INFRASTRUCTURE ASSET MANAGEMENT: HOW TO ACHIEVE THE MOST OUT OF YOUR WATER AND SANITATION ASSETS

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ABSTRACT

The South African water sector anticipates spending over R670 billion over the next ten years in infrastructure. Municipalities have an important role to play yet they are facing a number of chronic and acute challenges relating to the sustainable delivery of water and sanitation services. The underlying reason for many of these issues is the lack of robust, integrated infrastructure asset management systems and risk based decision making. In light of the problems faced and the funding being allocated to the sector, it is essential that these assets are managed effectively and the budgets are spent wisely. A system such as ISO55000 can facilitate significant improvements in the way water and sanitation assets are managed and guide the investment decision making process. The main components of ISO55000 are presented as well as a summary of some of the tangible benefits that may be achieved. Various asset management guidelines have been published over the years and these are also presented, with a particular reference to the South African municipal sector. An asset management system, and particularly a risk and value approach, will allow asset related decisions to be based on credible evidence and risk to service. Such an approach is central to ISO55000 and puts the customer and external stakeholders at the centre of decision making; as all operational and investment decisions will usually have an impact on customers and the environment. The implementation of a risk and value approach does not need to be complex as long as a few key components are considered and followed, in particular strong leadership, and a well-defined risk and value framework defining the scope of the risk management system and the business processes to be followed. A number of best practise examples are presented to show how some water utilities are using a risk based approach to improve performance, optimise costs, reduce risk and outperform stakeholder and customer expectations.

INTRODUCTION

The provision of good quality and reliable drinking water and the safe disposal of sewage is a fundamental requirement for healthy and sustainable communities. Furthermore, water is a strategic resource critical for social and economic development. The National Development Plan and the National Water Resource Strategy 2 have both highlighted the significant contribution that water plays in the transformation of South Africa (Department of Water Affairs, 2013; National Planning Commission, 2011).

South Africa has an extensive water and sanitation asset base. This includes raw water abstraction and storage; water, waste water and sludge treatment; water reticulation and sewerage; pumping stations and potable water storage systems. These assets are critically important infrastructure that provides significant social, environmental and economic benefit. Consequently, the effective management of these infrastructure assets is vital to ensure scarce resources are allocated efficiently and the strategic outcomes, objectives and targets outlined in the National Development Plan and the National Water Resource Strategy are met.

Legislative context

The Constitution provides for the rights of individuals to have access to basic water and sanitation and sets out the institutional framework for the provision of these services. The development and management of water resources is guided by the National Water Act of 1998. The National Water Act seeks to ensure that the country's water resources are protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all people. The delivery of water services is guided by the Water Services Act of 1997. The Water Services Act prescribes the legislative duty of municipalities as Water Service Authorities to supply water and sanitation. It also regulates Water Boards as Water Service Providers.

Legislation that relates to asset management includes the Municipal Finance Management Act of 2003, Municipal Structures Act of 1998, Municipal Systems Act of 2000, Physical Planning Act of 1991 and the Public Finance Management Act of 1999. Furthermore, the National Treasury Regulations describes the responsibility for managing physical assets in the public sector. These documents approach asset management generally from an accounting and financial reporting perspective and not from an asset management system perspective.

Water services infrastructure

There are almost 2000 wastewater treatment plants and over 800 water treatment plants distributed throughout South Africa (Development Bank of Southern Africa, 2012) as illustrated in Figure 1 below.

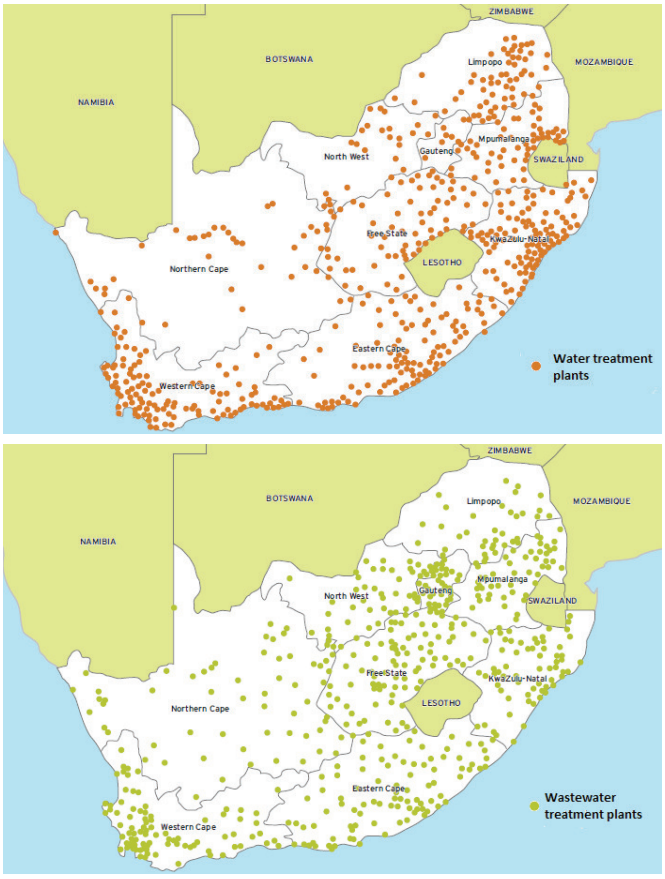

FIGURE 1 Indicative locations of wastewater treatment and water treatment plants (Development Bank of Southern Africa, 2012)

The Department of Water and Sanitation operates and maintains infrastructure comprising of dams, pipelines and pumping stations. The replacement value of these assets is approximately R139 billion (excluding land). Local and district municipalities operate and maintain local water and sanitation systems. At present municipal asset valuation information at the aggregate level is either outdated, unreliable or non-existent. Some estimates suggest wastewater treatment infrastructure has a replacement value of approximately R23 billion. The value of the municipal

water treatment and distribution infrastructure is not known (Development Bank of Southern Africa, 2012).

The Department of Water and Sanitation is putting together a comprehensive investment framework for the water and sanitation sector, with a particular focus on meeting the outcomes of the Strategic Infrastructure Project 18. This framework will help to facilitate effective and timely investment by informing budgeting and embedding integrated planning based on a life cycle approach.

Capital investment in water and sanitation infrastructure including the refurbishment of existing assets over the next ten years is projected to require an estimated R670 billion. On the basis of current budget allocations, about 45% of this is currently funded (Mokonyane, 2014; Development Bank of Southern Africa, 2012). This is a considerable sum of money, and in light of the budget constraints, it is imperative that the funds are allocated correctly, spent on the right asset at the right time and brings the necessary benefit and return on investment expected.

Challenges

The challenges facing the water sector, and in particular municipal Water Service Authorities, are well documented. A number of reports have highlighted the following as key issues, risks and challenges that need to be addressed urgently (Department of Cooperative Governance and Traditional Affairs, 2009; Development Bank of Southern Africa, 2012; South African Institute of Civil Engineers, 2011).

- Pollution of aquatic systems and water sources from poorly managed sewerage systems and waste water treatment plants
- Poor water conservation and demand management across the entire water sector value chain, leading to high water losses
- Deteriorating domestic water quality from poorly managed reticulation systems and water treatment plants
- Weak institutional capacity (management and governance) and a shortage of skills. This then affects the ability to plan, design, construct, operate and maintain assets and has resulted in a lack of integration in the development of water resources and water services
- Inability to accurately plan and spend capital renewal and maintenance budgets. Some budgets are under spent and others significantly over spent. Capital spend is often on new assets at the expense of refurbishing or maintaining existing assets. Maintenance spend is seen as discretionary and is deferred in favour of new capital projects or other operating costs
- Insufficient revenue base and generation. This is compounded by poor credit ratings and the inability to raise capital through banks
- Lack of credible data and information on asset age, performance, condition and residual value.

The problems are well known, but will be difficult to solve. What is more, each municipality will have its own challenges and therefore the solutions will vary based on the context of the problem. With that said however, there is a common theme emerging in the challenges listed above – there seems to be a mixed approach to the way infrastructure asset management is undertaken. Whilst there are some examples where South African water and sanitation organisations are practicing good asset management (Bhagwan, 2009), there is a lack of sector specific asset management policies, life cycle management models and management capacity for executing asset management to an appropriate standard in all municipal locations. Following an analysis of available Water Service Development Plans (WSDP), very few seem to use asset management principles or approaches in the way these plans are developed (Stephenson et al, 2001). As WSDP's are the primary vehicle for the planning and execution of asset interventions, and they directly inform the municipal Integrated Development Plan (IDP), this is a concerning situation. Given the challenges faced in the water services sector, there is a considerable opportunity to use an asset management approach in the way water and sanitation assets are planned for, operated and managed.

TABLE 1 Components of an asset management system and relevance to the municipal context

Component	Sub-Component	Municipal Context
Organisational Context	1. Understanding the organisation and its context 2. Needs and expectations of stakeholders 3. Scope of the asset management system 4. Asset management system	1. What you do, why you do it and how you do it 2. Where you want to be 3. How and when you want to get there 4. Understanding influences
Leadership	1. Leadership and commitment 2. Policy 3. Roles, responsibilites and authority	1. Mayor and Municipal Manager are accountable 2. Strategic objectives and outcomes you require linked back to customer and stakeholder expectations
Planning	1. Risk, value and opportunity 2. Asset management objectives and plans	1. Asset plans developed for each asset system/site aligned to WSDP and IDP 2. Must meet strategic objectives and based on risk and evidence 3. Blue Drop, Green Drop, Water Safety Plans and Risk Abatement Plans integrated 4. Planned approaches rather than reactive fire fighting
Support	1. Resources 2. Competence 3. Awareness 4. Communication 5. Information 6. Documented information	1. Skilled and resourced teams 2. Activities of teams complement each other 3. Cross functional processes in place 4. Collaborative working 5. Asset information systems integrated with financial systems 6. Tools needed are in place
Operation	1. Operational planning and control 2. Change management 3. Outsourcing	1. Operational and maintenance procedures aligned to asset plans, WSDP and IDP 2. Fit for purpose budgets to ensure whole life cost is considered 3. Outsourcing to Water Service Providers and others 4. Process control and governance
Performance evaluation	1. Monitoring, measurement, analysis and evaluation 2. Internal audit 3. Management review	1. Asset condition and performance monitoring, capacity assessments, service failure analysis 2. Auditor general compliance 3. Continuous improvement of asset management system
Improvement	1. Non conformity and corrective action 2. Preventive action 3. Continual improvement	1. Monitoring and implementing improvements to the asset management system 2. Incident management and investigation 3. Research, development and innovation

ASSET MANAGEMENT

A formal definition of asset management, which includes the management of infrastructure assets, is provided in the recently published ISO55000 suite of documents. Asset management is the coordinated activities of an organisation to maximise the value they achieve out of their assets. It is the integrated process of decision-making, planning and control over the acquisition, operation, maintenance, renewal, replacement and disposal of assets to maximise their service delivery potential and benefits, and to minimise their related risks and costs. An asset management system can provide a structured approach for the

TABLE 2 Benefits of an asset management approach

Benefit Statement	Specific Potential Benefits
Improved financial performance	1. Improving return on investments 2. Reducing operational and capital costs 3. Preserving asset value 4. Integrated physical asset and financial asset registers 5. Better compliance with financial regulations and audit requirements 6. Improved credit rating 7. Improved cost recovery and revenue generation
Informed asset investment	1. Evidence based decisions 2. Risk based decisions 3. Decisions consider all influencing factors 4. Appropriate asset data – information – knowledge transfer systems 5. Ability to balance cost, risk and performance 6. Ability to prioritise and compare solutions 7. Best whole life cost solution options are implemented
Improve the way risk is managed	1. Improved visibility of risks 2. Structured approach to risk identification, monitoring and treatment 3. Ability to balance cost, risk and performance 4. Reducing financial losses 5. Improving health and safety 6. Minimising environmental and social impact 7. Reduced liabilities such as insurance premiums, fines and penalties
Improved services and outputs	1. Improved asset reliability, condition and performance 2. Consistently meet or exceed customer and stakeholder expectations 3. Address service delivery backlogs in a structured and prioritised manner
Demonstrated social and environmental responsibilty	1. Reduce carbon and greenhouse gas emissions 2. Conserve resources and adapt to climate change 3. Reduce pollution and contamination of water resources 4. Optimise water resource abstraction
Demonstrated compliance	1. Transport business operation 2. Conform with legal, statutory and regulatory requirements 3. Better compliance with financial regulations and audit requirements 4. Improved Blue Drop and Green Drop compliance status
Enhanced reputation	1. Improved customer satisfaction 2. Improved stakeholder awareness, confidence and relationships
Improved organisational sustainability	1. Ability to manage conflicting interests 2. Overcoming short term decision making 3. Adopting a planned approach instead of a reactive approach 4. Improved budget management 5. Better staff skills, capabilities and retention
Improved efficiency and effectiveness	1. Optimised operations resulting in better use of time and resources 2. Better budget allocation and spend

development, coordination and control of these activities over different life cycle stages of the assets. (International Standards Organisation, 2014a, 2014b, 2014c).

The discipline of asset management has been around for a number of years, particularly in Australia and the United Kingdom (Britton and Rumsey, 1990; Institute of Municipal Engineers Australia, 1994; United Kingdom Water Industry Research, 2002). The adoption of asset management in the municipal environment in South Africa has been mixed even though various guidelines have been published. Water utilities around the world are realising the business, regulatory and customer benefits as a result of efficient and effective asset management, and there is no reason why the South African water sector cannot benefit in the same way.

Components of an asset management system

ISO 55000 provides an excellent framework for an organisation to undertake good asset management. When implemented, this framework will allow you to balance the conflicting priorities of cost, risk and performance. Good asset management organisations are reaping the rewards provided by such a framework; and will continue to do so as their assets are used to achieve maximum benefit. Figure 2 below shows a high level overview of an asset management system, the various components and how they interact with each other and the wider business context.

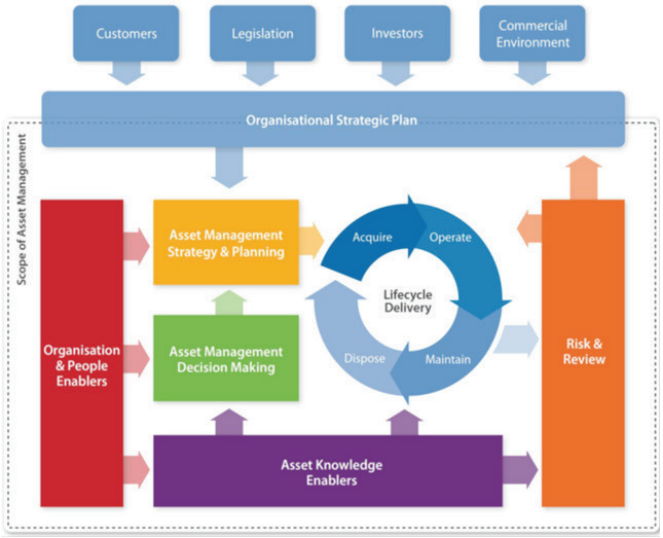

FIGURE 2 Asset management system (Institute of Asset Management, 2011)

The key components and sub-components of an asset management system as described in ISO 55000 (2014b) are shown in the table below together with the relevance to the South African municipal context.

Benefits of asset management

There are considerable benefits to implementing an asset management approach to the way infrastructure assets are managed. Water and sanitation systems are becoming more technologically advanced and complex. Assets are capital intensive to install and deteriorate over time and with continual use. When things go wrong it has serious social and environmental implications. Therefore it makes engineering and financial sense to monitor performance and condition, understand risk and manage assets effectively. Some benefits as identified in ISO 55000 (2014a) are outlined in the table below together with specific potential benefits to the water services sector.

The above table outlines some of the potential benefits that an asset management approach may yield. It must be noted however, that not all benefits will be applicable to all organisations. In addition, some of these benefits will only be achieved after some time and with the use of more advanced asset management systems, tools and techniques in place. However all water and sanitation organisations, regardless of their business context, will benefit in some way from an asset management approach being followed.

Implementation of an asset management system

Various standards, specifications, manuals and guidelines have been published over the years to support sound infrastructure asset management practice, including:

- ISO 55000 suite of documents (International Standards Organisation, 2014a, 2014b, 2014c)

- PAS55 (British Standards Institution, 2004)
- The International Infrastructure Management Manual (Institute of Public Works Engineering Australia, 2000)
- Managing Public Infrastructure Assets to Minimise Cost and Maximize Performance (National Association of Clean Water Agencies, 2002)
- Implementing Asset Management - A Practical Guide (National Association of Clean Water Agencies, 2007)
- Guidelines for Infrastructure Asset Management in Local Government (Department of Provincial and Local Government, 2006)
- Local Government Capital Asset Management Guidelines (National Treasury, 2008).

Each of these documents will provide a slightly different view on asset management and the various techniques and approaches that could be implemented; however the over arching principles will be the same. The ISO55000 standard however is the definitive document to be used in the design and implementation of an asset management system.

No two organisations are the same so it is likely that each Water Service Authority will be at a different stage of asset management maturity. The decision to implement an asset management system is a strategic decision and will require a commitment from all senior management representatives including the Mayor and Municipal Manager. A phased approach is recommended as shown in the figure below.

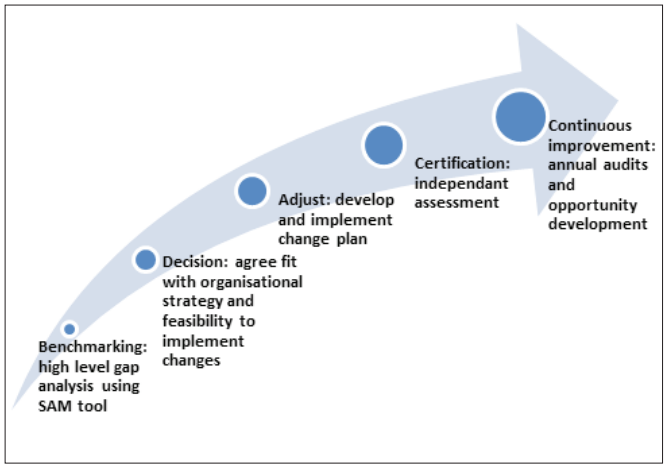

FIGURE 3 A phased approach to asset management implementation

Possibly the most important component when implementing an asset management system will be the asset management policy, which is owned by the senior leadership team. This must take into account the context of the organisation and the expectations of customers and stakeholders; it must define the asset management objectives and outcomes and align these with organisational objectives. Finally the policy must be communicated internally and the leadership team must create the values and vision to allow the policy to be successfully implemented.

RISK AND VALUE DECISION MAKING

The concept of risk and value is central to the ISO 55000 asset management system. This approach needs to be applied to all asset related decision making throughout the life cycle of an asset and must be incorporated into all business procedures and processes that relate to the asset. Risk management approaches should follow a structured method for identifying, analysing and evaluating risk.

Risk management approaches are well documented (International Standards Organisation, 2009; Kolluru, 1995; Pollard, 2008). Furthermore a risk based approach to decision making is advocated in the South African water services sector through the Blue Drop, Green Drop and Water Safety Planning processes. In reality, the implementation of risk based approaches will vary between organisations. The Blue Drop and Green Drop processes are also heavily focused on operational decision making relating to water quality, which is only one part of the business. The real benefit of a risk approach is when it is embedded in all decision making, particularly at the early stages of the asset investment life cycle.

The discipline of risk management is continually evolving, particularly with the advent of modern data analysis and diagnostic tools and techniques. No longer are risks just recorded on a spread sheet and quantified simply by likelihood and consequence. There are now many innovative and powerful approaches that can support effective decision making at all levels of an organisation.

However to achieve best practise or to have complex risk decision support tools is not always appropriate, particularly for organisations who do not have the capacity or the context is not appropriate. Instead, the improvement of risk management (an indeed asset management) needs to be undertaken as a journey, one step at a time, each step progressively improving on your last position, and working towards a long term vision. South African water service organisations will all be on a different part of this journey and will have different needs and expectations; and it is important for them to consider their specific needs and context when designing and implementing an improvement plan.

Best practise examples

This section describes a few examples of where a risk and value approach has been implemented and outlines some of the key components of implementation and the benefits achieved. Not all the benefits are fully quantifiable in monetary terms as in many cases a risk approach highlights hidden issues that have not yet come to light or a risk that has not materialised. Sometimes this will require additional budgets to suitably mange these risks. However in the long term, such an approach will be cost beneficial and yield significant benefits.

Risk and value business process

This water utility previously recorded and managed all risks on a spread sheet. Each regional operational team had their own spread sheet and used it according to their needs. This was a very simple way to record and manage risks and was seen as not fit for purpose as the different teams were following different approaches and therefore the level of risk in each area could not be compared. There was also no consistency in the level of funds being spent as some areas were under spending and other areas over spending, with no reference back to how much risk was really being addressed.

The water utility decided to implement a risk and value approach to the way it makes all operational and investment decisions relating to its assets. A risk and value framework was established to define the way risks were managed. The following improvements were addressed in the framework:

- risk and value ownership
- the business process flow to manage risks
- the system used to manage risks
- definition of how risks are identified (manually, decision support tools, condition monitoring)
- identification of the types of service failures and their associated public and private costs
- definition of how risks are quantified and prioritised
- identification of treatment – monitoring, avoiding, reducing, tolerating or transferring
- determining residual risk and evaluate the tolerability of the risks
- integration with other business areas and integration with whole life cost approaches.

The framework provided the utility with a defined risk management approach that could be applied across all aspects of the operational

business. All investment decisions now follow the risk and value approach and all capital investment stems from a risk. Furthermore, the business process flow was designed to ensure that throughout the lifecycle of a project, there was line of site visibility back to the original risk, which ensured that when the capital solution is designed and built, it achieves what it was originally intended for.

The figure below shows the business process from initial risk identification through to solution implementation.

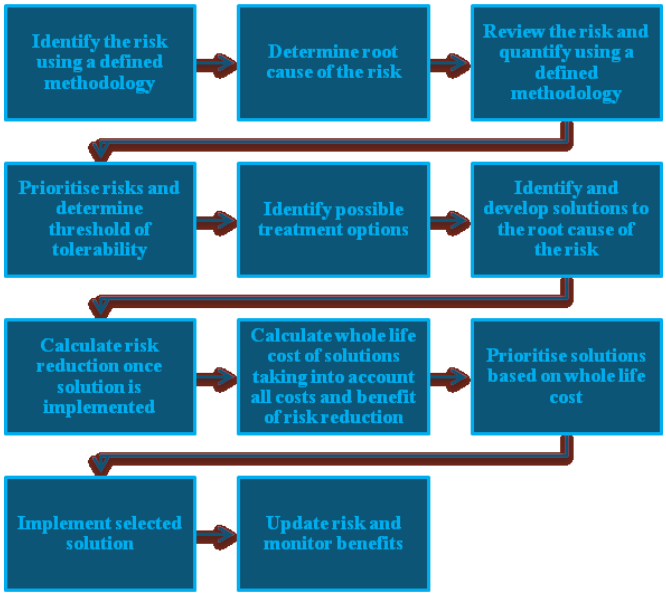

FIGURE 4 Process flow from risk identification to solution implementation

The above process is followed for each and every risk identified and is governed through the use of gateway meetings. These are strategic meetings that occur at key gateway points in a project lifecycle to monitor the risk as it progresses. Each meeting is attended by different stakeholders, as required, to ensure all relevant parts of the business are involved in decision making. The main benefit of the process is that it provides a joined up and collaborative approach to decision making whereby all stakeholders are involved at the right time. The process also allows for escalation of risks if they could not be addressed at that management level. Finally it integrates with whole life costing as solutions are evaluated on cost and benefit, rather than just cost.

The entire process is managed through an IT based risk register system which is a live system that shows real time records of a risk and its position in its life cycle. The main benefit of the system is it ensures consistency as it is the only system used to manage risk for all parts of the business and for all assets.

Aerator diffuser replacement plan based on performance evidence and risk

This water utility owns and operates a number of sewage treatment plants that have activated sludge as the primary biological removal process. A vital component of the system is the diffusers located on the end of the air pipework at the bottom of the tanks. The diffusers allow the release of air in a fine bubble pattern; however they are prone to blockage and fouling over time which reduces their efficiency. A drop in efficiency results in less biological removal and a risk that the effluent quality will deteriorate to unacceptable levels. This will require additional costly operational activities to manage. Historically, the approach to diffuser replacement was reactive and was only undertaken after the typical ten year asset life of the diffuser and when a noticeable deterioration in effluent was recorded. This approach was an acceptable strategy for some of the smaller sites. For the larger sites it was not appropriate simply because these sites had more stringent effluent quality requirements and the lead time to replace the diffusers was many months, during which time the site would fail its effluent consent. The utility undertook a strategic risk assessment across all the activated sludge sites to understand the impact of diffuser deterioration and the average time it took to deteriorate to a critical point. A number of teams were involved including process optimisation, process modelling, operations, engineering and asset planning.

Various intervention times were modelled over a 25 year period including replacement after seven years, nine years and ten years. The modelling suggested that an optimal replacement time was after seven years. If replacement costs were deferred to nine or ten years, the risk to effluent deterioration would increase resulting in increased operational costs to mitigate this risk. Inevitably the capital would need to be spent anyway and therefore the whole life cost would be greater (when accounting for capital costs, operating costs and the cost of risk reduction over the full 25 year period).

Based on the findings of this activity, the utility was able to develop an optimised replacement programme across all the sites. This programme identified which set of diffusers would require replacement and when. The seven year programme was identified as providing the optimal balance between cost and risk reduction. This was based on evidence and risk and as a result diffusers are now replaced before the effluent deteriorates to a critical point and as such allows enough time to replace them with minimal impact on water quality or operational cost. The investment decision is based entirely on risk to service rather than age of asset.

Pumping station renewal plan based on criticality and risk

This water utility owns and operates over 2000 sewage pumping stations (SPS). These range in size from small installations pumping just a few litres a second to very large installations pumping many hundreds of litres a second. As these sites were geographically widespread and operated by different teams, the utility had no robust way of identifying and comparing risk at these sites. As a result the utility developed a Decision Support Tool (DST) to provide a structured and consistent way of modelling risk. The DST used the standard risk equation:

Risk = consequence of asset failure x likelihood of asset failure.

Each site was allocated a criticality, which was a function of size, wet well capacity, location and consequence if the site were to fail. The consequence was calculated by undertaking overland flow modelling at each site, identifying the receptors at risk and then allocating a monetised cost of failure value for each receptor. The adjacent figure shows a map of a typical overland flow model and the receptors at risk should the system fail.

Typically the larger sites that are located in urban areas or adjacent to sensitive receptors (for example schools, hospitals or rivers) had a higher criticality. The smaller sites were usually found in rural locations and had a lower criticality. There were some smaller sites however that were also located adjacent to sensitive receptors and these had a higher criticality rating.

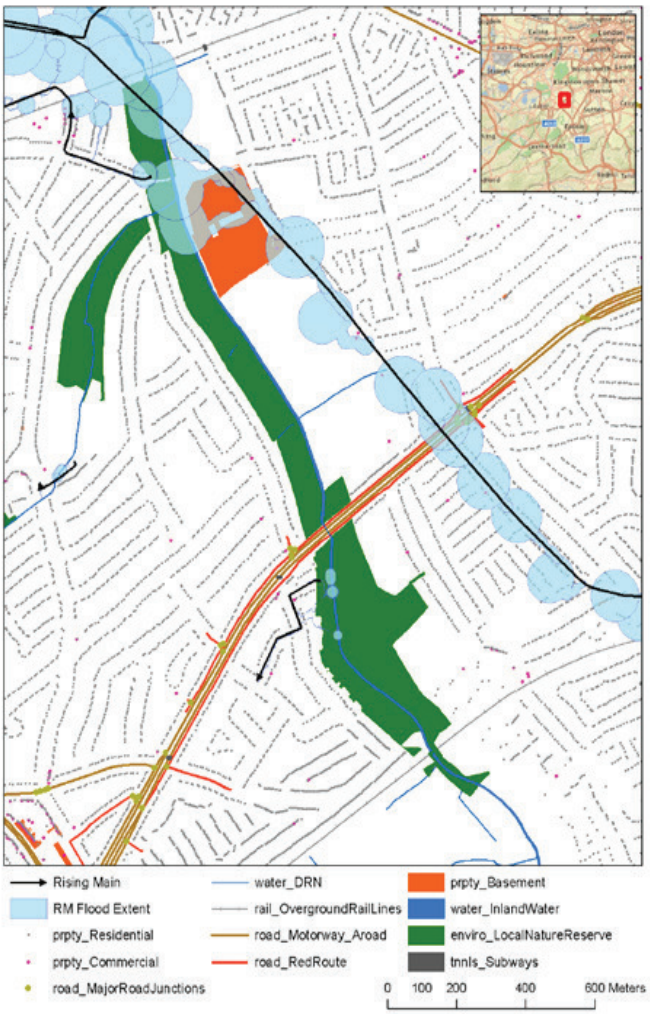

FIGURE 5 Overland flow modelling map

Each month a report was generated from the maintenance work management system showing the number of emergency work orders for each site. This data was used as a proxy for asset deterioration and likelihood of failure and was entered into the DST. A simple algorithm then calculated the risk for each site based on the cost of failure, criticality and likelihood of failure.

The outputs of the DST were used at the monthly risk review meetings to highlight sites of concern, deteriorating sites or high risk sites. This information was then used to inform operational and investment decision making. As a result of this approach, the utility was able to compare risk consistently across all the sites and have better visibility of deterioration thereby allowing them to intervene at the critical sites before the asset fails.

The utility was able to make informed decisions that were directly related to asset performance and deterioration (as indicated by emergency work orders) and consequence of failure. In many instances, this prevented the installation of new pumps as an improvement in operational performance was achieved by other means (such as attending to the root cause of the risk such as a pump blockage).

This criticality approach also informed the strategic asset management plan for the utility. Figure 6 below shows the classification of the SPS assets based on a function of criticality and expected asset age.

Criticality		Asset expected life: Short <10 years — Instruments, level monitors, telemetry	Medium — Pumps, valves, pipework, panels	Long >40 years — Civil structures, access roads, buildings
Low	Small sites <5 kw installed power	All reactive	Mainly reactive, some planned	Some reactive, mainly planned
	Medium sites 5-20 kw installed power	Mainly reactive, some planned	Mainly reactive, some planned	All planned
	Large sites 21-100 kw installed power	Some reactive, mainly planned	All planned	All planned
High	Very large sites >100 kw installed power	All planned	All planned	All planned

FIGURE 6 Criticality framework

The classification was based on the following principles:

- The smaller sites are usually less critical. If the site were to fail it is simple to provide an operational intervention (such as a tanker) to prevent a consequence occurring (such as flooding);
- The time to replace or refurbish an asset at a smaller site is short as spares are readily available and are easy to install;
- As the site size increases, so does the criticality, mainly as the site pumps higher flows and the consequence of an asset failing is higher. Bigger sites have bigger assets and these have longer lead times to replace or refurbish.
- The very large sites often have bespoke assets with very long lead times to replace or refurbish. Also, operational interventions are not usually cost effective or feasible as the flows are very high;
- Long life assets usually deteriorate slowly, the likelihood of failure is very low but the consequence could be catastrophic. A long term planned approach is therefore required to monitor these assets and intervene before they fail.

This framework provided the water utility with a structured approach to the way it plans investment, with a sound foundation based on criticality and risk.

CONCLUSION

Water Service Authorities in South Africa are facing a variety of chronic and acute challenges relating to the delivery of a sustainable service. The way these utilities operate and manage their assets varies due to many factors. One common theme that is emerging is the apparent lack of robust, integrated infrastructure asset management approaches being followed at all levels.

An asset management system can help to gain an understanding of water and sanitation assets, their performance and condition, the risks associated with managing these assets, investment needs, and asset value as an input to decision making and organisational strategic planning. The scope of asset management touches on all parts of an organisation, not just the engineering departments and employees who directly interact with assets, and therefore has the potential to influence the entire value chain of the business.

Central to asset management is a risk and value approach, whereby all operational and investment decisions are made based on evidence and risk. This is a departure from the current paradigm whereby decisions are made without credible evidence, often on gut feel, and do not routinely consider risk to service. All water and sanitation organisations should have systems, processes and procedures in place to determine

the actions necessary for addressing risks and opportunities. This will enable the assets to achieve their objectives, prevent or reduce undesired impacts, identify opportunities and achieve continual improvement. Effective control and management of risks and opportunity is essential to achieve the desired balance of cost, risk and performance.

The regulatory and legislative environment in which Water Service Authorities operate is increasingly challenging and the inherent risks that many assets present are constantly evolving.

The fundamentals of asset management can result in tangible benefits and opportunities. Through implementing an asset management and a risk and value approach, Water Service Authorities will be able to make improvements in the way they manage the whole lifecycle of their assets, thereby ensuring the sustainable delivery of the essential service of water and sanitation provision.

REFERENCES

- *Bhagwan, J. 2009. Compendium of Best Practices in Water Infrastructure Asset Management. Global Water Research Coalition.*
- *British Standards Institution. 2004. PAS55 Publicly Available Specification for the Optimized Management of Physical Assets.*
- *Britton, R.J. and Rumsey, P.B. 1990. The Role of Asset Management. Journal of the Institution of Water and Environmental Management, Volume 4, Issue 3, Pages 251–255.*
- *Department of Cooperative Governance and Traditional Affairs. 2009. State of Local Government in South Africa - Overview Report, Pretoria.*
- *Department of Provincial and Local Government. 2006. Guidelines for Infrastructure Asset Management in Local Government, Pretoria.*
- *Department of Water Affairs. 2013. National Water Resources Strategy 2, Pretoria.*
- *Development Bank of Southern Africa. 2012. The State of South Africa's Economic Infrastructure: Opportunities and Challenges, Development Planning Division, Halfway House.*
- *Institute of Asset Management. 2011. Asset Management – An Anatomy, Version 1.*
- *Institute of Municipal Engineers Australia. 1994. National Asset Management Manual.*
- *Institute of Public Works Engineering Australia. 2000. International Infrastructure Management Manual.*
- *International Organization for Standardization ISO 31000:2009. 2009. Risk Management Principles and Guidelines.*
- *International Organization for Standardization ISO 55000:2014. 2014a. Asset Management - Overview, Principles and Terminology.*
- *International Organization for Standardization ISO 55001:2014. 2014b. Asset Management. Management Systems – Requirements.*
- *International Organization for Standardization ISO 55002:2014. 2014c. Asset Management. Management Systems – Guidelines for the Application of ISO 55001.*
- *Kolluru, R.V. 1995. Risk Assessment and Management: A Unified Approach. In Kolluru, R.V., Bartell, S., Kolluru, R., Pitblado, R., and Stricoff, S. (Eds) Risk Assessment and Management Handbook for Environmental, Health and Safety Professionals, McGraw Hill, New York.*
- *Mokonyane, N. 2014. Unpublished data.*
- *National Association of Clean Water Agencies. 2002. Managing Public Infrastructure Assets to Minimise Cost and Maximize Performance.*
- *National Association of Clean Water Agencies. 2007. Implementing Asset Management - A Practical Guide.*
- *National Planning Commission. 2011. Our Future - Make It Work, National Development Plan 2030, Pretoria.*
- *National Treasury. 2008. Local Government Capital Asset Management Guidelines, Pretoria.*
- *Pollard, S. 2008. Risk Management for Water and Wastewater Utilities, IWA Publishing, London.*
- *South African Institute of Civil Engineers. 2011. Infrastructure Report Card for South Africa. http://www.saice.org.za/downloads/IRC2011-landscape-1-final-lr.pdf/. Accessed 2nd July 2014.*
- *Stephenson, D., Barta, B and Manson, N. 2001. Asset Management for the Water Services Sector in South Africa. Water Systems Research Group, University of the Witwatersrand. Water Research Commission Project No. 897/1/01.*
- *United Kingdom Water Industry Research. 2002. Capital Maintenance Planning: A Common Framework Volume 1: Overview (02/RG/05/3), United Kingdom.*