility is consistent with the lack of provincial capacity and resources, says the Bank, and it would not be appropriate at this time to agree to dismantle the water utility.

M. Bousquet stresses that full privatization 'is not an option in the current state sector, and in any case it would not raise enough interest.'

#### **Drive for decentralisation**

The proposed reform is seen as a pre-requisite for a more extensive reform involving decentralisation and private sector participation. In coordination with other donors active in the sector, and under the leadership of the Ministry of Energy, the project will finance studies to gather recommendations on concrete ways to organise the sector that fully take account of decentralisation.

Reducing governmental and

managerial interference will be critical in enabling REGIDESO to regain autonomy, the World Bank notes in its report, and achieving this is one of the key features of the proposed project. Its governance strategy will provide a clear and stable legal and institutional framework for the management contract, with well-defined oversight responsibilities channelled through a single focal point.

To achieve this, REGIDESO will be made into a 'société commerciale' with operations entrusted to the private sector as outlined above. The contract for the private sector operator, which has been drafted alongside the bid documents, provides incentives for it to achieve specified technical, commercial and financial goals. 'One of the main objectives of the management contract is to restore financial viability [to the utility]. There is some appetite in the private sector for that,' M. Bousquet notes. How much will be known at the end of the procurement procedure, which has not yet begun.

The operator will be set clear performance targets, which will be met by a general manager, technical director, commercial director and human resources director, who will be assigned by the operator. Independent financial and technical auditors will also be paid for as part of the project to measure and review the operator's performance.

A \$7 million repair, replace and rehabilitation fund will be allocated to enable minor equipment and works to be bought to enable the utility to reach its performance indicators across a variety of areas including replacing or repairing connections and meters.

A communication programme, costing at \$3 million, will also be used to ensure civil society and the principal stakeholders fully understand the objectives of the reform, improve bill collection and strengthen good governance, promote a strategy for sanitation, and to introduce hygiene and behavioural changes to prevent the spread of HIV/AIDS in selected cities.

Further funds have been allocated to build the capacity of the various ministries involved in the water sector, as well as REGIDESO itself, in fulfilling their roles. M. Bousquet styles it a 'pragmatic' contract design given the current world financial crisis. The target is to restore REGIDESO to financial viability within five years through the complex mix of measures being undertaken. There is a 'strong framework agreement, and strong monitoring,' M. Bousquet concludes. 'It is a comprehensive water sector reform.' ●

# Security solution for Israeli city

The first stage in a comprehensive security programme has been implemented at a major Israeli city. **LIS STEDMAN** heard about the approach from the company providing the programme, Whitewater Security.

**Whitewater Security, a subsidiary of the Whitewater Technology Group, has successfully completed the first part of a three-part programme to protect the drinking water systems in a major Israeli city.**

The company's approach combines an individually-tailored security plan with cutting-edge tools and expert training that enables water utilities to take full control, online and in real time, of all aspects of their water systems.

The aim of the company's programme is to protect a utility against both deliberate and accidental contamination, covering all aspects of water crisis management. An advanced decision support system helps in the planning of system design and component placement, as well as damage control in the event of actual contamination.

Based on an in-depth needs analysis, the solution is custom designed and implemented by some of the world's leading security experts. Whitewater Security CEO Dovev Levinson explains: 'In general there is a team of six to eight people conducting a vulnerability assessment. Each one is an expert in a specific field such as water monitoring, water quality, water engineering – water supply – physical security, electronic security, perimeter security, cyber attack, information security, and on the procedures for an emergency response, command and control systems and IT in general, as well as expertise in hydraulic modelling.'

The aim is to minimise infrastructure vulnerability and ensure that customers receive a continuous supply of safe, high quality water. Whitewater Systems says it is not a coincidence that the first company to offer such a completely-integrated and all-encompassing solution is based in Israel, which is globally respected for its expertise in both security and water technologies.

It is an expertise honed by decades of defending its population against terror threats in general and against the water supply in particular. Whitewater uses expertise from both fields, leveraging hands-on team knowledge gleaned during years of military experience and working closely with Israel's national water

utility, Mekorot, and Magal, an internationally-recognised security company.

During this pilot project, Whitewater Security and Mekorot were joined by the Technological Research Institute of Ben-Gurion University and the Israel Standards Institute – leaders in the area of international standards for water safety. The first phase of the project – vulnerability assessment – evaluated the vulnerability of the entire area for which the municipal authority is responsible. This stage involved identifying critical locations, evaluating all aspects and components of the system, and mapping threats – including the probability of

*'The process of risk assessment is a routine... Threats are changing. Risk assessment deals with both intentional and unintentional risks, and both have processes.'*  
**Dovev Levinson, Whitewater Security**

occurrence, consequences and the feasibility of any proposed solution.

The first stage has now been successfully completed. Mr Levinson says: 'The team conducted a six-week vulnerability assessment, which included a site survey lasting a few days, then meetings with each of the parallel professional key contract personnel. After that, it took four weeks to collate the information. The whole process took two months.'

There were criteria for each aspect that was examined, Mr Levinson explains. For example, for physical security, checks were made to determine whether a particular site was open to the public or not, or out in the desert. Each parameter was given a specific rating that resulted in an overall grade for each site. 'For other fields it worked differently,' he explains. 'There were a few things it was not possible to be quantitative about, such as the quality of things. Ultimately we had a table that listed all the risks we had found, and the severity of each one, multiplied by the potential effect. This was a common approach in every field.'

Each risk was then numbered in order of its assigned risk factor, probability and effect, from one to 100.

'It gives the decision-makers in the water utility a very clear picture of their organisation, and what is more and what is less important. One of the problems with risk assessments is that often they give too much information and without guidelines it is difficult to know what to do first, and what would have more effect in the process of risk management.'

The report also included recommendations about what the utility should do about the conclusions of the vulnerability assessment. 'We covered each and every aspect of the utility,' Mr Levinson says. 'This is not usual because often there is a consolidated physical security assessment but ours is much wider. It also indicates the connections between the monitoring system and the physical security system.'

The report then took two weeks to edit, incorporating comments from the utility. 'It is very important for our experts to involve the utility personnel,' says Mr Levinson. 'They should feel part of the process of risk assessment – they have the most important knowledge of the system and if you do not ask questions about what happened in the past, the risks and procedures, who knows how to start the generator, you will not be able to provide a good report.'

After further editing the report was published. It is essentially a manual through which the utility can apply the security programme. The company will now develop a tailor-made security programme for the city, followed by the third and final stage –



implementation and support.

'We are now implementing the system, and when we are finished we will check the vulnerabilities that we found again and see if our programme did solve the main problems and if there are any new ones that perhaps we did not identify or did not think were important before, and we now think differently. The process of risk assessment is a routine,' he emphasises. 'You check, you see if other steps are needed according to the situation. Threats are changing. Risk assessment deals with both intentional and unintentional risks, and both have processes.'

Conventional terror has less effect, he notes – but adds: 'Terrorists are always trying to find new, creative ways to wage unconventional terror.' There are other potential issues deriving from accidental contamination. For instance, the encroachment of industries upon urban areas poses an additional risk of industrial pollutants entering the water supply. Natural disasters are also becoming more frequent as climate change bites. Operational problems can also have knock-on effects on water systems – the company cites the Milwaukee contamination incident, when *Cryptosporidium* entered the water supply and over 100 people died. 'This approach is more relevant than ever,' Mr Levinson notes. It is hard to disagree. ●

### The security hardware

Physical security monitoring includes camera surveillance, physical and electronic barriers and similar equipment to safeguard assets from physical attacks. Placed at critical locations such as pumping stations and main valves, the design of this equipment is based on an approach developed through cooperation with water utilities.

Water quality monitoring includes real-time, online monitoring and control devices that are strategically placed and integrated throughout the system.

A sophisticated decision support system (DSS) module, based on a hydraulic simulator, supports the decision-making processes. This operates in two modes: planning and real-time. Planning mode supports planning of the placement of monitoring sensors and control valves, according to advanced optimisation models.

Real-time mode, triggered by Whitewater Security's SCADA system, operates in the event of contamination. It predicts the amount of contamination over time, and its spread (viewed on GIS displays), and generates a recommended operational set of actions to minimise damage.

## Competition and creditworthiness: prospects for England and Wales

Utilities in England and Wales are rated by credit rating agencies as part of their business financing activities. The sector regulator is looking to introduce greater competition in the water industry by separating out the various functions of utility operation. **MARK DAVIDSON** of Standard & Poor's Ratings Services discusses the effects of enhanced competition of the creditworthiness of the UK water sector.

**Since economic regulator the Office of Water Services (Ofwat) issued its paper 'Outcomes of Ofwat's internal review of market competition in the water sector' in April 2007 as part of its review of competition in England and Wales, much of the debate has focused on how competition might be increased in the water sector and whether it can successfully create value for the industry and consumers. Meanwhile, from Standard & Poor's Ratings Services' perspective, heightened competition in the water sector could affect our view of business and financial risks in the sector – and therefore our ratings on water utilities in England and Wales.**

The regulator proposes that competition be enhanced through unbundling the various activities that comprise the sector, as has already occurred in the former monopolies of telecommunications, gas, and electricity. Consequently, a rated entity's new structure may result in changes in its risk factors, which may in turn lead to a reassessment of credit quality. Utilities could, for example, withdraw from competitive segments to focus on regulated network activities. This could, all else being equal, maintain our view that the sector is exposed to low business risk. However, if expansion into competitive segments were to lead to greater cash flow volatility than that of utilities with purely monopolistic activities, the result could be a greater divergence of ratings within the sector.

### Competition as a driver of efficiency and innovation

Under Ofwat's proposal, contestable markets would be vertically separated from natural monopoly activities in both water and wastewater. In the water and sewerage sector, eight main segments constitute the 'value chain'

(see Figure 1). The regulator could enhance competition in the contestable segments – both upstream and downstream – while the network segments could remain regulated monopolies.

According to Ofwat, the majority of the water and sewerage value chains are composed of upstream (such as water resources and treatment) and downstream retailing activities, which have been identified as potentially contestable. In addition, Ofwat has said that several separate markets within the wider water and sewerage industries are or could be contestable, such as resources and abstraction, on-site effluent treatment and water and wastewater treatment.

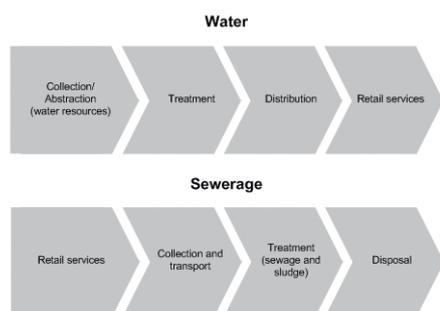
### Potential cost benefits

As a first step, Ofwat proposes that all water-only companies and water and sewerage companies are required to report disaggregated accounts for each element of the value chain from 2010. This will create the cost transparency that Ofwat needs to set price limits for each segment, which it aims to do on a trial basis during 2010–2015. Ofwat suggests that formal price control separation would then be implemented from 2015.

We at Standard & Poor's note that Ofwat views competition as potentially providing cost benefits to consumers while also driving the efficiency and innovation required to tackle long-term challenges such as climate change and security of supply. Furthermore, last February, the government appointed Professor Martin Cave of Warwick University to lead an independent review of the costs and benefits of competition in the water and wastewater sector. In his initial comments, Mr Cave expressly linked competition with meeting the 'challenge of delivering large capital programs on the basis of sustainable and low-cost finance'.

### Current water ratings

The majority of water utilities in



Source: The Office of Water Services.  
© Standard & Poor's 2008.

England and Wales achieve ratings of 'A-' or 'BBB+', and nearly all have a stable outlook (see table). The primary underpinning of these ratings is our view of low business risk in the sector, which is characterised by the utilities':

- significant share of profits from low-risk regulated activities
- established and relatively transparent regulatory process
- strong and stable operating performance and
- strategic focus on owning and managing regulated water and sewerage assets.

Nevertheless, we at Standard & Poor's view the sector as having relatively high financial risk and the utilities as having:

- relatively high financial leverage
- large mandatory capital expenditure programmes
- generally negative prefinancing cash flow and
- significant ongoing funding needs.

The relatively low business risk means that, for a given rating, a water utility can sustain more leverage than a company in a higher risk sector. To maintain ratings in the 'A/BBB+' range, we expect rated UK water utilities to maintain funds from operations (FFO) coverage of adjusted debt of about 10% to 15%.

By contrast, UK-based Scottish and Southern Energy PLC (A/Negative/A-1) – which operates in the unbundled energy market and has about 40% of earnings from unregulated, competitively exposed segments – requires FFO to adjusted debt of about 20% to sustain its ratings. Furthermore, in the competitively exposed UK telecommunication and retail sectors, telecomms company BT Group PLC (BBB+/Negative/A-2) had an actual FFO to debt ratio of about 36% (for the year ended 31 March 2008), while the ratio for supermarket chain Tesco PLC (A-/Stable/A-2) was about 25% for the 12 months to 23 August 2008.

Therefore it follows that, if business risk for rated water utilities in England and Wales increases – for example if enhanced competition increases the

Figure 1: The water and sewerage value chains

## Rated water entities in England and Wales (as of 13 November 2008)

### Water and sewerage companies

Kelda Group PLC  
Northumbrian Water Ltd.  
Severn Trent PLC  
South Staffordshire Water PLC\*  
Sutton and East Surrey Water PLC\*  
Three Valleys Water PLC\*  
United Utilities PLC  
Wessex Water Services Ltd.

### Corporate securitizations

Anglian Water Services Financing PLC  
Dwr Cymru (Financing) Ltd.  
South East Water (Finance) Ltd.\*  
Southern Water Services (Finance) Ltd.  
Thames Water Utilities Finance Ltd.

\* water-only companies

### Corporate credit ratings

A-/Watch Neg/A-2  
BBB+/Stable/--  
A/Stable/A-1  
BBB+/Stable/A-2  
BBB+/Stable/--  
A-/Stable/--  
A-/Stable/A-2  
BBB+/Stable/--

### Underlying senior/junior tranche ratings

A-/BBB  
A/BBB+  
BBB/--  
A-/BBB  
BBB+/--

volatility of revenues from the contestable segments – utilities in the sector would, in our view, likely need to reduce their financial risk in order to mitigate the effect on the ratings. Indeed, in this scenario, if the financial risk were to remain broadly unchanged, the ratings could be lowered, all other things being equal.

### Ratings currently based on consolidated analysis

Certainly, the potential future organisational structure of rated water utilities in an unbundled water market open to enhanced competition of course remains uncertain, and therefore a statement on the possible direction of ratings is premature. Currently, our ratings take a consolidated approach by assessing the financial and business risks of the consolidated group to determine the corporate credit rating (CCR). When assigning a debt rating for a particular entity within a consolidated group, the debt rating is notched up or down, if necessary, from the CCR depending on the characteristics and seniority of the debt instrument.

In theory, if rated water and wastewater utilities in England and Wales retain ownership of all segments of the value chain, pressure on the CCRs could develop if the contestable segments show greater revenue volatility than those segments of the value chain currently exhibit. However, it is not yet clear whether existing corporate ownership structures would continue. Utilities could withdraw from the contestable segments to focus on regulated monopolistic segments, which could, all else being equal, maintain our view that the sector is exposed to low business risk.

Conversely, if unbundling were to result in sector consolidation, however, those utilities that expand their presence in contestable segments would be expected to have a greater business risk than utilities that operate only in

monopolistic segments. If expansion into contestable segments were to lead to greater cash flow volatility than that of utilities with purely monopolistic activities, the result could be a greater divergence of ratings among utilities in England and Wales.

### Ofwat's plans to subdivide the asset base

In addition to legal and accounting separation, Ofwat's plans include a subdivision of a utility's regulated asset value (RAV) between each segment of the value chain. The RAV represents the value of the investment on which the utility earns a return through the payment of water rates.

The potential impact on each segment's leverage could affect the ratings. Separating the RAVs and associated cash flows of the contestable segments would, in our view, increase leverage at the regulated networks unless there was a corresponding separation of debt. However, the implications of subdividing a utility's RAV may present difficult implications because the debt of contestable segments could lie outside the regulatory ring-fence, which offers a number of advantages including a lower cost of debt. In addition, debt or RAV separation could trigger covenant breaches in loan documentation.

### Strong ratings needed to fund capital expenditure

Retaining access to relatively low-cost financing is more important to water utilities than ever before, especially considering the current difficult market conditions. Indeed, the regulator estimates that total investment by the water utilities will increase to about £27 billion (\$39.9 billion) in 2010-2015, from about £20 billion (\$29.6 billion) in 2005-2010.

Certainly, such access will be more easily facilitated if ratings within the sector remain healthy. ●

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# Regulatory risk assessment roll-out for England and Wales

Drinking water quality regulation in England and Wales is based around self monitoring by water suppliers accompanied by validation of that monitoring by the water quality regulator, the Drinking Water Inspectorate.

**ANNABELLE MAY** and **JENI COLBOURNE** look at how the regulatory framework was recently extended to incorporate risk assessments as a means of implementing the WHO Water Safety Plan approach.

**Since the privatisation of the water industry in England and Wales in 1989, drinking water quality regulation has been founded on the 'self regulation' model. To enable self regulation to work in the context of an industry intrinsically linked to the protection of human health required the setting up of robust systems of independent scrutiny, putting the quality of drinking water beyond question in respect of public confidence.**

The water industry in England and Wales was privatised after a long history of inadequate funding under a public regime. In order for privatisation to take place, a comprehensive regulatory regime was established comprising three regulators – the Drinking Water Inspectorate (DWI), the Water Services Regulation Authority (Ofwat) and the Environment Agency (EA). The DWI regulates drinking water safety and quality and therefore is responsible for verifying whether human health is being protected through the industry's compliance with regulatory requirements, including the standards set in the EU Drinking Water Directive, as well as holding water companies to account when things go wrong.

The DWI has 27 technically qualified inspectors and offices in central London. In addition, they have ten support staff managing information and data systems. This makes a total complement of 37 staff regulating a water industry made up of 25 utilities plus a small but increasing number of new entrants (licensees and inset appointments) collectively delivering water supplies to 99% of the population of England and Wales (53,635,479) via 1224 water works, 4522 service reservoirs and 338,546 km of water mains (2007 figures). The total cost of running the regulatory body is

approximately £3 million (\$4.2 million) annually which includes a research budget of £800,000 (\$1.12 million) managed on behalf of the Department for Environment, Food and Rural Affairs, the part of government with responsibility for water. The DWI is a lean organisation because it prioritises its work where it is most beneficial to the public interest. For this regulator, public confidence in drinking water, compliance with the EU Drinking Water Directive and the protection of human health are its key objectives.

## Self regulation

The drinking water quality laws and regulations are set out in primary legislation in the form of the Water Act 1991 (as amended by the Water Act 2003) and in secondary legislation in the form of the Water Supply (Water Quality) Regulations 2000 (England) and 2001 (Wales) (Amendment) Regulations 2007. In addition there are 'Directions' issued to the industry which are made under the Act. Through this legislation, the DWI is afforded a complete range of regulatory powers extending from advice and guidance, the making of recommendations, through to enforcement and prosecution. These powers have all been exercised by the DWI since its creation, although the pattern of use has changed over time. One model for using regulatory powers is depicted in Figure 1, with cooperation, negotiation and discussion being the most frequently used. These are collectively known as 'soft regulation' which, if successful, negate the need to use 'harder' regulatory tools, with prosecution being reserved for use only in the most serious of circumstances. Guidance on best practice is developed in collaboration with industry, thereby ensuring that the industry has full

ownership of operational matters.

Self monitoring is the foundation of the regulatory process adopted in England and Wales. The drinking water regulations set out in detail the duties of water companies in respect of how, when and where to test the quality of public drinking water supplies. Many of these requirements derive from the European Drinking Water Directive. The legislation requires water companies to report all water quality test results on a month by month basis to the DWI. So, how does DWI approach the task of being confident that these results are accurate?

To rely on self monitoring, there must be systems of checking that the legislation and guidance have been followed consistently by the industry. As well as auditing all water company laboratories, including those that are outsourced, DWI uses a technique known as vertical audit which targets a set of randomly selected samples on a regular basis. The 'vertical audit' is akin to establishing a chain of evidence, checking that scheduled samples were in fact taken at the scheduled place and time in the correct manner and then transported correctly to the laboratory, stored and tested according to recognised standards of analytical technique with appropriate quality control and finally reported openly via the company's information system. At each step, records and other evidence are scrutinised and best practice suggestions are made, or on finding a deficiency, formal recommendations backed up by enforcement if necessary. The DWI through this process does not therefore have to take samples of public water supplies itself and the monitoring costs are borne by the water suppliers and recovered as part of the price charged to customers.

When a result of a test exceeds the standard for a parameter under the self

**Figure 1: The Enforcement Pyramid for the England and Wales based on the Ayres and Braithwaite (1992) model**



regulation regime the water company must take action. Equally, any other operational event that may have an impact on drinking water quality or supply must be reported. The duty to rectify a quality problem is imposed upon the company with the actions being reported to the regulator. The onus is thus on the company to provide evidence that the action taken was appropriate, timely and that the remedy will reduce the risk of any recurrence of the problem. The regulator's role is to assess the company's action independently and, where necessary, to require additional or further action.

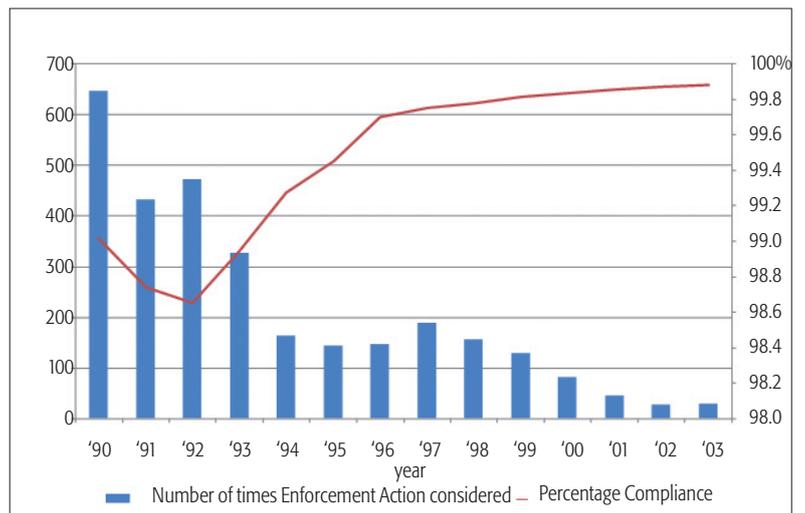
Self regulation has not resulted in any lessening of regulatory powers, rather it has focussed the use of enforcement powers where they are most needed to effect a permanent improvement in drinking water quality. Evidence that water quality has improved can be seen in the pattern of use of enforcement powers. Over time this has changed – in the first year of DWI operation, enforcement action was considered 648 times whereas 14 years later it was only necessary on 29 occasions (Figure 2).

The economic regulation of the water industry has been much studied and written about. The regime of self regulation of drinking water quality feeds into the water price review process of the economic regulator, Ofwat, by identifying the component parts of the Drinking Water Quality investment programme which is part of water companies' five year business plans. Before the start of each five year period companies have to specify their plans for achieving compliance with drinking water standards where there is a risk of failure. The companies have to produce evidence of the need for schemes such as quality data and other technical information as set out by DWI. If certain criteria are met, the DWI will make the scheme a 'statutory' duty on the company. Ofwat concerns itself then with the cost of delivery, not the justification, for each scheme when setting companies' price limits. The important aspect of the self regulation regime is that it is the water companies that own their improvement programmes within the context of their business plans, thereby ensuring that compliance with standards and therefore protection of public health is at the heart of the business.

### Risk assessment

Changes were made to the drinking water regulations in 2007 to clarify and strengthen the duties of water companies to adequately treat and disinfect water before it is supplied to

**Figure 2: Number of times enforcement action considered by DWI relating to supply zones and percentage compliance with drinking water quality standards**



consumers, and to introduce new provisions related to risk assessment and risk management. The essence of these new provisions is for companies to carry out a comprehensive risk assessment of each of their water supply systems from catchment to tap, identifying hazards, quantifying any associated risk and instigating risk mitigation measures. The new regulations require that further action must be taken if risk mitigation is insufficient to address the identified risk. As well as providing companies with an opportunity to demonstrate that mitigation measures are robust, a sound risk assessment and risk management process serves as due diligence in the event of an incident occurring. From the point of view of the regulator, risk assessment is a regulatory tool which is comprehensive and capable of dealing with all types of hazards, not just those which are regulated for by means of standards and monitoring. For example, the lack of an adequate power supply poses a risk to drinking water quality, but it is one that cannot be controlled by testing.

By introducing a regulatory requirement for companies to carry out risk assessments, the UK government formalised its adoption of the Water Safety Plan (WSP) approach as its policy for the provision of safe drinking water. In 2004, the World Health Organisation (WHO) published its third edition of the Drinking Water Guidelines (the Guidelines) which advocated 'Water Safety Plans' as 'the most effective means of consistently ensuring the safety of a drinking water supply... through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer.'

The DWI supported the launch of the Guidelines and advocated the approach encouraging all companies to adopt WSP principles. This informal cooperative approach, which took place over a period of about three years, enabled DWI and the industry to collectively gather the evidence

required to underpin the policy recommendation and resultant change to regulations to incorporate a risk assessment and risk management approach. The first formal Risk Assessment Reports for all of water supply systems in England and Wales were submitted by companies to DWI by 1 October 2008.

One of the overarching principles of WSPs is that they are unique to the management system of the water supplier, therefore, no one reporting format was prescribed, rather a set of minimum information requirements were published by the DWI. A key requirement was that companies must declare any significant risk identified and the action(s) the company had or will put in place to mitigate that risk in the short, medium and long term.

Almost 800 risk assessment reports were submitted to DWI covering all treatment works and their associated supply systems within England and Wales. Initially, each report was independently checked by DWI for completeness in respect of the minimum information requirements and a check was made that all water assets (treatment works, service reservoirs and water supply zones (distribution systems)) had been risk assessed. The quality of these reports varied greatly, sometimes this was due to a misinterpretation of the information (reporting) requirements, but in other instances it reflected the quality of the WSP from which the company was extracting the information.

All deficiencies were highlighted in an initial written response to companies, along with a deadline for resubmission. Although assessment of the reports was a complex and resource intensive process because of the variations in detailed methodology, even at this early stage it is evident that the reports have provided the regulator (DWI) with valuable evidence to support its own parallel 'better regulation' changes to the way in which it exercises its day-to-day regulatory functions. The reports and the information they contain are now being embedded into DWI databases

and operating procedures for compliance assessment, audits, inspections and enforcement.

The medium to long term improvements identified as required in Risk Assessment Report Action Plans have been included in the business plans of companies submitted to Ofwat for inclusion in the next five-yearly water price review (PR09 investment programme) where they fit Ofwat's criteria for funding. Those components of the action plans which do not qualify for funding in this way still have to be carried out by the companies as part of regulatory compliance. To ensure that all components of the action plans are delivered, DWI has the power to serve a 'Notice' on a company specifying the control measures to be carried out, and by when, to mitigate the identified risks. In this way there is therefore no possibility of an identified risk of supplying water that would constitute a risk to human health falling outside the delivery responsibility of the companies.

Additionally and importantly the WSP approach recognises that there can be a wide range of different types of effective control measures, and investment in water treatment is not the only or necessarily desirable solution. In many instances, the documented control measures are improvements in catchment control, monitoring, the performance and maintenance of existing assets, and enhancements in competence of staff. Through the application of water safety plan methodology in a regulatory framework, companies have been able to more clearly identify, document and communicate actual and potential risks, and commit openly to delivery of appropriate cost-effective mitigation measures using a process fundamentally owned by each company. This ownership, understanding and communication by the water supplier is central to the task of consistently delivering safe drinking water in a way which maintains public confidence.

Overall, the regime of self regulation of drinking water quality together with its link into the system of economic regulation of the industry has produced a framework that has enabled water companies to achieve and maintain a steady and affordable improvement in drinking water quality. The regime has kept the costs of drinking water regulation (and the financial cost to the consumer) to a minimum, by avoiding duplication of drinking water quality testing and targeting action on the basis of risk, and thus achieving the greatest benefit to public health. ●

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## GIS aids reporting of service disruptions

Incidents such as pipe bursts lead to wasted water and disruption, but if the location of an incident is not recorded accurately, it can also lead to substantial delays, increasing costs and impacting customer relationships. UK water utility Severn Trent Water has deployed a Geographic Information System in its customer service centre to ensure that all incident reports are accompanied by precise location references. As a result, the company can now locate and respond to faults more quickly and gather more accurate data for management reporting.

**Severn Trent Water is one of the UK's largest utility companies, supplying nearly two billion litres of drinking water a day to eight million people. The company operates in an area of more than 21,000 square kilometres and derives its name from the two significant river basins that make up the region.**

Every year, the company receives over 140,000 calls to its service centre from people reporting issues such as burst pipe and interrupted water supplies. The company has a duty to respond quickly to these incidents – but it wasn't always easy to establish precisely where they had occurred. Previously, customer agents in the service centre only had access to rudimentary address data on the computer system. If a caller was unable to provide an accurate address, it was very difficult to pinpoint the precise location of the incident. Customer agents often spent a lot of time looking at map books, road atlases and even business directories, trying to work out locations from vague verbal descriptions.

As many as 95% of incidents reported did not have a precise grid reference location and, inevitably, some jobs would be directed to entirely the wrong part of the company's area. At a more local level a misspelled road name or a wrong suburb name could result in inspectors being sent to entirely the wrong part of a city.

'Sending an engineering repair team to a wrong location is a very expensive mistake to make,' explains Dave Pearson, lead GIS architect at Severn Trent Water. 'Valuable time is lost and a lot of additional effort is wasted trying to find out the correct location.'

Severn Trent Water decided to address this problem by the introduction of a comprehensive and very flexible gazetteer service, backed up with digital maps made available to its customer agents. 'We needed a way to ensure the accuracy of the location information collected in the call centre,' says Pearson. 'By greatly reducing the probability of sending out inspectors and teams to the wrong location, we felt that we had an opportunity to improve efficiency and reduce costs.'

#### Solution and capability delivered

Severn Trent Water had been using GIS solutions from ESRI (UK) for a number of years to help it manage its underground assets. When it launched the project to deploy GIS in its customer service centre, it evaluated the latest solutions available from ESRI (UK).

'Because the solution was going to be used while callers were on the phone, it had to be extremely fast,' says Doug Cubin, GIS consultant to Severn Trent Water. 'We felt that ESRI's GIS technology would give us the fastest possible retrieval of addresses and maps. Indeed, it has lived up to our expectations and, in some areas, surpassed them.'

Severn Trent Water selected ESRI (UK)'s Intranet mapping solution to make GIS capabilities available to all customer agents in the service centre. In addition, it developed a gazetteer application based on ESRI's spatial database engine to provide customer agents with a comprehensive searching capability. Through the use of this solution, customer agents can search for maps by address, motorway

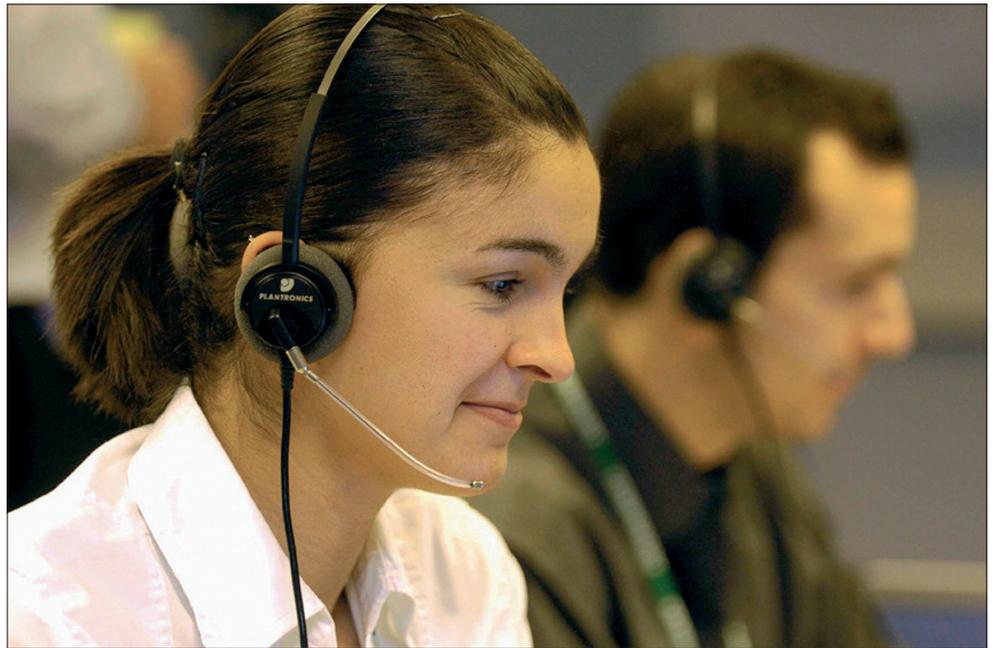
junction, schools and even the location of pharmacies and pubs / bars.

Within the service centre, the customer agents use a customer relationship management (CRM) application and follow an on-screen workflow. If a caller is not reporting an issue at his or her own home (when a precise address and postcode can be obtained), the GIS automatically opens. Customer agents then follow customer descriptions and drill down into the maps to find the right location. When they click on the map, a precise X-Y coordinate is automatically attached to the incident report, along with the postcode of the nearest address.

Severn Trent Water had the necessary skills to develop its gazetteer application in-house. However, it also took advantage of ESRI (UK)'s implementation expertise, taking advice and support from its solutions architects and support services at different stages in the project.

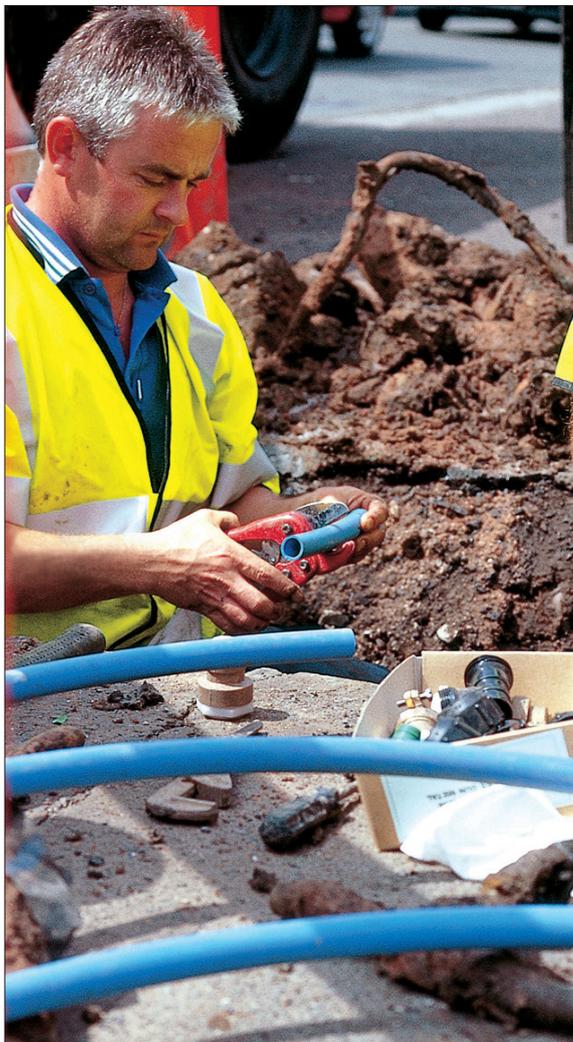
**The benefits**

GIS has quite literally transformed the way that customer agents work and has led to dramatic improvements in



**Severn Trent customer services**

**Severn Trent Water engineer on site**



efficiency. In situations such as flooded rural roads, inspectors and engineers have a far better chance of finding incidents quickly. There is less wasted time, which contributes to reduced costs and a better service for customers.

There are approximately 140,000 calls that result in a field job, many more are dealt with at the point of contact and go no further. The time taken to record a customer's (incident) location has more than halved, reducing the time taken over the average transaction in the call centre. 95% or more contacts that do result in a field visit now start life with an accurate grid reference before they leave the service centre. Also, addresses are spelt in a consistent manner and the job management system is automatically populated with accurate address information and grid reference.

As a result, there has been a significant fall in the number of incorrect locations reported by the field teams. Every year in June, Severn Trent Water plots the location of incidents on a map to help it analyse any patterns and clusters. This process is extremely important for reporting to economic regulator Ofwat and for making infrastructure investment decisions. In the past, a complex process involving much manual intervention was used to map historical incidents, and it took many months to clean up the data and gain location coordinates to accompany each incident report. Now, with the use of GIS, all incidents have precise X-Y coordinates which lend themselves to automatic processing, saving many weeks of manual data cleansing time that can be applied to other quality improvements. 'To make this year's reporting a less onerous task

it really was crucial for us to get an accurate spatial reference for each incident report – and that's precisely what we have achieved,' says a Severn Trent Water consultant.

The huge success of the GIS is evidenced by the strong reaction from users. The system's intuitive interface and seamless integration with existing workflows meant that customer agents and managers quickly got used to the new on-screen mapping capability and now, don't like to be without it. 'Almost immediately, GIS became indispensable in the service centre,' explains Severn Trent Water. 'As a result, it has become a 'priority one' business system. If a hardware failure causes a system outage, it has to be fixed straight away.'

**The future**

At present, Severn Trent Water's GIS is used by 250 customer agents at one site near Coventry, with up to 40 concurrent users. However, in the near future, the company plans to increase the number of users quite significantly. It has launched a new initiative to make an adapted version of its GIS available to all employees, so that everyone can search and access accurate digital maps of the region over the company Intranet. 'Scalability is a key advantage of the GIS solutions,' says Severn Trent Water. 'We plan to expand our GIS horizontally and balance an increasingly large load across multiple servers. As a result, we will be able to make this GIS available to potentially several thousand employees located across multiple sites, and will look to ESRI (UK) for help to realise this vision.' ●

Article provided by ESRI (UK).

# Water sector reforms in Malaysia

Current changes taking place in Malaysia's water sector are part of an ongoing reform. **DATO' TEO YEN HUA**, chief executive officer of SPAN, the country's National Water Services Commission, reviews the key strategic aspects of this reform.

**The Federal Government of Malaysia has set a very clear policy direction and laid down the necessary legal and regulatory framework for the water sector reforms covering Peninsular Malaysia and the Federal territory of Labuan. Sabah and Sarawak were not included in the reform as both states had decided that they would like to carry out the reforms on their own.**

Supplying treated water to consumers involves several processes. It starts with the abstraction of untreated water from the rivers. Incidentally, more than 98% of the country's sources of raw water supply come from the rivers. Then it is pumped to the treatment plants where the water is properly treated to meet the standard set by the Ministry of Health. The treated water is then distributed to the consumers through an extensive reticulation network of pipes, reservoirs, pumping stations etc.

Currently, the country's water industry is very fragmented. This is the result of an absence of a national law or any Federal Government policy for the sector. The need for reform caused the Federal Government to amend the Federal Constitution in January 2005.

The previously uncoordinated approach adopted by various State Governments to meet the needs of water supply in their respective states had led to many problems. For many years, the problems faced by the water industry have not been effectively addressed due to a lack of funding. Two alternatives were available to the states, one is where State Governments apply for interest free loans from the Federal Government to fund the water infrastructure and use tariff revenue to cover operating expenditure. This is the solution adopted by states with tariff revenue barely enough to cover operating costs. The other model adopted by some states is through privatization, partially or totally, of their water supply functions. Naturally these

are those with operating surplus but insufficient to meet capital expenditure requirements. Unfortunately, both approaches are found to be not sustainable leading to poor maintenance, difficulty in covering costs of services, high non-revenue water (NRW) and poor services to consumers.

## Previous models not sustainable

Water is a basic necessity for every human being. Consequently every Government, developed and developing alike, would want to ensure water charges or tariffs are kept low and affordable. There are still many countries which continue to put the responsibility of water supply to their Governments. However, without a sustainable funding mechanism in place, it is indeed a very difficult task for Governments to shoulder such responsibility. With global phenomenon such as climate change and environmental pollution, the costs associated with water supply will only move up and not the other way round.

Low tariffs mean low financial means to pay for the costs of providing a good service. Coupled with the fact that investments in water supply infrastructure are capital intensive with a very long payback period, many Governments found themselves caught in a vicious circle. Consequently it is not surprising that today more than one third of the global populations are still without access to piped water.

Even in most developed countries, many are still not on full cost recovery in water supply. Full cost recovery is generally defined as one when tariffs are sufficient to meet both the operational and capital expenditures without any form of support, governmental or non-governmental, direct or indirect. In the recent international conference in Vienna organized by the International Water Association (IWA), it was reported that globally only 31% of utilities have achieved full-cost recovery. These utilities are mainly

found in developed countries. The key word here is utilities, not countries. Thus it is not surprising that for Malaysia, the problems faced by many water supply operators, including those private entities, are not unique. Some countries, caught by unsustainable privatization concessions, resorted to re-negotiating or terminating their long-term agreements when confronted with insufficient tariff revenue to meet contractual payment obligations.

One common problem faced by developing countries is the lack of a proper or an effective regulatory regime. As a matter of fact, Malaysia is amongst the few developing countries which now have a comprehensive policy and legal framework for the water services reform.

With the amendments to the Federal Constitution, the Federal Government now has the necessary policy and regulatory control and oversight over the industry. The Water Services Industry Bill and the Suruhanjaya Perkhidmatan Air Negara (SPAN) Bill were passed by Parliament in 2006 to regulate the water supply services and sewerage services and to enforce the related laws and legislations. Incidentally, Malaysia is widely acknowledged internationally as a fine example of water reform, which is not even seen in many developed countries let alone developing countries.

## Implementing reform

Malaysia's water reform is now moving into its implementation stage. Although there are some changes in the local political scene; the Federal Government continues to stick to its set target and direction for reform. State Governments who are yet to corporatize their water supply departments had been reminded by the Federal Government to do so before the end of 2008.

Incidentally, the concept of corporatization is not something new. In many developed countries, state municipalities responsible for providing water supply have long embarked on a similar exercise. Basically for utilities to be effective they need to have managerial and financial autonomy. Corporatization

will also lead to clearer accountability.

Corporatization must not be misconstrued as privatization. Though there are some similarities between the two, especially from the point that the service is no longer provided by public agencies, there are also many differences. However, the main difference lies in the ownership of the entity. Under corporatization, ownership and control remains with the Government.

There are two strategic thrusts behind the Malaysian Government's policy reforms for the water sector. First, with the policy and legal framework in place, SPAN, the National Water Services Commission, can now take the necessary action to drive efficiency and effectiveness amongst the service providers. The regulator is expected to achieve this through strict and relentless enforcement of the Water Services Industry Act or WSIA 2006. It will also cover other related players such as the contractors, plumbers, developers, consultants and the materials suppliers. Principally this is to ensure that water supply systems constructed are robust and can last a long time. As a matter of fact, some water treatment plants constructed in the early 1900s are still in operation today.

To drive efficiency and effectiveness amongst service providers, SPAN will be adopting the practice of benchmarking, both process benchmarking and industry benchmarking. By process benchmarking it means service providers will be assessed against their past years performances. This is to be supported by industry benchmarking which is to assess performance against the best in the industry, which may also include comparing with similar utilities in other parts of the world.

### Creating asset-light water operators

Another strategic thrust is to effect an expeditious transfer of loans and assets from State Governments to the Federal Government through Pengurusan Asset Air Berhad or PAAB, a wholly owned Federal Government company. The main purpose is to enable all service providers to focus on providing services to the people without having to be burdened by the issue of funding. Whilst the long term goal for the sector is towards full-cost recovery, in the immediate and medium term it would be quite impossible for the sector to fund its requirements through conventional financing facilities. As at end of 2007, total outstanding loans by state governments amounted to over RM7.6 billion (\$2.1 billion). This amount does not include loans provided under the 9th Malaysian Plan.

The incentive to transfer the

liabilities and assets is already built into the scheme whereby states that subscribe to this arrangement will benefit as Federal Government will fund the cost of constructing water dams in these states in the future. Such an arrangement definitely will benefit all states. This is a very prudent policy as water is seen universally as a basic necessity and logically it should cut across political lines.

Under the above scheme, all outstanding loans by the State Governments are to be taken over by PAAB through a novation agreement. In return, the State will transfer all water assets to PAAB at values to be negotiated and agreed. These water assets will then be leased back to the service providers at affordable rates. All future capital investments will be borne by PAAB. However, service providers are required to plan and submit their facilities requirements to SPAN under the 30-year master plan and three-year business plan. Once approved, service providers will then submit to PAAB for funding and procurement. The assessment of needs by SPAN will be done on the basis of demand projection, impact on tariffs and funding availability. However, with PAAB being a Government-backed facility owner, it will have an AAA credit rating and thus be able to raise any financing at much cheaper cost than any private companies or operators. PAAB will try to optimize its financial resources through borrowing on a longer tenure to match the asset life and thus be able to impose a lower lease rental. Such flexibility would not have been possible under the previous financing mechanism in the form of conventional loans or the BOT (build-own-transfer) or BOO (build-own-operate) long term concessions.

Privatized concession holders are authorized until the end of 2009 after which they will have to migrate to the new licensing regime. However, if it chose not to migrate, the concessionaire will continue to be authorized for the remaining period of its agreement subject to terms and conditions to be imposed in line with the objective of WSIA 2006.

Generally, long term privatization concessions are not suitable for the water sector. Even the World Bank accepted this fact. There is also no one size fits all solution. No one model can meet the needs of all countries. The political structure between countries differs.

### Raw water charges

Since raw water continues to fall under the respective state's jurisdiction, the reform can only be successful if it receives support from the state

governments. Moving forward securing sufficient raw water may require some political arrangements or socio-economic agreements between stakeholders or state or municipality governments. To create a win-win solution and to ensure state preserves raw water source, the Federal Government has decided that State Governments be allowed to impose charges on raw water. However, states must adopt a prudent approach in setting the charges as any increase will be reflected in the tariffs.

Finally, the above two institutional mechanisms will not be sufficient to ensure a sustainable industry if there is no citizen support and commitment for the reforms. In order to achieve this, the Water Services Industry Act provides for citizen participation through a body known as the Water Forum. Under WSIA, SPAN is fiducially required to designate a body representing the interest of consumers to be the Water Forum. In this regard, SPAN has designated a NGO known as the Malaysian Water Forum and one of its functions is to provide views on any tariff review.

### Conclusion

In conclusion, the policy and legal framework for Malaysia's water reforms has been put in place. Though it may take a little longer than earlier anticipated, its implementation is definitely on track. Once all the necessary arrangements in the form of corporatization and migration to the new regulatory regime are completed, Malaysians can expect to see some quantum leaps in improvements especially in terms of service levels and transparency. There will be more funds available to finance new water infrastructure as well as for refurbishment of existing infrastructure. With greater participation by citizens through the Water Forum and the culture of transparency in place, consumers' willingness to pay is expected to improve. This will then pave the way for a sustainable water sector for the country. ●

### About the author:

Dato' Teo Yen Hua is Chief Executive Officer of SPAN, the National Water Services Commission of Malaysia. See: [www.span.gov.my](http://www.span.gov.my).



# Network modelling in the state of Johor, Malaysia

Network modelling can provide an accurate representation of the operation of a water distribution system, if the model is properly calibrated. **MARK NICOL** looks at an exemplary case study in Johor state, Malaysia.

**Network modelling is an important part of designing and operating a water distribution system, and for this reason SAJ Holdings in Malaysia decided to undertake a large-scale project to construct all-mains models for the entire state of Johor. This article outlines the step-by-step process undertaken to create a model, focusing on the work undertaken in Johor as a case study of what can be achieved.**

Network models are a mathematical representation of a water supply system, using internationally recognised hydraulic principles to simulate the flow and pressure across a network. By undertaking a time-varying analysis of a system, the impact of the diurnal changes in demand and supply can be assessed and predictions made regarding the implication of altering the network configuration. The results of these studies can then be used to aid a water utility with planning future investment and determining the best course of action to improve operational efficiencies and ensure maximum return on revenue.

However, in order to ensure that the results produced by a network model are accurate and reliable, it is important that the model is fully calibrated with live data collected from the field. This will ensure that the model is a true representation of the system.

## Principles of network modelling

Constructing and calibrating models to cover a large network can be seen as a huge task. However, if the tasks are broken down into easily manageable stages, which can be followed in a step-by-step process, then the overall objective can be achieved with relative ease.

There are four main stages to constructing a fully calibrated hydraulic model: model design/build, field testing, data analysis and model calibration.

## Model design / build

There are a number of applications that a model can be used for, and therefore it is important that the model is designed to meet the requirements of the scope of the works. Models can be constructed to cover an entire system (known as all-mains models), from the water treatment plant to the customer meter, or just to cover all of the major assets in the network, such as reservoirs and pump stations, without the finer detail of the district metered areas (DMAs). These are known as strategic mains models.

The final requirements of the model will give a good indication of the type and level of detail required within the model. The more detailed and accurately calibrated a model is, the more reliable the results will be. However, the more detail required, the longer the delivery period of the model and the higher the costs will be. Therefore it is important that correct type of model is chosen for the specific project.

Once a decision has been made as to the size and detail of the model, it is important that the modeller gains a full understanding of how the system operates, in order to ensure that the model is a true reflection of the system. This is achieved through studying network plans, schematics, GIS systems, undertaking site visits and liaising with the operations and distribution staff at the water utility.

Only after a full understanding of the system has been gained can the modeller begin the work of constructing the model. This can be achieved either by linking existing GIS systems to the modelling software, or by manually drawing/tracing the network into the model.

## Field testing

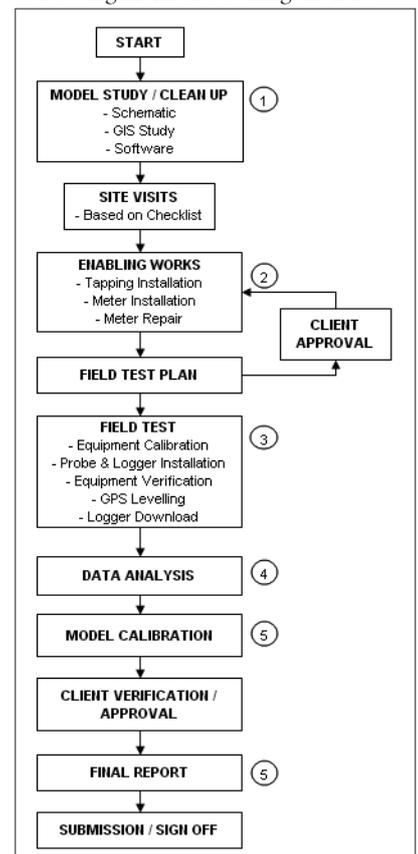
As previously mentioned, to ensure that the model is an accurate representation of the system, it is vital that the model is calibrated using live data

collected from the system. For this reason a field test must be undertaken.

The field test should be designed to ensure that data is collected at all strategic points on the network, particularly at any inlets or outlets from the system, at major assets (such as reservoirs, pumps, DMA meters, pressure reducing valves (PRVs), and at carefully selected points across the network (known as pressure calibration points).

Data is therefore collected from existing assets on the system such as production meters, DMA meters, PRV pressure tapplings and reservoir level transducers. However, where such assets do not exist, enabling works should be undertaken to allow data to be collected. These enabling works can take the form of new flow meters, tapplings for temporary flow probe installations and pressure tapping points.

It is also vitally important that all boundary valves are fully isolated, to ensure that all import and export flows are being monitored during the field



**Figure 1. Flow chart detailing the step-by-step process undertaken to construct a fully calibrated model**

test. Where boundary valves cannot be isolated, maintenance work should be undertaken to repair or replace the valves.

Once the field test has been designed and the enabling works have been completed, data collection can take place. This is achieved by installing data loggers at strategic points on the network. Normal practice would be to install a field test across the entire network for a minimum of seven days, and for an 'average day' to be selected that will be used to calibrate the model.

### Level data

Another vital piece of information required to produce a hydraulically accurate model is accurate ground level data for all field test points within the model. This is achieved through carrying out site ground level surveys, either through the use of traditional leveling techniques, or by utilising modern technology such as GPS.

### Data/demand analysis

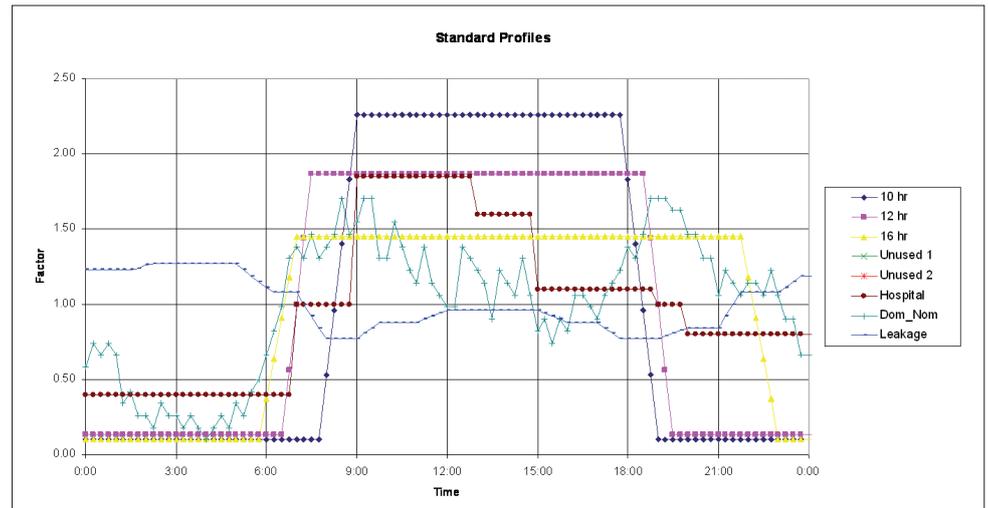
Once all the required field test data has been collected from the network, this needs to be analysed and flow/reservoir balances carried out to confirm the validity of the data.

Billing data is collected from the water utility for the period of the field test, which needs to be allocated into the model to ensure a true representation of demand on the network. In order to produce a hydraulically sound model, which can be run as a time-varying simulation, a demand analysis is carried out to determine the diurnal pattern of customer usage for domestic and commercial customers, as well as calculating a leakage profile for the area.

This is achieved by making use of standard profiles for different customer types and distributing the daily consumption data over a 24-hour period based on these profiles. Figure 2 illustrates the typical standard profiles used for both domestic and commercial properties. By calculating the Minimum Night Flow (MNF) for the area, and providing a level of legitimate night use for all domestic properties, the total level of leakage can be determined. This is then used to create a leakage profile for the area, with the remaining 'balance' being evenly divided between the domestic customers.

### Model calibration

Model calibration is essential if a true representation of the network is to be obtained. Calibration is achieved by altering factors already included in the model, so that the pressures and flows at the calibration points on the model reflect those recorded during the field test. As the demand nodes drive the flows within a model, in order to



**Figure 2. Typical daily consumption profiles for domestic and commercial properties**

calibrate it accurately it is essential that all demand is allocated correctly. If the demand is not fully allocated then the model will not produce a true representation of flow and pressure across the network.

Once all demand has been allocated into the model, the process of calibration can commence. When calibrating a model, the greater the level of accuracy the more reliable the results. As a general rule, the flows within a model are calibrated to within a tolerance of 10%, whilst the pressures across the network are within one metre and the depth in a reservoir is within 100mm. If the model results show a variance of no greater than these values at all calibration points, then the model is said to be fully calibrated.

The most challenging part of model calibration is determining which adjustments should be made to the model in order to align the model predictions with the field data. Pressure calibration within a model can be achieved by adjusting of the friction co-efficient in the model and through the addition of headloss devices to the system, such as partially shut valves (known as throttled valves).

It is essential when calibrating major assets such as reservoirs and pumps that the correct operational data is included. Data such as reservoir dimensions, top water level, pump operating speed and schedule are required and many of these factors can be adjusted to ensure accurate calibration of a model.

### Case study: Johor network modelling, Malaysia

Johor is the third largest state in Malaysia, situated at the southern tip of peninsular Malaysia, and is known as the southern gateway to the country via its connections with Singapore. The state covers an area of 19,000km<sup>2</sup> and has a population of 3.3 million. The main city in Johor is known as Johor Bahru, which is the second largest city in Malaysia after Kuala Lumpur and

contains the majority of the state's population.

The supply system for Johor has been divided into eight districts, with each being subdivided by water supply zones and then further into DMAs. In total, the system comprises 44 water treatment works, 490 reservoirs, 14 booster stations, 15,000km of pipework and 865,000 customer connections.

A private company, SAJ Holdings Sdn Bhd, manages the entire water supply for Johor, through a 30-year concession. In September 2005 a contract was awarded to Ranhill Water Services Sdn Bhd to design and construct fully-calibrated all-mains models for the entire state.

In total, 99 all-mains models (source to tap) are to be constructed using the Wallingford Software modelling package InfoWorks WS. The models are built using information obtained from the SAJ Holdings iGIS system, which incorporates GIS, live billing data and SCADA data. Accurate model calibration has been achieved through intensive field testing and collection of data from site.

Demand allocation has been achieved to a high level of accuracy within the models, due to the availability of customer billing data within the GIS database. Through geo-referencing the billing data, customers have been linked to the network at the precise location on the network. Also, by collecting live ground level data, using mobile GPS units and JUPEM (Department of Survey and Mapping Malaysia) base stations, elevation data to a high level of accuracy has been added to the model. Through constructing models to a high level of accuracy, more reliable results can be achieved when running future scenarios.

Through constructing these models, Ranhill has identified a number of anomalies on the network, which once rectified have led to huge improvements in the operability and efficiency of the network in Johor. These anom-



alies include throttled valves on the network, some of which were found to be buried, open DMA boundary valves, closed vales within the system and a number of connectivity issues that were not known and therefore had not been included in the GIS.

Identification of areas of high non-revenue water has led to further reductions in leakage and increase in revenue, whilst the design of the DMAs, pipe replacement and reconfiguration of the network has enabled the client to increase their understanding of the network and subsequently improve the service provided to the general public.

These all-mains models have also

been used by the operations department to assist with daily operations, particularly in terms of assessing risks and the consequence of typical daily activities such as mains isolation and reservoir cleaning.

The models have also been used to help create some of the 890 DMAs, which have now been established within the state. By designing DMAs using the existing models, Ranhill Water Services and SAJ Holdings were able to determine the best designs for these DMAs, with regards meter location and valve isolation. This has ensured that the maximum benefits can be obtained in terms of NRW reduction, whilst ensuring security of supply

for the customers.

These all-mains models were then skeletonised to create strategic mains models of the network, which did not include the detail of the DMAs. The client is using these models to undertake future planning and demand management at the water supply system level.

Ranhill Water Services is now working on a new collection of models, which will combine the entire strategic supply system of Johor Bahru city into one large model. By completing this model, SAJ Holdings will be able to understand the effects of closing one or more of its water treatment plants on the entire system, and to carry out future demand planning for the entire city. This is required particularly in relation to the Iskandar development region in Johor, which will see huge increases in demand over the coming years.

Through incorporating these calibrated models into the iGIS system, SAJ Holdings will be able to use them to carry out up-to-date simulations of the network and determine precisely what impact future demand and supply changes will have on the network.

The models can also be used to run water quality simulations to determine the impact of potential water quality incidents on the network. By collecting live data from the network, the models can be calibrated to enable scenarios to be run to determine what mitigating factors would be required to prevent potential issues in the future.

**Pressure calibration for an all mains model in Johor bahru, using Infoworks WS version 8.0**

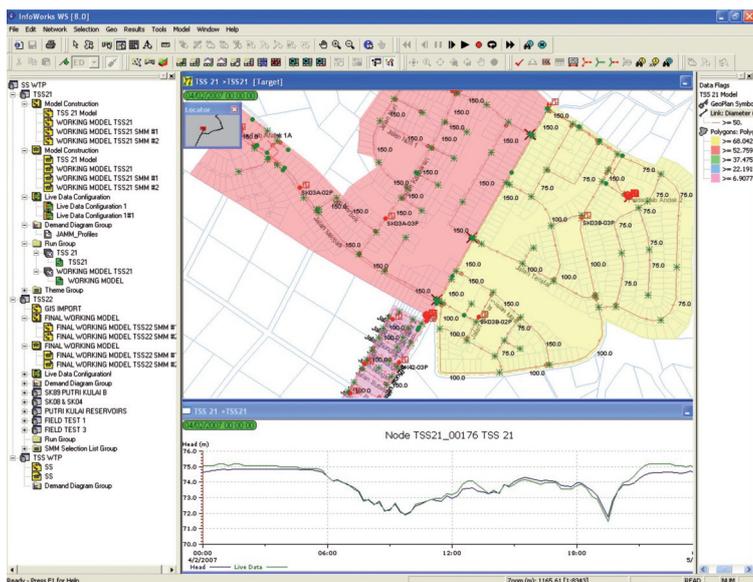
**Summary**

Network modelling has been proven worldwide to be an invaluable tool within the water industry, and can play a role in not only understanding the existing network, but also in determining the impact future changes in demand patterns will have across the system.

By linking modelling software with GIS, billing and SCADA systems, real time simulations can be run to discover issues and solutions can be identified without the delay of traditional techniques. ●

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