Department of Water and Sanitation

EDITION 2

Integrated Water Quality Management

POLICIES AND STRATEGIES FOR SOUTH AFRICA

3.2 STRATEGY, 2017

WATER IS LIFE - SANITATION IS DIGNITY

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

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Department of Water and Sanitation

WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA

INTEGRATED WATER QUALITY MANAGEMENT STRATEGY

Report Number 3.2

P RSA 000/00/21715/16

March 2017

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FOREWORD

Water management is one of the 21st Century's most critical challenges on a world scale, with pollution of surface and underground water resources in particular being a global concern. As nations make efforts to correct abuses to their water resources, there is a need to determine the causes of water quality degradation and to set forth holistic and integrated strategies to address these challenges.

Improving water quality though an inclusive and integrated approach is a priority objective which is why we have developed a strategy which translates our commitments as a concerned and engaged sector into actions. Together these actions aim to ensure that Government, in partnership with private sector and civil society, secure water that is fit for use, for all, forever.

This is a task that must be addressed with urgency, and with commitment. The strategy describes how, under the leadership of my department, other relevant organs of state will work together and within their own mandates, to achieve our joint vision for the improvement of the quality of water in our rivers, estuaries, dams, wetlands and aquifers across the country. It describes what is expected of a responsible private sector, and the critical role that civil society should be playing, at all levels.

I call on all South Africans, in all walks of life and in all areas of the country, to play their part in cleaning up and protecting our precious, and scarce water resources. Your health and well-being depends on it, as does the well-being and prosperity of future generations. This strategy sets out the path by which we are going to achieve a better future for all.

MRS NP MOKONYANE

MINISTER OF WATER AND SANITATION

FOREWORD

South Africa is a water scarce country and this reality is further compounded by the deterioration of water quality. The issue of water quantity and quality has a massive impact on sustainable economic growth, social development and the protection of the environment. As a country, we need to work very hard to ensure continued supply of water in all communities.

In pursuing our joint efforts in water conservation and demand management and water quality management, we need to work very closely with sectors such as the formal and informal industry working with breeding and caring for farm animals, the fruit and beverage industry and the municipal waste water organisations. These institutions in the world over use large amounts of water which can be collected and also treated for safe use in other industries.

Water pollution is today one of the major problems and is among the leading causes for disease and death worldwide. Most of the victims of this wide spread phenomenon are the poor and the marginalised communities.

Lagoons, large dams, rivers, water streams, water canals and water wells can be affected by pollution. With the contamination of water communities can experience bad odours arising from harmful water that disposed of in water sources and can be exposed to waterborne diseases coming from water that is not treated for social use.

The Department, through this strategy, needs to ensure continuous tests with the latest technology of all water sources to determine who the main culprits of pollution are. We also need to educate communities and all water users that water quality and quantity must be understood as two sides of the same coin.

The implementation of this Strategy must serve to enhance our economic development, social upliftment and environmental protection. This strategy should reduce the costs of water for agriculture, mining, manufacturing purposes, and general use by municipalities for household usage.

We must indeed, as guided by our Bill of Rights and the Constitution which explicitly provides for the right of every citizen to a healthy life, access to food and water and to have the environment protected, work together towards a sustainable environment and a developing society.

MRS P TSHWETE, MP

DEPUTY MINISTER OF WATER AND SANITATION

FOREWORD

This Integrated Water Quality Management Strategy sets out for the Department of Water and Sanitation the clear challenge of leading a government wide programme, which also involves the private sector and civil society, to clean up the nation's water resources. The task is much bigger than one department, but it remains the task of my department to put in place the necessary leadership, planning and inter-departmental structures to ensure that this strategy is implemented.

Turning around the current situation is going to take time, dedication and resources. The Department of Water and Sanitation commits to leading this process, working closely with other relevant departments, the private sector and civil society to make this happen. We commit to ensuring that this strategy is implemented, and that we report, annually, to the presidency and to the people of South Africa, on our progress in this critical task.

MR DM G MASHITISHO

DIRECTOR GENERAL OF WATER AND SANITATION

PREFACE

Background

South Africa is facing a multi-faceted water challenge, which, if not addressed effectively, has the potential to significantly limit the economic growth potential of the country, especially considering the levels of water scarcity, with frequent droughts, increasing water demands, and deteriorating resource water quality.

The deterioration in water quality is a factor of growing concern. Importantly, ***deteriorating water quality is an economic and developmental issue****, and should be addressed as such. Without a change in how water resources are managed, worsening resource water quality will continue to erode the socio-economic benefits from, and increase the costs associated with, the use of the country's water resources.*

In light of the above, the Department of Water and Sanitation (DWS) embarked on a journey to revise, update and consolidate its policies and strategies for managing the quality of the water in the Country's water resources and to develop a pragmatic plan for the conversion of the Integrated Water Quality Management (IWQM) Policy and Strategy into practice.

Integrated Water Quality Management Policy and Strategy

Since the inception of this initiative, several supporting documents were developed that aimed to establish the status quo with respect to water quality, its management practices and instruments, the challenges in South Africa and the institutional arrangements. A review of existing policies, strategies, and other relevant documents, both locally and internationally was used to i) analyse the root cause of the water quality issues; ii) determine the gaps in the IWQM approaches that have been used; iii) understand impacts that emerging trends may have on water quality (e.g. climate change, unconventional gas exploration, amongst others) and iv) look for innovative practices for IWQM.

Based on these learning's, the ***IWQM Policy*** *sought to amalgamate and describe an integrated, inclusive and adaptive approach to IWQM, that built on the tenets of sustainable development coupled with addressing the identified gaps in the policy framework. The IWQM Policy sets out the vision, goal, values, underlying principles and policy responses for managing the quality of our water in our surface and underground water resources.*

The ***IWQM Strategy*** *sets out those strategic actions which are required to be undertaken in order to realise the vision and goals for water quality in South Africa. It articulates the broader process of Integrated Water Quality Management and provides the prioritised strategic actions that need to take place over a short to medium term.*

The Implementation Plan *outlines the pragmatic approach to strategic implementation in the short to medium term and clearly articulates roles and responsibilities as well as the linkages and dependencies between key activities.*

The Monitoring and Evaluation Framework *articulates the indicators to be monitored to determine the progress of the actions to be implemented and provide the foundation required*

to manage water quality adaptively. It also outlines the reporting structures and processes to be followed.

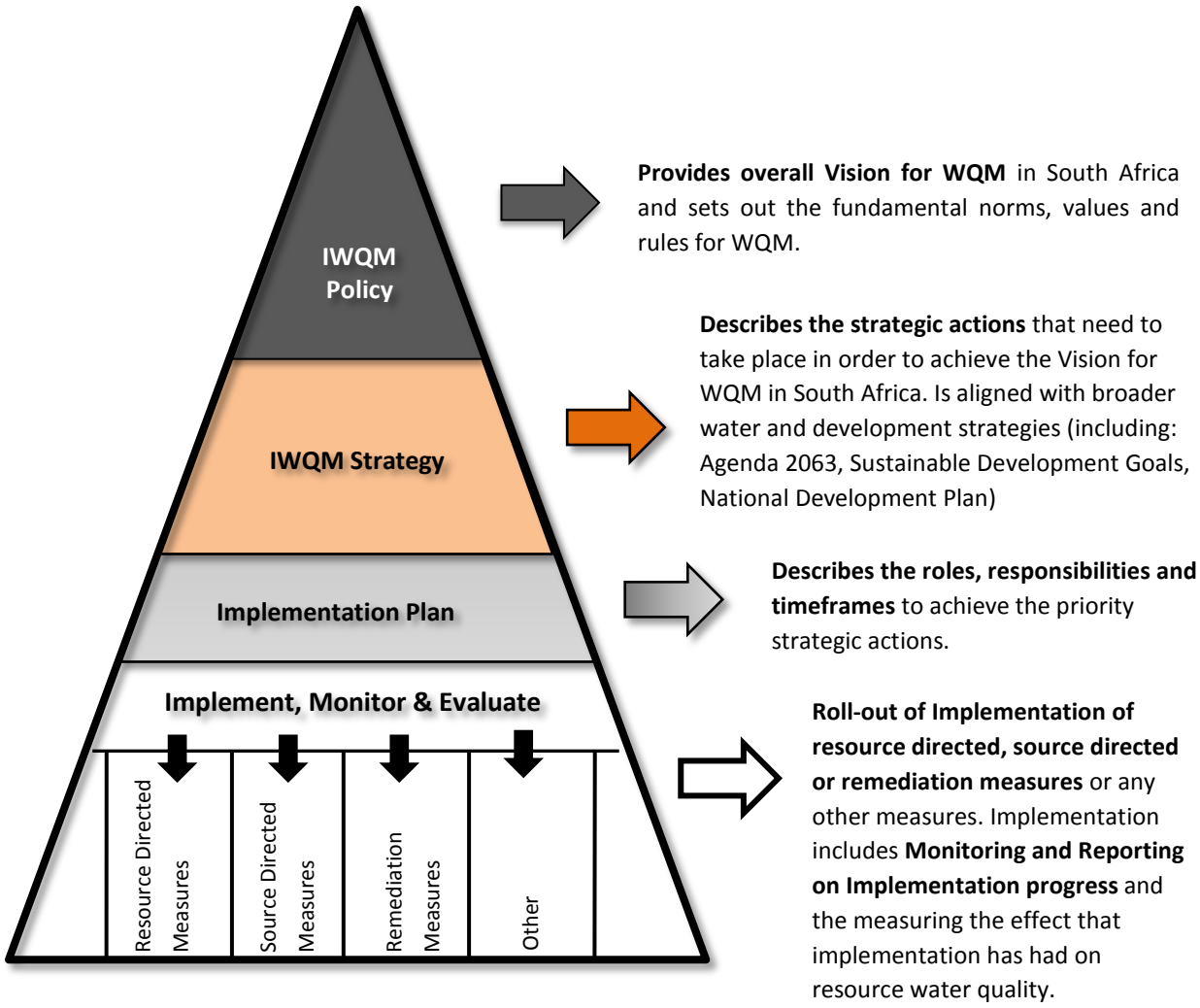

Figure P-1: Relationship between Policy, Strategy, and Implementation

Stakeholder Engagement

Given that the management of water quality constitutes an effort that is serviced and maintained by various role-players, a key element of the development of the IWQM Policy, Strategy and Implementation Plan was the involvement of relevant role-players, at a level where they may provide strategic and operational direction in the conceptualisation and finalisation of key areas and outputs. Consequently, a Stakeholder Consultation and Communication Strategy was developed to inform, consult, involve, collaborate and where possible empower the relevant key players by providing a strategic framework to: -

- ***Engage in policy and strategy development processes*** *of the key issues, priorities, guiding principles, and approaches regarding the IWQM Policy and Strategy.*
- ***Enhance the product*** *through inputs from stakeholders;*

- ***Establish Ownership and buy-in*** *of both the process and outcomes to ensure that stakeholders can relate and identify with the IWQM Policy and Strategy;*
- ***Facilitate Implementation:*** *a key result under this objective is the implementation of the Policy and Strategy. This will involve iterative process of learning-by-doing approach so that the implementation of the Policy and Strategy can serve as both a refining process and a learning curve;*
- ***Provide capacity development*** *and support through strategic collaborative efforts. This ensures that the necessary skills and capacities are shared between and among stakeholders;*
- ***Create awareness*** *and enhance the level of understanding on issues about the IWQM Policy and Strategy, in order to improve and strengthen active stakeholders' participation in WQM;*
- ***Consider appropriate mechanisms*** *for communication and publicising of the IWQM Policy and Strategy.*

Based on the fact that IWQM has environmental and social impacts, among others, it was imperative that consultation not be a single conversation but a series of opportunities to create an understanding about WQM amongst those it will likely affect or interest, and to learn how these internal and external parties view the initiative and its associated risks, impacts, opportunities, and mitigation measures. Listening to and incorporating stakeholder concerns and feedback is highly considered as a valuable source of information that can improve the design and outcomes of policy and strategy and help identify and control external risks. It is envisaged that the consultations done during this initiative form the basis for future collaboration and partnerships.

The Stakeholder Consultation and Communication Strategy focussed internally to relevant Government Departments and externally to targeted stakeholders.

- ***Internal to Government*** *- The purpose of targeting members within the Government Departments and its institutions (CMAs, Water Boards and other water management institutions) was to ensure that there was holistic preparation of staff at all levels. These staff have a range of interests that function at differing strategic levels within Government and as such have different capacity building requirements.*
- ***External to Government*** *- There are a range of stakeholders that are interested and affected by the IWQM Policy, Strategy and Implementation Plan. These include the private sector, research and academia, civil society including NGOs, other national and provincial government departments, umbrella organisations such as the South African Local Government Association (SALGA), the South African Cities Network (SACN), the Chemical and Allied Industries Association (CAIA), Business Unity South Africa (BUSA), AgriSA, the Chamber of Mines, amongst others. The purpose of targeting these stakeholders was to solicit their input, create awareness and guide external stakeholders on water quality management issues, strengthen the understanding of the policy, and strategy and their implications, and strengthen collaborative systems. Moreover, it is important for the*

successful implementation of the policy and strategy that external stakeholders become more engaged in both developing the policy and strategy as well as through the implementation of the policy and strategy.

Way Forward

A*s sector lead, the Department understands that the management of water resources requires a sector-wide approach and this is a central theme to the implementation of the National Water Resources Strategy. Similarly, the management of water quality requires that a broader engagement that moves roles and relationships beyond that of user, stakeholder, Policy-maker and regulator, but towards one of cooperation, partnership and stewardship. This necessitates the development of robust and pragmatic management instruments, supported by effective communication and capacity building, both internally to the Department and externally to the larger sector.*

DOCUMENT INDEX

Reports developed as part of this project:

WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES FOR SOUTH AFRICA		
REPORT SERIES	**REPORT TITLE**	**DWS REPORT NUMBER**
1. PROJECT REPORTS/SUPPORTING DOCUMENTS		
1.1	Inception Report	P RSA 000/00/21715/1
1.2	Literature Review	
1.2.1	A Review of the Water Quality Management Policies and Strategies for South Africa	P RSA 000/00/21715/2
1.2.2	A Review of the Water Quality Management Institutional Arrangements for South Africa	P RSA 000/00/21715/3
1.2.3	A Review of the Water Quality Management Instruments for South Africa	P RSA 000/00/21715/4
1.3	Water Quality and Water Quality Management Challenges for South Africa	P RSA 000/00/21715/5
1.4	Water Quality Glossary	P RSA 000/00/21715/6
1.5	Stakeholder Consultation and Communication Strategy	P RSA 000/00/21715/7
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2. POLICY REPORTS		
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2.2	Integrated Water Quality Management Policy - Edition 2	P RSA 000/00/21715/13
2.3	Summary of Integrated Water Quality Management Policy	P RSA 000/00/21715/14
3. STRATEGY REPORTS		
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3.2	**Integrated Water Quality Management Strategy - Edition 2**	**P RSA 000/00/21715/16**
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4.3	Monitoring and Evaluation Framework - Edition 2	P RSA 000/00/21715/20
4.4	Water Quality Management in the Department of Water and Sanitation: Organisational Design	P RSA 000/00/21715/21

** Two editions of the IWQM Strategy were produced. The first edition was based on the results from a literature survey, root cause analysis and reviews of exiting strategies related to water quality management. Edition 1 was revised to produce the second and final edition (this report) using stakeholder inputs and inputs from peer reviews.*

APPROVAL

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Afred Nzo District Municipality
Afri Forum
African Rainbow Minerals
Agri Eastern Cape
Agri Kwa-Zulu Natal (Kwanalu Initiative)
Agri Northern Cape
Agri SA
Agri Western Cape
Agricultural Research Council
Alliance for Water Stewardship
Amatola Water
Anglo American
AquaEco
ASA Metals
Association of Cementitious Material Producers
Award
Bloem Water
Bosch Capital
Breede-Gouritz Catchment Management Agency
Buffalo City Metropolitan Municipality
Centre for Environmental Rights
Chamber of Mines
Chemical and Allied Industries' Association
Chris Hani District Municipality
City of Cape Town Metropolitan Municipality
City of Johannesburg Metropolitan Municipality
City of uMhlathuze
Clean Stream Environmental Consulting
Council for Geoscience (CGS)
Council of Scientific and Industrial Research
Crocodile River Irrigation Board
De Beers
Department of Energy
Department of Environmental Affairs
Department of Health
Department of Higher Education and Training
Department of Human Settlement
Department of International Relations and Cooperation
Department of Mineral Resources
Harmony Mines
Department of National Treasury
Department of Planning, Monitoring and Evaluation
Department of Public Enterprises
Department of Rural Development and Land Reform
Department of Science and Technology
Department of Tourism
Department of Trade and Industry
Department of Water and Sanitation
DH Environmental Consulting (Pty) Ltd
Digby Wells
East Rand Water Care Company
Eco Monitor
Eco- Owl Consulting
Emfula Riverine Consultants
Endangered Wildlife Trust
EOH Coastal and Environmental Services
Eskom
eThekwini Metropolitan Municipality
Exova BM TRADA
Exxaro
Federation for a Sustainable Environment
Federation of Southern African Gem and Mineralogical Societies.
Fezile Dabi District Municipality
Frances Baard District Municipality
Free State Department of Agriculture and Rural Development
Free State Department of Health
Fresh Produce Exporters Forum
Freshwater Consulting cc
Galago Environmental
Gamtoos Irrigation Board
Gauteng Department of Health
Geo Arc
Glencore
Goadex Engineering and Water Science Consultants
Golder Associates
Goldfields
Govan Mbeki Municipality
Green Cape Sector Development Agency
Manten Marina
Marico River Conservation Association

Limpopo Department of Agriculture and Rural Development
Ikamva
Iliso Consulting
Impala Platinum
Inkomati Usuthu Catchment Management Agency
International Water Management Institute
iSAT
Isiqalo Cooperative
Jaco Consulting
Jantech
JCP Steel
JG Afrika
Joe Gqabi District Municipality
Johannesburg Water
Joint Water Forum
Jones & Wagener
Kaap River Irrigation Board
Kakamas Water User Association
Komati Basin Water Authority
Komati River Irrigation Board
Kumkani FM
Kwa-Dukuza Local Municipality
Kwa-Zulu Natal Agricultural Union
La Brie Estate
Land bank
Lebalelo Water User Association
Lemogang womens health
Lepelle Northern Water
Lephalale Local Municipality
Letaba Water User Association
Letsemeng Local Municipality
Liberty NPO
LIM 368 (Mookgophong LM and Modimolle LM)
Limpopo Department of Economic Development, Environment and Tourism
Limpopo Proto-Catchment Management Agency
Living Lands
Lonmin
Madibeng Local Municipality
Magalies Water
Makane Local Municipality
Maluti Water
Mangaung Metropolitan Municipality
Rhovan Operations
Rockwell Diamonds
Rowing SA
Royal Bofokeng Platinum
Masilonyana Municipality
MBB Consulting Services
Merafong City Local Municipality
Midvaal Water Company
Modikwa Platinum Mine
Mogalakwena Local Municipality
Mogalakwena Mine
Moses Kotane Local Municipality
Mpumalanga Water Caucas
Municipal Infrastructure Support Agent
Mzimvubu -Tsitsikamma proto CMA
Nala local municipality
Naledi Local Municipality
Naledzi Environmental Consulting
National African Farmers' Union
National Business Initiative
Nepad Business Foundation
New World Water Sanitation
North West Department of Rural, Environment and Agricultural Development
North West University
Northern Cape Department of Agriculture and Land Reform
Northern Cape Department of Environment and Nature Conservation
Northern Cape Provincial Government
Ntuzuma Enviro Cooperative
OR Tambo District Municipality
Orange Proto-Catchment Management Agency
Oranje-Riet Water User Association
Overstrand Municipality
Palabora Copper
Petra Diamonds
Phumelela Local Municipality
Pilanesberg Platinum Mines
Pioneer Foods
Platmines SA
Polokwane Local Municipality
Pongolo-Umzimkhulu Proto-Catchment Management Agency
PPC Cement
Prime Africa
Prop 5 Corporation
Randwater
RE-Solve
Rhodes University (Institute for Water Research)
University of the Free State
University of Venda
University of Witwatersrand
Usapho Consulting

Royal Haskin
Samancor Chrome Limited
SANParks
Sasol
Save the Vaal
Scherman Colloty & Associates
Sedibeng Water
SeeSaw
SEMBCORP Silulumanzi
Sephaka Cement
Sibanye Gold
Sidebelo Platinum Mines
Softchem
Source Point
South African Logal Government Association
South African National Biodiversity Institute
South African Sugar Association
SRK Consulting
Stellenbosch Municipality
Stellenbosch University
Stellvine
Strategic Water Partners Network
Swartland Municipality
T Squared Corporate Solutions
Tlokwe Local Municipality
Tlou Consulting
ToxSolutions
Trans Caledon Tunnel Authority
Transnet
Tshegofents Facilities and Engineering
Tsogang Local Municipality
Tshwane Local Municipality
TTM Water Quality Engineering
Umfula Wempilo Consulting
Umgeni water board
Umzinyathi District Municipality
University of Cape Town
University of Fort Hare
University of Johannesburg
University of KwaZulu-Natal
University of Pretoria
Vaal Catchment Management Agency
Vele Colliery
Vhembe Water User Associations
Vin Pro
Vunene Mining
Water Institute of South Africa
Water Research Commission
Western Cape Department of Agriculture
Western Cape Department of Environmental Affairs and Development Planning
Western Cape Government
White River Valley Conservation Board
Wildlands
Wildlife and Environment Society of South Africa
WineTech
World Wildlife Fund
Xylem Water Solutions

EXECUTIVE SUMMARY

Introduction

South Africa faces a wide range of water quality challenges impacting on both surface water and groundwater, originating from both point source discharges such as industrial processes and municipal waste water treatment works, and from diffuse sources due to run-off from land. These pollution challenges manifest at various scales, differ between catchments, and have different severities of impact. These impacts are likely to be affected by a number of growing future trends including increased demands for limited water supplies, changes in temperature and rainfall due to climate change, increased urban impacts due to rapid urbanisation and increased needs for food and energy production.

Despite considerable attention being paid by government to water quality management over the years, the current state of the country's water resources indicates that the management of water quality has not been as effective as required to ensure that water resources are sustainably used. This is due to a number of complex and inter-connected challenges such as balancing of socio-economic development needs, on-going uncertainties in governance, challenges with appropriate technical capacity and impacts of global shocks like climate change and disasters.

The Imperative to Act

Water is a key part of the development of all sectors and as such water quality is an important dimension of ensuring that water resources do not constrain the developmental agenda. The socio-economic benefits that can be accrued from our water resources are being eroded at a rapid rate as our country develops and places increasing demands upon what is already a scarce resource.

If not addressed effectively, the current and future water quality challenges have the potential to significantly limit the economic growth of the country and may severely impact human and the healthy functioning of aquatic ecosystems. Deteriorated water quality reduces the amount of water available for use as more water must be retained in our river systems to dilute polluted steams to acceptable standards. It increases the costs of doing business as many enterprises are forced to treat water before using it in their industrial processes. Municipalities also incur additional costs as the cost of municipal water treatment increases. The deterioration in water quality also impacts on human well-being with productivity falling as more work days are lost due to water-related illnesses and finally, it threatens several economic sectors by impacting on crop yields, making crops vulnerable to import restrictions in key trading partner countries. Some of the impacts of water quality deterioration are immediately visible, such as in the case of major fish kills, while others are more insidious and long term. Combined, however, they have the potential to have a significantly negative impact on socio-economic development in South Africa.

The management of water quality is complex and has a number of unique challenges. Contrary to historical views that relatively simple command and control approaches could be

used to manage water quality, it is now recognised that a far more comprehensive suite of approaches is required. At the catchment scale, both human and bio-physical systems interact to create significant degrees of complexity. Whilst any suite of interventions can result in different outcomes, there is an increasing requirement to ensure that we strengthen our coordination and adapt as conditions change. There will always be the need for rapid response to issues, and we will always have to plan for the future, however, our system of governance must embrace the requirement that we will need to become more adaptive.

This will require more flexibility in response, enable structured learning throughout the process in order to inform and amend policy and practice over time, and also understand that there are many different sets of knowledge that must be brought together to address the problem.

Managing water quality requires integrating a wide range of knowledge in a structured process that allows co-learning, co-creation, and co-adaptation as our society and economy develops.

With this in mind, the responsibility for managing water quality cannot be that of the Department of Water and Sanitation alone. In effect, **there is a significant array of Government Departments that oversee sectors that impact upon land and water use**. Whilst the Department of Water and Sanitation will importantly continue to lead the water sector, the challenge of ensuring sustainable water use will require a more holistic response from broader Government, the private sector and civil society.

The necessary tools and knowledge to affect significant change exists and are sufficient to turn the situation around. The challenge lies in co-ordinated and effective action from government, civil society and the private sector.

This strategy, therefore, forms a call to action for government, civil society and the private sector, to change the way that water quality challenges are addressed, and to bring about a measurable improvement in the quality of water in our rivers, dams, estuaries, wetlands and aquifers across the country.

Strategic Response

The IWQM Strategy is an integral part of the NWRS which notes that a paradigm shift in sustainable resource development is needed in order to support inclusive growth. Water quality, is articulated throughout the NWRS as a core element of the strategy, but the role of water quality is not fully distilled and, therefore, this IWQM Strategy provides the strategic intent required to ensure that WQM supports the implementation of the NWRS.

Aligned to the vision of the NWRS, the vision for IWQM in South Africa is:

"Government, in partnership with private sector and civil society, secures water that is fit for use, for all, forever!"

This IWQM Vision is brought to life through 5 core mission statements of intent, namely:

- *To support a consistent inter-departmental approach to how water quality is managed in our country.*
- *To foster and support cooperative and integrated approaches to IWQM across sectors, including the private sector and civil society.*
- *To adopt an adaptive management approach in which co-creation and co-learning by key players is entrenched and supported by the exchange of data and information.*
- *To drive programmes to build capacity for longer-term improvement in water quality.*
- *To undertake initiatives to progressively realise improvements in water quality in key systems with the intention of redressing priority water quality issues and showing that, as a country, we can halt the deterioration of our water resources.*

In responding to the Vision and Mission for IWQM, this Strategy is based upon five Strategic Goals, which derive from the four WQM Policy Pillars (Figure E-1).

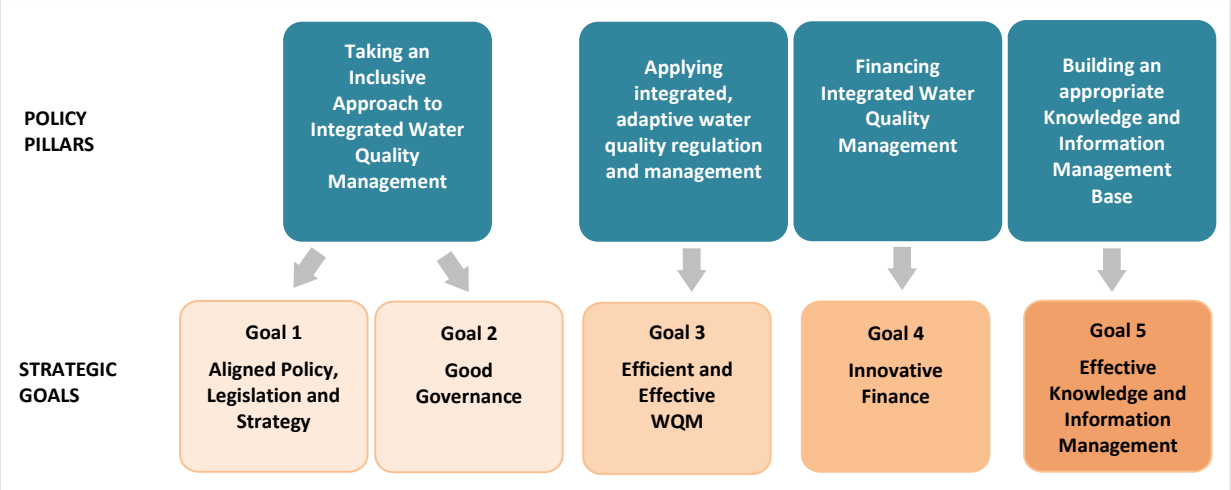

Figure E-1: Policy Pillars and Strategic Goals

The five Strategic Goals are:

- ***Goal 1:*** *Aligned Policy, Legislation and Strategy:* In order to support our drive to be more inclusive in our approach there will be a need to find ways to improve the alignment between policy and legislative instruments, as well as in our strategic approaches. This will take time and considerable effort, but will prove critical.
- ***Goal 2:*** *Good Governance:* An inclusive approach will require that we find ways to improve functional roles and responsibilities. This will require innovative approaches to the way we structure our approaches both within Government and externally with non-Governmental actors.
- ***Goal 3:*** *Efficient and Effective WQM Practice:* The need to be more adaptive in our responses to WQM will require increasingly efficient and effective practices within

catchments. This will mean critical review of these processes and practices at various levels within the WQM system.

- ***Goal 4:*** *Innovative Finance:* To date there has been too much dependence upon funds from the national fiscus to support WQM. Noting that financial resources are limited, there will be a need to be more innovative in generating the funds required to support more effective IWQM.
- ***Goal 5:*** *Effective Knowledge and Information Management:* The old adage that you cannot manage what you do not measure holds true. This requires a renewed and strengthened drive to improve than monitoring networks and to strengthen and consolidate information management systems. Our adaptive management approach is based upon the support of these networks and systems.

During the Assessment and Policy development phases, a large number of issues were identified. These were collated into clusters, taking into consideration the policy responses, resulting in eleven Strategic Issue areas. These align with the IWQM Strategic Goals as shown in the figure below.

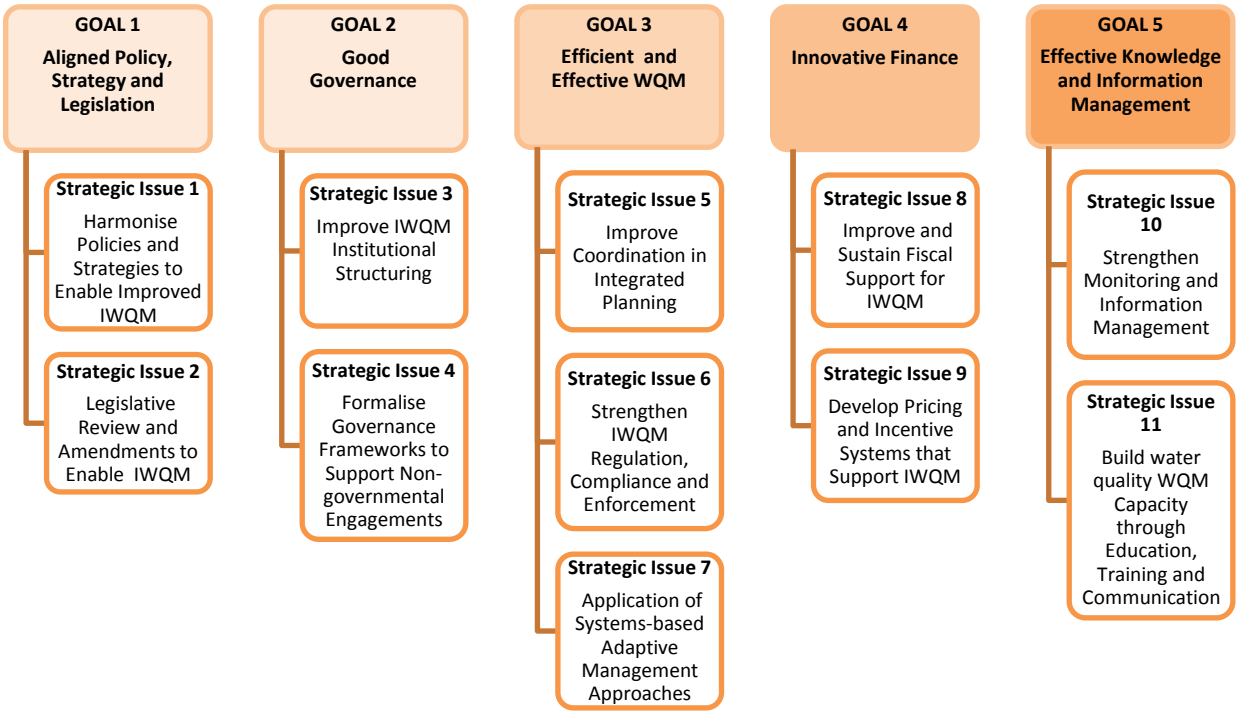

Figure E-2: Relationship between the Strategic Goals and the Strategic Issues

A number of Strategic Objectives (SOs) and Strategic Actions (SA's) have been identified for each of these Strategic Issues. A summary of these Issues, Objectives and Actions is provided in ***Appendix E****.*

Towards Implementation

It is not possible to address all of the many water quality challenges simultaneously; human and financial resources as well as information and systems constraints will inhibit this. Therefore, the focus of this strategy is on delivering change for prioritised challenges. The

bulk of the resources of the state, supplemented by the support of the private sector and civil society will, therefore, need to be focused on key priorities for water quality management. This does not mean that work on other areas pertinent to water quality will not continue, but it serves to guide the allocation of human and financial resources for the short to medium term of the strategy, with the objective of building for longer term improvements.

The development of an implementation plan, to support this strategy, then provides the opportunity to articulate in a structured way, how this strategy can be pragmatically implemented (Figure E-3). This will be supported by a monitoring and evaluation framework that will enable the DWS to monitor and report on progress. In addition, the DWS is also undertaking a review of the existing organisational structure which will assist in enabling implementation.

In effect the implementation plan become the critical catalyst for shifts in approach towards achievement. As such there is a need to carefully consider the nature of the implementation plan and develop this to create the opportunity to achieve, and demonstrate success.

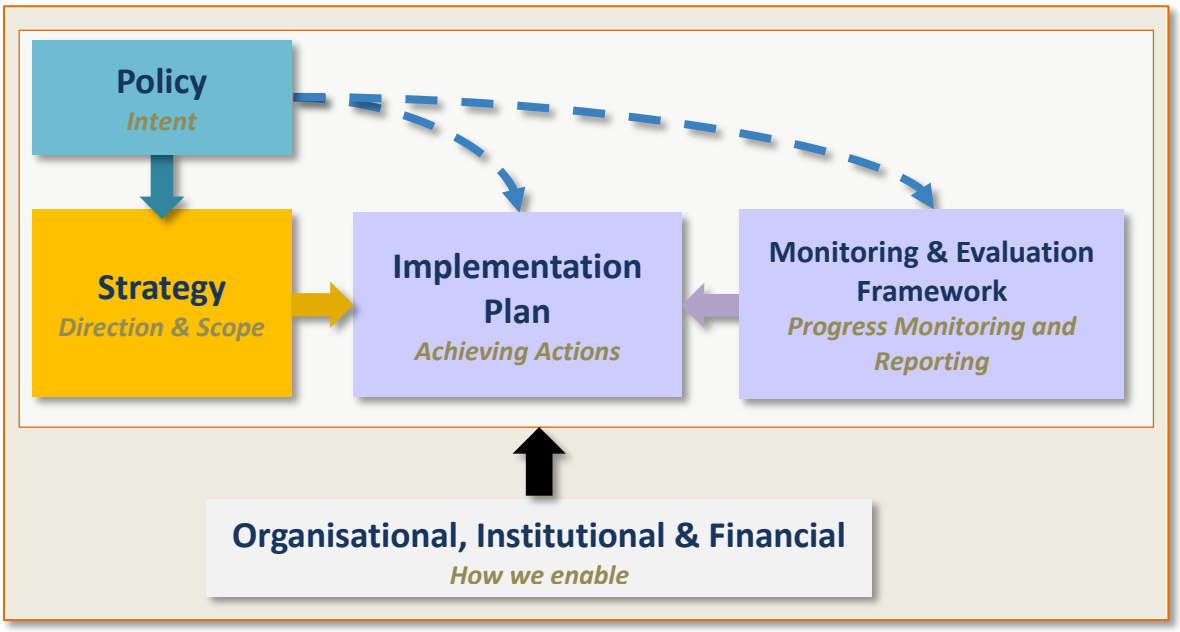

Figure E-3: From policy to strategy to implementation

Core considerations for the formulation of the implementation plan include:

- **Focus on short to medium term timeframes, while building a platform for future strategies** in line with the vision and mission for water quality management,
- **Prioritising critical concerns**, while ensuring that other issues are addressed through on-going management or monitoring for future prioritisation and action,
- **Relevance at national, catchment and local scales,** while ensuring horizontal alignment across sectors and institutions at each scale,
- **Provide the strategic intent and framework for actions** to be described in the implementation plans, and
- **Enables adaptive response** to changing circumstances and achievements based on effective on-going monitoring and evaluation.

The IWQM Strategy articulates the need to show success and so it is important to be able to reflect that our efforts can improve the status of water quality in identified catchments and not be seen as theoretical or academic exercises. Therefore, in the implementation of the strategy key systemic and institutional issues will need to be addressed, whilst reflecting the need to be rooted in our catchments and show impact. Focus on the business of water quality management in this first period of implementation should be towards:

- **Strengthening the water quality management function:** Whilst this may involve some elements of organisational design, this would ostensibly be about resolving roles and responsibilities as well as determining accountability.

  The identification of a champion to lead the water quality management function is priority. This will be supported by a drive to communicate the IWQM Strategy to the broader sector.

- **Improving our information management:** The need to improve our systems to support adaptive management responses is critical and whilst much effort has been applied within DWS, the need to create more integrated systems across Government is becoming increasingly important.

- **Mobilising the sector:** The need to develop a sector-wide approach underpins the philosophy of IWQM. There are, and will continue to be, questions of clarification regarding roles and responsibilities between various actors, but noting that these will be resolved through experimentation and implementation means that efforts to mobilise across a wider spectrum of actors needs to be initiated sooner than later.

  Establishing the "Community of Practice" across the sector is a significant priority in initiating and maintaining sector wide engagement.

- **Realising impact:** Nothing breeds success, like success. It is critically important that as a sector we can demonstrate that we can fix key challenges in prioritised catchments or systems. The broader water quality management approaches, mentioned above, will support these impacts on the ground.

  Priority catchments must be identified and processes initiated to address the core issues of eutrophication, salinization, urban pollution, sedimentation, and acidity/alkalinisation. The development of IWQM plans will be a priority in supporting this drive.

Ultimately, the IWQM Strategy is a document for every individual or institution or organization that plays a role in South Africa's socio-economic growth and development, impacts or is impacted by water quality and has a stake in the country's future. It consists of a number of strategic objectives and actions that collaboratively aim to ensure that water that is fit for use is provided for the countries current and future socio-economic growth. It covers a wide range of aspects associated with water quality management and includes the need to: align policies and strategies across government, create the right capacity to strengthen our management of water resources, show real success and improved water quality in key catchments, improve our funding provisions and mechanisms and strengthen our monitoring and information management.

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Abbreviation	Meaning
AMD	Acid Mine Drainage
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CM&E	Compliance Monitoring and Enforcement
CMA	Catchment Management Agency
CMF	Catchment Management Forum
CMS	Catchment Management Strategy
COGTA	Department of Cooperative Governance and Traditional Affairs
DAFF	Department of Agriculture, Forestry and Fisheries
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DRDLR	Department of Rural Development and Land Reform
DST	Department of Science and Technology
DTI	Department of Trade and Industry
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EMI	Environmental Management Inspector
IDP	Integrated Development Plan
IRWMC	Integrated Regional Water Monitoring Committees
IWQM	Integrated Water Quality Management
IWQMP	Integrated Water Quality Management Plan
IWRM	Integrated Water Resource Management
IWUL	Integrated Water Use Licence
M&E	Monitoring and Evaluation
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
NDP	National Development Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NIWIS	National Integrated Water Information System
NPSS	Non-Point Source Strategy
NWA	National Water Act, 1998 (Act no. 36 of 1998)
NWRS	National Water Resource Strategy
PAC	Project Administration Committee
PMC	Project Management Committee
PSC	Project Steering Committee
RDM	Resource Directed Measures
RQO	Resource Quality Objective

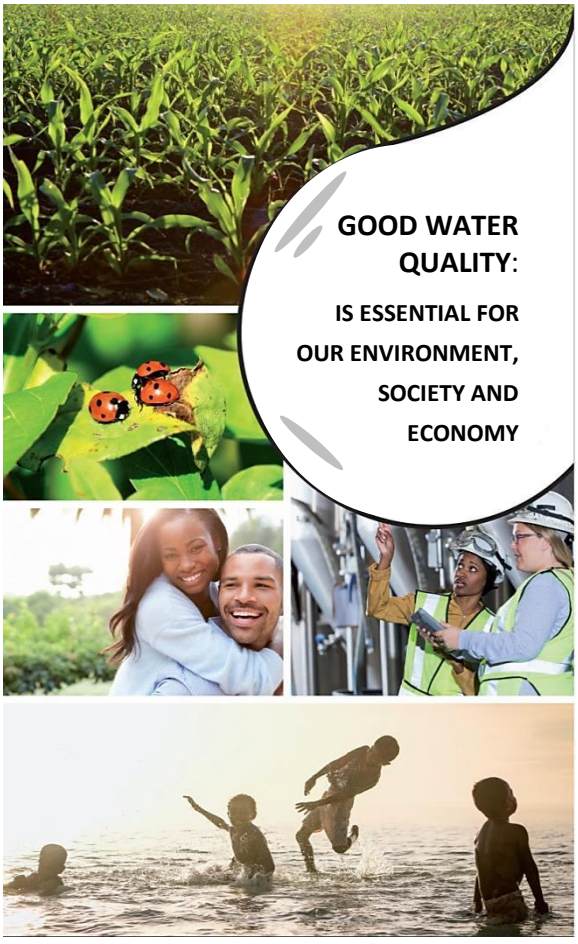
Abbreviation	Meaning
RWQO	Resource Water Quality Objective
SA	Strategic Action
SAHRC	South African Human Rights Commission
SAICE	South African Institute for Civil Engineers
SALGA	South African Local Government Association
SALGA	South African Local Government Association
SANAS	South African National Accreditation System
SANBI	South African National Biodiversity Institute
SBAMA	Systems Based Adaptive Management Approach
SDC	Source Directed Controls
SDF	Spatial Development Framework
SDG	Sustainable Development Goal
SEMA	Specific Environmental Management Act
SI	Strategic Issue
SO	Strategic Objectives
SPLUMA	Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013)
SWOT	Strengths, Weaknesses, Opportunities and Threats
SWPN	Strategic Water Partners Network
TCTA	Trans-Caledon Transport Authority
UNESCO	United Nations Educational, Scientific and Cultural Organization
WARMS	Water Allocation and Registration Management System
WDCS	Waste Discharge Charge System
WfGD	Water for Growth and Development Framework
WHO	World Health Organisation
WISA	Water Institute of South Africa
WMA	Water Management Area
WMS	Water Management System
WQM	Water Quality Management
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WUL	Water Use Licence
WWF	World Wildlife Fund
WWTW	Waste Water Treatment Work

1. INTRODUCTION

1.1 Background

The Department of Water and Sanitation, as custodian of the country's water resources, must not only ***ensure the equitable distribution of water*** to all South Africans, but must also ***protect the water resource for future generations***. This ***cannot be achieved*** without the Department ***managing the water quality*** of the resource.

Whilst it is impractical to maintain a pristine resource, socio-economic and long-term development should not result in unsustainable miss-use of the resource (DWAF, 1991). Consequently, water quality management requires balancing protection of the water resource with the need for development and growth in South Africa. Key criteria for the balance can be found given active engagement, and therefore in support of the Integrated Water Quality Management (IWQM) calls for inclusive approach of all key role players, i.e. Government in partnership with private sector and civil society. The water box (UNESCO, 2009) shows the complexity and diversity of the water sector, and the range of considerations affecting decision-making for water resource management (**Figure 1**).



As sector lead, the Department understands that the management of water resources requires a sector-wide approach and this is a central theme within the second National Water Resources Strategy (NWRS) and well as the IWQM Policy (DWS, 2017). Similarly, the management of water quality requires that a broader engagement that moves roles and relationships beyond that of user, stakeholder, policy-maker and regulator, but towards one of cooperation, partnership and stewardship. This will require the development of robust and pragmatic management instruments, supported by effective communication and capacity building, both internally to the Department and externally.

In light of the above, the Department of Water and Sanitation (DWS) embarked on a journey to revise, update and consolidate its policies and strategies for managing the country's resource water quality.

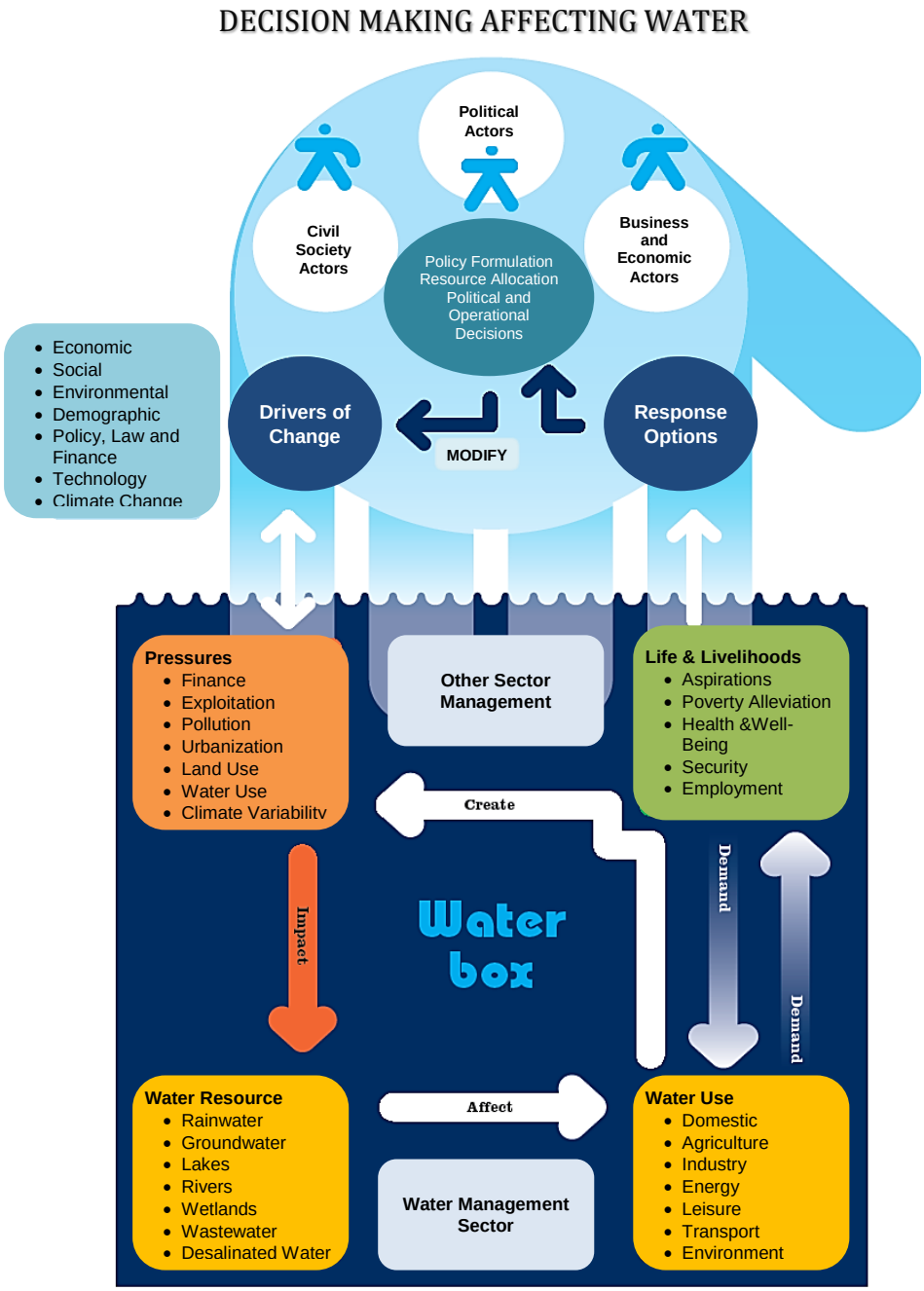


Figure 1: Decision making affecting water (The Water Box: UNESCO, 2009)

1.2 Approach and Purpose of the IWQM Strategy

The approach and development of any strategy goes through a number of key steps and which can be understood to be cyclical in nature. The key element of this process is to critically determine where one is within the 'business of managing water quality' and to understand what is important to achieve within this 'business of managing water quality'. This is typically complex and is even more so within government/public environments where one is considering the integrated management of scarce natural resources.

Although there has been substantial work conducted as part of the project in order to identify the issues around water quality and WQM in the country, the true strength of this IWQM

Strategy will lie in the extent to which implementers of the strategy and stakeholders have been able to conceptualise issues and the ability to develop appropriate strategic responses. Water quality management is a multifaceted and complex issue, affecting all South Africans, and as such, needs to be pursued in a participatory manner, taking into account the varying and differing perspectives of stakeholders (government, private sector and civil society). Therefore, in the development of the IWQM Strategy, two processes of engagement occurred: **one to develop** the IWQMS (i.e. Edition 1 of the Strategy) and the second **to test and finalise** the IWQM Strategy (i.e. Edition 2 of the Strategy).

Therefore, the IWQM Strategy:

- is based on an analysis of existing information, including previous documented recommendations and existing relevant strategies (including the 2006 Resource Directed Measures for Water Quality Strategy), and expectations and recommendations from stakeholders.
- is aligned with relevant executive policies and strategies, including the IWQM Policy and the NWRS. It should be noted that going forward, future strategies should be aligned the IWQM Strategy.
- translates the goal of the IWQM Policy into strategic objectives and actions.
- considers a wide range of aspects. Those that related to (but were not limited to): the application of regulatory, financial, self-regulation and civil instruments; research and innovation; communication, capacity building and empowerment; mechanisms for integration and co-operation; and various thematic water quality issues, such as nutrient enrichment. Various emerging aspects, such as the use of buffer zones, and the management of complex organic compounds, were also considered.
- defines define what needs to be done by the larger water sector in order to achieve improved IWQM. As part of the development of the Strategy, the IWQM process, and roles and responsibilities with respect to functional mandates are defined at the appropriate level.
- addresses the 'integrated' component of IWQM.
- is principally pragmatic, allows for the application of the concept of adaptive management and provides the necessary level of detail on how to address and prioritise the challenges identified in the assessment phase of the strategy development process.

Purpose: The **IWQM Strategy is a national strategy** and as such gives clear and adequate direction to other scales of strategy development and implementation. This **Strategy considers the short, medium and long-term actions and prioritises the actions and interventions that need to be implemented** to move the country forward towards achieving the WQM Policy and improved water quality.

1.3 Target Audience

This IWQM Strategy is a national document, based on a set of Strategic Goals, Issues, and Actions to improve the management and status of water quality in the water resources of the country, whilst aligning with the IWQM Policy and other relevant local and global imperatives. Whilst the Department of Water and Sanitation is the custodian of the country's water resources, this Strategy is directed at all National and Provincial Government departments. It also speaks to South Africa as a whole, including the country's many sectoral institutions, provincial and local governments, as well as non-governmental entities including the private sector, the research community, and civil society.

Critically, the IWQM Strategy is meant for anyone in South Africa who is involved in socioeconomic initiatives, from planning to implementation. The IWQM Strategy is not an "environmental sector" policy. It is a document for every individual or institution or organization that plays a role in South Africa's socio-economic growth and development, impacts or is impacted by water quality and has a stake in the country's future.

1.4 Structure of the IWQM Strategy

The document is structured as follows:

CHAPTER 1 **INTRODUCTION**

- provides the overall rationale for the integrated water quality management strategy in South Africa and the structure of the document.

CHAPTER 2 **THE IMPERATIVE TO ACT**

- provides a high-level situational analysis of water quality and water quality challenges in South Africa and provides the motivation for the call to action.

CHAPTER 3 **ALIGNING WITH THE SUSTAINABLE DEVELOPMENT AGENDA**

- provides the alignment required to support the national and international sustainable development agenda.

CHAPTER 4 **FROM POLICY FRAMEWORK TO STRATEGIC RESPONSE**

- provides the vision, mission and goals for water quality management in the country.

CHAPTER 5 **THE STRATEGIC RESPONSES**

- translates the IWQM Policy into a suite of strategic issues, objectives and actions to be tackled.

CHAPTER 6 **TOWARDS IMPLEMENTATION**

- provides a synopsis of the paradigm shift in the way water quality management should be tackled, the principles and policy responses to support that shift.
- provides the prioritised strategic actions to take forward in the short to medium term.

2 THE IMPERATIVE TO ACT

There is a clear legal requirement, starting with the Constitution of South Africa and compelling socio-political, economic and environmental argument to be made for changing the country's declining water resources. These arguments are elaborated below.

2.1 Water Quality in South Africa

2.1.1 Status Quo

South Africa faces a wide range of water quality challenges impacting on both surface water and groundwater, originating from both point source discharges such as mining, industrial processes and municipal Wastewater Treatment Works (WWTW), and from diffuse sources due to run-off from land. The pollution challenges manifest at various scales, differ between catchments, and have different severity of impact. Add to that the increasing demands for limited water supplies, deteriorating raw water quality and changes in temperature and rainfall due to climate change all find themselves the makings of a perfect storm, if not addressed urgently, will significantly limit our socio-economic growth.

This deterioration in water quality is a key factor in this challenge and is **an economic and developmental issue**: -

- it **reduces the amount of water available** for use as more water must be retained in our river systems to assimilative to acceptable standards;
- it **increases the costs of doing business** as many enterprises are forced to treat water before being able to use it in their industrial processes and the cost of municipal water treatment increases;
- it **reduces economic productivity** as an increased number of work days are lost due to water-related illnesses and as poor water quality reduces productivity in certain sectors (e.g. poor water quality impacts on crop yields and makes crops vulnerable to import restrictions from countries with strict quality standards; and on recreation and tourism);
- it **threatens human health and livelihoods** where people are exposed to poor water quality for consumptive or domestic usage; and
- it **has environmental implications** where biological and chemical contamination of water can impact on important aquatic species and sustainable functioning of eco-systems.

Some of these impacts are clearly visible, such as major fish kills, whilst others are more insidious and long-term in nature. Combined, however, they are already having a significant negative impact on socio-economic development in South Africa.

The above impacts and subsequent deterioration of water quality in our rivers, streams, dams, wetlands, estuaries and aquifers, is due to effluent discharges and run-off from urban and industrial areas, seepage and discharges from areas that support mining, and pollution from intensive agriculture:

- Sewage from urban areas is often not treated properly prior to discharge, due to inadequate or broken sewerage systems, overloaded or poorly managed sewage treatment plants, aging infrastructure and poor management capacity at municipal level resulting in poor operation and maintenance of infrastructure.
- Many industrial processes produce waste that contains hazardous or even toxic chemicals that are discharged into sewers, rivers or wetlands.
- Waste products disposed of in landfills or slag heaps may release pollutants that seep into nearby watercourses or groundwater.
- The mining sector is a significant source of water pollution, both immediate and long-term.
- Agricultural practices add to the pollution burden, with pesticides and fertilisers entering water resources.

These impacts are illustrated in the figure below, which summarises the in-stream state of water quality at 276 selected monitoring points (DWA, 2011).

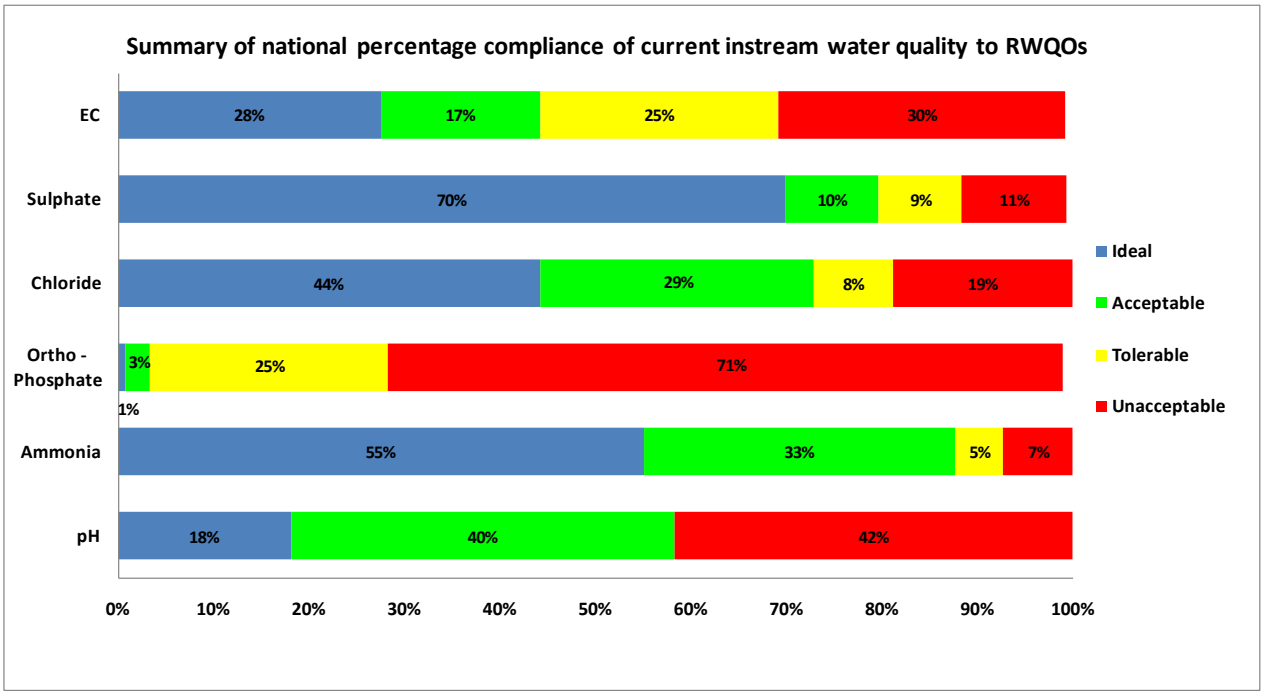


Figure 2: Summary of the national percentage of compliance of in-stream water quality to generic resource water quality objectives for South Africa (DWA, 2011)

Without a change in how land and water resources are managed, worsening water quality will continue to decrease the socio-economic benefits from, and increase the costs associated with, the use of the country's water resources.

2.1.2 The Key Challenges

Water quality and water quantity issues are inextricably linked. One of the elements of WQM is recognising that water resources have a certain assimilative capacity which can dilute pollution to acceptable levels. Increased abstraction of water from our water resources has two impacts on water quality:

- firstly, it decreases the amount of water available in the water resources, resulting in reduced assimilative capacity and increased concentrations of pollutants; and
- secondly, a portion of the abstracted water is usually returned to the water resources at the tail end of the use processes, usually in a worse quality than when abstracted.

Thus, the **management of water quality in South Africa cannot be done in isolation from water abstraction, storage and use**.

Water quality management can similarly not be done in isolation of **the management of activities that affect the beds and banks of water courses,** especially as these aspects of rivers, dams and wetlands often provide important buffers against contamination from non-point sources of pollution, as well as from upstream impacts.

The prevalence and/or severity of impact of particular water quality issues vary markedly from river system to river system and between water management areas (**Figure 3**).

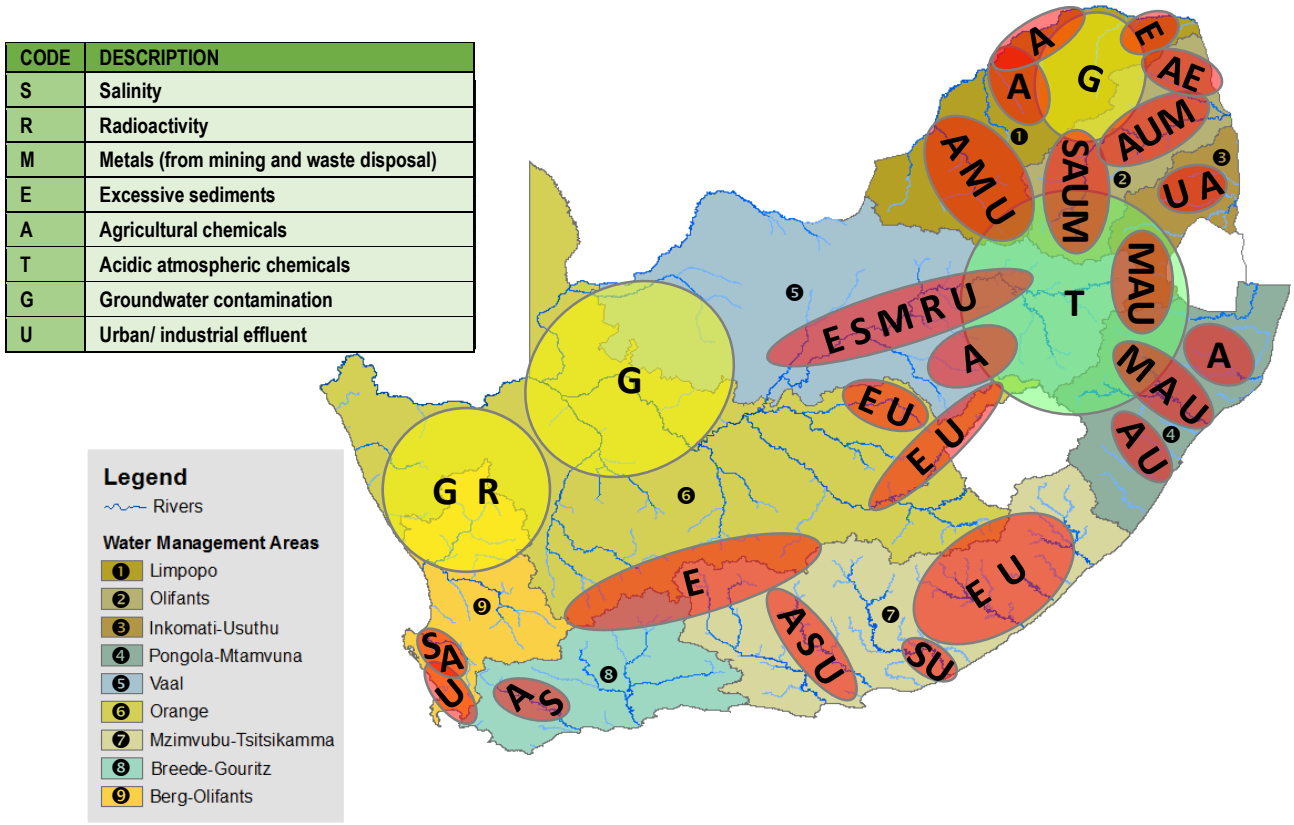


Figure 3: Different types of water quality problems across South Africa (adapted from Ashton, 2009)

The report on "*Water Quality and WQM Challenges in South Africa*" (DWS, 2016a) outlines 13 water quality issues as illustrated in the figure below.

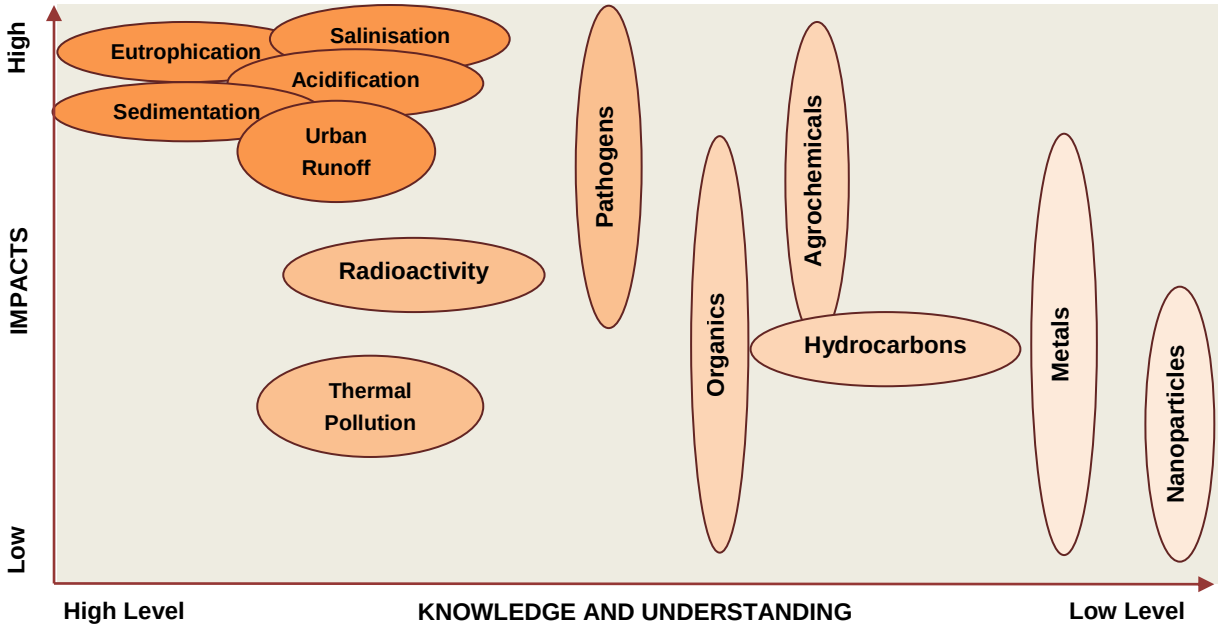


Figure 4: Water quality issues mapped against impacts and knowledge/understanding

Individually, these 13 issues differ in terms of the following characteristics:

- the geographical extent of their impact;
- the cumulative severity of their impacts on the fitness-for-use of the resource, on water users' health, on the local and regional economy, and on local and downstream ecosystems;
- the extent to which they have been/are being monitored; and
- levels of technical/scientific knowledge and understanding of the above impacts, their temporal patterns and geographic prevalence.

Based on the above analysis five issues stand out, around which there is considerable knowledge for action, and the impacts are recognised as being highly significant. Each of these five issues emanates from various sources (**Table 1**) and have a range of factors that exacerbate their impact. **These are significant issues in terms of societal and economic impact and require a strategic, adaptive and action oriented approach, as such, will be prioritised for action in this Strategy.**

Many of the other sources of pollution display localised effects (e.g. radio-activity and thermal pollution) or the level of knowledge, understanding or impact (e.g. nanoparticles, hydrocarbons) were too low to make informed decisions around their management, some of the remaining water quality issues, such as microbial (pathogen), agrochemical and metals pollution, are known to be potentially harmful, but due to inadequate monitoring and their geographical prevalence not being known, challenges exist in effectively managing these

types of pollution. Monitoring to improve our understanding of these pollutants and their impacts will be strategically critical (DWS, 2016a).

Table 1: Prioritised water quality issue and source of pollution

Eutrophication	Salinisation	Acidification/ Alkalinisation	Urban Pollution	Sedimentation
• Agricultural sources • Domestic wastewater • Urban stormwater runoff • Diffuse sources	• Natural sources • Agricultural sources • Industrial sources • Domestic wastewater • Diffuse sources	• Mining sources • Industrial sources and emissions	• Microbial pollution • Solid waste • Hydrocarbon sources • Sedimentation • Nutrient enrichment • Stormwater runoff	• Natural runoff • Agricultural sources • Urban runoff

As the economy develops, more pressure will be placed upon our water resources. In order to improve the management of these resources, it is crucial to have a full understanding of the root causes of these water quality challenges and the way they are currently managed.

The five primary water quality challenges outlined above all have multi-sectoral characteristics and speak to the overlapping or adjacent mandates of a range of government institutions. For that reason, the requisite future management responses to these challenges will need to go well beyond the statutory and regulatory mandate, measures, controls, instruments and processes of DWS alone. **The future management of these water quality challenges will need strategic regulatory collaboration and partnerships between DWS and various other state institutions across all three tiers of government, the CMAs, water boards, the private sector and organised civil society**.

To understand these primary water quality challenges, it is useful to explore the drivers, the root causes and the cooperative governance and civic partnership considerations relevant to these challenges. This understanding starts to provide insight as to how solutions should be formulated to improve WQM. The **analyses ultimately points to deep seated institutional challenges, specifically with regards to cooperative governance** (these are summarised in **Appendix B and C**). Whilst there are some issues around technical capability, and a few point at social and political causes, the priority action is to address the institutional issues so as to unlock significant impact.

2.2 Water Quality Management in South Africa

2.2.1 Status Quo

Currently, the Department's approach to the protection of the resources is two-pronged and consists of Resource Directed Measures (RDM) and Source Directed Controls (SDC). Resource Directed Measures set the goals for resource protection and are informed by the Water Resource Classification system, which allows for different levels of protection for different water resources. The RDMs also make provision for the "Reserve", defined as the quantity and quality of water required to maintain healthy aquatic ecosystems, whilst meeting

the basic human requirements. Sensitive receiving environments, like dolomitic groundwater resources, and rivers with a high conservation value will receive greater management attention, and pollution sources in these areas may be required to implement more stringent management.

In addition, the National Water Act specifies that Resource Quality Objectives (RQOs) will be established for different water resources and this process is currently underway for a number of catchments in the country. These are aimed at specifying appropriate numeric and narrative objectives for different water resources, and can include management objectives for water quality, as well as for the biological and physical characteristics of the resource (DWAF, 2002).

The National Water Act dictates that water resources management practices and strategies must give effect to the Reserve, the RQOs, and to the Water Resource Classification system. In the absence of the RQO's, certain catchments have implemented the agreed Resource Water Quality Objectives (RWQO's), also known as water quality planning level limits.

The key components to effective water quality management include the effective co-ordination between the various planning, information management, monitoring and source directed control activities (such as water use licensing and compliance monitoring and enforcement) and well as engagement with stakeholders (DWS, 2015). Given that water quality management considers the collective impact of land use and water use processes, coordinated planning and action is required not only within the Department but at all levels, from national government through provincial and local authorities to individual landowners and affected stakeholders, such as civil society. The provision and implementation of clear policies, strategies and plans, which provide the necessary direction to the Department as well as the larger water sector, for the effective, equitable, sustainable and integrated management of South Africa's surface and ground water quality is paramount for the management of its water resources. These strategies and guidelines may be applicable nationally, or for a certain catchment or specific water quality related challenge. A typical hierarchy of WQM management instruments is shown in **Figure 5** below.

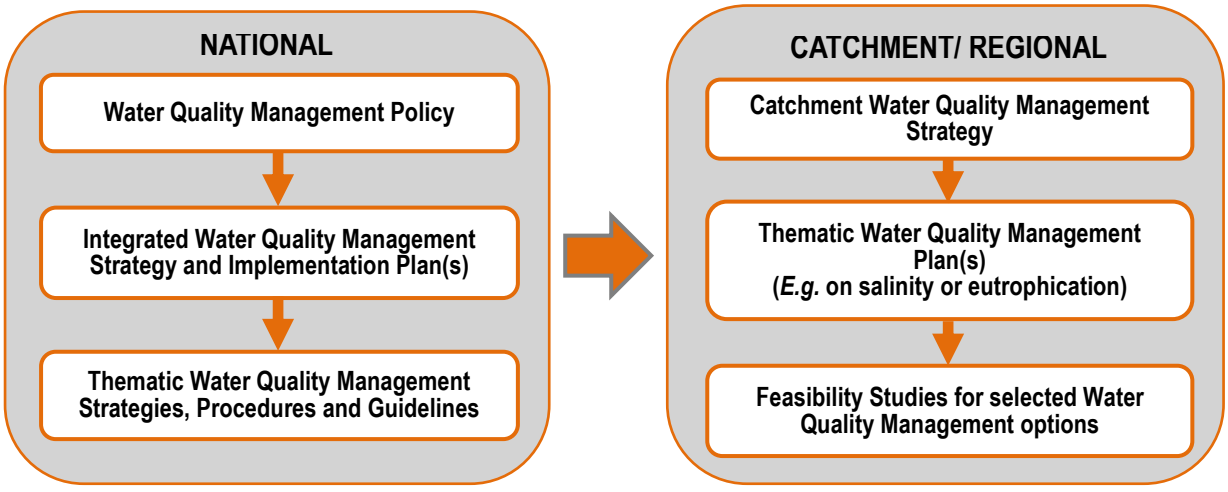


Figure 5: Hierarchy of IWQM Instruments at National and Catchment/Sub-Catchment Scales (adapted from DWA, 2015)

Currently, water quality is managed and controlled by the Department through the application of a number of management instruments. These are *inter alia* the Integrated Water Quality Management Strategy (2017, this report), the Water Quality Management Policy for the RSA (DWAF, 1991), the Resource Directed Management of Water Quality Policy (DWAF, 2006), the Policy and Strategy for Ground Water Quality Management (DWAF, 2000), the National Water Resource Monitoring Strategy (DWAF, 2004), Regulation 810, which developed a system for the classification of water resources (DWA, 2010), Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (DWAF, 2006) and the Blue and Green Drop Initiative and Reports (DWA 2009 and DWA 2010). To further guide water quality management at catchment scale, IWQM strategies for the Vaal (2009) and Olifants catchments (2017, in prep) have been developed.

The Department's WQM functions, and how this relates to the 2-pronged approach of RDMs and SDCs is shown below (**Figure 6**). Here the Integrated Water Resource Planning function provides the required resource planning and management cohesion that links the Resource Objectives (*i.e.* RDMs) with Water Use Management requirements (i.e. the SDC component of the WQM approach).

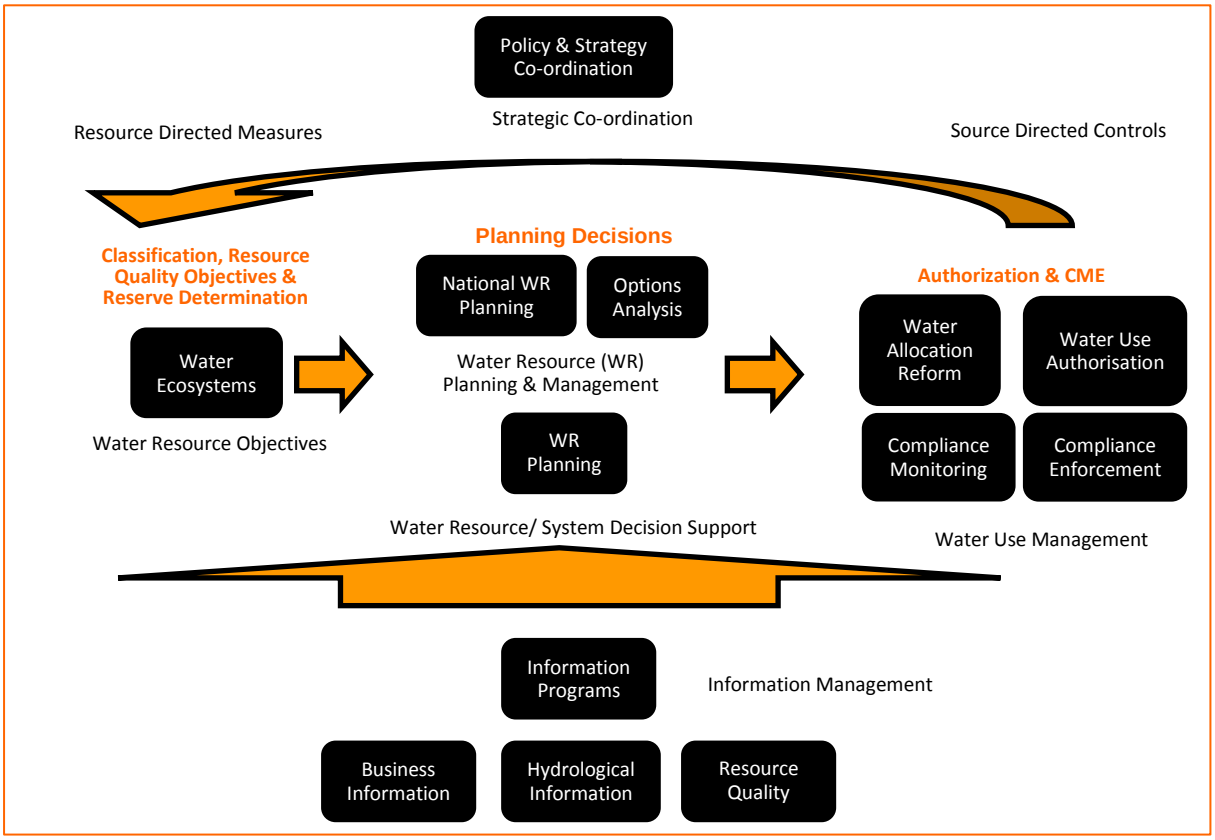


Figure 6: Water Quality Management Functions in DWS

2.2.2 The Key Challenges

Despite considerable attention being paid to WQM over the years by government, the current state of the country's water resources indicates that the management of water quality has not been as effective as required to ensure that water resources are sustainably used.

This is mainly due to a number of complex and inter-connected challenges such as the requirement to balance socio-economic development needs with the need to restrict contamination of water, on-going uncertainties in governance, challenges with appropriate technical capacity and impacts of global shocks like climate change and disasters (**Figure 7**).

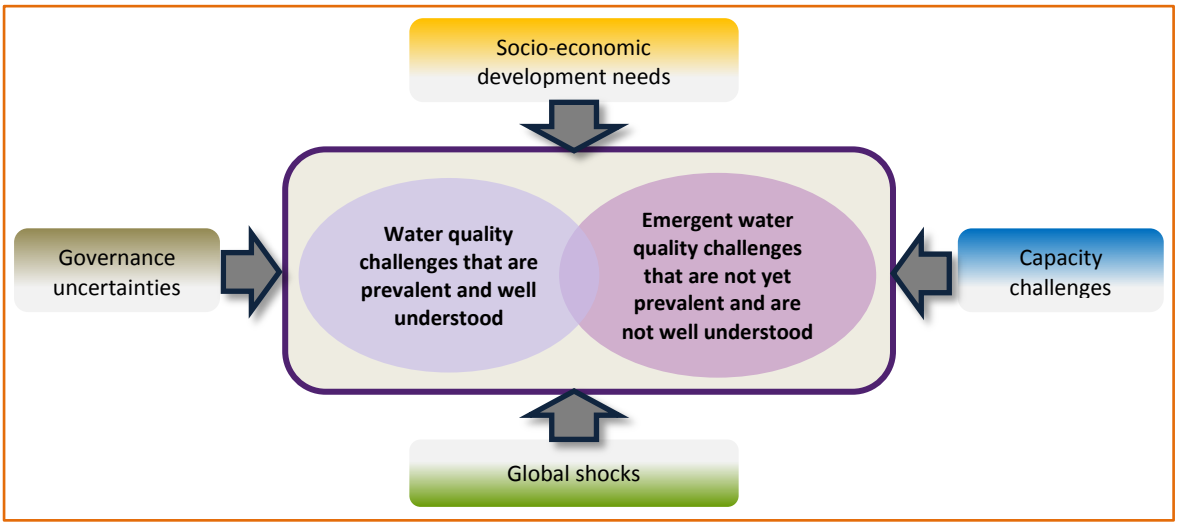


Figure 7: The complex nature of water quality management

Broadly, the WQM challenges can be split into 4 categories: (i) Non-aligned policy, legislative and governance frameworks, (ii) Inappropriate practices, (iii) Insufficient finances and (iv) ineffective knowledge and information management. These are elaborated on below:

Non-aligned policy, legislative and governance frameworks:

- ***Fragmented policies and implementation***
  - Current government policies and strategies are fragmented, and there is a lack of cooperative governance and alignment between different government departments and within the different spheres (national, provincial and local).
- ***Insufficient cooperative governance*** between different government departments to ensure effective WQM with limited state resources both in relation to authorisation of activities that impact on water quality and in terms of compliance monitoring and enforcement.
- ***Unclear regulatory responsibility and associated cooperative governance*** pertaining to agriculture (DAFF), mining (DMR), and wastewater treatment (municipalities).
- ***Fragmented responsibility for WQM functions*** is spread across various branches and units, with inadequate systems in place to ensure co-ordinated activities.
- ***Delay in the development of Catchment Management Strategies***
  - The slow process of establishment of Catchment Management Agencies (CMAs) has led to a delay in the development of catchment management strategies (CMSs). These strategies are understood to play a key role in creating alignment between various sectors and stakeholders, and as such become a key strategic tool for enabling improved WQM.

- ***Lack of a Non-Point Source Strategy (NPSS)***
    - As part of the situation assessment in the three pilot areas for the WDCS, it became evident that a significant portion of pollution emanated from diffuse/non-point sources. This was not historically the case where, about a decade ago, the attribution of pollution from diffuse sources was approximately 20% of the load. In 2014, this attribution increased to approximately 60-80% in some of the catchments due to various reasons such as failing sewers, mine seepage etc. Whilst a NPSS was developed as part of the implementation readiness for the WDCS, it was never taken any further. In order to fully mitigate the issues around pollution, the issue of diffuse sources needs to be dealt with.

Inappropriate practices:

- ***Inadequate measures to counter adverse land use practices***
    - Inappropriate practices for surface soil tillage, fertiliser application, riparian buffer zones and other cultivation land management needs for both agricultural crops and commercial timber plantations cause nutrient, chemical and sediment pollution in downstream water courses or underlying groundwater resources.
    - Poor management of mining and industrial areas can result in waste water and stormwater wash-off polluting local streams, rivers and aquifers, resulting in wetland degradation. Within municipal environments activities such as the development of poorly-serviced dense human settlements and reckless construction activities all can have significant impacts.
- ***Challenges with treating wastewater***
    - A notable degree of dysfunction is present in the management of wastewater treatment works at municipal level. This is illustrated by the latest Green Drop report which rated almost 50% of 824 municipal wastewater treatment facilities as “critical” or “poor”, resulting in extensive nutrient and pathogenic pollution of water courses due to untreated or inadequately treated sewage effluent from such facilities.
    - Dysfunction has a number of causes, primary among which are lack of technically qualified and experienced staff, poor maintenance of infrastructure, and weak financial management and billing systems.
- ***Dysfunctional municipalities*** also result in an increase in wide-spread urban runoff pollution, caused by a lack of implementation of best-management practices in urban land-use planning (residential, commercial, industrial, recreational, conservational), poor storm water management systems, and a lack of or poor enforcement of municipal by-laws.
- *Mushrooming of informal dense human settlements* in and around most urban centres during the past two decades due to rural-to-urban economic migration has caused steadily increasing diffuse source pollution of local and downstream water courses, as well as of underlying groundwater resources.
- *Lack of an integrated, catchment approach*
    - The DWS has recognized the gap, and catchment specific IWQM plans (IWQMP) are in the process of being developed for prioritised catchments (Olifants; Crocodile-West;). However, the integrated, sectoral approach is required for more efficient planning and practice.

Insufficient financing:

- ***Budget allocations for WQM is insufficient*** to address the water quality challenges of the country. This has implications for the number of staff, the nature of systems and the spatial and technical extent of our monitoring networks. The development of catchment based water management plans will underline the requirements in this regard.
- ***Lack of broadened finance mechanisms***
  - Increasing the funding available through implementation of the Waste Discharge Charge System (WDCS).
  - Other options include access to donor funds, green funds, climate financing and more importantly, options around intergovernmental funding.

Ineffective Knowledge and Information Management:

- ***Limited technical capacity in government***
  - General lack of technically skilled and experienced staff in DWS, resulting in weaknesses in authorisation of waste discharges by DWS, gaps in water quality and compliance monitoring, including failure to take effective action against polluters.
  - General lack of technically skilled and experienced staff in municipalities contributing to high levels of pollution from municipal wastewater treatment.
  - Limited uptake of innovation from Water Research Commission (WRC) and other academic and research institutions
- ***Inadequate monitoring systems***, including the number and spatial extent of monitoring points, shortage of staff to carry out monitoring, and monitoring of new and emerging contaminants.
- ***Insufficient translation of data into appropriate information*** and ensuring effective enforcement of regulations based on the data.

In addition, there are several trends which already are, or can be expected to unfold in South Africa over the next few decades, which may lead to new or accelerated water quality impacts in many locations across the country, such as:

- *changes in rainfall patterns due to climate change;*
- *increases in water demand and changes in the rate of biogeochemical and ecological processes that determine water quality due to higher temperatures;*
- *increases in unconventional oil and gas extraction in the form of hydraulic fracturing;*
- *increases in population growth and urbanisation resulting in increases in growth of inadequately serviced densely populated settlements;*
- *increases in industrialisation; and*
- *increases in water demand due to the water-food-energy nexus.*

Given the above, it was important to develop a robust IWQM Strategy.

2.3 A Watershed Moment

South Africa is at a watershed moment. For many years there has been an assumption that the country generally has sufficient water resources to support the expectations in socio-economic development. The recent drought has underlined once again that water resources need to be managed in a careful and innovative manner. This especially so when one also considers that the options in terms of large scale infrastructure developments are becoming fewer as our reliance on water conservation and water demand management increases. Economic growth and the need to support the redress of historical social inequities will place further pressure on both water quantity and quality. This will beg of the country difficult questions in terms of water sector demands versus contributions to the economy and the employment opportunities that sectors provide. Furthermore, the country still has a large rural population that has a very direct relationship with the environment and water, and are often exposed to the worst environments. At this watershed moment, we are reminded of the old adage about South Africa's water resource, namely, "too much, too little, too dirty".

2.3.1 A Country in a State of Flux

After two decades into democracy, South Africa is once again on the precipice of change. The challenges of governing a developmental social economy are multiple. Within the context of shifts in global power and economic downturn, these challenges are multiplied. This has played out in a frustrated populous that has reflected their desire for employment, security and improved services through various protests. These wishes are understandable, but the reality of supporting the kind of upliftment and empowerment that the country requires is not always fully understood. Clearly, government policy is focused upon creating jobs and addressing societal inequalities, but ensuring impact continues to be difficult.

To address these challenges government has started to create more platforms that enable the private sector and civil society to support processes. More effort is being focused upon forums and how these are supported, whilst strategic partnerships such as the Strategic Water Partners Network (SWPN) are being maintained. This drive has the benefit of bringing a range of insights and experiences into the problem-solving space, as well as importantly strengthening the social compact between government, the private sector and civil society.

The envisaged outcome is one of increasing stability through continued engagement and exchange, however, if parties chose not to engage and assist in co-creating the future, one can expect on-going instability which will be typified by extreme views and poor alignment. Water resource crashes and longer-term damage to ecological infrastructure can be expected.

2.3.2 Transitional Institutions

The cohesive response of the broader water sector does need to be built upon a strong institutional platform. The institutional frameworks enabled by the National Water Act, 1998 (Act no. 36 of 1998) (NWA), and other legislation, have been in transition for some time. This has created some uncertainty regarding role and responsibilities, but most significantly has opened up the space for considerable amounts of non-compliance and unlawful water use. In

particular, there have been significant delays in the establishment of CMA's. The institutions have a very important planning and regulatory role which needs to be realised through the implementation of a CMS. There has also been some institutional uncertainty around the delegations of powers and duties to the CMAs and this has also contributed to poor regulatory responses. The DWS is now resolving the delegations and is in the process to establish the next tranche of CMAs. The DWS is also currently in a process of restructuring in order to improve its delivery, noting the additionality that the sanitation function brings.

Over and above the internal structuring of DWS, there is the potential for legislative conflict or overlap between the various sector players, as well as the possibility of gaps that are not being addressed in terms of pollution control. For example, raw and drinking water quality standards are imposed at the national level, with local government putting in place practices to meet these requirements, through a range of treatment processes. Provincial departments of environment have a concurrent competence of pollution control, which includes water pollution, resulting in potential overlaps. Cross sectoral responsibilities are more complex but have significant impact on water resources. This is typically the case for those departments, within all spheres of government, that manage land and ecological infrastructure, and which has real impact of water resource quality. The role of CMAs in creating the cooperative arrangements at the catchment scale is key and is part of their initial functions. They will play an important brokerage role between government departments within all spheres and hence balance the needs at the local levels with the interests at the national level.

2.3.3 Technology Shifts

New technologies push operational boundaries every day, ranging from agricultural technologies that enable greater yields with less water in a more variable climate, through to cost-effective renewable energy that enables desalination of sea water, to improved drilling technologies that enable access to deep aquifer groundwater resources, and to communications technology that allows connectivity between local, regional and global actors (Breede Overberg Catchment Management Agency, 2013).

Many systems within Government are not current (in terms of data and technology) nor integrated. Within the DWS, the Water Monitoring Governance established Integrated Regional Water Monitoring Committees (IRWMC) (reporting to the National Water Monitoring Committee), of which the main aim is to integrate ALL water monitoring Programmes within the whole water sector (mining, industrial, agricultural and domestic sectors) in order to facilitate decision support for management reporting. However, consideration needs to be given as to how the monitoring systems of the Department of Health would interface with this.

In addition, the National Integrated Water Information System (NIWIS), a web-based application was launched in 2015 and is still in the process of being taken to full functionality. The data backlog creates a challenge for real-time monitoring, and with the advent of the smartphone, information is now at our fingertips. Simple data applications allow for the collection and sharing of information seamlessly, supporting the process to have active and engaged citizens. This has led to a plethora of studies that have shown the benefit that can be

derived from citizen science and crowd-sourcing. This technological revolution needs to be capitalised to ensure data systems are accessible to the relevant parties and current.

2.3.4 Water-Food-Energy Nexus

There is an on-going world-wide debate around the water-energy-food nexus and the challenges that the world will increasingly face in terms of meeting demands for water, food and energy. Of course, there are important linkages between these elements that are core to human development and increasing constraints in one element will place this nexus under pressure. This has fuelled discussions about how countries start to shift towards a green economy and the opportunities that these changes can provide.

There is the pursuit of renewable energy and the shift away from coal to gas, has seen unconventional oil and gas exploration and deep bed fracturing come into the spotlight. There are many concerns about these, especially with the lack of information to effective regulate the industry. Improvements in technology to capture this shale gas has made fracking a reality in South Arica, however, the impacts upon the water resources are still not entirely clear. There is insufficient information to assess the impact of fracking on the country's resources, and more information is required to fully assess the situation.

The uncertainties that arise from the new technologies and resource development opportunities will continue to abound and will influence management approaches for the future.

2.4 Building the Economy

As a developing country, South Africa needs to balance its strong desire for economic growth and development with the scarcity and preciousness of its natural resources. This means that difficult decisions need to be made regarding the direction and speed of growth, especially between competing economic sectors and the health and livelihood of the people of South Africa. Prioritised water use as well as stricter enforcement of stringent measures to reduce water pollution should be vigorously implemented.

Water is a key part of the development of all sectors and as such water quality is an important dimension of ensuring that water resources do not constrain the developmental agenda. In so doing, WQM becomes a key element of eradicating poverty and significantly reducing inequality by 2030. This is aligned to the shifts towards understanding the importance of green economy, the duality that economic growth can drive an "unsustainable" agenda of resource degradation and that overly excessive concern about the environment can hinder economic development (Global Water Partnership, 2012).

Water pollution has direct, but insufficiently recognised, impacts on economic growth, human health, ecosystems, job creation and the cost of doing business. Consequently, improving resource water quality in our Country will impact positively on economic growth and on human health and well-being.

2.4.1 Livelihoods and Productive Sectors

Water pollution impacts negatively on productive economic sectors like agriculture, aqua-culture, the commercial sector, industry and tourism, as well as on rural livelihoods, through, for example, reduction in crop yields, loss of tourism, and increased requirements for pre-treatment of water in industrial and agro-processing enterprises.

Industrial water users require water of a suitable quality for their industrial processes. Where such water is abstracted directly from a polluted water resource, industry must treat the water to a suitable quality, thus impacting on their profitability.

In the agricultural sector, deteriorating water quality impacts on crop yields: for example, heavy-metal pollution can not only result in lower plant growth rates (ranging from 13% to 70%), but also in a decrease in the yield of wheat (40% to 83%) (Athar and Ahmad (2002)). It also impacts on long-term soil productivity through, for example, salinization of land, and, critically, on export of crops where irrigation water quality does not meet the stringent standards of the EU or the USA (thus making crops unacceptable).

Farmers risk losing contracts with international clients because of poor water quality. In 2014, it was reported that the European Union had given a final warning that it would “stop imports from crops irrigated with water from the Olifants because of the level of health-threatening pollutants from mines seeping into the river”. Later that year, the non-profit Bench Marks Foundation released a statement about the impact of poor water quality on the economy, saying that farming exports were “affected by the influx of collieries with many vegetable farmers downstream from the mines in the Kendal Ogies area losing European clients due to the bad quality of water used for irrigation” (CER, 2016).

Case Study 1: *In India a study compared two villages in Andra Pradesh, one of which was polluted by nearby industries, and the other which was not. In the polluted village, water contained very high levels of arsenic and had abnormally high chemical oxygen demand, total dissolved solids, and other contaminant levels. The amount of land under cultivation in this village declined by 88 percent over nine years after being affected by water pollution. The loss of cultivable land is attributed solely to contamination of soils from polluted irrigation water (Reddy and Behera 2006).*

In the tourism sector, water pollution may cause loss of wildlife sanctuaries and degradation of protected areas, fish kills, health impacts for tourists, and visual impairment of water resources, discouraging tourist activity in affected areas.

Case Study 2: *It is estimated that the U.S. tourism industry loses close to $1 billion each year, mostly from losses in fishing and recreational activities because of nutrient-polluted water bodies. In the Philippines, tourism losses due to water pollution represent around 70 percent of the total US$ 1.3 billion annual economic losses from water pollution (WB 2003).*

The Middle Vaal River is an area with particularly high urban, mining and industrial pollution. The direct and indirect costs of contamination in the form of salinisation in this area were estimated by Urban Econ in 2000: it was estimated that direct costs of R80.5 million per

annum would be saved if levels dropped to 200 mg/l TDS; on the other hand, a level of 1,200 mg/l TDS would increase salinity-related costs to R183 million. (Nieuwoudt et al., 2004).

In 2010, an economic impact study conducted by Plus Economics concluded that a decrease in the quality, and therefore usability, of water in South Africa by 1% might result in the loss of 200,000 jobs, a drop of 5,7% in disposable income per capita, and an increase of 5% or R18,1 billion in government spending. Additional macroeconomic effects of poorer water quality included a drop of R16-billion in household spending, a drop of 1% in the GDP growth rate as well as a drop of R9-billion (2,5%) in total fixed investment.

A Feasibility Study for a long-term solution to address Acid Mine Drainage (AMD) associated with the East, Central and West Rand underground mining basins in the Gauteng Province was completed by the Department of Water Affairs in 2013. If AMD is discharged without treatment into the Vaal River System, the high salt load requires large dilution releases to be made from the Vaal Dam to maintain the fitness-for-use objectives set for the Vaal Barrage and for further downstream users. This would result in unusable water surpluses developing in the Lower Vaal River and threaten the acceptable levels of assurance of water supply from the Vaal Dam with an increasing risk of water restrictions in the Vaal River water supply area, which would have negative economic and social implications (DWA 2013b).

Case Study 3: *"It is estimated that water from current mining operations entering the Witbank and Middelburg Dams amounts to 30 million cubic metres per annum and this will rise to 44 million cubic metres by 2030. To treat this water to pre-mining standards would cost R300 million Rands per annum currently, rising to R440 million per annum in 2030 (at present Rand value). What the final discharge of polluted water will be is uncertain but one estimate places it at around 200 million cubic metres per annum, which will cost R2000 million per annum to treat at current Rand value. It is unclear for how long acid generation will continue, but it is likely to persist for hundreds of years." (McCarthy and Pretorius 2009)*

2.4.2 Municipal Services

Water services authorities and water boards face rising costs in treating increasingly polluted water to potable standards. In addition, treatment systems require upgrading and modification to deal with the range of pollutants in raw water. These costs are passed onto consumers, pushing up costs for households and water intensive businesses in particular.

Case Study 4: *In the United States, freshwater pollution by phosphorus and nitrogen cost government agencies, drinking water facilities and individual Americans at least $4.3 billion annually as estimated in 2008.*

2.4.3 Human Health

Not only does poor water quality impact on the right to an environment that is not harmful to health or well-being, but it carries significant economic costs through lost productivity and high health costs.

Every year, more people around the world die from unsafe water than from all forms of violence, including war – and the greatest impacts are on children under the age of five. Diarrhoeal disease results in the death of around 1.5 million people each year (WHO 2012) with 58% (842 000 deaths per year), resulting from unsafe water supply, sanitation and hygiene. This includes the death of 361 000 children under the age of five, mostly in developing countries (WHO 2014). While over 95% of South Africans have access to water supply infrastructure, aging infrastructure and poor management of water services in many municipalities means that both neither the supply nor the quality of water provided is adequate, and in some areas the quality of water provided has deteriorated over time.

Poor water quality, whether in municipal systems or water resources, increases the incidences of water borne diseases, resulting in costs to households in medical treatment, lost working days, costs to the public and private health care systems, and loss of life from water borne diseases. People in rural areas and isolated communities are particularly at risk due to lower capacity for treatment of water quality and poor water services. These same communities are often also disadvantaged by geographical and economic isolation and poor health care services.

There is an increasing problem of bacterial growth in water resources - in 2010, the quantity of bacteria found was more than five times the concentration that the World Health Organization recommends (Mellor et al., 2013). This can cause intestinal deterioration, bacterial diarrhoea, arthritis, and kidney disease.

In 2005, an outbreak of typhoid in Delmas resulted in five deaths, 596 cases of typhoid and 3,346 cases of diarrhoea. In 2003, nearly 4000 cases of cholera were reported in South Africa. A recent WRC study shows cholera, shigella, salmonella and other harmful viruses and bacteria at every sampling point on the Umgeni River between the Inanda Dam and Blue Lagoon in Durban. In June 2014, three babies died in Bloemhof from drinking contaminated water.

Case Study 5: *In 2010 it was estimated that Hospitalizations for three common waterborne diseases, Legionnaires' disease, cryptosporidiosis and giardiasis, cost the US health care system as much as $539 million annually. Estimates suggest waterborne pathogens are the cause of between 12 million and 19.5 million cases of illness per year in the USA. In Dutch coastal bathing waters, halving the risk of infection would save around US$ 256 million per year. Human health-related costs can be highly significant – for example, economic losses as a result of the mortality and morbidity impacts due to the lack of water and sanitation in Africa are estimated at US$ 28.4 billion or about 5 percent of GDP (UNESCO, 2009).*

Agricultural land irrigated with polluted water can result in metal bioaccumulation in crops, with potential health hazards to humans including the possibility of chronic toxicity and ultimately organ failure from high doses and prolonged exposure. Livestock fed on crops containing heavy metals may accumulate these metals in their meat, with subsequent risks to humans from the consumption of this meat.

Emerging research indicates that pollutants have different impacts on women and men, and this is an area where significantly more research is needed to understand the gender disaggregated health impacts of water pollution.

2.4.4 Ecosystems

Aquatic ecosystems provide valuable goods and services to the country. Deteriorating water quality impacts negatively on these ecosystems, destroying this value. In 2010, the economic value of aquatic ecosystems in the then Inkomati, Olifants and Usuthu to Mhlatuze water management areas was calculated at close to R3 billion per annum for rivers, and a further R1,6 billion for wetland and estuarine ecosystems (DWA 2010).

Water pollution weakens or destroys natural ecosystems that support human health, food production, and biodiversity. Studies have estimated that the value of ecosystem services is double the gross national product of the global economy, and the role of freshwater ecosystems in purifying water and assimilating wastes was valued at US$ 400 billion (in 2008-dollar value) (Costanza *et al.* 1997). Freshwater ecosystems are among the most degraded on the planet, and have suffered proportionately greater species and habitat losses than terrestrial or marine ecosystems (Revenga et al. 2000) (UNEP, 2010). This degradation of freshwater ecosystems is evident in South Africa as well, with unrecognised long-term economic costs for the country.

Case Study 6: *Rehabilitation and clean-up of Hartbeespoort Dam, in the North West Budgeted government expenditure from 2004 to 2015 for the clean-up and rehabilitation of the dam and its catchment, and for related community projects, amounted over R500 million. In 2010, the economic value of aquatic ecosystems in the then Inkomati, Olifants and Usuthu to Mhlatuze water management areas was calculated at close to R3 billion per annum for rivers, and a further R1,6 billion for wetland and estuarine ecosystems.*

In 2009 leading researchers, scientists, conservationists and wildlife pathologists joined forces to respond to the death of hundreds of crocodiles in the Kruger National Park's Olifants Gorge. The programme was initiated after it became clear that the death of the crocodiles was symptomatic of a serious and growing environmental problem in the Olifants River system including pollution from industrial, mining and agricultural sources. According to officials of the Kruger National Park, at least 160 crocodile carcasses were found, although the actual number of deaths may have been higher due to carcasses being consumed or swept away by the river.

There are also negative feedback loops related to deteriorating water quality and aquatic ecosystems. Increased levels of nitrogen and phosphates lead to eutrophication and increased weed growth (particularly of invasive exotic species such as water hyacinth (*Eichhornia crassipes*), red water fern (*Azolla spp.),* water lettuce (*Pistia stratiotes*), Kariba weed (*Salvinia molesta),* Hydrilla (*Hydrilla verticillata*) and parrot's feather (*Myriophyllum aquaticum*). If left uncontrolled, water weeds can disrupt water abstraction facilities, destroy fishing grounds, disable water sports areas, block up irrigation channels and watercourses causing siltation and flooding, provide breeding grounds for mosquito larvae and habitat for bilharzia snails, and

devastate aquatic biodiversity. South Africa spends considerable sums of money annually on control of water weeds but their growth is fuelled by other water quality challenges.

2.4.5 Water Infrastructure

Poor water quality increases the costs to both the public and private sectors related to the corrosion of equipment and conveyance systems, clearing of waterways and drainage systems, and the decreasing storage capacity of impoundments due to sedimentation. The current water infrastructure in South Africa is valued at around R143 billion (DWS owned), R160 billion (Water Boards) and R370 billion (Municipalities). This excludes the value of any privately-owned infrastructure. Even a small percentage of this value being eroded as a result of water quality challenges results in a significant economic and public finance impact.

Surveys of accumulated sediment in South Africa's registered dams indicate that 34% of dams have lost more than 20% of their original capacity, while 16% have lost more than 50% of their original capacity (Gibson et al. 2010). Considering that the total investment in these dams amounts to tens of billions of rand in current-day terms, the economic cost of sedimentation is self-evident. Equally important is the loss of water storage in a water scarce country, and the significant cost of replacing such lost storage through the creation of new dams, particularly in a context of limited viable dam sites in the country.

Case Study 7: *Randburg, Tshwane and Sunderland Ridge, located in the Upper Crocodile Catchment are currently upgrading their WWTWs. The unit cost for these upgrades was used as estimates for upgrading Olifantsfontein WWTW to the 1mg/L discharge standard. The cost for the upgrade involves high capital costs estimated at R10million/ML/day. The overall cost for upgrading the Olifantsfontein is therefore estimated at about R1 050 million (DWA, 2014).*

2.4.6 Mining

The costs of rehabilitation of degraded water resources, or of emergency responses to pollution incidents can be extremely high. South Africa faces a particular challenge in relation to its mining legacy, and the costs to the private sector and the state of treating acid mine drainage from closed mines, including abandoned mines which are the sole responsibility of the state.

Case Study 8: *In 1998, a mining-related accident in Spain, in which a dam failure caused the release of approximately 5 million cubic meters of toxic sludge into the River Agrio, cost US$ 44 million in regional government clean-up costs, plus another US$ 53.3 million in government acquisition of land polluted by the spill (UNECE 2007).*

In 2003 the cost of cleaning up the mercury pollution from Thor Chemicals in Kwa-Zulu Natal was estimated by the Department of Environmental Affairs to be in the region of R60 million, in addition, locally, the cost of Brugspruit Treatment Works is in the magnitude of millions.

2.5 Shifting Gears

To move forward, South Africa needs the following:

- *A change in direction by benefiting from national and international experience and insights;*
- *An increase in speed by capitalising on the existing strengths in managing water quality; and*
- *An increase in momentum by seizing and employing new opportunities that present themselves.*

These are further elaborated below.

2.5.1 Learning from International and National Experience

This strategy builds on South African and international experience in managing water quality, drawing on good practice from both to develop an effective and implementable strategy. It also draws on the excellent work of South African researchers and innovators in the field of water quality and environmental management in how to address this complex, wicked problem.

Both in South Africa and globally it has been recognised that managing water quality requires a systems-based approach, coupled with adaptive management techniques, and supported by strong partnerships between government, civil society and the private sector.

This means seeing the catchment as an integrated social and ecological system, in which human and bio-physical elements interact. The challenge in managing a system like this is that a system is not the sum of its parts, but the product of a vast number of on-going interactions between different elements of the system. Complex systems do not respond in simple and linear ways. Predicting trends and responses accurately in complex systems of this nature is difficult, if not impossible.

Adaptive management allows one to work in a complex system like this, to put in place management responses to identified challenges, and then to see how the system responds. Conscious learning based on the feedback from monitoring and evaluation allows managers to adapt their actions to achieve better results. While adaptive management is receognised as the appropriate approach, implementation is much harder, and requires investment of time and commitment. Adaptive management requires a profound shift away from crisis management to a proactive and deliberate approach to solving problems.

The second part of the approach is the bringing together of relevant stakeholders from government, civil society and the private sector to develop a common vision for WQM, and to develop joint approaches to solving the complex problems facing the catchment.

This systems-based, adaptive management approach (SBAMA), as adopted in this strategy, is supported by a suite of tools ranging from conventional command and control tools, to innovative approaches such as citizen-based monitoring and science, the use of administrative penalties, and economic instruments such as the Waste Discharge Charge System (WDCS).

2.5.2 Water Quality Management: The Strengths to Build on

Government already has a number of initiatives to support good WQM and are strengths that can be built on. These already provide a strong foundation from which WQM can be improved. These are:

Legal, regulatory and policy frameworks:

- Sound statutes, policies, strategies and regulations: Constitution, NEMA, CARA, MPRDA, SPLUMA, NWA, WSA, NWRS, CMSs.
- "New" Water Act can strengthen the focus on WQM.

Considerable governance and institutional frameworks:

- CMA establishment process recently prioritised and delegation of roles finalised.
- Willingness by DWS officials to collaborate with other Government and private sector institutions in support of WQM.
- Strong water institutions – e.g. TCTA, Water Boards, Regional Water Utilities.

Robust regulatory instruments: - check this heading

- Incentive based regulation at municipal level, e.g. Blue-, Green- and No-Drop accreditation, is now well-established.
- Sound WQM instruments - guidelines, protocols, manuals, strong licensing process.
- Classification and RQOs development in progress and RQO implementation will be facilitated by the DWS project on improved operationalising of the RQO's
- New integrated NIWIS system being developed.

Established monitoring network and information systems:

- DWS and CMAs mostly have reasonable water quality data to support decision-making.
- Increased strategic spatial coverage of monitoring network (Project underway to identify localised monitoring gaps and to prioritise their resolution).
- Growing appreciation among water resource planners and managers that water quality and quantity should be managed as an integrated whole.
- Sound chemical analysis laboratory facilities, accredited by SANAS, at national & regional levels.

Increasing knowledge and information:

- IWRM is a central competency in DWS and CMAs.
- Pockets of scientific and management excellence in Government, CMAs and other local institutions.
- DWS and DEA have embarked on increasing capacity in CM&E at national level.
- Internal WQM training course has been partially re-instated and investment in relevant graduate training programmes.

- Alignment of DWS bursaries with scientific implementation needs of the Department, i.e. Learning Academy for graduate trainees.
- Continuity of research funding by WRC relevant to WQM.
- Ability of Government to mobilise in times of water crisis.

Finance and pricing Instruments

- Waste Discharge Charge System
- pricing instruments (penalties, fines, amongst others)

2.5.3 Water Quality Management: The Opportunities to Seize

There are number of opportunities that if seized correctly, will allow for a significant improvement in the way water quality is being managed and can act as game-changers:

Opportunities to elevate water quality and WQM in Policy Review Process:

- DWS is currently in a process of *reviewing its current policies, and amalgamating the NWA and WSA.* The NWRS2 will evolve to include water service functions. There are also a number of new policies being developed that will support WQM around mine-water management, wetlands, energy, unconventional gas exploration, partnerships, etc., that provide an opportunity to strengthen WQM.
- DAFF, DMR, DEA are also in the process of developing policies to improve water quality and its management (Mine-water management Policy, etc.)

Opportunities from renewed focus on Cooperative Governance/Partnerships:

- Water stewardships/CEO Water Mandate – Alliance for water stewardship has developed standards and protocols.
- Integration of monitoring and sharing of resources relevant to WQM through collaboration among government institutions.
- Involvement of private sector and civil society to support WQM through a dynamic sector-based programme.
- Incentivising of water users, industries and businesses to reduce water pollution.
- *On-going DWS/CMA engagement of sectoral and social stakeholders and partners* and promoting the concept of joint custodianship of WQM (e.g. implementation of the NWRS2)

Opportunities to have a more integrated planning processes:

- Recognised need for not only water quality, but quality of water required to support the National Development Plan (NDP).
- WSDPs and IDPs should give WQM priorities prominent consideration.
- Sustainable Development Goal (SDGs) actions given RSA's signed commitment; e.g. use of SDGs to influence IDPs.
- Climate Change – raises the profile of WRM, including WQM.

- Establishment of CMAs, and development of CMSs provide opportunity for integrated, sectoral approach to catchment management.

Opportunities for Innovative Funding:

- Green Fund/Climate Funds - DBSA initiative to investigate issuing of water bonds.
- National Biodiversity and Business Network and other investments in ecological infrastructure;
- Financial incentives for water re-use.
- Financial incentives (including donor funds) for municipalities to maintain declared targets for WQM.
- Economic down-turn - WQM institutions to be more effective with spending, finding innovative ways of treating water and seek alternative sources of funding. This also provides an opportunity to ensure water quality is taken into account in grant processes.
- Implementation of the Waste Discharge Charge System.

Opportunities to strengthen and support WQM capacity:

- Organised civil society involvement - engaged public can contribute to monitoring and management of WQM.
- Improved and integrated multi-institutional WQM awareness campaigns - lead by DWS.
- Improved and supported Civilian Science, e.g. Adopt-a-River – typically used to spot major problems that need urgent attention, e.g. spills, illegal activities.
- Drought and other water-related crises, such as pollution events – mobilise political attention, raise profile of water management and engender innovative approaches to support WQM.
- Use of social media by DWS and CMAs to mobilise public knowledge banks and public sense of custodianship.
- DWS to take the lead to develop and support a compendium of external WQM-related training courses conducted by various universities, Council for Scientific and Industrial Research,, WISA, Agricultural Research Council, SAICE, etc.
- Opportunities for further research on water quality and WQM issues through WRC and other academic and research institutions, as well as look to opportunities to influence school curriculums.

2.6 Development Scenarios

This strategy is aimed at short term responses that build towards a longer-term objective. This means strategizing into an uncertain future. Scenario planning has become a useful tool for considering response to uncertainty and can outline key focal areas for attention. In considering these scenarios it is clear that two core themes act as drivers, namely, our ability to regulate and manage the resource in a sustainable manner and the degree to which participation is enabled (**Figure 8**). These scenarios are as follows.

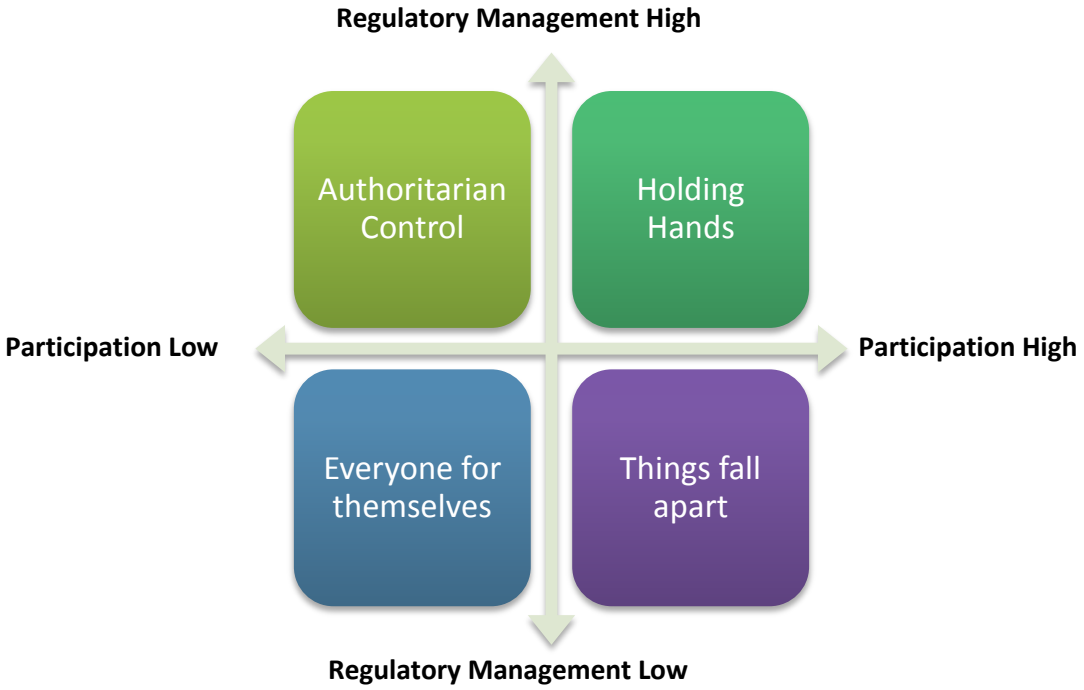


Figure 8: Four future scenarios for the management of water quality

SCENARIO 1: Everyone for themselves

There is continued growth, albeit slowly. Continued inequality and limited cooperation maintains the current status quo in the broader social economy fuelling discord. This is not helped by the inadequacy of institutional capacity, which also plays out into the regulatory arena where there is insufficient regulation of water use or waste discharge, causing a steady degradation of water resource quality. Strong individual interests are dominant with limited to little consideration of common interests or the needs of marginalised communities. Under this scenario water is considered as an input to economic development with limited understanding of environmental and social requirements. Economic growth is therefore a primary objective and the requirements for commercial and municipal use of water increases with production and population growth. As a result, the degradation of environmental resources is on-going.

SCENARIO 2: Things fall apart

This scenario is characterised by increased participation and engagement noting the importance of this in steering away from a scenario where everyone selfishly overexploits the

country's natural resources. However, with limited institutional capacity and ineffective policy there is poor oversight and regulation. There are sound instruments for the management of water resources, but capacity constraints hamper the ability to apply these effectively. As a result, whilst there is some social cohesiveness and participation there are explosive reactions to inequalities and failure to redress societal challenges. There are still on-going debates and discussions, but the sense is the country lurches from one crisis to the next. This impacts upon economic growth, which implies little significant increases in water requirements from agricultural or urban users, although the existing use is become less efficient with a failure to implement water conservation measures. Environmental quality and role of ecological infrastructure is understood, but not prioritised and regulatory control cannot be maintained, Hence, there is continued degradation albeit at a lower level than what may otherwise be expected.

SCENARIO 3: Authoritarian control

The recognition of the need to support social and economic growth drives the government to take strict action against unlawful water use. This has required a rapid upscaling of capacity within DWS and the CMAs as well as significant shifts in systems capabilities to underpin this regulatory approach. This tight control is aimed at providing the resource capacity to redistribute water and address inequalities in water use across the country. However, the lack of participation in the face of a firm command and control approach has caused significant rifts in the water sector, so that despite the approach, unlawful water use continues to place the resource under increasing pressure. The lack of discourse over the needs of the economy results in slower growth than could be expected. Water resource quality continues to degrade despite the firmer regulation.

SCENARIO 4: Holding hands

With the water sector working more cooperatively there is sustained development, growth and institutional strengthening. The development of functional partnerships with the private sector and civil society has created a better understanding of social, economic and environmental needs. Inter departmental cooperation underpins these partnerships. This provides a favourable environment for balanced and effective water resources protection, development, sharing and efficient use. This fuels strong economic growth and hence increased demands for water associated with economic development and urban population growth. Understanding of the needs of rural communities' results in the establishment of viable commercial farms by emerging farmers supported by organised agriculture and large corporate business. The discourse with civil society helps to shape an understanding of the importance of environmental functioning to support ecosystems, local tourism and greener residential areas. This underpins a drive for improved efficiencies in water use. To this end regulatory initiatives are strengthened, but the support of this by the private sector and civil society provides the basis for a more cooperative approach that is typified by self/peer regulation as well as support from local institutions.

Whilst it is clear that Scenario 4 presents a desired outcome, it is of importance to understand what these scenarios imply in terms of attaining this desired state. The first scenario is in effect the counterfactual in that we realise this would not be a sustainable future. Scenario two does require a stronger regulatory response as well the strengthening of the instruments and systems that would be required to support sustainable resource development. Success in strengthening regulation as well as success in addressing key WQM issues would bring societal groups together to further strengthen partnerships. This clearly requires an upscaling of capacity. Scenario three requires a rapid upscaling of institutional capacity due to the failure to effectively court partnerships. The failure to establish partnerships isolates water use groups and so the need to shift the capacity away from firm regulation towards cooperative partnerships would be more effective in creating the discourse needed.

These scenarios then reflect core strategy elements as being the development of partnerships (government-private sector-civil society); improvement/ strengthening of existing instruments and systems; and the development of strengthened capacity within DWS and the CMAs in order to provide the drive and support required.

2.7 Time to Act

South Africa is feeling the negative impacts of poor water quality, and without swift and concerted action, the impacts will worsen over time. The necessary tools and knowledge to affect significant change exists and is sufficient to turn the situation around, however, the challenge lies in integrated, co-ordinated, adaptive and effective action from government, civil society and the private sector working in collaboration.

This strategy, therefore, forms a call to action for government, civil society and the private sector, to change the management of water quality and to bring about a measurable improvement in the quality of raw water across the country

3 ALIGNING WITH THE SUSTAINABLE DEVELOPMENT AGENDA

Previous strategies have been designed to provide more effective governance towards resource protection, however, the IWQM Strategy must move beyond this towards providing a pragmatic roadmap to support sustainable development. As such this strategy is aligned with the objectives of the WQM Policy, but is also consistent with the broader water and development policies, and strategies.

This strategy unlocks key actions and aligns with the Constitution, the National Development Plan, the NWRS, the strategic objectives of the IWQM Policy, international obligations and the global sustainable agenda. Presented below are brief descriptions of the key national and international imperatives.

3.1 The Constitutional Imperative

The Constitution places a duty on the national Government, in co-operation with the other spheres of government, to make sure that our limited water resources are used to improve the quality of life of all South Africans. The legal and policy framework for water resources protection begins with relevant provisions in the Constitution of South Africa, 1996 (Act No. 108 of 1996), and cascades down through national policy to legislation supported by secondary legislation or regulations. Furthermore, "by elevating the environment to a fundamental justiciable human right, South Africa has irreversibly embarked on a road which will lead to the goal of attaining a protected environment by an integrated approach, which takes into consideration, *inter alia*, socio-economic concerns and principles."[1]

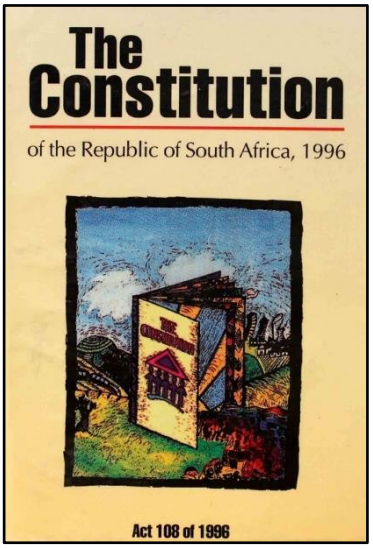


Figure 9: The Constitution

The Constitution creates concurrent national and provincial competence in the realm of pollution control, allocates storm-water management, water supply and sanitation to municipalities, and allocates water resources management (which includes management of water quality) to national government. However, the legislative and administrative competence has consequences for integrated pollution control. For example, raw and drinking water quality standards are imposed at the national level, and local government must put in place practices to meet these requirements, including through treatment of potable water, treatment and management of sewage and waste water, management of storm water, and management of solid waste. Provincial departments of environment have a concurrent competence of pollution control, which includes water pollution. There is the potential for legislative conflict or overlap between the various players, as well as the possibility of gaps that are not being addressed.

[1] BP Southern Africa (Pty) Ltd v MEC for Agriculture, Conservation and Land Affairs 2004 (5) SA 124 (W) at 144D

While co-operative governance is thus a critical element of WQM, current practice suggests that water pollution control has not been dealt with in a sufficiently inclusive and integrated manner, and that improvements in this regard are required to obtain improved impacts with limited state resources. To this end, the WQM Policy calls for an inclusive and integrated approach to managing the country's water quality.

3.2 The Sustainable Development Agenda

The Sustainable Development Goals (SDGs) (**Figure 10**), adopted in December 2015, are aimed at ending poverty, protecting the planet, and ensuring prosperity for all as part of a new sustainable development agenda. South Africa, as a signatory to the SDGs, must strive to meet the targets under each of the SDGs. Water quality has a direct bearing on our ability to meet the goals of ending poverty, ending hunger and achieving food security, ensuring healthy lives and promoting sustainable economic growth. In relation to Goal 6: Ensure availability and sustainable management of water and sanitation for all, water quality is particularly relevant.

Figure 10: The Sustainable Development Goals

Under Goal 6, there are three targets that are particularly relevant to water quality:

- By 2030, **improve water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;
- By 2030, **implement integrated water resources management** at all levels, including through trans-boundary cooperation as appropriate; and
- By 2020, **protect and restore water-related ecosystems**, including mountains, forests, wetlands, rivers, aquifers and lakes.

These SDGs mirror the sustainable socio-economic development path of South Africa as outlined in the National Framework for Sustainable Development (2008): *"South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration".*

The ***SDG's further illuminate the link that a healthy water resource is required from both a security and development point of view****. It is precisely for this reason, that the IWQM Policy, and subsequent* ***IWQM Strategy, seeks to redress and elevate WQM to not only a water quality issue, but a development and socio-economic issue as well.***

3.3 The National Development Plan

The National Development Plan (NDP), supported by the NWRS will be the key drivers for the IWQM Strategy over the next 5 to 10 years at least. The primary aim of the NDP – 2030 is to eliminate poverty and reduce inequality by "*growing an inclusive economy, building capabilities, enhancing the capacity of the state and promoting partnerships throughout society*" (NPC, 2012). This will be undertaken within the international context of the sustainable development agenda as well as Agenda 2063, which are both aimed at ensuring inclusive growth and sustainable development.

Nine primary challenges were identified in the Commissioner's Diagnostic Report in 2011, and four of these have direct relation to the quality of the country's resources, either impacting on the resource, or being impacting by the resource (NPC, 2011):

- The public health system cannot meet demand or sustain quality - illuminates the additional burden that poor water quality puts on the human health.
- The economy is unsustainably resource intensive - links to the competing demands of the economic sectors (mining, agriculture, industries, amongst others and the water resource)
- Infrastructure is poorly located, inadequate and under maintained - supports the challenges experiences by municipalities and WWTWs.
- Public services are uneven and often of poor quality – links to the capacity to manage water quality in Government.

The NDP recognises of the importance of shifts in the global economy, rural-to-urban economic migration; increased urbanisation, gender equality, climate change and the continent's economic growth, in order to try and understand the resources and capabilities required to address these shifts.

The key departure point being that **all sectors need to jointly contribute to the vision and objectives of the plan**. This is an important centrality that takes South Africa away from a more programmatic approach towards one of recognising that integrated action is essential.

The NDP is looking to prioritise and address the challenges in rural agricultural development, the requirements for economic infrastructure build, the need for increasing partnerships with the private sector, obligation to address the crisis in healthcare management, commitment to increasing vigilance in the protection of the environment, the duty to professionalise the public sector, and the responsibility to strengthen accountability and improve coordination.

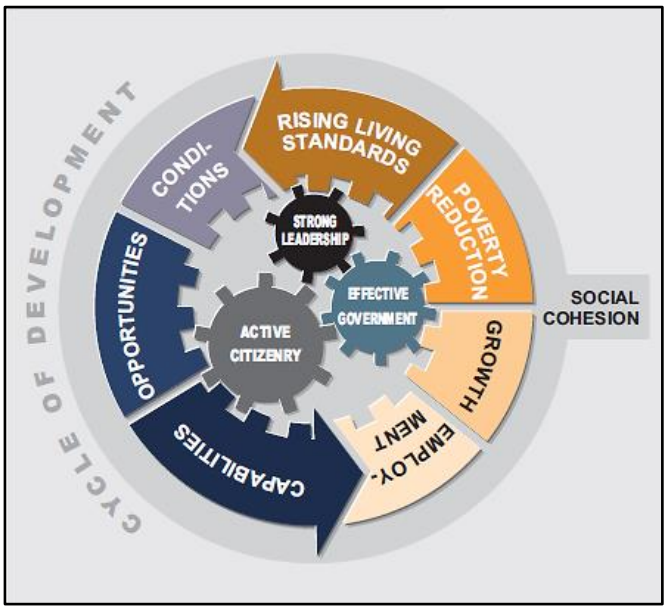


Figure 11: The NDP's approach to change

In order to manage these challenges, the NDP's approach to change (**Figure 11**) **identifies active citizenry, together with effective government and strong leadership as key drivers** of the country's development and support towards social cohesion. Concerns around the state's capacity and capability to implement identified actions are also concerns experience in managing the country's water quality.

The one critique of the NDP, is that even though it addresses water as an economic infrastructure, it mainly alludes to ensuring that the country's water supply issues are a top priority, while making little to no reference to the debilitating effect of poor water quality on the country's resources**.** The alignment of the NDP to the SDGs is also important in taking the country forward.

The shorter-term vision for the country is generally set by the President. An **outcomes approach** is adopted, which sets the goalposts for the residing ministers for the period 2014 to 2019. The way in which water quality is managed in the country will affect five of those proposed outcomes:

Outcome 2: A long and healthy life for all South Africans.

Outcome 6: An efficient, competitive and responsive economic infrastructure network.

Outcome 7: Vibrant, equitable and sustainable rural communities with food security for all.

Outcome 8: Sustainable human settlements and improved quality of household life.

Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced.

The NDP has a number of strategic objectives and enabling factors that serve to shape the priorities of government. Of these, several have direct relevance for this strategy.

Table 2: IWQM Strategy in support of the National Development Plan

NDP Strategic Targets	IWQMS Alignment and Support
By 2030 Eliminate income poverty	Improved raw water quality will contribute to a reduction in the cost of doing business, a reduction in the cost of treating water, and a reduction in the illness burden on poor households. All of these will contribute to economic growth and the potential to eliminate poverty.
Increase employment from 13 million in 2010 to 24 million in 2030	Increased employment opportunities arise from the need to improve the management of water quality. This includes infrastructure development and maintenance through to those jobs related to managing and monitoring the water resource. These would range from more artisanal work through to more highly skilled jobs, both directly in the water sector and indirectly in the private sector.
Establish a competitive base of infrastructure, human resources and regulatory frameworks	Investments in infrastructure development and maintenance is a key element of the IWQMS and is a fundamental part of the country's continued growth. Regulatory frameworks become critical when managing scarce natural resources. The development of human capacity is equally critical to support the development and maintenance of infrastructure and to give effect to regulatory systems.
Ensure that all South Africans have access to clean running water in their homes	Improvements in raw water quality will reduce the costs and challenges of providing potable water to all residents of South Africa.
Realise a food trade surplus, with one-third produced by small-scale farmers or households	Increasingly poor water quality will impact upon the ability of agriculture to maintain crop yields and in some instances, may render agriculture non-viable. Current requirements for dilution of salts uses water that could be used for social and economic purposes.
Ensure household food and nutrition security	Improved water quality, particularly in relation to microbial pollution, will contribute to improving the nutritional status of poor households in South Africa, especially in more rural settings where communities are dependent upon raw water resources.
Realise a developmental, capable and ethical state that treats citizens with dignity	Effective management of water quality is a critical part of recognising and protecting the rights of all people living in South Africa to an environment that is not harmful to their health or well-being.

3.4 The National Water Resource Strategy

The NWA required the establishment of a NWRS by the Minister of Water. At the same time, a decentralized approach to water resources management was introduced, with the Act requiring the establishment of CMAs that have the responsibility to develop and implement a CMS that is consistent with the framework provided by the NWRS. The South African water resources planning framework is based on the international principles of IWRM. However, the complexity of integrated planning and the capacity needed to implement the results have outstripped the ability of the country to deliver.

Whilst the first NWRS (DWAF, 2004) set out the policies, strategies, guidelines and procedures for the management of water in the country, as required by the National Water Act, 1998 (No. 36 of 1998), the second strategy, NWRS2, aims to "*ensure that national water resources are managed towards achieving South Africa's growth, development and socio-economic priorities in an equitable and sustainable manner over the next five to 10 years*."

The strategy also responds to the priorities set by government in the NDP and NWA imperatives that support sustainable development. Under the NWRS2 are a number of national thematic plans, including the National Climate Change Strategy for Water Resources. The NWRS2 has been described by the National Climate Change Response White Paper as setting out the short-term response to climate change, with the Water for Growth and Development Framework (WfGD) 2030 seen as the medium to long-term responses. It recognises that climate change will increase the pressure on already stressed water resources, further impacting on water quality, and there is thus a crucial requirement for the effective management, use, allocation and re-allocation of available water resources. The **revised NWRS2** has incorporated aspects of the WfGD that pertain to water resource management as key core strategies and further **looks to adopt a sectoral approach in its implementation.** Whilst the water quality issues are illuminated in the NWRS2, it lacks the appropriate strategy to deals with both the water quality issues, as well as issues around WQM. It is this very lack of approach to WQM, that initiated the development of this current project to support the future revisions of the NWRS.

The IWQMS is an integral part of the NWRS2 and as such underpins the intent of that strategy to support the National Development Goals as laid out in Vision 2030 of the NDP. The NWRS2 provides an overarching framework and vision for the water sector to support these national development objectives noting the centrality of water in our country's development. This is laid out in the vision, goal, objectives and strategic themes of the NWRS2 (**Figure 12**). Water quality is a critical element across all objectives and strategic themes.

Equally, the five foundational elements that are important to ensure execution are critical to ensuring effective WQM. As such, the objectives and actions outlined in this strategy support these objectives of the NDP and the NWRS2, through a practical and achievable approach.

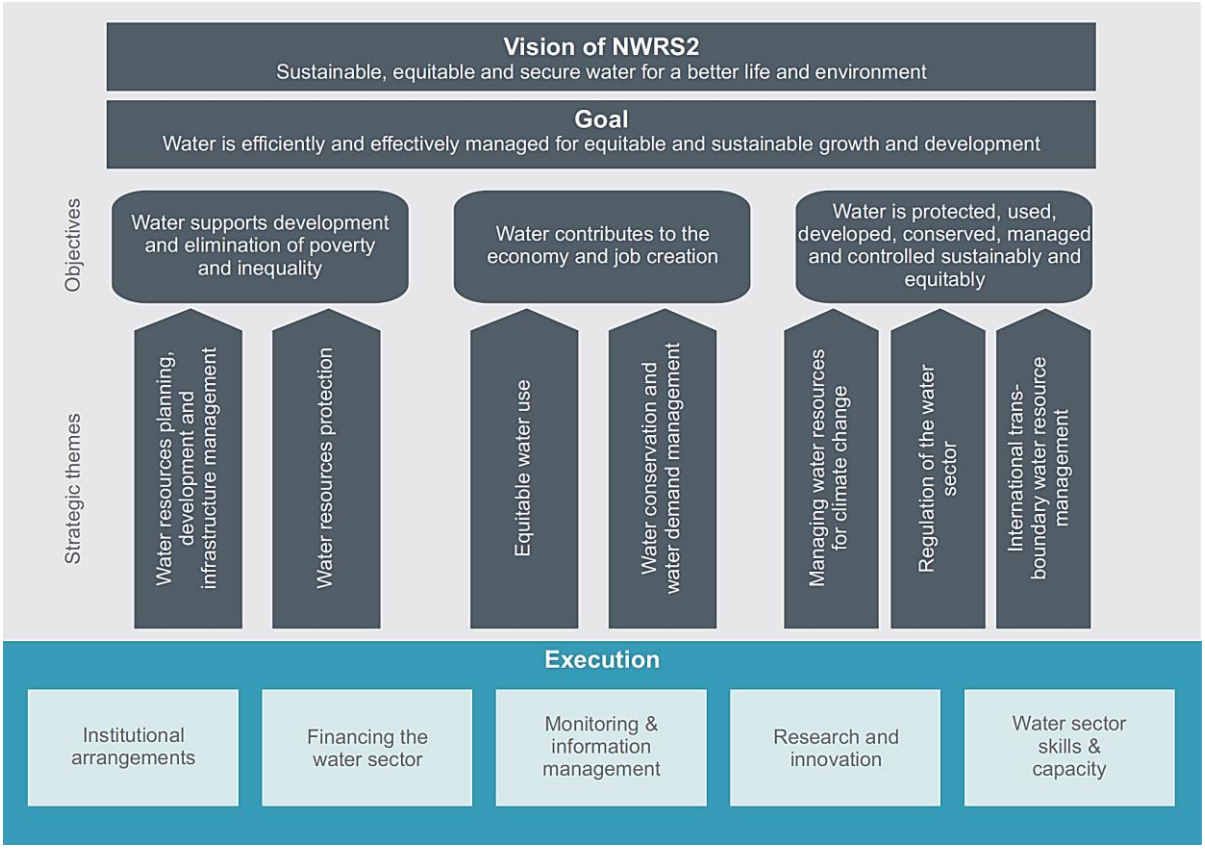


Figure 12: Overview of the NWRS2 (DWS, 2013)

3.5 Placing the IWQM Strategy in Context

The IWQM Strategy does not sit in isolation, instead it both informs and is informed by various other international, regional, national, sectoral and local frameworks.

These are outlined below:

- **National Legislation:** The Constitution, The Bill of Rights, The Public Access to Information Act (PAIA), National Environmental Management Act,1998 (Act No. 107 of 1998) (NEMA), Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA); National Water Act, 1998 (Act no. 36 of 1998), Water Services Act, 1997 (Act No. 107 of 1997), Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA), Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA), amongst others.
- **National Frameworks:** National Development Plan, National Water Resource Strategy 2 (NWRS2), Strategic Framework for Water Services, National Non-point Source Strategy (NNPS)
- **International Obligations:** The Sustainable Development Goals (SDGs), Agenda 21, Agenda 2063, Africa Water Vision, UN-Convention on the Law of the Non-Navigational Uses of International Watercourses, Hyogo Framework for Action, amongst others.

- **Regional Protocols:** SADC Protocol for Shared Watercourses, Regional Strategic Actin Plan (RSAP), amongst others.
- **Bilateral/Multilateral and Basin Wide Agreements:** Limpopo Watercourse Commission (LIMCOM), Orange-Senqu River Commission (ORASECOM), Rivers of mutual interest, amongst others.
- **National Policy Development:** Sanitation Policy, WQM Policy, Mine-water Management Policy, Irrigation Policy, Wetlands Policy, amongst others.
- **Other Strategies:** National Groundwater Strategy, Catchment Management Strategy, Waste Discharge Charge System (WDCS), amongst others.
- **Implementation plans and guidelines:** IWQMP, Agriculture Policy Action Plan, Water Services Development Plan (WSDP), Integrated Development Plan (IDP), Norms and Standards, amongst others. NWRS sector plans.

Cognisance must be given to the above when looking to implement any strategy or operational guideline that informs or is informed by this IWQM Strategy.

4 FROM POLICY FRAMEWORK TO STRATEGIC RESPONSE

4.1 The Policy Framework

Water is a key part of the development of all sectors and as such water quality is an important dimension of ensuring that water resources do not constrain the developmental agenda.

If not addressed effectively, the current and future water quality challenges have the potential to significantly limit the economic growth of the country and may severely impact human and the healthy functioning of aquatic ecosystems. Deteriorated water quality reduces the amount of water available for use as more water must be retained in our river systems to dilute polluted steams to acceptable standards. It increases the costs of doing business as many enterprises are forced to treat water before using it in their industrial processes. Municipalities also incur additional costs as the cost of municipal water treatment increases. The deterioration in water quality also impacts on human well-being with productivity falling as more work days are lost due to water-related illnesses and finally, it threatens several economic sectors by impacting on crop yields, making crops vulnerable to import restrictions in key trading partner countries. Some of the impacts of water quality deterioration are immediately visible, such as in the case of major fish kills, while others are more insidious and long term. Combined, however, they have the potential to have a significantly negative impact on socio-economic development in South Africa.

The management of water quality is complex and has a number of unique challenges. Contrary to historical views that relatively simple command and control approaches could be used to manage water quality, it is now recognised that a far more comprehensive suite of approaches is required. At the catchment scale, both human and bio-physical systems interact to create significant degrees of complexity. Whilst any suite of interventions can result in different outcomes, there is an increasing requirement to ensure that we strengthen our coordination and adapt as conditions change (**Figure 13**). There will always be the need for rapid response to issues, and we will always have to plan for the future, however, our system of governance must embrace the requirement that we will need to become more adaptive.

This will require more flexibility in response, enable structured learning throughout the process in order to inform and amend policy and practice over time, and also understand that there are many different sets of knowledge that must be brought together to address the problem.

Managing water quality requires integrating a wide range of knowledge in a structured process that allows co-learning, co-creation, and co-adaptation as our society and economy develops.

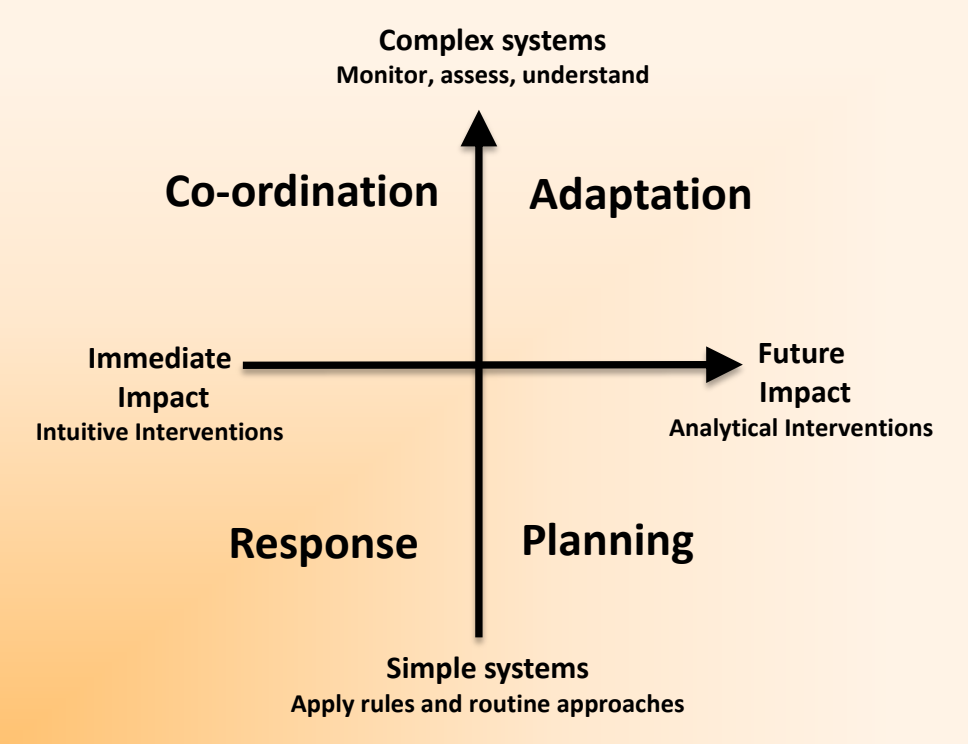


Figure 13: Managing simple and complex systems

With this in mind, the responsibility for managing water quality cannot be that of the Department of Water and Sanitation alone. In effect, there is a significant array of Government Departments that oversee sectors that impact upon land and water use. Whilst the Department of Water and Sanitation will importantly continue to lead the water sector, the challenge of ensuring sustainable water use will require a more holistic response from broader Government, the private sector and civil society.

IWQM is a government-wide task, under the leadership of the Department of Water and Sanitation, with the private sector and civil society playing a key role

The IWQM policy brings together the best elements of existing WQM policy. These operational policies have been developed over time and include the 1991 Water Quality Management Polices and Strategies (DWAF, 1991), the 2006 Resource Directed Management of Water Quality (DWAF, 2006), the draft policy on Mine-Water Management Policy (DWS, 2016f, in progress), and the principles of the NWRS2. These instruments remain to provide insightful guidance on day-to-day operational approaches.

4.2 The IWQM Values

The successful implementation of WQM Policy and Strategy is premised on a suite of core values. These values support the vision for WQM, guide the principles that are used to shape Policy responses, and reflect the ethos for managing water quality in South Africa (**Figure 14**).

Figure 14: Values underpinning IWQM

4.3 Vision and Mission

The IWQMS is an integral part of the NWRS which notes that a paradigm shift in sustainable resource development is needed in order to support inclusive growth. Water quality, is articulated throughout the NWRS as a core element of the strategy, but the role of water quality is not fully distilled and, therefore, this IWQMS provides the strategic intent required to ensure that WQM supports the implementation of the NWRS.

Aligned to the vision of the NWRS, the vision for WQM in South Africa is:

"Government, in partnership with private sector and civil society, secures water that is fit for use, for all, forever!"

This vision is brought to life through 5 core mission statements of intent:

i. To support a consistent inter-departmental approach to how water quality is managed in our country.

ii. To foster and support cooperative and integrated approaches to WQM across sectors, including the private sector and civil society.

iii. To adopt an adaptive management approach in which co-creation and co-learning by key players is entrenched and supported by the exchange of data and information.

iv. To drive programmes to build capacity for longer-term improvement in water quality.

v. To undertake initiatives to progressively realise improvements in water quality in key systems with the intention of redressing priority water quality issues and show that, as a country, we can halt the deterioration of our water resources.

In order to achieve the above vision and mission, 17 policy principles for the management of resource water quality have been defined (**Table 3**) and collectively provide a new framework for WQM in South Africa. Importantly, these principles have drawn upon international experience, to add new positions to the foundation provided by the previous WQM policies that were developed by the Department.

Table 3: IWQM Principles

IWQM PRINCIPLES
• **Principle 1:** Government-wide integrated water quality management
• **Principle 2:** People-centric
• **Principle 3:** Subsidiarity and accountability
• **Principle 4:** Transboundary water quality management
• **Principle 5:** Partnerships
• **Principle 6:** Administrative fairness and implementability
• **Principle 7:** Adopt administrative penalties
• **Principle 8:** An integrated and adaptive approach
• **Principle 9:** Hierarchies for pollution management
• **Principle 10:** Promotion of Green/ecological Infrastructure restoration and rehabilitation
• **Principle 11:** Risk-based approach
• **Principle 12:** Water quality is a developmental issue
• **Principle 13:** Broadened funding mechanisms
• **Principle 14:** Polluter pays
• **Principle 15:** Informed public
• **Principle 16:** Data is a strategic asset
• **Principle 17:** Publicly available information

Principles 1, 5, 7, 10, 11, 13 and 16 are those principles that are "new" principles, referring to the way in which they are applied to WQM. A detailed description of the WQM principles are presented in **Appendix C**.

The principles listed in table 3 form the foundation for four, integrated policy pillars *(***Figure** 15):

- **Taking an inclusive approach to IWQM:** This response deals with the need for an inter-departmental strategic, adaptive and systems-based response to the WQM challenges facing the country, some of the key policy aspects that must be addressed in achieving such an approach, as well as the need to build partnerships between government, civil society and the private sector in order to be able to successfully address the challenges.
- **Applying integrated, adaptive water quality regulation and management:** This response spells out the integrated, adaptive and systems-based approach to WQM, including the adoption of a risk-based approach and the application of a hierarchy of decision-making.
- **Financing IWQM:** This response examines the financial underpinnings of IWQM, looking at tools for financing the required actions. This looks to a broader basket of funding options that go beyond just the national fiscus.
- **Knowledge and information management:** This describes the policy with regard to the knowledge, human resource capacity and information base requirements that are essential to effectively and efficiently implement the policy approaches.

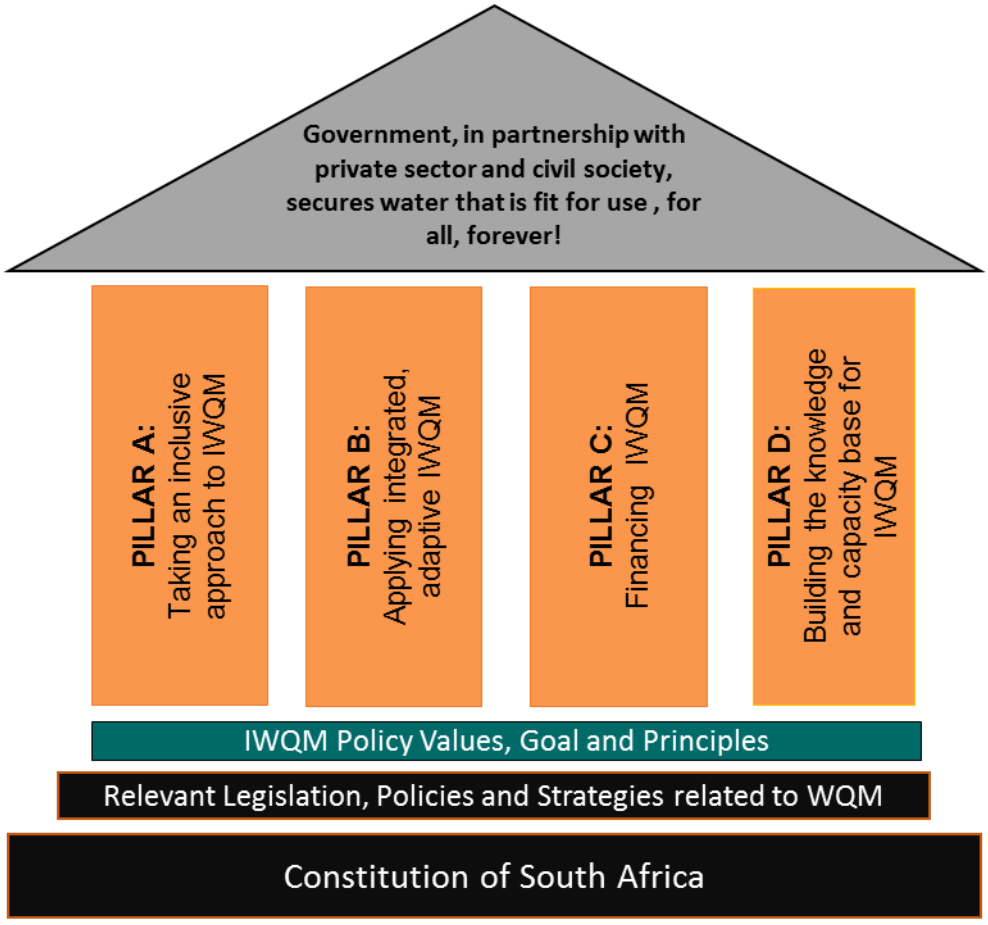


Figure 15: The WQM policy pantheon. The 4 policy pillars are based on a foundation laid by the constitution, relevant legislation and policies and a set of core values and principles. Together they support the vision for WQM in South Africa.

4.4 Strategic Goals

In responding to the Vision and Mission for WQM, the IWQM strategy is based upon five goals, which derive from the four IWQM Policy Pillars (**Figure 16**).

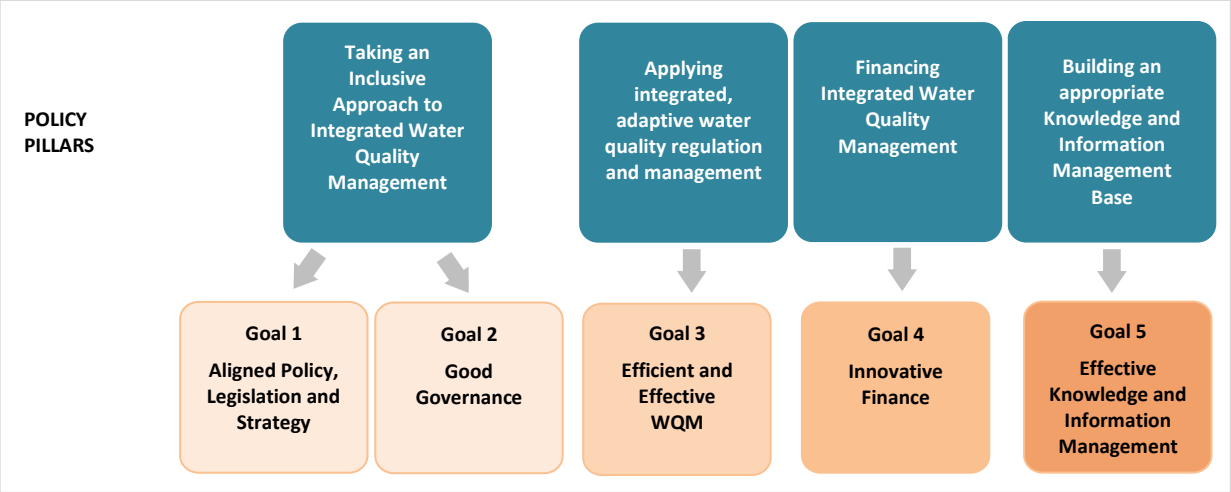


Figure 16: Policy Pillars and Strategic Goals

The five goals are:

- ***Goal 1:*** *Aligned Policy, Legislation and Strategy:* In order to support our drive to be more inclusive in our approach there will be a need to find ways to improve the alignment between policy and legislative instruments, as well as in our strategic approaches. This will take time and considerable effort, but will prove critical.
- ***Goal 2:*** *Good Governance:* An inclusive approach will require that we find ways to improve functional roles and responsibilities. This will require innovative approaches to the way we structure our approaches both within Government and externally with non-Governmental actors.
- ***Goal 3:*** *Efficient and Effective WQM Practice:* The need to be more adaptive in our responses to WQM will require increasingly efficient and effective practices within catchments. This will mean critical review of these processes and practices at various levels within the WQM system.
- ***Goal 4:*** *Innovative Finance:* To date there has been too much dependence upon funds from the national fiscus to support WQM. Noting that financial resources are limited, there will be a need to be more innovative in generating the funds required to support more effective IWQM.
- ***Goal 5:*** *Effective Knowledge and Information Management:* The old adage that you cannot manage what you do not measure holds true. This requires a renewed and strengthened drive to improve than monitoring networks and to strengthen and consolidate information management systems. Our adaptive management approach is based upon the support of these networks and systems.

5 IWQM STRATEGIC ISSUES, OBJECTIVES AND ACTIONS

Once the Vision, Mission and Strategic Goals were developed, consideration was given to identifying the priority WQM issues and how to best address them.

During the Assessment and Policy development phases, a large number of issues were identified (See **Appendix A & B**). These were collated into clusters, taking into consideration the policy responses, resulting in eleven Strategic Issue (SI) areas. These align with the IWQM Strategic Goals as in **Figure 17**.

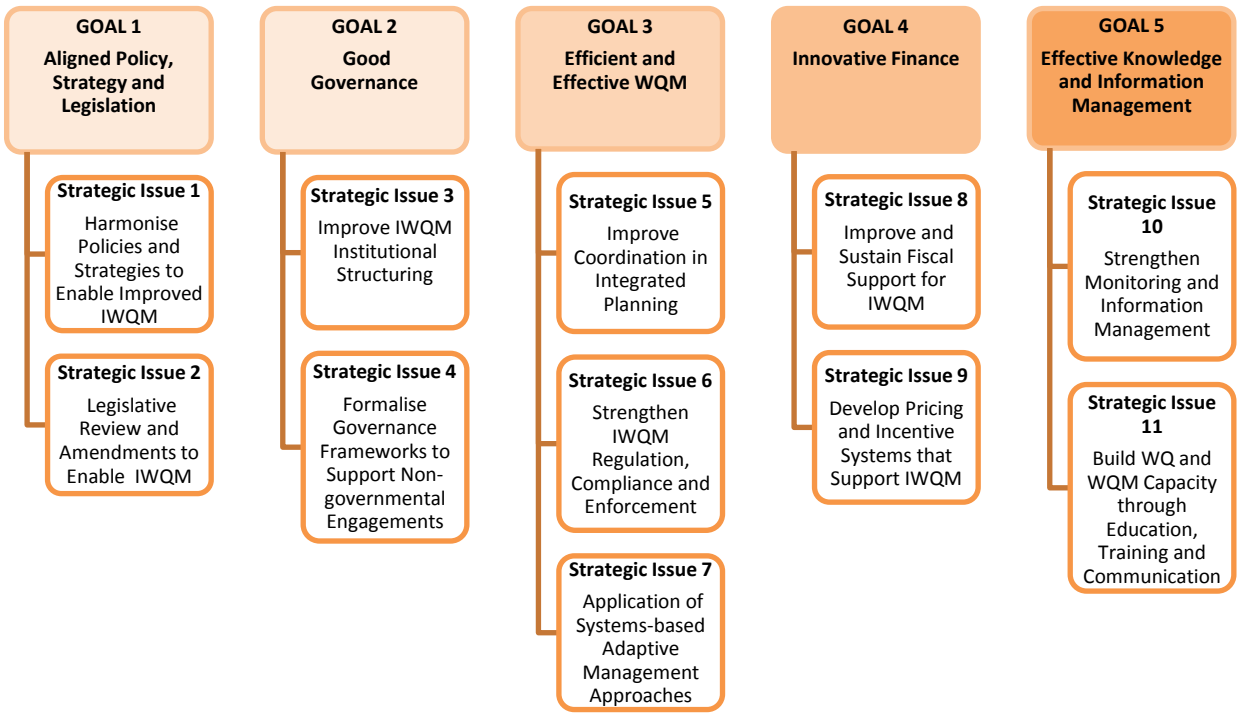


Figure 17: The Eleven Strategic Issues

The following section unpacks each of the strategic issues by:

- Outlining why it is a Strategic Issue;
- Discussing the associated Strategic Objectives (SO) and Strategic Actions (SA); and
- Presenting a summary table of Strategic Objectives and Strategic Actions that address the Strategic Issue.

A consolidated summary of all the Strategic Issues, Objectives and Actions are presented in **Appendix E.**

STRATEGIC ISSUE 1: HARMONISE POLICIES AND STRATEGIES TO ENABLE IMPROVED IWQM

WHY IS IT A KEY STRATEGIC ISSUE?

Implementing effective IWQM requires a coherent approach across sectors, government departments and spheres of government. This coherent approach will also **increase the efficient use of limited resources**. Furthermore, ensuring that future sectoral policies and strategies address both water quality and water quantity is crucial to **entrench IWQM as a government-wide challenge and to secure its sustainability** going forward.

Aligned and harmonised policy and strategy (SO1a) will also **enable improved cooperative governance** in relation to the authorisation of activities that impact on water quality and in terms of compliance monitoring and enforcement.

STRATEGIC OBJECTIVES AND ACTIONS

The IWQM Policy outlines the vision for WQM in South Africa and calls for an inclusive and integrated approach to managing water quality. While the Constitution, through Chapter 2 (the Bill of Rights) provides the imperative for protecting water quality, the regulatory responsibility needs to be spread between the DWS, and the Departments of Environmental Affairs, Mineral Resources, Cooperative Government and Traditional Affairs, Rural Development and Land Reform, Agriculture, Forestry and Fisheries, as well as their provincial counterparts.

Historically, DWS has acted almost singularly (DEA has played a key role in terms of the Environmental Impact Assessment regulations) in terms of the management of water quality by setting policy, implementing the National Water Act, 1998 (Act No. 36 of 1998), developing strategic plans, instruments, tools and guidelines, and by regulating water use. However, it is clear that our resources are under increasing pressure and that water quality is in decline in many catchments. This reflects the 'tragedy of the commons' scenario and without a fundamental shift in responsibility for this common-pool resource we are likely to see resource crashes in some of our key catchments. The impact upon society and economy would be significant.

With this in mind, there is a need for a more comprehensive governmental response to this growing threat, noting that the decline in resource quality requires the fuller responsibility of different sector departments and different spheres of government. This needs to be supported by a harmonised suite of policy and strategy instruments.

In order to give effect to this, Catchment Management Strategies, and internal DWS operational policies and strategies, as developed or amended over time will also need to be aligned both to the IWQM Policy and this Strategy (SA1). Internally, DWS will need to identify a champion (be that an individual or committee) that will drive these alignment processes.

A number of policies and strategies within the relevant government departments and spheres of government must be refined, aligned or amended (SA2). The alignment of policy and strategies is needed to support a coherent IWQM programme across government. Policy and

strategy coherence at the national level will drive similar coherence and integration at the provincial, catchment and local levels.

This alignment will also provide the opportunity for a coherent approach towards addressing the role of the private sector and civil society in IWQM.

As part of the adaptive management approach outlined in the IWQM policy and in this strategy, relevant policies and strategies in government will need to be amended to address emerging concerns and to address lessons learned through the implementation process. In this light, DWS is currently undertaking a National Water Policy Review (NWPR) of the documents that underpin water legislation: The White Paper on Water Supply and Sanitation (1994), the White Paper on National Water Policy (1997), the White Paper on Basic Household Sanitation (2001) and the Strategic Framework for Water Services (2003). The Department is also in a process of developing a number of policies and regulations for Wetlands, Unconventional Gas Exploration, Mechanisms for Partnerships, Mine-Water Management, in collaboration with the DEA and DMR. Similarly, other Departments are in the process reviewing/updating their policies and strategies. In order to fully embed the WQM approach, all future policies and strategies need to take into account issues of water quality.

Non-point sources are a significant contributor to water pollution and need to be urgently addressed through an appropriate strategy. Whilst both the NWRS-1 and NWRS2 alluded to the development of this strategy, little progress has been made. A national Non-Point Source Strategy (NPSS) for the management of non-point source pollution, including economic, regulatory and education / awareness mechanisms, and a decision support system for the implementation of the WDCS is a short-term priority (SA3). The NPSS should be reviewed regularly to improve the response going forward.

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 1.

Table 4: Strategic Objectives and Actions to address harmonisation of policies, strategies and legislation

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 1: Harmonization of Policies and Strategies to enable improved WQM	**SO1a**: Policies and Strategies impacting upon IWQM are harmonized	**SA1:** DWS to ensure that policy and strategy development and refinement within DWS addresses WQM
		SA2: Sector departments to harmonise policies and strategies to support IWQM
		SA3: DWS to finalise and implement a non-point source pollution strategy

STRATEGIC ISSUE 2: LEGISLATIVE REVIEW AND AMENDMENTS

WHY IS IT A KEY STRATEGIC ISSUE?

In line with the Constitution, all relevant **government role players are required to develop and implement appropriate legislative** (and other) measures, and to operate in concert through formalised co-operative governance structures, **to protect water resources from pollution** (SO2a and SO2b).

Policies and strategies do not have the legal authority to hold polluters accountable and ensure the protection of water resources from pollution. While there are already several pieces of legislation that give government the mandate to manage water quality, there is a need to **amend the legislation** to enable the implementation of elements of this strategy, such as those that apply to the administrative penalties approach and the promulgation of a Money Bill.

STRATEGIC OBJECTIVES AND ACTIONS

Legal instruments are critically important in underpinning the approach to IWQM. This is because the more regulatory dimensions of water quality management are critical where water resources are severely constrained and where there is considerable unlawful activity with regards to water use. Amendment of legislation is a slow and onerous process, and the need to amend legislation is not taken lightly. Nonetheless, key amendments identified in the IWQM Policy need to be addressed to fully support and enable good IWQM, particularly amendments to the NWA to allow (SA4):

- Changes to the resource class of a resource;
- Declaration of protected water source areas;
- Categorisation of polluting industries, based on risk;
- Publication of a pollution register;
- Promulgation of a Money Bill for the Waste Discharge Levy (SA6); and
- Inclusion of Administrative penalties.

The necessary protocols and guidelines for the effective use of these instruments, as well as existing instruments in the NWA must be developed to enable officials in DWS and CMAs to apply them consistently and effectively (SA5).

The IWQM Policy also notes that there has been insufficient consideration of water quality impacts in various sector laws such as CARA, NEMA, MPRDA, SPLUMA, particularly in relation to land use and spatial planning. To embed the inclusive, inter-departmental approach, identification of potential amendments to sector legislation is required in collaboration with the sector leaders (SA7).

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 2.

Table 5: Strategic Objectives and Actions to address Legislative Review and Amendments

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 2: Legislative review and amendments to enable IWQM	**SO2a:** IWQM is effectively supported by the NWA/WSA	**SA4:** DWS to amend NWA and WSA to provide effective support to IWQM
		SA5: DWS to develop guidelines and protocols on the effective use of instruments
	SO2b: IWQM is effectively supported by other legislation	**SA6:** National Treasury and DWS to promulgate a Money Bill for the Waste Discharge Levy
		SA7: Government to identify and amend relevant legislation to strengthen IWQM, including efficient by-laws for WQM

STRATEGIC ISSUE 3: IMPROVE WQM INSTITUTIONAL STRUCTURING

WHY IS IT A KEY STRATEGIC ISSUE?

The inter-departmental approach referred to in Strategic Issue 1 must be supported by **appropriate institutional arrangements**. This includes resolving operational and functional challenges, clarifying structural and organisational issues, improving the internal systems and procedures for IWQM in relevant departments and organs of state, establishing effective interdepartmental co-ordinating structures and ensuring that regulatory bodies are effectively mandated and resourced to perform their IWQM functions.

This strategic issue aims firstly to **strengthen DWS and CMAs by ensuring that internal structures, capacity and systems are streamlined** towards effective and efficient management of water quality (SO3a). Secondly, it aims to ensure that national, provincial and local government departments take responsibility for their roles in managing water quality and that **institutional structures are established to enable a co-ordinated response from government, and to support an effective governmental reporting framework** (SO3b).

STRATEGIC OBJECTIVES AND ACTIONS

As has been identified in the policy and in Strategic Issue 1, there is a need for improved water quality governance, including a more inclusive approach that brings to the table a number of government departments and spheres of government. The objective is, therefore, to strengthen water quality management governance by resolving internal arrangements within DWS, whilst establishing inter-departmental structures that can support the development of an integrated approach.

Internally within DWS, the water quality management function is spread across differing line functions. This does enable improved governance by splitting policy development and sector support from water use authorisation and compliance monitoring and enforcement. There is, therefore, a need for the internal line functions within DWS to be reconfigured, where necessary, in order to ensure that departmental interventions are both efficient and effective and to enable integration or co-ordination with the relevant processes in other government departments, particularly DEA and DMR (SA8). The DWS has initiated a restructuring process in order to find improved structural mechanisms to implement legislation and policy. However, there is currently no strategic champion for water quality management and as result coherence in approach is being lost (SA9). This needs to be addressed as a matter of some urgency in order to lead the implementation of the IWQM Policy and Strategy.

Noting that many challenges are multi-sectoral in nature, it is important for the DWS to work closely with sector departments and as well as representative organisations to develop structures that may operate at various scales (transboundary, national, catchment, local) to find cooperative and coordinated ways to manage water quality (SA10). This needs to be supported by plans that outline actions, roles and responsibilities, time-frames and resource requirements as well as a reporting system that yields an annual, integrated report on actions taken, progress against targets, and the state of water quality (SA11). A key priority for the implementation of the strategy will be the development of the modalities for the inter-governmental structures. This will outline who convenes these structures, when these structures will meet, reporting requirements and so forth. Noting that resources are stretched, it is noted that these structures do need to be fit for purpose.

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 3.

Table 6: Strategic Objectives and Actions to Improve WQM Institutional Structuring

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 3: Improved WQM related governance	**SO3a:** IWQM is supported by effective DWS departmental arrangements	**SA8:** DWS to reconfigure the departmental WQM function as needed to ensure efficiency and effectiveness
		SA9: DWS to identify a strategic water quality management champion that will drive and monitor the implementation of the IWQM Policy and Strategy
	SO3b: Inter-sector departmental structures established to support integrated WQM	**SA10:** Establish inter-governmental WQM structures at trans-boundary basin, national and provincial levels to ensure coordination and joint action supported by regular reporting
		SA11: Government departments to develop sector WQM plans and report annually on progress

STRATEGIC ISSUE 4: FORMALISE GOVERNANCE FRAMEWORK TO SUPPORT NON-GOVERNMENTAL ENGAGEMENTS

WHY IS IT A KEY STRATEGIC ISSUE?

The increasing levels of impact and complexity in managing water quality requires more active engagement of stakeholders. Both local and international experience has shown that active **engagement and partnerships with the private sector and civil society** can substantially contribute to the management of water quality. Engaging these players brings greater knowledge to the table, and engages a wider range of individuals and organisations that are able to support actions by government in WQM. This supports the concept of developing local solutions for local problems, and enables cooperative and coordinated actions that reduce the burden on government for command and control style compliance. Supported by improved reporting systems these partnerships can enable timeous, efficient and effective response to water quality issues.

STRATEGIC OBJECTIVES AND ACTIONS

The private sector and civil society need to be understood as strategic partners in the strategy to strengthen WQM. In recent years, there has been a growing recognition of the role that the private sector can play through partnerships, voluntary regulation and stewardship approaches. This has been evidenced by the work of the United Nations CEO Mandate, the Alliance for Water Stewardship, and others. Already in South Africa, there is a strong tradition of engagement of several large private enterprises on water issues. However, often the engagement of the private sector has often been adversarial in nature, with the private sector utilising lobbying and advocacy approaches, whilst with government acts as policy maker and regulator.

The objective of this strategy is, therefore, to take this discourse towards one of active partnerships and engagement. This to ensure that the principle of sustainable water use is mainstreamed into the business practices of the private sector whilst civil society plays a strategic watchdog and advocacy role. It is important to note that the role of civil society is dual in that it communicates to government as well as to broader society and the private sector.

When water quality challenges are linked to key corporate risk areas they become of increasing significance to business. This understanding of the goods and services that the private sector accrue from water resources and the broader environment will assist in shifting the private sector to play stronger stewardship roles in catchments.

This will require the development of a partnership framework that will assist in the structuring and development of these partnership arrangements (SA12). DWS will continue to foster these partnerships through initiatives such as the Strategic Partners for Water Network and the uMngeni Ecological Infrastructure Partners (SA13).

The role of civil society is different in that civil society organisations often play a key watch-dog and advocacy role. As such, civil society often holds government and the private sector to account. This is a critical role and DWS, together with the various government departments that partner the water sector, will continue to support the active engagement of civil society through a variety of platforms such as the Water Sector Leadership Group, various working groups and catchment management forums (SA15). This engagement with civil society will take place in line with a framework developed by DWS, DEA and CMAs, through a consultative process with civil society (SA14).

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 4.

Table 7: Strategic Objectives and Actions to Formalise Governance Framework to Support Non-Governmental Engagements

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 4: Formalise governance frameworks to support non-governmental engagements	**SO4a:** Partnerships/stewardships established and maintained	**SA12:** Government to develop a partnership framework that is fair and equitable
		SA13: Government to develop and foster strategic sector partnerships
	SO4b: Governance framework for active citizenry formalized	**SA14:** DWS with DEA and CMAs to develop an engagement framework that enables more active participation of civil society at transboundary, national and catchment levels
		SA15: DWS, DEA and CMAs to support and drive functional platforms for the engagement of civil society nationally and within catchments

STRATEGIC ISSUE 5: IMPROVE COORDINATION IN INTEGRATED PLANNING

WHY IS IT A KEY STRATEGIC ISSUE?

The lack of integrated, inter-departmental planning has significant impacts on water quality as different departments and spheres of government engage in and support development activities with potentially significant impacts on water quality, particularly from changes to land-use. **Pro-active and integrated planning** to timeously address future water resource challenges is essential to maintaining water security. In those catchments that are highly developed due to urbanisation, industrialisation or intensive irrigation, water quality planning becomes even more critical with a need for **integrated plans that will address the specific water quality issues in those catchments**. Such plans can inform appropriate responses from a range of government, private sector and civil society actors.

The catchment is at the 'coal-face' for IWQM and integrated, coordinated planning ensures the effective use of resources (human and financial) in managing water quality.

STRATEGIC OBJECTIVES AND ACTIONS

Water quality challenges manifest differently across the country, and have different geographical footprints. While some water quality issues are of national importance, others have more localised impacts. The former requires intervention and support from the national level Government, while the latter require more localised management responses.

Of national importance are issues such as:

- Addressing water quality in national priority catchments, including those with significant transboundary water quality concerns;
- The rehabilitation and upgrading of WWTWs in prioritised areas;
- Resolving mining related pollution challenges;
- Finding effective solutions to non-point source pollution; and
- Finding effective solutions to the management of industrial discharge within the municipal environment.

In addition to the national response, however, integrated approaches at the catchment level are also critical. The DWS develops water supply reconciliation strategies that plan for water supply to key strategic systems. Water quality dimensions are included in these strategies, but do require strengthening. CMAs have the responsibility to develop and implement CMS that are consistent with the NWRS. The CMS will enable the alignment of various sectoral plans, including Regional Mining Plans, Spatial Development Plans, and municipal IDPs, to support sustainable WQM. CMAs, through the CMS, will be central actors in embedding an IWQM approach in each water management area and it will be critically important that catchment based IWQM plans are developed that support the CMS. Whilst CMAs will be lead actors in the development of these planning instruments, the role of DWS in terms of strategic support and guidance will be critical. Noting the degree of inter-connectivity between water

management areas, the DWS must advise the CMAs on strategic planning dimensions to ensure consistency in content and detail, as well as to ensure the national interests are secured.

There are concerns that the complexity of integrated planning and the capacity needed to implement the results have outstripped the ability of the country to deliver. In this regard, the role of institutional engagement platforms (Strategic Issue 4) and programmes for the development of capacity (Strategic Issue 11) are important.

There are a number of government departments across all three spheres of government that support development activities that have potential impacts on water quality, be they urban development, mining, industrial development, changes in run-off through construction of roads and increases in impermeable surfaces, or changes in agricultural practice. Changes to land-use, in particular, may result in diffuse source pollution, but do not require water use authorisation unless an Environmental Impact Assessment is required. Proactive interdepartmental planning that considers the water quality impacts of potential development scenarios within a catchment can assist in managing water quality while still supporting the development required to meet the socio-economic requirements of the country.

In some catchments, water quality is sufficiently bad that plans need to address how to reduce the existing pollution and to restore water quality. In these catchments, which are considered national priorities, DWS, with CMAs, will drive an inclusive and consultative process to develop an IWQM Plan for the catchment (SA16). In areas in which pollution from mining is an issue, DWS, DEA and DMR will ensure that the IWQM plans and the Regional Mining Plans are integrated and that a common approach from government is ensured that will protect water quality from the impacts of mining (SA22). In other catchments, CMAs will develop IWQMPs as part of the CMS (SA21).

A major challenge that affects water quality across the country is the pollution derived from poorly managed or failing WWTW. This challenge has been widely recognised, and plans are already in place for addressing some of the challenges. To take this work forward, DWS, with NT, SALGA, CMAs and COGTA will develop a strategic action plan for the rehabilitation and upgrade of prioritized WWTWs (SA17). DWS, DEA, SALGA and COGTA will also develop a protocol for the management of industrial discharge within the municipal environment (SA 20), since this is a contributing factor to water pollution from urban areas and to the challenges municipalities face in treating urban waste water. In addition, DWS and COGTA will ensure that WSDPs, IDPs and SDFs reflect WQM priorities and management responses (SA 23).

Non-point source pollution remains a significant challenge in managing water quality, with pollution from agricultural land, mining, and urban settlements posing particular challenges. DWS, with CMAs, DAFF, DEA, SALGA and DMR, will develop a strategic action plan for managing non-point source pollution, which will include the roles and responsibilities of the various departments in reducing non-point source pollution within their spheres of control (SA19). A significant part of the non-point source pollution challenge in specific catchments is pollution from existing and closed mines, with the potential pollution from new mines as an additional challenge. While considerable work has been done on the issue of mining pollution,

and effective strategy has not yet been finalised and implemented, and this remains a serious challenge in a number of catchments. To address this, DWS will lead a process with DMR and DEA to develop a strategic action plan to support the implementation of the mine-water management policy which will include annual reporting on progress against agreed targets (SA18).

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 5.

Table 8: Strategic Objectives and Actions to Improve Coordination in Integrated Planning

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 5: Improved coordination in integrated planning	**SO5a:** Integrated sectoral planning approach is adopted at transboundary and national level	**SA 16:** DWS to lead the development of an IWQM plan for national priority catchments, ensuring consideration of transboundary water quality concerns
		SA 17: DWS, with NT, SALGA and COGTA to develop a strategic action plan for the financing, rehabilitation and upgrade of prioritized WWTWs
		SA18: DWS, with DMR and DEA, to develop a strategic action plan for the implementation of the mine-water management policy
		SA 19: DWS/DAFF/DMR/DEA/DRDLR/COGTA to develop strategic action plans to reduce non-point source pollution
		SA 20: DWS, DEA, SALGA and COGTA to develop a protocol for the management of industrial discharge within the municipal environment
	SO5b: Integrated sectoral planning approach adopted in catchment/regional plans	**SA 21:** CMAs to develop an IWQM plan for each water management area as part of the CMS
		SA 22: DWS, DEA and DMR to integrate IWQM and water resource planning with Regional Mining Plans in priority areas
		SA 23: DWS and COGTA to ensure that WSDPs, IDPs and SDFs reflect WQM priorities and management responses

STRATEGIC ISSUE 6: STRENGTHEN IWQM REGULATION, COMPLIANCE AND ENFORCEMENT

WHY IS IT A KEY STRATEGIC ISSUE?

Poorly managed discharges into water resources have significant impacts on aquatic ecosystem and human health and water use more generally. The socio-economic impacts can be severe. Poor administration of water use authorisations has historically created significant backlogs in applications. Weak compliance monitoring and enforcement is currently enabling the discharge of water containing waste to go unchecked, and for water users not to meet the conditions of their water use licences. Often, the conditions under which authorisations are given change and appropriate management or treatment is not sufficiently applied prior to discharge. This is exacerbated by an increasing non-point source pollution (see Strategic Issue 1) as a result of poor or uncontrolled land use management practices.

A consolidated approach to strengthen regulation and enforcement is critically important in ensuring that we protect water quality with the most effective use of limited state resources. This will entail strengthening the water use authorisation processes (SO6a) as well as improving the approach to compliance monitoring and enforcement (SO6b).

It is also important that the key organs of state responsible for WQM are capacitated and able to operate efficiently. This requires that **CMAs are established and delegated appropriate water management functions** over and above their inherent and initial functions. The resources of the **private sector and civil society** can also assist government in building effective regulatory and compliance monitoring mechanisms.

While there is a need to develop a more rigorous and integrated command and control approach to the enforcement of authorisations, there is also a need to develop partnerships across sectors and between users to develop improved approaches that incentivise lawful and sustainable water use.

STRATEGIC OBJECTIVES AND ACTIONS

Whilst there is a need to establish a more cooperative institutional environment to enable improved WQM, there is still an important need to strengthen the manner in which water use is regulated. Where water resources are more abundantly available, or where water use has lower levels of impact, there can be an argument for less stringent compliance with regulatory instruments. The pressure that is being placed upon the water resources of South Africa is creating increased complexities in ensuring that adequate quantities of water, of suitable quality for use, is reliably available. Backlogs in the processes to issue water use authorisations have been a significant challenge and focused projects to redress this have been instituted. This will be an on-going challenge as pressure upon the resource increase. Land-use authorisations, which impact upon water resources, do need to be strengthen to ensure that water resources are effectively considered in the decision making process.

Noting that the levels of unlawful water use and non-adherence to water use license conditions requires redress, a structured approach is required to improve compliance monitoring and enforcement. Whilst this does still require the command and control approach, the use of other innovative mechanisms for incentivising compliance does need to be explored (see Strategic Issue 9).

The DWS is already taking significant steps to improve capacity in this regard and has been working closely with DEA to train more staff as Environmental Management Inspectors (EMIs). However, it is important that other government departments (see Strategic Issue 3) also improve their regulatory approaches. In some instances, there are benefits to be achieved from government departments acting conjunctively and partnerships between DWS, DEA, DMR and DAFF are deemed as strategically important.

This will require an array of actions that include strengthening our understanding and implementation of the WQM hierarchical and differentiated approaches, continuing to work on the back-log of license applications and to ensure that new licences are resolved within agreed timeframes (SA24), developing risk-based protocols for water use regulation, based on the likely magnitude of potential impacts (SA25) that also set out the roles and responsibilities of CMAs in water use authorisation, and compliance monitoring (SA26), developing and implementing an integrated licensing protocol (SA27) as well as the information management systems required to support this integrated licencing approach (SA28).

In addition, improved regulatory mechanisms will be developed which will support:

- Improved regulation of pollution from land-based activities, in line with the NPSS that will be developed (see Strategic Issue 5);
- Approaches for more impactful and integrated CM&E between Government Departments, and
- Approaches to regulation that enables government to focus limited resources on high-risk/high impact activities (SA28). This includes for example, dividing water use licence application types into categories of complexity and level of risk, with appropriate fees allocated to each category, putting in place a protocol ensuring that public participation is required for all water use licence applications determined as posing a high risk to water quality and paying greater regulatory attention to high risk industries and waste dischargers with a history of non-compliance.

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 6.

Table 9: Strategic Objectives and Actions to Strengthen IWQM Regulation, Compliance and Enforcement

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 6: Strengthen IWQM Regulation, Compliance and Enforcement	**SO6a:** Licencing processes streamlined	**SA 24:** DWS to address the backlog of Water Use Licence applications urgently and to meet stipulated timeframes for new licence applications.
		SA 25: DWS to categorise risk-based protocols for determining water use authorization
		SA 26: DWS/CMAs to develop protocols for CMA engagement in Integrated Water Use Licence applications and approval processes
		SA 27: DWS, DEA, DAFF and DMR to develop and implement a protocol for integrated licensing processes
		SA 28: DWS, DEA, DAFF and DMR to develop information management systems to support the integrated licensing approach
	SO6b: Targeted/strengthened compliance monitoring and enforcement of key polluting sectors	**SA 29:** DWS, DEA, COGTA, Department of Human Settlements, DRDLR to develop improved regulatory approaches to manage water quality pollution from land-based and in-stream activities, including the review and establishment of mandatory national waste discharge standards.
		SA 30: DWS, DEA, CMAs to develop a targeted approach for the enforcement of regulation
		SA 31: DWS, DEA to assess gaps in regulatory frameworks and instruments and develop revised approaches and instruments as necessary
		SA 32: DWS, DEA, CMAs to develop approaches to strengthen operational CME and the EMI network

STRATEGIC ISSUE 7: APPLICATION OF ADAPTIVE MANAGEMENT APPROACHES

WHY IS IT A KEY STRATEGIC ISSUE?

There are a wide range of forces at play in a catchment, from the bio-physical, such as rainfall, temperature, wind, and vegetation, to the socio-economic, such as population trends, economic development trends, and the nature of socio-economic development pathways. All of these impact on water resources in subtle or not-so-subtle ways. Some of these forces may have complex patterns of interactions and cumulative impacts. The result is a complex system, in which particular actions or changes may not have linear, or even expected results. The management of complex systems is always a challenge, and considerable work has been done globally in recent years on how to manage complex systems. The widely recognized best practice is the implementation of adaptive management, and in the case of catchment management, adaptive management that recognizes the systemic nature of the catchment, giving rise to systems-based adaptive management.

Systems thinking recognizes that a system is driven by the inter-relationships and interactions of its various parts, with the potential for positive and negative feedback loops in these interactions. Thus, impacting on one part of the system may have a range of impacts on other parts of the system that are difficult to predict. Adaptive management recognizes this challenge, and brings to bear a management system that enables on-going course-correction through structured monitoring and learning from the results of actions taken.

Systems-based adaptive management is an imperative for managing water quality, supported by **information and knowledge networks that provide the evidence base for decision-making** (SO7a).

STRATEGIC OBJECTIVES AND ACTIONS

There is an increasing recognition of the fact that catchments are complex systems and require management approaches that are appropriate to this complexity, as in adaptive management. In addition, this adaptive management takes place within a complex socio-ecological system, giving rise to the need for systems-based adaptive management (SBAM). There are a number of aspects to developing an effective SBAM approach, including the need for the development of a common vision amongst government, private sector and civil society players at the catchment level, through the IWQM plans (see Strategic Issue 5).

In addition, a suite of supporting instruments that enable the adaptive approach is needed, including:

- **Willingness**: Those responsible for the management of the resource need to have the vision and intent to undertake processes step for step and to willingly adapt to developing circumstances. CMAs will lead a process at the catchment level to develop a common vision for managing water quality at the catchment level and to build the necessary commitment by relevant players to realise the vision. Based on this, the

CMA will lead an inclusive process to review, identify and address priority water quality challenges at regular intervals, within an adaptive management approach (SA35) as well as set the RQOs for the country (SA36).

- **An enabling environment**: The policy and strategic environment needs to support the need to make adaptive responses. These are policies that recognize the importance of integration between sectors (horizontally) and between scales (vertical). This is also supported by an enabling institutional environment where adaptive decisions are enabled.
- **Information and knowledge**: Adaptive management responses need to be based upon information and knowledge triggers that inform the need to adjust. This needs to be supported by learning systems that enable stakeholders to engage and own decisions. CMAs have a critical role in developing programmatic monitoring and reporting of actions at outcomes at the catchment level to support SBAM (SA33) and to develop the protocols for SBAM, including how monitoring, the assessment of knew knowledge, and learning take place and inform decision making (SA34).
- **Institutions**: Localised and catchment based institutions, at various scales, that are responsible for water resources management are able to respond more efficiently and effectively to changing circumstances. Some degree of self-organisation is needed to ensure that these institutions are supportive of the context.

Therefore, there is a need to provide support and guidance that develops the protocols for localized programmatic monitoring and reporting of outcomes to enable adaptive responses.

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 7.

Table 10: Strategic Objectives and Actions to Address Application of Adaptive Management Approaches

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 7: Application of Systems-based Adaptive Management Approaches	**SO7a:** Adaptive systems-based management is applied at catchment level	**SA 33:** CMAs to develop localised programmatic monitoring and reporting of actions and outcomes
		SA 34: CMAs to lead process with other relevant government departments and agencies, and stakeholders, to review, identify and address priority water quality challenges at regular intervals
		SA 35: DWS and CMAs to develop protocols for systems-based adaptive management for IWQM
		SA 36: DWS to determine RQOs for all catchments in South Africa

STRATEGIC ISSUE 8: IMPROVE AND SUSTAIN FISCAL SUPPORT FOR IWQM

WHY IS IT A KEY STRATEGIC ISSUE?

Improving our resource water quality to achieve positive impacts on economic growth as well as human and ecological health r**equires reliable, sufficient and sustained financing**. Currently the government budget allocation is insufficient to address all water quality issues that require redress, and alternative sources of funding are required if there is to be a turnaround in the way that water quality is managed (SO8a).

Part of the challenge is that there is not a complete understanding of what the real costs of managing water quality should be and what **investment is required** over the next ten years in order to be able to manage water quality effectively. This is a complex challenge noting that the management of water quality cuts across spheres of Government and has interfaces along the entire water value chain. The development of a complete water quality management investment framework will be an important step in understanding the financial injections that are required.

Funding of WQM initiatives should not be limited to DWS and will include other relevant government departments and public entities. Inter-departmental **co-operation will ensure greater impact from fiscal allocations for IWQM** across the suite of relevant departments**.**

STRATEGIC OBJECTIVES AND ACTIONS

The mechanisms for funding IWQM will need to be revised to address the significant impacts of declining water quality. Some of the funding-related challenges are:

- inadequate funding raised through the regulatory mechanisms available to DWS due, for instance, to delayed implementation of the Waste Discharge Charge System (WDCS);
- the lack of sustainable financial models for local government, leading to inadequate funds to maintain Waste Water Treatment Works;
- inadequate implementation of environmental provisions related to mine rehabilitation;
- poor co-ordination and planning across the sector and spheres of government;
- insufficient skills and capacity for WQM in government;
- establishing and capacitating of the CMAs to develop CMS's and IWQM Plans;
- poor cooperative governance frameworks and interventions; and
- economic policy uncertainties and anomalies as well as the generally uncertain political climate, which have resulted in inadequate investment by private sector companies in WQM.

Funding is required not only for regulatory activities such as water use authorisation, compliance monitoring and enforcement, but also for a range of other key activities that support IWQM. This includes, amongst others:

- staffing;
- on-going training and capacity building;
- stakeholder engagement;
- public awareness and information dissemination;
- research on emerging pollutants;
- WQM systems development;
- rehabilitation of degraded areas and in some cases, the construction and management of water and wastewater treatment facilities; and
- the management and maintenance of green infrastructure.

As water quality challenges increase funding requirements will also escalate. The mechanisms for funding WQM will need to be revised to address these changes. In this light, it is crucial that this framework is updated annually, to reflect the progress made in improving water quality. This annual reflection allows for the adaption of the investment framework to allocate and align resources to water quality management issues of strategic importance.

Water pollution has direct, but insufficiently recognised, impacts on economic growth, human health, ecosystems, job creation and the cost of doing business. The financial resources currently available for managing water quality are insufficient for the task, and do not recognise the level of investment that is required to counteract the economic harm done by declining water quality. These economic and environmental impacts need to be quantified in order to understand the return on investment on the use of state funds to manage water quality, not least in order to be able to motivate for greater resource allocation (SA37). In addition, it is important to be able to quantify the investment in water quality management (infrastructure and management responses) over the next ten years in order to be able to mobilise the necessary funding (SA38). This investment framework will expand the current investment framework for water supply developed by DWS. In developing the IWQM Investment Framework, new approaches may be required such as ring-fencing of funds specifically for IWQM, or these establishment of a CMA trust fund. These innovative mechanisms may pave the way for increased donor, NGO or private sector contributions for localised interventions.

The funding for addressing mine water challenges remains an on-going challenge, with a combination of state and private sector funds required to address the challenge. While NEMA and the NWA allow for financial provisions for managing the water impacts of mining after closure, as of now, the NEMA related funding is insufficient to address the on-going water quality challenges from closed mines, and the NWA facility to require financial provisions has not been utilized. Protocols and financial mechanisms are required in to support the of expanding the financial provision to other high-risk polluters, who are not from the mining industry and the use of the NWA provision for the mining industry (SA40). It should be noted

that access to the current financial provision made by mines for the rehabilitation of polluted areas, both land and water, has proven to be very difficult. Protocols and mechanisms to unlock this is also required.

Revision of WUL application fees to reflect the complexity of the application should also be undertaken to ensure that the revenue from WUL application fees serves to cover the costs of reviewing the WUL application.

Municipal discharge is a significant challenge for WQM in South Africa and the sustained maintenance and rehabilitation of failing municipal WWTWs is a critical step in turning this around. The current system of municipal grants is incentivising a build-operate-decay-rebuild approach, with insufficient funding being made available for proactive maintenance programmes in many municipalities. A review of the municipal conditional grants and municipal budgets for the rehabilitation and effective operation and maintenance of WWTWs is required by DWS COGTA, and National Treasury (NT) (SA39).

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 8.

Table 11: Strategic Objectives and Actions to Improve and Sustain Fiscal Support for IWQM

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 8: Fiscal support for integrated WQM	**SO8a:** WQM interventions are financially supported by the fiscus	**SA 37:** DWS/WRC to support research into the socio-economic-environmental and management costs of poor water quality
		SA 38: Government to develop an investment framework including innovative mechanisms to mobilise funding for sustained support to IWQM
		SA 39: DWS, with NT, COGTA, SALGA, to review municipal conditional grants
		SA 40: DWS to develop and implement a protocol for extending the financial provisioning clause to all industries that are deemed “high-risk” polluters.

STRATEGIC ISSUE 9: DEVELOP PRICING AND INCENTIVE MECHANISMS THAT SUPPORT IWQM

WHY IS IT A KEY STRATEGIC ISSUE?

There is a considerable amount of unlawful water use in South Africa. Whilst some if this can be accredited to backlogs in the processes to obtain water use authorisations, this is often about users not adhering to their water use conditions. On the other hand, some water users are adhering to the discharge standards, laid out in the water use authorisation, but are still contributing significant load to the system. There is then a need to incentivise improved behaviours by water users.

Appropriate pricing and economic incentives have been shown, globally, to result in **behavioural change while also raising revenue** for water management interventions. Government is highly resource constrained and innovative financing mechanisms can increase the financial resources available for integrated WQM.

STRATEGIC OBJECTIVES AND ACTIONS

The implementation of the WDCS in key priorities catchments is urgently required since it has the ability to not change behaviour, but also raise revenue to initiate real change in critical catchments. Implementation should take place in priority catchments as a matter of urgency (SA41) with a roll-out over time to all catchments (SA42). This economic instrument, which adopts the “polluter pays” principle is aimed at changing polluter behaviour while also raising revenue for IWQM. The development of the WDCS has taken over a decade to reach implementation readiness, and implementation is now overdue and will be prioritised.

Another area identified for the use of economic instruments to reduce pollution is around the re-use and sale of treated water. This primarily speaks to mine water, and is being address as part of the Mine-Water Management Policy (SA44).

In addition to these economic incentives, it is important to look to the development of further economic incentives, based either on local knowledge or global best practice (SA43).

The introduction of administrative penalties is a financial penalty system aimed at driving a reduction in pollution and improved adherence to regulatory requirements. While the primary aim of the administrative penalty system is to impose sanctions on illegal actions, the finances derived from administrative penalties can also be used to reduce pollution in the catchment. Significant legislative requirements and institutional arrangements to support the introduction of administrative penalties are required. Currently, the DEA together with the Centre for Environmental Rights is investigating the feasibility of this and DWS will work with them to ensure the introduction of an effective administrative penalty system for water quality (SA45).

In addition, partnering with other institutions in the financing of grey and green infrastructure, and in improved IWQM, will broaden the funding streams available. For example:

- SANBI's ecological infrastructure directorate funds ecological infrastructure that is critical for IWQM; and
- There is potential to access funds from funds focused on climate change adaptation and the SDGs.

Once again, it will be important to develop the relevant governance and financial frameworks to support these innovative finance mechanisms.

The implementation and operation of collaborative action poses specific challenges and risks to government, municipalities and private sector in terms of its credibility, security, quality and management of risk. Collaboration must be done within the spirit of sharing risks and benefits, through good cooperative governance, management and implementation between all partners. While various institutional models may be developed by government or the private sector (e.g. mining companies in the catchment) to provide this function, an autonomous statutory committee housed by a public entity may provide particular advantages in ensuring independence and stakeholder acceptability, maintaining quality and managing risk. The SWPN has developed a business case for the establishment of a Mine Water Coordinating Body in the Witbank Coalfields to assist with the facilitation, coordination and management of mine water in the area. These types of initiatives should be considered for roll-out.

In addition, clean technology supported by green economy initiatives and financing mechanisms provides targeted ways of reducing pollution at source. The private sector has a crucial role to play in minimising its impacts on water resources. Collaborative efforts by the private sector and international funding organisations (such as the World Bank) and/or NGOs (such as WWF) illustrate that by sharing water risks, benefits can also be shared. There is therefore recognition that business risk associated with physical, reputational and/or regulatory impacts has contributed to collective action initiatives associated with new emerging partnerships. This, however, requires an enabling environment for research and development and the promotion on the clean technology industry.

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 9.

Table 12: Strategic Objectives and Actions to Develop Pricing and Incentive Mechanisms that Support IWQM

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 9: Develop pricing and incentives that support integrated WQM	**SO9a:** The Waste Discharge Charge System is implemented	**SA 41:** DWS, with CMAs, to implement the WDCS in priority catchments
		SA 42: DWS, with CMAs, to develop an action plan to support the phased implementation of the WDCS across the country
	SO9b: Mechanisms for incentivising good practice developed	**SA 43:** DWS/DEA/WRC to explore innovative financing mechanisms for incentivising good IWQM practice
		SA 44: DWS and NT to determine financial incentives for water-reuse (AMD, other)
		SA 45: Government to develop the legal and institutional mechanisms for introducing administrative penalties for environmental non-compliance including water pollution.

STRATEGIC ISSUE 10: STRENGTHEN MONITORING NETWORKS AND INFORMATION MANAGEMENT

WHY IS IT A KEY STRATEGIC ISSUE?

It is not possible to manage what you don't measure. Good water quality **monitoring enables effective enforcement and compliance**. Added to this, the timely sharing of data and information allows the development of relevant and applicable WQM interventions, which have a high likelihood to succeed. Updating of the monitoring network and monitoring services (such as online monitoring) enables effective enforcement and compliance of laws and regulation and supports the systems-based adaptive management approach.

STRATEGIC OBJECTIVES AND ACTIONS

The main function of a water quality monitoring programme is to produce the information, based on the analysis of data, that supports appropriate water management decisions. The social, legal, ecological and financial implications of making incorrect decisions as a result of unreliable, inaccessible or non-existent data or information is significant. The adaptive management approach, adopted in this strategy, is highly dependent on current, scientifically sourced and legally defensible data and information in order to inform changes to the management approach over time. The information systems to support the management and sharing of information.

South Africa has programmes in place to monitor water quality across the country, however, such monitoring is constrained by limited financial resources, cumbersome procurement processes, insufficient monitoring stations, inadequate numbers of suitably skilled staff, uneven availability of access to accredited laboratories for testing of samples, and the complexity of monitoring the number and variety of pollutants entering water resources, including new and emerging pollutants. There is thus a need to expand the coverage of both raw water and wastewater quality data monitoring to enable an integrated approach that will ensure optimal evaluation of water quality across the country, identifying what is required for a national monitoring network and what for catchment level management, and aligning the systems of different organs of state, such as DWS, DEA and CMAs (SA46, SA47).

Whilst the ability to generate data from these monitoring networks is important, the management of such data once generated also needs to be addressed. The conversion of the data into useful information, through analysis and assessment, that is available and accessible to different parts of the public is also crucial to support the capacity, both within and outside government (SA48). Equally important is developing the necessary systems and protocols to ensure that the information from monitoring programmes for source and resource pollution, and new and relevant information, feed into the decision-making process to ensure adaptive management is implemented (SA49, SA50).

In addition, with the expansion of ICT accessibility, huge strides have been made around citizen-based monitoring and science in the water sector. The smart-phone enabled mini-

SASS app developed in South Africa is an excellent example of what is possible. The development of citizen-based monitoring programmes can contribute significantly to data and information on water quality across the country, and DWS and the WRC have a leading role to play in this regard (SA47)

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 10.

Table 13: Strategic Objectives and Actions to Strengthen Monitoring Networks and Information Management

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 10: Strengthen Monitoring and Information Management	**SO10a:** An integrated and functioning water quality monitoring network	**SA 46:** DWS/CMAs to strengthen national and catchment water quality monitoring networks through spatial expansion and identification of priority constituents for catchment-specific monitoring
		SA 47: DWS to support the network expansion with an initiative to ensure that accessible accredited laboratories are available to ensure efficient and effective analyses
	SO10b: Information systems that are current and accessible to support adaptive WQM	**SA 48:** DWS, with the WRC and CMAs, to lead the development of a programme to create and support citizen-based monitoring programmes
		SA 49: Government to ensure the harmonisation of data and information systems pertaining to resource water quality
		SA 50: Government to ensure the harmonisation of data and information systems pertaining to source water quality
		SA 51: Government to develop systems to enable data and information access by stakeholders/ public
	SO10c: Routine assessments inform adaptive WQM	**SA 52:** DWS/DEA/CMAs to develop protocols and systems to ensure M&E and new information inform adaptive management decisions for IWQM

STRATEGIC ISSUE 11: BUILD WATER QUALITY AND WQM CAPACITY THROUGH EDUCATION, TRAINING AND COMMUNICATIONS

WHY IS IT A KEY STRATEGIC ISSUE?

Capacity building is fundamentally about improving effectiveness, often at the organisational level. To this end, there is a dire need to strengthen the approach of DWS and its sector partners ensuring that internal structures, capacity and systems are improved and aligned towards the effective and efficient management of water quality. Equally important is that national, provincial and local government departments take responsibility for their roles in managing water quality and to this end institutional structures should be established to enable interaction and integration, as well as support the development of a governmental reporting framework. It should be noted that even though developing countries are, traditionally, less likely to have the institutional, technical or financial capacity to undertake many water resource management activities, several developing and developed countries have illustrated how innovation, through research and development, can help conquer traditional barriers.

The building and maintaining of WQM capacity in DWS and its sector partners, including civil society, through education, training, research and communication is crucial in supporting the inclusive approach towards ensuring effective WQM.

STRATEGIC OBJECTIVES AND ACTIONS

The lack of technically skilled and experienced staff in water quality and WQM in all spheres of government has significantly contributed to the decline of the country's resources, mainly from weaknesses in authorisation of waste discharges by DWS, gaps in water quality and compliance monitoring and failure to take effective action against polluters, and poor management of WWTW. Whilst there is a myriad of tools that speak to the different aspects of management of water quality, a consolidated approach and the inter-linkages between functions is not well understood or supported. It is critical to act swiftly to build capacity through training, professionalization of staff in key areas (SA 55) and to adopt a longer-term vision for sustaining and ramping up capacity to manage increasing water quality challenges in future (SA 53). It is also extremely important to build the capacity of civil society and the private sector (particularly smaller companies with significant water quality impacts) to enable them to play a fuller role in the monitoring and management of water quality across the country (SA54).

The provision of bursaries and scholarships for studying WQM at tertiary institutions is also critical (SA56).

Access to the data and information on water quality and its management is crucial, however, without the knowledge and experience to effectively utilise the information through sustained capacity development initiatives, the effort is futile. In this light, developing and maintaining WQM capacity needs to be fast tracked for an improved governmental response, and ensuring that there are active, informed and engaged citizens to support the process.

On-going research, innovation and development is needed to ensure that the most effective tools and approaches are being used for managing water quality across the country. It is also critical to ensure that this information and knowledge is conveyed to the relevant policy makers and implementers in a manner that supports the introduction of new tools, technologies and systems in an effective and sustainable manner (SA57, SA58).

DWS, with the WRC, will develop the necessary systems to ensure easy access to water quality and WQM related information on line (SA60).

Finally, reporting on water quality trends and progress against targets is a critical element of this strategy, and DWS will report annually, to Parliament, on the state of raw water quality in the country, and on progress against targets by all relevant government departments, as well as on the role played by the private sector and civil society (SA59).

SUMMARY OF STRATEGIC OBJECTIVES AND ACTIONS

The table below gives a summary of the Strategic Objectives and Strategic Actions required to address Strategic Issue 11.

Table 14: Strategic Objectives and Actions to Build Water Quality and WQM Capacity through Education, Training and Communications

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 11: Build water quality and WQM Capacity through Education, Training and Communication	**SO11a:** Sustained capacity for Government /CMA/sector to effectively manage and support WQM through improved education and training	**SA 53:** DWS/WRC to develop and implement a capacity building programme for officials in DWS, CMA and other sector departments in systems-based, adaptive IWQM
		SA 54: DWS/CMAs to expand capacity-building initiatives to civil society and private sector
		SA 55: DWS to develop regulations to ensure the professionalization of key water services functions
		SA 56: DWS/private sector to providing bursaries/learnerships pertaining to WQM at tertiary institutions
	SO11b: WQM decisions are underpinned by best practice, research and innovation	**SA 57:** DWS, with the WRC, to investigate the options provided by recent innovative developments to improve water quality
		SA 58: WRC to lead the sector in innovation, research and development for IWQM
	SO11c: A well informed and actively engaged South Africa	**SA 59:** DWS to report annually on the state of water quality in the country
		SA 60: DWS/WRC to develop online tools for easy access to water quality and WQM related information
		SA 61: DWS/DEA/DAFF/DMR/CMAs to develop and maintain multi-sector stakeholder platforms for sharing information
		SA 62: DWS, with other Departments and sector institutions, to lead and roll-out awareness creation campaigns

6 TOWARDS IMPLEMENTATION

The progressive development of the water quality management function over the course of a century and has taken place in parallel to the socio-economic development of South Africa. In most instances, there has been a regulatory response to the growing pressures upon water resources, and so from a water quality management perspective there have been shifts to address emergent water quality challenges being driven by socio-economic development.

The current development of an IWQM Policy and Strategy is equally a response to an increasing array of water quality challenges. In the current context of increasing complexity, it is realised that the approaches of a far more regulatory nature, whilst still important, can no longer be the backbone of an approach to managing water quality. The complexity demands a far more integrated and adaptive approach that will require near real-time decision making based on data and information, supported by engaged stakeholders.

The more technically based regulatory approach, headed by DWS, is not yielding the required changes in water quality status in the country. There is continued pressure on water resources and resource quality continues to decline. Clearly the current strategies are either not being implemented (due to limited resources) or are not effectively dealing with the increasing water quality challenges arising from, amongst other things, economic and population growth, historical legacies, and aging infrastructure.

To be able to address current challenges and be prepared for future challenges, a new approach is required. The IWQM Policy and Strategy have been structured around a fundamental shift in approach that enables sector-wide engagement through more active partnerships with Government Departments and institutions, as well as with the private sector and civil society.

This IWQM Strategy provides a significant suite of Strategic Issues, Objectives and Actions. It must be understood that this strategy will be implemented in the short term to achieve a longer-term intent. As such, there are parts of the strategy that need to be initiated rapidly, with the understanding that the action will quickly generate results. Other actions will be initiated in the short term knowing that the outcomes will only be realised in the longer term.

The development of an implementation plan, to support this strategy, then provides the opportunity to articulate in a structured way, how this strategy can be pragmatically implemented (**Figure 18**). This will be supported by a monitoring and evaluation framework that will enable the DWS to monitor and report on progress. In addition, the DWS is also undertaking a review of the existing organisational structure which will assist in enabling implementation.

In effect the implementation plan becomes the critical catalyst for shifts in approach towards achievement. As such there is a need to carefully consider the nature of the implementation plan and develop this to create the opportunity to achieve, and demonstrate success.

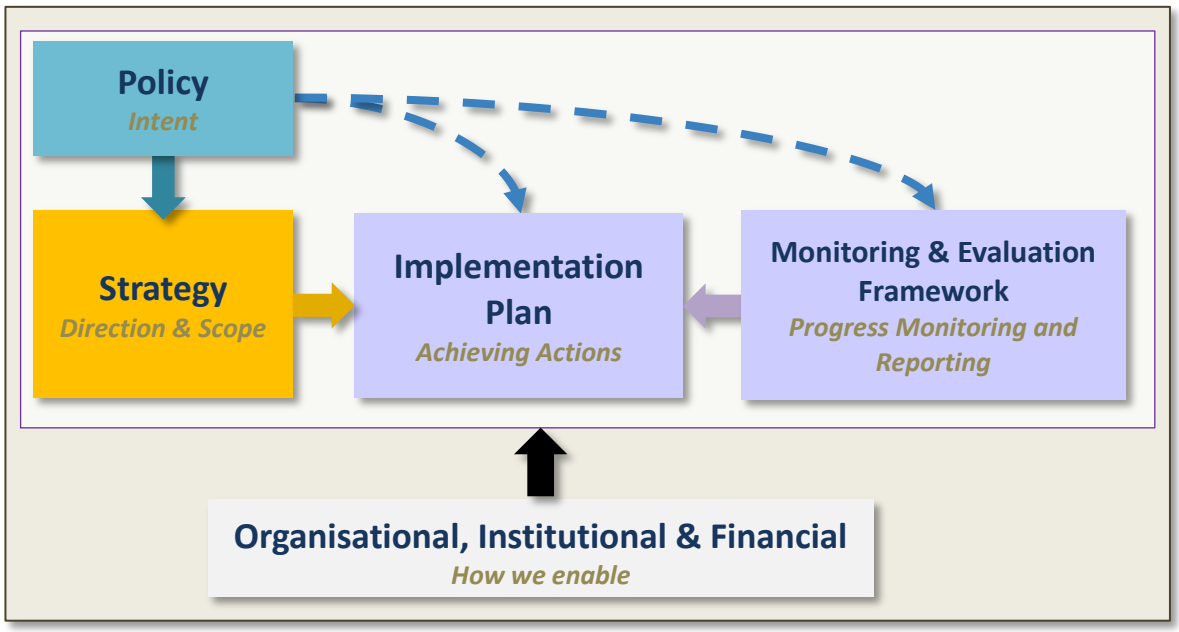


Figure 18: From policy to strategy to implementation

Core considerations for the formulation of the implementation plan include:

- **Focus on short to medium term timeframes, while building a platform for future** strategies in line with the policy and visions for water quality management
- **Prioritising critical concerns**, while ensuring that other issues are addressed through on-going management or monitoring for future prioritisation and action
- **Relevance at national, catchment and local scales,** while ensuring horizontal alignment across sectors and institutions at each scale
- **Provide the strategic intent and framework for actions** to be described in the implementation plans
- **Enables adaptive response** to changing circumstances and achievements based on effective on-going monitoring and evaluation.

6.1 Time frames

Focus on short to medium term timeframes, while building a platform for future strategies in line with the policy and vision for water quality management.

The NWA enables the NWRS to be developed progressively over time as well as requiring that the strategy be reviewed and updated every 5 years. This enables the NWRS to have a longer- term vision supported by short to medium term action. It also enables the strategy to be improved and updated more regularly as required, in order to be adaptive.

The IWQM Strategy as part of the NWRS will then focus critical and prioritised actions for a short to medium timeframe, whilst also providing the framework for the longer-term the actions that must be undertaken to achieve effective WQM. The implementation plan needs to be pragmatic in giving effect to the strategy in a clear, concise and measurable way.

6.2 Prioritised actions

Prioritizing critical concerns, while ensuring that other issues are addressed through on-going management and monitoring for future prioritisation and action

It is not possible to address all of the many water quality challenges simultaneously; human and financial resources as well as information and systems constraints will inhibit this. Therefore, the focus of the implementation plan must be on delivering change for prioritised challenges. This does not mean that work on other areas pertinent to water quality will not continue, but it serves to guide the allocation of human and financial resources for the 5-year period of the strategy, with the objective of building for longer term improvements.

6.3 Scale and sectors

Relevant at national, catchment and local scales, while ensuring horizontal alignment across sectors and institutions at each scale

The strategy has to be relevant between different spatial scales (transboundary, national, catchment, local), whilst also addressing the issues that are specific to certain sectors, as well as between sectors (**Figure 19**). These vertical and horizontal interfaces present an array of institutional and administrative challenges that are not easy to overcome, but are critical in ensuring effective water quality management.

Whilst the roles of different departments and organisations vary according to spatial scale and mandate, the catchment level is understood as the critical scale for managing water quality and it is the various interfaces at the catchment scale that are key in successful water quality management. As such the role of CMAs becomes an important facilitator to this end. The development of catchment management strategies then becomes a key tool to guide in the strategic, adaptive management of water quality. As such the implementation plan needs to prioritise catchment level interventions.

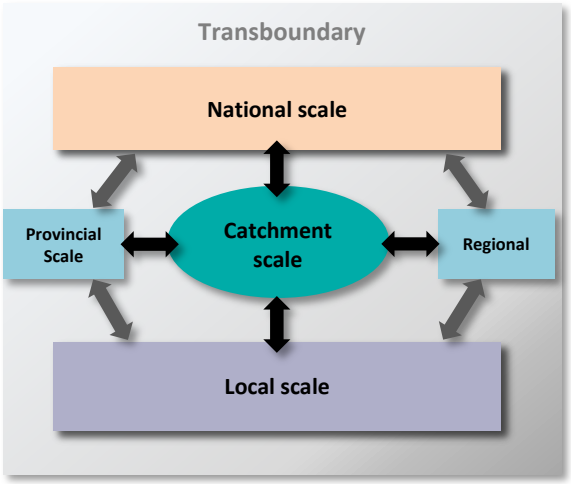


Figure 19: Scale and alignment for the implementation of the IWQMS

6.4 Supporting implementation

Provide the strategic intent and framework for actions to be described in the implementation plans

Noting the complexity of water quality management which involves dimensions of protection, planning, authorisations, monitoring, regulation and oversight, it is important to provide a purposeful and pragmatic framework that enables short term achievement towards a longer-

term purpose. In this regard, the implementation plan must have a short-term implementation focus and review cycle, and must support the use of annual performance plans in government. Of critical importance is the development of SMART (Specific, Measurable, Agreed-upon, Realistic, Time-based) targets in these plans.

6.5 Systems-based Adaptive Management

Enables an adaptive response to changing circumstances and achievements based on effective on-going monitoring and evaluation

The management of a complex socio-ecological system requires an adaptive management approach. Successful implementation of this strategy will be based on the ability of the state, particularly at the catchment level, to implement a deliberate, systems-based, adaptive management approach. This approach must be inclusive, bringing together state, private sector and civil society players on a regular basis to review and adapt plans and actions.

Adaptive management enables the refinement of strategies and plans and the refocusing of financial and human resource allocation once certain actions have been implemented or certain milestones achieved, when the expected results from implemented actions are not achieved or when new information becomes available that informs improved approaches.

The implementation plan should look to support this approach, supported by an effective monitoring and evaluation system. This needs to take place at the catchment level where the most substantial implementation of the strategy will take place. This system needs to be structured around a broader programmatic monitoring and evaluation that would include a reflection of impact upon water resources themselves.

6.6 An Implementation Approach

In many instances strategies fail due to the fact that there is significant pressure to develop and implement various solutions, without fully understanding the challenges at hand. In those instances there is often an over emphasis on placing form over function, and institutions start restructuring. This results in avoiding addressing real issues like creating improved, efficient and effective action, and that often there is not the creation of active learning environments that enable staff and stakeholders to jointly learn and develop adaptive responses (Andrews, Pritchett and Woolcock, 2012).

There is therefore a need for a change in approach in order to ensure that the trajectory of declining water resource quality is checked, that we start to create the right capacity to strengthen our management of water resources whilst working towards a longer-term vision of on-going IWQM that is supported and enabled through adaptive management approaches.

The IWQM Strategy articulates the need to show success and so it is important to be able to reflect that our efforts can improve the status of water quality in identified catchments and not be seen as theoretical or academic exercises. Therefore, the implementation plan will reflect the need to deal with the key systemic and institutional issues, whilst reflecting the need to be rooted in our catchments and show impact (**Figure 20**). Focus on the business of water quality management in this first period of implementation should be towards:

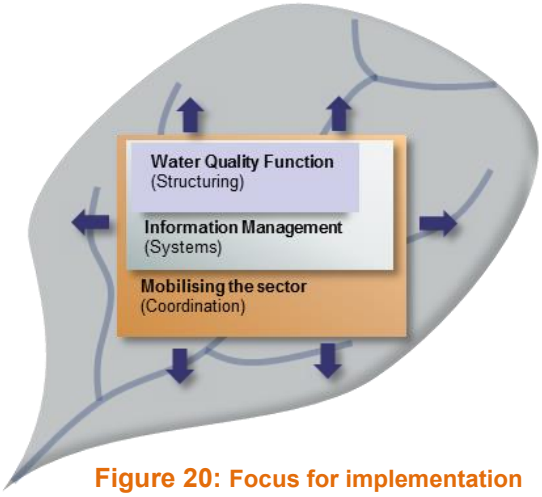


Figure 20: Focus for implementation

- **Strengthening the water quality management function:** Whilst this may involve some elements of organisational design, this would ostensibly be about resolving roles and responsibilities as well as determining accountability.

  The identification of a champion to lead the water quality management function is a priority. This will be supported by a drive to communicate the IWQM Strategy to the broader sector.

- **Improving our information management:** The need to improve our systems to support adaptive management responses is critical and whilst much effort has been applied within DWS, the need to create more integrated systems across Government is becoming increasingly important.

- **Mobilising the sector:** The need to develop a sector-wide approach underpins the philosophy of IWQM. There are, and will continue to be, questions of clarification regarding roles and responsibilities between various actors, but noting that these will be resolved through experimentation and implementation means that efforts to mobilise across a wider spectrum of actors needs to be initiated sooner than later.

  Establishing the "Community of Practice" across the sector is a significant priority in initiating and maintaining sector wide engagement.

- **Realising impact:** Nothing breeds success, like success. It is critically important that as a sector we can demonstrate that we can fix key challenges in prioritised catchments or systems. The broader water quality management approaches, mentioned above, will support these impacts on the ground.

  Priority catchments must be identified and processes initiated to address the core issues of eutrophication, salinization, urban pollution, sedimentation, and acidity/alkalinisation. The development of IWQM plans will be a priority in supporting this drive.

6.7 Priorities for Implementation

Consultation and communication with stakeholders has formed an essential part of the development of the IWQM Strategy. This has included a range of governmental and non-governmental stakeholders. Nine provincial road shows, preceded by a work-session with the DWS Provincial Office and Proto-CMA, as well as a national workshop that involved many Government Departments has provided insights as to matters of priority at the national and provincial levels for the finalisation of this IWQM Strategy and for the development of the Implementation Plan.

These priorities provide guidance as to issues that need to be addressed within the first phase of implementation of this strategy (**Table 15**) noting that it will be essential to initiate activities that require longer-term time frames to be realised.

Table 15: Identified priorities for implementation

Goal	Strategic Issue	Strategic Objective	National / Provincial Priority	Comment
Aligned Policy, Strategy and Legislation	**1:** Harmonise Policies and Strategies to Enable Improved IWQM	**1a**: Policies and Strategies impacting upon IWQM are harmonized	National	Recognising the importance of enabling more seamless governance, this longer-term process needs to be initiated. DWS internal, operational policies and strategies also require strengthening to be more inclusive of WQM issues.
	2: Legislative review and amendments to enable IWQM	**2b:** IWQM is effectively supported by other legislation	Provincial	Urban runoff and other water quality impacts from urban areas are largely controlled through municipal by-laws. There is a need to ensure that these by-laws adequately address issues around water sustainable urban designs and water quality management.
Improved Governance	**3.** Improved WQM institutional structuring	**3a:** DWS departmental structures support IWQM	National	The WQM function within the DWS and its institutions is spread across various line functions. Whilst there is a need for this to ensure good governance, there may be ways to strengthen the coordination as well as provide an aligned intent.
		3b: Inter-sector departmental structures to support IWQM	National	The need to have inter-governmental structures that enables improved coordination and reporting as well as better planning for interventions is fundamentally important to enable IWQM.

Goal	Strategic Issue	Strategic Objective	National / Provincial Priority	Comment
	4: Formalise Governance Frameworks to Support Non-Governmental Engagements	**4a**: Partnerships / stewardships established and maintained	Provincial	Whilst there are some partnerships that will be important at a national level, the importance of these arrangements at the catchment scale is a key part of enabling IWQM. Stewardships are most effective when focused upon specific catchments.
Improved, Effective and Efficient WQM Practice	**6**: Strengthen IWQM Regulation, Compliance and Enforcement	**6a**: Licencing processes streamlined	National Provincial	There are water use authorisation process and procedural issues that require attention at national and provincial level. This includes both the quality of the licence conditions as well as the timelines and information requirements that officers in catchments need to interface upon between DWS, water users and other government departments. To assist in streamlining authorisations, regulations pertaining to water quality such mandatory national waste discharge standards are required.
		6b: Targeted/ strengthened compliance monitoring and enforcement of key polluting sectors	National Provincial	Driven nationally, there is a need for a targeted programme to address priority issues. There is a need to reflect success at the catchment scale to influence behaviours. This requires a strong and coordinated partnership between national, provincial and local actors.
Innovative Finance	**8:** Fiscal support for IWQM	**SO8a:** WQM interventions are financially supported by the fiscus	National	The need to fully understand the cost of managing water quality is priority. Government then needs to develop an investment framework including innovative mechanisms to mobilise funding for sustained support to IWQM
	9: Develop Pricing and Incentive Systems that Support IWQM	**9a**: The Waste Discharge Charge System is implemented	National	The Waste Discharge Charge System has been approved and work towards implementation readiness has been undertaken. Nationally, DWS with National Treasury, need to initiate implementation, but this will require some systems issues and legislative challenges to be resolved.

Goal	Strategic Issue	Strategic Objective	National / Provincial Priority	Comment
Improved Knowledge and Information Management	**10:** Strengthen Monitoring and Information Management	**10a**: An integrated and functioning water quality monitoring network	National Provincial	Nationally driven, with provincial and local support to operationalise. The need for data is critical to enable IWQM. This data is needed by many other national and provincial departments to inform management decisions.
		10b: Information systems that are current and accessible to support adaptive WQM	National Provincial	Access to data and information at national, provincial and local levels is essential for adaptive management. Improvements in terms of systems has been significant but there is still much to do, especially with regards to inter-departmental data and information, and regarding access by non-governmental stakeholders.
	11: Build water quality and WQM Capacity through Education, Training and Communication	**11a**: Sustained capacity for Government/CMA/sector to effectively manage and support WQM through improved education and training	National Provincial	In the technical arena of IWQM the need for qualified, skilled and competent staff is dire at national, provincial and local levels. The development of this capacity does not happen rapidly, and requires structured programmes with clear targets. This cuts across sectors and various government departments. This is a matter of absolute priority and was possibly the most discussed issue during the engagements on the strategy.

6.8 Coordinating across the sector

The largest challenge for the implementation of the strategy, and indeed to the success of IWQM, will be the challenge to mobilise the sector. This strategy has articulated repeatedly how the operational policies and strategies that DWS has used to implement the NWA are in effect sound, however, DWS cannot ensure that sustainable use of the resource without the buy-in and support of the broader sector.

Noting that different Government Departments and sectors have quite different interfaces with water resources, there is a need for a differentiated approach to this mobilisation (**Table 16**). This will need to be outlined in the implementation plans that support this strategy and these will develop iteratively with time. The leading role of DWS in developing and maintaining these relationships will be critical.

Table 16: Government interfaces with IWQM

Government Departments	National / Provincial / Local	Concern	Interfaces	Strategic Objectives
Water Quality Impacting Sectors				
Agriculture, Fisheries and Forestry	N / P	• Water quality for irrigated agriculture • Impacts upon water and agricultural resources	• Policy • Planning • Regulation • Adaptive management • Monitoring and information • Capacity building	• SO1a • SO5a-b • SO6a-b • SO7a • SO10a-c • SO 11a-c
Cooperative Governance and Traditional Affairs	N / P	• Support inter-governmental cooperation • Oversight of municipal services	• Policy • Planning • Regulation • Monitoring and information • Building capacity	• SO1a • SO5a-b • SO6a-b • SO10a-c • SO11a-c
Energy	N	• Water quality of water used in power generation i.e. largely for cooling purposes	• Planning • Regulation	• SO5a-bb • SO6a-b
Environmental Affairs	N / P	• Environmental impact assessments • Protection of specific sites of importance • Compliance with SEMA legislation	• Policy • Planning • Regulation	• SO1a • S05a • SO6a-b
Health	N / P	• Water quality of domestic supplies (urban and rural supplies)	• Planning • Regulation • Monitoring and information • Build capacity	• SO6a-b • SO10a-c • SO11a-c
Human Settlements	N / P / L	• Water quality of domestic supplies • Sanitation	• Planning • Regulation	• S05a • SO6a-b
Mineral Resources	N / P	• Planning mining developments • Impact of mining developments	• Planning • Regulation • Adaptive management • Monitoring and information	• SO5a-b • SO6a-b • SO7a • SO10a-c
Municipalities	L	• Bylaws • Water quality from industrial discharges • Stormwater runoff • Municipal discharges from WWTW	• Policy • Planning • Regulation • Adaptive management • Monitoring and information	• SO1a • SO5a-b • SO6a-b • SO7a • SO10a-c
Public Enterprises	N	• Oversight of Public Entities adherence to environmental policy and regulation	• Regulation • Monitoring and information	• SO6a-b • SO10a-c

Government Departments	National / Provincial / Local	Concern	Interfaces	Strategic Objectives
Rural Development and Land Reform	N	• Water quality for irrigated agriculture	• Policy • Planning	• SO1a • SO5a-b
Tourism	N / P / L	• Water quality of domestic supplies • Environmental health	• Planning • Regulation	• S05a • SO6a-b
Trade and Industry	N / P / L	• Water quality for industrial use purposes • Water quality of industrial discharges	• Policy • Planning	• SO1a • SO5a-b
Water and Sanitation	N	• Sustainable water use management and development • Sector coordination • Sector development	• Policy • Governance • Structuring • Planning • Regulation • Adaptive management • Financial support • Monitoring and information • Building sector capacity	• All SOs
Enabling Improved Water Quality				
Basic Education	N / P	• Broader societal awareness • Early career guidance	• Building sector capacity	• SO11a-c
Communications	N / P	• Broader societal awareness	• Building sector capacity	• SO11a-c
Higher Education	N / P	• Technical career guidance	• Building sector capacity	• SO11a-c
National Treasury	N / P	• Good governance • Financial resources to support IWQM	• Policy • Governance • Structuring • Financial management	• SO1a • SO3a-b • SO5a-b • SO8a • SO9a-b
Planning, Monitoring and Evaluation	N	• Oversight of strategic sector achievements	• Policy • Governance • Structuring • Financial management	• SO1a • SO3a-b • SO5a-b • SO6a-b • SO8a • SO9a-b
Science and Technology	N	• Support water research and technology development	• Cross cutting projects that touch all aspects	• All SOs

There are different ways in which these coordination committees could be developed. In the first instance the national matters of policy, legislation, regulation and key systemic issues could be coordinated through a national coordinating committee, whilst the more operational aspects of resource management and development would be handled at the provincial level working through the DWS Proto-CMA and would involve the provincial departments as well as the municipalities. It would be useful for the provincially based committees to report on matters so that key policy and regulatory challenges are swiftly resolved, as well as providing an opportunity for the national committee to gather lessons learned that may influence policy positions or day to day practice.

These structures, their formats and modalities will be developed progressively, and this will be articulated in the implementation plan.

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Rod Bulman	Umsunduzi Catchment Management Forum
Thulani Mnyandu	Umzinyathi District Municipality

Regional Workshop
Gauteng

D Rama	ACMP
Chris Boshoff	Afri Forum
Marcus Pawson	Afri Forum
Wayman Kritzinger	Agri SA
Vinesh Dilsook	Anglo American Platinum
Anthony Duigan	Armour
Matome Makwela	Chamber of Mines
Nhlanhla Baloyi	City of Johannesburg Metropolitan Municipality
Chris Callaghan	Cleanstream
James Dabrowski	CSIR
Vhahangwele Masindi	CSIR
Lesego Mazibuko	Department of Energy
Carol Hooghiemstra	Digby Wells
Alexra Hlengani	DWS
Moses Mukoto	DWS
Nosibusiso Mfuywa	DWS
Sazi Mthembu	DWS
Barbara Kalembo	DWS Gauteng Provincial Office
Hellen Mathedimosa	DWS GPO
Faith Khosa	DWS GRO
Sivashni Naicker	DWS Groundwater Planning
Isa Thompson	DWS National Water Resource Planning
Seef Rademeyer	DWS National Water Resource Planning
Nolusindiso Jafta	DWS REMP
Dikeledi Baloyi	DWS Resource Protection and Waste
Kama Meso	DWS Resource Protection and Waste

Philani Khoza	DWS Water Ecosystems
Betty Nakene	DWS Water Quality
Busiswe Mudziri	DWS Water Quality
Depa Siphokazi	DWS WIP
Sam Kotsoane	Fezile Dabi District Municipality
Bertus Fourie	Galeyo Environmental CC
Joanna Goeller	Gold Fields
BV Twala	Ikamva
Martin van Veelen	Iliso Consulting
Charlie Crawford	Independent facilitator
Louis Naudé	Jones & Wagener
Alistair Collier	Lehalelo Water User Association & Olifants Joint Water Forum
Thihanedzwi Ratshibvumo	Petra Diamonds (Cullinan)
Warrick Ross	Re-Solve
Thys Kapp	Rowing SA & Usapho Consulting
Karl-Heinz Riedel	Sasol Group Technology
Matsidiso Thelingwani	Sephaka Cement
John Dini	South African National Biodiversity Institute
John Annandale	University of Pretoria
Gavin Snow	University of the Witwatersrand
Mogale Matseba	Vaal River CMA
Victor Nkuna	Vaal River CMA
Bonani Madikizela	Water Research Commission

Regional Workshop
Mpumalanga

Litshani Magoba	DWS
Nonceba Noqayi	DWS CME
Sanantna Saayman	DWS CME
Masala Nemubula	DWS Environmental Officer
Nomadiba Lamani	DWS Environmental Officer
Percy Ratombo	DWS Environmental Officer
Samuel Maliaga	DWS Environmental Officer
Mercy Ralushai	DWS Geohydrology
Patricia Mdhlovu	DWS Head Office
Deon Joubert	DWS Hydro Mpumalanga
Adam Ramalisa	DWS IE WQM
Portia Munyai	DWS IE WQM
Marcia Macapatle	DWS Mpumalanga
Sydney Nkuna	DWS Mpumalanga
Rasekhwela Kgaogela	DWS Strategy Coordination
Phindi Mlangeni	DWS SWSS (Pretoria)
Khanyiso Nkumanda	DWS Water Policy
Nnzumbeni Tshikalange	DWS WQM
Lutho Totsa	Eskom
Nthabiseng Ntoampe	Eskom
Debbie Turner	Irrigation Boards
Nancy O'Farrell	Irrigation Boards
Ronelle Putter	Irrigation Boards
Caroline Tlowana	IUCMA
Mduduzi Nkuna	IUCMA
Busi Mahlangu	IUCMA Control Environmental Officer
Thabo Cecil Rasiuba	IUCMA Control Environmental Officer
Adolph Mbetse	IUCMA WQM
Rofhiwa Ramunenyiwa	IUCMA WQM
Stephan Kitching	Jaco K Consulting
Ronel Oelofse	Kaap River Irrigation Board

Nokwanda Mhlanga	KOBWA
Sakhiwe Nkomo	KOBWA
Martin Slabbert	Komati River Irrigation Board (KRIB) & LRIB
Robert Davel	Mpumalanga Agri
Betty Mnguni	Olifants Proto-CMA
Hloniphekile Ayanda Madonsela	Olifants Proto-CMA
Mmadi Moloto	Olifants Proto-CMA
Mokgadi Maloba	Olifants Proto-CMA
Musa Lubambo	Olifants Proto-CMA
Isaac Tlagadi	Olifants Proto-CMA Environmental Officer
Linda Desmet	Palabora Copper
Thabang Mokgatle	Quality Engineering
Eddie Riddell	SANParks
Robin Pietersen	SANParks
Guiseppe Sappa	Sapienza University, Rome
Mouritri Bezbieri	Sapienza University, Rome
Yolanda Oosthuizen	SEMBCORP Silulumanzi

Regional Workshop
Limpopo

Robert Bologo	
Faith Mugivhi	ASA Metals
Kai Petty	AvDE Consulting
MP Lekoane	COGHSTA
Thembinkosi Ndou	De Beers
Ramaano Masibigiri	DWS CAO
Marencia Mashilo	DWS CME EOSP
NS Mello	DWS IGR
Motlogonang Maeosele	DWS IOM
Adolph Maredi	DWS Limpopo
Joseph Phasha	DWS Limpopo
Ben Sengani	DWS LPNW Proto-CMA
Damaries Thotse	DWS P&I
Moses Malete	DWS P&I
Regina Kganyago	DWS Regional Office
Kenneth Makhubele	DWS Strategy
Margaret Matide	DWS SWSS
Molly Maluleke	DWS Water Sector Regulation
Mpho Sinthumule	Eskom
Tshiphiwa Matamela	Eskom
Anthony Dikgale	Exxaro Coal Mine
Baloyi Khanamola	IVA Plats
Ansia de Jager	Joint Water Forum
Jakes Louw	Joint Water Forum
Solomon Monyepao	LDARD
A Letsoalo	LEDET
MC Mphahlele	LEDET
PD Mathole	LEDET
Lebo Sebola	Lepelle Northern Water
Lekwato Marakalala	Lephalale Municipality
Ngoako William Moremi	Lephalale Sub-catchment
Nkele Lodgina Ditsela	Lephalale Sub-catchment
Andre Venter	Letaba Water User Association
Manamela Lehabo	LIM 368
Mokgadi Thobejane	LIM 368
Sandra Ramaphala	LIM 368
Matshamaite Gilbert	Lower Mogalakwena Sub-catchment
ER Kutama	Luvhuvhu CMF

MIR Bohego	Luvhuvhu CMF
Nebonde Dominick	Makhado Catchment
Thema Maishibe	Mogalakwena
Hlengwane Joseph Nkhona	Mogalakwena CMA
Calvin Shiburi	Mogalakwena Mine
Richard Nemaungani	Mutale CMA
Patrick Muthelo	Mutale CMF
Modikwa Motibane	NAFU
Doyoyo Farani	Naledzi Environmental Consulting
Matsenene Thendo	Naledzi Environmental Consulting
Nembahe Aluweni	Naledzi Environmental Consulting
Ramathieledza Ronald	Naledzi Environmental Consulting
Shitlhangu Aaron	Naledzi Environmental Consulting
Sithabusiwe Ncube	Naledzi Environmental Consulting
Ndou Africa	Naledzi Water Works
Sepadi Motau	North West Proto-CMA
CJ Emmerich	Nzheleke/Nwandi CMF
Moses Mudau	Nzheleke/Nwandi CMF
Alidzulwi Mudau	Office of the Premier
Salome Sathekge	Polokwane Municipality
Letsatsi Chuene	Sand Catchment Management Forum
Joseph Sara	University of Limpopo
Kris Bal	University of Limpopo
Freeman Chauke	Vele Colliery
Jacques Willemse	Vhembe WUA/ Werpe Farmers Union

Regional Workshop
Western Cape

Carolyn Howell	ARC
Reckson Mulidzi	ARC
Nico Rossouw	Aurecon
Patrick van Coller	BGCMA
Phumla Ngqumshe	Bitou Local Municipality
Richard Nell	City of Cape Town
Linda Rossouw	Consultant
Jonas Mphepya	DEA
Annabel Marian Horn	DEA&DP (BRIP)
Juan Hugo	DEA&DP (BRIP)
Marlé Kunneke	DEA&DP (BRIP)
Wilna Kloppers	DEA&DP (PCM)
Izak Toerien	Department Local Government
Sibusiso Maseko	DWS Institutional Oversight HO
Felicia Nemathaga	DWS RPW Mines
Michiel Meets	Eco-Owl Consulting
Bridget Fundikwa	Green Cape
Gareth McConkey	Jantech CC
Irene Waller	La Bri
Jiahnah Göbel	Living Lands
Elizabeth Were	See Saw (probably)
Adriaan Kurtz	Stellenbosch Municipality
Esmari Steenkamp	Swartland Municipality
Johan de Jager	Vin Pro
Rudolph Rescher	Western Cape Department of Agriculture
Lydia van Rooyen	Wildlands
Adriaan Oelofse	Winetech
Anel Andrag	Winetech
Derick Kellerman	Xylem

Regional Workshop
North West

Anna Malemela	DWS
Jenny Evans	DWS
Kevin Khoze	DWS
Lillian Siwelane	DWS
Mahadi Mofokeng	DWS
Phillip Tjale	DWS
Sebenzile Ntshangase	DWS
Sharlotte Tema	DWS
Tshepo Mathebe	DWS
Kentse Mathiba	DWS Head Office
Ndivho Mphuma	DWS Limpopo North West Proto-CMA
Lucky Motsoeneng	Glencore BHK
Lelanie du Preez	Glencore Rhovan Operations
Lynette Tungwane	Glencore Western Mine
Keneilwe Makwela	Glencore Western Mines
Tania Rademeyer	Impala Platinum
Abram Semata	Land Bank
Beatrice van der Merwe	Marico River Conservation Association
Irene van der Merwe	Marico River Conservation Association
Shalene Janse van Rensburg	Midvaal Water Co
Mothusi Mafatshe	Pilanesberg Platinum Mines
Peter Lentsoane	Platmin SA
Tshepo Dire	RB Plats
Stenly Makuwa	Tlokwe City Council
Thuli Letseka	Tlokwe City Council
Hlulani Chauke	Union Mine Anglo American
Mmalenyalo Moeng	Union Mine Anglo American

IWQM National Symposium

Tswelopele Pida	African Rainbow Minerals
Hannes De Wet	Agri MP
Janse Rabie	Agri SA
Janse Rabin	Agri SA
Mark Dent	AWS
Misaveni Ngobeni	BNT
Melissa Fourie	CER
Amanda Mkhonza	CER
Johan Kapp	CRM
Sibonginkosi Maposa	CSIR
Matome Mathetha	CSIR
Edwin Mametja	DAFF
Nomvuzo Mjadu	DAFF
Takalani Sithi	Department of Tourism
Joan Arrikum	DPE
Andretta Tsebe	DPE
Phawen Maluleke	DRDLR
Magamase Mange	DST
Tsakane Baloi	DWS
Wilna Bezuidenhout	DWS
Eustathia Bofilatos	DWS
Marie Brisley	DWS
Laura Dotse	DWS
Fanus Fourie	DWS
Nwabisa Fundzo	DWS
Johan Greyling	DWS

Rachalet Grobbelaar	DWS
Geert Grobler	DWS
Jackie Jay	DWS
Millicent Kabwe	DWS
Marius Keet	DWS
Kwaila Lamola	DWS
Knowledge Langa	DWS
Musa Lubambo	DWS
Maduvha Maseda	DWS
Patrick Mlilo	DWS
Zama Mncwabe	DWS
Ndileka Mohapi	DWS
Lerato Mokoena	DWS
Lebo Mosoa	DWS
Thobile Mthiyane	DWS
Anet Muir	DWS
Mxolisi Mukhawana	DWS
Moses Mukota	DWS
Namisha Muthraparsad	DWS
Beason Mwaka	DWS
Noxolo Ncapayi	DWS
Tovhowani Nyamande	DWS
Bongizenzo Nyawo	DWS
Rivashi Panday	DWS
Sputnik Ratau	DWS
Isa Thompson	DWS
Nnzumbeni Tshikalange	DWS
Itan Tshohale	DWS
Jurgo Van Wyk	DWS
Niel Van Wyk	DWS
Fred Van Zyl	DWS
Pieter Viljoen	DWS
Barbara Weston	DWS
Luvuyo Zigana	DWS
Anne Kilian	Engineering News
Ian Midgley	Eskom
Lutho Totsa	Eskom
Mariette Liefferink	FSE
Gabi Khumalo	GCIS
Annah Ngope	Glencore
Lynette Tungwane	Glencore
Joanna Goeller	Gold Fields
Zeveli Masuku	Govan Mbeki Municipality
Victor Munnik	Independent
Marcus Selepe	IUCMA
Stenly Makuwa	Johannesburg Water
Bertus Bierman	Lebalelo WUA
Shalene Janse van Rensburg	Midvaal Water
Marina Krüger	Midvaal Water
Robert Davel	Mpumalanga Agri
Iqbal Mohamed Ali	National Treasury
Sara Bopape	NTD
Amanda Nyingwa	Pegasys
Guy Pegram	Pegasys
Traci Reddy	Pegasys
Barbara Schreiner	Pegasys
Derek Weston	Pegasys
Francois Van Wyk	Rand Water
Morakane Madiba	Rhodes University
Tally Palmer	Rhodes University

Heather Booysen	Samancor
Shane Laubscher	Samancor
Bongani Mtsweni	Samancor
David Schaub-Jones	SeeSaw
Marilyn Govender	South African Sugar Association
Vukosi Tinghitsi	South Deep Gold Mine
Michelle Proude	SWPN
Nick Tandi	SWPN
Tinashe Mukuta	University of Pretoria
Willem Hazewindus	WESSA & ARMOUR
Nonhlanhla Kalebaila	WRC
Robyn Arnold	Write Connection
Samir Randera-Rees	WWF
Klaudia Schachtschneider	WWF

Capacity Building Training Sessions

Anet Muir	Director: CM Institutions
Sizani Moshidi	Director: CM Agriculture
Elijah Mogakabe	SM: RQIS
Siboniso Mkhaliphi	Director: CM Agriculture
Mxolisi Mukhawana	PM: D.A.M Strategy
Tovho Nyamande	Scientific Manager: Information Programmmes
Pieter Viljoen	SM: WQP
Jackie Jay	Water Quality Planning: Central
Jurgo van Wyk	Water Quality Planning: Central
Geert Grobler	Water Quality Planning: East
Lebo Mosoa	Water Quality Planning: North
Yakeen Atwaru	Director: Reserve Determinations
Raquel Nosie Mazwi	Director: RPW
Desmond Mutshaine	RPW
Thivhafuni Nemataheni	RPW
William Mosefowa	RPW
Rendani Ndou	RPW
Malise Noe	RPW
Shibambu Steven	NC: Upington
Zethu Makwabasa	KZN: Pongola-Umzimkulu Proto-CMA
Renelle Pillay	KZN: Pongola-Umzimkulu Proto-CMA
Marcus Selepe	MPUM: Inkomati-Usuthu CMA
Samantha Saayman	MPUM: DWS (Inkomati)
Mercy Ralushai	MPUM: DWS (Inkomati)
Dephney Kabini	FS: DWS
Landile Jack	EC: DWS
Melissa Lintnaar-Strauss	WC: DWS
Nelisa Ndobeni	WC: DWS
Lillian Siwelane	NW: DWS
Petrus Venter	NW: DWS
Dennis Mtsweni	DWS
Lerato Mbotja	DWS: BFN
Mpho Mabuda	DWS
Machaba Motlatso	DWS
Ramahuma Livhuwani	DWS
Mathebe Tshepo	DWS
Nicole Vosloo	DWS: FS
Ramaremela Kedibone Peggy	DWS: FS
Thwala Mmapheto	DWS
Sebenzile Ntshangase	DWS: NW
Mokoena Lerato	DWS: BFN
Marie Brisley	DWS
Herbert Kutama	DWS

Kenneth Masindi	DWS
Sibusiso Maseko	DWS
Isaac Ramukhufa	DWS
Michael Munzhelele	DWS
Amanda Nyingwa	Pegasys
Derek Weston	Pegasys
Traci Reddy	Pegasys
Barbara Schreiner	Pegasys

APPENDIX B: SUMMARY OF ROOT CAUSES OF PRIORITISED WATER QUALITY ISSUES

Table A-1: Summary of Root Causes of prioritised water quality issues

WATER QUALITY ISSUE	DRIVER	ROOT CAUSE
Eutrophication	▪ Wide-spread discharge of raw or inadequately treated municipal sewage. ▪ Raw sewage overflows. ▪ Diffuse runoff and drainage from fertilized cultivated land.	**Point Source** ▪ Dysfunction in many municipalities, manifested by any or all of the following shortcomings: inadequate financial and operational planning, inappropriate financial prioritisation, lack of pro-active infrastructure maintenance, inadequate problem reporting/response systems, lack of appropriate technical personnel and financial shortfalls. ▪ Inadequate cooperative governance and cross-regulatory interfaces between DWS and the affected municipalities, the Department of Cooperative Governance and Traditional Affairs (COGTA) and various other government institutions. **Diffuse/Non-Point Source** ▪ Inappropriate farming practices, such as over-fertilisation, inappropriate tillage, over-irrigation and encroachment on or destruction of riparian buffer zones and wetlands. ▪ Inadequate cooperative governance and cross-regulatory interfaces between DWS and the National Department of Agriculture, Forestry and Fisheries (DAFF) and its provincial counterparts and various other government institutions hinders the management of these phenomena.
▪ **Salinisation**	▪ Diffuse drainage and wash-off of rainfall-mobilised natural in-situ salts in soils. ▪ Diffuse sub-surface irrigation return flows. ▪ Mine water drainage and atmospheric deposits.	▪ Inappropriate farming practices, such as inappropriate dry-land tillage, inappropriate dry-land crops, over-irrigation, inappropriate irrigation technology, lack of intercepting drainage and related evaporation pond infrastructure, and inappropriate irrigation water conveyance practices. ▪ Inadequate cooperative governance and cross-regulatory interfaces between DWS and DAFF and its provincial counterparts. ▪ Acidic atmospheric deposits: inappropriate licence conditions for Eskom and Sasol; lack of monitoring and reporting of their own pollution loads; lack of enforcement; and inadequate cooperative governance and cross regulatory interfaces between Eskom, Sasol, the National Energy Regulator, DEA and DWS.
Acidification and alkalinisation	▪ Discharge into surface waters from abandoned mine shafts /	▪ Water resource acidification: historical and recent lack of precautionary planning, regulation and enforcement by the relevant authorities, and of ring-fenced rehabilitation financing for the necessary rehabilitation by the relevant

WATER QUALITY ISSUE	DRIVER	ROOT CAUSE
	▪ Contaminated seepage, leaching, runoff and spills. ▪ Wash-off and leaching of widespread acidic atmospheric deposits.	mining companies. ▪ Heavy metals contamination and related issues: lack of compliance by mines and thermal power stations of their licence conditions; lack of or inappropriate licence conditions; lack of monitoring and reporting of their own pollution loads; inadequate enforcement capacity in the national and provincial Environment Affairs departments and DWS; and inadequate cooperative governance and cross-regulatory interfaces between the Department of Mineral Resources (DMR), the National Energy Regulator, DEA and DWS. ▪ Acidic atmospheric deposits: inappropriate licence conditions for Eskom and Sasol; lack of monitoring and reporting of their own pollution loads; lack of enforcement; and inadequate cooperative governance and cross regulatory interfaces between Eskom, Sasol, the National Energy Regulator, DEA and DWS.
Urban Pollution Runoff	▪ Storm-water runoff from formalised pervious and impervious urban areas. ▪ Sewer overflows into storm-water conduits. ▪ Storm-water runoff from less-formalised dense peri-urban or rural human settlements.	▪ Dysfunction in many municipalities. ▪ Lack of or inappropriate infrastructure, inadequate financial and operational planning, inappropriate financial prioritisation, inadequate problem reporting/response systems, lack of pro-active infrastructure maintenance, lack of appropriate technical personnel and financial shortfalls. ▪ Inadequate cooperative governance and cross-regulatory interfaces between the affected municipalities, DWS, and (COGTA).
Sedimentation	▪ Anthropogenically-driven erosion of surface soils of catchments and of stream/river banks.	▪ Erosion: inappropriate crop cultivation and silviculture practices; over-grazing; destruction or encroachment of riparian vegetation buffer zones; destruction or encroachment of wetlands; physical modification of river channels and banks; excessively dense less-formalised human settlements; careless construction activities; amongst others. ▪ Lack of suitable qualification criteria for farmers entering the field, combined with inadequate support from Government and the sector. ▪ Inadequate cooperative governance and cross-regulatory interfaces between DWS and DAFF and its provincial counterparts, DEA and its provincial counterparts, and various other government institutions.

APPENDIX C: WATER QUALITY MANAGEMENT SWOT ANALYSIS

Table A-2: Summary of WQM SWOT Analysis

INTERNAL TO DWS AND CMAs	
STRENGTHS	**WEAKNESSES**
Legal/Regulatory: 1. Sound statutes, policies, strategies and regulations: Constitution, NWA, NWRS, CMSs, etc. 2. Fully developed Waste Discharge Charge System (WDCS) - ready for implementation. 3. "New" Water Act – strengthen focus on WQM. 4. e-WULAAS (Electronic Water Use Licence Application and Authorisation System) is active – Client can upload data directly and is aimed at enabling DWS to keeping better records of water use authorisations. 5. Incentive based regulation at municipal level, e.g. Blue- , Green- and No-Drop accreditation, is now well-established. 6. Sound mine water regulations. **Institutional – Structural:** 7. Improved implementation of NWRS2 8. CMA establishment process recently prioritised. 9. Strong water institutions – e.g. TCTA, Water Boards, Regional Water Utilities.	**Legal/Regulatory:** 1. Inappropriate water use licence conditions. 2. Inaccurate or out-of-date water use licence database 3. "New" Water Act – non-transparent process hitherto **Institutional - Structural:** 4. The WQM structure of the Department too fragmented – needed: a single "centre of excellence". 5. WQM roles and responsibilities not clear, no clearly stated goals, no dedicated WQ programme with reporting. 6. Inadequate or insufficient enforcement, conviction and punitive measures for non-compliance due to inadequate integration in DWS - enforcement relies heavily on functions of / information gathered by other DWS sections. **Institutional – Management:** 7. Slow implementation of the NWRS. 8. Failure to implement the WDCS. 9. Inadequate implementation of sound policies and strategies. 10. Slow CMA establishment processes until recently. 11. Inadequate understanding of WQM at senior management level. 12. Insufficient succession planning and gaps created by loss of both experienced and recently trained staff. 13. Lack of a customer service orientation in some regional offices.

INTERNAL TO DWS AND CMAs	
STRENGTHS	**WEAKNESSES**
Institutional – Processes: 10. Sound WQM instruments - guidelines, protocols, manuals, strong licensing process. 11. IWRM is a central competency in DWS and CMAs. 12. Classification and RQOs development in progress and RQO implementation will be facilitated by the DWS project on operationalising RDM. 13. IWQMS project has been initiated. 14. New integrated NWIS system being developed. 15. Ability of DWS to mobilise in times of water crisis. **Institutional – Capacity:** 16. Pockets of scientific and management excellence in DWS and CMAs. 17. Increasing capacity in CM&E at national level. 18. Internal WQM training course has been partially re-instated. 19. Investment in relevant graduate training programmes. 20. Alignment of DWS bursaries with scientific implementation needs of the Department. 21. Learning Academy for graduate trainees. 22. Continuity of research funding by WRC relevant to WQM. **Technical:** 23. Strategic spatial coverage of RSA by DWS monitoring network. 24. Project underway to identify localised monitoring gaps and to prioritise their resolution. 25. DWS and CMAs mostly have reasonable water quality data to	14. DWS currently does not have active contracts with a number of private laboratories. 15. Inadequate delegations within DWS with regard to WQ - supresses innovation. 16. Poor staff morale, leading to decreasing productivity. 17. Long delays in decision-making at most senior levels in DWS. 18. Lack of senior management understanding of integration necessities for WQM and their costs. 19. Reduced resourcing of WQ monitoring – leading to backlogs at DWS's RQIS laboratory. 20. Lack of alignment of functions between National and regional/provincial DWS and/or CMAs. 21. Poor alignment of CD Business Plans and NWRS2. 22. Inadequate communication by senior DWS leadership to officials. 23. Repeated restructuring – hampers functionality and demoralises staff. 24. Lack of leadership by DWS in the Water Sector and poor promotion of /understanding of the importance of sectoral partnerships with DWS. **Institutional – Processes:** 25. Historical lack of alignment/interfaces of current IT infrastructure (WARMS/SAP/WMS/NWIS) – inadequate regional implementation. 26. Verification and validation projects do not include water quality information. 27. Lack of clarity regarding respective WQM roles and responsibilities at catchment level of DWS National, DWS Provincial/Regional, CMAs and Catchment Forums. 28. DWS functionality affected by a blurred mandate of having to be both referee and player in WQM, leading to conflicting strategic or tactical approaches. 29. Deficient implementation of RQOs - currently no guidelines for the implementation of RQOs. 30. Inadequate knowledge input regarding WQM, as well as inadequate project/ programme management. 31. Inadequate stakeholder databases for Classification and RQO determination processes. 32. Uneven and silo-like engagement of stakeholders. 33. Lack of formal policies and guidelines on how DWS should deal with innovative technologies,

INTERNAL TO DWS AND CMAs	
STRENGTHS	**WEAKNESSES**
support decision-making. 26. Growing appreciation among WR planners and managers that water quality and quantity should be managed as an integrated whole. 27. Sound chemical analysis laboratory facilities, accredited by SANAS, at national & regional levels. **Cooperative Governance:** 28. Willingness by DWS officials to collaborate with other Government and private sector institutions in support of WQM. **Social:** 29. Positive public perception of DWS.	e.g. what criteria should be met in terms of acceptable risk, or what stance DWS should take towards new technologies. 34. Water quality guidelines and procedures are becoming outdated and have not been reviewed. 35. Lengthy procurement processes to appoint accredited private labs to support regional office sampling. 36. Inadequate network / system for learning-sharing of experience. 37. Problematic procurement processes prevent initiation of crucially needed studies. **Institutional – Capacity:** 38. Absence of DWS's internal WQM training course during recent years. 39. Insufficient or unsuitable technical and scientific capacity in DWS (national and regional) and CMAs. 40. CM&E function at provincial/regional level not sufficiently staffed. **Technical:** 41. Localised gaps in DWS strategic monitoring network. 42. Water quality dimensions of planning often poorly considered in water resource planning. 43. Inadequate alignment between WRC research and DWS priorities. 44. Monitoring and data increasingly insufficient to undertake effective management of the resource. 45. Groundwater quality not adequately monitored and managed. 46. Water quality data not available on WMS- therefore difficult to access. 47. Inaccurate entering of WQ-related data into DWS's systems. 48. Insufficient accredited laboratories in certain strategic regions. 49. Unfriendly data entering in current systems - officials could be using cell-phones to load data instead of having to come into the office to download / upload data. 50. Long-term streamflow gauging stations and sampling sites being de-commissioned.

INTERNAL TO DWS AND CMAs	
STRENGTHS	**WEAKNESSES**
	51. Only one laboratory available for analysis of certain key constituents. 52. Inadequate monitoring of emerging problematic water quality constituents. **Cooperative Governance:** 53. DWS's dependency on other departments to jointly regulate and on regulatory mechanisms and tools developed by those departments. 54. DWS's current mandate precludes direct intervention in instances of dysfunctional municipalities or failing water services. 55. Insufficient communication by DWS to the public regarding pollution issues; lack of integration of communication initiatives relevant to WQM with those of other Government Departments. **Political:** 56. Inadequate political support for WQM caused by multiple changes in DGs and Ministers during recent years. 57. Lack of political will to fundamentally change approaches or tactics that have not yielded water quality improvements. 58. Perception in DWS management that consultants should not be needed and that all work should be done in-house. **Social:** 59. Lack of trust in recent and current water quality monitoring data and DWS monitoring. 60. Forums lack sufficient engagement support from DWS. 61. Confused public perception of WQ-related mandates – contributed to local government's neglect of WWT functions.

EXTERNAL TO DWS AND CMAs	
OPPORTUNITIES	**THREATS**
Legal/Policy/Regulatory: ○ Alignment of measures under NEMA, CARA, MPRDA and NWA to support WQM. ○ "New" Water Act – opportunity to strengthen focus on WQM. ○ DWS to promote institutional/legal framework to intervene in failing water and sanitation functions at municipalities with a lead by COGTA and National Treasury. ○ Water policy - currently under review. ○ Establishment of integrated regulatory water monitoring committees. ○ Influence SADC processes/agreements re WQM. **Cooperative Governance / Partnerships:** ○ Renewed government focus on cooperative governance. ○ Integration of monitoring and sharing of resources relevant to WQM through collaboration among government institutions. ○ Water stewardships/ CEO Water Mandate – Alliance for water stewardship has developed standards. ○ Involvement of private sector to solve water quality problems through a dynamic sector-based programme. ○ Incentivise water users, industries and businesses to reduce water pollution. ○ On-going DWS / CMA engagement of sectoral and social stakeholders and partners and promoting the concept of joint custodianship of WQM.	**Legal/Policy/Regulatory/Mandates:** 1. Lack of law enforcement by municipalities in cases of water quality pollution. 2. Municipalities ignore effluent licence conditions – lack of enforcement by DWS. 3. Overlaps/confusion of statutory/regulatory/oversight mandates that affect WQM. 4. Water policy - currently under review. 5. "New" Water Act – non-transparent process hitherto. 6. Impacts of international trade agreements on WQM. **Institutional:** 7. Dysfunction in many municipalities. 8. Political uncertainty / instability at local government level - affects human and financial resources. 9. Decision-making paralysis at senior levels in non-DWS government institutions relevant to WQM. 10. CMAs not adequately prepared to deal with competing interests, e.g. mining and water are both strategically important for development in a region. 11. Susceptibility to seek quick fixes among senior managers in government institutions relevant to WQM. 12. Sustainability of water institutions, such as CMAs and Regional Water Utilities. 13. Lack of a dedicated facility external to DWS that can take the lead in water quality monitoring and reporting. **Cooperative Governance / Partnerships:** 14. Fragmented or absent cooperative governance regarding WQM between DAFF, DMR, DEA, DTI, COGTA, DHS, provincial and local governments and DWS. 15. Inadequate resourcing (human and financial) of cooperative governance mechanisms. 16. Inadequate cooperative governance between Government Departments (e.g. DMR, DEA and

EXTERNAL TO DWS AND CMAs	
OPPORTUNITIES	**THREATS**
Planning Processes: ○ National Development Plan (NDP). ○ WSDPs and IDPs – need to give WQM priorities prominent consideration. ○ Sustainable Development Goal (SDGs) actions given RSA's signed commitment; e.g. use of SDGs to influence IDPs. ○ Climate Change – raises the profile of WRM, including WQM. **Funding:** ○ Green Fund/Climate Funds - DBSA initiative to investigate issuing of water bonds. ○ NBBN and other investments in ecological infrastructure; SANBI's ecological infrastructure directorate funds eco-infrastructure critical for WQM. ○ Financial incentives for water re-use. ○ Financial incentives (including donor funds) for municipalities to maintain declared targets for WQM. ○ Economic down-turn - WQM institutions to be more effective with spending, finding innovative ways of treating water and seek alternative sources of funding. **Social:** ○ Organised civil society activism - engaged public can contribute to monitoring and management of WQM. ○ Improved and integrated multi-institutional WQM awareness campaigns - lead by DWS. ○ Improved and supported Civilian Science, e.g. Adopt-a-River –	DWS) regarding licence conditions. 17. Inadequate buy-in to the new IWQMS by relevant senior officials in DAFF, DMR, DEA, DTI, COGTA, DHS, provincial and local governments, organised agriculture, Chamber of Mines. 18. Lack of macro-strategy by DWS to foster understanding among water user sectors of importance of joint custodianship of the resource and partnerships with DWS and CMAs. 19. Confusion about water governance set-up and lack of understanding of the WQM function among relevant government institutions - leading to poor coordination and/or conflicting strategic approaches – impacts WQM negatively. **Planning Processes:** 20. Increased resource pressure from economic and social development drivers (linked to NDP) – focus on economic growth (short-term) versus sustainable growth (long-term). 21. Inadequate coordination between government development planning functions and National Treasury. 22. Unclear impacts on Water Quality by climate change (pathogens, flooding, disaster management). 23. Fragmented approach to planning – national, regional and municipal planning lacks integration. **Funding:** 24. Lack of sustainable financial models for local government, leading to inadequate funds to maintain WWTWs. Alternatively, the financial models may be sufficient but there is a lack of political will to use them / address the financial provisioning requirements. 25. Current economic downturn - impacts finances available for WQM - impacts of poorer Water Quality on economic productivity. 26. Mining industry has been in serious decline in recent years – not amenable to investing in WQM, regardless of the Green Credits that might accompany such investments.

EXTERNAL TO DWS AND CMAs	
OPPORTUNITIES	**THREATS**
typically used to spot major problems that need urgent attention, e.g. spills, illegal activities. ○ Drought and other water-related crises, such as pollution events – mobilise political attention, raise profile of water management and engender innovative approaches to support WQM. ○ Use of social media by DWS and CMAs to mobilise public knowledge banks and public sense of custodianship. **Technical:** ○ Re-mining slimes dams and centralising slimes disposal frees up land for further development. ○ Re-use of and extraction of beneficial products from polluted water. ○ Introduce enforced metering of all water abstractors. ○ Independent water producers – "smart" solutions. **Capacity:** ○ Further research on IWRM implementation in South Africa. ○ DWS to take the lead to develop and support a compendium of external WQM-related training courses conducted by various universities, CSIR, WISA, HSRC, ARC, SAICE, etc.	**Social:** 27. Lack of public awareness regarding importance of WQM. 28. Failures by municipalities to execute their water/sanitation-related functions adequately, are increasingly undermining public confidence in DWS. **Technical / Management:** 29. Inadequate monitoring and management of monitoring data of effluent quality and quantity by water users & regulators. 30. Current drought conditions – loss of dilution. 31. Green/Natural Infrastructure - not adequately maintained. 32. Threats from new technologies, e.g. unconventional gas and oil production – lack of ability to test and monitor threats; lack of applicable legislation re WQM impacts. 33. Insufficient information on emerging WQM threats. 34. Radioactivity, brackish water, hydrocarbons – not in baseline monitoring – lack of addressing previously unknown risks. 35. Lack of understanding or accommodation of cumulative impacts of different pollutant drivers and different WQM activities. 36. Spatial and temporal variations make it difficult to manage the resource and interconnectivity of basins makes WQM complex - can have perverse outcomes across basins. **Capacity:** 37. Technical and scientific capacity challenges in local government. 38. Continuing loss of senior technical / scientific capacity in relevant government institutions. 39. Lack of understanding or inconsistent application of the "WQM hierarchy" by water user sector managers.

EXTERNAL TO DWS AND CMAs	
OPPORTUNITIES	**THREATS**
	Other: 40. Deteriorating Water Quality poses a risk for competitiveness of business, particularly, fruit and vegetable exporters, and a general risk to the economy of South Africa. 41. Economic and financial losses in crop production and manufacturing caused by deteriorating Water Quality. 42. Political interference in WQM-related decisions - resulting in perverse outcomes. 43. Unsure political climate - results in limited investment, including in WQM

APPENDIX D: WATER QUALITY MANAGEMENT POLICY PRINCIPLES

Table A-3: WQM Policy Principles

POLICY PRINCIPLE	POLICY POSITION	POLICY AND LEGISLATIVE ENVIRONMENT
PRINCIPLE 1: GOVERNMENT-WIDE IWQM	It is the constitutional duty of all spheres of government to protect the quality of South Africa's water resources.	This principle is supported by the constitutional imperative for co-operative government.
PRINCIPLE 2: PEOPLE-CENTRIC	Public participation is a crucial element of IWQM must be promoted to ensure active and engaged citizenry.	This principle is supported by the Constitutional imperative and enshrined in the 1990 African Charter for Popular Participation in Development and Transformation.
PRINCIPLE 3: SUBSIDIARITY AND ACCOUNTABILITY	Water quality must be managed at the lowest appropriate level and the institutions responsible for managing water quality must be held accountable.	This principle is supported by the position on subsidiarity and the role of CMAs set out in the *White Paper on a National Water Policy for South Africa*.
PRINCIPLE 4: TRANSBOUNDARY IWQM	Water pollution has spatial dimensions that traverses an array of administrative and natural boundaries. International, national, provincial and local boundaries do not typically align with natural boundaries creating an array of planning, management and operational challenges that need consideration.	This Policy position is supported by Constitution in requiring cooperative government across the various spheres of government. The revised *SADC Protocol on Shared Watercourses* and the *White Paper on a National Water Policy for South Africa both recognise the importance of cooperative approaches to the management of shared watercourses.*
PRINCIPLE 5: PARTNERSHIPS	In order to manage water quality effectively, partnerships must be developed between government, the private sector and civil society.	This Policy position is based on the IWRM principle that water development and management must be based on a participatory approach, involving users, planners and Policy-makers at all levels, as well as the concept of type II partnerships developed at the World Summit on Sustainable Development held in Johannesburg in 2002.
PRINCIPLE 6: ADMINISTRATIVE FAIRNESS AND IMPLEMENTABILITY	Regulation must be administratively fair, and must also be effectively implementable within technical and financial resource constraints.	This Policy position is in line with the constitutional requirements of administrative justice, participatory governance, and a differential approach to achieve equity and redress historical racial and gender imbalances.
PRINCIPLE 7: ADOPT ADMINISTRATIVE PENALTIES	A system of effective administrative penalties for water pollution offences must be adopted.	This is a new Policy position, but is supported by international best practice, and by local practice as enshrined, for example, in the Competition Act (Act 89 of 1998).
PRINCIPLE 8: AN INTEGRATED	An integrated and adaptive, systems-based resource, remediation and source directed	This Policy position is supported by international best practice, as well as by the

AND ADAPTIVE APPROACH	approach which manages the water resource system as a whole at catchment or sub-catchment scale will be adopted, *e.g.* to include integration between *"quality"* and *"volume"*, integrated planning and integrated regulation.	*White Paper on a National Water Policy for South Africa (2016)*, and the *Policy on Resource Directed Management of Water* (2006).
PRINCIPLE 9: HIERARCHIES OF POLLUTION MANAGEMENT	Pollution management will follow a hierarchy of decision-making permeated by: • Prevent, where possible. • Minimise, where possible or be subjected to specific licence conditions or minimum standards. • If the above options have been exhausted, then the Precautionary approach applies minimum standards. • For catchment specific responses, a differentiated approach is applied. This allows for continuous improvement and adaptive management approaches. Rehabilitation and reclassification will be applied catchment specific contexts as needed.	This approach is supported by the *White Paper on a National Environmental Policy*, and current water quality Policy documents in place in DWS. It is also an internationally accepted principle.
PRINCIPLE 10: PROMOTION OF GREEN/ECOLOGICAL INFRASTRUCTURE RESTORATION AND REHABILITATION	Rehabilitation and restoration of catchments will be pursued, including the use of green/ecological infrastructure	This is a new Policy position.
PRINCIPLE 11: RISK-BASED APPROACH	A risk-based approach to regulation will be adopted, based on the likely magnitude of potential impacts.	This is a new Policy position.
PRINCIPLE 12: WATER QUALITY IS A DEVELOPMENTAL ISSUE	In addressing the management of water quality, the developmental, economic, social and environmental impacts of deteriorating water quality must be taken into account.	This Policy position builds on the internationally accepted IWRM principle that water is both a social and an economic good, extending this specifically to recognise the social, economic, and environmental costs associated with declining water quality. It also recognises the approach taken in the *White Paper on a National Water Policy for South Africa* of integrating economic, development and environmental goals.

PRINCIPLE 13: BROADENED FUNDING MECHANISMS	The mechanisms for funding integrated water quality management must be broadened, given that water quality has impacts on, and is impacted by, many different sectors, and recognising the negative developmental impact of declining water quality.	This is a new principle, developed from the Policy positions that declining water quality is an economic and developmental issue, and that the management of water quality is a concern of all spheres of government and several different departments, not just the Department of Water and Sanitation.
PRINCIPLE 14: POLLUTER PAYS	The costs of remedying pollution, degradation of resource quality and resulting adverse health effects, and of preventing, minimising or controlling pollutions is the responsibility of the polluter.	This is an internationally accepted principle in environmental and water Policy, and is also enshrined in the *White Paper on a National Water Policy for South Africa*.
PRINCIPLE 15: INFORMED PUBLIC	Efforts to ensure that broader societal awareness of the importance of resource water quality will prove increasingly important in catalysing more responsible behaviours.	The need to engage stakeholders and develop the capacity of broader civil society to participate are core concepts to Integrated Water Resource Management and as such the *National Water Policy for South Africa.* This Policy is in line with the Constitution, Promotion of Access to Information Act (Act 2 of 2000), Promotion of Administrative Justice Act (Act 3 of 2000) and in line with international best practice.
PRINCIPLE 16: DATA IS A STRATEGIC ASSET	Data on water quality must be standardised, reliable and scientifically defensible and must be collected, managed and protected as a strategic asset for monitoring, management, legal actions and research purposes, while also being used to support co-learning and adaptive management.	This is a new Policy position.
PRINCIPLE 17: PUBLICLY AVAILABLE INFORMATION	Information and data on water quality and waste discharges must be available in the public domain[2] and should be used to enhance public awareness and education, and to support adaptive management approaches.	This Policy is in line with the Constitution, Promotion of Access to Information Act (Act 2 of 2000), Promotion of Administrative Justice Act (Act 3 of 2000) and in line with international best practice.

[2] Legal opinion is required to support this principle.

APPENDIX E: SUMMARY OF THE IWQM STRATEGIC OBJECTIVES AND ACTIONS

Table A-4: Summary of Strategic Issues, Objectives and Actions

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
STRATEGIC ISSUE 1: Harmonization of Policies and Strategies to enable improved WQM	**SO1a**: Policies and Strategies impacting upon IWQM are harmonized	**SA1:** DWS to ensure that policy and strategy development and refinement within DWS addresses WQM
		SA2: Sector departments to harmonise policies and strategies to support IWQM
		SA3: DWS to finalise and implement a non-point source pollution (NPS) strategy
STRATEGIC ISSUE 2: Legislative review and amendments to enable IWQM	**SO2a:** IWQM is effectively supported by the NWA/WSA	**SA4:** DWS to amend NWA and WSA to provide effective support to IWQM
		SA5: DWS to develop guidelines and protocols on the effective use of instruments
	SO2b: IWQM is effectively supported by other legislation	**SA6:** National Treasury and DWS to promulgate a Money Bill for the Waste Discharge Levy
		SA7: Government to identify and amend relevant legislation to strengthen IWQM, including efficient by-laws for WQM
STRATEGIC ISSUE 3: Improved WQM related governance	**SO3a:** IWQM is supported by effective DWS departmental arrangements	**SA8:** DWS to reconfigure the departmental WQM function as needed to ensure efficiency and effectiveness
		SA9: DWS to identify a strategic water quality management champion that will drive and monitor the implementation of the IWQM Policy and Strategy
	SO3b: Inter-sector departmental structures established to support integrated WQM	**SA10:** Establish inter-governmental WQM structures at trans-boundary basin, national and provincial levels to ensure coordination and joint action supported by regular reporting
		SA11: Government departments to develop sector WQM plans and report annually on progress
STRATEGIC ISSUE 4: Formalise governance frameworks to support non-governmental engagements	**SO4a:** Partnerships/stewardships established and maintained	**SA12:** Government to develop a partnership framework that is fair and equitable
		SA13: Government to develop and foster strategic sector partnerships
	SO4b: Governance framework for active citizenry formalized	**SA14:** DWS with DEA and CMAs to develop an engagement framework that enables more active participation of civil society at transboundary, national and catchment levels

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
		SA15: DWS, DEA and CMAs to support and drive functional platforms for the engagement of civil society nationally and within catchments
STRATEGIC ISSUE 5: Improved coordination in integrated planning	**SO5a:** Integrated sectoral planning approach is adopted at transboundary and national level	**SA 16:** DWS to lead the development of an IWQM plan for national priority catchments, ensuring consideration of transboundary water quality concerns
		SA 17: DWS, with NT, SALGA and COGTA to develop a strategic action plan for the financing, rehabilitation and upgrade of prioritized WWTWs
		SA18: DWS, with DMR and DEA, to develop a strategic action plan for the implementation of the mine-water management policy
		SA 19: DWS/DAFF/DMR/DEA/DRDLR/COGTA to develop strategic action plans to reduce non-point source pollution
		SA 20: DWS, DEA, SALGA and COGTA to develop a protocol for the management of industrial discharge within the municipal environment
	SO5b: Integrated sectoral planning approach adopted in catchment/regional plans	**SA 21:** CMAs to develop an IWQM plan for each water management area as part of the CMS
		SA 22: DWS, DEA and DMR to integrate IWQM and water resource planning with Regional Mining Plans in priority areas
		SA 23: DWS and COGTA to ensure that WSDPs, IDPs and SDFs reflect WQM priorities and management responses
STRATEGIC ISSUE 6: Strengthen IWQM Regulation, Compliance and Enforcement	**SO6a:** Licencing processes streamlined	**SA 24:** DWS to address the backlog of Water Use Licence (WUL) applications urgently and to meet stipulated timeframes for new licence applications.
		SA 25: DWS to categorise risk-based protocols for determining water use authorization
		SA 26: DWS/CMAs to develop protocols for CMA engagement in IWUL applications and approval processes
		SA 27: DWS, DEA, DAFF and DMR to develop and implement a protocol for integrated licensing processes
		SA 28: DWS, DEA, DAFF and DMR to develop information management systems to support the integrated licensing approach

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
	SO6b: Targeted/strengthened compliance monitoring and enforcement of key polluting sectors	**SA 29:** DWS, DEA, COGTA, Department of Human Settlements, DRDLR to develop improved regulatory approaches to manage water quality pollution from land-based and in-stream activities, including the review and establishment of mandatory national waste discharge standards.
		SA 30: DWS, DEA, CMAs to develop a targeted approach for the enforcement of regulation
		SA 31: DWS, DEA to assess gaps in regulatory frameworks and instruments and develop revised approaches and instruments as necessary
		SA 32: DWS, DEA, CMAs to develop approaches to strengthen operational CME and the EMI network
STRATEGIC ISSUE 7: Application of Systems-based Adaptive Management Approaches	**SO7a:** Adaptive systems-based management is applied at catchment level	**SA 33:** CMAs to develop localised programmatic monitoring and reporting of actions and outcomes
		SA 34: CMAs to lead process with other relevant government departments and agencies, and stakeholders, to review, identify and address priority water quality challenges at regular intervals
		SA 35: DWS and CMAs to develop protocols for systems-based adaptive management for IWQM.
		SA 36: DWS to determine RQOs for all catchments (WMAs) in South Africa
STRATEGIC ISSUE 8: Fiscal support for integrated WQM	**SO8a:** WQM interventions are financially supported by the fiscus	**SA 37:** DWS/WRC to support research into the socio-economic-environmental and management costs of poor water quality
		SA 38: Government to develop an investment framework including innovative mechanisms to mobilise funding for sustained support to IWQM
		SA 39: DWS, with NT, COGTA, SALGA, to review municipal conditional grants
		SA 40: DWS to develop and implement a protocol for extending the financial provisioning clause to all industries that are deemed "high-risk" polluters.
STRATEGIC ISSUE 9: Develop pricing and incentives that support integrated WQM	**SO9a:** The Waste Discharge Charge System is implemented	**SA 41:** DWS, with CMAs, to implement the WDCS in priority catchments
		SA 42: DWS, with CMAs, to develop an action plan to support the phased implementation of the WDCS across the country
	SO9b: Mechanisms for incentivising good practice developed	**SA 43:** DWS/DEA/WRC to explore innovative financing mechanisms for incentivising good IWQM practice

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
		SA 44: DWS and NT to determine financial incentives for water-reuse (AMD, other)
		SA 45: Government to develop the legal and institutional mechanisms for introducing administrative penalties for environmental non-compliance including water pollution.
STRATEGIC ISSUE 10: Strengthen Monitoring and Information Management	**SO10a:** An integrated and functioning water quality monitoring network	**SA 46:** DWS/CMAs to strengthen national and catchment water quality monitoring networks through spatial expansion and identification of priority constituents for catchment-specific monitoring
		SA 47: DWS to support the network expansion with an initiative to ensure that accessible accredited laboratories are available to ensure efficient and effective analyses
	SO10b: Information systems that are current and accessible to support adaptive WQM	**SA 48:** DWS, with the WRC and CMAs, to lead the development of a programme to create and support citizen-based monitoring programmes
		SA 49: Government to ensure the harmonisation of data and information systems pertaining to resource water quality
		SA 50: Government to ensure the harmonisation of data and information systems pertaining to source water quality
		SA 51: Government to develop systems to enable data and information access by stakeholders/ public
	SO10c: Routine assessments inform adaptive WQM	**SA 52:** DWS/DEA/CMAs to develop protocols and systems to ensure monitoring and evaluation and new information inform adaptive management decisions for IWQM
STRATEGIC ISSUE 11: Build water quality and WQM Capacity through Education, Training and Communication	**SO11a:** Sustained capacity for Government /CMA/sector to effectively manage and support WQM through improved education and training	**SA 53:** DWS/WRC to develop and implement a capacity building programme for officials in DWS, CMA and other sector departments in systems-based, adaptive IWQM
		SA 54: DWS/CMAs to expand capacity-building initiatives to civil society and private sector
		SA 55: DWS to develop regulations to ensure the professionalization of key water services functions
		SA 56: DWS/private sector to provide bursaries/learnerships pertaining to WQM at tertiary institutions

STRATEGIC ISSUES	STRATEGIC OBJECTIVES	STRATEGIC ACTIONS
	SO11b: WQM decisions are underpinned by best practice, research and innovation	**SA 57:** DWS, with the WRC, to investigate the options provided by recent innovative developments to improve water quality
		SA 58: WRC to lead the sector in innovation, research and development for IWQM
	SO11c: A well informed and actively engaged South Africa	**SA 59:** DWS to report annually on the state of water quality in the country
		SA 60: DWS/WRC to develop online tools for easy access to water quality and WQM related information
		SA 61: DWS/DEA/DAFF/DMR/CMAs to develop and maintain multi-sector stakeholder platforms for sharing information
		SA 62: DWS, with other Departments and sector institutions, to lead and roll-out awareness creation campaigns