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SUB-SERIES NO. WQP 1.5.2

Resource Directed Management of Water Quality

Volume 2.2

Strategy

August 2006

Edition 1

water & forestry

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DEPARTMENT OF WATER AFFAIRS AND FORESTRY

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DOCUMENT INDEX

Reports as part of this project:

REPORT NUMBER	REPORT TITLE
1.1	*Inception Report
1.2	*National and International Literature Survey and Contextual Review
1.3	Appendix E: Project Document. Glossary of terminology often used in the Resource Directed Management of Water Quality
1.4	Volume 1: *Policy Document Series*
1.4.1	Volume 1.1: Summary Policy
1.4.2	Volume 1.2: Policy
1.5	Volume 2*: Strategy Document Series*
1.5.1	Volume 2.1: Summary Strategy
1.5.2	Volume 2.2: Strategy
1.5.3	Volume 3*: Institutional Arrangements*
1.6	*1st Edition Management Instruments Series (Prototype Protocol)*
1.6.1	Appendix B: Project Document. Conceptual Review for water licence application from a Resource Directed Management of Water Quality (RDMWQ) perspective
1.6.2	**Guidelines on Catchment Visioning for the Resource Directed Management of Water Quality
1.6.3.1	**Guideline for determining Resource Water Quality Objectives (RWQOs), water quality stress and allocatable water quality
1.6.3.2	**Guideline on the conversion of the South African Water Quality Guidelines to fitness-for-use categories
1.6.3.3	**Guideline for converting Resource Water Quality Objectives (RWQOs) to individual end-of-pipe standards
1.6.3.4	Appendix D: Project Document. ACWUA Decision-making support system for Resource Directed Management of Water Quality (RDMWQ)
1.6.4	**Decision-support instrument for the Assessment of Considerations for Water Use Applications (ACWUA)
1.6.5	**Guideline on pro-forma licence conditions for the Resource Directed Management of Water Quality
1.7	Volume 4: *2nd Edition Management Instruments Series*
1.7.1	Volume 4.1: Guideline for Catchment Visioning for the Resource Directed Management of Water Quality
1.7.2	Volume 4.2: Guideline for determining Resource Water Quality Objectives (RWQOs), Allocatable Water Quality and Stress of the Water Resource
1.7.2.1	Volume 4.2.1: Users' Guide. Resource Water Quality Objectives (RWQOs) Model (Version 4.0)
1.7.3	Volume 4.3: Guideline on Monitoring and Auditing for Resource Directed Management of Water Quality
1.7.4	Appendix A: Project Document: Philosophy of Sustainable Development
1.7.5	Appendix C: Project Document: Guidelines for Setting Licence Conditions for Resource Directed Management of Water Quality (RDMWQ)
1.7.6	Introduction

Bold type indicates this report.

*These reports are internal project management documents that are not available for publication.
**These reports are earlier versions that have been improved upon in the second edition and thus are not available for publication.
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EXECUTIVE SUMMARY

"Making water resource management water quality friendly"

Policy implementation

This strategy provides the general implementation plan for the resource directed management of water quality policy ("the Policy") (DWAF, 2006a). It describes "who should do what by when" and is presented in a way that explicitly links the Policy and its principles with specific management approaches and instruments to facilitate its practical implementation.

Sustainable development

The link between the adaptive "Plan-Implement-Check-Review" cycle of Integrated Water Quality Management (IWQM) and sustainable development is described as well as how this plays out at various levels (varying from short-term to long-term).

An approach to balancing the principles of sustainable development is also proposed. In particular, how this should be done to achieve socio-economic development is presented. An example is also presented of how strict protection of ecosystems can be achieved where appropriate. A simple familiarisation plan for inexperienced practitioners is also proposed.

Institutional arrangements

How the institutions will evolve during the phased decentralisation of water management roles and responsibilities from the Department to Clusters and catchment management agencies (CMAs) is described. Specific challenges and institutional implications are identified. The phases include:

- Phase 1: Post restructuring (current),
- Phase 2: Decentralisation to Clusters,
- Phase 3: CMAs establishment, and
- Phase 4: Fully functional CMAs.

Roles and responsibilities within the Department for IWQM management functions are presented as well as roles played by external stakeholders, and local, regional and national government departments.

The various facets of institutional capacity are also identified.

Summary strategies

Summary strategies are provided for a series of well-defined scenarios. In each case, the reader is (a) referred to associated enabling principles in the Policy and (b) provided with references to guidelines and further reading that will provide the necessary detail.

Scenarios include:

- Catchment assessment,
- Catchment visioning,
- Determining resource directed measures (RDMs), including addressing issues of confidence, and water quality variables of concern, and

- Giving effect to RDMs, including developing catchment management strategies, attaining a management class, maintaining a management class, managing point and non-point sources, water use authorisation, long-term non-compliance with resource quality objectives (RQOs), non-compliance with licence conditions and remediation.

Water quality monitoring is also addressed.

Capacity creation and maintenance

Capacity creation for the short-term and long-term as well as internal and external to DWAF, is described. The short-term strategy focuses on empowering external stakeholders and creating knowledgeable DWAF staff. The long-term strategy focuses on adapting to changing external stakeholder demands (for awareness and empowerment) and refining and improving the capabilities of DWAF staff. The ultimate aim is to facilitate creation of a learning institution in which appropriate knowledge is created.

A three-dimensional approach to empowering DWAF staff for sustainable management is also proposed (objective empowerment, competence, and subjective empowerment).

Action Plan

An immediate action plan is proposed to "kick start" appropriate data collection and information generation in support of resource directed management of water quality. It is based on defining resource water quality objectives (RWQOs) in priority catchments that can begin to generate nationally consistent water quality information in anticipation of determination of RQOs when the classification system is developed.

The development of a detailed capacity creation plan is also recommended.

Management approaches

A brief summarised description is also provided (in the appendix) of management approaches available to IWQM practitioners. These include:

- Regulatory (general authorisations, command-and-control – *ad hoc* licensing, compulsory licensing, RQOs, Reserve, directives, etc. – , and economic – pricing strategy, waste discharge charge system), and
- Non-regulatory (civil society, self-regulatory, and supportive).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

CMAs	Catchment Management Agency
CMS	Catchment Management Strategy
CSD	Committee for Sustainable Development
DBSA	Development Bank of South Africa
DEAT	Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DoA	Department of Agriculture
DPLG	Department of Provincial and Local Government
DTI	Department of Trade and Industry
DWAF	Department of Water Affairs and Forestry
ECA	Environment Conservation Act
EMS	Environmental Management System
EMPR	Environmental Management Plan Report
IDPs	Integrated Development Plan
ISO	International Organization for Standardization
ISP	Internal Strategic Perspective
IWQM	Integrated Water Quality Management
IWRM	Integrated Water Resource Management
NQF	National Qualifications Framework
NWA (36:1998)	National Water Act
NWRS	National Water Resource Strategy
P&R	Policy and Regulation
PSIR	Pressure-State-Impact-Response
RDM	Resource Directed Measures
RDMWQ	Resource Directed Management of Water Quality
RO	Regional Office (DWAF)
RQOs	Resource Quality Objectives
RWQOs	Resource Water Quality Objectives
SA	South Africa
SAQA	South African Qualifications Authority
SDC	Source Directed Control
SMO	Source Management Objective
WDCS	Waste Discharge Charge System
WMA	Water Management Area
WMI	Water Management Institution
WRC	Water Research Commission
WRM	Water Resource Management
WSDP	Water Services Development Plan
WUA	Water User Association

SECTION 1: SUMMARY STRATEGY

1.1 Introduction

The objective of this strategy is the implementation of the resource directed management of water quality policy ("the Policy") (DWAF, 2006a) of the Department of Water Affairs and Forestry ("the Department"). It addresses "who should do what by when", explicitly linking the Policy to management approaches and management instruments to facilitate its practical and pragmatic implementation. It is also the intention that, in some contexts, this strategy presents a first level of interpretation of the policy.

Simultaneous review of this strategy with the Policy every five years in respect of objectives and effectiveness is recommended.

1.2 Sustainable development

1.2.1 Integrated water quality management

Integrated water quality management should be implemented in a cyclical process aimed at continual improvement (fundamental to the principle of adaptive management). This cycle occurs at a number of different levels. They range from individual (local) source and resource management initiatives (short-term) through re-consideration of the catchment management strategy (medium-term) to re-consideration of the resource directed measures and vision (long-term).

The principles of sustainable development apply at all stages. However, the designated resource management class is the 'first line of defence' against development that is unsustainable. The 'second line of defence' is embodied in the catchment management strategy and its implementation through resource directed measures, individual source directed controls and resource management initiatives.

1.2.2 Balancing the principles

The emphasis placed by the Policy on socio-economic development means that particular attention must be paid to the principles of current equitable access, optimal water use and environmental integration.

Current equitable access is achieved by first determining the Reserve and then allocating water quality to national priorities. The remainder is then allocated equitably, and with emphasis on optimal water use, to other users. Less emphasis is given to protection of water resources by accepting some degree of impact though not to the extent that the resource becomes unacceptably degraded and unsustainable.

When strict protection of water resources is warranted, the resource will typically be classified as Natural. In this case, it is the principles of protection of water resources, and by implication, equity between generations, that receive most emphasis. Importantly, this does not preclude other water uses. However, these water uses must be such that their impact on water quality is minimal and well within the ability of the ecosystem to sustain the provision of goods and services in order to maintain the management class.

As an example of how this emphasis might be applied, a related strategic national recommendation has been made in respect of freshwater biodiversity (DWAF, 2005a).

Balancing sustainable development principles is complex. To gradually increase the familiarity of practitioners with these principles, it is recommended that less experienced practitioners should first simply practice identifying what factors and actions refer to which principle. With experience, the explicit application of these principles in resource directed measures will become more evident.

1.3 Institutional arrangements

1.3.1 Phase institutional change

Institutional arrangements are dominated by transition to full decentralisation to catchment management agencies (CMAs) over four phases: *Phase 1* follows the recent restructuring of DWAF. Decision-making is shared between Policy and Regulation (P&R) and Regional Clusters, while systems are being developed and piloted. *Phase 2* is characterised by completion, or near-completion, of piloting and the establishment of stable macro-systems. As a result, further decision-making and implementation is transferred to the Regional Clusters, while the proto-CMAs take on those current regional cluster functions that centre on water use management and coordination. In *Phase 3* proto-CMAs are transferred, along with their functions and staff, from DWAF into the CMAs within the first 2 years. The CMAs are then formally established. In *Phase 4*, fully functional CMAs are established, with the majority of Water Resource Management (WRM) implementation roles and responsibilities within the CMAs (including Responsible Authority functions).

1.3.2 Management effort

In Phases 1 and 2, management effort is reasonably evenly spread between P&R, Clusters and proto-CMAs. In Phase 3, with the establishment of the CMAs, all roles and responsibilities of the proto-CMAs are transferred to the CMAs along with a continuing shift of roles and responsibilities from P&R to Clusters to CMAs. P&R takes on new responsibilities centred on oversight and support – co-ordination, collaboration and transfer of information between CMAs, Clusters and P&R. In Phase 4, the CMAs are established and stabilised and now bears the majority of water quality management effort.

1.3.3 Institutional implications

Phases 2 and 3 will present the greatest challenges relating to capacity. Broad institutional capacity building will be required. When the CMAs become established, mentoring by DWAF and the Clusters will be particularly important.

1.3.4 Institutional roles

Water quality management inherently requires the management of activities and resources that are the mandate of other government departments or property of private sector entities. Key institutions include stakeholders, and local, regional and national government departments.

1.3.5 Institutional capacity

The process for building institutional capacity should (a) be carefully planned, and (b) establish coherent, simple and stable systems, introducing as much routine as available the capacity is able to deal with.

1.4 Implementation strategies

Resource directed management of water quality can occur in a very wide variety of contexts. The following sub-sections briefly summarise strategies in well-defined scenarios.

1.4.1 Catchment assessment

Catchment assessments should engage with stakeholders constructively, take cognisance of legislation such as the Promotion of Access to Information Act (2:2000), be appropriately

integrative in their data collections and assessment, and be pragmatic in the allocation of financial and human resources according to the level of confidence required.

1.4.2 Catchment visioning

Catchment visioning is an indispensable component of this strategy and integrated water resource management in general. Although this strategy primarily addresses water quality management, visioning must encompass resource quality holistically and clearly identify how water quality issues contribute.

The context of the vision must be principle-based and should be the strategy to move towards the vision. Relevant legislation goes well beyond the National Water Act (36:1998). Stakeholders must be engaged in a way that (a) facilitates meaningful contributions, and (b) develops a sense of buy-in and, preferably, ownership. Catchment visioning initiatives should be carried out to a level of confidence appropriate to the circumstances.

1.4.3 Resource directed measures

1.4.3.1 General issues

The necessary degree of confidence required to determine the management class, resource quality objectives (RQOs) and the Reserve must be determined by considering factors relating to:

- The immediate purpose of the RDM sub-process,
- The present ecological state,
- Potential changes in water quality, and
- Potential impacts of changes in water quality (*e.g.* relating to the ecological, social and economic sensitivity).

Appropriate water quality variables ('variables of concern') must be identified, which depend on:

- The nature of the individual water uses and their impacts,
- Ecosystem requirements, and
- The RQOs (both narrative and quantitative) that may exist.

The chosen variables must be:

- Representative of the water quality that matters the most to overall ecosystem health,
- Socially relevant and acceptable (*e.g.* relating to human health),
- Economically appropriate, and
- Institutionally sound and consistent across organisations.

1.4.3.2 Determining the resource management class and RQOs

Stakeholders must be empowered to make meaningful contributions. Specifically in respect of water quality, they must be sufficiently well-informed in respect of:

- The meaning and value of water quality in respect of (a) constituents, and (b) associated ecological responses and social and economic impacts of worsening water quality.
- The relationship between aquatic ecosystems and water quality, and
- The effects of their water uses on water quality and hence downstream users.

To facilitate integration across catchments, account must be taken of current and potential impacts upstream, downstream and on catchments receiving or donating water via inter-basin transfers.

Care should be taken to ensure that achievable RQOs (relating to water quality) are defined.

1.4.3.3 Giving effect to RDM

In general, the RDM need to be translated into strategies and actions that:

- Achieve the objectives set for the water resource,
- Manage causes of adverse impacts on water quality, guided by RQOs, resource water quality objectives (RWQOs) and source management objectives, the latter given effect through source directed controls (SDCs), and
- Remediate water resources where necessary.

The following sub-sections provide examples.

1.4.3.4 Catchment management strategies

The catchment management strategy (CMS) is the operational strategy that gives effect to RDM. The development of the CMS must be issues driven and aligned with Water Services Development Plans (WSDPs) and Integrated Development Plans (IDPs).

A water quality framework plan must form part of the CMS. It must include a water quality allocation plan that allocates the source management objective (SMO) load reductions (or increases) to priority sectors in the catchment. These must be based on resource water quality objectives (RWQOs) that support the attainment of RQOs.

1.4.3.5 Attaining a management class

In catchments that are stressed in respect of water quality, the first step is to establish a performance monitoring programme that quantifies the degree of stress. The strategy is primarily one of reactive management to minimise current impacts by engaging individual water users or responsible authorities. Specific management approaches include compulsory licensing, directives, strict regulation, prohibition of land use, remediation, waste discharge charge system, and encouraging general cooperation and awareness.

1.4.3.6 Maintaining a management class

In catchments that are unstressed in respect of water quality, allocatable water quality must still be sensibly distributed among water users, while taking due consideration of all the enabling principles of sustainable development. The strategy is mainly one of proactive management to ensure the water quality impacts of new developments are within the capacity of the water resource to absorb these inputs. Reactive management is likely to be necessary to ensure existing water users maintain their impacts on water quality within agreed limits. Regular assessment of monitoring data should be undertaken to determine when reactive management is necessary.

1.4.3.7 Managing point sources

The catchment management strategy will dictate the general nature of the required source directed controls. However, it is specifically the RQOs and RWQOs in place that determine the precise actions to be taken. Use of appropriate existing guidelines and Best Practices relating to the water use and, in particular, water resource protection should be encouraged, especially for new water users. The general strategy in respect of self-regulatory mechanisms is to encourage the adoption of ISO 14000 standards with the aim of increasing in-house responsible environmental management. New uses must be in accord with the catchment vision and associated RDM and can only be authorised if there exists allocatable water quality. After a licence is issued, a compliance monitoring programme must be established as soon as possible. However, complying with such licence conditions should never be regarded as guaranteeing attainment of RQOs.

1.4.3.8 Managing non-point sources

The overall management strategy is to place emphasis on improved management of the overall land use causing water quality impacts. In general, the approach used to manage the water quality effects of dense settlements should be used as a basis for dealing with non-point sources responsible for water quality problems. This entails engaging with the responsible authorities and reaching agreement on appropriate interventions.

1.4.3.9 Water use authorisation

The general strategy must be to streamline processing of water use authorisations, preferably using a simple screening protocol that will fast-track granting of water use authorisations when impacts are likely to be low.

The choice of end-of-pipe licence conditions relating to water quality for users discharging water containing waste into the water resource should depend on the degree of water quality stress. If the water resource has significant allocatable water quality (*i.e.* is not stressed or threatened), then end-of-pipe licence conditions can be based on effluent standards, although the applicant will typically not be allocated all that is available.

If the water resource is only slightly unstressed (*i.e.* threatened), then end-of-pipe licence conditions can be based on at least the following considerations:

- End-of-pipe effluent uniform national minimum requirements or standards (should they exist).
- End-of-pipe effluent targets back-calculated from downstream RWQOs or RQOs (DWAF, 2006; DWAF, 2004a).

Effective use must be made of available software decision support (*e.g.* DWAF, 2004b).

1.4.3.10 Long-term non-compliance with RQOs

The following strategy should be applied when there is consistent non-achievement of RQOs over long periods (five years). First, the appropriateness of the source directed controls should be investigated. For example:

- Consider whether (a) National Water Act Schedule 1 uses or (b) uses occurring under general authorisations may be responsible.
- If uses under general authorisations are causing problems, also consider changing the conditions for defining general authorisations to make them stricter in that area (following due process).
- Also examine whether or not water users, especially those discharging waste into the water resource, are taking all reasonable steps to minimise their impacts.
- Consider the possibility of illegal water use.

If the degree of source management is considered adequate, then consider whether or not the determination of the RQOs was based on a water quality dataset that was sufficiently representative of the resource.

If the water quality dataset used for the RQOs is considered to be sufficiently representative of current times, then the appropriateness of the management class itself can be questioned and revised if necessary (again following due process).

1.4.3.11 Non-compliance with licence conditions

Compliance with specific water use licence conditions may not be occurring and this may be suspected as being responsible for non-compliance with RQOs and/or RWQOs. In this case, the regulatory procedures described in the Source Management Strategy should be applied.

1.4.3.12 Remediation

Responsibility for costs lies with those who caused the impact. However, when they cannot be made responsible (*e.g.* cannot be identified), for example in so-called "legacy cases", the Department may need to assume responsibility. Given the inevitable expense of remediation, particularly when groundwater is involved, the need for remediation should be carefully prioritised to ensure cost-effectiveness, based on the following considerations:

- The most desirable time frame for achieving the designated management class.
- The current and intended use of the water resource.
- The positive and negative socio-economic impacts, and
- The precautionary approach.

1.4.4 Water quality monitoring

The objectives of monitoring for resource directed management of water quality are (DWAF, 2006f): *To measure, assess and report on a regular basis the status and trends broadly relating to water quality in water resources, and their management, in a manner that will support balanced decision-making and planning in the contexts of fitness for use and aquatic ecosystem integrity in the Catchment Management Agency's quest for sustainable development.*

The most pressing programmes will be water quality monitoring programmes that provide information that is directly and immediately useful to water resource managers. These include the following:

- Performance monitoring of RQOs or RWQOs.
- Compliance monitoring of water use licence conditions.
- Baseline monitoring for the ecological Reserve.
- National water quality status and trends monitoring.

More holistic information than just resource quality is required to properly manage (a) the resource, (b) those impacting on the resources and (c) those impacted by the resource. Monitoring that genuinely supports decision-making related to sustainable development must therefore go well beyond just water quality (DWAF, 2006f). The Pressure-State-Impact-Response (PSIR) framework can be used to provide a structure for the broader monitoring required. A phased approach will be important with priority given initially to (a) state monitoring followed by (b) pressure monitoring (or those activities impacting on water quality) and then (c) impact monitoring (of resource, societal and economic impacts of inadequate water quality) and finally (d) response monitoring (referring to the decisive responses of society) which further improves the understanding of the impacts of inadequate water quality.

1.4.5 Capacity creation and maintenance

Two specific dimensions must be addressed in order to create appropriate capacity:

- *Time dimension (short-term & long-term)*.
- *Internal-external dimension*: Capacity must be created both within the Department and Water Management Institutions (WMIs) and in external stakeholders.

The most demanding of the above two dimensions is the time dimension. There is a desperate need to facilitate better resource directed management of water quality immediately. The strategy must be to move from pragmatic, and perhaps low confidence, decision-making initially to doing things better (with greater confidence) in the longer-term. In effect, the short-term requirements should be met using management instruments that are currently available. However, the long-term strategy must be to move towards more fundamental "knowledge creation".

Knowledge can be defined as the *capacity for informed action*. It should be the ultimate aim to create a "learning environment" within the water sector and within the Department in particular.

The learning principles proposed by Roux *et al.* (2006) for good ecosystem governance should form the basis of any detailed capacity creation strategy relating to the resource directed management of water quality. These are summarised as follows: "*Good ecosystem governance requires positively persistent and adaptive people with a culture of empathy for other knowledge systems and levels. Their knowledge must be transdisciplinary, moulded by a common future focus, acquired by patiently engaging their prior knowledge and learning by doing in an environment of social knowledge sharing.*"

Attention must also be given to ensuring that management is sustainable. The empowerment required to achieve this includes objective empowerment (improved opportunities), competence (basic skills) and subjective empowerment (self-confidence). All three must be addressed for a capacity creation strategy to be successful. Training must include a wide variety of conceptual outcomes relating to understanding all facets of water quality and familiarity with currently available management instruments (especially software and other guidelines that can facilitate better water quality management).

Existing training courses relating specifically to resource directed management of water quality should continue to be made available on an annual basis (or on demand based on the level of staff turnover). They should be extended and enhanced as and when necessary. Refresher courses should also be offered.

Communication mechanisms such as the use of posters, pamphlets, and newsletters should be reviewed on an annual basis to (a) create awareness among new staff members and external stakeholders (like other government departments), and (b) maintain awareness among experienced water resource managers.

1.4.6 Action plan

1.4.6.1 Resource water quality objectives

It is important that nationally consistent information be generated relating to water quality that can begin to provide a sound basis for more focused catchment assessments, catchment planning, catchment visioning exercises and ultimately catchment management strategies.

Initial efforts must focus on water resources currently experiencing water quality stress. A software facility exists that helps to determine the degree of water quality stress in watercourses (DWAF, 2006e). This inherently "low-confidence" decision support tool should be used to prioritise such surface water resources on a national basis on the basis of their degree of water quality stress.

The next phase will be to begin the process of determining management objectives that can better focus water resource management in the immediate future. Catchments should be identified in which there are (a) adequate financial and human resources, and (b) commitment to the process from relevant regional offices of the Department or CMAs. The level of confidence required to determine RWQOs should then be assessed (medium or high confidence). The appropriate procedures should then be followed to determine RWQOs at appropriate locations in the water resources (DWAF, 2006d).

Once the RWQOs have been determined, a suitable performance monitoring programme must be implemented as soon as possible. It will also be essential that the necessary source directed controls be identified and that these become firmly embodied in the catchment management strategy.

1.4.6.2 Capacity creation

An initiative should be started that will produce a detailed capacity creation plan that includes the following:

- Explicit recommendations that will move the Department towards becoming a learning organisation.
- Detailed recommendations that expand on the proposed short- and long-term strategy.
- Explicit consideration of the learning principles proposed by Roux *et al.* (2006).
- Explicit attention to objective and subjective empowerment and increasing basic competencies.
- Resources (financial and human) required for such capacity creation, and
- Detailed time plan that expands on that given in this strategy.

SECTION 2: INTRODUCTION

This section:

- Illustrates policy-strategy-management relationships (**2.1**),
- Summarises associated frameworks and strategies (**2.2**),
- States the scope of this strategy (**2.3**), and
- Shows how to use this document (**2.4**).

2.1 The policy

Implementation plan

This strategy is the implementation plan for the resource directed management of water quality policy ("the Policy") (DWAF, 2006a) of the Department of Water Affairs and Forestry ("the Department"). In cases where detailed management instruments are available for specific purposes, these are clearly referenced (and not duplicated in this document). The following figure illustrates the relationship between the Policy, this strategy and the associated management instruments.

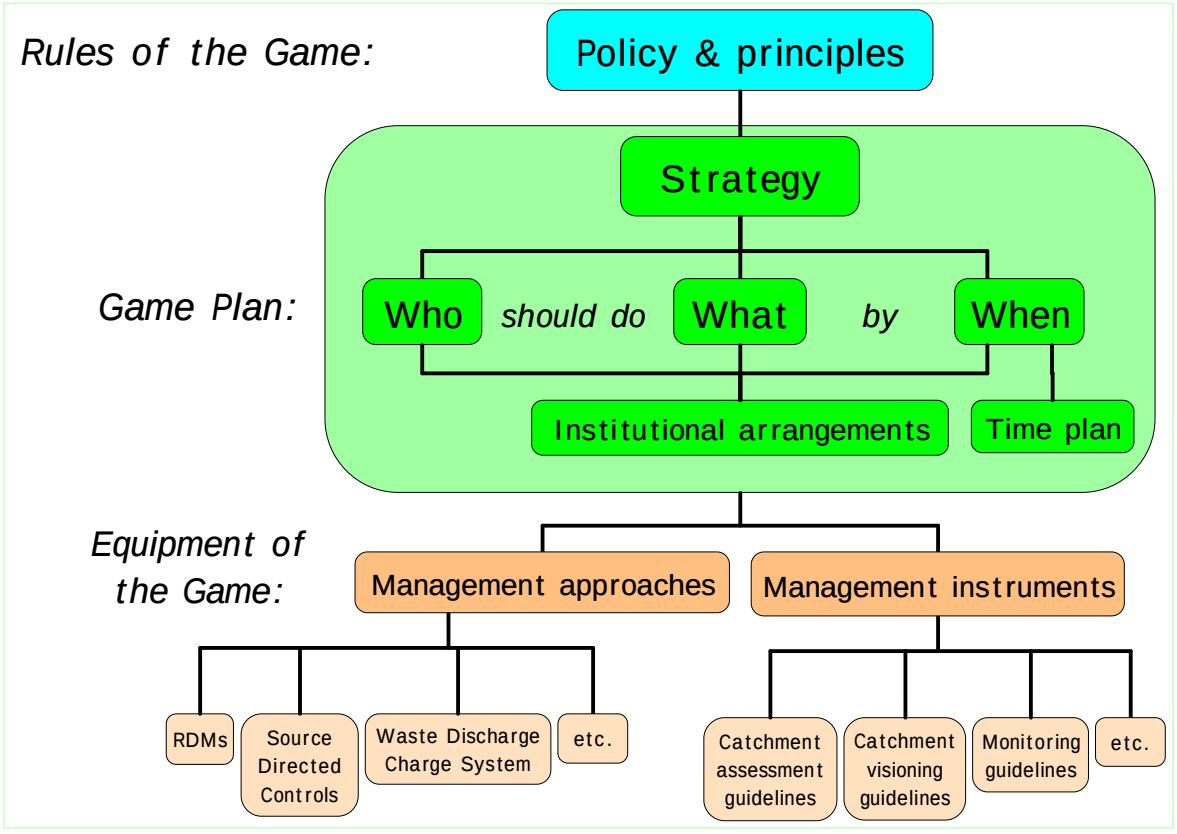


Figure 2.1. Illustration of relationship between the Policy, this strategy and the management approaches and instruments

2.2 Associated frameworks and strategies

Adaptive management

The Policy advocates an adaptive management approach to achieve continual improvement in integrated water quality management. Strategic adaptive management is also specifically promoted by the national water resource strategy (DWAF, 2004a). One common manifestation of adaptive management is the "Plan, Implement, Check and Review" process. The review step specifically feeds into a re-planning step making the overall process cyclical.

Integrated water resources management

The Policy and therefore this strategy are inherently aligned with integrated water resources management (IWRM).

National water resource strategy (NWRS)

The National Water Act (Act No. 36 of 1998) (NWA (36:1998)) explicitly states that South Africa's water resources must be protected, used, developed, conserved, managed and controlled in accordance with the national water resource strategy (NWRS) (DWAF, 2004a). Therefore, any strategy addressing a subset of water resource management, such as resource directed management of water quality, must be consistent with the NWRS. This strategy is not only aligned with the NWRS, but expands considerably on issues related to water quality.

Source management strategy

A draft strategy for management of water uses (or sources of impacts on water) has been developed (DWAF, 2003b). The strategy for resource directed management of water quality (contained in this document) must inform implementation of the source management strategy. In particular, resource directed measures (RDMs) should set the objectives to be achieved in water resources, which in turn influence the "source directed controls". Alignment between the two strategies is therefore important.

Remediation strategy

Development of a remediation strategy is currently in progress (www.sa-remediation.co.za). This includes remediation of degraded land that may pose a risk to water quality in water resources. As described above for the source management strategy, the exact nature of any local remediation strategy must be determined by the RDMs in place.

Catchment management strategies

A catchment management strategy addresses water resource management at the spatial scale of water management areas. The NWRS provides the conceptual and technical framework for all catchment management strategies. This resource directed management of water quality strategy is intended to provide input to the development of the water quality component of catchment management strategies.

2.3 Scope

Water resources

The scope of this strategy is defined by the Policy. In particular, the water resources include watercourses, surface and groundwater, wetlands and estuaries.

2.4 Review

Simultaneous review

Review of this strategy must take place at least every five years. Furthermore, it should be done at times that ensure the results of the review are available to inform planned reviews of other related strategies, particularly the National Water Resource Strategy.

The Policy is explicit about review of not only this strategy but the Policy itself. The Policy, its objectives and the effectiveness of this strategy must be reviewed simultaneously. This includes examining the degree to which catchment visions have been achieved. The Policy document should be consulted for more detail.

2.5 How to use this document

Who	To establish who has, or will have, responsibility for specific RDM-related actions (associated with water quality), see **Section 5: Institutional Arrangements**.
What	Technically what needs to be done is described in the following sections: • Determining and giving effect to RDM: **Section 6: Implementation Strategies.** • Water quality monitoring supporting both routine decision-making and sustainable development: **Section 6.5.3: Water Quantity Monitoring.** • Capacity creation: **Section 7: Capacity Creation & Maintenance**.
When	Time scales depend on what aspect of the strategy is being implemented. • Decentralisation of Departmental responsibilities: **Section 5: Institutional Arrangements**. • Implementing the monitoring programmes related to sustainable development: **Section 6.5.3: Water Quality Monitoring**.
Approaches	General approaches, both regulatory and non-regulatory, which enable resource directed management of water quality are briefly summarised in **Appendix: Management Approaches**.
Instruments	Management instruments such as guidelines and software decision support, as well as recommended further reading, are referenced **in the associated sub-sections**.

SECTION 3: OBJECTIVES

This section defines the formal objective of this strategy.

Vision

The vision of the Policy is to ensure that the water quality in South African water resources enables an equitable and sustainable balance to be achieved between its use by society and its protection as a critical component of a natural system so that the quality of life of all South Africans is improved and sustained in the long-term (DWAF, 2006a).

Strategy objective

The objective of this strategy is the comprehensive implementation of the policy on the resource directed management of water quality (DWAF, 2006a). This will comprise practical approaches:

- That ensure water quality considerations are appropriately incorporated into all water resource management initiatives, and
- That are ecologically, socially, economically and institutionally sustainable.

It is also the specific intention that this strategy:

- Demonstrates a first level of interpretation of the policy, and
- Is explicitly linked to policy statements and principles, and
- Is explicitly linked to detailed guidelines that comprise the necessary management instruments.

SECTION 4: SUSTAINABLE DEVELOPMENT

This section describes (1) how integrated water quality management can be implemented to achieve sustainable development (**4.1** and **4.2**) and (2) how the enabling principles of sustainable development should be applied in different circumstances (**4.3**).

4.1 Integrated Water Quality Management

"Part of our poverty is due to poor management of our natural resources"

Wangari Maathai, Nobel Peace Prize Laureate, 2004.

Multi-level continual improvement cycles

Van Wyk *et al.* (2002) have proposed an integrated water quality management (IWQM) model for South Africa. This is based on the cyclical "Plan, Implement, Check and Review" process.

Adaptive management

A cyclical process aimed at continual improvement (fundamental to the principle of adaptive management) plays out at a number of different levels, each relevant to a different time scale. Success at one level depends on successful implementation at lower levels.

IWQM process and principles

The principles of sustainable development apply at all stages of the IWQM process illustrated in Figure 4.1. However, the designated resource management class is the 'first line of defence' against development that might be unsustainable. The 'second line of defence' is embodied in the catchment management strategy and its implementation through resource directed measures, individual source directed controls and resource management initiatives.

Monitoring

Monitoring using a holistic series of sustainability indicators that go beyond simply water quality (and beyond resource quality) is necessary (See Section 6.5.3: Water quality monitoring). Assessment of these indicators provides the basis for corrective actions and, if necessary, for strategic review.

Stakeholder engagement

Effective stakeholder engagement is fundamental to sustainable development. It should occur at all stages of the overall IWQM process. It is particularly important during the catchment visioning process.

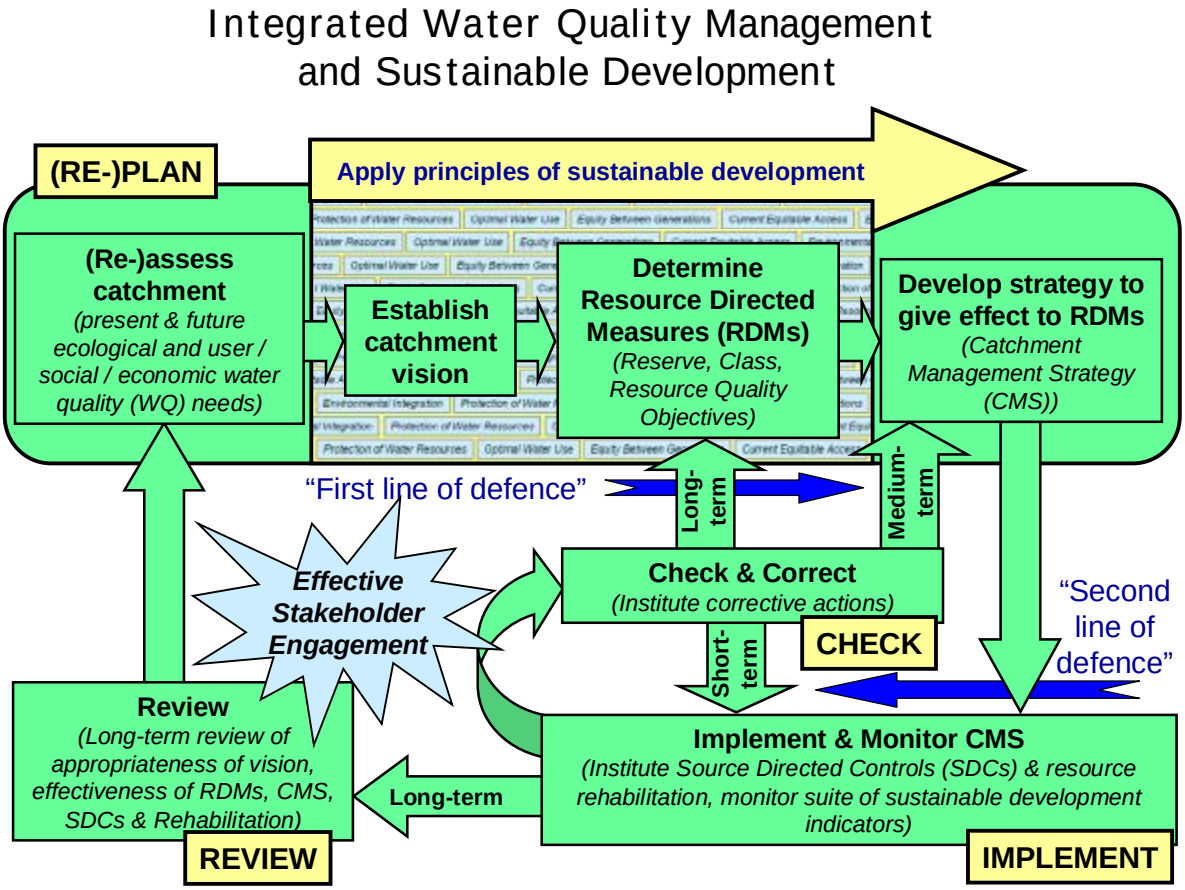
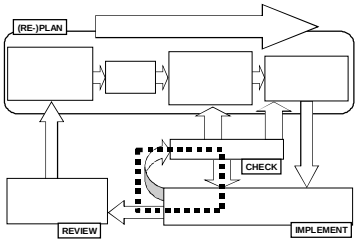


Figure 4.1: Illustration of the relationship between the integrated water quality management process and sustainable development

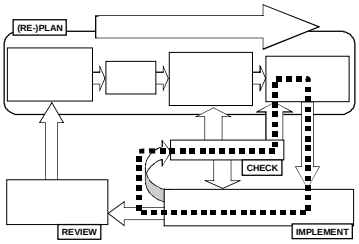
Individual initiatives (short-term cycle)

At the lowest level, **individual (local) source and resource management initiatives** must cycle through the Plan-Implement-Check steps on a relatively short time scale (typically one year or less). Cycling at this level typically occurs with individual water users and resource management initiatives (like remediation).

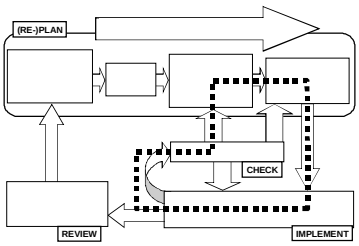


Re-consideration of the CMS (medium-term cycle)

The catchment management agency (CMAs) must implement the CMS on the same cyclical basis, checking it periodically (on, for example, a three- to -five year basis) to track its efforts to attain the management classes (as defined by their RQOs) designated for water resources under its jurisdiction. The successful implementation of the CMS depends heavily (but not solely) on the successful implementation of the individual short-term source and resource management initiatives. Persistent failure of these to achieve targets set by the CMS may prompt re-consideration of the CMS.

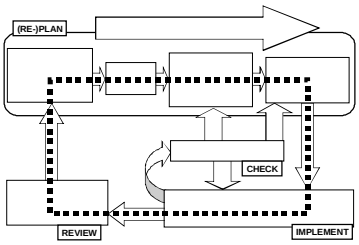


Re-consideration of the RDM (long-term cycle)



Persistent failure of the CMS to attain the management class and the RQOs, may lead to re-consideration of the RDMs. However, this should only occur when there is good reason to believe that no reasonable (*i.e.* practical and affordable) CMS can possibly give effect to the RDMs. In this case, the RDMs themselves, in particular the management class, can be reconsidered and changed (following due process). One motivation for this may be that the original dataset upon which the RDMs were based may be inappropriate for present conditions.

Reviewing catchment vision (long-term cycle)



Reviewing the catchment vision is the highest strategic level at which the continual improvement process occurs within a particular catchment. This should be reviewed on a time scale of about five years. It will be closely, if not inextricably, linked to the RDMs, especially the management class and associated RQOs. Once revised, all lower level cycles (relating to the RDMs, the CMS and individual source and resource management initiatives) may need to be re-considered (*i.e.* re-planned, implemented and monitored, checked and corrected, etc.). That is, the cyclical process then shifts back to medium-term and short-term continual improvement cycling.

4.2 Planning and operational sequences

Establishing versus achieving the vision

Effective stakeholder engagement is a fundamental principle enabling sustainable development. At the highest level this engagement manifests itself in determining the catchment vision. However, it is important that establishing the vision and striving for it are two different phases and processes. In effect, the former occurs in the planning phase and the latter in the operational phase.

Planning sequence

Ideally, planning begins with a catchment vision that is developed by all stakeholders in the catchment (see Figure 4.2). RDMs are then determined and established that accord with this vision. A CMS is then developed to give effect to the RDMs that focus on specific individual source management initiatives (SDCs) and resource management initiatives (such as remediation).

Operational sequence

Once these are in place, the operational sequence begins. The SDCs and remediation initiatives give effect to the strategy, which in turn gives effect to the RDMs, and which in their turn, give ultimate effect to the vision.

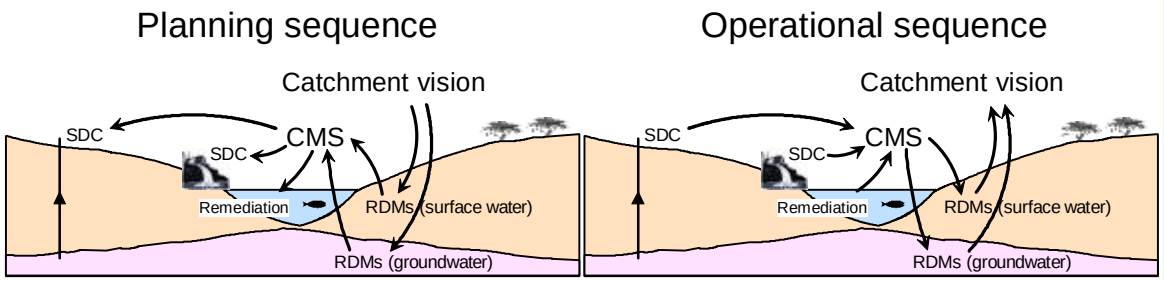


Figure 4.2: Planning sequence from catchment visioning to source directed controls and remediation, and the subsequent operational sequence from implementing the latter to achieve the vision

4.3 Balancing the principles

The Policy

The Policy lists six enabling principles of sustainable development:

- Protection of water resources,
- Optimal water use,
- Equity between generations,
- Current equitable access,
- Environmental integration, and
- Good governance.

The Policy further states that, from an overall national perspective, the balance between use of water resources and their protection must give preference to their use for socio-economic development, especially for poverty eradication and redress of past inequities.

However, the Policy also states that strict protection of selected aquatic ecosystems will occur when this is considered necessary to sustain their biodiversity and general integrity.

Good governance

Good governance is always important. Effective stakeholder engagement is a critical factor and all stakeholders must manage their affairs with integrity and in a lawful manner and apply accepted principles and procedures.

Emphasis on socio-economic development

Emphasis on socio-economic development means that special attention is paid to the principles of current equitable access, optimal water use and environmental integration.

Current equitable access is achieved by first determining the Reserve and allocating water quality to national priorities. The remainder is then allocated equitably to other users who ideally use their water optimally. Less emphasis is given to protection of water resources by accepting some degree of impact though not to the extent that the resource becomes unacceptably degraded and unsustainable.

In effect, this will be achieved when resources are classified as being either moderately used/impacted or heavily used/impacted (*i.e.* not as Natural).

Emphasis on protection of water resources

When strict protection is warranted, the resource will typically be classified as Natural. In this case, it is the principles of protection of water resources, and by implication, equity between generations, that receive most emphasis. Importantly, this does not preclude other water uses. However, these other water uses must be such that their impact on water quality is minimal and remains well within the ability of the ecosystem to sustain the provision of goods and services.

As an example of how this emphasis might be applied, a related strategic national recommendation has been made in respect of freshwater biodiversity (WRC, 2006). A panel of riverine ecologists and representatives from Department of Water Affairs and Forestry (DWAF), Department of Environmental Affairs and Tourism (DEAT), National Department of Agriculture (DoA), and Department of Provincial and Local Government (DPLG) recommended that:

- "*The quantitative target for freshwater conservation in South Africa is to maintain (and restore where necessary) at least 20% of the country's water resources in a Natural Class, where Natural Class refers to the highest level of protection awarded by DWAF's Water Resource Classification System.*
- *National custodian departments will identify up to 10% of water resources (50% of the target) for conservation, based on the national and strategic importance of such resources. The remainder of the national conservation target would be satisfied through delegation to sub-national levels [spheres] of government.*"

Strategy for experienced practitioners

As the 'first line of defence' against development that is unsustainable, more experienced practitioners in the field of water quality management should ensure that balancing of the principles of sustainable development manifests appropriately in the resource directed measures.

As the 'second line of defence' once the class and resource quality objectives have been established, achieving equitable allocation of water, and water quality in particular, practitioners should continue to apply the principles enabling sustainable development. This can be done by, for example, ensuring that water use is optimal and that there is holistic consideration of all important interactions with, and within, ecosystems (the environmental integration principle).

Strategy for inexperienced practitioners

It is not possible to sensibly "balance principles" unless one can clearly recognise the application of different principles in site-specific contexts. Accordingly, less experienced practitioners should first simply practice identifying the factors and actions that refer to each principle. For example, an action or decision that deliberately ensures that a specific economic activity can reach its full potential while using water quality very efficiently is a good example of optimal water use. On the other hand, a decision that specifically prevents a particular human activity that impacts negatively on water quality from occurring is an example of applying the principles of protection of water resources and optimal water use.

Once this is achieved, attention can be given to the concept of "balancing" these principles in which some are given preference over others.

SECTION 5: INSTITUTIONAL ARRANGEMENTS

This section describes how the institutions for water resource management will decentralise over time and how roles and responsibilities will change.

5.1 Introduction

Dependence on co-operation

The success of integrated water resource management (IWRM) in general, and resource directed management of water quality in particular, will depend heavily on co-operation between all stakeholders. This section identifies those stakeholders and describes the changing arrangements of the encompassing institution. For more detail consult DWAF (2006b).

Underlying principles

The Policy describes a variety of principles that have direct relevance to institutional structure and function (DWAF, 2006a). These include people first (*"Batho pele*") and sustainable development (including current equitable access, equity between generations, etc.). The National Water Act (36:1998) also demands decentralisation and subsidiarity of water resource management.

5.2 Phased institutional change

Phase 1: Post restructuring (current)

Phase 1 follows the recent restructuring of DWAF. Decision-making is shared between P&R and Regional Clusters, while systems are being developed and piloted. Policy and Regulation branch of DWAF head office (P&R) is responsible for piloting of RDM and the compulsory licensing process, while the approaches are being developed. Through the piloting process, significant implementation responsibility is delegated to the Clusters and proto-CMAs. Similarly water quality planning and management will be strongly supported by P&R as capacity is built in the Clusters.

Challenges: Iterative establishment of stable systems and their piloting.

Phase 2: Decentralisation to Clusters

Phase 2 is characterised by completion, or near-completion, of piloting and the establishment of stable macro-systems[1]. As a result, further decision-making and implementation is transferred to the Regional Clusters, while the proto-CMAs take on those current regional cluster functions that centre on water use management and coordination.

Accordingly the proto-CMAs are implementing most WRM responsibilities (except Authorisation and RDM). This phase is sometimes circumvented.

Challenges: Capacity in Clusters and proto-CMAs and coordination with

[1] Macro-systems are the broader conceptual and strategic systems that lead to the establishment of the institutional structures. Systems (or micro-systems), as defined here, pertain to those systems (often internal) that provide the detailed institutional processes and dynamics, resulting in stable and fully established institutions with clear differentiation of roles and responsibilities.

P&R.

Phase 3: CMAs establishment

Proto-CMAs are transferred, along with their functions and staff, from DWAF into the CMAs within the first 2 years. The CMAs are then formally established. They then start to assume the role of Responsible Authority. DWAF takes on new responsibilities centred on oversight and support.

Challenges: Coordination of widely distributed roles and responsibilities, especially in respect of development of catchment management strategies and water use authorisation.

Phase 4: Fully functional CMAs

A fully functional CMAs has now been established, with the majority of WRM implementation roles and responsibilities within the CMAs (including Responsible Authority functions). The relationships between the CMAs, Regional Clusters and P&R are well established, and the systems and processes within and between these institutions are stable. DWAF has assumed the role of oversight and support of systems, process, institutions and institutional arrangements.

Challenges: Building and maintaining capacity within the subsidiary institutions (especially maintenance of consistency and development of information transfer, review and feedback systems under changing circumstances).

5.3 Roles and responsibilities

5.3.1 Management functions

Visioning

Visioning is a strategic process that guides strategy development (DWAF, 2006c). It feeds back into both RDMs and the CMS. Conducted at catchment level, it informs the classification process during Phases 1 and 2. In Phase 3, visioning is conducted on behalf of the CMAs (*e.g.* by a catchment forum), as preparation for the CMS (DWAF, 2006c).

Resource directed measures

The water resource classification system is a national strategy and is therefore seated in P&R: RDM. Determining the Management Class is initially the responsibility of RDM piloting in P&R (Phase 1) and is delegated to the Clusters from Phase 2 onwards. When the water resource is only of local significance (*i.e.* not of national importance), the recommendation of the Management Class may be delegated to the CMAs.

From Phase 2 onwards, establishment of stable systems of coordination and co-operation, review and information transfer between CMAs (proto-CMAs), Clusters and RDMs, is a function of P&R, which gradually moves towards increasing institutional oversight and support.

Once a stable classification system has been developed, its implementation becomes relatively routine, and the responsibility for achieving this is passed to the Clusters (Phase 2 onwards). Determination of the Reserve is a technical process, and therefore may be delegated to the CMAs once established (Phase 4). Similarly, for resources that are only regarded to be of local significance (and possibly for all resources), determination of the RQOs may be delegated to the CMAs during Phase 4. Gazetting the Reserve and the RQOs is the responsibility of P&R.

Water Resource Management strategies

The NWRS is the responsibility of P&R (Strategic Coordination). As with the classification system, the institutional transfer of information both feeding into the NWRS and informing processes and decisions at the regional and local levels, requires the establishment of sound and stable coordination and co-operation systems and the development of appropriate relationships based on close institutional fit. Establishment of these systems and relationships starts during Phase 2, and is completed and stabilised during Phase 3.

P&R (National Water Resource Planning) has developed and maintains an initial, interim strategy for catchment management, the ISP (Phases 1 and 2). By Phase 3, the ISP is superseded by the CMS, the development of which is one of the initial functions of the CMAs (Phase 3). The CMAs gazettes the CMS after review by DWAF.

The abstraction allocation plan and the plan for allocatable water quality are catchment level decision-support tools. They are determined by P&R (Integrated Water Resource Planning) during Phases 1 and 2, when they are partly captured in the ISP. In Phases 3 and 4 they are determined by the CMAs (as part of the CMS).

Authorisation

The overall water use authorisation process (application, evaluation and authorisation) will ultimately be the responsibility of the CMAs (Phase 4). However, in the interim, responsibility is divided between P&R (Water Use), Regional Clusters and the CMAs (proto-CMAs).

Control and enforcement

Development of directives, initially the responsibility of P&R (Water Use), will be delegated to Clusters, ultimately with CMAs involvement (Phase 4). Ultimately, the CMAs will be responsible for control and enforcement.

Management approaches

Compulsory licensing will be the responsibility of Clusters for resources of national importance. Responsibility for those of local importance may be shared with CMAs.

The Waste Discharge Charge System (WDCS) is initially the responsibility of P&R (Water Use), being transferred to Clusters and ultimately to CMAs when stable.

Self regulation and awareness approaches are primarily CMAs responsibilities although these can also be applied at national and regional levels by P&R (Water Use) and Clusters.

Monitoring

Monitoring related to sustainable development is the responsibility of P&R (Information Management) with Cluster and ultimately CMAs involvement. Performance monitoring (of RQOs) is carried out by Clusters and, ultimately, by the CMAs. Compliance monitoring is catchment-based and achieved principally through self-regulation (with auditing by the Clusters and CMAs).

Review

Reviews of all systems will be conducted by P&R during Phase 1. However, multiple levels of review are anticipated by Phase 3, with review of issues of national significance/strategic nature conducted by various P&R components with some functions delegated to Clusters and CMAs.

Oversight and support

Oversight and support is necessary for national consistency. It is both *technical* (*e.g.* implementation of the WDCS) and *institutional* (*e.g.* development of institutional systems and capacity to enable the CMAs to perform its Responsible Authority functions). It also involves a significant *monitoring and review component* and a *support component* to address identified issues or problems through, for example, capacity building. These responsibilities are principally seated in P&R, supported by Clusters, becoming a core function of P&R from Phase 3 onwards.

5.3.2 Management effort

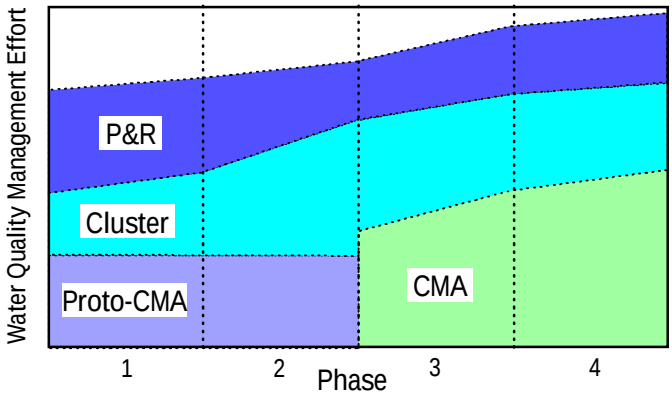


Figure 5.1: Evolving management effort during transition phases (DWAF, 2006b)

Phases 1 and 2

Figure 5.1 illustrates the shift in water quality management effort through the transition phases consistent with the shifting roles and responsibilities. Management effort is reasonably evenly spread between P&R, Clusters and proto-CMAs during Phase 1, with a progressive transfer of responsibilities from P&R to the Clusters during Phase 2.

Phase 3

With the establishment of the CMAs, all roles and responsibilities of the proto-CMAs are transferred to the CMAs along with a continuing shift of roles and responsibilities from P&R to Clusters to CMAs. P&R takes on new responsibilities centred on oversight and support – co-ordination, collaboration and transfer of information between CMAs, Clusters and P&R.

Phase 4

The CMAs are established and stabilised and now bears the majority of water quality management effort. The roles and responsibilities of the Clusters have shifted further (some to the CMAs, with new responsibilities coming down from P&R), with the Clusters taking on an increasing responsibility and capacity in collaboration, information transfer, review and assessment. The functions of P&R have been further focussed, with roles

and responsibilities centred on oversight and support.

5.4 Institutional implications

Phase 1

The management cycle is largely coordinated and partly implemented by P&R, in co-operation with the Clusters. The cycle involves RDM (classification system and implementation), Integrated Water Resource Planning (strategy development), Water Use (authorisation and regulation) and Information Management (monitoring and review), with Strategic Coordination assuming oversight of the process. These groups are relatively well capacitated and resourced (generally supported by professional service providers), and coordination is efficient, implying that the piloting processes in this phase are likely to be successful (DWAF, 2006b).

Phase 2

Shifting responsibilities to the Clusters (and proto-CMAs) during this phase introduces potential problems, because their capacity and expertise tends to be limited. Although stable macro-systems are established, detailed institutional processes and dynamics (*i.e.* micro-systems) are not yet fully developed. There may therefore be some initial institutional instability unless this is carefully phased and supported by broad institutional capacity building. However, as both the proto-CMAs and the regional cluster are still contained within DWAF (*i.e.* decentralisation is not yet complete), collaboration, communication and capacity is more easily achieved.

Phase 3

Nineteen CMAs will be established and will take on key planning responsibilities. In effect, these become the interface between the P&R (RDMs) and the high-level visioning process on the one hand, and authorisation on the other. The CMAs will be new, young organisations with limited capacity and resources (although transfer of staff and resources from proto-CMAs does strengthen the new CMAs). In addition, mentoring by DWAF and the Clusters will be required. Accordingly, a range of challenges present themselves and hinge on (a) the resources and capacity in the new CMAs, (b) systems of mentoring, decision making and information flow between the CMAs, Clusters and P&R, and (c) wider review and contextualisation of institutions and roles and responsibilities.

Phase 4

The CMAs are fully established and their systems, capacity and resources are stable. The people within the institution should have grown as capacity is improved, and roles and responsibilities are defined: capacity building of the CMAs staff over 5 years ensures that the institution evolves and the roles and responsibilities are refined according to the management needs and requirements of the WMA.

5.5 Institutional roles

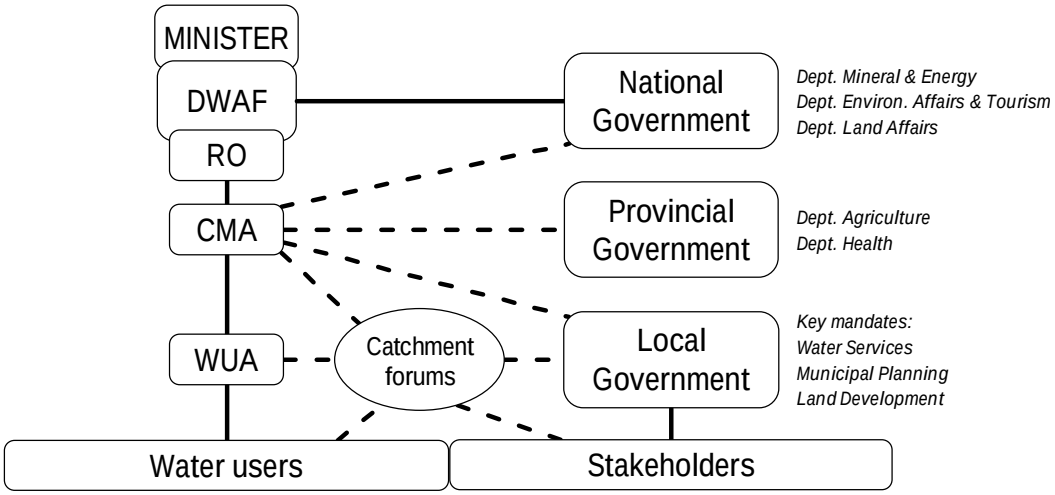


Figure 5.2: Primary institutional relationships (DWAF, 2006b)

Key players

Water quality management inherently requires the management of activities and resources that are the mandate of other government departments or property of private sector entities. Figure 5.2 indicates the key institutions relevant for Resource Directed Management of Water Quality (RDMWQ), with the CMAs / DWAF as the main focus of this management attention.

Resource directed measures

The process of development and establishment of the classification system is consultative ("consensus seeking process") and requires input from other national government departments and from interested and affected local and national agencies (*e.g.* WUAs, Forums, national representative bodies). DWAF achieves this consultation through the CMAs/proto-CMAs.

Determination of the Reserve and the RQOs may be conducted at the CMAs/Cluster level. As this is largely a technical process, participation by peripheral agencies is not a prerequisite. However, local government and other local agencies (*e.g.* WUAs) may be involved in the technical process.

Water Resource Management strategies

The establishment of the NWRS by National Government (DWAF) necessitates co-operative government with other National Government departments, such as DEAT, Department of Finance, Department of Agriculture, and Department of Minerals and Energy (DME).

The development of a CMS involves regional and national government and local agencies (*e.g.* local government, Water User Associations and Forums). Engagement with Provincial Government (e.g. Office of the Premier, Ministry of Agriculture and perhaps Nature Conservation) forms an important component of the review, assessment and harmonisation of the CMS. Brokerage of this relationship is principally undertaken by the Cluster.

Water use authorisation

The application process requires some consultation at a local level with water users and dischargers (including local government). Similarly, evaluation and authorisation require consultation and co-operation with local, regional and national departments. As such, the water use authorisation process comments on, and is informed and influenced by other processes, such as the development of the Environmental Management Plan Report (EMPR) within the mining sector (a requirement of DME) or the requirements of the Environmental Conservation Act (Act 73 of 1989) of DEAT for waste disposal (e.g. landfills).

Control and enforcement

Control and enforcement functions of the CMAs require the establishment of co-operative governance frameworks with the local agencies (local government, justice, law enforcement). Establishment of the water management directives requires close co-operation with the national and regional bodies responsible for development and implementation of management and control measures in the Water Management Area (WMA) (commonly DEAT, DoA, and local and regional government).

Compulsory licensing

Compulsory licensing is inherently a co-operative process that must engage the developmental and spatial planning priorities of other government departments. The linkage with Local Government is critical in terms of integrated development planning (including water services) and local economic development, while Provincial and National Government is key in supporting people with access to water and other productive resources (including land reform, agricultural resource protection, etc).

Waste Discharge Charge System

The emerging nature of the WDCS necessitates close co-operation with National Treasury. Moreover, engagement at the local level is necessary to give effect to the mitigation element, requiring close co-operation with water users, dischargers and impacted communities/enterprises. In developing and reviewing the charge system, co-operation and engagement of DME (mining sector), DTI, DEAT (Environment Conservation Act) and DoA will ensure harmonisation and consistency of the system with other relevant legislation and control and management approaches.

Self-regulation and awareness

Development of self-regulation and the creation of awareness require the development of co-operative governance at the local level between the CMAs, local government and WUA, specific users and dischargers.

Monitoring and review

Monitoring related to sustainable development requires consistency with, and input from CSD, DBSA and various levels of national strategy.

Performance monitoring requires close co-operation with local government, WUA, forums and individual users/dischargers.

Compliance monitoring and monitoring of the water management institutions are largely internal functions conducted at varying levels (CMAs, Regional Clusters, P&R). Development of co-operative governance

relationships is not a pre-requisite, although the involvement of local, provincial and national government and other agencies in the appropriate review process could be beneficial.

5.6 Institutional Capacity

Types of institutional capacity

Institutional capacity includes:

- *Policy and legal capacity*.
- *Planning and managerial capacity*.
- *Organisational and procedural capacity*.
- *Financial capacity*.
- *Human and infrastructural capacity*.
- *Networks and associations*.
- *Stakeholders.*

Consult DWAF (2005b) for more detail.

Institutionally orientated approach

The process for building institutional capacity should (a) be carefully planned, and (b) establish coherent, simple and stable systems, introducing as much routine as the available capacity is able to deal with. For example, see the strategy proposed for water use authorisation (Section 6.5.2.7).

SECTION 6: IMPLEMENTATION STRATEGIES

This section is an interpretation of how the Policy should be implemented in a variety of scenarios. It is the technical link between the Policy and the management instruments.

6.1 Introduction

Technical link between Policy and instruments

The following sub-sections briefly summarise how the Department will ultimately integrate the technical aspects of resource directed management of water quality into broader water resource management. It is this technical implementation that the institutional arrangements, action plan, and capacity creation, aim to facilitate.

Each of the strategy sub-sections provides direct references to the associated management instruments.

Common themes

The technical theme throughout is primarily "making water resource management water quality friendly". Specifically, this strategy focuses on achieving this through resource directed measures (RDMs).

- First, it does this by briefly addressing how water quality should be taken into account in the determining the management class, resource quality objectives (RQOs) and the Reserve.
- Secondly, it addresses how RDMs should be incorporated into a catchment management strategy to ensure the management class, RQOs and the Reserve, and hence the catchment vision, are achieved and maintained.

Another common thread that extends from the Policy through this strategy to the management instruments is consistency with the philosophy of sustainable development.

Sustainable development guidelines

The Policy should be consulted for a more detailed discussion on the philosophy and enabling principles of sustainable development relating directly to water resource management, and to water quality management in particular. The generic philosophy of sustainable development should also be consulted for more general background information on the concept of sustainable development (DWAF, 2005b).

6.2 Catchment assessment

Primary purpose

A catchment assessment is an important planning function of integrated water quality management and hence integrated water resource management in general. Its primary purpose is to provide useful information on a catchment for the following:

- Catchment visioning.
- Resource directed measures.
- Water quality management programmes and plans.
- Catchment management strategies.
- Source directed controls (particularly source-specific management interventions).
- The National Water Resource Strategy (NWRS).
- Institutional development.
- Water quality reconciliation foresight and scenario planning.
- Water resource development.

Interpretation of enabling principles

Practitioners should familiarise themselves with the enabling principles of catchment assessment in the Policy. They should ensure that the process is guided by these principles. For example:

- The nature of engagement with stakeholders should always be constructive and be at a level that ensures the catchment visioning process in particular (and subsequent efforts to attain that vision) are adequately supported.
- Catchment assessment is about collating information and making it available. Take cognisance of legislation such as the Promotion of Access to Information Act (2:2000).
- Catchment assessments must be appropriately integrative in their data collections and assessment. Consider the "state" of water quality, the causes of deteriorating water quality ("pressures"), the ecological and socio-economic consequences (the "impacts") of this and the reactions of society, in both the public and private sector (the "responses"). (See Section 6.5.3: Water quality monitoring)
- Although human and financial resources must be pragmatically allocated to catchment assessments, this must also demonstrate good judgement and be based on the level of confidence required.

Level of confidence

The level of confidence that should be strived for in a catchment assessment study should be determined primarily by the degree of confidence required for the processes or applications it is intended to support.

Management instruments	Conceptual introduction Catchment assessment studies	DWAF, 2003c DWAF, 2003d

6.3 Catchment visioning

Importance

One core tenet of the National Water Act is participatory management of water resources *(Principle: Effective Stakeholder Engagement)*. The degree of stakeholder engagement is likely to increase in importance and frequency in the near future as water resources are classified and associated resource quality objectives are defined. The Department also recognises that good governance depends intimately on effective stakeholder engagement.

Catchment visioning is an essential planning tool that drives all aspects of integrated water resource management and is an indispensable component of this strategy. Although this strategy primarily addresses water quality management, visioning must encompass resource quality holistically and clearly identify how water quality issues contribute.

Interpretation of enabling principles

Individuals who are responsible for initiating and facilitating a catchment visioning process should familiarise themselves with the enabling principles of the process described in the Policy. They should ensure that these principles are applied appropriately to the process at all times.

Vision content principles

The content of the vision (including the associated objectives hierarchy) should also be strongly principle-based *(Principle: Principle-based Decision-Making)*. In particular, all stakeholders should be:

- Familiar with the enabling principles of sustainable development as described in the Policy, and
- Encouraged to incorporate these either explicitly or implicitly into their vision.

Sustainable development

Awareness should be created of the philosophy and principles of sustainable development *(Principle: Sustainable Development)*. Consideration of sustainable development should be facilitated by:

- Investigating creative techniques that open up debate, discussion and problem solving. These should be open-minded and positive and have a common future focus in which stakeholders have true ownership. (*Principle: Creative Problem Solving*),
- Instilling a desire to put effort into finding "win-win" solutions to problems that at first sight may seem unsolvable, and
- Providing stakeholders with all the necessary ecological, social and economic information to ensure informed decisions are made *(Principle: Environmental Integration)*.

Other legislation

In defining the vision, and in particular in the subsequent process of its achievement, cognisance must be taken of all legislation that may be relevant. This will go well beyond the National Water Act (36:1998). For example, this may include environmental management, conservation, biodiversity, etc. *(Principle: General Legislative Alignment)*.

Buy-in and ownership

South African stakeholders are becoming more acutely aware of their rights in respect of being consulted. Any perceived deficiency in this regard can result in an implementation strategy being derailed or delayed. This can be particularly problematic if the dissatisfied stakeholders would have played an important implementation role.

For this reason the strategy of the Department will be to apply the principles of effective stakeholder engagement described in the Policy. Furthermore, the Department's strategy will, whenever appropriate, do more than merely "consult" stakeholders. It will engage them with the intention of:

- Allowing them to contribute meaningfully to the formulation of the vision,
- Creating at least a sense of buy-in, and
- Preferably enabling a significant feeling of ownership in the subsequent achievement of the vision.

Confidence levels

Establishing an effective stakeholder base is time consuming and potentially costly. This may create a tension with the need to make water resource management decisions quickly and effectively. Catchment visioning initiatives should therefore be carried out to a level of confidence that is appropriate to the circumstances. Confidence, in the current context, refers to the degree to which stakeholders can comfortably rely on:

- The vision adequately reflecting their future aspirations, and
- The associated objectives hierarchy being practically implementable.

Catchment visioning will necessarily need to be pragmatic, but this pragmatism must also be sensible in its choice of priorities (*Principle: Prudent Pragmatism*).

Confidence determined by enabled processes

The degree of confidence in catchment visioning is ultimately determined by the degree of confidence required for the processes it is immediately intended to enable. For example, in the absence of a management class and where a need exists for low confidence resource water quality objectives, a low confidence catchment visioning exercise is acceptable.

Subsequent movement towards achieving the vision should be understood by all to require a management approach that takes account of current uncertainties and adapts to future changes that may be unpredictable *(Principle: Adaptive Management)*.

In those instances where a low confidence catchment visioning exercise is performed, this should always be seen as laying the groundwork for a future process that should ultimately provide greater confidence.

Management instruments	Catchment visioning Public participation	DWAF 2006c DWAF, 2001a;DWAF, 2001b

6.4 Resource directed measures

6.4.1 Introduction

6.4.1.1 General issues

RDM determination

An "RDM determination" for a water resource refers collectively to the following sub-processes:

- Determination of the resource management class and resource quality objectives (RQOs), and
- Determination of the Reserve (basic human needs and ecological).

These are described in sub-sections below.

Determination & legal establishment

"Determination" of RDMs is a largely technical process including primarily ecological, social and economic issues. Having been so determined, the legally binding act of setting the RDMs requires approval by the Minister or the delegated authority.

Importance

The importance of a water resource management unit, in particular relating to quality of life and all factors that determine this, ultimately guides the level of protection required and the degree of confidence that is required in the RDM sub-process. Relating to water quality, the following issues should be considered:

- *Ecological importance*. A high biodiversity of biota and habitats in a resource unit increases its ecological importance. This importance is further increased if these biota or habitats are rare. The water quality may be an important component of such habitats.
- *Social importance*. This is the extent to which the local human population and downstream users depend on water of particular quality. For example, such uses may include recreation, drinking, laundry, stock watering and various religious and cultural practices. They may also regard the water as simply having aesthetic value.
- *Economic importance*. This refers to the extent to which water of a particular water quality should be accessible for economic activities such as agriculture and industry, and more specifically those activities that are associated with significant job creation and hence an increased potential for poverty eradication.

Consideration of all three dimensions of importance is critical for achieving sustainable development *(Principle: Environmental Integration)*.

Sensitivity

The sensitivity associated with a water resource management unit also determines the level of protection that is required. Relating to water quality, the following issues may increase the level of protection required:

- *Ecological sensitivity*. Biota or ecological processes may respond significantly to very small changes in water quality. Estuaries and wetlands are examples of systems that usually have a high ecological sensitivity.
- *Social sensitivity*. Local or downstream users may rely on a demanding water quality range for social activities and small deviations from this range may cause potential problems.
- *Economic sensitivity*. Economic activities of water users may be negatively affected by small changes in water quality.

Vulnerability

Besides importance and sensitivity, vulnerability is also used particularly for groundwater to represent its susceptibility to contamination (expressed as a likelihood or probability). It depends largely on the nature of the unsaturated zone that overlies groundwater. The greater the vulnerability of a groundwater resources the greater the level of protection that is warranted.

6.4.1.2 Confidence

Confidence levels

Table 6.1 shows some factors that can determine the level of confidence that should ultimately be associated with the outcome of any proposed RDM sub-process. Each relevant factor should be considered and weighed against other relevant factors. (Note: Different factors will be relevant in different circumstances, while some factors may not be relevant in certain instances. Also, the factors are not all mutually exclusive, *i.e.* there may need to be some degree of overlap in their interpretation.) ***The final level of confidence chosen should be based on the factor that demands the highest level of confidence.***

Risk

The level of confidence required is closely related to the risk of problems occurring. The higher the potential risk, the greater the confidence in the RDM sub-process should be.

Table 6.1: General and water quality-related factors determining the degree of confidence that should be associated with any single proposed RDM sub-process that is associated with a particular water resource unit.

FACTOR	DEGREE TO WHICH FACTOR APPLIES		
Factors related to the immediate purpose of the RDM sub-process			
Confidence required in a subsequent process to be enabled (*i.e.* informed) by the RDM sub-process	Low	Medium	High
Required for water use allocation plan in catchment management strategy?	No		Yes
Required for compulsory licensing?	No		Yes
Number of applications for water use licences currently being processed in the resource unit.	One	Few	Many
Factors related to the present ecological state (PES)			
Present ecological importance and sensitivity (EIS) of resource unit (directly related to the degree of protection of the water resource considered necessary)	Low / Local	Medium / Regional	High / National/ International
Degree of present water quality stress (if this can be quantitatively determined)	Unstressed	Stressed	
Factors related to potential changes in water quality			
Potential negative impact of the proposed water use(s) on water quality (may be dependent on EIS)	Low	Medium	High
General likelihood of developments in the short- and medium-term that may impact negatively on water quality	Low	Medium	High
Vulnerability of resource	Low	Medium	High
Degree to which water resource is already used (in terms of water quality impact)	Minimal	Medium	High
Factors related to potential impacts of changes in water quality			
Severity of potential impact of changes in water quality on existing social or economic users (may be dependent on EIS)	Low	Medium	High
Spatial scale of potential impact of changes in water quality	Highly localised	Fairly local	Regional
CONFIDENCE THAT SHOULD BE ACHIEVED IN THE PROPOSED RDM SUB-PROCESS	**LOW**	**MEDIUM**	**HIGH**

6.4.1.3 Variables of concern

Beyond water quality

A main objective of this strategy is to "ensure water quality considerations are appropriately incorporated into all water resource management initiatives" (see Section 3: Objectives). This requires thinking beyond water quality.

The causes and effects (impacts) of deteriorating water quality must also be considered if a truly integrated approach to water quality management is to be implemented successfully.

Water quality variables

Nevertheless, at the most fundamental and obvious level, "incorporating water quality considerations" often means choosing indicators that reflect those water quality properties that are relevant to the situation being considered. Identifying "variables of concern" may depend on:

- The nature of the individual water uses and their impacts on water resources (and therefore may need to be established through stakeholder engagement).
- Ecosystem requirements.
- The RQOs or preliminary RQOs (both narrative and quantitative) that may exist for the water resource unit in question. These necessarily reflect desired resource quality in general, some of which will relate directly to water quality. Although specific water quality attributes may often be explicit in the RQOs, it must be ensured that all RQOs are properly interpreted to ensure that all important water quality variables of concern are chosen.

New mindset

A conscious effort should be made to move away from a common traditional mindset that chemical variables are the only water quality variables of importance. The following should also be considered:

- Microbial variables such as *E. coli* are useful indicators of faecal contamination. Faecal contamination is problematic when water is used for domestic purposes because human health can be affected.
- In certain circumstances, like when a known source of toxicants exists or is suspected, measurement of the toxicity of water to selected organisms (such as algae, *Daphnia*, or fish) can provide information not easily obtained by the usual chemical methods.

Sustainability

The other objective of this strategy is to ensure the approaches adopted to implement it are "ecologically, socially, economically and institutionally sustainable" (see Section 3: Objectives). In respect of water quality variables specifically, this means ensuring the variables are:

- Representative of the water quality that matters the most to overall ecosystem health.
- Socially relevant and acceptable. (Human health is one obvious consideration).
- Economically appropriate. (Consideration should be given to more than just the financial costs. The broader economic implications relating to causes and effects of water quality need to be considered).
- Institutionally sound. (Different organisations are often likely to be stakeholders. Variable levels of capacity relating to either measurements of the chosen variables, or interpretation of their data, across different organisations must be aligned).

Management instruments	RDM manuals Monitoring Determining water quality stress	DWAF, 1999 DWAF, 2006f DWAF, 2006e
Further reading	Introductory manual Variables of concern	DWAF, 2005b DWAF, 2006g&i

6.4.2 Resource water quality objectives

Short-term measures

Because the determination of the class and associated RQOs (Section 6.4.3) is time-consuming (because of their formality and the need to follow due process), appropriate interim measures should be taken to facilitate water quality management in the short-term.

In those water resources requiring immediate attention, resource water quality objectives (RWQOs) can be defined at selected strategic locations. As far as possible, and when human, financial and time resource permitting, their determination should apply the same principles that will underpin the determination of RQOs (when the classification system becomes established). In so doing, these RWQOs serve two purposes: (a) they facilitate short-term water quality management, and (b) they form a basis for the ultimate determination for formal RQOs.

In the short-term, these RWQOs are then regarded for most practical purposes as (preliminary) RQOs and interim management objectives can then be defined to facilitate their gradual attainment (equivalent to the strategy for "attaining a management class" (see Section 6.5.2.3).

6.4.3 Determining the resource management class and RQOs

Fundamental importance

Having water resources classified into specific present and desired future categories is arguably the most fundamental concept of future water resource management. This is because it will provide the main framework of criteria upon which the Department can make decisions regarding the appropriate balance between use and protection in the quest for sustainable development. The role of water quality issues in this process is as important as water quantity and other resource quality attributes. *(Principle: Sustainable Development)*.

Essential management objectives

Resource quality objectives (RQOs) are management objectives, the monitoring of which will allow stakeholders to establish whether the designated management class is being attained or maintained. This makes them essential tools for effective water resource management.

Setting RQOs is intimately related to designating the management class. They define the limits of the chosen class and take account of all users, as well as the Reserve, and are extremely important sustainability indicators.

Familiarisation with principles

All stakeholders and decision makers who are involved in the classification process should familiarise themselves with the enabling principles of sustainable development as outlined in the Policy. It is precisely the relative application of these principles for which a balance must be found.

Effective stakeholder engagement

Effective stakeholder engagement in the classification process is essential. See the Policy for details on the enabling principles. The stakeholder engagement process must be embodied in a catchment visioning exercise (see Section 6.3).

Those stakeholders that rely on water of particular quality are important because it is such reliance that often needs to be balanced against the need to protect aquatic ecosystem health. RQOs must reflect this balance. *(Principle: Effective Stakeholder Engagement)*

Empowering stakeholders

Stakeholders must be empowered to make informed inputs into the process. In respect of the water quality component of their resources, if necessary, they must be adequately informed about the following:

- The meaning and value of water quality in respect of (a) constituents contained in the water, and (b) associated ecological responses (such as diminished ecosystem integrity) and social and economic impacts of worsening water quality (for example on human health).
- The relationships between aquatic ecosystems and water quality.
- The effects of their water uses on water quality and hence downstream users.

Although general statements can usually be made about these issues, more convincing and empowering information can only come from a detailed understanding of water quality-related processes that are specific to the catchment in question. This can only come from catchment assessments (see Section 6.2: Catchment Assessment) and holistic water quality monitoring (see Section 6.5.3: Water quality monitoring). The information should be communicated to stakeholders through effective channels such as catchment forums.

Integration across catchments

Although a management class and associated RQOs may be specific to sub-catchments or even Level II Ecoregions within a water management area, they must also take account of current and potential impacts:

- Upstream, and
- Downstream, and
- On catchments receiving or donating water via inter-basin transfers.

In such cases, stakeholders from such catchments must also be engaged *(Principles: Environmental Integration & Effective Stakeholder Engagement)*.

Achievable RQOs

Care should be taken to ensure that achievable RQOs (relating to water quality) are properly defined. This may necessitate at least a preliminary consideration of interim water quality objectives for the resource – these will link the formal RQOs to conditions that might be imposed on individual water uses. Affected stakeholders must feel comfortable that these interim objectives, and hence the RQOs, are achievable progressively over a specified period of time *(Principle: Prudent Pragmatism)*.

Management instruments	Empowering stakeholders (catchment assessment)	DWAF, 2003c
	Empowering stakeholders (monitoring)	DWAF, 2006f
	Resource water quality objectives	DWAF, 2006e&d
	SA water quality guidelines	DWAF, 2001c

6.4.4 Determining the Reserve

Basic right

The National Water Act defines the Reserve as the quantity and quality of water required (a) to satisfy basic human needs and (b) to protect aquatic ecosystems, in order to secure ecologically sustainable development and ensure sustained use of the relevant water resource. The Reserve is also dependent on the designated management class *(Principle: Sustainable Development)*.

Familiarisation with principles

All stakeholders are concerned with Reserve determinations relating to water quality should familiarise themselves with the Reserve-related issues in the Policy. Both the ecological and basic human needs Reserve will contribute in a fundamental way to achieving sustainable development if they are properly determined and applied.

Variables of concern

When choosing the variables to represent those attributes of water quality that are relevant to the Reserve, cognisance should be taken of the comments in sub-section 6.4.1.3 (Variables of concern) above.

Management instruments	Water quality guidelines (aquatic ecosystems) Water quality guidelines (domestic use) Water quality guidelines and fitness-for-use categories	DWAF, 2002 WRC, 1998; DWAF, 1995 DWAF, 2006e
Further reading	Introductory overview Biotic response	DWAF, 2005b Malan and Day, 2005

6.5 Giving effect to resource directed measures

6.5.1 Introduction

Sustainable development

Having determined the RDMs it is important that these guide water resource management, both by the Department and by catchment management agencies (CMAs), effectively and efficiently. Even though the management class is the 'first line of defence' against development that may be unsustainable, giving effect to RDMs (or 'making RDMs operational') continues to require explicit consideration of the principles of sustainable development. This is the 'second line of defence' because these remain the guiding principles even when the management class has been attained and is being maintained. (See Figure 4.1.)

Translating RDM

In general, the RDMs need to be translated into strategies and actions that:

- Achieve the objectives set for the water resource,
- Manage causes of water quality impacts, guided by RQOs, resource water quality objectives (RWQOs), interim objectives and source management objectives (SMOs), the latter given effect through source directed controls (SDCs), and
- Remediate water resources where this may be necessary.

In practice, the SDCs will be the main focus of efforts to give effect to RDMs. However, the following sub-sections give specific emphasis to translation of RDMs to SDCs. The SDCs *per se* are not the focus of this strategy. Rather, this strategy describes how the overall source management strategy in a catchment should be determined by the RDMs, including RWQOs, that are in place.

Proactive and reactive

RDMs must guide SDCs in both a proactive and reactive manner:

- Proactive management focuses on measures that will prevent or minimise future water quality problems. For example, this involves the Department and/or CMAs using RDMs to assess future developments that may impact on water quality.
- Reactive management focuses on managing existing sources of negative impact on water quality to achieve the RDMs.

6.5.2 Scenarios

6.5.2.1 Introduction

Strategies

The following sub-sections each identify a specific scenario for which a strategy is presented that will help to implement the policy on resource directed management of water quality.

6.5.2.2 Catchment management strategies

Scenario	A catchment management agency (CMAs) is assumed to have been established and that a catchment management strategy (CMS) must now be developed progressively for its water management area (WMA).

Importance of principles

The CMAs is responsible for developing the CMS. All involved in this process should familiarise themselves with the Policy relating to CMS and their associated principles. They should ensure that all principles are appropriately reflected in:

- The process of developing the CMS, particularly relating to effective stakeholder engagement not being an exclusive process in any way, and
- The CMS itself, either explicitly or implicitly.

Alignment

The development of the CMS must be issues driven and must be aligned with Water Services Development Plans (WSDPs) and Integrated Development Plans (IDPs).

Catchment assessment

A catchment assessment study will need to be undertaken to ensure the various stages of the development of the CMS can be based on a sound understanding of the catchment and optimal use of local knowledge. (See Section 6.2: Catchment Assessment).

RDM not determined

The CMS is the operational strategy that gives effect to RDMs (see Figure 4.2). If RDMs are not yet in place, then the CMS should include a sub-strategy to request the Department to determine the RDMs, or co-ordinate, the determination, and setting of RDMs. The Policy should be consulted in respect of RDMs and appropriate choices must be made in respect of:

- Practical spatial management units for water quality.
- The levels of water quality stress.
- Degrees of confidence required in RDMs.

Relevant sections of this strategy should be consulted for general guidance on RDM determinations (Section 6.5).

ISP

Existing Internal Strategic Perspectives (ISPs) can be regarded as precursors to the CMS in each WMA. However, these have not been developed with adequate stakeholder engagement nor do they take adequate account of water quality. It is therefore essential that mechanisms be put in place to engage with stakeholders, beginning with catchment visioning exercises. The associated overview and situation assessment reports can be used as a basis and, in many cases, instead of a formal catchment assessment report, at least during the initial phases. However, the lack of water quality data requires the collecting, assessing and reporting of data that will fill this gap. (See Section 8: Action Plan.)

Resource Water Quality Objectives (RWQOs)

Resource water quality objectives (RWQOs) are management objectives that support the attainment of resource quality objectives (RQOs). In particular, they should be chosen to allow a more detailed level of water quality management to be implemented over an appropriate time frame so that the RQOs are achieved and/or maintained. The RWQOs relate to those variables that will be monitored over time to enable accurate assessment of the effectiveness of the water quality management actions (SDCs and remediation) in the catchment. While both spatial and temporal RWQOs should be used for surface waters, groundwater monitoring is likely to be based more on temporal RWQOs (*i.e.* RWQOs targets defined at selected boreholes at specified time intervals, *e.g.* annually). RWQOs may need to be developed for each "variable of concern" (see Section 6.4.1.3: Variables of concern).

Source management objectives (SMO)

Based on the RWQOs, source management objectives (SMOs) must also be developed. These are technical objectives that provide mechanisms for achieving the RWQOs (DWAF, 2003a). They may include the following:

- Pollution load reductions (for stressed catchments).
- Pollution load maintenance (in threatened catchments).
- Pollution load increases (in unstressed catchments).

The SMOs must balance the ideal load targets with technical, economic and administrative realities. They outline what needs to be done but not how and by whom it will be done.

Water quality management framework plan

The water quality management framework plan outlines the approach to water quality management in the water management area as a whole. It is strategic in nature and should clearly account for linkages with other components of the CMS (such as water quantity and other attributes of resource quality).

The water quality framework plan also includes a water quality allocation plan that allocates the SMO load reductions (or increases) to priority water use sectors in the catchment. In deciding on this allocation plan, sustainable development and the hierarchy of decision-making (the enabling principles which are described in the Policy) should be applied.

Implementation plan

A water quality management implementation plan must specify management actions, roles and responsibilities, resources required and time frame.

The plan should aim to mitigate the adverse impacts on water quality that may be associated with priority sectors in the catchment in order to give effect to the load allocation plan.

Management instruments	Conceptual introduction	DWAF, 2003c
	Source management objectives	DWAF, 2003b
	Water quality management framework plan	DWAF, 2003f
	Converting RWQOs to end-of-pipe standards	DWAF, 2006e
	Complex wastewater discharges	DWAF, 2005d
	Non-point source impacts	DWAF, 2001d
	Effluent discharge impacts	DWAF, 1995
	Determining water quality stress	DWAF, 2006e

6.5.2.3 Attaining a management class

Scenario	A water resource has recently been designated a specific management class and the present state of the resource is actually worse than the designated class. In effect, the catchment is therefore water quality stressed.

Responsibility

It is primarily the responsibility of the CMAs, or the Department in the interim, to achieve compliance with RQOs. However, all stakeholders, particularly individual water users, have valuable roles to play and bear important responsibilities.

Performance monitoring (RQOs)

A performance monitoring programme must be established as soon as possible, in order to establish the degree to which RQOs (or RWQOs) relating to water quality are not being achieved.

Interim objectives

An equitable and achievable time frame must be chosen to achieve compliance with the RQOs or RWQOs. Interim objectives relating to water quality can be defined (see Figure 6.1) so that milestones can be set at specific times (*e.g.* annually) to enable a steady phased improvement.

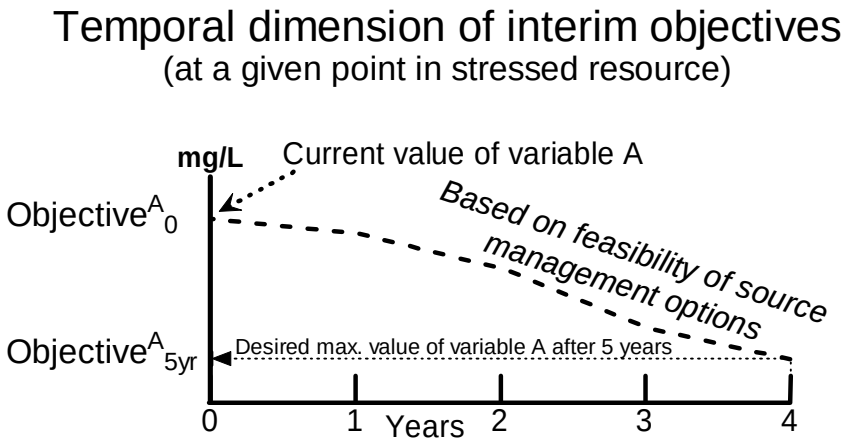


Figure 6.1: Illustration of how interim objectives may vary over time for a specified point in a stressed resource at specified time intervals (points 1, 2 or 3 of Figure 6.2). If the point is where an RQOs is defined (point 3), the final objective equals the RQOs

High resolution spatial objectives

Management objectives can also be set at a higher spatial resolution throughout the catchment (see Figure 6.2), which will provide more detail on the spatial variability of variables of concern (specifically those associated with RQOs). Each can also have interim (temporal) objectives that provide milestones at specific times. These objectives will typically be resource water quality objectives (RWQOs) that were not set as formal (gazetted) RQOs (see Section 6.4.2: Resource water quality objectives).

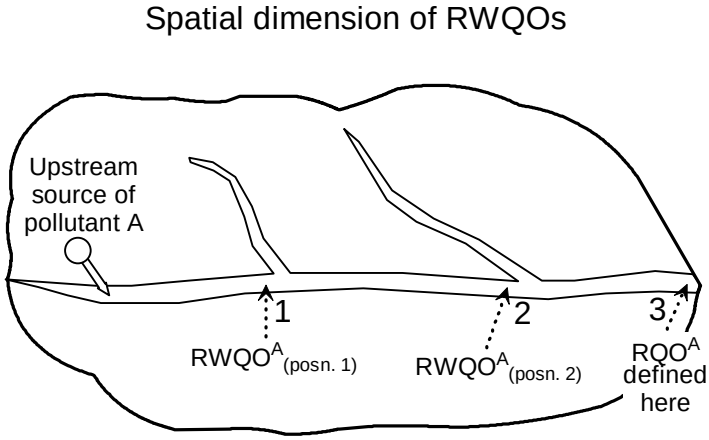


Figure 6.2: Illustration of where RWQOs might be defined

Reactive then proactive

Primarily reactive management will be required to minimise the adverse impacts of existing water users by engaging individual water users or responsible authorities. Although all such impactors should be engaged in an equitable manner, those that are considered to be causing the greatest impacts should be engaged with greater urgency. Specific management approaches include compulsory licensing, directives, strict regulation, prohibition of land use, remediation, waste discharge charge system (and other financial provisions provided for by Chapter 5 of the Act) and encouraging general cooperation and awareness. Proactive management will also be important to manage the water quality impacts of new developments.

Overall strategy

Overall, the approaches described in the Source Management Strategy (DWAF, 2003b) should be adopted to manage causes of water quality impacts. However, the precise nature of these SDCs (*e.g.* concerning the variables of concern, end-of-pipe standards or targets, monitoring frequency, etc.) will depend on the downstream RQOs. The strategies described below for point and non-point sources and remediation should be applied (Section 6.5.2.5, 6.5.2.6 and 6.5.2.10).

Management instruments	Performance monitoring	DWAF, 2006f
	Managing water quality impacts of settlements	DWAF, 2001e
	Source management strategy	DWAF, 2003b

6.5.2.4 Maintaining a management class

Scenario	The present state of a water resource corresponds to the desired state (*i.e.* the designated management class). This is equivalent to saying that the RQOs are being achieved. Depending on how close individual water quality variables are to the RQOs, the water resource may be unstressed or only have limited allocatable water quality. Performance monitoring of RQOs and compliance monitoring of individual licence conditions are assumed to be in place.

Second line of defence

Allocatable water quality must still be sensibly distributed among water users, taking due consideration of all the enabling principles of sustainable development. (See Section 6.5.2.7: Water use authorisation)

Proactive then reactive

Maintaining a management class will require mainly proactive management to ensure that the water quality impacts of new developments remain within the overall capacity of the water resource. Reactive management is likely to be necessary to ensure that existing water users maintain their impacts on water quality within agreed limits. As with attaining a management class (Section 6.5.2.3), cognisance should also be taken of the financial provisions provided for by Chapter 5 of the Act.

Assessment of monitoring data

Regular assessment of monitoring data should be undertaken on a number of levels:

- Performance monitoring data to confirm that the water quality at the specific points at which RQOs are defined remains in compliance with the RQOs.
- Compliance monitoring data to confirm that the water quality at specific points at which RWQOs are defined remains in compliance with the RWQOs.
- End-of-pipe monitoring to confirm that water quality remains in compliance with any end-of-pipe standards or targets that may have been imposed as licence conditions.
- Other monitoring data, for example socio-economic, are being provided by licensees as specified in their licence conditions.

Non-compliance

In all cases, the data should be examined to detect possible existing non-compliance, or trends towards possible future non-compliance, so that appropriate actions can be taken promptly. (See Section 6.5.2.5: Managing point sources and Section 6.5.2.6: Managing non-point sources.)

Management instruments	Performance and compliance monitoring Determining allocatable water quality	DWAF, 2006f DWAF, 2006e

6.5.2.5 Managing point sources

Scenario	A management class, Reserve, RQOs and interim objectives have been established for a water resource and source directed controls for one or more point sources must be implemented to attain or maintain the class.

Localised initial impact

Water users whose actual or potential initial impact on a local water resource is highly localised (at so-called "point sources") are usually more easily managed than those whose impact is more diffuse (from "non-point sources"). The CMS will dictate the general nature of the required source directed controls. However, it is specifically the RQOs and interim objectives in place that determine the precise actions to be taken.

Proactive approach to problems

Use of appropriate existing guidelines and Best Practices relating to the water use and, in particular, water resource protection should be encouraged, especially for new water users. Practical, economically feasible, and equitable time periods should be set in consultation with individual water users for such implementation. These time periods should be consistent with the time frame chosen to achieve the RQOs.

ISO 14000 standards

The general strategy in respect of self-regulatory mechanisms is to encourage the adoption of ISO 14000 standards. The aim is to increase in-house responsible environmental management by water users and hence facilitate the quest for sustainable development. The Department should work closely with such organisations to ensure that this results in pollution prevention, waste minimisation and continual improvement in compliance with licence conditions and attainment of interim objectives and RQOs.

Water use authorisation

New water uses must be in accord with the catchment vision and associated RDMs and can only be authorised if there exists allocatable water quality (see Section 6.5.2.7: Water use authorisation). Every effort should be made to streamline the processing of water use authorisations, preferably using a simple screening protocol that will fast-track the granting of authorisations when their impacts are likely to be low.

Compliance monitoring

After a licence has been issued, a compliance monitoring programme must be established as soon as possible. End-of-pipe licence conditions are particularly important and their careful monitoring and surveillance is a core function of compliance monitoring. However, complying with such licence conditions should never be regarded as guaranteeing attainment of RQOs, which should be monitored independently (in a performance monitoring programme) (DWAF, 2006f).

Management actions

Table 6.2 describes what management actions might be appropriate depending on the compliance and non-compliance with RQOs, RWQOs (at a higher spatial resolution) and end-of-pipe conditions. The phrase "engage transgressor" is taken to mean the following: *Approach transgressor, identify causes of problems, identify effective interventions and associated outcomes, agree on time scales consistent with achieving interim objectives, RWQOs and RQOs, implement and monitor*.

Table 6.2: Recommended actions based on compliance with RQOs, RWQOs and end-of-pipe licence conditions for authorised point sources

Compliance with			Initial action	Medium-term action if initial action unsuccessful
RQOs	RWQOs	Ends-of-pipe		
No	No	No	Engage transgressors (*i.e.* initially assume authorised point sources are the only causes of RWQOs and RQOs non-compliance). **Priority: High.**	Consider prosecution of transgressors.
No	No	Yes	Consider existence of other sources (*e.g.* unauthorised, general authorisations, NWA Schedule 1 uses) upstream of RWQOs. **Priority: High.**	Consider stricter end-of-pipe standards. As last resort consider remediation.
No	Yes	Yes	Consider existence of other sources (*e.g.* unauthorised, general authorisations, NWA Schedule 1 uses) downstream of RWQOs. **Priority: High.**	Consider recalculation of RWQOs. As last resort consider remediation or reconsider suitability of RQOs.
No	Yes	No	Engage transgressors and consider existence of other sources (*e.g.* illegal uses, general authorisations, NWA Schedule 1 uses) downstream of RWQOs. **Priority: High.**	Consider recalculation of RWQOs. Consider prosecution of transgressors.
Yes	No	No	Engage transgressors. **Priority: Medium.**	Consider prosecution of transgressors.
Yes	Yes	No	Engage transgressors. **Priority: Medium.**	Consider prosecution of transgressors. Consider relaxation of end-of-pipe standards if RQOs will not be compromised.
Yes	No	Yes	Consider existence of other sources (*e.g.* illegal, general authorisations, NWA Schedule 1 uses) upstream of RWQOs. **Priority: Medium.**	Consider recalculation of RWQOs.
Yes	Yes	Yes	Continue routine surveillance of monitoring data. (Class attained.)	

Management instruments	Compliance monitoring design Compliance monitoring (end-of-pipe standards) Compliance monitoring (licence conditions) Decision support (water use authorisation) Resource water quality objectives Determining allocatable water quality Source management strategy	DWAF, 2006f DWAF, 2006e 2004e DWAF, 2006g DWAF, 2006h DWAF, 2006d&e DWAF, 2006d&e DWAF, 2003b
Further reading	Virtual water use	Earle and Turton, 2005; Allan, 2005

6.5.2.6 Managing non-point sources

Scenario	A management class, Reserve, RQOs and RWQOs have been established for a water resource and source directed controls for one or more non-point sources must be implemented to attain or maintain the class.

Land use management

Non-point sources usually cannot be managed in the same way as point sources simply because there is not a localised point of initial impact that can be monitored. Emphasis is rather on improved management of the overall land use or other dispersed activity causing the impact. Typical significant non-point sources from which surface runoff enters local surface waters or from which downward percolation into groundwater occurs, are:

- Agricultural land.
- Dense settlements, both formal and informal.
- Industrial and mining complexes.

New water uses

Notwithstanding the lack of a localised point of initial impact, new applications for water use should be assessed as described above for point sources. In particular, they must be in accord with the catchment vision and associated RDMs and can only be authorised if there exists allocatable water quality.

Reactive approach

In general, the same approach used for managing the water quality effects of dense settlements should provide the basis for dealing with non-point sources responsible for water quality impacts (DWAF, 2001d). The water users or responsible authorities should be approached; the likely causes of the problems examined, evaluated, and appropriate interventions chosen to address the problems that have been identified. The specific outcomes of these interventions, such as achieving specified RWQOs, should also be identified. An agreement should be reached on when the responsible authority will implement the interventions. Should the interventions not be implemented, or the agreed outcomes not be reached, the Department can issue a directive or write a letter asking the authority to implement the interventions. Should this not be successful, the matter should be referred to the appropriate Directorate (DWAF, 2006b).

Local authority capacity gaps

Sometimes water quality problems from non-point sources (such as dense settlements) can be a direct result of a capacity gap in a local authority (DWAF, 2001d). This capacity gap can relate to mandate, or be legal, organisational, technical, financial, procedural, or relate to networking capacity.

Although raising awareness, increasing payment levels for local services and building local authority capacity seem obvious solutions, they may not constitute the most cost-effective approach to achieve short- to medium-term gains.

A more appropriate response may be to make conditional bridging finance available (in co-operation with other departments) to ensure water resources are protected and the above capacity gap is addressed within a specified time period (DWAF, 2001d).

The intervention must be subject to the following conditions:

- Financial assistance must be for a limited term and be once-off.
- Interventions, *e.g.* in dense settlements causing the water quality problems, should focus on high priority settlements (such as those whose downstream RWQOs are least in compliance).
- Any finance should be "ring-fenced" to ensure it is used only for the intended purpose.
- Interventions should be linked to fiscal responsibility and institutional capacity development.
- The role of target communities must be emphasised.
- Interventions should be linked to performance criteria, like RWQOs.

Management actions

Similar to the table above for point sources, Table 6.3 describes what types of specific management actions might be appropriate depending on the compliance and non-compliance with RQOs and higher spatial resolution RWQOs downstream of non-point sources.

Table 6.3: Recommended actions based on compliance with RQOs and RWQOs for known non-point sources

Compliance with		Initial action	Medium-term action if initial action unsuccessful
RQOs	RWQOs		
No	No	Engage responsible authority or water user (*i.e.* initially assume these sources are the only causes of RWQOs and RQOs non-compliance). **Priority: High.**	Consider prosecution of transgressors. Consider existence of other sources (*e.g.* illegal, general authorisations, NWA Schedule 1 uses) upstream of RWQOs. If none, consider remediation.
No	Yes	Consider existence of other sources (*e.g.* unauthorised, general authorisations, NWA Schedule 1 uses) downstream of RWQOs. **Priority: High.**	Consider recalculation of RWQOs. As a last resort reconsider suitability of RQOs.
Yes	No	Consider existence of other sources (*e.g.* illegal, general authorisations, NWA Schedule 1 uses) upstream of RWQOs. **Priority: Medium.**	Engage responsible authority or water user. Consider recalculation of RWQOs.
Yes	Yes	Continue routine surveillance of monitoring data. (Class attained.)	

Management instruments	Managing water quality impacts of settlements	DWAF, 2001e
	Source management strategy	DWAF, 2003b
	Non-point source impacts	DWAF, 2001d
	Determining allocatable water quality	DWAF, 2006e

6.5.2.7 Water use authorisation

Scenario	An application for a water use licence has been received by the Department.

New water uses

New applications for water use that will potentially impact on water quality must be assessed as described in the Policy and following the procedures in the Source Management Strategy. New uses must be in accord with the catchment vision and associated RDMs and can only be authorised if there exists allocatable water quality. Every effort should be made to streamline the processing of water use authorisations, preferably using a simple screening protocol that will fast-track the granting of authorisations when impacts are likely to be low. Effective use should be made of available software decision support (*e.g.* DWAF, 2006h).

Equitable allocation

If some allocatable water quality exists, the applicant will typically not be allocated all that is available. An appropriate fraction may be allocated that takes account of all the considerations in Section 27 of the National Water Act, and addressed in the software decision support system (DWAF, 2006h), as well as:

- The approximate nature of, or confidence in, the determination of the allocatable water quality.
- Unforeseen circumstances.

End-of-pipe licence conditions

The choice of end-of-pipe licence conditions for users that discharge water containing waste into the water resource should depend on the degree of water quality stress. Appropriate variables of concern should be selected and monitored at suitable intervals (DWAF, 2006f; DWAF, 2006g).

If the water resource has significant allocatable water quality (*i.e.* is not stressed or threatened), then end-of-pipe licence conditions can be based on effluent standards.

If the water resource is only slightly unstressed (*i.e.* threatened), then end-of-pipe licence conditions can be based on at least the following considerations.

- End-of-pipe effluent uniform national minimum requirements or standards (should they exist).
- End-of-pipe effluent targets back-calculated from downstream RWQOs or RQOs (DWAF, 2006e).

In accordance with the Policy, these should be regarded as multiple lines of evidence. They may be apparently contradictory. The Department must attempt to rationalise such contradictions, taking cognisance of underlying assumptions, inherent uncertainties and local conditions. This should form the basis of an equitable final choice of end-of-pipe conditions.

Insufficient allocatable water quality

If insufficient allocatable water quality exists, then the following are some available options:

- Stricter regulation can be imposed.
- The prospective water use can be modified (*e.g.* through appropriate effluent management and/or treatment) to ensure that any allocated water quality is not exceeded.
- Allocatable water quality can be traded with another nearby water use.
- The concept of "virtual water use", an enabling principle of optimal water use, can be considered (see Policy). Although internationally the concept has not been formally developed for water quality, moving the production of products that place high demands on water quality to another locality that is not water quality stressed, and then importing those products, could relieve the pressure on local water quality.
- Compulsory licensing, following due process and stakeholder engagement. This can be invoked if it is regarded as necessary, and as a last resort, to achieve a more appropriate balance of application of the enabling principles of sustainable development.
- Prohibition of water use. In certain instances the authorisation to use the water can be revoked.

Management instruments	Conceptual review of licence applications	DWAF, 2006i
	Converting RWQOs to end-of-pipe standards	DWAF, 2004e
	Determination of RWQOs and stress	DWAF, 2006d&e
	Determining allocatable water quality	DWAF, 2006e
	Compliance monitoring design	DWAF, 2006f
	Compliance monitoring (licence conditions)	DWAF, 2006g
	Software decision support (water use authorisation)	DWAF, 2006h
	Source management strategy	DWAF, 2003b
Further reading	Virtual water use	Earle and Turton, 2005; Allan, 2005

6.5.2.8 Long-term non-compliance with RQOs

Scenario	A management class and its associated RQOs have been in place for a considerable period (*e.g.* more than five years) and a performance monitoring programme indicates that one or more RQOs are consistently not being achieved.

Appropriateness of source directed controls

First consider whether or not the likely causes of the non-compliance with RQOs can be better managed. There are a number of possible causes:

- Consider whether (a) National Water Act Schedule 1 uses or (b) uses that occur under general authorisations may be responsible. If so, apply approaches that educate such users about their water use and their impacts on downstream users. Efficient use, in particular, should be strongly encouraged at all times.

- If uses under general authorisations are causing problems, also consider changing the conditions used to define general authorisations in order to make them stricter in that area. (This must follow due process and may therefore take time). However, this will result in some of the water uses now requiring licensing. It must be ensured that (a) those new uses are those causing the non-compliance with RQOs, and (b) appropriate conditions can be associated with such licences that will allow effective monitoring.
- Also examine whether or not water users, especially those discharging waste into the water resource, are taking all reasonable steps to minimise their impacts (for example applying self-regulatory approaches, using cleaner production technologies and Best Practices, complying with licence conditions, etc.). If not, apply appropriate source directed controls using suitable regulatory or other management approaches (see for example Sections 6.5.2.5 and 6.5.2.6).
- The possibility of illegal water use should also be considered and, if suspected, appropriate steps should be taken to end such activities.

Appropriateness of RQOs

If the degree of source management is considered adequate, then consider whether or not the determination of the RQOs was based on a water quality dataset that was sufficiently representative. In particular, the general hydrological behaviour, land use and climatic conditions in the time period covered by the dataset should be adequately representative of current times. If this is considered not to be so, a case can be made to determine new RQOs based on a more representative dataset. However, this process, and their subsequent legal establishment, must follow due process and will take time.

Appropriateness of class

If the water quality dataset used for the RQOs is considered to be sufficiently representative of current times, then the appropriateness of the class itself can be questioned and revised if necessary. This must also follow due process and will take time. This must at least include effective and inclusive stakeholder engagement.

6.5.2.9 Non-compliance with licence conditions

Scenario

A water use authorisation (licence) and the associated compliance monitoring programme is in place for a given water user. However, specific conditions in the licence are consistently not being complied with and these are suspected to be responsible for non-compliance with RQOs and/or RWQOs.

Responsibility

It is the responsibility of the licensee (the water user) to comply at all times with the licence conditions associated with the water use. It is the responsibility of the Department or CMAs to enforce such compliance (*e.g.* in accordance with Part 10 of the Act (NWA (36:1998)).

Source directed

The actions described in Table 6.2 and 6.3 can be applied. For more

controls	detail, the Source Management Strategy should be consulted. See also Appendix: Management Approaches.	
Management instruments	Source management strategy	DWAF, 2003b

6.5.2.10 Remediation

Scenario	Reduction in water resource quality is occurring, or has already occurred, and remediation is necessary to (a) attain or maintain a management class, or (b) comply with the Reserve and/or RQOs. For example, remediation may be considered necessary if source directed controls alone are not achieving, or are not likely to achieve, the RQOs (or RWQOs) that have been set for the resource.
Responsibility	Responsibility for costs lies with the polluter. However, when the polluter cannot be made responsible (*e.g.* cannot be identified), for example in so-called "legacy cases", the Department may need to assume responsibility. The Department may also invoke remediation measures at its own cost when this is seen as a high priority and the polluter is unable to contribute immediately. The Department can then later recover such costs from the polluter.
Setting priorities	Given the inevitable expense of remediation, particularly when groundwater is involved, the need for remediation should be carefully prioritised to ensure cost-effectiveness, based on the following considerations: • The most desirable time frame for achieving the designated management class. • The current and intended use of the water resource. • The positive and negative socio-economic impacts. • The precautionary approach.
Management instruments	See www.sa-remediation.co.za (work in progress).

6.5.3 Water quality monitoring

Purpose

In its simplest sense, monitoring should be seen as measuring progress in order to provide useful management information (DWAF, 2006f). In the current context of resource directed management of water quality, this specifically means measuring the progress towards achieving the vision of the Policy (see Section 3: Objectives).

Objectives

The objectives of monitoring for resource directed management of water quality are (DWAF, 2006f) are:

To measure, assess and report on a regular basis the status and trends broadly relating to water quality in water resources, and their management, in a manner that will support balanced decision-making and planning in the

contexts of fitness for use and aquatic ecosystem integrity in the Catchment Management Agency's quest for sustainable development.

Water quality monitoring programmes

The most pressing programmes will be water quality monitoring programmes that provide information that is directly and immediately useful to water resource managers. These include the following:

- Performance monitoring of RQOs and RWQOs.
- Compliance monitoring against end-of-pipe standards or targets.
- Baseline monitoring for the ecological Reserve.
- National water quality status and trends monitoring.

In some instances such monitoring already exists to some extent. However, this will need to be sustained, modified, or extended, to be aligned with any newly defined RQOs and associated RWQOs.

Each of these kinds of monitoring programmes exists in its own right with its own well-defined objectives (DWAF, 2006f).

Beyond water quality

More holistic information than just resource quality is required to properly manage (a) the resource, (b) those impacting on the resources and (c) those impacted by the resource (DWAF, 2006f). Consistent with the principle of environmental integration, a key component and enabling principle of sustainable development, monitoring that genuinely supports decision-making related to sustainable development must therefore go well beyond just water quality.

PSIR framework

The Pressure-State-Impact-Response (PSIR) framework, used in South Africa for state of environment reporting, can be used to provide a structure for the broader monitoring required (DWAF, 2006f). The four categories refer to those human activities that cause negative impacts on water quality (pressures), the actual state of the water quality (state), the impacts of deteriorating water quality on ecosystem health and fitness for use (impacts) and the decisive reactions of society, including government, to these negative impacts, that aim to solve or mitigate water quality problems (responses).

Phased implementation

It is important that a phased approach be taken to implement the PSIR monitoring programmes. Accordingly, the following are recommended in order of decreasing priority for the initial stages of implementation (see Figure 6.3).

- *State monitoring*. This is by far the most important monitoring that should be initiated in a water management area. Essentially, it requires performance monitoring of resource quality objectives supplemented by compliance monitoring (of licences). Once in place, the results of this will drive the more detailed design of the following monitoring programmes.
- *Pressure monitoring*. This will become important once a good picture is obtained of the state of water resources. It will allow more focussed source directed controls to be imposed.
- *Impact monitoring*. This information will begin to provide a broader spectrum of information on impacts of water quality.

Response monitoring. This will provide further insight into (a) the impacts on society and (b) the real needs and priorities of society. This can be the last type of monitoring to be implemented.

Spatial scales	Each monitoring programme should be implemented in such a way as to achieve continual improvement by cycling through design, implementation and review stages (see Section 4.1). In each case, implementation is assumed to include data acquisition, data management and storage, and information generation and dissemination.	
Management instruments	Guidelines for monitoring and auditing National strategic framework	DWAF, 2006f DWAF, 2004c

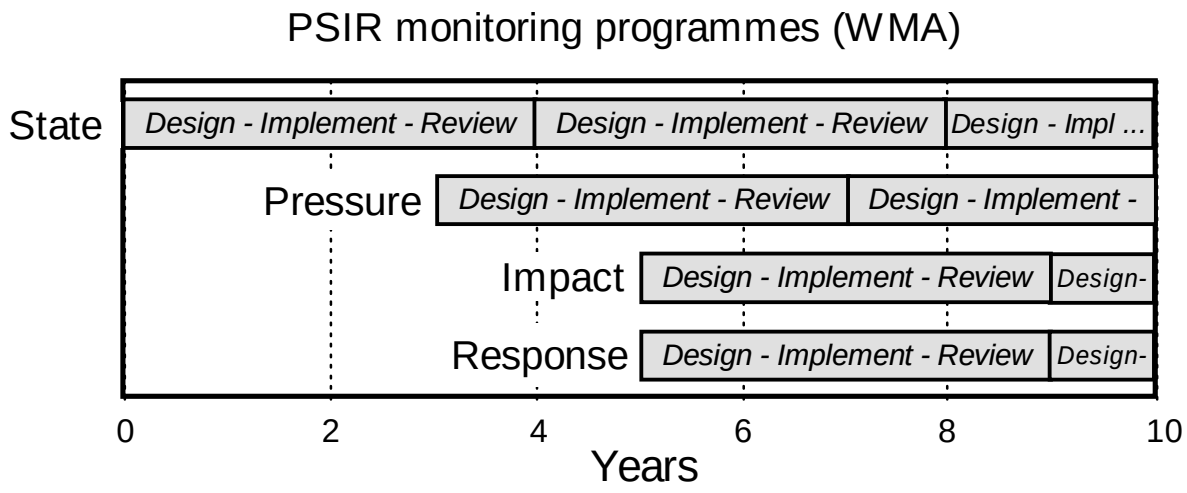


Figure 6.3: Phased implementation timetable for PSIR monitoring programmes

SECTION 7: CAPACITY CREATION & MAINTENANCE

This section describes a knowledge-based philosophy and general strategy for creating and maintaining capacity.

7.1 Introduction

Definition

Capacity creation is the process whereby people are enabled to better perform defined functions either as individuals, through improved technical skills and/or professional understanding, or as groups by aligning their activities to achieve common purpose (Breen *et al.*, 2004).

Two dimensions

Two specific dimensions must be addressed in order to create appropriate capacity:

- *Time dimension (short-term and long-term):* Specific technical capacity is required immediately to facilitate efficient water resource management for certain well-defined scenarios in the short-term. However, more sophisticated capacity will be required in the long-term to enable a more complete implementation of the National Water Act (36:1998). There are also changing demands on institutional capacity as roles and responsibilities evolve and water resource management becomes more decentralised (see Section 5.6: Institutional Capacity).

Internal-external dimension: Capacity must be created both within the Department and Water Management Institutions (WMI) and amongst external stakeholders.

Legislative context

A number of frameworks (including Acts and involving various authorities) exist that are intended to guide the training aspects of capacity creation. These include the South African Qualifications Authority (SAQA) that is responsible for the National Qualifications Framework (NQF). The Skills Development Act (Act No. 97 of 1998) provides the institutional framework for skills development strategies integrated with the NQF.

FETWater

The Framework Programme for Education and Training in Water (FETWater) is an initiative of the Department and the Water Research Commission in collaboration with UNESCO and the Flemish Government (DWAF, 2004b). FETWater provides an overarching programme within which capacity creation for resource directed management of water quality can be undertaken.

7.2 Knowledge creation

7.2.1 Introduction

Framework

The most demanding of the above two dimensions is the time dimension. There is a desperate need to facilitate better resource directed management of water quality immediately. However, this strategy also focuses on moving gradually over time towards doing things better, even if this requires radical changes in the capacity creation philosophy within the Department. In effect, the short-term requirements should be met using management instruments that are currently available and in the spirit of adaptive management. However, the long-term strategy must be to move towards more fundamental "knowledge creation".

Creating a learning environment

In practical terms, knowledge can be defined as the *capacity for informed action*. This is obviously required both within the Department and in external stakeholders. It is assumed here that an ideal ultimate aim is to create a "learning environment" within the water sector and within the Department in particular. This should facilitate "good governance" in general, though for current purposes, this is specifically in the context of water quality management.

Learning principles

Knowledge management and learning are complex disciplines. The reader is referred to Roux *et al.* (2006) for a discussion of the key concepts of knowledge, learning and ecosystem governance. They also propose (a) the type of knowledge that should be created, (b) the best processes for doing so, and (c) the characteristics of good learners. They use these to further propose a series of principles to create appropriate learning environments for ecosystem governance.

Summary of principles

Roux *et al.* (2006) propose the following summary of the principles:

"*Good ecosystem governance requires positively persistent and adaptive people with a culture of empathy for other knowledge systems and levels. Their knowledge must be transdisciplinary, moulded by a common future focus, acquired by patiently engaging their prior knowledge and learning by doing in an environment of social knowledge sharing.*"

These principles should form the basis of any detailed capacity creation strategy relating to the resource directed management of water quality.

7.2.2 Short-term strategy

For external stakeholders

The ultimate aim is to empower external stakeholders to contribute efficiently and meaningfully to water quality management. The following are priority short-term actions:

- Stakeholders must be made aware of (a) their rights relating to water and to water quality in particular and (b) new concepts in the NWA (36:1998). This must "inform, create understanding and win support and buy-in to change perceptions, attitudes and behaviour" (DWAF, 2001a).
- Protocols must be developed and implemented that go further than more awareness creation. Communication for effective stakeholder engagement will necessarily need to be focussed on specific projects about which an informed decision needs to be made (DWAF, 2001a). However, generic protocols must exist that provide guidance.

For Departmental & WMI staff

The ultimate aim is to create knowledgeable staff with the capacity for informed action and decision-making. However, this must be balanced with the need for immediate decision-making capabilities. The following short-term actions address these:

- Simple procedures and guidelines for well-defined scenarios must be developed and adopted as soon as possible to address current bottlenecks in decision-making.
- Training must include emphasis on core concepts, including basic principles.
- Learning-by-doing and interaction with stakeholders, peers and mentors should be facilitated to begin the long-term process of knowledge creation.
- The relative emphasis on theoretical and experiential learning must be balanced to meet both short-term and long-term aims (Roux *et al.*, 2006).

The following are some specific career-related considerations (Roux *et al.*, 2006):

- All three of the career paths in the Department should be addressed (specialist, line function and strategic policy function).
- Opportunities for learning and personal development should be provided that are appropriate to the career stage (early, middle and late).

7.2.3 Long-term strategy

For external stakeholders

Long-term actions aim primarily at adapting to changing demands:

- Awareness creation and empowerment protocols must be adapted on the basis of experience and changing demands of stakeholders.

For Department & WMI staff

Long-term actions aimed at Departmental staff must also adapt to changing circumstances:

- The simple procedures and guidelines must be adapted and refined to maintain, and extend where appropriate, their effectiveness.
- The effectiveness of all aspects of training and learning should be monitored to determine the degree to which management in general is successfully changing from being reactive to proactive.
- This monitoring should provide the basis for review and refinement of learning approaches.

Table 7.1: Summary of short- and long-term actions to address (a) external stakeholders and (b) Departmental and Water Management Institution (WMI) staff

To address	Short-term actions	Long-term actions
External stakeholders	• Awareness creation (water rights, NWA (36:1998) concepts). • Develop protocols to empower stakeholders to contribute effectively.	• Adapt and update awareness creation mechanisms. • Adapt and update empowerment protocols.
Internal Department and WMI staff	• Develop and implement simple procedures and guidelines. • Teach core concepts (including principles). • Facilitate learning-by-doing. • Facilitate learning through social interaction.	• Adapt and update simple procedures and guidelines. • Monitor effectiveness (reactive to proactive management) and review regularly.

7.3 Empowerment for sustainable management

7.3.1 Introduction

Operational

The above sub-section focussed on the fundamental concept of knowledge creation and overall strategies for achieving it. This sub-section is more operational. It addresses some of the more basic competences and types of empowerment that are required.

Dimensions of empowerment

Cook (1997) proposed a relatively simple model highlighting three important and interdependent dimensions of empowerment:

- ***Objective empowerment***. This refers to the individual's movement from oppression to influence and opportunity in organisational terms. This can occur through promotion, exposure to information, job enrichment, exposure to opportunities, and use of reward systems that support personal development.
- ***Competence***. This refers to possessing the necessary skills to carry out functions successfully. These refer to technical skills, interpersonal relationships, and self-management.
- ***Subjective empowerment***. This manifests in a sense of confidence, motivation, enjoyment of the challenge of other's high expectations, and reliance on one's own initiative.

Sustainable management requires that all three dimensions receive attention.

7.3.2 Strategy

7.3.2.1 Empowerment

3-Dimensional empowerment

The strategy of the Department should be to carefully consider and address the degree to which all stakeholders, both internal and external, are empowered in all three of the above dimensions.

7.3.2.2 Competence

Basic skills

The first essential prerequisite is basic competence (skills). All involved in integrated water quality management in the Department should receive appropriate training to improve this basic skills needed to implement IWQM. These should be aligned with the NQF, *i.e.* have well-defined outcomes and associated assessment criteria.

Conceptual outcomes

Attention needs to be given to achieving at least the following basic conceptual outcomes, which focus on giving effect to water quality aspects of resource directed measures (RDMs). In all instances the underlying theme should be "Creating a quality life for all South Africans", the central message of the Department's water quality management communication strategy (DWAF, 2001a).

Outcomes should include a clear conceptual understanding of:

- The fundamental role that the resource management class will play in future water resource management, in particular its role in striving for sustainable development.
- The role of RQOs and RWQOs and their relationship with the management class.
- The special characteristics of groundwater quality and the interactions between groundwater and surface water. Misconceptions about groundwater must be dispelled.
- Basic mathematical modelling approaches.
- The intention of the ecological and basic human needs Reserve.
- The concept of allocatable water quality.
- The socio-economic value of good quality water.
- Water quality-related monitoring required for holistic IWQM.
- How to communicate water quality issues to the general public in stakeholder engagement initiatives.
- The catchment visioning process.
- Co-operative governance – how to forge a working partnership between science, government and society.
- Collaborative learning and knowledge sharing – how to engage people around future building and problem solving given disciplinary, cultural and contextual diversity.

Such formal "learnerships" can also be made available to external stakeholders.

Training courses

The training courses already exist for DWAF regional officers (and catchment management agency staff) that address:

- Catchment visioning,
- Determination of RWQOs, stress and allocatable water quality,
- Assessment of applications for water use, and
- The Policy.

These should continue to be made available on an annual basis (or on demand based on staff turnover) by the appropriate Directorate (DWAF, 2006b).

They should be extended to include monitoring and the philosophy of sustainable development (ensuring that this is ultimately included in decision-making). Refresher courses should also be made available on an annual basis to more experienced practitioners.

These courses should be structured so that feedback can be obtained on the suitability of the various management instruments. This should in turn feed back into the review phases of the plan-implement-check-review cycle to determine whether or not fundamental updating might be necessary.

User-friendly documentation

Communication mechanisms such as the use of posters, pamphlets, and newsletters should be reviewed on an annual basis to (a) create awareness among new staff members and external stakeholders (such as other government departments) and (b) maintain awareness among experienced water resource managers. Existing documentation should be re-circulated from time to time and new formats developed when appropriate.

7.3.2.3 Objective empowerment

Objective empowerment

The second prerequisite is that the working environment is appropriately empowering. Those involved in IWQM, within the Department, CMAs or external stakeholders, should collaborate to identify the characteristics of such an enabling environment. Guidelines should be developed for all stakeholders, internal and external. The following are some considerations:

- Mechanisms for better exposure to water quality-related data and information, and
- Access to resources to implement adequate water quality monitoring.

7.3.2.4 Subjective empowerment

Subjective empowerment

The approaches adopted above for both competence and objective empowerment should be designed in such a way that outcomes relating to increased self-confidence and motivation are also assessed.

7.3.2.5 Supportive approaches

Creating capacity and increasing awareness

A number of supportive approaches can be adopted by the Department and CMAs to create capacity and increase awareness both within and outside the Department:

- Research and development can be supported.
- Create education and awareness programmes.
- Training of Departmental officials and external stakeholders.
- Greater involvement in land-use planning.

7.3 Institutional capacity

Multi-faceted

Institutional capacity is multi-faceted and requires the broader framework (beyond just water quality) to developed in a phased manner as many roles and responsibilities devolve to CMAs over time. DWAF (2006b) should be consulted for more detail.

SECTION 8: ACTION PLAN

This section describes immediate actions that should be taken that will facilitate implementation of the Policy.

8.1 Introduction

Priority actions

Previous sections of this strategy provide summarised and generic strategies in individual scenarios and contexts. In contrast, this section recommends specific priority actions that should be implemented in the immediate future. The primary purpose is to "kick start" appropriate data collection and information generation to support resource directed management of water quality.

8.2 Resource water quality objectives

Introduction

The current Internal Strategic Perspectives (ISPs) concentrate primarily on water quantity (flow) issues and provide only marginal information on water quality. It is important that nationally consistent information be generated relating to water quality that can begin to provide a sound basis for more focused catchment assessments, catchment visioning exercises and ultimately catchment management strategies.

Cost-effectiveness

It is important to ensure optimum use of financial and human resources and maximise service delivery where it is most urgently needed. Therefore initial efforts must focus on those water resources currently experiencing water quality stress (*i.e.* the current water quality is inadequate for the desired water uses).

Prioritise national surface water resources

A software facility exists that facilitates the determination of the degree of water quality stress in watercourses (DWAF, 2006d). This is inherently a "low confidence" decision support tool because it is based on generic water quality guidelines. This tool should be used to prioritise such surface water resources on a national basis on the basis, based on degree of water quality stress. This will require the following:

- Identifying the most appropriate spatial scale (*e.g.* tertiary catchment).
- Obtaining appropriate flow and quality data for the major watercourses.
- Using the software to identify the specific water quality variables which indicate water quality stress and to quantify the extent and possible severity of this stress.

Given the low confidence nature of this approach, the results can be reported in a simple colour-coded spatial format that highlights those water resources that are stressed in respect of water quality.

Determine RWQOs

The next phase will be to begin the process of determining management objectives that can better focus water resource management in the immediate future (see Section 6.4.2: Resource water quality objectives).

Focusing on the priority water resources, an assessment should be made of available national and local financial and human resources that can be channelled towards determining RWQOs. Stressed catchments should be identified in which there are (a) adequate financial and human resources and (b) commitment to the process from relevant regional offices of the Department or CMAs. Co-operative governance should guide interactions with any relevant upstream (or downstream) water management areas.

The level of confidence required for determining RWQOs should then be assessed (medium or high confidence). The appropriate procedures should then be followed to determine RWQOs at appropriate locations in the water resources (DWAF, 2006e).

Monitoring

Once the RWQOs have been determined, a suitable performance monitoring programme must be implemented as soon as possible. This will enable water resource managers to monitor the effectiveness of subsequent source directed controls aimed at minimising impacts on water quality (see Section 6.5.2.3: Attaining a management class).

Catchment management strategies

It will also be essential to ensure that the necessary source directed controls are identified and that these are firmly embodied in the catchment management strategy. The following will be required to achieve this:

- Determine the source management objectives (SMOs) from the RWQOs (DWAF, 2003b).
- Translate these SMOs into a water quality management framework that allocates load reductions to specific sectors (DWAF, 2003b).
- Ensure that this framework becomes an integral part of the catchment management strategy.

In the interim the simplest approach to managing point source waste discharges in unstressed water resources will be to apply uniform national minimum requirements or standards (should they exist) in end-of-pipe licence conditions. (See Section 6.5.2.7: Water use authorisations.)

8.3 Capacity creation

Capacity creation plan

An initiative should be started that will produce a detailed capacity creation plan, which includes the following:

- Explicit recommendations that will move the Department towards a learning organisation.
- Detailed recommendations that expand on the short- and long-term strategy summarised in Table 6.1.
- Explicit consideration of learning principles (Roux *et al.*, 2006).
- Explicit attention to objective and subjective empowerment and increasing basic competencies.
- Resources (financial and human) required for such capacity creation.
- Detailed time plan that expands on that given in this strategy.

SECTION 9: GLOSSARY

Allocatable water quality. The maximum worsening change in any water quality attribute away from its present value that maintains it within a pre-determined range reflecting the desired future state (typically defined by resource quality objectives). If the present value is already at or outside the pre-determined range, this indicates that none is allocatable and that (a) reduced pollution loads relating that affected attribute(s), and/or (b) remediation of the resource may be necessary.

Allocation plan, water quality. A part of a water quality management framework plan, developed as a sub-strategy of a catchment management strategy, which specifies how allocatable water quality will be apportioned among water users in the water management area.

Capacity building. The process whereby people are enabled to better perform defined functions either as individuals, through improved technical skills and/or professional understanding, or as groups aligning their activities to achieve common purpose (Breen *et al.*, 2004).

Compliance monitoring programme. A monitoring programme designed to measure, assess and report on a regular basis the degree to which individual water users are remaining within (*i.e.* complying with) the conditions defined in their water use authorisations (licences).

Decision-making. An intellectual activity comprising the making of a rational choice between alternatives.

Ecoregion. Relatively large area of land and water that contains geographically distinct assemblages of natural communities.

Effluent standards. Generic (*i.e.* not site-specific) values of water quality variables that can be used for end-of-pipe licence conditions.

Effluent targets. Site-specific values of water quality variables that can be used for end-of-pipe licence conditions, typically back-calculated from downstream RWQOs or RQOs.

Equitable. Fair and just in the sense of being based on laws and accepted principles.

Equity. The quality of being equitable.

Fitness for use. A scientific judgement, involving the objective evaluation of available evidence, of how suitable the quality of water is for its intended use or for protecting the health of aquatic ecosystems.

Internalisation of externalities. Externalities, also called external costs, spill-overs or social costs, are costs generated by a producer but paid for by someone else. A typical example is a water user that discharges polluted water into a stream. The downstream user may then need to treat the water before it can be used. This treatment in effect means that the downstream user is paying part of the production costs of the upstream user. Internalising these externalities means the polluter should be responsible for these costs. (Adapted from www.csir.co.za/era/ policy/Ap_inte.html.)

Management approaches. General courses of action, including formal regulatory command-and-control methods and self-regulatory and supportive mechanisms, which enable the strategy to be implemented.

Management instruments. Detailed procedures, guidelines and software decision support that enable the strategy to be implemented.

Minimum requirements. A regulation or standard set by the Department that specifies the very least that should be complied with.

Minister. The Minister of Water Affairs and Forestry.

Monitoring. The measurement, assessment and reporting of selected properties of water resources in a manner that is focussed on well-defined objectives. These monitoring objectives should also be clearly linked to water resource management objectives.

Monitoring design. The definition of all aspects necessary for successful implementation of a monitoring programme. These include the monitoring variables, sampling site selection, sampling methods, sampling frequency, analytical procedures, data assessment, reporting formats, etc.

Non-point source. A source of pollution whose initial impact on a water resource occurs over a wide area or long river reach (like un-channelled surface runoff from agricultural land or a dense settlement).

Performance monitoring programme. A monitoring programme designed to measure, assess and report on a regular basis the degree to which present resource quality conforms to resource quality objectives (RQOs) and hence whether a water resource is within its designated management class, or improving towards it or deteriorating away from it.

Point source. A source of pollution whose initial impact on a water resource is at a well-defined local point (such as a pipe or canal).

Preliminary classification. An interim classification of a water resource established in the absence of the formal classification system required by Section 12 of the National Water Act. A preliminary classification is permitted in terms of Section 14.

Preliminary resource quality objectives. An interim resource quality objective established in the absence of the formal classification system required by Section 12 of the National Water Act. Preliminary resources quality objectives are permitted in terms of Section 14.

Remediation. Direct intervention in (a) degraded land, to minimise contamination risk to a water resource, or (b) a degraded water resource, to maintain or improve water quality in the water resource.

Reserve. Defined by the National Water Act as the quantity and quality of water required:

1. to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act (Act No. 108 of 1997), for people who are now or who will in the reasonably near future, be (a) relying upon, (b) taking water from or (c) being supplied from, the relevant water source; and

2. to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

Since the Reserve is a legally binding quantity, it is typically not subject to rivalry. However, its very nature creates excludability since water uses not encompassed by basic human needs and maintaining aquatic ecosystem health are explicitly excluded. Therefore, the Reserve is strictly a quasi-public good.

Resource quality. Includes all aspects of water quantity, water quality and aquatic ecosystem quality, the latter including the quality of in-stream and riparian habitats and aquatic biota.

Resource quality objectives (RQOs). Numeric or descriptive (narrative) goals for resource quality within which a water resource must be managed. These are given legal status by being published in a Government Gazette.

Resource water quality objectives (RWQOs). Numeric or descriptive (narrative) in-stream (or in-aquifer) water quality objectives typically set at a finer resolution (spatial or temporal) than RQOs, and that provide greater detail upon which to base management of water quality.

Source Management Objectives. Objectives relating to (a) incremental reduction, (b) maintenance or, under special circumstances, (c) incremental increase, in pollution loads calculated to give effect to resource water quality objectives. They refer to the water resource management unit as a whole, not to specific water users, though they do consider technical, economic and administrative realities.

Schedule 1 use. A permissible use of water as described in Schedule 1 of the National Water Act.

Stakeholder. An individual, group or organisation that has an interest in, or is affected by, an initiative and who may therefore affect the outcome of an initiative.

Stewardship. The provision of supervision and guidance.

Stress, water quality. A state in which the water quality is inadequate for the desired or designated water use. For many uses, water quality stress exists when there is no allocatable water quality.

Stressed water resource. A water resource for which the demand for benefits exceeds the supply. This can apply to either the quantity of water or to the allocatable water quality.

Vulnerability: Susceptibility to harm.

Waste. Defined by the National Water Act as including any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or can be expected to be reasonably likely to cause, the water resource to be polluted.

Watercourse. Defined by the National Water Act as a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which, or from which, water flows and any collection of water that the Minister may declare to be a watercourse. Furthermore, reference to a watercourse includes, where relevant, its bed and banks.

Water Management Institution. Defined by the National Water Act as a catchment management agency, a water user association, a body responsible for international water management, or any person who fulfils the functions of a water management institution in terms of the Act.

Water quality. The physical, chemical, radiological, toxicological, biological and aesthetic properties of water that (1) determine its fitness for use or (2) that are necessary for protecting the health of aquatic ecosystems. Water quality is therefore reflected in (a) concentrations of substances (either dissolved or suspended), (b) physico-chemical attributes (*e.g.* temperature), (c) levels of radioactivity and (d) biological responses to those concentrations, physico-chemical attributes or radioactivity.

Water resource. Defined by the National Water Act as including a watercourse, surface water, estuary or aquifer.

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Annexure A:
Management Approaches

This appendix summarises the various management approaches and instruments that are available to water resource managers.

A1.1 Introduction

Acts

Although the Constitution (Act No. 108 of 1996) and the National Environmental Management Act (Act No. 107 of 1998) refer to resource management, the National Water Act (Act No. 36 of 1998) is the highest level of legislation addressing water resource management and water quality management specifically and in detail. The NWA (36:1998) is therefore the "first port of call" for describing available regulations in the current context.

Source directed controls

The approaches described below are usually applied in the context of source directed controls and explicitly strive to give effect to resource directed measures (RDM).

Hierarchy of decision-making

The hierarchy of decision-making (described in the Policy) provides an overall framework that is based on the relative importance of a number of enabling principles of "protection of water resources", which in turn is one of the five main enabling principles of sustainable development. This framework should lie behind all decisions relating to source management objectives, setting resource water quality objectives and the water quality management plan of the catchment management strategy.

Descriptions, not strategies

The following sections merely provide brief descriptions of the range of instruments that are available to responsible authorities in giving effect to RDM. They do not describe specific strategies for their implementation as this will differ from one situation to the next.

A1.2 Regulatory

A1.2.1 General authorisations

Introduction

The NWA (36:1998) provides for the general authorisation of water use (NWA (36:1998): Section 39) that allows the use of water without the need for a licence under certain circumstances and in certain catchments. Only registration of the water use is required.

Objective

The definition of general authorisations attempts to balance the following issues:

- The need to limit the administrative burden of licensing (and other potential negative impacts of this burden, such as delays) to those water uses that are important.
- The need to ensure an adequate degree of regulatory control is created in respect of protection of water resources, optimal water use and current equitable access.

Changes

By making the conditions upon which general authorisations are based more stringent more water users would be required to apply for authorisations. This may provide the Department with extra control over such users and hence allow better management in a stressed catchment. However, since general authorisations are published in the Government Gazette, changing them cannot be made on an ad hoc basis. They must follow due process at all times.

A1.2.2 Command-and-control

Introduction

The command-and-control approach relies on regulatory mechanisms that are implemented on water users to enforce achievement of management objectives (van Wyk *et al.*, 2002). The following are some such mechanisms.

Water use licensing

The NWA (36:1998) provides for formal authorisation of water use (Section 40) and describes the relevant factors that must be taken into account (Section 27).

No licence may be issued without a preliminary Reserve and due consideration of its requirements. Besides this, the following should be used as a more general basis for water authorisation recommendations and decisions, in decreasing order of priority.

- Catchment management strategy (CMS), in particular resource water quality objectives (RWQOs). If these do not exist, then use the following.
- RDM, especially RQOs relating to water quality, or RWQOs. If these do not exist, then use the following.
- Preliminary RDM, especially preliminary RQOs relating to water quality. If these do not exist, then use the following.
- A catchment vision, with (a) relevant aspects of current state and behaviour of water quality in the management unit understood, (b) assessment of potential impact available and (c) preliminary Reserve (basic human needs and ecological) determined. The enabling principles of sustainable development must be very carefully considered.

In all cases, RDM and a catchment vision must have been determined with a degree of confidence that is appropriate to the resource management unit (see Section 6.4.1.2: Confidence). If this has not been the case, then RDM or a catchment vision of adequate confidence must be determined first.

Compulsory licensing

The NWA (36:1998) provides for a "compulsory licensing" mechanism in which existing water users in an area may be requested to re-apply for an authorisation to use water (Section 43). This can be invoked if it is regarded as necessary, and as a last resort, to achieve a more appropriate balance of application of the enabling principles of sustainable development (see Policy (DWAF, 2006a)). Therefore, in the process of such re-consideration, the following must be taken into account:

- The catchment vision and all stakeholder concerns.
- RDM in place. In the current context, these measures should have been determined with a significant degree of confidence.
- Any Departmental Water Allocation Policy.
- The degree of water quality stress and the allocatable water quality.

Resource Quality Objectives (RQOs)

Since RQOs will be described in the *Government Gazette* (NWA (36:1998): Section 13), they become "command-and-control" regulatory tools to which all stakeholders (*i.e.* including the Department) are formally bound. Monitoring programmes must be put in place to ensure that they are achieved and maintained (see Section 6.5.3: Monitoring). Since RQOs are the most important sustainability indicators relating to water resources, and water quality in particular, conforming to RQOs becomes one of the most important endeavours that will ensure at least a basic degree of sustainable development.

Reserve

Once the classification system has been published in the *Government Gazette* the NWA (36:1998) also provides for the Reserve to be formally published in the *Government Gazette* (Section 16). The Reserve therefore also becomes a "command-and-control" management instrument to which all stakeholders are formally bound.

"Pollution prevention" directives

The NWA (36:1998) also provides for directives (*e.g.* Section 19) given in terms of the Act to be issued by a catchment management agency to any person who fails to take reasonable measures to prevent pollution from occurring, continuing or recurring. This situation is relevant specifically to the application of the "pollution prevention" principle that enables protection of water resources and hence sustainable development. These directives may be issued on the basis of evidence of transgression provided by compliance monitoring. As such, directives comprise a regulatory mechanism for making RDM operational.

Management instruments	Software decision support Monitoring guidelines	DWAF, 2006h DWAF, 2006f

A1.2.3 Economic

Introduction

Economic regulatory instruments rely on incentives and disincentives to achieve management objectives. These are provided for by the NWA (36:1998) in Section 56(6). These approaches are based on the polluter pays principle, another enabling principle of protection of water resources and hence of sustainable development. The polluter pays principle requires the "internalisation of externalities" (see Glossary) to ensure that those responsible for significant ecological impacts are accountable for costs in proportion to the impact.

Pricing strategy

The original pricing strategy (DWAF, 1998) addressed the establishment of charges only for those NWA (36:1998) Section 21 water uses that can be expressed in volumetric terms regarding annual quantities abstracted, stored or reducing streamflow (typically "consumptive uses"). Those uses that can potentially cause significant changes in water quality were not explicitly dealt with except to note that a waste discharge charge system would need to be developed. Nevertheless, the following were noted (though translated here into the principles as defined in the Policy) as shaping the overall strategy:

- Current equitable access.
- Protection of water resources, including the ecological Reserve and pollution prevention.
- Financial sustainability (through applying sound financial management).
- Optimal water use.

Waste discharge charge system (WDCS)

The WDCS has three distinct purposes, involving three different water use charges:

- *Management cost recovery*. This water use charge must cover the costs of water resource management activities related to waste discharge.
- *Mitigation cost recovery*. This water use charges must cover the quantifiable costs of infrastructure or other measures for mitigation of existing impacts of waste discharge.
- *Discourage waste discharge.* This water use charge must act as a disincentive to the discharge of waste.

A guarantee will also be retained by the Department in order to finance possible remediation of failed or abandoned activities that have impacted negatively on water resources.

Further reading	Draft Pricing Strategy	DWAF, 2004d

A1.3 Non-regulatory

A1.3.1 Civil society

Peer pressure

An enabling principle of good governance is transparent governance (see Policy). This promotes (a) the application of procedures that are open to scrutiny, and (b) keeping an adequate "record of decision". This will inevitably lead to peer pressure on those who are responsible for unacceptable reduction of water quality. Therefore, ensuring transparency, without sacrificing rights to confidentiality that may exist, can be an effective mechanism for regulating transgressors.

"Name and shame"

Another mechanism that can bring about peer pressure is to explicitly name transgressors to allow those who have been impacted or other interested parties to bring pressure to bear on the transgressor. This is also referred to as "management by shame" (van Wyk, *et al.*, 2002). However, antagonising transgressors in this way can have negative ramifications.

Duty of care

To provide for a specific regulatory mechanism that facilitates peer pressure, the National Environmental Management Act (107 of 1998) places a general "duty of care" on each citizen to take reasonable measures to prevent pollution or environmental degradation. Furthermore, "any person may institute and conduct a prosecution in respect of any breach or threatened breach of any duty", if this is either "in the public interest" or "in the interest of protection of the environment".

A4.3.2 Self-regulatory

ISO 14000 and sustainable development

The ISO 14000 family of standards on environmental management was developed to provide a practical toolbox to assist in the implementation of actions supportive to sustainable development (http://www.iso.org). In today's global economy, organisations are increasingly being called upon to demonstrate sound management of economic, social and ecological issues. Evidence suggests that this "triple bottom line" results in advantages in financing, insurance, marketing, regulatory treatment and other areas (http://www.iso.org). An Environmental Management System (EMS) is a structured approach to addressing the ecological bottom line.

ISO 14000 family

The ISO 14000 family comprises about 25 documents covering the following (http://www.iso.org):

- Implementing environmental management systems,
- Conducting environmental audits and other related investigations,
- Evaluating environmental performance,
- Using environmental declarations and claims,
- Conducting life cycle assessments, and
- Addressing environmental aspects in products and product standards.

ISO 14001

ISO 14001 is the world's most recognised EMS framework that helps organisations both to manage better their impacts on the environment and to demonstrate sound environmental management.

Management instruments	ISO 14000 SABS ISO	http://www.iso.org SABS ISO 14001

A4.3.3 Supportive

Constructive influence

The Department can also act in a supporting role to constructively influence water users to be appropriately aligned with RDM. It will inevitably need to work closely, in a spirit of co-operative governance, with other government departments and organisations. Support can be provided in a number of ways:

Research & development

Research and development can be supported, both in kind and financially, to build capacity both within and outside the Department in areas that will give better effect to RDM. This should be done in close collaboration with local and international organisations that can act as co-funders and those that can perform the technical aspects of the work. The South African Water Research Commission and various international donor agencies can be used in this role.

Education

Education and awareness programmes can be used to:

- Raise the awareness of water users and communities to the value of water, and good water quality in particular.
- Create awareness within neighbouring countries to further develop and improve their policies and strategies relating to resource directed management of water quality.
- Empower water users to understand their water resources better and recognise how to protect them and hence create a culture of stewardship of the water resource.
- Raise the principle of protection of water resources, particularly relating to water quality, to a national priority.

Training

Training of officials within the Department and external stakeholders can increase their basic skills and understanding and contribute significantly to overall capacity creation. (See also Section 7: Capacity Creation & Maintenance.)

Land-use planning

The Department should be intimately involved in land-use planning decisions, particularly with those that can result in impacts on water quality (*e.g.* through runoff or direct discharges into water resources). Planning guidance should be provided to optimise associated socio-economic development while affording an appropriate level of protection to water resources through RDM.

Further reading	Groundwater Quality Protection for Farmers Artificial Groundwater Recharge Managing Water Quality: How Users can Participate.	Conrad and Colvin, 2000 Murray, 2003 DWAF, 2003e

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