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VOLUME 9 ■ ISSUE 1

water utility management
INTERNATIONAL

FINANCING

A smart mechanism for financing water services and infrastructure

ASSET MANAGEMENT

Addressing asset management challenges in small water utilities

METERING

Developing the CustARD database: assessing the impact of metering on customer bills

PLUS ...

Applying asset management analysis to strategic business decisions

Paradigm shift from engineering to asset management: Rand Water, the largest water utility in Africa

Global utility survey highlights trends in network management

SWAN, the Smart Water Networks Forum, has recently published the findings of its Global Utility Survey.

33 utilities from 15 countries worldwide undertook the survey, which looked at areas such as business drivers, utility challenges, network management and spending in order to achieve a snapshot of current water utility networks.

'The SWAN Utility Survey provides an insightful window into global trends in water utility network management,' says the report's conclusion. 'The survey found that customer service is the number one business driver and O&M accounts for the greatest portion of distribution operating expenses. Leakage and OPEX effectiveness are the primary concerns and opportunities for utilities worldwide, and energy costs and aging infrastructure are top-of-mind for networks of all sizes and ages. The survey also found that utilities that are highly sectorised tend to have lower NRW rates and that those low NRW utilities are then able to shift their focus to improving other network challenge areas, such as water quality and OPEX effectiveness.' ●

The full report can be accessed by SWAN members at: www.swan-forum.com.

EC programme seeks sustainable potable water solutions

A European Commission Seventh Framework Programme (FP7) project being undertaken with the Indian Department of Science and Technology is focusing on the development of innovative and sustainable ways of producing potable water at community level.

The €500,000 ($685,300) funded ECO-India consortium, consisting of the Tyndall National Institute of Ireland, Denmark's Technical University, the Helmholtz Centre in Germany and four small to medium-sized enterprises (Trustwater, Adelphi, Dryden Aqua and AGM), will develop energy-efficient solutions for filtration and disinfection of supplies from surface water sources and tubewells that suffer from arsenic contamination.

These systems will utilise Dryden Aqua and Trustwater technologies. The Helmholtz centre will lead development of field-deployable arsenic sensors to screen tubewells, and an online system from AGM will facilitate remote monitoring of water quality.

Tyndall will develop capacitive modules for removing ions from brackish surface water and heavy metal ions, particularly arsenic, from groundwater, and will develop new sensors to monitor dissolved oxygen.

The complete system will run off solar power, with a mains or battery backup. ●

Saudi Arabia National Water Company announces major project tranche

The Saudi Arabia National Water Company has released a statement, saying that it is undertaking 60 projects worth SR5.5 billion ($1.46 billion) for the city of Makkah (Mecca).

Works include the repair and rehabilitation of main pipelines and sub-networks as well as new household connections and a strategic 1.3M.m^3 water storage facility costing SR1 billion ($266.6 million).

The company added that other projects currently being implemented include water networks in Bathaa Quraish and Awali worth SR127 million ($33.86 million) that will be over 200km in length with 13,000 household connections, as well as 11,000 sanitation connections in Afaiha at a cost of SR198 million ($52.8 million) and 15,000 connections in Sharaie at a cost of SR110 million ($29.3 million). The company is also working on replacing the existing wastewater network in Aziziya with a new one at a cost of SR170 million ($45.3 million).

The company explained that its currently expanding the treatment plant tri West Makka (Hada -2) at a cost of SR136 million ($36.3 million) to increase capacity by 125 thousand m^3 per day to achieve a total capacity of 250 thousand m^3 a day.

The projects are part of the company's strategy to achieve a storage capacity of about 1.3 million m^3 as well as the improvement and rehabilitation of sanitation facilities in the city. ●

Accenture wins Thames monitoring contract

Accenture has won a Thames Water contract to provide new ways of working by integrating the utility's business systems with its operations technologies.

Using Accenture's Smart Grid Services, the company will undertake an 18-month pilot through to spring 2015 at a number of Thames Water sites, testing, monitoring and assessing the benefits of the technology integration.

Thames Water is one of the first movers on the intelligent use of real time data to monitor its assets in an efficient way, Accenture says.

Accenture will implement advanced analytics capabilities, which will enable more efficient water sourcing and remote monitoring of assets. The information and data will help Thames anticipate equipment failures and respond in near real-time to critical situations, such as leaks or adverse weather events, the IT provider explains. ●

Jordan launches strategic wastewater plan

Jordan has launched its first national strategic wastewater master plan to help identify investment priorities to 2035. The plan identifies needs and priorities for every governorate, to ensure the Ministry of Water and Irrigation can focus donor and government resources in areas where services are limited or treatment and collection capacities are overstretched.

At the launch of the plan, the secretary general of the Water Authority of Jordan, Tawfik Habashneh, said that the water sector is facing unparalleled challenges that have dramatically worsened because of the influx of Syrian refugees.

He added: 'This master plan is very important because it takes our national policy goal to provide wastewater services to all areas with more than 5000 residents and turns it into an action plan for investment, development and donor support through 2035.' ●

New Zealand local authorities seek to shift fluoridation responsibility

Local authorities in New Zealand's Wellington region have decided to propose making health authorities, rather than local councils, responsible for the decision whether or not to fluoridate water supplies.

The remit, which will be heard at the Local Government New Zealand national conference in July, urges an amendment to the relevant legislation to ensure that responsibility no longer lies with local authorities.

'There is a significant amount of both positive and negative literature available and numerous experts with medical credentials willing to present the case in opposition and in support of the addition of fluoride to drinking water supplies,' says the remit. 'There are numerous Councils who have incurred costs and spent time on considering an issue that by its own admission, the MoH (Ministry of Health) considers to be an issue of national importance. The MoH supports the addition of fluoride to drinking water supplies and yet there is no mandatory requirement within the drinking water standards to require its use. This then leaves the decision on what is supported by the MoH as a National Public Health issue to be made by elected officials, who are reliant on conflicting expert advice.'

A senior official is quoted as saying: 'As long as councils are left to deal with fluoride, they will continually come under pressure to review the policy and potentially have to spend ratepayers' money fighting judicial reviews and legal responses to any decision they make.'

In a separate case, New Zealand's High Court has rejected a challenge from an anti-fluoride campaign group, New Health New Zealand, which was trying to prevent the South Taranaki District Council adding fluoride to its water supply. The group had argued that the council had no legal power to add fluoride to the water, and was breaching the right to refuse medical treatment. The judge ruled that there was an implied power under the Local Government Act for councils to add fluoride to drinking water, and that no further consent was required from the health minister. He added that while he accepted that fluoridation had a therapeutic purpose, it did not constitute medical treatment. The group has said it will appeal the decision. ●

Haya Water to be granted major extension to remit

Oman's wastewater services company Haya Water has been given the go-ahead to operate and manage the sultanate's wastewater treatment infrastructure in a major extension to its remit.

All 57 wastewater treatment works currently owned by municipalities, as well as Ministry of Regional Municipalities and Water Resources assets, will revert to Haya Water control by the end of the year, according to local press.

The only exception will be wastewater treatment assets in the industrial hub of Sohar and Salalah, the capital of Dhofar province. The announcement was made at the Korea-Oman Environmental Cooperation Forum this week.

As a first step, Haya Water is said to be planning to appoint a consultant to evaluate the existing infrastructure and assets under construction later this year, and another to develop a master plan examining strategies for operating and managing the infrastructure and wastewater disposal.

The utility will also take over some 900km of wastewater network, 21 construction projects and 11 projects to operate wastewater treatment works, the announcement added. ●

FEATURES

Cover photo credits: Doru Popa and Thames Water. See features p5 and p10.

EIB agrees Lake Victoria water infrastructure funding

The European Investment Bank (EIB) has agreed to back a new water infrastructure investment scheme that is expected to transform access to clean water and sanitation around the southern shores of Lake Victoria.

Over 500,000 inhabitants of Mwanza, Bukoba and Musoma, as well as other communities around the Lake Victoria basin, are expected to benefit once the scheme is implemented.

Once complete, 95% of the population of Mwanza will have access to clean drinking water and half the city's inhabitants will benefit from improved sanitation.

The EIB will provide €45 million ($62.5 million) to the government of Tanzania, matched by French Development Agency (AfD) funding. There will also be significant support from the government of Tanzania. Project preparation and implementation will be supported by technical assistance worth €10 million ($13.9 million). ●

Government condemns independent water testing efforts

Civil rights NGO AfriForum has announced that it plans independent tests of potable water and wastewater quality across the country to ensure national standards are upheld. South Africa's Water Affairs department said: 'Such actions carry the possibility of a legal challenge and an even more dangerous potential to mislead the public about the true nature of water services regulation and performance monitoring.' In response, AfriForum announced that it intends to continue with the project. On its website it says that 'the threats of the DWA will not stop us. But it does create some concern about what is actually going on in South Africa.'

Pakistan announces major potable water spend

Punjab's chief minister Shahbaz Sharif has declared that Rs10 billion ($95 million) has been allocated for potable water supply improvements in the province. Rural areas are to be a special focus, and a supply of clean potable water for the entire province is promised within the next five years.

Suez Environnement buys Acea stake from GDF Suez

Suez Environnement has announced that it has bought GDF Suez's 3.95% stake in Rome energy and water utility Acea, taking its shareholding to 12.5%. Suez and Acea partner to provide water and sanitation services in Florence, Pisa, Arezzo, Siena and Grosse to for 2.5 million people.

ProInversión launches Lima water tender

Peru's private investment promotion agent ProInversión has launched the tender for a $400 million, 30-year design-finance-build-operate potable water concession for the capital, Lima. The three components of the project are a 10km trans-Andes tunnel to bring water from Pomacocha lagoon to the Blanco river, an upgrade to the Huachipa water treatment works, and construction of an additional water uptake and distribution system to bring water to the southern districts of the city. Additional works include expanding two existing reservoirs.

Mexico suffering 43% water loss from pipelines

An infrastructure summit in Mexico city heard utility Proactiva Medio Ambiente director Sebastian Buira warn that 43% of water in the country is lost due to poor pipeline maintenance. He added that water supply projects would be futile until the distribution network is repaired, and warned that delaying the projects would mean higher costs.

World Bank loan for Rio

The World Bank has approved a $48 million loan to Rio de Janeiro state that will finance a project designed to improve delivery of public services. The funding will provide technical assistance in developing fiscal and infrastructure reforms to better integrate Rio de Janeiro's 19 municipalities, and will also support installation of an early warning system for heavy rainfall events that will cover all of the state's municipalities.

Accenture wins Thames monitoring contract

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AfDB embraces infrastructure in new Kenya strategy

The African Development Bank's board has approved a country strategy paper for Kenya that highlights infrastructure, including water, as a priority area. The bank noted in a statement that investments in physical infrastructure, specifically energy, transport and water, will boost private sector activity, increase productivity and stimulate structural transformation and employment. At the same time, households and vulnerable groups will benefit from the improvements, it added.

water utility management INTERNATIONAL

EDITORIAL

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Water Utility Management International focuses on the interests of utility executives, policy makers and advisors around the world engaged with the key management issues faced by water and wastewater utilities. As well as senior utility managers, WUMI will be of interest to regulators, consultants, contractors, academics, and financial, technical and legal professionals.

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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A smart mechanism for financing water services and infrastructure

Romania must fill the huge gap between the performance of the country's obsolete infrastructure and the levels required by customers and EU Directives, which require it to tackle serious long-term financing issues as well as the challenge of providing sustainable services. **TEODOR POPA**, chair of IWA's Tariffs and Finance working group, discusses a smart financing mechanism that can help utilities meet investment needs.

As in other socialist countries, Romanian water utilities were heavily subsidised before the 1990s. Water infrastructure investments were financed by direct subsidy from the central budget, with few resources available from local budgets or the operators themselves. Industries were often asked to provide water supplies for the local population alongside their own treatment facilities. Companies operating at county level provided water services and other public services such as solid waste collection and gardening. Local authorities directly, or often indirectly, subsidised operational costs, frequently through cross subsidies, such as a higher tariff for industry and a reduced tariff for institutions and domestic customers.

After the collapse of the socialist economy and industry, Romania's utilities faced new challenges: the failure of water systems due to their poor technical condition; dramatic reductions in demand and reduced bill collection; high inflation; and the effects of inappropriate tariff policies. Two financial problems remain today: how to ensure day-to-day operational costs are met, and where to obtain the funding for the large-scale investments needed to ensure a proper service.

In the early 1990s there was another issue: no one – neither the government or the local authorities – was responsible for providing water services, which remained solely the task of the operators. To balance the books, the water companies waived not only their investment plans but also maintenance, with only emergency repairs being done. It is not surprising that the infrastructure degenerated into such poor condition that problems remain today, several decades later.

A major leak on a 1000mm steel mains pipe in Brasov, Romania in February 2014. 100,000 people were affected by water shortages and restricted supply. Credit: Doru Popa.

Romanian water infrastructure

Despite all its efforts, only 57% of Romania's population are connected to a centralised water supply system, an increase from 29% over the last 20 years, and only 44% are connected to sewer networks (Romanian Water Association 2012 annual report). The wastewater treatment situation is even worse: 25% of wastewater is discharged untreated directly into rivers, 20% is only treated mechanically and there is no tertiary treatment anywhere in the country.

According to the institutional framework analysis prepared by the Management Authority (2008), only 32 major municipalities (with over 100,000 inhabitants each) have benefited from capital investment programmes for the rehabilitation of their water and wastewater infrastructure since 1990 and only a small minority of the 276 towns in Romania had benefited from these programmes by the end of 2003. Around 230 small and medium-sized towns have not been able to attract financing from either international financial institutions or private operators. Due to this lack of funds, these towns have made very few investments over the past 20 years in maintaining and developing their water and wastewater infrastructure. As a consequence, the condition of their water and wastewater systems is very poor.

Development programmes

Romanian water infrastructure financing mainly depends on government subsidy or EU grants. Water companies only make a small fraction (around 10%) of the investment, preferring loans through International Financial Institutions (IFIs). Very few public-private partnerships (PPPs) or commercial loans are active in the Romanian water sector. As in other Eastern European countries, Romania began its infrastructure renewal process mainly with international assistance from EU supporting programmes, and some IFIs such as the European Bank for Reconstruction and Development (EBRD) and European Investment Bank (EIB).

EU Water Directives introduced new obligations and challenges for water operators and, as a result, over the past few years new, large-scale infrastructure projects have been implemented through the EU Sectoral Operational Programme

Fixing the pipe break in Brasov, Romania. Credit: Doru Popa.

'Environment' (SOP Environment), with the aim of increasing the population's access to water services and improved wastewater treatment.

Institutional reform of the Romanian water sector

After more than four decades of centralised management, Romania decided to return to the principle of local autonomy through decentralisation, transferring major and concrete responsibilities to the local public administration. As a result of a several national programmes for renewal and extension of water and wastewater systems some 40 major (regional) water companies have emerged, financially healthy and technically powerful, and capable of operating on a proper basis. There is an ongoing need to ensure that all towns are able to invest in maintaining and upgrading their infrastructure to provide good services that meet EU standards. This requires the adoption and implementation of adequately designed development policies, focused on meeting people's real needs, if services are to be affordable for everyone.

The regionalisation process

Until 2008, water and wastewater services were mostly undertaken by many (often small) municipal utilities, resulting in inefficient operation at a sub-optimal scale, with no access to finance and limited technical and managerial capability. This left the utilities unable to ensure further development of their water systems.

Institutional reform and the regionalisation strategy were included as part of the application for SOP Environment, which was co-financed by EU Cohesion Funds and prepared by consultants. According to an institutional analysis prepared for Brasov county by CES et al (2009), regionalising the water services would resolve the excessive sector fragmentation and achieve economies of scale. The capacity-strengthening scheme is designed to provide links to investment programmes that support the rehabilitation, modernisation and upgrading of local water and wastewater infrastructure.

At the time investment was approved, the water companies were required to expand their area of operation to cover more regions, providing the required economies of scale to strengthen investment capacity and ensure the new infrastructure would be operated properly.

As a result, the former water companies were turned into commercial companies, with 100% public local authority shares, gathered into intercommunity development associations (IDAs), which keep the operator under control on the basis of delegation (concession) contracts. Not all the local authority members of IDAs need to also be shareholders of the water company, they can be part of the delegation contract, as shown in Figure 1.

The delegation contract

Delegating management of services is at the heart of the operational and institutional organisation for regional water and wastewater service management, and establishes specific obligations and rights for each party relating to the development of investment programmes and achieving subsequent levels of service performance. The delegation contract is a long-term commitment, depending on the length of time assigned for depreciation of investments carried out by the regional operator company (ROC). The ownership of public assets remains with the local authorities, together with responsibility for supplying adequate water and wastewater services at an affordable price.

The ROC is appointed to manage, operate, maintain, upgrade, renew and expand, where appropriate, all of the public assets designated in the contract at its sole risk and peril, in consideration of a payment (tariff) made by customers, subject to and in accordance with the provisions of the contract. Financial and commercial risks are carried by the regional operator. The delegation contract states very clearly that the tariff policy will be followed to ensure the full cost recovery.

The 'smart financing mechanism' case study

Over the past few decades Romania has successfully implemented projects with a value of more than €3 billion ($4.1 billion), most of them in major cities. One of the most valuable lessons learned relates to implementing a subsequent tariff policy.

The tariff policy and regulatory regime

Article 9 of EU Directive 2000/60/EC, regarding Framework for Community action in the field of water policy in the recovery cost for water services, states: 'The Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis... and in accordance in particular with the polluter pays principle.'

Romanian legislation therefore stipulated that tariffs should cover all costs (operational, financial and capital), including environmental costs and a residue to ensure loan reimbursement. There is the possibility of a moderate profit margin and a special part dedicated to specific projects approved by local authorities. The 'polluter pays' principle is applied through varying tariffs for industrial wastewater discharges, depending on the chemical load.

In Figure 2 the cost elements, adjustment methods and the forces that dictate the level of tariff are shown. The cost elements and investments push the tariff up. On the other hand, customer affordability is the ceiling for the price level.

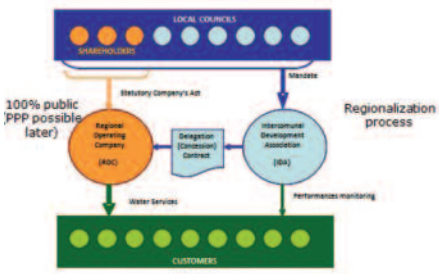

Figure 1: Institutional arrangement

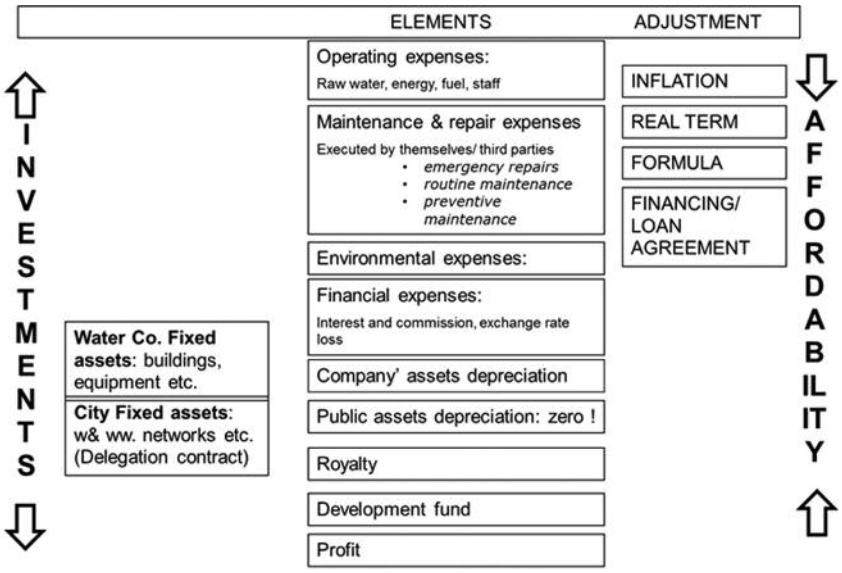

Figure 2: Water price structure and adjustment

The price of water is the same for all types of consumers, whether they are a resident or a company. Currently, the operators are on their way to unifying prices in all the cities / villages where they operate. The water and wastewater tariff could be adjusted by inflation, in real terms and according to a formula of loan agreement provisions, prior approved by the ANRSC (the regulator). In any case, the resulting water price should be set at a level that is reasonable for all users to ensure real access to water services and a high level of bill collection.

The tariffs are proposed by operators and checked by the regulator (ANRSC) and eventually approved by local councils or (where they have been established) intercommunity development associations (IDAs), according to a process described in Figure 3.

The tariff policy is reinforced through the international financing memoranda provisions established for the EU and IFI agreements that co-financed the investments, and which are reflected in the delegation contracts CES et al (2009b).

Maintenance, Replacement and Development mechanism

The Maintenance, Replacement and Development (MRD) Reserve, Fund, or Account was established in 1995, as part of the first loan agreement signed between EBRD and the Romanian government. This co-financed the municipal utilities development programme, the first major investment programme in Romania. Based on its success, after ten years the MRD mechanism entered into legislation via Governmental Ordinance no 198 of 2005 on the establishment, funding and utilisation of the MRD Fund.

The MRD Fund is a reserve account opened and used by the borrower (either the water services operator or the local authority) that benefits from non-refundable EU financial assistance. This mechanism is kept for the lifetime of the investments that result from these programmes. The MRD mechanism ensures that all the funds gathered from water tariffs are reserved to finance water infrastructure and do not disappear through taxation.

Sources for MRD Funds

There are two types of contributors to an MRD Account: local authorities and the water company itself. The former should contribute local budget allowances that are at least equal to the sums received from the utility as royalties, tax on profits and a share of net profits (if distributed). In the statutory deed all the shareholders agreed not to distribute dividends. In a situation where fiscal law requires dividends to be paid, the corresponding amount will be returned to the company.

At the same time, in line with fiscal law, local authorities will assist in obtaining preferential fiscal facilities for taxes on tangible assets belonging to the utilities, by their nature or purpose, as well as other taxes affecting prices and tariff rates. The local authorities have an option to exempt water companies from taxation (if it is legally possible) or to reimburse them through local budget allowances to an amount equivalent to a tax introduced after signing the delegation contract, but due to the financial crisis this is not being applied anymore.

The water utility must contribute to the MRD Fund the following sums: all the local budget allowances it receives; an amount at least equal to asset depreciation plus the income arising from sales of fixed assets; part of the net profit of the company (the undistributed net profit); the VAT paid on MRD and recovered from the central budget; and all the sums accrued from the monthly capitalisation of interest calculated on the available funds in an MRD account.

The financial flows are described in Figure 4, with all the sources of MRD accounts detailed afterwards.

Royalties

The operators have to pay a royalty, similar to a concession fee, to the local authority for the public assets they delegate. If the borrower is a water company, the royalty could be any amount between zero and another value. According to Romanian legislation, no depreciation can be calculated for public assets; the entire value of the investment becomes a cost at the time of commissioning. To encompass the role of depreciation, in some cases the royalty is set equivalent to the corresponding depreciation of the delegated fixed assets, calculated as if they belonged to the operator. When the borrower is a public authority, the royalty cannot be less than the debt service amount for the year of the contracted loan.

It is not surprising that there are huge differences between the royalty levels paid by water companies. According to research undertaken by Boer (2013) for 22 Romanian Regional Operator Companies, the average level of the royalty and depreciation costs (the latter being calculated only for owned assets) within the operational cost is between 4.9% and 18.8% (see Figure 5).

As a cost element, the royalty level is a very important part of the final tariff and it cannot differ too much from year to year, as happens when it is related to the annual debt service for a non-linear

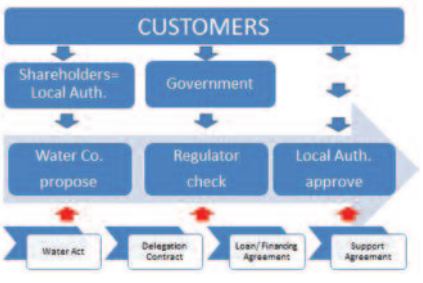

Figure 3: The tariff approval process

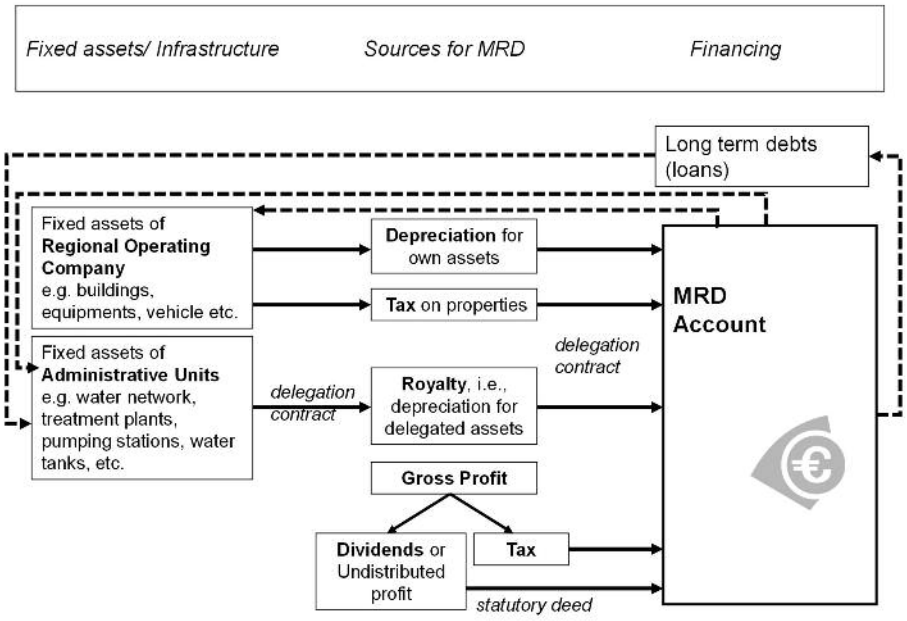

Figure 4: The Maintenance Replacement for Development (MRD) mechanism

reimbursement loan. At the same time, a symbolic royalty amount would deprive the owner of the assets of the resources to renew after the lifetime of the assets has expired. According to the delegation contract provisions, the royalties paid should be returned to the water company MRD Account within five days.

The gross profit tax

According to the Romanian Fiscal Code, every company must pay a 16% profit tax to the state budget, apart from water companies involved in programmes co-financed by EU grants. Water companies pay the profit tax to their main shareholder, the local authority that signed the delegation contract for water services. According to the provisions of this agreement, profit tax paid by a utility should be returned to the MRD Fund within five days as an investment subsidy to the water company.

Dividends

The former water operators in Romania were organised as a local companies under a single local authority, either a city or a county, as a 'regia' (autonomous administration). The regia did not have to distribute dividends, but had to transfer 50% of its net profit (after paying a gross profit tax) to the local authority. The remaining 50% became the company's own fund for further development. Starting in 2006, all the regia began a process of corporatisation that transformed them into commercial companies with their shares owned entirely by local authorities. In the constitutive deed, all shareholders agreed that the water utilities would not distribute dividends.

The net profit and undistributed profit

The remaining profit after paying the gross profit tax that is not distributed as dividends is transferred into the MRD account, and it is considered to be the company's own private fund. This is not considered to be like the other sums (royalty, profit tax and dividends), which are subventions and are treated as public funds.

Value Added Tax

The classification into public and private sums of funds that enter the MRD account is important from the point of view of VAT, given that the VAT level in Romania is 24%. Until 2010, the water companies had the right to deduct VAT for all expenditure they undertook from the MRD reserve. After 2010, the Ministry of Finance took a different approach, asking for VAT to be paid on all expenditures from public contributions to the MRD.

This meant that VAT became non-deductible, which reduced the resources for new investment. This is the toughest challenge for the financing mechanism; transferring money from the water tariff to the central budget. Currently there are advanced discussions with the Ministry of Finance about classifying all sources of funding as private funds and reverting to the original situation.

To maximise the resources available for further development, water utilities have to go through a veritable maze to find the perfect mix between the available sources of funding and the expenditures from the MRD Fund.

Expenditures from the MRD Fund

There are two main destinations for the money collected in the MRD account: one is financing the debt service obligations under the loan agreements concluded for co-financing EU programmes, and the other is replacing and developing water supply and wastewater assets.

Conclusions

Like other infrastructure elements, water and wastewater systems require a long-term, strategic approach. It is essential, but difficult, to find financing for these investments, but even more difficult to ensure the costs of proper operation are covered and a reserve generated for renewal when the time comes.

Sometimes, water companies experience periods where they lack money for predictive maintenance or investment in necessary upgrades to works. There are years with low levels of capital investment or operational expenditure that could impair the ability of operators to respond to the technical challenges of the water and wastewater system, or to customers or market changes. In some cases, political influences could make the situation worse by imposing unrealistic tariffs, tasks beyond the capacity of the utility, or taxation, not to mention weak management on the part of the operators. It has been proved that the cost 'saved' by not taking appropriate measures at the correct time eventually has to be paid and is

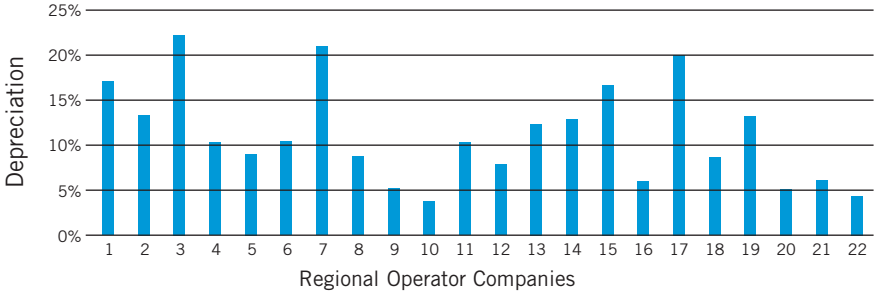

Figure 5: Depreciation and royalties

more expensive. For instance, a water system could fail simply by not being able to supply customers during peak hours or to treat water or wastewater properly.

To cover all reasonable costs it is necessary to set the correct level of tariff or tariff structure. This should include operational costs that allow predictive maintenance, not just emergency repairs. Financial and capital costs must also be determined taking into consideration the actual value of assets.

At the same time it is very important to have a high level of bill collection to ensure the necessary liquidity for the utility, as well as its long-term operation. To accomplish this, affordability should be achieved through a mix of tariff levels and schemes to support of poor customers.

Support for poor customers is a sensitive issue that needs a careful approach. Water companies do not have the necessary data to establish which people are eligible for such support, or the legal means to do this. The most common solution to the problem is for the authorities to keep the tariff level very low, so that even the poorest can afford it. This policy reduces the available funds, which could be generated through a higher tariff that the average customer could afford.

Different tariff schemes could be used, starting with simple ones such as flat, single block charges (a single price per unit charged) and moving to sophisticated ones such as increasing block (where each consecutive 'block' of water is sold at a higher unit price) or seasonal pricing (where a higher price applies during the summer season).

Such tariff schemes could help both water conservation and customer equity. Many authors have discussed the use of different water tariff policies for residential consumers and other types of consumer, including Tsagarakis (2005).


Teodor Popa

The customer's alternative for water and wastewater services is very important for utilities when the system is being enlarged. It is common in Romania for people not to want to pay, and therefore to connect to the water grid and sewerage network, and to use alternatives such as shallow wells or fountains for fresh water and direct discharge of their sewerage.

The real costs should be transparently shown within the water price. Depreciation and the royalty charge should be not set purely for administrative purposes, but at a level that ensures the economic means to recover capital costs at the value of replacing the fixed assets.

Water taxation has an important role to play in financing the water sector. Romania applies the MRD mechanism, which ensures that all the money generated by water services is set aside for infrastructure development, but the country has one of the highest levels of VAT in the world. Unfortunately over the past few years new fiscal pressures have arisen, which are trying to change the preferential treatment of VAT for investments financed by that part of the MRD to which the public authorities contribute.

There have also been fiscal tests that force water companies to distribute dividends so they are obliged to pay tax on them and the introduction of new taxes for construction. These distortions weaken the water utilities and alienate investors and banks. In the end, the money extracted by these taxes will be reflected in the tariff (as a 'par fiscal' tax) and eventually in the future budget allocation for water infrastructure renewal. In this crisis time, this is a temptation that is hard to refuse, but hopefully can be avoided.

The results of applying a strategic tariff policy and the 'smart' MRD financing mechanism can be measured in 40 major current projects throughout Romania, which have been implemented by the new Regional Operating Companies, many with co-financing from the commercial banks or through loans without a third party guarantee from government or local authorities. ●

Financing Water Utilities and Infrastructure workshop

The IWA Specialist Group on Statistics and Economics held a Financing Water Utilities and Infrastructure workshop last September in Poiana Brasov, Romania in order to address issues that Romania and the other Eastern European countries face when renewing and expanding their water and wastewater infrastructure and increasing sector capacity. Over 75 participants from Romania, the US, The Netherlands, Belgium, France, Norway, Spain, Switzerland, Germany, Hungary, Albania and Moldova joined in the debates about water and wastewater tariffs, water infrastructure financing, water taxation and customer protection, institutional arrangements and regulatory regimes.

The next SG workshop will be held during the IWA World Water Congress & Exhibition in Lisbon on 21-26 September 2014. For more information, visit: **www.iwa2014lisbon.org**.

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Presented at the IWA 3rd International Conference on Water Economics, Statistics and Finance in Marbella, Spain in April 2013, and in September 2013 at the Financing Water Utilities and Infrastructure workshop in Poiana Brasov, Romania (see box).

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Developing the CustARD database: assessing the impact of metering on customer bills

Metering plays an important part in enabling water companies to balance supply and demand, and understanding the impact on customers is key to developing a comprehensive metering strategy. **CRAIG ROBERTS, VIKKI WILLIAMS** and **JOHN WHITE** explain at a solution they have developed for Thames Water, the Customer Analysis and Rollout Design Database (CustARD), which brings together information from numerous datasets.

Thames Water is the UK's largest water company, supplying nine million customers with water and 14 million customers with sewerage services in London and the Thames Valley, in the South East of England.

The South East of England is the driest part of the country, so good water resource planning and demand management are essential to ensure that Thames Water provides its customers with a safe and reliable water supply, both now and in the long term.

Every five years, water companies in England and Wales are required to produce a Water Resources Management Plan that sets out how they aim to maintain water supplies over a 25-year period. Managing water demand is a key component of this planning. Table 1 sets out the current and future levels of metering and customer consumption over the 25 year period for Thames Water.

Thames Water has a strategy of progressively metering all domestic and commercial properties in order to achieve the demand benefit, which includes identifying where water is being lost through leakage on Thames Water and customers' pipes, and identifying customers who use large volumes and helping them to use water more wisely. The target of 78% in 2040 reflects the number of multi-occupancy buildings in London, where it is not possible to meter every single household. In this situation, Thames Water will bulk meter such properties.

CustARD has been developed to identify the impact of metering on customers. Credit: Thames Water.

With this progressive metering strategy Thames Water is able to analyse which customers may be adversely impacted by affordability issues or have a significant need for water. The company has also designed the most effective way to implement a targeted metering programme to minimise the cost to both the company and the consumer. The way the company approached this was to develop a Customer Analysis and Roll-Out Design Database (CustARD), which is a geo-database that incorporates a substantial number of datasets.

This paper sets out some of the analyses and benefits that CustARD has achieved to date, and also provides a look forward to what further benefit may be derived in future.

CustARD concept model

The data sets discussed below are combined to undertake specific analyses and scenario modelling to answer specific business questions.

Property data

The property data was derived from the internal billing database. The majority of customers are on an unmeasured tariff based upon the Rateable Value (RV) of their property, which was a local authority's assessment of the annual rental value of an individual property. Each local authority took a number of factors into account when it set rateable values, including the size and general condition of the property and the availability of local services.

This gives Thames Water a broad assessment of the property type, but since RV

Table 1: Forecast metering and daily usage over the planning period

	Current (2011-2012)	Five years into the plan (2020)	25 years into the plan (2045)
Metering (percentage of households)	30	56	78
Customers' daily use in litres per head per day	161	153	141

assessments stopped in 1990 the company has had to rely on customers providing updates on changes to the property. The disadvantage of this is that it is ad hoc and does not always pick up substantially altered properties, particularly where houses have been subdivided into flats. One instance where Thames has considered upgrading property information is by cross-referencing this with the UK Ordnance Survey Address information to determine anomaly properties.

Affordability data

Experian is the external provider of definitive measures of the demographic, socio-economic and lifestyle characteristics of every adult and household in the UK, which is updated on an annual basis. Economic information such as household income has been combined with Thames Water's billing data to give an indication of whether particular households are likely to have affordability issues.

Operational data

The District Metered Areas (DMAs) have been included in the CustARD database as the principal geographic area of analysis (Thames Water will also roll out metering on a local authority basis so that it can communicate with customers along boundaries they understand). This is because Thames Water analyses leakage on this geographic basis, and as high consumption areas can occur because of leakage or because of legitimate demand it is beneficial to analyse the data on a like-for-like basis.

Customer contact data is also incorporated into the model to ensure that customers who have already requested a meter are not contacted again. These areas would be avoided in the development of a selective metering programme.

Company initiatives

Incorporated into CustARD are company initiatives to ensure that areas are targeted with sufficient knowledge of the potential impact of metering to be fully aware of the impact upon customers.

Benefits realised from customer modelling

Identifying the impact of metering on customers

Using this model, Thames Water can now identify for the first time, with a high degree of confidence, which areas would see higher or lower bills from being metered. The data can be presented by property, street, postcode, DMA and Local Authority area. This has been achieved by integrating detailed datasets of property type, income and customer information, with an assessment of post-metering consumption at a local level. The results are represented with a geo-spatial map of the Thames Water supply area.

The assessment of post-metering consumption is based on an industry-leading module within the model that assesses likely consumption based on house type and cultural diversity. This has proven very successful when trying to account for the water used within the customer base, and is a key building block within the model. This model enables the identification of potential post-metering consumption, and thus the impact on customer bills and company revenue streams.

Figure 2 illustrates the percentage of customers who could potentially see increases and decreases in their bills within each DMA post metering. The darker the colour, the greater the degree of change. Green areas represent locations where customers are likely to be better off from switching to a meter, and brown areas represents where customers are likely to be worse off from switching to a meter.

This degree of detail enables Thames Water to understand where there may be high density areas of customers who would experience financial hardship or large bill increases and plan accordingly to avoid this.

The differences are most marked in two areas – one which might be expected, and one which might not be. In the East End of London, there are a high proportion of customers who are likely to pay more, particularly for larger families in low RV properties. The other area where customers are likely to pay more is rural Wiltshire – where RVs are typically low relative to other areas due to historically low farmland property valuations.

This is a good illustration of the point made by Anna Walker in her review in 2009 on charging (Walker, 2009) that RV charges alone can help households who do not need help, and help only some of the households that do need help. RV is, therefore, not an efficient way of targeting help to those who most need it.

A second way in which the data can be analysed is by household income level. Figure 3 illustrates the impact on customer bills at a property level (aggregated up to District Metering Area, each being approximately 1000 properties) by

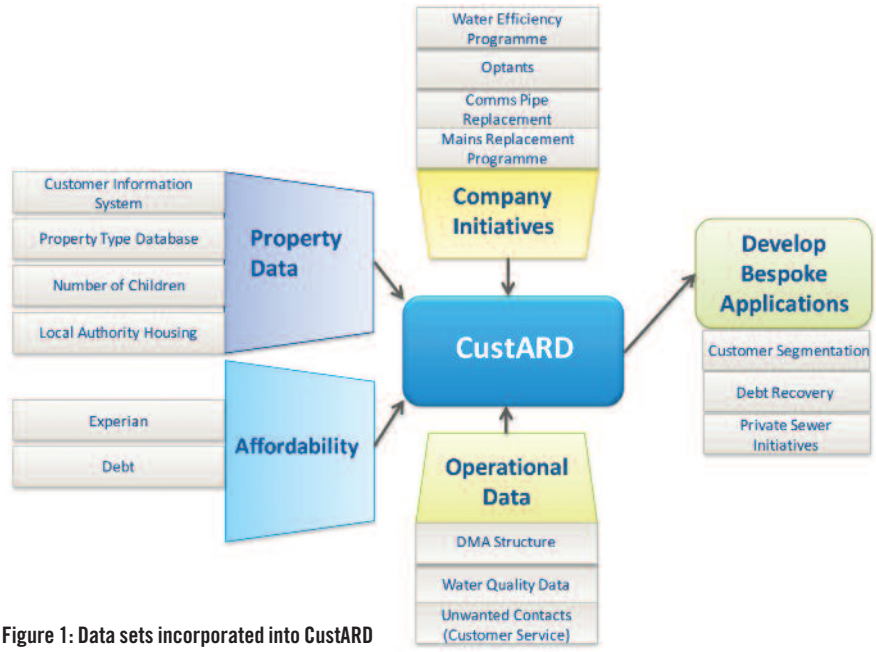

Figure 1: Data sets incorporated into CustARD

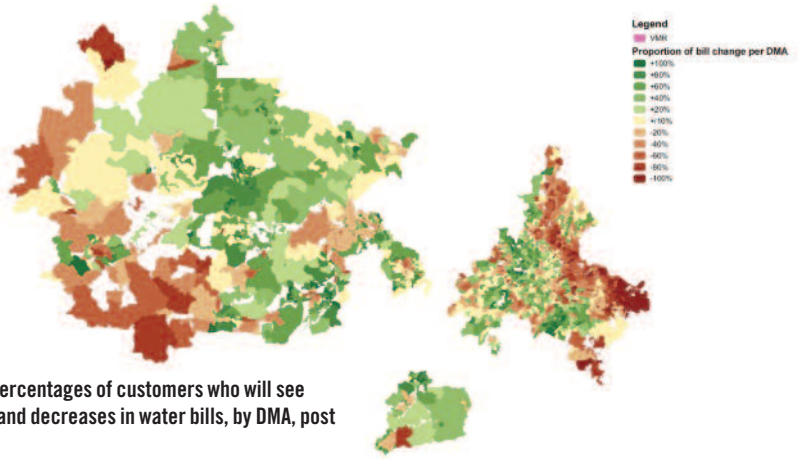

Figure 2: Percentages of customers who will see increases and decreases in water bills, by DMA, post metering

income deciles. This graph shows that across all household income levels there are customers who would pay both more and others who would pay less post metering, and these are fairly evenly distributed.

This shows that a considerable number of lower income customers would benefit financially from being metered. In its current consultation on affordability (Defra, 2011), the Department for the Environment Food and Rural Affairs (Defra) has highlighted this point and is encouraging promoting optional metering for particular low income customer groups who would be likely to benefit. Defra cites studies by economic regulator Ofwat in utility South West Water's area to support this – initial analysis in the Thames Water area also supports this, and provides the property-level information to be able to implement this policy in practice.

Determining the best metering strategy

Being able to model the customer base at different levels has allowed different metering scenarios to be tested. An early benefit has been better targeting of the meter optant campaign. Historically Thames Water has had an approximate annual uptake of 20,000 out of a target base of 2.3 million customers. Targeting mail shots to customers who are likely to benefit from a meter has seen an increase in the uptake rate of 8% to 10%.

The property level information also means that those with affordability issues or those that may be vulnerable can be readily identified within any targeting strategy, and then can either be addressed with mitigation measures or can be deferred until later on in the plan when mitigation measures can be implemented.

The improved information has also had benefits for contractors working for Thames Water. Contractors have been provided with street maps (see Figure 4) with detail down to property level, showing the distribution of assets, including identifying where meter chambers are already available, existing metered customers, special needs customers, or meter optants who have switched back to unmeasured charging. This enables more efficient planning of the metering programme, resulting in significant cost savings and reduced risk e.g. Thames Water can clearly identify and map customers that are regarded as special needs customers and therefore flag up the sensitive areas.

The improved understanding that CustARD has given Thames Water has already been shared with Ofwat, the Consumer Council for Water and the Greater London Authority as part of demonstrating an evidenced-based approach for developing the company's metering strategy.

Introduction of new social tariffs

The Defra consultation on affordability raised the possibility of the introduction of new social tariffs to support households which were struggling to pay their water and sewerage charges. In June 2012 Defra issued a guidance document on social tariffs for water and sewerage undertakers (Defra, 2012).

In the guidance document there is an explicit expectation from the UK government for each water and sewerage company to consider the potential benefits of bringing forward an effective social tariff as part of a company's overall strategy for addressing water affordability. This has raised some concern on behalf of companies that because there is no new government subsidy to pay for social tariffs it relies on the cross subsidy between customers for funding. What this does is potentially create a gap between what customers are willing to pay for social tariffs and addressing the affordability issues that some customers face.

As part of the Defra issued guidance, Thames Water has been expected to identify which customers will benefit from a social tariff and provide the justification for assisting these customers. In response to this Thames Water has made some incremental changes to CustARD in order to model certain tariff scenarios, for example determining different eligibility criteria, the level of bill reduction while determining the likely revenue impact on the company, and the degree of cross subsidy for other customers. Different scenario modelling has underpinned Thames Water's development of a social tariff, which has been met with a favourable reception from regulators and consumer groups.

Potential future benefits

Customer scenario modelling has been in place within Thames Water for two years and continues to be developed as more and more uses of the data present themselves. As well as enabling better targeting of metering programmes and the development of social tariffs, it is anticipated to use the detailed modelling and customer

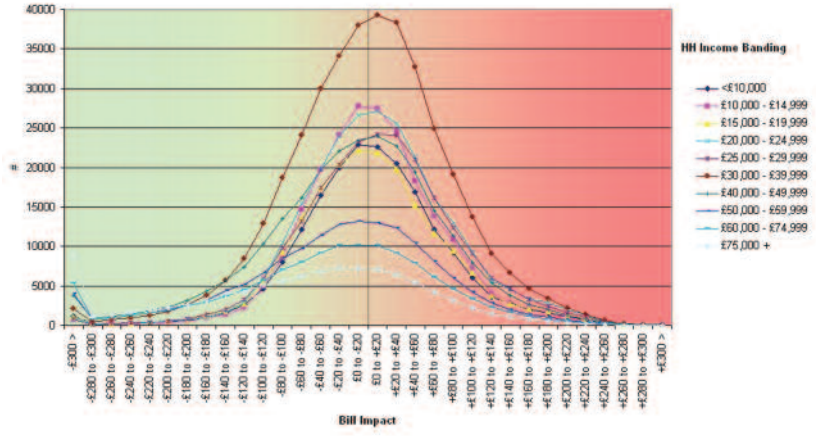

Figure 3: Impact upon customer bills at a property level by income deciles

Figure 4: Contractor map showing current metering situation

profiling capability in other areas. Some of these areas are covered below.

Managing customer debt

There has been a 20% increase in the number of customers in debt within Thames Water's service area over the last two reporting years. The debt issue has become more significant with the downturn in the UK and World economy, and the lack of instruments a water company has to recover unpaid debts from customers. In the 2012/13 financial year, the Thames Water customer bad debt charge increased 33% to £93.7 million (2011/12: £70.6 million)[1].

Using the CustARD model, Thames Water can also undertake analysis to develop a customer segmentation model, as shown in Figure 5. By examining the socio-economic attributes Thames Water can establish the difference between those customers who 'won't pay' and those who 'can't pay'. Once this is established, different strategies can be deployed to recover debt.

For instance, Thames Water can potentially target those customers that are struggling financially and potentially determine which of them would benefit from having a meter installed, or would benefit from being on a different tariff. This programme could include working with local authorities to support water and energy efficiency programmes to reduce customers' financial outgoings.

Commercial model (non-household)

The current model has recently incorporated non-household customers, as it will also be used in the development of a meter replacement programme. One area yet to be explored is undertaking a historic analysis of where sewer blockages have occurred and examining the customer and property attributes to determine whether there are any patterns or correlations between customers and operational issues. If Thames Water can demonstrate a customer/property contribution to operational issues, then this will be a potential stepping stone to predicting where future problems may occur.

Service incentive mechanism

UK water companies are assessed by the regulator Ofwat on the levels of customer service they provide using the Service Incentive Mechanism or SIM. This is based on two consumer experience measures:

- A quantitative measure based on the number of complaints and unwanted contacts a company receives
- A qualitative measure (based on the quality of the experience) derived from a consumer experience survey

These two measures aim to capture both the number of times a company fails to meet the expectations of its consumers, and the experience of those consumers.

The use of mapping and the visibility of customer details helps Thames Water understand its customer and asset base prior to customer visits, potentially helping to reduce negative customer feedback. This has been used in order to develop metering programmes but could be used for other operational areas, for example in managing mains replacement programmes or dealing with water quality issues.

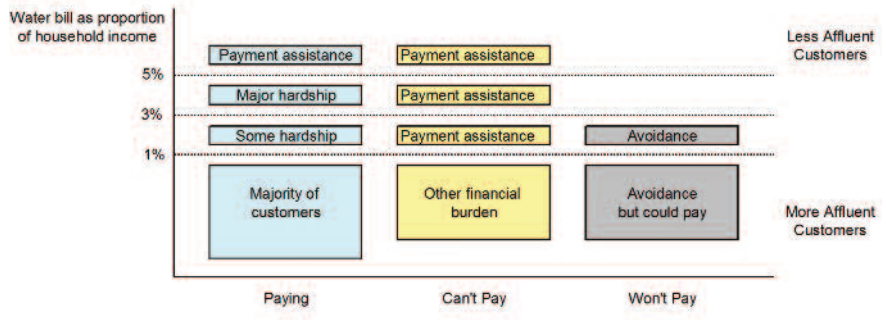

Figure 5: Potential customer segmentation model regarding debt

Conclusions

Thames Water, in conjunction with Black & Veatch, has developed a powerful tool driven by the need to manage its selective metering programme and metering strategy going forwards. This has proved to be very successful, and has generated a number of spin-off benefits including the development of social tariffs. As CustARD provides an effective way to segment the customer base, further applications of the tool have been identified. ●

Note

[1] *Thames Water's financial results for the year up to 31 March 2013: www.thameswater.co.uk/media/press-releases/17145.htm*

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Paradigm shift from engineering to asset management: Rand Water, the largest water utility in Africa

Rand Water, the largest water utility in Africa, is in the process of making a paradigm shift from an engineering approach to an asset management (AM) approach. **LES LANGE** and **HAMANTH KASAN** of Rand Water provide insights into the initiatives undertaken and the results achieved so far.


Les W Lange

Rand Water provides 4400 million litres of quality potable water to 12 million people each day in the economic heartland of South Africa. Since its inception in 1903, Rand Water has built a proud history of never failing to supply a continually-growing customer base. To meet this increased demand, the organisation has always been focused on engineering projects to procure additional infrastructure. It therefore boasts a strong engineering division that undertakes planning, design, acquisition, construction and putting assets into service.

Johannesburg and Pretoria are large cities that are not built on or near a sustainable river or dam. Innovative solutions have had to be engineered over the years to meet the challenge of providing a water supply. With many assets now reaching the age of 50 to 100 years, implementing a formal asset management approach has become vital.

From engineering to asset management

The methods used to move from an engineering approach to an asset management (AM) approach were to:

- Develop an AM framework
- Restructure the Strategic Asset Management (SAM) division
- Assess the AM maturity of the organisation
- Address the planning activities in accordance with PAS 55 (Woodhouse et al, 2008)
- Address the implementation of asset lifecycle and asset improvement activities in accordance with the PAS 55 standard for the optimized management of physical assets

Asset management framework

The first step was to develop an AM framework (von Holdt et al, 2011) to adopt and implement AM for Rand Water's physical production asset portfolio. At this stage, the level of understanding of what AM comprises was low. The multi-disciplinary task team that initially developed the AM framework consisted of in-house experts from engineering, operations and finance. The document was then reviewed and finalised by more in-house team members and an external consultant.

PAS 55 concepts were adopted, and the AM framework clarified concepts including responsibility and authority, the definition of AM, stakeholders, statutory requirements, organisational structure, implementation process, policy development, strategy development, strategy implementation, improvement management and system concepts.

Restructuring of the strategic asset management division

The SAM division was originally discipline specific, silo-based and strongly focused on project execution. It was comprised of the Development, Civils, Installations and Operational Support departments (Figure 1).

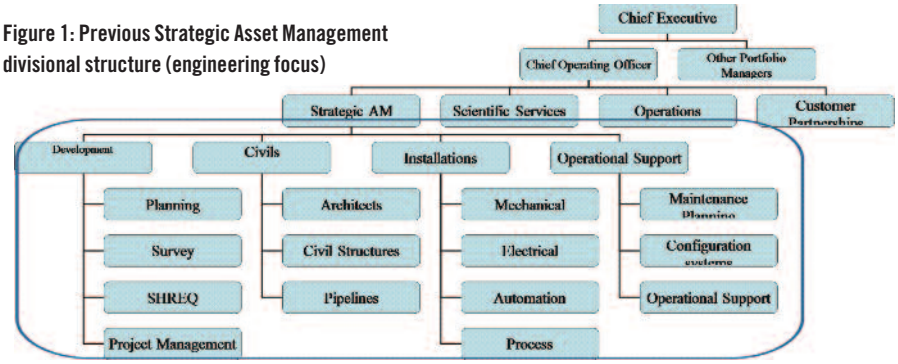
The Development department was responsible for future planning, proposals for augmentation, survey, GIS, maintenance support and project support. Renewal of existing assets was based on ad hoc requests from end users or reduced reliability of plant.

The Civils department was responsible for civil structures, pipelines and buildings. Its functions included specification and design, acquisition, project management, contract management, construction supervision, commissioning and handover of new or renewed assets to the operations division or installations department for equipping.

The Installations department was responsible for procuring and installing electrical, mechanical, automation and process equipment in the civil structures and buildings. Its functions also included design, acquisition, project management, contract management, supervision of manufacture, supervision of construction, commissioning and handover of new or renewed assets to end users, mostly the Operations division.

Operational support was in the form of maintenance planning services, configuration systems and operational technical support. Maintenance planning services were provided to the operational maintenance departments, which included running the computerised maintenance management system (CMMS), plant criticality analysis (PCA), reliability centred maintenance (RCM) plans, planned maintenance (PM) plans and root cause analysis (RCA) for plant failures. Configuration systems related to plant drawings, manuals and plant

Figure 1: Previous Strategic Asset Management divisional structure (engineering focus)



codification services. Operational technical support provided specialist services to help the Operations division with finding faults and technical asset related problem solving.

The SAM division was restructured on 1 July 2011 to provide an improved asset life cycle management approach. It is now fully involved in all asset life cycle phases, namely:

- Needs identification
- Feasibility and approval
- Specification and design
- Acquisition
- Construction and commissioning
- Operation and maintenance
- Decommissioning

The SAM division now comprises the Assets, Projects, Strategic Projects and Project Controls departments.

The Assets department is the custodian of assets over their full life cycle. It is responsible for future planning, maintenance planning, information management, needs identification, feasibility studies, specification, design, maintenance management, research and development.

The Capital Projects department is responsible for executing all projects related to new assets, renewals, replacements and major repairs.

The Project Controls department is responsible for business support, business assurance and document management.

The Strategic Projects department is responsible for non-core business projects of strategic importance, namely the in-house pipe manufacturing plant, the in-house pipeline construction crew, energy management and new business related projects to support the organisation's growth strategy initiative.

AM maturity assessment

The utility decided to determine the maturity of AM in the organisation after the restructuring, with the aim of identifying and implementing improvement opportunities. A maturity assessment (Moir et al 2012) was conducted and focused on 17 key performance areas (KPAs) (see box) through a maturity assessment methodology developed by Pragma Africa. These KPAs are in line with PAS 55:2008 (Woodhouse et al and Figure 3).

Pragma has developed what it terms best practices (BPs) for each KPA. There are 127 BPs for the 17 KPAs. The score for the BPs are averaged to get a score for the KPA. Assessment criteria have been developed for each BP as well as a rating mechanism as follows:

- Level 1: Fire fighting
- Level 2: Stabilising
- Level 3: Preventing
- Level 4: Optimising
- Level 5: Excellence

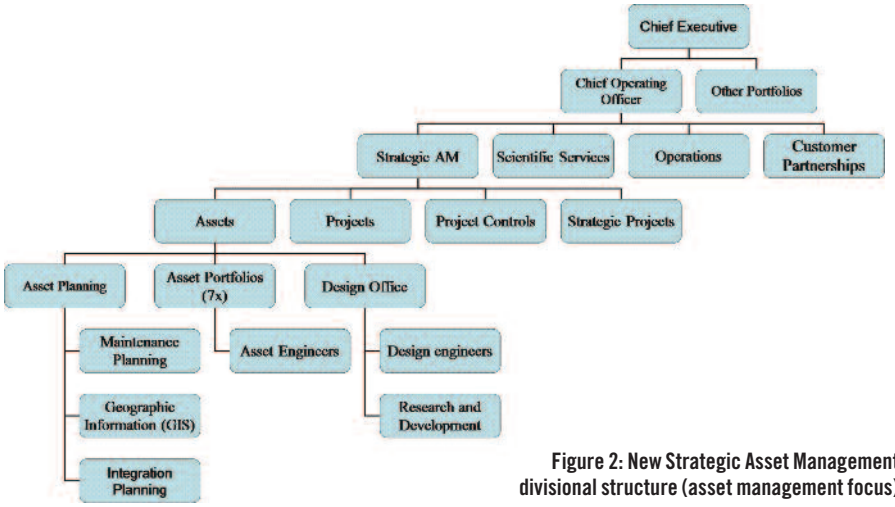


Figure 2: New Strategic Asset Management divisional structure (asset management focus)

The assessment results indicated a maturity of 2.44 on average for all 17 KPAs, with the lowest being 2.00 for KPA 1 and the highest 3.00 for KPA 13 (Figure 4). The AM maturity assessment helped tremendously in giving guidance on the AM implementation strategy going forward.

Planning

The planning (Figure 5) was done by improving KPA 1: strategy management. The AM maturity for KPA 1 was a score of 2.0. The best practices comprise:

- AM Steering Committee – this only existed for the Assets department at a lower level
- AM Policy – this was in draft format and not yet approved by top management
- AM Strategy – this long-term action framework was non-existent
- AM Objectives – no objectives were defined
- AM Master Plan – this short-term action plan was non-existent
- AM Strategy Communication – was ad hoc and at lower levels
- AM Progress Management – was non-existent
- AM Maturity Assessment – had not been done before

The maturity assessment not only helped the utility to understand how mature the AM practices were, but it also provided guidance in improving KPA 1's best practices. The assessment was completed by November 2012 and by June 2013 the status of KPA 1's best practices was:

- AM Steering Committee – approved by top management
- AM Policy – approved by top management
- AM Strategy – compiled for implementation through the AM Steering Committee
- AM Objectives – compiled for implementation through the AM Steering Committee
- AM Master Plan – compiled for implementation through the AM Steering Committee
- Strategy Communication – ready to start through the AM Steering Committee
- Progress Management – ready to start through the AM Steering Committee
- AM Maturity Assessment – ready to start through the AM Steering Committee

The AM Steering Committee members were nominated by top management in July 2013. They are senior managers from different business areas, who take responsibility for all 17 KPAs. As a result, there is now buy-in from the whole organisation and not just the technical staff.

Implementation

The implementation (Figure 5) focuses on life cycle activities and asset improvement activities.

Life cycle activities

The life cycle activities consist of:

- Needs identification
- Feasibility and approval
- Specification and design
- Acquisition
- Manufacturing, construction, installation and commissioning
- Operation and maintenance
- Decommissioning

Lifecycle activities are being improved though clear conceptualisation of what

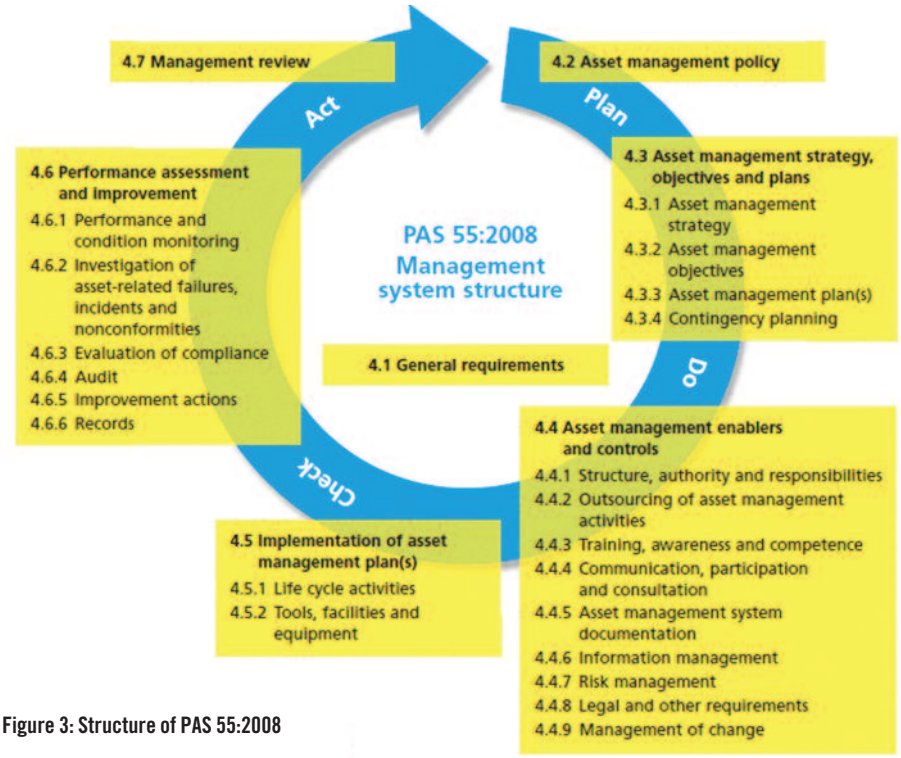


Figure 3: Structure of PAS 55:2008

constitutes each phase of the asset life, and clear definition of the roles and responsibilities during each phase. The utility is also improving skill levels to better fulfil roles and responsibilities, and obtaining a clear understanding of the inputs, activities and outputs of each phase of asset life. Other life cycle activities include implementing life cycle gates in the Enterprise Asset Management System (EAMS), and developing asset life cycle processes and procedures.

Asset improvement activities

Asset improvement activities consist of developing an asset hierarchy with eight levels, as follows:

- Level 1 – Corporate
- Level 2 – Corporate systems (supply chain)
- Level 3 – Sites (supply chain)
- Level 4 – Site systems (supply chain)
- Level 5 – Plants
- Level 6 – Sub-plants
- Level 7 – Equipment
- Level 8 – Components

Activities include: compiling an asset register in a database format with advanced search attributes; grouping assets in asset portfolios according to skill disciplines (civil, mechanical, and so on); structuring a planning section in the Assets department to identify needs and undertake feasibility studies for supply chain augmentation and corporate system, sites and site systems improvements; structuring seven discipline-specialised AM sections in the Assets department to identify needs and undertake feasibility studies for improvements to existing plant and equipment; and structuring a Design section in the Assets department to specialise in the specification and design phase of the asset lifecycle.

Further activities included: structuring a Projects department to specialise in the project execution element of asset life cycles, namely the specification and design, acquisition, manufacture, construction, installation and commissioning phases; the development of a responsibility matrix to link the asset systems with disciplines; and the development of a plant performance and condition rating scale of 1 to 5 where:

- 1 is very good. No work will be required in the next three to five years.
- 2 is good. Acceptable, but there is potential to deteriorate in the next three to five years.
- 3 is fair. Shows signs of deterioration, will required work in the next three to five years.
- 4 is poor. Likely to fail in the next three to five years. Renewal or replacement is needed.
- 5 is very poor. Has failed or failure is imminent. Renewal, replacement or decommissioning is urgently required.

Plant performance and conditioning assessment (PPCA) templates were also developed, as well as a PPCA plan to assess all plants over three years, starting with plants that have a condition rating of Level 4 and 5, some plant performance and condition assessments were executed, resulting in new renewal projects, plant criticality analysis methodologies were standardised across the organisation, and finally maintenance planning was improved through plant criticality assessments, reliability centred maintenance for the top 20% of plants in terms of criticality, planned maintenance for plants rated 40% to 80% in terms of criticality, ad hoc maintenance for plants rated 0% to 40% in terms of criticality, preventative maintenance optimisation and root cause analysis for a plant that fails.

Results and discussion

Planning

One big challenge was creating awareness of and developing buy-in for the immense value AM can bring to the organisation. This is of particular importance at top management level and in areas of the business other than the technical staff. Management focus sessions are held quarterly for the top

Figure 4: AM maturity results as of November 2012

200 managers of the organisation with a staff compliment of ±3000.

An opportunity was granted to make a presentation in December 2012, when the AM maturity assessment had just been completed. The concepts and benefits of AM and the results of the maturity assessment were highlighted, and the interest in the subject was so high that another presentation was made in February 2013. This helped with creating awareness and in getting the AM policy and the formation of an AM Steering Committee approved by top management.

AM policy

The AM policy (Lange et al 2013) was structured in accordance with guidelines provided by PAS 55 and was approved by top management in May 2013. It provides the AM definition, AM vision and AM mission for Rand Water and supports the organisational strategic initiatives.

AM strategy

The compilation of the medium to long-term AM strategy (Lange 2013) was aided by the results of the maturity assessment. It dovetails nicely with the AM policy and provides a framework for the improvement of all 127 best practices of the 17 KPAs to achieve:

- Level 3 maturity for all best practices by June 2015 (short-term)
- Level 4 maturity for all best practices by June 2018 (medium-term)
- Level 5 maturity for all best practices by June 2020 (long-term).

This strategy may be ambitious, but it is the utility's intention to become a leading edge water supply authority in AM. The AM Steering Committee will guide the strategy and updates to it going forward.

The AM Master Plan (Lange 2013) proposes short-term actions to be undertaken by the AM Steering Committee members and their technical sub-committees. The goal is to obtain at least a level 3 maturity for all 127 best practices by June 2015. It will also incorporate any additional actions required to become ISO 55000 certified by June 2015.

The AM objectives (Lange 2013) propose KPI scores for each of the 127 BPs, which are specific, measurable, achievable, realistic and time based (SMART). These objectives were formulated without an opportunity for proper consultation, and will no doubt be moderated by the AM Steering Committee in future.

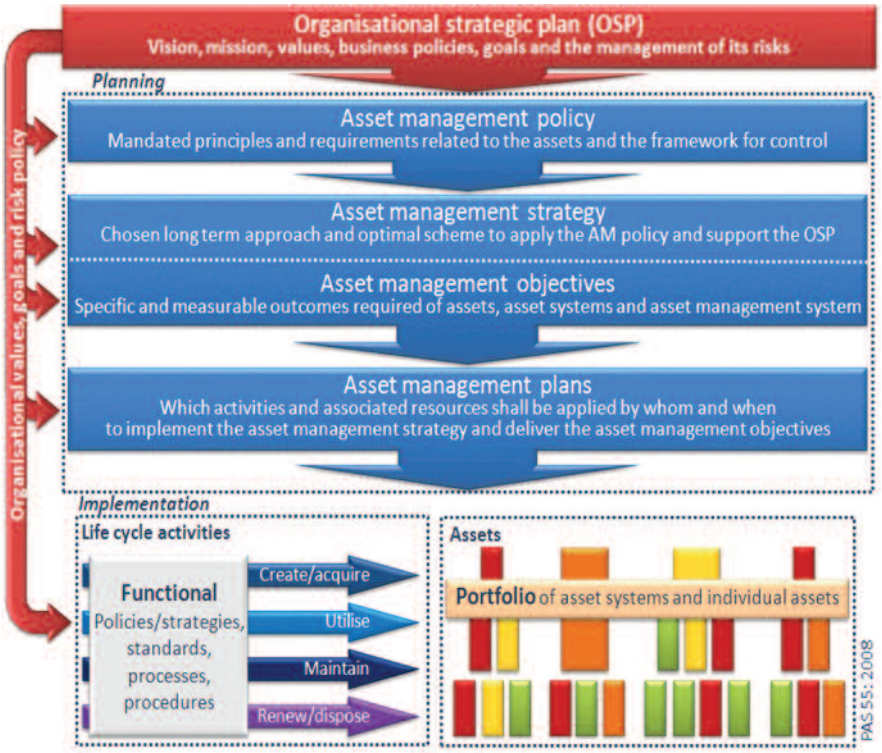


Figure 5: Planning and implementation elements of an asset management system (PAS 55)

The AM Steering Committee will be tasked with developing and implementing an AM strategy communication plan. It is envisaged that high level presentations about the AM strategy will continue to be made at key management forums, and to top management, the board of Rand Water, divisional workshops, maintenance workshops, operational workshops and conferences such as LESAM.

Achieving the required AM maturity levels will also be built into the performance contracts of top management, managers and individuals who impact AM implementation. The AM Steering Committee reports directly to the top management committee, who will also assist with communication.

Progress will be managed through measuring KPIs and tracking actual performance against targets. The AM maturity will be assessed regularly. The next assessment will be in February 2015, in order to determine what still needs to be done by June 2015 to achieve ISO 55000 certification.

Implementation: lifecycle activities

Needs identification

The need for augmenting assets is researched by the Planning department. Existing asset adaptation needs were previously identified reactively through ad hoc end user requests, asset failures, reduced reliability and poor asset performance. The approach now is more structured and proactive, and a formal gated approval process has been introduced for project requests.

The need for work on existing assets will be increasingly identified through formalised plant performance and condition assessments, plant criticality analysis, reliability centred maintenance, planned maintenance optimisation and root cause analysis. Once a project request has passed a simple five question process, it is passed to proceed to the feasibility and approval stage.

Feasibility and approval

All facilities have been allocated to portfolio asset managers, for example a reservoir to the civil asset manager, a pump room to the mechanical asset manager and an electrical sub-station to the electrical asset manager. Approved project requests are allocated to the planning manager if they are of a supply chain nature, or to the applicable asset manager, depending the discipline.

A comprehensive feasibility study is undertaken with solution proposals and cost estimates, and the proposed project is then scored via 15 questions. A pre-project investigation report (PPIR) is tabled for consideration in the newly-instituted Site Asset Review Committees – the relevant manager presents the report and, after deliberation, it either receives a 'go' or 'no go' decision.

Key performance indicators

Asset management policy, strategy, objectives and plans
- KPA 1 – Strategy management

Asset management enablers and controls
- KPA 2 – Information management
- KPA 3 – Technical information
- KPA 4 – Organisation and development
- KPA 5 – Contractor management
- KPA 6 – Financial management
- KPA 7 – Risk management
- KPA 8 – Environment, health and safety

Implementation of asset management plan(s)
- KPA 9 – Asset care plans
- KPA 10 – Work planning and control
- KPA 11 – Operator asset care
- KPA 12 – Material management
- KPA 13 – Support facilities and tools
- KPA 14 – Life cycle management
- KPA 15 – Project and shutdown management

Performance assessment, improvement and review
- KPA 16 – Performance management
- KPA 17 – Focused improvement

Specification and design

After receiving a 'go' decision, the project proposal awaits budget allocation, after which a project number is allocated by the system. The proposal is now a full-blown project and funds are authorised for scoping by the relevant delegated authority. A project manager from the Projects department is allocated to the project, whose responsibility is to manage the project life cycle including specification and design, acquisition, manufacture, construction, installation, commissioning and handover. The project manager appoints a project team. System engineering design processes are applied to generate specifications and designs, which are incorporated in standardised tender documents.

Acquisition

The tendering process has three stages. The first approves the tender document for issue, the second evaluates the tenders received, and the third awards the work. Before the award, funds for the complete project are authorised by the relevant delegated authority. Quantity surveyors estimate costs to ensure tender prices are market related.

Manufacturing, construction, installation, commissioning and handover

The successful contractor is responsible for quality control of the manufactured and installed assets. Project execution engineers are responsible for quality assurance, and asset engineers oversee the process to ensure compliance with the designs and specifications. Operation and maintenance staff are trained during this phase.

Operation and maintenance

The Operations division (see Figure 2) operates and maintains the assets. The four main sites all have specialist teams for operation and maintenance. The role of the Assets department during this life cycle phase is to provide maintenance planning services, implement the computerised maintenance management system (CMMS), undertake plant criticality analysis, generate reliability centred maintenance plans for the top 20% of critical plant, make planned maintenance plans for plant rated between 40% to 80% in terms of criticality, undertake ad hoc maintenance for plant rated 0% to 40% in terms of criticality, and carry out root cause analysis for plant failures. The large shift to proper asset management is provided through plant performance and condition assessments.

Decommissioning

This is a phase that is not currently well managed, despite the existence of an asset disposal policy. It will no doubt be improved by June 2015, to obtain at least Level 3 maturity.

Asset improvement activities

The structuring of the asset hierarchy helped in splitting a large asset base down into smaller manageable asset bases, and the asset register has improved asset knowledge. The challenge now lies in aligning the new asset register with the existing legacy asset registers.

Challenges encountered with the new organisational structure are mainly teething problems. In the past the engineers did everything from feasibility, design, specification, project management and contract management to quality assurance. Now responsibility is handed over each time from planning and asset engineers to design engineers and then to project execution engineers. The challenge is to improve the handover processes to ensure the quality of the end products. It was important to continue business as usual through the transformation.

The responsibility matrix helps to ensure that all supply chains and plant are covered to ensure supply chain reliability and plant effectiveness. Maintenance planning services will be helpful in getting the maintenance strategies and implementation up to the required standards. Plant condition and performance assessments and identification of any associated needs will create an effective and sustainable water supply for the long-term.

Conclusion

The results achieved so far can be summarised as excellent preparation for a full-scale asset management implementation in the years to come in a large water utility. Asset expansion, renewal, replacement, repairs and maintenance will be undertaken scientifically, ensuring that Rand Water continues its proud history of providing a reliable supply of high quality water into the future. The difference will be improved asset performance, reduced costs and reduced risks. ●

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Addressing asset management challenges in small water utilities

Small utilities in Australia provide essential services to a few hundred communities with populations from 10 to 5000 people, but their small size raises a range of issues with regards to finance, human resources and the management of widely dispersed infrastructure. **ANEURIN HUGHES** discusses the challenges faced by these small water utilities and how this affects asset management.

The Australian water industry has an excellent reputation for asset management gained over the past 20 years. Many of those at the forefront of asset management tend to be the larger utilities with significant customer growth and financial resources, a large infrastructure base, ageing infrastructure and specialist asset management resources and skills. In addition, many of these utilities are subject to a rigorous regulatory framework, with operating licences that specifically address their asset management obligations.

At the other extreme, Australia has many small utilities (mostly local governments) that service a much smaller customer base, have limited financial and human resources, and manage a number of geographically dispersed schemes. Such utilities provide essential services to around 150 communities in regional New South Wales and Queensland, and this article examines their scope, the challenges they face and options for addressing these challenges. For the purposes of this article, a small utility is one that serves a population of 5000 people or fewer.

Service demand

The population growth rate in Australia between 2011 and 2012 was 1.6% per year. As of June 2012, 70% of the population lived in Australia's major cities. By comparison, just 2.3% lived in remote or very remote centres (ABS, 2013). Analysis of population statistics (ABS, 2013) indicates that 213 of Australia's 542 local governments serve fewer than 7000 people (a population of this size is assumed in this article to contain approximately 5000 urban dwellers). The total population served is 536,000, around 2.4% of Australia's population. Table 1 summarises the extent of population decline by state and territory.

Structure of the Australian water industry

South Australia, Western Australia, the Northern Territory and the Australian Capital Territory each have a single state or territory-owned water corporation to deliver urban water services. Victoria has four metropolitan and 13 regional urban water providers. Tasmania has recently gone through a reform process, which resulted in water services being provided through one state-wide local government-owned corporation from July 2013, replacing the four corporations that had existed since July 2009. As a result, servicing small local government areas and settlements in these states and territories, while still challenging, can be easier because:

- Financial resources are available to invest in and sustain smaller schemes. For instance, the Water Corporation of Western Australia is given funding by the Western Australian government to help serve smaller communities, which is seen as a Community Service Obligation
- The smaller schemes gain access to in-house specialist skills, systems and processes to support day-to-day operations and asset management

Artesian bore for a central west Queensland township. These bores are critical assets, but are often over 100km apart. Credit: Aneurin Hughes

New South Wales and Queensland are the only two jurisdictions in Australia where ownership and management of water and sewerage infrastructure is predominantly through individual local governments (except for the larger centres of Sydney, Newcastle and south east Queensland). In New South Wales and Queensland, local governments (163 in total excluding the local government-owned corporations in south east Queensland) serve a population of around 3.5 million. There are 70 local governments (including Indigenous councils) that serve fewer than 5000 people, and these are expected to provide quality, sustainable urban services to a total population of around 120,000 across approximately 150 communities. These utilities have annual revenues ranging between AUS$200,000 and AUS$1.8 million (US$179,000 to US$1.6 million) for water supply, and revenues of a similar order for sewerage. There has been greater recognition of these smaller water utilities over the past few years in reviews of the urban water sector.

Table 1: Extent of population decline in smaller local governments

State / Territory	Total number of local governments with a population <7000	Number of these local overnments with a population decline 2011 to 2012	% of local governments with population <7000 experiencing a decline
New South Wales	31	14	45%
Northern Territory	8	1	13%
Queensland	39	23	59%
South Australia	29	13	45%
Tasmania	10	7	70%
Victoria	7	5	71%
Western Australia	87	23	26%
Total	**211**	**86**	**41%**

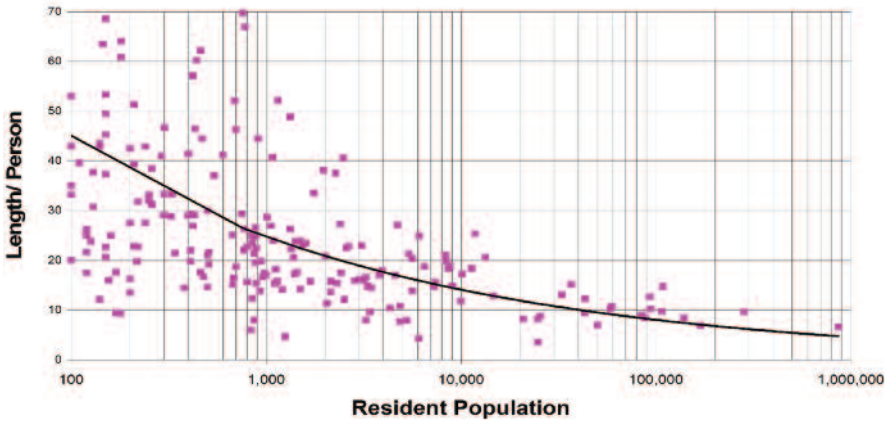


Figure 1: Length of water mains by size of population served (Qld)

Characteristics of small local government utilities

The following comments are based on the author's observations on smaller local governments in Queensland.

These organisations typically have a pragmatic board (that is, the Council), which tries to balance a wide range of community needs within a constrained financial environment, have water and sewerage as a minor component of a wider infrastructure portfolio, particularly highly-visible roads, and are very customer focused, but tend to have difficulty reconciling being owners of a 'business' and being a customer representative. This is seen in a reluctance to charge the full cost of service.

Water and sewerage services for these smaller utilities were typically installed in the 1950s, 60s and 70s during boom periods in the agricultural sector. Since that period many of these communities have either stagnated or declined. These utilities have to provide a greater amount of infrastructure per connection than larger utilities, as illustrated in Figure 1, and therefore have significant financial constraints because of the small customer base, which is declining in over 40% of these Councils. Table 2 illustrates the diseconomies of scale experienced. In addition to this, they do not have dedicated resources to deal with regulation, as the large utilities would, and have few technical resources. At the lower end, the most qualified technical person is the water officer or operator and sometimes these individuals may not hold formal qualifications. At the higher end the Council may have an engineer, but much of the engineer's time will be thinly spread across a wide range of Council services and in particular, roads. There are limited financial resources for specialist consultants. However, despite these utilities experiencing an even greater difficulty in attracting and retaining staff than the rest of the water industry, they continue to present an optimistic view of the future.

Asset management challenges faced by small utilities

A recent study examined smaller (fewer than 1000 connections) and medium-sized drinking water service providers (fewer than 25,000 connections) in Queensland (Oliver and Hughes, 2010). This produced findings relevant to asset management. While providers endeavoured to provide a reasonable standard of service to their customers within the constraints of limited resources, it was found that key constraints to service delivery were insufficient revenue, ageing infrastructure and inadequate skills. Many providers indicated that they only had sufficient resources to meet short-term requirements and a limited capability to undertake proactive strategic management activities (for example, planning to improve or maintain service standards).

There is also a tendency towards a short-term focus, with an emphasis on the day-to-day delivery of services, maintenance was generally reactive with limited planned strategies and operational practices and supporting systems and processes were generally informal, with an over-reliance on tacit knowledge. Documented operational practices are often either unavailable or unused.

There are limited opportunities to analyse data, take stock of performance and plan for the future and more than half of the respondents indicated that they did not have adequately skilled / trained staff or relief staff to operate their schemes, had difficulty attracting and retaining suitable staff and had experienced long lead times in replacing qualified staff.

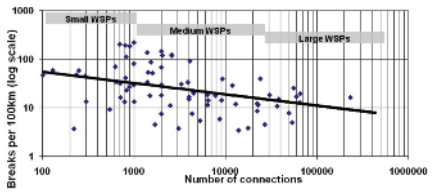
The analysis of mains break data suggested that the performance of distribution mains was quite variable, with some services experiencing higher incidences of mains breaks in comparison with services of a similar size, as illustrated in Figure 3. Small providers were more likely to detect *E. coli* in samples, despite the fact they generally take fewer samples, and large providers are more likely to achieve compliance with state-set water quality standards for *E. coli*. A similar trend was noted in smaller water schemes in New South Wales by Cretikos et al, 2010.

A comparison of service provider financial data can be difficult due to the variability of the number, types and locations of schemes managed, differences in approaches to cost allocation and so on. However, analysis of the relationship between the actual revenue received by the provider compared to the full cost of service delivery (that is, operation, maintenance, administration and depreciation) indicates the following trends (see Figure 3):

- Economies of scale exist with the size of the provider
- The smaller the provider, the less likely it is to be fully recovering the full cost of its water services

This is likely to impact on long-term sustainability.

In summary, the findings of the survey indicated that the standard of drinking water services provided by small and medium providers was highly variable and dependent on a wide range of factors, including finances, the capacity to respond to specific issues impacting their schemes, and the ability to attract and retain suitably qualified staff. These challenges became more pronounced



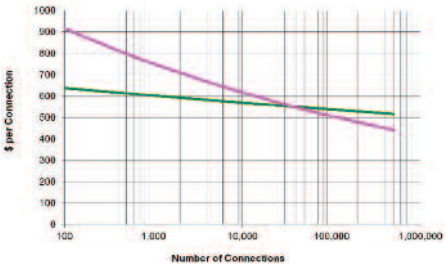


Figure 2 (TOP): Mains breaks per 100km of main (2002-2007) Qld

Figure 3 (BOTTOM): Full cost of water services versus revenue (Qld) (Oliver and Hughes, 2010) Key: green = revenue; purple= full cost of service.

Table 2: Diseconomies of scale by size of water utility – water supply. Source: 2011-12 New South Wales Water Supply and Sewerage Performance Monitoring Report

	Size of water utility			
	>10,000 connected properties	3001 to 10,000 connected properties	1501 to 3000 connected properties	200 to 1500 connected properties
Number of utilities	27	28	19	22
Water supply				
O&M and administration cost per property	$337 (US$302)	$477 (US$428)	$442 (US$396)	$545 (US$488)
Treatment cost per property	$46 (US$41)	$111 (US$100)	$127 (US$114)	$166 (US$149)
Pumping cost per property	$23 (US$21)	$34 (US$31)	$78 (US$70)	$93 (US$83)
Energy cost per property	$15 (US$13)	$15 (13)	$36 (US$32)	$50 (US$44.8)
Water main cost per property	$56 (US$50)	$87 (US$78)	$71 (US$64)	$79 (US$71)
No of employees per 1000 properties	1.4	1.6	1.8	2.2
Economic real rate of return	0.5%	0.4%	0.3%	-0.4%
Properties served per km main	39	26	26	24

the smaller the size of the providers. These challenges may not always be recognised by all utilities.

In recent years there have been a number of reviews that have identified the challenges faced by small regional water utilities. These have included the New South Wales Government (2008), Infrastructure Australia (2010), the National Water Commission (2011) and the Productivity Commission (2011).

Findings from these are similar to those of Oliver and Hughes (2010). In summary, these related to the financial capacity, issues around attracting and retaining staff, variable regulatory compliance and population decline experienced by many of the smaller utilities. All the reviews recommended institutional reform, for example, the National Water Commission (2011) recommended that: 'Governments and service providers should undertake reforms in regional, rural and remote areas to ensure that there is sufficient organisational, financial, technical and managerial capacity to meet service delivery requirements and protect public health and the environment, particularly in New South Wales and Queensland.'

An appropriate asset management approach

In some ways it should be easier for a small utility to implement asset management, because it has a smaller amount of infrastructure, the schemes are generally small and quite simple to understand, information should be readily available and the internal stakeholders are very few. In the author's experience the only difference between a well performing small utility and a poorly performing small utility is the continued presence or absence of one committed person. Unfortunately, when this asset management champion retires or moves on, the asset management journey starts again, often in a different direction.

To achieve sustainable asset management within a small utility requires an understanding by the 'board' (that is, the Council) of the need for asset management, with this understanding being reinforced at regular intervals. It also needs:

- Agreement and documentation of simple, readily understandable customer service standards
- Shared knowledge of the extent of the asset base, its capacity, loading, performance, condition, replacement cost and value and remaining life that is kept up to date. This can be captured in a simple spreadsheet / database and / or GIS.
- An understanding of the asset (service and structural) failure risks faced by the utility, with actions implemented to minimise the risks
- A simple operation and maintenance schedule supported by some succinct documentation that operational staff have been involved in developing
- A simple process for collecting recording, analysing and reporting operation and maintenance data
- A means of managing demand
- The financial resources required to sustainably invest in operation, maintenance, renewal and augmentation of infrastructure, people, systems and processes
- The availability of financial support where costs increase beyond what is reasonable for customers to bear
- Management and staff with the skills to manage and operate the water and sewerage services

It is also necessary to have the above documented in a simple strategic asset management plan that becomes a real working document for managers with relevant parts 'operationalised' for operational staff, and to have processes embedded in place to implement the plan. This is the most difficult part, particularly when the team is small and there is a high level of staff turnover.

Options to achieve effective asset management

There are various options to improve asset management in smaller utilities. These include capacity uilding and targeted support services, as well as institutional reforms. The institutional options are a local government alliance, a binding alliance, or a local government-owned regional water corporation. Other asset management improvement tools include regulation, financial support and skills development.

Capacity building

Both the New South Wales and Queensland state governments have provided guidance and support for smaller utilities to implement asset management over a number of years. IPWEA's NAMS.AU initiative is continuing to provide guidance to local governments in developing strategic asset management plans and supports programmes such as the LG Asset Programme to improve elected members' understanding of asset management in supporting service delivery.

Qldwater (the Queensland Water Directorate) and the New South Wales Water Directorate provide guidance and technical direction and promote good practice to local government in managing urban water. While both these organisations have been very effective in providing technical support to local governments, they also suffer from limited resources. However, opportunities exist for these organisations to continue to provide a wide range of capacity building services, including further knowledge sharing and dissemination of best appro-

Table 3: Organisational structure evaluation criteria (from New South Wales Government, 2008)

	Assessment criteria
Water and sewerage services	Viability – ability to raise sufficient revenue for operating and capital requirements
	Expertise – ability to attract the required skills to operate a successful business and satisfy regulatory requirements
	Efficiency – willingness to accept independent pricing review and maximum price setting
	Effectiveness – ability of the organisation to deliver positive commercial, social and environmental outcomes
Local governments	Economies of scope – ability of councils to continue providing services other than water supply and sewerage services
	Planning integration – ability of councils to continue with integration of water supply and sewerage planning, land use and development
	Employment – impact of organisational structure on employment
Communities	Social and economic – impact of organisational structure on communities

priate practice, and expansion, facilitation and coordination of skills development.

Targeted support services

This type of service was successfully implemented in the Torres Strait islands for a number of years. Following a significant investment in upgrading water supply and sewerage schemes in the outer 17 Torres Strait islands, an Infrastructure Support Group, which reported to the Island Coordinating Council, was set up. It included a core of specialist support staff, acting as the asset manager with operations being performed by water officers based on each island. Targeted support services included:

- Proactive strategic management in areas such as risk management, infrastructure planning, development, implementation and monitoring of asset management plans and financial modelling
- Knowledge management including O&M manuals, drawings, GIS, an asset register, operational data analysis and reporting
- Management of all regulatory reporting activities
- Operational troubleshooting
- Planning, coordination and procurement of maintenance through a maintenance management system
- Commissioning consultants to under take specialist services

The author considers this option to be particularly appropriate to small, remote communities including indigenous communities.

The smaller utilities can adequately cope with day-to-day operational activities, but have few resources to undertake any undertakings beyond this. There is a definite need to provide on-going support to embed formalised asset management practices, particularly in an environment where there is a high staff turnover.

Institutional reform

Local government alliance

This involves local governments working together on particular initiatives. There is a move in some areas of Queensland and New South Wales for Councils to form voluntary alliances to address specific issues in a more cost-effective manner. Examples of initiatives being addressed by some voluntary alliances include:

- Regional water security planning
- A regional drought management strategy
- A training, mentoring and resource sharing strategy
- Procurement practices to achieve economies of scale
- Regional asset valuation
- Strategic business planning
- Preparation of drinking water quality management plans

Binding alliance

This is a mandatory alliance between local governments as proposed in the report commissioned for the New South Wales Government (2008). Under this model, local governments become the owner while the Alliance becomes the strategic asset manager responsible for:

- Strategic business planning
- Strategic asset management
- Long term financial planning
- Tariff setting
- Specifying service and operational standards
- Prioritising investments
- Other activities such as those listed for local government alliances (see above)

Local governments also become the 'operator' and undertake works, operation and maintenance as specified by the Alliance.

Local-government owned regional water corporation

This is a separate body that owns the assets and provide services. A skills-based board is appointed by the shareholders (that is, the participating local governments).

The New South Wales Government (2008) adopted the criteria listed in Table 3 to assess these models. The review concluded that a 'one size fits all' solution was impractical because of the great diversity in geographic and socio-economic conditions across the state. However, the review recommended that the 'binding alliance' and 'local government owned regional water corporation' options be considered for the future delivery of water supply and sewerage services.

The author agrees with the finding that a 'one size fits all' solution is not appropriate but that the current situation is not sustainable in either regional New South Wales or Queensland.

Regulation

Queensland has had a legislative requirement for registered water service providers to have strategic asset management plans and customer service standards in place since 2001. There has also been a requirement for annual reporting and regular audits. The legislation provides for smaller providers (fewer than 1000 connections) to seek an exemption. This legislation has further required the development of drought management plans, system leakage management plans and more recently drinking water quality management plans. Currently the Queensland Government (2013) is investigating the benefits of moving away from a rigid process of approving plans (with associated costs of regular reporting and compliance programmes) to business-based performance reporting.

New South Wales (2008) has made proposals to strengthen water utility regulation including mandatory implementation of relevant plans, guidelines and standards complemented by an adequate reporting and monitoring framework and the designation of a regulator with adequate enforcement powers. Proposals also include pricing regulation, with prices set in accordance with approved business and financial plans, overseen by an independent authority.

Both Queensland and New South Wales have implemented tighter drinking

water quality legislation over the past few years. Regulation has a number of advantages, which include the fact that it makes formalised asset management practices mandatory and, if well developed, it can encourage innovation and continuous improvement.

However, the disadvantage is that asset management can be seen as just a compliance issue, not related to day-to-day activities and continual improvement. In the case of the smaller utilities, the cost of regulatory compliance can be substantial compared to the utility's revenue; this would only reinforce the perception that asset management is an imposition.

Skills development

There is increasing recognition within the Australian water industry that greater investment is needed in people, skills and capacity, and better use of local expertise and skills, which includes recognising, retaining and skilling staff. In December 2009 the Council of Australian Governments (COAG) agreed to commit to the National Water Skills Strategy. The challenges experienced by the smaller utilities and indigenous communities are recognised in this document, which includes strategies such as improving the water skills support base for rural, regional and remote communities, and attracting and retaining skilled staff.

Financial management

Without financial resources it becomes very difficult to invest in staff, specialist advisors, systems and processes and infrastructure renewal and/or augmentation. Unless utilities adopt the COAG / NWI pricing policies and principles (that is, full cost pricing) it will be extremely difficult to sustain services. In the case of the smaller utilities, who suffer from significant diseconomies of scale, it will be necessary for state governments to provide some subsidies to ensure that the service remains affordable to customers. Both the New South Wales and Queensland governments have provided capital works subsidy programmes over many years. The bias of subsidies towards new capital works can often distort investment decisions.

The New South Wales government's country towns water supply and sewerage programme has a goal of providing appropriate, affordable, cost effective and well managed water supply and sewerage services in urban areas of country New South Wales. To be eligible for financial assistance, water utilities must comply with the New South Wales' 'Best-practice management of water supply and sewerage framework', which includes the following elements:

- Integrated water cycle management
- Strategic business planning (outputs include a total asset management plan and a long-term financial plan
- Pricing
- Water conservation
- Drought management
- Performance monitoring

The provision of subsidies needs to encourage good asset management, but in practice this can be difficult. Evidence of implementation of these plans may be a better incentive to encourage continuous improvement; in the case of New South Wales this may be through the well-established state-wide performance monitoring programme.

Conclusion

Small utilities are facing increasing challenges, which become more pronounced as a result of population decline, ageing infrastructure, difficulty in attracting and retaining skilled staff and limited financial resources.

A number of options exist to help these utilities to continue providing affordable, sustainable, quality water and wastewater services to their customers. Foremost amongst these options is the need for institutional reform.

These smaller utilities provide a significant contribution to the health and wellbeing of the communities they serve. They deserve support and encouragement to continue to provide these essential services.●

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Applying asset management analysis to strategic business decisions

Implementing a formal asset management programme has been key to delivering the strategic goals and objectives of the US utility Loudoun Water. **DAVID SKLAR** and **RODDY MOWE** explain the details and lessons learned for key integration points between asset management and strategic business planning.

Since 2010, Loudoun Water, a US water utility located in the Washington DC Metro area, has been developing and enhancing its asset management programme through an incremental process, carefully integrating many different practices, programmes, and organisational disciplines.

As both the utility and the county have focused heavily on growth and development over the past decade, the asset management programme has developed in parallel with many other strategic initiatives. This has enabled Loudoun Water to blend asset management principles with many other strategic business decisions, including capital investments, technology implementation and integration, business process and data management improvements, and customer service enhancements.

It is important to note that Loudoun Water views asset management not as a stand-alone function or activity, but a set of tools, techniques, and methodologies that can be integrated throughout the existing organisation. To date, representatives from engineering, operations, maintenance, finance, IT, and customer service have all been involved in shaping and implementing the programme. In addition, the organisations' senior leadership has been actively involved in providing guidance and governance, ensuring that asset management and business management concepts are integrated together, and that related initiatives are aligned. Many of these initiatives have a common goal of supporting strategic business decisions that are thoroughly analysed and drive optimal long-term decisions for the utility.

The remainder of this article will provide an overview of key elements of the programme, along with a selection of initiatives that provide greater insight into how asset and business decisions can be best aligned. These elements include starting with a strategic plan foundation that aligns with the principles of asset management, ensuring the entire organisation is aligned and avoiding 'silos'.

Other aspects include integrating risk and triple bottom line (TBL) frameworks for decision making, as well as applying analytical tools and techniques to strategic business decisions and establishing leading edge technology tools and data that support business decisions. The article will also address developing an incremental approach that builds on short-term successes, responding to public and market forces and fostering continued improvements over time.

Strategic plan – aligning business and asset management objectives

In late 2010, Loudoun Water developed an updated strategic plan to guide the organisation through 2014. The strategic plan helped lay the foundation for many of the initiatives that are discussed in this article, as several of the goals and initiatives were directly aligned with asset management and business decision making. This ensured a strong understanding of needs and drivers for both employees and the board of directors.

Some of the specific goals and objectives most directly aligned included the aim of proactively planning, developing and managing resources to serve Loudoun Water customers and the community, enhancing sound financial performance and safeguarding customers' investment, as well as leveraging technology to optimise Loudoun Water's business practices.


David Sklar

The strategic plan led to an internal effort to pilot asset management concepts and tools based on the US Environmental Protection Agency (US EPA) guidance documents. This pilot allowed Loudoun Water staff to form collaborative teams and become familiar with some of the basic asset management techniques and terminology.

A more formal programme was initiated in early 2011, and one of the initial activities involved developing a formal statement to further solidify and communicate the importance of this effort to the entire organisation (see Figure 1). Another key output was a comprehensive gap analysis and implementation plan that identified seven key initiatives and 23 specific tasks that would form the basis for a long-term programme, and provide a checkpoint to track progress.

LOUDOUN WATER

"Loudoun Water is committed to maintaining an integrated and sustainable asset management program that enables improved decision-making, facilitates focused resource allocation, and meets our core mission of providing safe, reliable, high-quality services to our customers"

Figure 1: Asset management programme statement

Ten of these tasks were identified as being of the highest priority for the first two years of the programme, as they were agreed to be the most likely to offer significant near-term benefit to the organisation. Some of the initial goals for the first two years included building processes and tools to optimise asset life-cycle cost and ensuring appropriate funding for renewal and replacement, and implementing risk-based approaches for objective decision making, including project prioritisation.

Other priority goals included supporting the enterprise resource planning (ERP) decision process and configuration, including data capture and management procedures for asset commissioning, and developing a comprehensive and consistent framework for inventory, attributes, condition, criticality, risk and valuation.

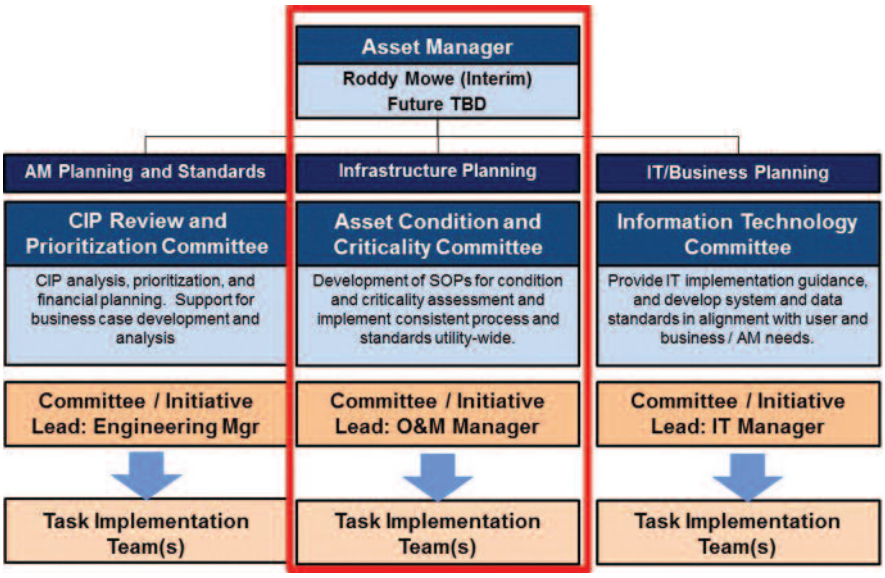

Figure 2: Asset management programme organisation structure

Organisational alignment

Integrated work teams have been critical to the success of Loudoun Water's asset management programme and other strategic initiatives, and have included staff from operations and maintenance, finance, engineering, customer service and IT. As the asset management programme was developed, Loudoun Water had a clear aim of avoiding a 'siloed' structure, and insisted on a framework that emphasised integrating additional roles and responsibilities within their existing organisation (see Figure 2).

A senior level leader for the programme was appointed from the outset, with strong support from several cross-functional implementation committees. The most critical near-term committee was tasked with addressing and owning the asset condition and criticality methodologies. This committee was chartered with specific roles, responsibilities, and implementation plans. A diverse range of members was appointed, including individuals not just from O&M but also from many other departments, to foster a collaborative environment and promote knowledge sharing.

Loudoun Water also deliberately involved all staff in methodology development and also in actual fieldwork. As an example, this offered an opportunity for staff in IT and finance to gain experience with the real world needs of staff maintaining equipment, enabling them to better understand the importance of accurate asset data and simple, easy to use information systems.

Another clear example is the on-going SAP ERP implementation. This is one of the most critical and complex projects that the organisation has ever initiated, with equal importance and impact across asset management, business strategy and finance. SAP must align with and incorporate complex business rules such as asset management data and risk methodologies, ensuring that IT investments deliver their true value to the organisation. While ERP systems avoid disparate tools, they also require the development of business rules and logic that can support diverse organisational and business process needs.

One of Loudoun Water's desired outcomes for the SAP implementation project is a common business platform for data and information sharing that can support a unified and collaborative organisation by improving data availability and consistency. This would not be possible with disparate decision support systems owned by individual departments, and it was one of the key reasons for deciding to choose an ERP solution.

To achieve this aim, the SAP implementation team has been working closely not only with billing, customer service and finance but also with the asset management team to ensure that Standard Operating Procedures (SOPs) developed for infrastructure maintenance and reporting will work with new software systems as they go live. Based on previous successes, Loudoun Water will continue to use collaborative and cross-functional work teams to ensure that critical business decisions consider the needs of all facets of the business, and all departments feel they are active participants.

Risk and triple bottom line frameworks

Sound business decisions require a balanced analysis of financial implications,

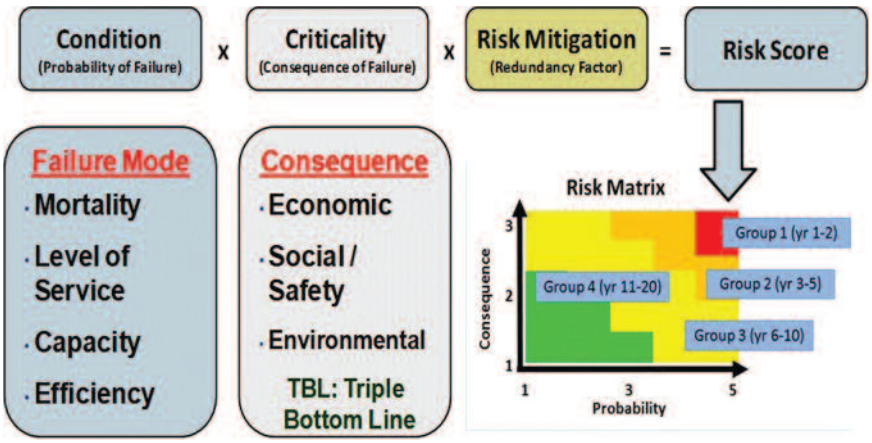

Figure 3: Loudoun water asset risk framework

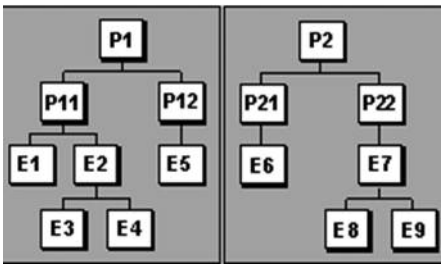

Figure 4: Use of SAPs hierarchical measuring points

as well as social and environmental impacts. The asset management risk methodology used by Loudoun Water (see Figure 3) specifically incorporates a TBL approach when evaluating the consequences of an asset's failure. This ensures that impacts such as public and employee safety (social), regulatory compliance (environmental), and operations and maintenance (financial) are considered when evaluating an asset's risk to the organisation.

For example, if assets in a wastewater pump station were to fail, the utility must consider not only the environmental impact of a potential sewage spill, but the financial costs of repair as well as potential public and employee safety issues, depending on the expected failure mode and the location of the facility.

The TBL framework has also been embedded in Loudoun Water's approach for select capital project business cases. Comprehensive business cases have recently been developed for several significant multi-year programmatic investments, and in the future Loudoun Water hopes to put in place more formal processes for all of their most significant projects, incorporating a formal review and approval by a senior management committee before projects are approved and funded.

A comprehensive written manual for programmatic business cases was developed in 2012 in parallel with the development of a strategic business case for expanding the water reuse programme. Water reuse / reclaimed water is an excellent application of the business case approach, as it is a very visible initiative to the board of directors and the public, requiring a thoughtful and transparent evaluation. The water reuse programme also specifically aligns with the organisation's strategic plan goal of managing environmental impacts.

Loudoun Water's business case manual establishes a foundation for TBL analysis to be completed using a qualitative analysis or multi-criteria evaluation at a minimum. In many situations, however, it may need a more quantitative approach using monetised TBL analysis. The latter would require Loudoun water staff to look more formally and in greater detail at the expected benefits and costs related to impacts such as greenhouse gas emissions, energy use, system reliability, customer interruptions, system security / vulnerability, economic development, and even things like traffic control and community disruption during construction.

The business case also encourages measurable objectives, by requiring tracking of metrics that demonstrate specific quantified benefits after investments are completed. Examples include monitoring of benefits such as additional revenues, improvements in reliability, and maintenance cost reductions. By tracking projects in this way, Loudoun Water will be able to provide feedback and input for future projects, to determine which investments met or exceeded expectations and provide information and transparency to stakeholders.

When developing quantitative values for social and environmental benefits and costs, assumptions should be clearly defined and documented. In addition, sensitivity analyses can be performed to assess whether a range of values for social and environmental costs would have a significant impact on overall investment decisions. This can help answer the question of 'how much analysis is enough'. In addition, any monetised benefit analysis must be shown to align with business drivers, asset management and organisational goals by explicitly documenting the specific drivers and strategies that an individual project supports.

Loudoun Water intends to continue to cultivate increased use of these tools in future to help tackle ongoing technical and strategic challenges and questions. A formal risk and TBL framework that aligns with strategic business drivers and challenges will help to ensure that the utility can meet increasingly stringent customer expectations and environmental compliance regulations while delivering demonstrated cost efficiencies and providing clear justifications to stakeholders.

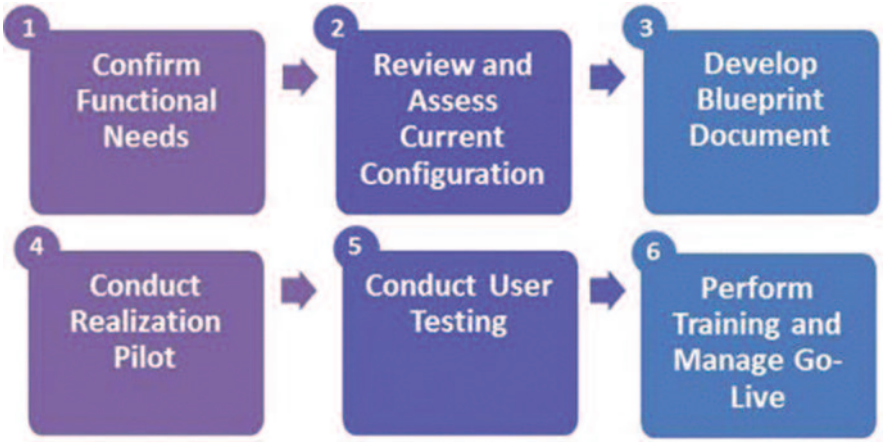

Figure 5: Key tasks required for future SAP enhancements

Data and systems alignment and integration

Loudoun Water is planning to go live with a comprehensive SAP implementation in 2014. Driving the decision to go with an ERP system was the desire to build an integrated solution that could support all core utility functions including finance, customer service, billing and asset / maintenance management. The asset management team were heavily involved in this effort from the start, and Loudoun Water recently developed a blueprint to align SOPs for asset hierarchy, attribute data, condition, criticality, risk and asset valuation methodologies with the SAP implementation efforts.

While some of the more advanced functionality may not be deployed until later configurations, the goal was to ensure that the initial SAP implementation met basic needs. At the same time, the organisation wanted to ensure that a path was established for SAP to support advanced asset management analysis and risk reporting in the future, and stay aligned with business and financial strategies. The end goal was to realise the most benefit possible from IT investments.

Loudoun Water understood that maintaining consistent and accurate data in the SAP system was critical in enabling the basic functionality of a work management system. While a solid asset inventory ensures that crews can easily find assets to write work orders against, it is just as critical to gathering data and applying more sophisticated analysis of condition,

criticality and risk, as well as TBL analysis.

A consistent data management and analysis process enhances capital and maintenance planning, and supports overall asset management implementation. As the baseline SAP effort was nearing completion, a blueprint document outlining future asset management needs was developed to provide a clear approach that addressed the specific elements of condition, criticality and risk methodology that have been developed over the past two years.

This document addressed supporting asset hierarchy and attribute information, to ensure that data follows standard format for collection, updates and reporting. It also focused on supporting asset condition data, to ensure that condition information can be stored and tracked over time and used as an input into maintenance and capital decisions. In addition it tackled supporting asset criticality and risk data and calculations, to ensure that formal risk scoring can be determined and used in prioritising investment needs.

Other issues addressed in the document included support for useful life and replacement cost data and calculations, to ensure that the utility can feed information into capital and financial planning decisions; and support for overall data management, to ensure that staff can enter and update information as needed in a user friendly way. The document also looked at support for analysis and reporting, to ensure that data entered can be extracted from the system, then analysed and presented in a business friendly way so it can become a useful management tool.

Another key component of the SAP blueprint document is the provision of guidance for using 'measuring points' to store and track condition data over time. In the asset management methodology, an asset's physical condition score is a weighted average of several criteria (such as corrosion, leakage and vibration) that are assigned a score from 1 (excellent) to 5 (very poor).

Measurement points are standard SAP functionality that can track individual scores for each criterion. This supports tracking of not just overall asset deterioration over time, but specific condition issues that are driving O&M needs. For example, if there are eight criteria that make up the overall physical score for a mechanical assessment, a piece of equipment would have eight physical condition measuring points, each being used to track one of the criteria scores. Loudoun Water can then use hierarchical measuring points that enable the transfer within an object hierarchy (see Figure 4). This approach will support the ability to score equipment at a higher level in the hierarchy (asset group or process level), and allow the equipment below to inherit scores, as desired.

As part of the SAP analysis, a detailed work plan was developed to incrementally roll out these and other enhancements after the initial go-live (see Figure 5). This work plan outlined and detailed key tasks including formal documentation of functional needs, pilot implementation, user testing, training and go-live. This work is expected to start in 2014/15.

Applying strategies to business decisions and capital investments

As mentioned above, Loudoun Water has started to implement the requirements to develop comprehensive business case evaluations for strategic investment projects that also incorporate TBL analysis. Recent efforts have focused on developing a standardised business case template that will be available to all staff, to ensure a consistent approach to analysis and decision making for the utility's strategic projects in future.

The two most recent applications of this practice are a planned expansion of the reclaimed water system, and an investigation of the feasibility of connecting selected small community systems to existing central system assets. These projects were both of strategic importance to Loudoun Water and its stakeholders, and have important considerations from engineering, operations, and financial perspectives.

Water reuse business case

Expansion of the reclaimed water system in support of the water reuse programme is an important strategic objective for Loudoun Water. It supports a key objective in the strategic plan of 'evaluating and developing business practices and systems that manage Loudoun Water's impact on the environment'. Even more specifically, the strategic plan calls for expanding the use of reclaimed water to reduce drinking water demand, increase revenue and reduce nutrient loading. Therefore the water reuse programme has a direct impact on all three TBL components.

The water reuse programme has many complex drivers and issues as well as multiple stakeholders both inside and outside the utility. For the past few years, Loudoun Water has worked with the development community to raise awareness of the business benefits of using reclaimed water for building / facility cooling, with the primary users being IT data centres. This programme also supports community economic development and broader social goals of sustainability.

Business cases performed on these specific projects have been comprehensive and have optimised decision making at Loudoun Water, applying a broad range of analytics across finance and engineering. These include life cycle cost (LCC) analysis and monetisation of social and environmental benefits including green infrastructure, water reuse and community economic growth. The business case for the water reuse programme evaluated the technical, financial, social, and environmental implications for several likely engineering alternatives.

Specific analysis undertaken included cash flow and revenue forecasts, projected

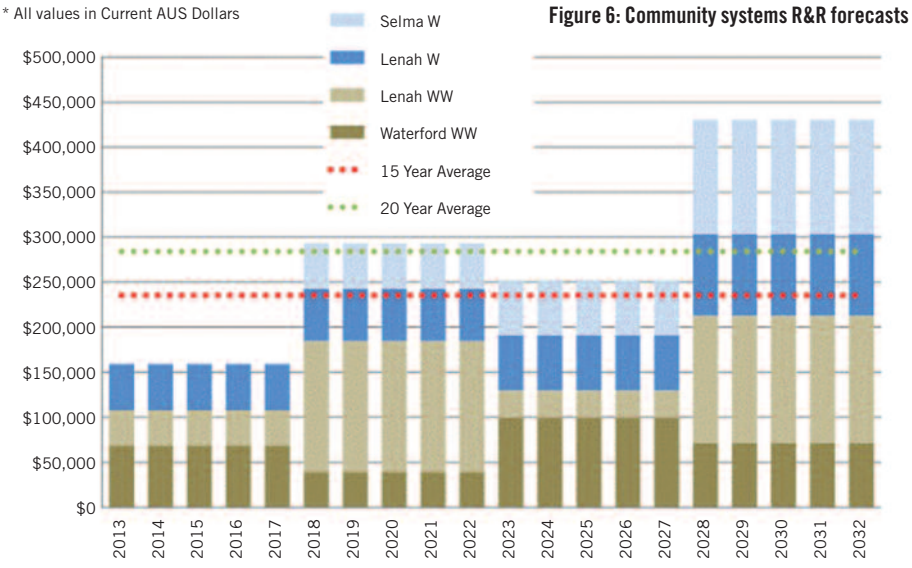

Figure 6: Community systems R&R forecasts

operations and maintenance costs, renewal and replacement projections, expected customer demands, deferred wastewater treatment costs and potable water production / purchase costs. Market uncertainties such as economic growth were also analysed.

The business case also included general policy recommendations, building requirements for large commercial customers near the reclaimed water system. At the end of the process, the analysis projected a strong net return on investment based on supporting data and analysis, and as an end result the project was strongly supported and approved by the board.

Community system connection business case

As part of an initial asset management pilot, Loudoun Water undertook a comprehensive asset inventory, condition, criticality and risk assessment for several of its smaller community system assets. Separate from the main central system, the community systems are small water and wastewater treatment facilities that typically serve 50 to 500 residents in less developed areas of the county. These systems are typically designed and installed by developers, but after commissioning are owned and operated by Loudoun Water. As such, the utility has responsibility for O&M and future capital needs over the life of the asset.

Some of these systems are either in the middle or towards the end of their useful life, and will need significant capital investment to continue to operate effectively and efficiently and meet regulatory requirements. As part of the asset management pilot, Loudoun Water was able to develop 20-year replacement and renewal (R&R) forecasts for several of these facilities (see Figure 6), providing critical management data. Because these systems represent a small portion of the total customer base, historically there had been minimal formal analysis or data collection, and capital replacements were projected based on more informal or short-term decisions and processes.

Installation of Loudoun Water's reclaimed water system. Credit: Loudoun Water.

As the county continues to grow and develop many of these systems, which were previously in rural areas, are now within reasonable distance of the central system. Accurate R&R forecasts are critical in deciding how to operate and maintain these systems in future, and in the case of the Lenah Run community, this information helped Loudoun Water to make the final business decision to connect its water and sewer system to the central system and decommission the existing treatment facilities in the near future.

While there were many other factors examined in the business case including regulatory compliance and community impacts, having a solid understanding of the true life-cycle cost of maintaining these systems over the next 20 years was a factor in supporting these business decisions. As smaller systems continue to age and the central systems continue to expand, Loudoun Water will need information for many similar business cases in the future, and the process can be repeated.

Conclusions and benefits achieved

Over the past few years, Loudoun Water has continued to develop an improved focus on business decision-making that integrates asset management and business management best practices, and is driven by solid information systems and data. This has enabled the utility's leadership to develop strong and transparent relationships and a culture of trust with both its board and customers. These principles will continue to be applied to future decisions, which will be enhanced by ongoing process, systems, and data improvements.

Key benefits achieved to date include repeatable SOPs to allow condition, criticality and risk to be evaluated at both asset and project level and sustainable, long-term process and practices, with Loudoun Water as owner and champion. Other advantages include enhanced risk analysis to support capital needs and accurate long-term financial forecasts, and the availability of robust data to enable staff to better evaluate infrastructure priorities. The utility can also make transparent decisions and provide strong supporting information to share with stakeholders, and its systems are configured to meet business needs across departments and functions.

Ongoing initiatives and next steps

As noted throughout this article, Loudoun Water is certain that the asset management programme will continue to play a strong role in aligning with other strategic programmes and decisions. The programme will continue for the foreseeable future, with several additional initiatives already underway or planned for the next several years. Highlights include continued condition and risk assessment of water and wastewater system assets and the development of data collection and commissioning SOPs for new capital projects and assets, as well as the development of simplified business case templates and TBL prioritisation methodologies. The company also plans to complete SAP implementation and ongoing configuration enhancements. ●

This paper was presented at LESAM 2013 – the IWA Leading-Edge Strategic Asset Management conference, held 10-12 September 2013 in Sydney, Australia.

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