



The need to do ordinary things well

The South African government has prioritised infrastructure asset management as a critical element in sustaining services to all. Responsibility for implementing water services lies principally with municipalities in their role as statutory water services authorities.

by Nino Manus, Leonardo Manus, Kevin Wall, and Arno Ottermann

NATIONAL GOVERNMENT departments – such as the Department of Water Affairs (DWA), prior to April this year, the Department of Water Affairs and Forestry (DWAF), the National Treasury and the Department of Cooperative Governance and Traditional Affairs (CGTA), prior to April (mostly) the Department of Provincial and Local Government (DPLG) – are responsible for supporting and ensuring infrastructure asset management (IAM) within water services institutions. The challenge to these national government departments, with the DWA taking the lead, is to ensure that municipalities manage their infrastructure assets adequately to deliver services sustainably. Interventions

such as this project are required to build sector-wide mobilisation on effective IAM – a slow process that must be spearheaded by political will across all spheres of government. Municipalities must be held accountable for their water services IAM. However, where there is an inability to respond, external support must be provided, by provincial and national government, as appropriate.

Background

For a number of years, the DWA has been in the process of progressively formulating the many layers of a national water services IAM strategy. The results of a scan of the state of South Africa's water services IAM, and of a

process of analysis of the state of IAM, identifying elements needed for an enabling environment to ensure sound IAM, were reported on at the 2007 IMESA conference (Manus et al, 2007). Other subsequent work to complete that stage of the DWA's national water services IAM initiative included the identification of a set of priority strategic actions. Building on previous work, the next stage commenced at the end of 2006. Early in 2009, this was completed with the tabling of the following key documents:

BELOW Infrastructure asset management (including water pipelines) remains a key aspect to optimum service delivery levels





- National Water Services Infrastructure Asset Management Strategy
- National Water Services Strategy IAM Implementation Framework
- Municipal Guide on Roles and Responsibilities to perform Infrastructure Asset Management for Water Services.

Progress 2005 to 2007

A DWA-appointed team led by the CSIR – in association with Matingi and Associates, Makgoleng Projects and Pula Strategic Resource Management – assisted the DWA to undertake the first stage of the DWA's IAM initiative. This delivered:

- Phase 1: Desktop strategic study on the state of water services infrastructure and the state of its management (completed late 2005).
- Phase 2A: A process of identifying key factors that drive these states, and identifying elements to ensure sound asset management (completed late 2006).
- Phase 2B: The identification of a set of priority actions (completed early in 2007). Phase 1's findings were the foundation upon

which the work of phase 2 was built. Phase 2 ('proceeding from fact-finding to solution-identifying') commenced with a process of identifying the key factors that drive the existing state of water services infrastructure and the state of its management, learning this from the phase 1 work and from meetings with sector experts. This phase involved not just problem identification, but also analysis and classification of problems. It led to identification of elements needed for an enabling environment to ensure improved infrastructure asset management, and also started to identify broadly which institution should be responsible for leading each element of the improvement process. More than 400 generic challenges were identified. These were then rigorously analysed and classified into challenge areas. This analytical approach facilitated better understanding of individual challenges, as well as of the bigger picture in terms of priority needs.

Progress 2007 to 2009

The objective of the next phase, phase 3, of the DWA's water services IAM initiative, was

building on the work of phases 1 and 2 to:

- draft an integrated IAM implementation strategy in consultation with stakeholders
- plan the implementation of the strategy.

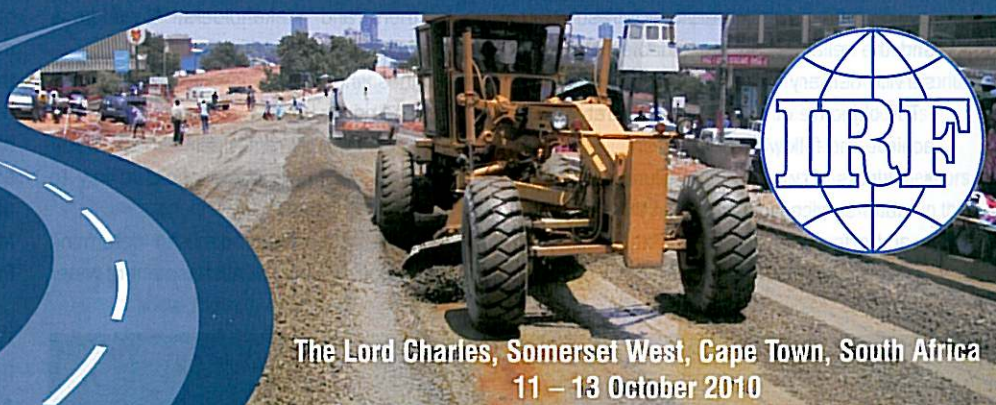
The DWA-appointed team was led by PD Naidoo and Associates (PDNA), with sub-contractors being the CSIR, Pula Strategic Resource Management and i@ Consulting.

The principal deliverables were:

- National Water Services Infrastructure Asset Management Strategy, which purpose is to guide the sector in its IAM work. The section 'The strategy vision, objective and principles' describe this further.
- National Water Services Strategy IAM Implementation Framework. This is designed to articulate the full gamut of work required by national supporting agencies – principally, the DWA, CGTA and Treasury, in appropriately supporting municipalities and other water services institutions in implementing appropriate IAM for water services provision. It has 10 outputs which come directly from the strategy, each of which will need its own implementation plan. The section

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'the key outputs' describes this further.

- The (draft) Municipal Guide on Roles and Responsibilities to perform Infrastructure Asset Management for Water Services. This is designed to support municipal decision makers – both political and administrative. It outlines roles and responsibilities for IAM from a municipal perspective and has, as an appendix, a roles and responsibilities matrix'. (As at the time of writing, this is incomplete and requires further work.)
- The national implementation framework and municipal guide requires extensive engagement with all sector stakeholders to ensure the continued and appropriate launch of the national strategy. The work done has undoubtedly raised the profile of IAM within government, and contributed towards strengthening the ability of sector stakeholders to participate in developing a common goal and way forward for effective IAM.

The strategy: Vision, objectives and principles

The DWA's vision is that it, together with its strategic partners, will empower and guide water services institutions to practise sound infrastructure asset management (IAM), aimed at ensuring optimal utility from public investments in water services infrastructure, and the reliable and sustainable meeting of service delivery obligations.

The objective of the Water IAM Strategy is to achieve the following outcomes:

- address service delivery failures in targeted water services institutions in the short term, and effect improvements that can be publicised to demonstrate the benefits of IAM

- develop a culture of sustained improvement in IAM in the water sector in the longer term.

The strategy therefore sets out at a high level how this objective will be achieved by the DWA and its strategic partners. In particular, it:

- defines the practice of IAM, and outlines the principles of good IAM, in particular in respect of water services infrastructure
- outlines what will be done to support water services institutions in adopting this good practice, among others through sector-specific guidelines, skills development and related planning, control and knowledge management tools
- outlines what will be done to address water-services delivery failures in targeted institutions in the short term
- outlines what will be done to publicise improvements resulting from the above, and to disseminate information
- outlines what will be done to facilitate the development of a culture of sustained improvement in the water sector in the longer term
- identifies major impediments to the application of sound IAM practices, and outlines what will be done to engage with strategic partners and other key stakeholders for the DWA, together with these partners and stakeholders, to address these impediments
- outlines what will be done to raise the profile and priority of IAM, and especially water services IAM, in municipalities and water boards, and in other stakeholders key to water services IAM
- outlines what will be done to determine regular milestones for assessment of water

services reliability and sustainability, in particular IAM performance, and what will be done to monitor progress towards these.

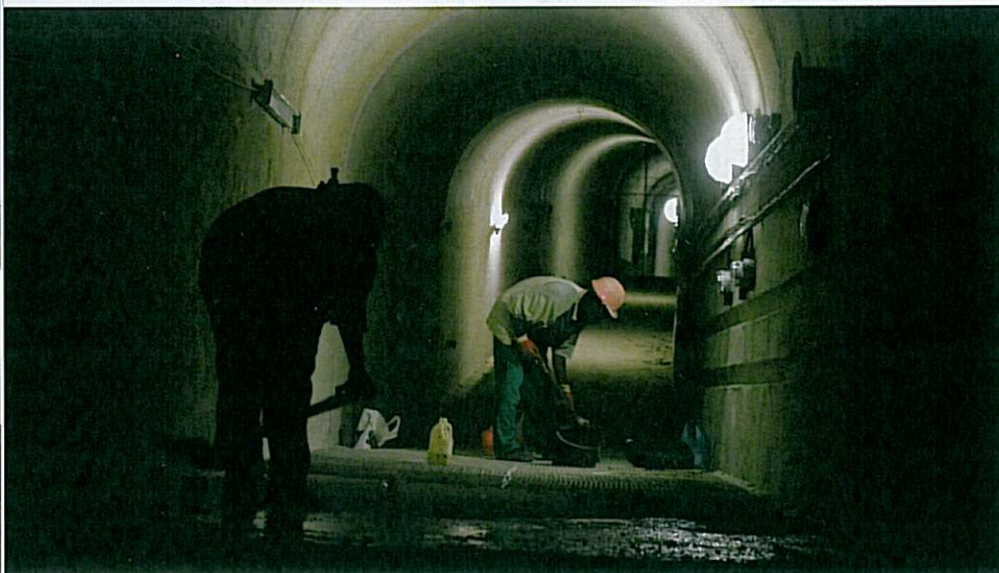
The strategy and the implementation frameworks identify the 'what and who' that needs to be done – but not the 'when' – in respect of each important action. These outline a suite of instruments designed to achieve the outcomes quoted above – including both a facilitative approach, through empowerment and guidance, and an approach that relies on monitoring and regulation.

While the strategy is firmly focused on water services, linkages between the strategy and water resource IAM initiatives must, in the broader interest of the water sector and consumers, be forged, and good IAM practices pursued across the whole of the water sector, water resources included.

The DWA is leading the more in-depth determination, and subsequent programming and implementation, of the required actions, taking responsibility for those that are within its power to do so, and working closely with other national government departments where responsibility for the envisaged action is statutorily with those departments. In all of this, the DWA is cooperating with the key stakeholders, which include not just National Treasury and other government departments, but also other spheres of government, local government and other associations. Overarching that, the context of the Water IAM Strategy described in this document is that it is one of a number of national IAM initiatives that are planned to complement each other under the umbrella of the National Infrastructure Maintenance Strategy (NIMS) (Department of Public Works 2007).

The most important principles underlying the Water IAM Strategy and its implementation framework are:

- This is a strategy that seeks to empower and guide water services institutions to improve IAM.
- This is the high-level water sector strategy, complementing NIMS and the high-level IAM strategies of CGTA and National Treasury, with which it is in harmony.
- 80/20 rules throughout, and 'quick-and-rough' actions are often preferred.
- One size does not fit all.
- Start with the basics, and get them right. Do not attempt to progress further until the basics are right. In almost all circumstances, 'good' practice is needed, not 'best'.



LEFT Effective maintenance strategy begins with getting with basic principles right



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- Address the weakest links in turn, and as each is improved and is no longer the weakest link, attend to the new weakest link.
- Where there is a strength, support it, and build on it.
- IAM is not a once-off intervention. It must become ingrained in the operational processes of the water services institution – not an external intervention, but part of the institutions' standard operating procedure.

The key outputs

Ten key outputs constitute a recipe for acceleration towards efficiency. The outputs are:

- increasing the awareness of IAM in the water services sector
- achieving greater synergy with other services IAM initiatives, for example those not driven by the DWA
- through targeted support from national government, improving IAM in water services institutions
- developing a municipal IAM implementation framework, with a supporting suite of tools
- developing a water services IAM-monitoring

- and -evaluation system, and linking it to other relevant management information systems
- defining and implementing a regulatory framework supportive of water services IAM
- through outsourcing, supporting water services IAM resources procurement
- developing appropriate human resources for IAM in the water services sector
- increasing the research, development and knowledge dissemination in water services IAM
- on-time and within-budget management of the implementation of the framework, with appropriate guidance and support.

These, the most important actions needed, have been identified on the basis of extensive investigation of water services IAM practices and the state of water services infrastructure. Whereas the primary source has been the investigations undertaken for the purposes of phases 1 and 2, the experience in respect of water services IAM of the DWA itself, and its external team and strategic partners, has also been taken into account.

To emphasise: The foundation of the strategy

and its implementation framework is the rigorous process of phase 1 and 2 fact finding and analysis that preceded its formulation. In more detail, the key outputs are:

- Increase awareness. Start with issuing a water-services IAM policy statement and with priming the sector.
- Scan and analyse IAM initiatives other than those of the DWA, and also other initiatives for support to water services institutions, and achieve synergy with these where appropriate.
- Among others, drawing up a pro-forma recovery plan. Make it clear to institutions what they are expected to do for themselves and what they can get assistance with. And, as quickly as possible:
 - set out, in sufficient detail, the criteria for selection of water-services institutions for priority attention from the DWA and its strategic partners, and for identification of the specific actions in respect of each, and prioritise
 - in addition, set out the information requirements of the selection process,

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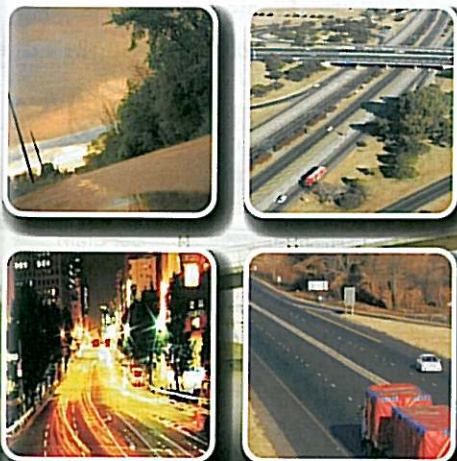
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and create appropriate links to the existing and evolving databases identified for this purpose

- initiate the selection process, select, and programme the work for the first year or other period decided upon and resource it
- then begin implementation.
- Among others, identify, adapt if necessary, and prioritise utilisation of existing tools, such as guidelines and systems, which are required for each level of need. Identify the further tools needed, and start the process of developing these, together with means for their use.
- Review existing water services monitoring and evaluation. Extend monitoring and evaluation coverage before increasing depth. Outline how regular milestones for assessment of water services reliability and sustainability, and, in particular IAM performance, will be determined, and how progress towards these in particular will be monitored.
- Define and structure incentives for water services IAM. Tighten the regulatory process, and build on existing corporate and individual incentives – such as levying penalties for non-compliance, enforcing skills level requirements, and offering assistance to those institutions willing to improve.
- Facilitate, where advisable, bringing needed skills to bear through outsourcing. Assess the most frequently encountered procurement and outsourcing obstacles to bringing the needed resources to bear on improvement and, where advisable, resolve these. Also assess the advantages and disadvantages of, and opportunities for, outsourcing.
- Among others, analyse skills resources in the sector, decide on required actions, and start the process of resolving this.
- Among others, discover, select, organise, and disseminate good practice in water services IAM so that the good practice lessons are put to good use.
- On-time and within-budget management of the implementation of the framework, with appropriate guidance and support.

NIMS identifies many actions similar or complementary to these, as do other national non-water IAM initiatives, and it is essential that all these actions, to the same end, seek synergy where it would be efficient and effective to do this. In all of the actions, the most important principles must be followed, especially:

- start with the basics, and get them right – do not attempt to progress further until the basics are right

- one size does not fit all.

The outputs listed above constitute a set, the carefully considered final output of an extensive water services infrastructure asset management investigation. All must be proceeded with if water services infrastructure asset management is to improve significantly. None must be omitted or put on hold for an indefinite period. Putting some on hold would jeopardise progress with others.

The DWA does not have the mandate or resources to address all of these. Some of these, entirely or partially, are the responsibility of other parties to resolve. The DWA

The DWA should only seek to influence what must be addressed and its outcome

should only seek to influence what must be addressed and its outcome. The issue of procurement, for example, sits squarely with other national government departments (CGTA and National Treasury, in particular).

For example, whereas the DWA needs to assist with the devising of appropriate norms for budgeting for water services IAM, the financial situation of water services authorities, and regulation of their budgets, is the responsibility of National Treasury and not of the DWA. Furthermore, as the strategy acknowledges, "Water services authorities, being municipalities or combinations thereof, have a range of responsibilities other than water services responsibilities." No doubt, progress towards improved water services IAM will be assisted as there is currently:

- growing recognition on the part of national and provincial government of the serious problems facing many water services institutions, and of the necessity for water services IAM improvement – if necessary, through intervention from outside the institutions
- increasing public pressure for improvement in service delivery, including for improvement in delivery by existing infrastructure.

Finally, and very importantly, whereas the emphasis of the strategy, and of the key outputs listed, is generally on practices establishment and improvement, with the assumption that the state of water services infrastructure and the state of its management will as a direct result improve, it is acknowledged that in many cases, the infrastructure asset decay is so serious that direct intervention by national government, for example, of a capital works nature – e.g. complete refurbishment

of the asset, or even its replacement – would first be necessary.

Recommendations for taking the work forward

The strategy recommends that the DWA take immediate action in terms of the following:

- Check all assumptions made in the national implementation framework – primarily around capacity – and endeavour to make the framework implementable. Feedback from both the Municipal Indaba and the Municipal Reference Group meetings held in 2008 on the national implementa-

tion framework was that some capacity assumptions should not be made, and that aspects of the framework will remain unable to be implemented. This is a serious issue which should not be ignored, but raised openly in the reference groups.

- Determine one clear IAM programme for the department, with one vision, a single implementation framework between directorates, and clarity on roles and responsibilities, budgets, etc. Ideally, an IAM structure should be located within the DWA at the highest level. This would ensure that the national implementation framework developed within this project, and amended as necessary, does indeed guide the vision and teamwork of the DWA and the sector.
- Strengthen political ownership to set directives and level of importance for IAM within the ministry, cabinet, and wherever else may be appropriate.
 - Work with other national government departments to build capacity to implement the national implementation framework.
 - Strengthen the Stakeholder IAM Reference Group at the highest level in each of participating organisations to ensure:
 - high-priority attention is given to the implementation of the national implementation framework, beginning with finalising the draft indicators in the national implementation framework through verifiable resource commitments, including budgets
 - appropriate strategic oversight and guidance from the group for national IAM support
 - strengthen the Municipal IAM Reference Group so that it can take the lead in articulating the need for tools development,

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- communication and awareness needs, etc
- ensure ownership of the national implementation framework within the DWA, and across the Stakeholder IAM Reference Group
- complete the municipal guide and ensure ownership within the DWA as well as across the stakeholder and municipal reference groups.

Some recommendations for priority actions

Given the vastness of the work, and the need to flesh out the implementation framework in bilateral engagement with leading partners, the following are presented as immediate actions for the DWA to take forward:

- **Clarify roles and responsibilities as an extremely high priority.** This requires political drive and dedication by DWA, CGTA and National Treasury as sector leaders. That some current problems with water quality receive media attention poses an opportunity to use political pressure and leadership to resolve the uncertain roles and responsibilities in the sector. As a start, the DWA needs to ensure that its own institutional structure and capacity has dedicated leadership and capacity to manage the change process and intervene where necessary.
- **Establish monitoring and evaluation (M&E).** Mechanisms are dedicated to M&E for IAM, or add to or modify existing mechanisms, to empower the DWA as sector leader to take charge of the situation at ground level and to be able to react more proactively to challenges to the operation and maintenance of water services infrastructure. Suitable M&E tools have been developed, e.g. P-Systems, and can be implemented as a 'quick win'. Such M&E must be integrated with existing M&E functions and tools within the DWA and the sector.
- **Address the capacity problem in the sector, which needs specific attention and support mechanisms.** This can be supported by the outsourcing and public-private partnership or public-public partnership (PPP) options which have been scoped by this and other projects. The DWA or CGTA should dedicate resources to manage these support mechanisms, similar to PPP unit at National Treasury.
- **Maximise opportunities for leveraging existing priority projects** such as the department's Blue Drop certification system to measure drinking-water quality management performance (DWA 2009a), launched in

May this year, and the Green Drop certification system to measure wastewater treatment works effluent. These are incentive-based programmes, and are not regulations. To raise standards of performance, these programmes go beyond what is legally required, and focus on what the department deems to be international good practice.

One of the scoring criteria for the Blue Drop reporting is adequacy of process control, maintenance and management skill. This requires, among others, proof of annual process audit implementing process optimisation, proof of an updated asset register, and proof of maintenance budget as the Wastewater Services Refurbishment Programme and the Accelerating Access to Water Supply and Sanitation Services Programme.

Progress so far, and way forward

The strategy is being aligned with a similar document developed by DWA for the water resources infrastructure, which it owns. It will then be launched, with the participation of other sector role players. National Treasury

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has already allocated R1.5 billion to the DWA over the next three financial years. This funding will be used to accelerate access to sanitation, water demand management and conservation, giving priority to addressing failing wastewater treatment works. Partnerships are being built with the Development Bank of Southern Africa, among others. The DWA is continuing with awareness and training on IAM through the councillor-development programme and similar initiatives.

Conclusion

It is appropriate that increasing attention is being paid to water services IAM. The recent work by the DWA and others in discovering and documenting the poor state of so much water services infrastructure is serving to underline the importance of the DWA water services IAM Strategy, and the need for it to be programmed and budgeted for, and implemented without delay. The appearance of this strategy and implementation framework, key milestones signalling the DWA's determination that increasing attention be paid to water services IAM, is timely. Implementation of the National Water Services Infrastructure Maintenance Strategy will promote sound management

of infrastructure and facilities across the whole of the water sector. Measures that will be implemented include strengthening the management and water-service performance and governance framework, and requiring infrastructure asset management planning and linking this to budgets. They also include assisting institutions to develop the required maintenance management capacity, monitoring progress and feeding this into a process of continuous improvement. While there are indeed, in certain circumstances, quick wins to be had, in the longer term there are no such things as quick fixes.

As Warren Buffett, who for good reason is known as The Sage of Omaha, periodically reminds his devotees: "You don't have to do extraordinary things to get extraordinary results. Just do ordinary things extraordinarily well."

Following the same line of thinking, it is noted earlier in this paper that, in respect of all of the actions that constitute the National Water Services Infrastructure Maintenance Strategy, the most important principles must be fol-

lowed, especially starting with the basics, and getting them right. Significantly, sound IAM must be founded on application of basic principles such as ensuring that operation and maintenance staff are appropriately trained, experienced, enabled and resourced to perform their jobs. These are the ordinary things of IAM – which have to be done well. 35

References

- cidb (2009). National Infrastructure Maintenance Strategy (NIMS). Infrastructure maintenance budgeting guideline. CIDB, Pretoria, 2009.
- Department of Public Works, CSIR and Construction Industry Development Board (cidb) (2007). *The National Infrastructure Maintenance Strategy*. cidb, Pretoria, 2007.
- Department of Water Affairs and Forestry (2009a). *Blue Drop Report 2009: version 1. South African drinking water quality management performance*. DWAF, Pretoria, 2009.
- DWAF (2009b). *Blue Drop Audit Protocol*. In course of development. DWAF, Pretoria.
- Manus A, Wall K, Ottermann A (2007). *From fact-finding to priority actions – the national water services IAM strategy study*. Presented at IMESA conference, October 2007, Durban.