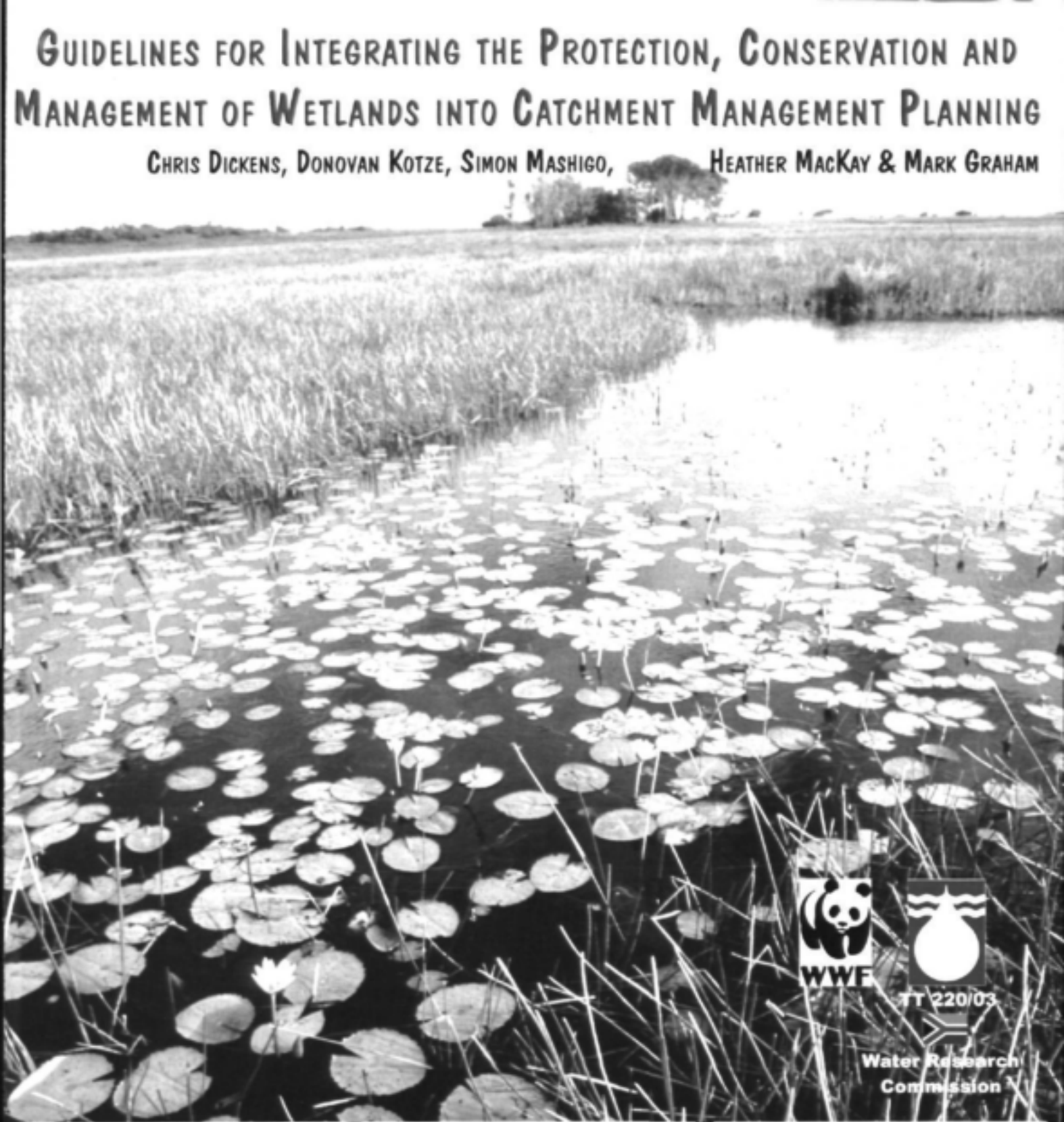
Guidelines for Integrating the Protection, Conservation and Management of Wetlands into Catchment Management Planning

Chris Dickens, Donovan Kotze, Simon Mashigo, Heather MacKay & Mark Graham



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Water Research Commission

Guidelines for Integrating the Protection, Conservation and Management of Wetlands into Catchment Management Planning

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Contents

Summary

The legal framework that exists in South Africa provides every incentive to ensure that the water resources of this country, including its wetlands, are used sustainably. From the Constitution to legislation such as the National Water Act, the National Environmental Management Act, the Conservation of Agricultural Resources Act and others, an environment is created whereby the protection, conservation and management of wetlands could and should happen in order to ensure the sustainable use of natural resources. Yet, all is not well with the wetland resources of this country. Already suffering from years of abuse and over-utilisation, wetlands remain under threat as part of the water resource.

So, what are the problems? Why are the water resource contributions of wetlands not appreciated by society? Why are procedures not in place to protect them to ensure the ongoing supply of benefits they provide? Essentially, there are three main problems:

1. Protection of wetlands requires protection of both the land uses around and within wetlands, as well as the water which feeds them and maintains their essential character. Generally, these two critical aspects are the responsibilities of different agencies, resulting in a lack of alignment of objectives and priorities, which in turn leads to one or the other of the land or water aspects not being adequately addressed.

2. The web of legal and institutional responsibilities is complex and confusing. Wetlands are an issue for so many legal instruments and government departments that there is a tendency to hand over the responsibility of dealing with them to someone else. The result is that wetlands tend to be ignored.

3. The technical tools needed to protect, conserve and manage wetlands as an important water resource are generally deficient. So, while there may be a strong desire to manage wetlands, as well as adequate (albeit fragmented) legislative and policy support, the wherewithal to ensure that the efforts invested are well spent, is inadequate.

This Guideline sets out to chart a way through the complexity that exists in the hope that the responsible agencies can incorporate wetlands into their catchment management planning processes.

The Guideline provides a template, (summarised in the Critical Path: Figure i) on which CMAs and other agencies responsible for water management will be able to implement wetland management in their areas. The Critical Path intends to help agencies navigate from (a) planning at catchment level for wetlands management and protection, to (b) implementation of wetland protection, rehabilitation and management strategies at site level.

The Guideline provides these agencies with the following information:

1. Summarised information on the International Conventions that give support to the protection of wetland resources.

2. Summarised information on the laws within South Africa that create the environment necessary for effective wetland management, and that can be used to strengthen the implementation of plans and strategies.

3. An introduction to social and technical issues such as:
   a. Involving Stakeholders in the process
   b. The survey and inventory of wetlands
   c. Determination of the health of wetlands
   d. Setting of objectives and priorities for wetlands.

4. The guideline also provides template style Terms of Reference that CMAs and other agencies can use in order to direct teams to the necessary tasks.

It is important for those individuals and organisations who have responsibility for the management of water resources, especially wetlands, to crystallise a vision for the future of wetlands as an important part of the water resource in South Africa, and begin to take the steps that will lead to the fulfilment of that vision. This Guideline is an aid to achieving this aim.

This guideline makes every effort to present a workable model for the management of wetlands in a whole-catchment context. However, the diversity of situations around the country necessitates that management plans be adapted to specific circumstances. The Guideline can be used as a template for developing and implementing plans and strategies that are tailored for local situations.

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Introduction

The South African Constitution calls for the prevention of pollution and ecological degradation, promotion of conservation, and the securing of ecologically sustainable development and use of natural resources. Wetlands are important elements of these natural resources and yet they have received little specific attention in national and regional plans such as the National Water Resources Strategy, Provincial Environmental Implementation Plans and Integrated Development Plans for various provinces and local governments.

In general, strategies for protection and management of wetlands have been focused on managing the impacts of land uses and harvesting of biological resources around and within wetlands. Yet without water, wetlands would not exist. And without healthy, functional wetlands, the flow patterns and quality of water in a catchment can be greatly affected, often causing negative impacts for people reliant on the water resources as well as the wetland resources. More attention now is being placed on the provision of sufficient water of adequate quality to maintain the essential character of wetlands. The aim is to move towards matching water resources strategies with land use management strategies, so that these can be implemented jointly to ensure the maintenance of healthy, functional wetlands.

An enabling environment for the protection, conservation and management of wetlands is clearly provided through several pieces of legislation such as the South African National Conservation of Agricultural Resources Act, World Heritage Convention Act, Environmental Management Act, Water Act, Development Facilitation Act, and the Biodiversity, Land Use and Protected Areas Bills. Yet, implementation is weak due to fragmented institutional arrangements, confusion about overlapping jurisdictions and areas of responsibility, and lack of appropriate management strategies that mainstream wetlands in the water and natural resources sectors.

This Guideline is intended to chart a way through this complex web, to enable land and water resource managers to effectively tackle the issue of wetlands. A template is provided (summarised in the Critical Path Figure i) against which CMAs and other agencies responsible for land and water management will be able to plan for and implement wetland management in their areas. The Guideline provides these agencies with the information to understand the legal and institutional issues in South Africa. It introduces the necessary technical issues that they will need to address in order to manage, conserve and protect the wetland resources in their catchments. These include guidelines for the survey and inventorying of wetlands, the determination of the health of wetlands and the setting of objectives and targets. The Guideline also provides template style Terms of Reference that CMAs and other agencies can use in order to direct teams to the necessary tasks of planning, implementation and management.

Introducing the Guideline overleaf is a Critical Path (Figure i) to guide the reader to successful management of wetlands from catchment to site level. While this Guideline makes every effort to present a workable model for the management of wetlands on a catchment basis, the diversity of situations around the country must be recognized. The Guideline can be adapted to suit catchment-specific circumstances.

Who is this Guideline for?

One of the primary reasons that wetlands 'fall through the cracks' between the many responsible agencies and relevant pieces of policy or legislation is that they are ecosystems which are partly land-based and partly water-based. South Africa's recent water legislation (NWA, 1998) recognizes catchments as the primary geographic units of water resource management. However, even this very progressive legislation still provides tools that focus primarily on the water component of a catchment, rather than tools for integrated catchment management, that would allow for the integrated management of land and water in a catchment.

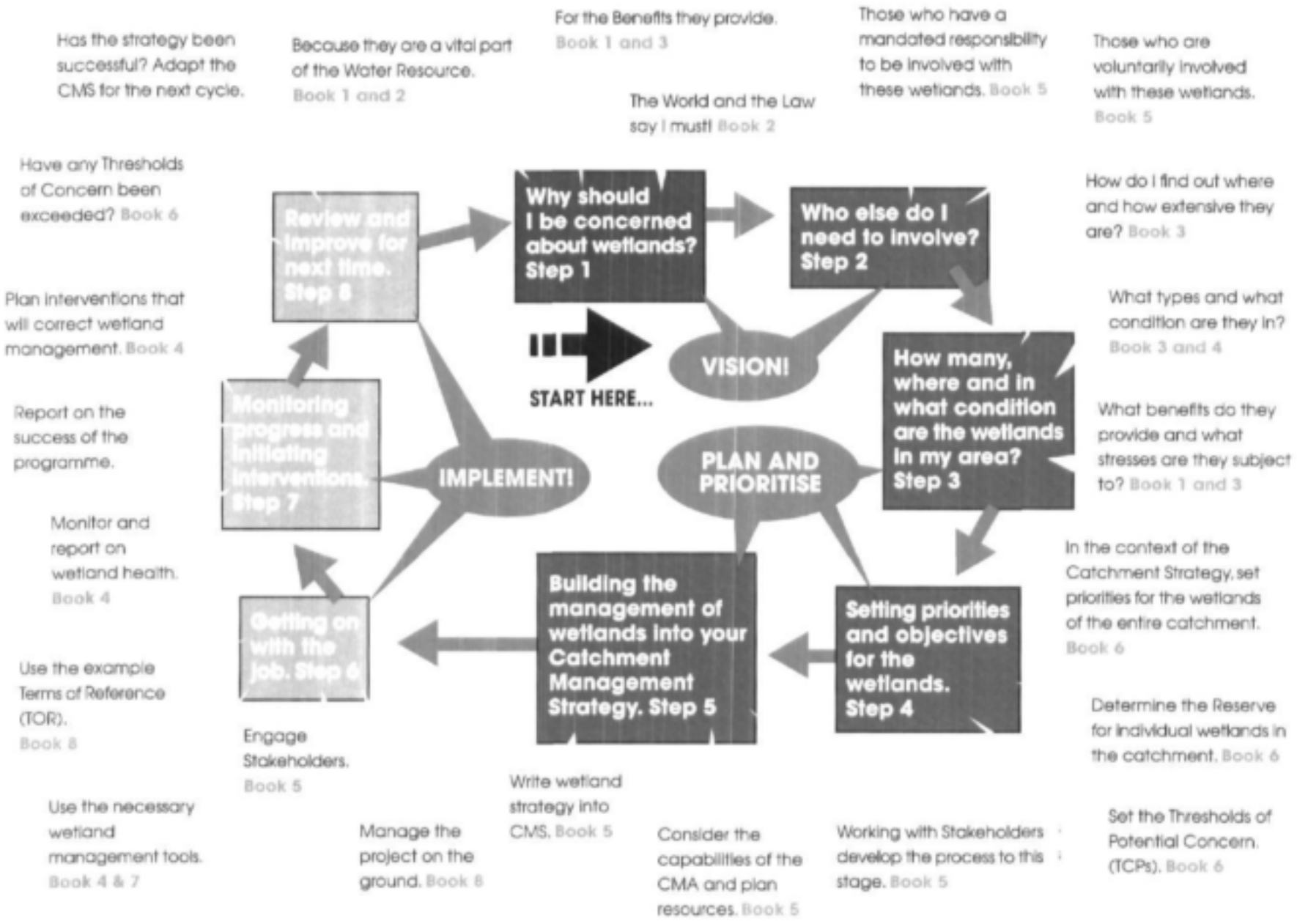
The Catchment Management Agencies (CMAs) provided for in the 1998 National Water Act will primarily be responsible for integrated water resources management at a catchment level. However, wetlands are also important elements of the water resources in a catchment: CMAs, and more particularly, the Catchment Management Strategies (CMS) which CMAs must develop and implement, can potentially play an important role in bridging the land-water divide which has proved so problematic for the protection and management of wetlands. Though it is recognized that CMAs will probably have limited resources, and their powers and functions will be limited to those allowed for in the National Water Act, they can be a focal point for partnerships and facilitated approaches which address both the land and water management needs of wetlands.

The Guideline is intended to assist in the incorporation of wetland protection, conservation and management issues into a CMS. Hence, this Guideline is aimed principally at Catchment Management Agency staff who are responsible for the development and implementation of the Catchment Management Strategy in a Water Management Area. However, it can also be used by interested people or agencies responsible for wetlands, who may wish to assist or advise the CMA in ensuring that wetlands are adequately provided for in a CMS.

The Guideline will also be useful for:

- Municipal managers involved in the IDP process.
- National & Provincial departments and agencies involved with environmental management and biodiversity conservation.
- Extension workers who are actively engaged in addressing catchment issues.
- Landowners and landholders particularly those with extensive landholdings such as major timber and mining companies.

Figure i. A Critical Path for including wetlands in a catchment management strategy



Step 1. Why should water resource managers be concerned about wetlands?

Wetlands are a feature of just about every landscape in South Africa. But what is a wetland? The most useful definition for the purposes of this document is the one below.
Definition: According to the National Water Act (1998) a wetland is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water or would support vegetation typically adapted to life in saturated soils".

A wetland is therefore defined in terms of hydrology (flooded), soils (saturated), and plants (adapted to saturated soils). Note that this Guideline has been developed for palustrine wetlands, i.e. those that have a swamp/marsh nature as described in the definition above. For an overview of wetlands, see Book 1.

Why should I manage wetlands? Because they are a vital part of the water resource

It is easy to look at our water resources and only see flowing rivers and great storage reservoirs and dams. On the other hand, wetlands tend to be small, scattered all over the landscape, and may not appear to be important bodies of water. Yet, the opposite is true. Within a catchment, wetlands are generally intimately linked with the stream network and strongly influence the quality, quantity and timing of streamflows. What happens to wetlands profoundly affects the nature of streamflows. If wetlands are not wisely managed, floods may become more severe, dry season flows less prolonged and the quality of water poorer, particularly if there is a lot of human activity in the catchment. The close link that wetlands have with the stream system and other components of the catchment also means that wetlands are affected by what happens in the greater catchment and this is reflected in the state of health of the wetlands. The wise use of wetlands therefore provides a vehicle for promoting the wise and integrated management of catchments.

Why should I manage wetlands? For the benefits they provide (see Book 1)

Wetlands can easily be overlooked for the benefits they provide but in fact they supply society with so many services that are essential, but which depend on maintaining healthy, functional wetland ecosystems.
These services include:

- Water supply
- Flow regulation, primarily flood control
- Erosion Control
- Sediment removal and/or retention
- Nutrient removal and/or retention
- Toxicant removal and/or retention
- Natural materials
- Opportunities for conservation
- Recreation and tourism
- Socio-cultural significance
- Opportunities for research and/or education

Numerous studies throughout the world have shown that it is almost always more cost-effective to maintain natural wetlands than to drain or convert the wetlands to other (often marginal) uses, and then to try to provide the same services through structural control measures such as dams, embankments, water treatment facilities, etc." (Ramsar Convention Bureau, 2000.)
But a number of pressures on wetlands and associated water resources, have placed the continued supply of these benefits under threat. Pressures include: the abstraction of water from surface and groundwater resources for offstream use; draining and cultivation of wetlands; overgrazing and excessive trampling by cattle resulting in donga erosion; invasion by alien weeds such as American bramble and wattle and, topping the list, ignorance about the services that wetlands provide and the kind of protection and management that wetlands need.

Why should I manage wetlands? South African legislation and the World say I must! (See Book 2)

Both internationally and in this country, there is broad agreement that wetlands are an important part of the natural resource that need to be protected for our own good and for that of future generations. Indeed, in the Water Act the definition of water resource specifically includes wetlands. These are some of the conventions and laws that highlight the importance of wetlands:

- Ramsar Convention on Wetlands – signed by 136 countries including South Africa, is dedicated to the wise use of wetlands. The Ramsar Wise Use Concept states that 'The wise use of wetlands is their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem' (Ramsar, 2000).

- The South African law gives support to the protection and proper management of wetlands in several laws. The most important of these include the National Water Act, Conservation of Agricultural Resources Act, the National Environmental Management Act and the Environmental Conservation Act. Details of how these Acts give support to wetlands management and protection are provided in Book 2.

Where to from now?

For years wetlands have been taken for granted in the landscape. Wetlands, and the water which sustains them, have been exploited to the point where today it is estimated that 50% of the wetlands in some catchments in South Africa have been destroyed. Why should this be of concern to us now? With increasing pressures on the land and with a water resource that is becoming more and more stretched, it is imperative that we start to protect those parts of the water resource that will ensure a continued supply of the benefits that society needs. If we carry on as before, the long-term consequences, for water resources, for wetland ecosystems and for the services which they provide, could be extremely serious.

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Ramsar Convention Bureau. 2000. Ramsar handbooks for the wise use of wetlands. Ramsar Convention Bureau, Gland, Switzerland.

Step 2. Who do I need to involve?

Management of wetlands poses unique difficulties in that the benefits of wetlands are seen by various agencies in different ways. Although wetlands are water resources, managed by water authorities, they are found on land that can be owned or occupied by people or organisations with ideas about their management that may differ to those of water resource managers. Wetlands are also a source of natural resources that are seen in another light by conservation authorities and other interested parties. Successfully managing the water-related benefits of wetlands thus necessitates working together with agencies that have their own needs, priorities and responsibilities.

CMAs cannot take on all of these challenges on their own but must bring in others, especially where these others are required by law to perform certain of these wetland management functions. Collaboration should also be expanded to other institutions that may be keen to participate on a voluntary basis. CMAs therefore need to assess the profiles of various stakeholders and decide how they can be brought on board.
Below is a guide to agencies and parties who will be interested in the management of the wetlands in your area.

Those with mandated & legal/statutory responsibilities (see Book 5)

National Government and provincial departments have responsibilities that directly affect wetlands. Some of the more important departments include:

- Department of Water Affairs and Forestry and their delegated agent the CMA - required to protect the country's water resources including those associated with wetlands.

- Department of Environmental Affairs and Tourism – environmental management and biodiversity conservation including the biodiversity of wetland ecosystems.

- Department of Agriculture – required to protect the resources on which agriculture is based, particularly soil and vegetation.

- Provincial conservation and environment departments and agencies – environmental management and biodiversity conservation at provincial level.

- The Landowner/holder (including traditional structures) – all landowners/holders have a legal responsibility, under the National Environmental Management Act, in terms of how their use of the land affects the environment, including wetlands.

- Industries – are required, in terms of the relevant legislation (NEMA, NWA) to limit their impact on the environment.

Those voluntarily involved in promoting the management of wetlands (see Book 5)

Parties who have a vested interest in maintaining healthy wetlands include:

- Water Boards and bulk water suppliers, including local government, who wish to receive abundant and clean water for potable water supply.

- Environmental lobby groups and individuals who desire to influence the protection of the environment.

- Industry, who use the water resource and wish to protect the supply or who may have obligations to international watchdog agencies.

- Subsistence users, who rely on the ecological services for subsistence livelihoods.

These parties may already be organized and mobilized through networks and fora such as the South African Wetlands Action Group or a provincial Wetland Forum (e.g. the Eastern Cape Wetland Forum). Alternatively, these networks or fora may be able to provide information about other interested groups or organizations in the catchment.

Some of these parties will be involved in planning and implementation at the catchment level, others at the site or individual wetland level, and the process of consultation and co-operation needs to be designed so that parties are involved and take up their responsibilities at appropriate times and at appropriate levels.

Working together to manage wetlands
(See Book 5)

Because of linkages between land and water issues, multiple responsible agencies and overlapping jurisdictions, co-operation among the different administrative role-players is critical to achieving the integration required for effectively managing wetlands. Co-operative governance will allow CMAs to exert more meaningful influence over land use activities affecting wetland resources, through the following possible routes:

- The CMAs can bring wetland and water resource perspectives to the IDP spatial planning process undertaken by municipalities.
- CMAs can and should comment on EIAs from a wetland water resource perspective.
- CMAs can collaborate with a variety of organisations in an advocacy role designed to promote protection of wetland water resources.
- CMAs can work with provincial government to draft Environmental Implementation Plans to ensure the inclusion of wetland water resources.

A process for reaching common objectives for wetlands

Ideally, in a catchment, there needs to be a process whereby all the interested and responsible parties come together to co-operatively develop and implement common land and water management objectives for the protection, conservation and management of wetlands. This process can be initiated and facilitated by the CMA, from its interest in wetlands as important elements of the water resource in a catchment. Alternatively, the CMA can participate in and make a significant contribution, from the water perspective, to a broader process of planning for wetlands protection and management if such a process has already been initiated by another agency or interested party.

In a co-operative process, the various relevant policies and pieces of legislation, from the water, environment, agriculture and development sectors, can all be pieced together in a 'patchwork quilt' kind of process to provide the comprehensive land- and water-related measures required to protect and manage wetland ecosystems.

Step 3. How many, where & in what condition are the wetlands in my catchment?

What functions do they perform,
for users inside and outside the catchment?

"You can't manage what you can't measure...."
Unless you have an idea how many, how big and of what type they are, where they are on the map and what pressures are being exerted on them, you cannot begin to manage wetlands. Book 3 describes the survey and inventory of wetlands so that you can reach this starting point.

How to go about mapping the wetlands in your catchment (see Book 3)

The task of mapping and developing an inventory is part of a rapidly evolving field of expertise. New ways of detecting wetlands from satellites and aerial photos, and placing these onto GIS maps, are making the exercise easier and cheaper. However, we are a long way from having complete information available. Before tackling this work, it is advisable to check on recent developments.

What types of wetlands are in your catchment? (See Book 3)

After locating the wetlands, divide them into types e.g. hillslope seep, valley bottom with a channel etc. Factors that determine wetland type include their altitude, the geology and soils on which they lie, the source and patterns of input of water to the wetland, and the position where they lie in the landscape, for example on hill slopes or valley floors. These physical characteristics lead to the presence of different vegetation types and different fauna that would frequent these wetlands.

These factors give wetlands their unique character and each plays a unique role in the water resource, for example some wetlands store source-waters for long periods, while others only trap flood water.

What are the water resource functions and benefits provided by the wetlands in your catchment? (See Book 1)

We have concentrated solely on wetland functions that benefit the water resources of an area in this guide. From a water resource point of view, benefits of wetlands that can be identified and mapped or otherwise highlighted for the attention of water resource managers include:

1. Water supply
2. Flow regulation, primarily flood control
3. Erosion control
4. Sediment removal and/or retention
5. Nutrient removal and/or retention
6. Toxicant removal and/or retention

It is important to identify and understand, at a quantitative level if necessary, the links between the wetlands in the catchment and the water that sustains them. We need to know about the connections between the wetlands in a catchment and the surface and/or groundwater bodies, in order to identify (i) the primary sources of water for the wetlands, and (ii) the dependencies, (hydrological, water quality-related and biological) between these wetlands and critical water resources functions.

How to go about measuring the ecological health of wetlands (see Book 4)

Determining the condition or ecological health of wetlands enables us to determine if they are functioning properly and playing their role in the water cycle in a catchment. If they are not functioning correctly, then appropriate actions need to be taken to restore them to the desired level of functionality. (Determination of the desired level of functionality is related to the setting of the management class for a wetland, which is described in more detail in Step 4 and Book 6.) Once the health of individual wetlands has been established it is then appropriate to look at this from a catchment perspective and determine the overall health of the wetlands in the catchment, in order to prioritise responses and actions.

Wetland health assessment involves investigating all the physical and biological characteristics of the wetland and comparing the present condition with the condition that the wetland would have been in if it were in its natural state. A recent move has been to convert what can be a prodigious amount of raw environmental data, into indices of wetland health. These indices could take the form of:

- Physical indices – the land and hydrology aspects and possibly including the quality of the water.
- Vegetation indices – the integrity of the vegetation communities in the wetland.
- Faunal indices – the integrity of animal populations, probably limited to invertebrates but in some cases including amphibians, fish or birds.

The need for this type of assessment has only recently been introduced, so this field of science is in its infancy. While some methods do exist there is a need for several more. It is probable that new indices will become available within the next few years.

Reporting on the health of wetlands (See Book 4)

Reporting on environmental issues has changed tremendously over the past few years with the advent of GIS maps, digital photographs, the internet etc. A proposed way of reporting the health of wetlands appears in Book 4, but there are many good reporting examples from around the world and here in South Africa. A reporting approach should be chosen which is appropriate for:

- The size and significance of the catchment,
- The level of detail required,
- The data available, and
- The information needs of key decision-makers in the CMA and those responsible for or interested in land and water management in the catchment.

Action Summary: How many, where & in what condition are the wetlands in my area?

1. Obtain broad-scale information from the National Wetland Inventory.
2. Check on existing inventories and sources of information.
3. Prioritise areas according to importance for water resource management using information at an appropriate level of resolution.
4. Map the location and size of wetlands in an area and divide them into wetland types (eg. hillslope see p etc)
5. Determine (desktop only) and map the functions of the wetlands including any available knowledge or information on the hydrological and water quality relationships between these wetlands and surface and/or ground water bodies in the catchment.
6. Measure the ecological health of selected wetlands using physical and biological indices.

Step 4. Setting priorities and management objectives for wetlands on a catchment basis

Once there is a clear picture of where the wetlands are in a catchment, how they are linked to surface and groundwater resources, what functions they are performing and what state they are in, then it is necessary to look forward and set management objectives for the future, based on agreed priorities. Without a clear set of future management objectives, management of wetlands becomes reactive and *ad hoc*; actions are not built into a structured plan and budget, and this frequently results in loss of or long-term degradation of wetlands.

While there are many technical guidance documents available for drawing up management plans for individual wetlands (e.g. Ramsar 2002), there is as yet little explicit guidance and only a limited number of examples of how to set management objectives on a priority basis for all wetlands in a catchment, in a manner that recognizes the linkages between the wetlands and the water resources in the whole catchment. However, the National Water Act (1998) provides a powerful suite of tools for doing this through the provisions in Chapter 3 (Resource Directed Measures for the Protection of Water Resources).

Resource directed measures (RDM)

Chapter 3 of the NWA includes measures for setting the class, Reserve and resource quality objectives (collectively formed the Resource Directed Measures or RDM) for all significant water resources in a catchment, including wetlands. These provide a statutory basis for determining the level of protection which should be afforded to a water resource, the quantity and quality of water which must be provided in order to protect the water resource and the associated riparian and instream habitat. The intention, in setting the RDM and requiring all responsible agencies to work towards achieving the RDM, is to protect the essential ecological character of a water resource that is necessary for the ongoing provision of benefits from that water resource, including economic, social and environmental benefits.

The RDM, when applied to wetlands, focuses on the water-related aspects of wetland structure and function, and the CMA has the primary responsibility for implementing RDM.

However, if a similar process can be established with the other responsible government departments or agencies to set land use management objectives that are consistent with the RDM, and if this can be undertaken at the same time as RDM are determined, then the potential exists to draw up and implement a very efficient and effective programme of protection, conservation and management of wetlands in a whole catchment.

The RDM are designed to be applied within a process of stakeholder consultation and joint decision-making, to ensure that water resources are given the level of protection which befits their economic, social or ecological importance. The process recognizes that we cannot afford to keep all water resources (including wetlands) in a pristine state, but that some water resources are more important and/or sensitive than others and, because of their resulting higher priority, should be managed to meet more stringent and protective objectives.

Detail regarding RDM determination, specifically for wetlands, can be found in Book 6. The procedures for determination of RDM, particularly the Reserve (the quantity and quality of water required to protect an aquatic ecosystem) have been well developed and tested for riverine ecosystems, less so for wetlands. Nevertheless, the scientific principles behind the process of determination remain the same, and can be adapted for wetlands.

Prioritizing wetlands in a catchment and determining RDM

It is necessary to prioritize wetlands in a catchment in terms of their social, economic and ecological importance, as well as their importance in relation to the protection and management of linked water resources. This assessment of relative importance guides the setting of the management class for each wetland or group of wetlands, and determines the ultimate protection status afforded to each wetland. Considerations for prioritisation include:

- Key individual wetlands, such as Ramsar sites, wetlands in protected areas and those providing critical water resource benefits;
- Collective wetlands in priority areas of the catchment, for example in headwater areas where wetlands are vitally important as the sources of tributaries;
- The collective wetlands of the catchment as a whole, in relation to wetlands in other regions or catchments, taking into account issues such as regional biodiversity and biodiversity 'hotspots'.

Tools are available for assessing the economic value and importance of wetlands (see Ramsar guidance on valuation of wetlands (Barbier et al. 1997), and methods based on participatory appraisal techniques can provide information on social importance (Huggins and O'Keeffe 1999). Several approaches are available for assessing ecological importance (Kleynhans 1999). In addition, targets should be set for the total area of wetlands in a catchment that should be managed in a particular condition (Natural, Good or Fair are the management classes allowed for in the RDM). As an example, it could be proposed that at least 40% of the wetlands in a catchment should be managed in a functional state, bearing in mind that some reports suggest that 50% of wetlands in South African catchments are already in poor condition or non-functional. Expert specialist advice will be needed to guide the setting of such targets in a particular catchment.

These various approaches and methods should be used to assist in ranking the wetlands in a catchment in order of their overall importance and sensitivity, in order to inform the setting of appropriate management classes in the RDM determination process.

Implementing RDM – setting measurable targets for protection, conservation and management of wetlands in a catchment

One of the key benefits of the RDM process is that it requires the establishment of an agreed list of measurable criteria, addressing water quantity, water quality, habitat and biota that represent management goals or objectives for each wetland in a catchment. These criteria should be formally captured in the CMS, where they then serve as the basis for implementation of appropriate management programmes by the responsible water management agency, generally the CMA.

Once the RDM have been determined and the quantitative criteria established, these can be broken down further, to identify distinct thresholds, above which wetland management activities would be deemed to be succeeding, and below which some action or intervention must be initiated to remedy a particular situation. These thresholds are sometimes referred to as 'Thresholds of Potential Concern' (TPCs). Although TPCs are not specifically mentioned in water policy or legislation as statutory mechanisms, they can provide very useful operational guidance for water and wetland managers. For example, a TPC could state that if the concentration of total nitrogen in water coming from a wetland increases above x mg/l, then a certain remedial action must be initiated in response. A good example of the development and application of TPCs for a large system is that recently implemented in the Kruger National Park (Rogers and Bestbier 1997).

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Action summary: setting priorities and objectives for wetlands on a catchment basis

- Once the location and state of wetlands in a catchment have been determined, assess the economic, social, ecological and water resource-related importance of each significant wetland or group of wetlands. This can be done at a desktop level, or through intensive consultation and field surveys, as necessary and appropriate.

- In consultation with stakeholders, and in tandem with an RDM determination process for the whole catchment if appropriate, decide what portion of the wetlands in the catchment, and which individual wetlands, should be in a Natural, Good or Fair class. The prioritization should be divided according to wetland type as described in Book 3, in order to ensure that an agreed proportion of each type of wetland is kept at a functional level.

- Decide which wetlands need special attention (e.g. Ramsar sites or wetlands in protected areas) and set objectives for them.

- Determine the Reserve and resource quality objectives for each wetland, associated with the class which has been decided for each, starting with those wetlands that are most important.

- Set Thresholds of Potential Concern for each of these wetlands.

Step 5. Building the management of wetlands into your Catchment Management Strategy

Why should I prepare a CMS?

A strategy provides an action plan for using limited resources to leverage value or to achieve desired outcomes. Preparing a strategy makes good sense for any business and any society that wishes to progress. Developing the strategy with input from stakeholders and after giving consideration to parallel strategies will give the strategy a broader focus and make it more useful, fulfilling several needs instead of just one. The National Water Act calls for CMAs to put together a catchment strategy (CMS) in a phased and progressive manner together with stakeholders in the catchment, so that the water resources are managed for the benefit of all. According to the Act, water resources include wetlands and therefore their management needs to form part of the objectives contained in the CMS.

Aside from the legal requirements, wetlands are part of the water resource in a catchment. Wetlands affect and are affected by water resources management decisions and actions, and so water-related issues relevant to the management of wetlands should be made explicit in the CMS in order to protect both the wetlands and the overall water resources benefits and functions. As noted earlier, protection of wetlands also requires attention to the management and control of land uses around and within wetlands. Land use issues may have to be addressed through other planning and policy instruments, but land use objectives can be set jointly with water resources objectives, in co-operation with the other responsible agencies, and reference to land use management can be made in the CMS to ensure that the land-water links, so important for wetlands, are retained.

How do I prepare a CMS and incorporate wetlands into it?

The preparation of a CMS is well documented in the "Development of a generic framework for a catchment management strategy" report (See Book 5). This report deals mainly with the inclusion of wetlands into that strategy. The following points will have relevance:

Look to the CMA itself

CMAs need to understand and define what business they are in and how much responsibility they can take on. This must account for the situation on the ground and be in line with the Act's defined functions of the CMA. Depending on the local institutional environment and the availability of capacity, resources and expertise, some CMAs will be in a position and be interested in taking the lead in the protection and management of wetlands, while facilitating the involvement and co-operation of other responsible agencies. Some CMAs, however, may act primarily as an "interested and affected party" where wetlands are concerned, co-operating where they are able while another agency or group takes the lead. Catchment Management Strategies are likely to differ in how they address wetlands, depending on the role played by the CMA and the level of interest and involvement from other stakeholders in the catchment.

Involving stakeholders in decision making and planning

Most WMAs contain diverse stakeholders with different cultures, backgrounds and knowledge systems. The CMS must, as far as possible, address the concerns and needs of all water users, so public and stakeholder participation is essential if the planning process is to be credible. This makes it a difficult but important matter to mobilise stakeholders and to get them involved. For this purpose a communication plan related to wetlands needs to be developed and integrated into the broader communication and participation strategies of the CMA.

Effective collaboration between CMAs and stakeholders increases the chance of success in achieving effective wetland and catchment management. Early collaboration can also help identify and prioritise previously unknown wetland and catchment issues. The consultative process should provide a vision and long-term objectives for the wetlands of a catchment, supported by stakeholders, and based on their wishes, aspirations and available information. Professional facilitation and conflict management processes will often be required from the outset noting that people may have different views and ideas. The vision should preferably be set through a consensus-based process but must be aligned with realities on the ground. The factors discussed below will be useful in this process.

Make use of Foundation and Supporting Strategies

Foundation Strategies include those that provide the overarching framework for managing water resources (See Books 2 & 5.) The following are examples:

The National Water Resources Strategy, Resource Directed Measures (RDM), Spatial/Landuse Planning Strategy and Data and Information Management Strategy.
Supporting Strategies include: Water Resources Protection Strategies, Water Use Strategies, Water Resource Development Strategies etc. The basic information relating to these strategies is covered in the NWRS and the actual details will vary from one WMA to the other depending on their circumstances. Ideally, a Supporting Strategy devoted to the protection, conservation and management of wetlands should be developed and included as a chapter in the CMS, and much of the emphasis in this Guideline serves to support such an initiative.

Refer to the document entitled "Development of a generic framework for a catchment management strategy" (DWAF 2001b see Book 5) which explains these strategies and management instruments.

Set strategic objectives and action plans

Once information relating to laws, complementary strategies, threats, opportunities, management of water resources (components of the NWRS) and institutional arrangements have been assimilated, stakeholders need to set strategic objectives that will guide the process of achieving their objectives (see Book 6).
Further to this, the action plans, times and resources that will be needed must be included. If the CMAs are to champion conservation and management of wetlands, they must take note of different financing mechanisms available viz. water resources management charges, exchequer grant, multilateral funding, penalties etc. Like any project, risk assessment and cost benefit analysis need to be undertaken. Provision must be made for monitoring and reporting based on the set targets.

Action Summary - Building the management of wetlands into your CMS

- Bring stakeholders on board, by strengthening the existing stakeholder groupings in the catchment with regard to their understanding and appreciation of wetlands issues. Expand existing stakeholder groups and processes, if necessary, in order to promote better representation of wetlands management in the development and implementation of the CMS.
- Carry out a preliminary situation assessment, to identify the wetlands, their functions, benefits and state of ecological health.
- Consider the in-house skills available at the CMA – bring skills in where necessary through forming collaborative partnerships with other responsible agencies and interested stakeholders.
- Synchronise wetland aspects with foundation and supporting strategies that operate at both a National level and a WMA or catchment level.
- Together with stakeholders, develop the vision for wetlands, consolidate and expand the knowledge base, set the land and water management objectives for wetlands and develop the necessary action plans at the catchment level as well as for individual wetlands.
- Ensure that the CMS contains the necessary information, strategy and actions related to wetlands, for which the CMA is responsible. These might see the CMA taking a strong lead, or they might indicate exactly where and when the CMA must act in co-operation with and in support of another lead agency.

Step 6. Getting on with the job — the transition from planning to implementation

The essence of the transition from planning to action is via an Implementation Plan, which goes to operational detail. Often an implementation plan will need to be developed at two levels:

- Firstly, there should be an implementation plan related to the protection, management and conservation of wetlands at catchment level. Such a plan would set out water resources objectives for the catchment: important aspects would include identifying which wetlands should be assigned a high priority for protection or rehabilitation, and how much water, at what times and of what quality, will be provided for wetlands in the various parts of the catchment.

- Secondly, each individual wetland or group of wetlands may need a site-specific implementation plan which fits "inside" the catchment level implementation plan.

Developing an implementation plan

Most implementation plans will need to consider the following:

- Keeping catchment water resource objectives and actions aligned to national and international policies and initiatives.

- Keeping wetland protection, management and conservation actions aligned with catchment and CMA water resources objectives.

- Identifying effective enforcing legislation that targets specifically the pressures on wetland water resources and can be used to strengthen a co-operative approach.

- Improving the protection afforded important wetlands in the catchment, (e.g. through procurement of land by the state/CMA or through programmes such as the Natural Heritage Site Programme).

- The rehabilitation of wetlands, targeting those wetlands that will provide the greatest returns in terms of improving the state of the catchment's water resources.

- Incentives for landholders/owners to improve or maintain the state of health of their wetlands (e.g. funded support for the rehabilitation of wetlands).

- Promoting the active participation of local communities.

- A communication, education and public awareness programme.

- A monitoring programme to regularly assess and report on the status of wetlands, in order to ensure that the implementation stays on track. The monitoring programme should include agreed indicators which, when exceeded, require some form of reaction or intervention. Responsibilities for reaction must be made explicit.

- Milestones, budgets and clearly defined roles and responsibilities will be required.

Aspects that will affect the nature of an implementation plan

The following points highlight some aspects that should also be included in an implementation plan but that will vary depending on specific circumstances.

The Institutions in the Water Management Area (See Book 5)

- The capacity of persons and institutions involved in the CMA.

- The level of development of the Catchment Management Strategy.

- The framework for institutional co-operation.

The team of stakeholders gathered

- All those who ought to participate as well as those who wish to participate, should be listed in the implementation plan, along with their agreed roles and responsibilities.

The size and type of wetlands. (See Book 3)

- The size and type of the collective wetlands and of each individual wetland will affect the budget and human resources needed.

The land use in and around the wetlands and in the catchment.

- The people living around the wetlands and in their catchment will determine what happens to the wetlands.

The present condition of the wetland and the objectives for the future. (See Books 4&6)

- If some of the wetlands are in pristine condition, they need to be treated differently to those that are already impacted or over-exploited.

The management structure, personnel and budget.

- Each wetland management project will attract a different suite of expertise and funding. Due to the co-operative nature of wetland work, the sourcing of people and funds may come from several quarters. In many cases, several stakeholders can be encouraged to build the necessary personnel and financial resources into their own business plans, to be contributed to the overall project direction.

Note: A single budget and team of people, located within one organization, is not essential for successful wetland management. In fact, multi-organisational collaboration and co-operation is usually a more effective approach, if objectives and action plans are properly aligned.

Step 7. Monitoring progress and initiating appropriate interventions

Monitoring success

Ramsar documents (see Book 6) give guidance on the issues that need monitoring to ensure successful wetland management. These are:

1. Wetland health and land use monitoring.
2. Programme success monitoring.
3. Monitoring the flow of benefits from wetlands.

To ensure that strategy and planning are effectively implemented, monitoring of these aspects is imperative.

1. Wetland health and land use (see Book 4)

Wetland health is measured using indices or by measuring attributes of the wetland directly. Monitoring would include:

- The biophysical condition including the hydrological regime. Is the wetland functioning properly as a water resource?
- The quality of the wetland including the water quality, habitat, the vegetation and the animal life. Are these in a condition to support the wetland functions as part of the water resource?
- Catchment land use from the perspective of whether the use of land in the catchment is negatively affecting the functioning of wetlands.
- Thresholds of Potential Concern (TPCs)

Compare the actual condition of the wetlands of a catchment or each individual wetland against the TPCs that were set. Any exceedence should result in immediate and appropriate interventions designed by management to return the wetlands to their desired state.

2. Programme success

Monitoring would include:

- Successful inclusion of wetlands into the Catchment Management Strategy.
- Successful execution of CMS implementation plans related to wetlands.
- Effective participation of stakeholders.
- Project management.
- The implementation team – have the skills available been adequate or are there gaps? Has the team performed?
- The budget – was the project done within budget? Was the project under or over-resourced?

3. Flow of benefits from sustainable use of wetlands

The ultimate measure of success in the protection, management and conservation of wetlands is the sustainable utilisation of the wetland resource in a catchment. The flow of benefits is usually monitored in the beneficiary communities, using indicators which can track the social and economic impacts, both positive and negative, and which are linked, as far as possible, directly to wetland utilisation.

Reporting of progress

Where appropriate a report describing the state of the wetlands in the catchment should be produced at regular intervals. It should effectively translate complex information into a form useable by management. The frequency of reporting can be varied to suit local circumstances, information needs and capacity. For example, a report on an impacted wetland, or one in the process of being rehabilitated, may be generated several times a year, while a more strategic report on the trajectory of change of the wetlands in a catchment may be done once in five or ten years. Reporting should specifically target changes to wetlands that will reflect on their functioning in relation to water resources in the catchment.

Interventions

Having invested so much in the implementation and monitoring of a wetland management programme, those responsible for management of wetlands need to take the necessary steps to correct the causes of degradation of the wetlands. Interventions will vary depending on circumstances. As the CMA or the agency responsible for wetlands cannot always dictate how all interventions are carried out, negotiation and co-operation will be necessary. Sometimes the CMA can take direct action itself to remedy aspects within its mandate, such as making dedicated flow releases to maintain wetlands. Sometimes, however, the CMA must encourage, persuade or demand action from another agency, group or individual, which may, as a last resort, require the additional force of regulation to ensure follow-through. Examples of interventions include:

- a catchment-wide education programme to alert the public to the threats faced by the wetland water resource and to elicit active support;
- rehabilitation of excessively impacted wetlands;
- purchase or expropriation of wetlands important for the water resource;
- balancing loss of wetlands due to development by the construction or rehabilitation of off-site wetlands;
- negotiation with a landowner to alter stocking density or other activities that are having a detrimental impact on a wetland's hydrological functioning;
- research into the workings of local wetlands, in order to provide the information necessary to manage the water resource successfully.

Step 8. Review status and progress, and learn for next time

Steps 1 to 7 are based on the commonly-used business management system the Adaptive Management Cycle, illustrated below. Sometimes referred to as a "learn by doing" approach, the adaptive management cycle requires closure through an explicit review and reflection step. In this step, the results of structured monitoring programmes are carefully reviewed in order to:

- understand better the response of the catchment ecosystem (including wetlands) to specific management actions;
- correct activities that have not proved useful;
- check that the issues, needs and priorities which drove planning and decision making in the previous cycle are still valid, and if not, revise the priorities and objectives accordingly.

Ideally, the review and reflection step should be "hard-wired" into the business processes of the CMA and other agencies responsible for the protection, management and conservation of wetlands. All too often, monitoring and data collection become favourite pastimes of water management institutions, but the link to implementing management actions is tenuous. The National Water Act has provisions for review and revision of catchment management strategies and their foundation and supporting strategies, but good quality, high-confidence information must be available on which to base such review. The review step itself should be reflective and deliberate, rather than just an administrative nicety.

The Adaptive Management Cycle

Book 1. Overview of wetlands

What is a wetland?

The term wetland is a family name for a variety of different systems that include areas commonly described as marsh, swamp, vlei and bog and sometimes floodplains. Some wetlands remain permanently flooded or saturated throughout the year while others are flooded or saturated for brief periods but long enough to develop waterlogged conditions.

The wetland definition given below encompasses a broad range of different ecosystem types. These guidelines have been developed for a sub-set of these types, referred to as palustrine wetlands, primarily because these are the types of wetlands most commonly associated with river courses and hence with management of surface water resources. Palustrine wetlands are defined as non-tidal wetlands dominated by persistent emergent plants (e.g. reeds, shrubs or trees). This includes wetlands commonly described as marshes, swamps, bogs and vleis. The Ramsar Convention describes wetlands much more broadly to include systems such as estuaries, marine shores and lakes. These have not specifically been covered in this Guideline, but many of the principles presented could be applied to them.

Why are wetlands so important?

The World Conservation Strategy identified wetlands as the third most important life support system on the planet. According to Ramsar, 'wetlands are among the world's most productive environments'. Wetlands are essential for the continued survival of humankind on this planet.
The catchment water manager needs to focus on wetlands for three main reasons:

1. They are an important part of the water resource, and their health and functions affect the quantity, quality and reliability of water supplies;

2. They provide abundant benefits, based on their ecological functions and processes;

3. They need to have an assured supply of sufficient water of adequate quality in order to maintain appropriate levels of health and functioning.

1. They are an important part of the water resource

As they are an integral and inseparable part of the water resource, wetlands are necessarily important to the water manager whose is tasked with protecting and managing the water resource. Giving attention to rivers and dams only, while neglecting wetlands, would be equivalent to monitoring waste that comes out of the end of a pipe without managing the source of the waste.

***Definition:** According to the South African National Water Act (1998) a wetland is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water or would support vegetation typically adapted to life in saturated soils". A wetland is therefore defined in terms of hydrology (flooded), soils (saturated) and plants (adapted to saturated soils).*

Information Box 1.1 - Understanding how a wetland functions

Unless there is an adequate supply of water and the water is retained, there will be no wetland. At the same time, unless land use around and within a wetland, including removal/disturbance of vegetation or soils, grazing, fire and harvesting, is managed and controlled, there will also be no wetland.

Wetlands tend to be found where water is spread out and the speed of water-flow is reduced. Slow water-flow increases the entrapment of sediment in the wetland and also leads to the saturation of the soils for extended periods, creating anoxic conditions below the surface (the 'bad egg' smell in some wetland sediments). The saturated conditions create a favourable environment for certain plants and microorganisms to grow. The waterlogged state of the soil slows down the decomposition of the soil's organic matter and provides a suitable environment for many chemical processes that help to trap pollutants like heavy metals.

Abundant plant growth in wetlands creates extensive habitat, particularly around the plant roots, for microorganisms that help with the removal of pollutants such as nitrogen from the water.

The special way in which wetlands function provides several benefits to people (See Table 1.1.). One of these benefits is the removal of nutrients that can potentially pollute catchment waters. The function of wetlands in slowing down water-flow, supporting abundant growth of plants, waterlogged soils and the activity of soil microorganisms, especially those occurring in the root zone of plants, all help to purify water.

Because the different components of a wetland are inter-connected, interference with one component can affect the functioning of other components. Artificial drains that speed up the flow of water, for example, reduce the level of soil saturation, plant growth and the occurrence of waterlogged conditions. This, in turn, reduces the levels of soil organic matter and many of the chemical processes that are useful in removing pollutants from the water.

Figure 1.1. A typical palustrine wetland

2. They provide abundant benefits

Our existence on this planet depends on the benefits - often referred to as goods and services - we receive from the environment that we often take for granted. From the air we breathe to the water we drink and the food we eat, environmental goods and services are part of our everyday lives. They are also under increasing threat due to ignorant decisions and actions of society. Wetlands are, in no small measure, part of this system of providing benefits. It is often said that if you take care of the water resources of the planet, the rest will fall into place.

The benefit of wetlands refers to those functions, products, attributes and services that have value to humans. Listed below are details some of these benefits.

Table 1.1 Benefits (goods and services) provided by wetlands (Adapted from Howe et al. 1991.)

1. Water supply

i. **Direct extraction**

Wetlands are frequently used as sources of water for domestic, agricultural and industrial use, either by direct abstraction or shallow wells

ii. **To other locations**

a. **To an aquifer (groundwater recharge)**

Water moving from the wetland into the underlying aquifer can remain as part of the shallow groundwater system, supplying water to surrounding areas, or may eventually move into the deep groundwater system, from where it can provide a long-term water resource to more distant communities or natural systems.

b. **To another water resource**

Supply of water to a downstream water resource is maintained by a wetland higher in the catchment. Water in the second water resource may be important for extraction or support of the ecosystem.

2. Flow regulation, primarily flood control

Wetlands can store excess amounts of water generated by heavy rainfall or high river flows. This water may enter the wetland by rain, run-off, rivers or underground sources. Floodwater can be stored either in soils (peat can be up to 90% porous) or retained as surface water. Wetland vegetation retards the velocity of floodwater. The result of these processes is that downstream flood peaks are reduced and river flows are maintained for longer periods.

3. Erosion Control

Physical characteristics of wetland vegetation prevent or reduce erosion of banks, shores and substrate. This is accomplished by binding and stabilising of the substrate by roots and deposited plant matter, dissipation of energy and trapping of sediments.

4. Sediment removal and/or retention

The physical properties of some wetlands (eg. vegetation, size, water depth) tend to slow the velocity of water flow. This facilitates the deposition of sediment, and is closely linked to toxicant and nutrient removal since these processes operate simultaneously to, and sometimes as a result of, sediment removal. This benefits downstream users by maintaining water quality, and benefits agricultural users of the wetland by renewing nutrients and soil.

5. Nutrient removal and/or retention

Nutrients, especially nitrogen and inorganic phosphorous, may be stored in sediment, absorbed by wetland vegetation or transformed by chemical and biological processes. The removal of excess nutrients maintains water quality and prevents eutrophication.

6. Toxicant removal and/or retention

Since many toxicants enter wetlands bound to sediments or within the molecular lattice of clay particles, the process of removal is similar to that of sediment trapping. Toxicants may be stored, transformed or absorbed by plants in the wetland, thereby maintaining or even enhancing downstream water quality. Toxicants can however be released back into the water column by disturbance to wetland sediments or changes in water flow patterns.

7. Source of natural products (on site)

Encompasses all animal, plant and mineral products which may be harvested directly from the wetland. These products may be used for food, building materials, fuel, manufacture of crafts, medicine, animal fodder etc.

8. Source of natural products (off site)

Products which are produced by the wetland and then either migrate or are transported by natural processes to another site. They may be used directly at this second site by people, act as a food source for other organisms or perform some other function. Examples are organic and inorganic material transported downstream, migratory fish and birds.

9. Significant for conservation

i. **Significant habitat for the life cycles of important species of animal and plant**

Some species may complete their entire life cycle in a particular wetland, while others may depend on wetland areas for a part of a more complex life cycle eg. spawning and juvenile development of fish, resting and feeding for migratory birds

ii. **Presence of rare species, habitats, communities, ecosystems, landscapes, processes or wetland types**

Encompasses most of the elements of biodiversity from a micro to macro scale. Rarity is often valued by people and governments, as the chance of permanent loss is high.

10. Recreation and tourism

Areas which are being, or have the potential to be, utilised for recreation and tourism. The importance of an area for tourism is enhanced by high values for other wetland benefits such as 9. Significance for conservation and 11. Socio-cultural significance.

11. Socio-cultural significance

i. **Aesthetic significance of a landscape or landscape component**

Landscape is the sum of all components of the view and has different values to different groups. It may be important to communities as part of their perceived quality of life, or to planners and entrepreneurs in their attempts to attract tourists or business to the area.

ii. **Religious and spiritual significance**

A religious or spiritual site may not necessarily be a wetland, but cleanliness and washing rituals may be important and the link is often made with areas of water. Local inhabitants may have a strong spiritual attachment to a site because of its utilisation by their family or community for many generations. Several African cultures have strong religious beliefs associated with the water and reeds.

iii. **Presence of distinctive human activities**

These include specialised/traditional methods of fishing, collecting wetland products, cultivating wetland soils etc. In some cases these activities demonstrate sustainable use of resources, constitute traditional knowledge and are part of the nation's cultural heritage.

iv. **Wilderness**

These areas can have economic significance for ecotourism eg. hiking, provide pristine catchments for water supplies and allow natural processes to occur without human interference.

v. **Historically important site**

May be the site of historically significant research or event eg. Settlement, battle, human migrations etc. Such sites constitute an important component of the nations or humanity's cultural heritage.

12. Significant for research and/or education

i. **Scientific research**
Many wetlands are used as sites for research, including monitoring, experimentation and reference, and are often used to study long-term or global environmental trends.

ii. **Education**
Some wetlands contain evidence of past and present processes, historical features that may lead to better understanding of human occupation, or examples of wetland species, communities or habitats.

13. Contributes to the maintenance of existing processes or natural systems

i. **Ecological, geomorphological and geological processes and systems**
Natural systems are the result of the interactions between these processes. Many of the benefits of wetlands arise from, and are dependent on, these processes and natural systems.

ii. **Carbon sink**
Permanently anaerobic soil conditions in many wetlands results in the accumulation of large amounts of undecomposed plant material (peat). Carbon locked in this material is prevented from contributing to the levels of carbon dioxide and other greenhouse gases in the atmosphere.

3. They require water to sustain essential ecological functions and processes

In order to maintain a desired level of ecological health and function, wetlands require sufficient water of adequate quality, at the right time and in the right pattern. This means that the water requirements of wetlands, whether these requirements are met from surface runoff or groundwater, must be taken into account in any plan for allocation and abstraction of water from a catchment or discharge of water or waste into a catchment. Water users may have requirements which conflict with those of wetlands, for example irrigation releases from a dam are generally made in the dry season when farmers need the water, but this may cause artificially high flows into a wetland in a season when the wetland has typically been used to receiving little or no inflow, which may in turn disrupt key ecological processes and functions. Many wetlands have strong linkages to groundwater, and may either be fed from groundwater or be instrumental in recharging groundwater bodies from surface water.

In recent years, it has become generally accepted that water can have value both offstream and instream: water can be allocated for offstream uses with high economic value such as industry, irrigation and domestic use, but water retained instream and allocated for maintenance of wetland functions and processes also has value since it maintains the range of ecological goods and services on which people rely.

Information Box 1.2 - Impacts of grazing on wetland function

Many wetlands evolved from grazing by indigenous animals such as buffalo and these animals would have had an important effect on the habitat provided by the wetlands. Domestic livestock may have a similar and positive effect in maintaining habitat diversity, especially where a diversity of tall and shortly grazed areas result from the grazing. However, where wetlands are grazed heavily and uniformly short, the quality and diversity of habitats provided is likely to be decreased.

Wetlands with high erosion hazards can erode when disturbed by excessive trampling and grazing, with the soils being particularly susceptible when they are wet. The area of a wetland where flow is concentrated from a diffuse situation into a channel is often the most sensitive part of the wetland. Disturbance of this area by cattle might cause gully erosion to advance through the wetland, drying it out and destroying much of its value as part of the water resource. The impact of grazing therefore depends on grazing intensity, timing and location, relative to sensitive areas.

So, what are the problems?

The following quotation from Ramsar introduces the threat to the functions wetlands perform "These functions, values and attributes can only be maintained if the ecological processes of wetlands are allowed to continue functioning. Unfortunately, and in spite of important progress made in recent decades, wetlands continue to be among the world's most threatened ecosystems, owing mainly to ongoing drainage, conversion, pollution, and over-exploitation of their resources." (Ramsar Information Pack)

What is causing the loss of benefits from wetlands?

The driving forces leading to the damage of wetlands and loss of benefits provided by them are the burgeoning population of the world as more and more people try to live off fewer resources. Probably equal to this is the ignorant and careless approach to the use of resources that has been characteristic of modern society over the past decades. Much of this stems from greed, as people take resources in a way and at a rate that cannot be replenished by the environment. This abuse has gradually led to the collapse of many of the systems that provide us with our benefits, none more evident than in the case of wetlands where somewhere in the region of 50% of wetlands no longer exist! Add to this urban expansion, forestry, water supply schemes and other macro developments and the reason for their decline becomes obvious.

Below are some of the key factors resulting in pressures on wetlands:

- Human population increase (may be localised).
- Expansion of urban areas.
- Ignorance/ lack of awareness of benefits provided by wetlands.
- Greed – priority given to maximising short-term benefits from resources.
- A focus on direct economic benefits with little consideration of external costs.
- Poorly enforced legislation protecting wetlands.
- Weak local institutions unable to promote wise use and conservation of wetlands.
- Poor overall planning of wetland protection and wise use.

These driving forces are the critical reasons wetlands are under pressure. The resultant pressures described in Table 1.2 impact on wetlands directly, but may originate from two levels: (i) from activities within or adjacent to the wetland itself (mostly related to land use impacts and localized water abstraction), and/or (ii) from activities taking place elsewhere in the catchment (mostly related to water abstraction and changes in surface water flow patterns and regional groundwater levels due to disturbances in the catchment's flow regime).

Information Box 1.3. Impacts of cultivation on wetland function

Drainage and the cultivation of crops in wetlands can have several severe impacts on wetlands and most of the services they supply may be lost. Removing indigenous wetland plants greatly reduces the habitat value for other wetland dependent species. Drainage channels speed up the movement of water through the wetland, reducing its effectiveness in regulating streamflow and purifying water and increasing the danger of erosion. Fertilisers and pesticides further reduce the effectiveness of the wetland's ability to purify water and may alter the natural vegetation to something less useful. The disturbance of wetlands for cultivation is strongly discouraged by conservation and environmental bodies. Two important regulations that must be adhered to here are the Conservation of Agricultural Resources Act and the Environmental Conservation Act (see Book 2)

It must be noted, however, that the potential impacts of traditional subsistence hand-cultivation methods are significantly lower than large-scale mechanised cultivation, provided only areas with low erosion hazards are cultivated and that the cumulative loss of wetlands is not high in an area.

Table 1.2. Direct pressures or stresses on wetlands and the implications for water resource management

Activities taking place within the wetland	Some key associated impacts	Implications for water resource management
Poor livestock grazing management (see Box 1.2)	Decreased plant cover, increased soil disturbance by tramping	Increased erosion of wetland substrate, possible gully formation and ultimate loss of hydraulic function
Poor burning practices	Long-term reduction in cover and soil organic matter, alteration in species composition	Instability of wetland structure and erosion of substrates and resulting loss of water resource functionality
Drainage and cultivation of subsistence crops (see Box 1.3)	Total removal of indigenous plants, frequent disturbance and reduction in plant cover	Benefits of water logged soils and associated vegetation are removed leading to loss of wetland hydraulic function
Drainage and cultivation of commercial crops (see Box 1.3)	Drainage and disturbance often more severely compounded by addition of agro-chemicals	Loss of the water resource functionality of the wetland may be complete
Drainage and cultivation of planted pastures	Total removal of indigenous plants; disturbance of soil and addition of agro-chemicals	Loss of the water resource functionality of the wetland may be complete
Deep flooding of wetlands by dams (see Box 1.5)	Destruction of natural habitat; change in flow regime of stream	Dams may provide some of the functions associated with wetlands (e.g. water storage) but not others (e.g. release of water during dry periods and some water purification benefits)
Invasion by alien plants	Loss of natural vegetation, change to functioning of wetland ecosystem	Depending on the species the effects on waterflows may be minor (e.g. for small sedges) or large (e.g. Eucalyptus)
Poorly planned roads	Disruption of natural flow patterns often resulting in donga erosion, localised destruction of natural vegetation, potential sedimentation or scouring of wetland structure	Effects on the water resource will be variable but may extend to total destruction and loss of functionality
Infilling of wetland (including urban and industrial)	Total loss of wetland habitat and conversion to drain	Loss of water resource functionality
Mining - sand winning	Disturbance of wetland structure, alteration of hydraulics	Potential loss of wetland functionality
Mining – open cast	Total loss of wetland habitat	Loss of water resource functionality
Plantation forestry (see Box 1.4)	Drying out of wetland water supply and localised destruction of natural vegetation due to desiccation and competition from trees	Potential for complete loss of wetland functionality as water retention and release qualities compromised
Direct pollution of wetland	Reduction in diversity of plant and animal species. Increased nutrients lead to excessive plant growth while toxins eliminate biota from the wetland	Depending on the nature of the pollutants, the alteration of wetland ecological functions will affect hydrological function in different ways
Factors reducing runoff (e.g. plantation forestry, water abstraction/irrigation)	Drying out of wetland	Loss of that water resource functionality normally associated with the inundated ecosystem of wetlands
Factors reducing catchment infiltration and therefore increasing flood peaks (hardened surfaces, e.g. parking lots; poorly managed veld)	Increased erosion in the wetland and reduced inputs to the wetland during low flow periods. Damage to the wetland form leading even to scouring and resultant drainage. Desiccation of vegetation in dry periods	Potential loss of wetland function as the wetland is reduced to a drain
Factors increasing pollutant inputs to the wetland	Reduction in diversity of plant and animal species. Increased nutrients lead to excessive plant growth while toxins eliminate biota from the wetland	Depending on the nature of the pollutants, the alteration of wetland ecological functions will affect hydrological function in different ways

So what are the solutions?

Put simply, wetlands need to be given their due attention. This may take the form of the following:

- Elevate the status of wetlands in land, water and catchment planning and management. In particular, ensure that the protection, conservation and management of wetlands are specifically addressed in Catchment Management Strategies.
- Elevate the status of wetlands in environmental management.
- Ensure that all responsible parties agree on common land and water management objectives which will ensure protection of wetlands.
- Define and confirm the responsibilities for implementation, and allocate the resources necessary to do the job.
- Refer to the guidance given by Ramsar's Wise Use Concept: 'The Wise Use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem'. (Ramsar Convention Bureau 2000)
- Implement the full cycle of management from vision through to implementation, monitoring and review as outlined in this Guideline (see summary in Step 8).

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Information Box 1.4. Impacts of forestry plantations on wetland function

In wetlands the water table is characteristically shallow and water is therefore freely available to transpiring plants. Because of this high availability of water and the high use of water by trees, the effect of forest plantations in reducing surface water in or near wetlands may be considerable. Forest plantations are thus unacceptable within wetlands. Excessive numbers of trees in the wetland catchment will also have a detrimental effect by reducing the input of both surface and groundwater to the wetland. It is important that undisturbed buffer areas around wetlands are established. The loss of wetland condition associated with reduced water availability will mean that several of the wetland's functions in relation to the water resource are compromised, in particular that associated with high flows and water retention.

Information Box 1.5. Impacts of dams

Because wetlands frequently occur in deep river valleys, they are often flooded out by the construction of dams. Small farm dams have accounted for the loss of a large number of wetlands, especially in the upper reaches of catchments. There may be some mitigation in that small wetland areas may be formed around the perimeter of the dam but only if the dam has a reliable and relatively stable water level. Dams with widely fluctuating levels are unable to maintain the hydrological conditions required for a wetland to function.

Besides the simple flooding out of wetlands, the removal of water from a river course by a dam will have an impact on wetlands downstream. This impact will be largely confined to riparian and floodplain wetlands as these are closely associated with river flow. Large storage dams in particular may have considerable impacts on floodplain wetlands. Although floods have negative connotations because of the damage they sometimes cause, they are a natural process and are, in fact, critical to maintaining floodplain wetlands. Fauna and flora on floodplains are generally well adapted to floods and, in fact, often rely on these events for their survival. It is essential therefore that larger dams include adequate flood events in their water release regime.

Book 2. International agreements and SA law

Legislation encapsulates the values of a society and sets out rights, responsibilities and obligations of individuals and institutions. Government and its agents are entrusted with the responsibility of administering and implementing the laws. In general, legislation, policy and regulation can be used in two ways:

- Firstly to provide a proactive, enabling framework, essentially setting out what should be done if government as well as civil society are to act in accordance with the values and spirit enshrined in legislation;

- Secondly, legislation and regulation may (and usually will) contain provisions for enforcement and reactive interventions when co-operation and the enabling framework are not sufficient to encourage appropriate behaviour.

As well as government being able to enforce the requirements of legislation and regulation in a more reactive manner, citizens can challenge government agencies who fail to carry out their assigned responsibilities in a suitably proactive manner.

Any detailed management plan (such as a Catchment Management Strategy) should reflect agreement between all the responsible and interested parties as to which regulations or provisions of law will be used to enforce which aspects of the management plan, where enforcement is appropriate, and when these enforcement mechanisms should come into effect.

But the government of South Africa does not act in isolation to the rest of the world. The values and views of other countries and the world in general are expressed in numerous conventions or declarations to which South Africa may or may not be signatory.

South Africa recognises its international obligations for the responsible use of wetlands and has signed a number of conventions relating to the conservation and management of natural resources. Most of these conventions have been effected in South Africa by national legislation and local institutions with the intention of implementing these worldwide trends. Indeed, international conventions to which South Africa is signatory are binding on all organs and agents of the state and serve as a guide to sustainable management of resources. It is thus important that CMAs demonstrate commitment to the principles contained in such conventions by reflecting the principles in their management plans and strategies.

SOUTH AFRICAN LEGISLATION

The current suite of South African environmental and natural resources legislation provides every opportunity for the protection and conservation of natural resources. It creates a framework of rights and obligations which bind the government and its agents, landowners and the civil society (Kotze et al., 2001). Several of these pieces of legislation also have important associated regulations or provisions for enforcement of (for example) cleanup, rehabilitation or implementation. These provisions can be used in reactive mode to enforce decisions and plans, or to remedy certain problems or situations. However, this book deals mostly with the use of these pieces of legislation in their "proactive or enabling mode". The user of this Guideline should access professional legal advice on the specific remedies for various situations, which may be available in association with these pieces of legislation. In order to assist the CMA /or catchment water resource manager with the design of a strategy, the relevant legislation is discussed below.

Government has the responsibility to minister to the needs of society, by exercising its wisdom in the making and implementation of wise laws that will preserve the resources which we all need to utilise, for this generation and the future.

The SA Constitution

The constitution is the supreme law of South Africa and no national, provincial or local law may conflict with it. It calls for the prevention of pollution and of ecological degradation, promotion of conservation, securing of ecologically sustainable development and use of natural resources. Wetlands are an integral part of the natural resources and yet they have received little specific attention in national and regional plans such as Environmental Implementation Plans and Integrated Development Plans. In the interest of integrated water resources management, CMAs need to incorporate the management of wetlands into their planning and call on other role-players to become involved.

The Bill of Rights in the Constitution provides for the right of all people to have access to adequate water and the right to an environment that is not harmful to their health and well-being. Government agents such as CMAs and local government are required to work co-operatively with other institutions to implement this constitutional mandate. An integrated approach through collective intelligence, joint planning and sharing of resources would certainly be more effective and would enhance the quality of life of the people of South Africa as well as offering greater protection of citizens' rights. The responsibility for management of wetlands is therefore also about ensuring the constitutional rights of the country's citizens and is not only a green issue.

National Water Act (NWA)

The National Water Act provides for the protection, use, development, conservation, management and control of water resources based on the guiding principles of sustainability and equity. In this the Act provides for both present and future generations and balances the need to protect water resources with the need to promote social and economic development. In its definitions, the Act clearly includes wetlands as a type of 'watercourse' which in turn is an integral part of the water resource. Wetlands are thus an integral part of the water resource and as such are fully covered by this law. The Act is also explicit in stressing the interconnectedness of water systems and includes both physical and biological aspects. The Act recognises aquatic ecosystems as the resource base from which water is derived, rather than as competing users of water.

Note: These guidelines do not attempt to review or evaluate existing legislation but simply present them. This information has been summarised from the report by Uys (in press)

Protection of water resources including wetlands

The Act stipulates that water resources, including wetlands should not be irreversibly damaged while being used and that their protection should be balanced with the need for sustainable development. This applies to all water resources as defined by the Act.

The Act calls for the Minister to use a classification system to determine the Class, Reserve and Resource Quality Objectives for all 'significant' water resources. This process requires stakeholder consultation, which is the first step towards the protection of water resources and is discussed in more detail in Books 5 & 6.

Catchment Management Agencies (CMA)

The NWA requires the Minister to establish CMAs and delegate to catchment level certain powers and duties related to management of water resources. CMAs are to be established through a process of participatory democracy with a preliminary deliverable being a proposal for the establishment of a CMA, which includes a description of the water resources in the Water Management Area to be managed by the CMA. This is the first critical stage at which to mainstream wetlands into catchment management planning. Baseline information gathered at this early stage will have a bearing on how the CMA is formed and what functions it assumes, as well as on the anticipated relationships with other institutions in the catchment.

In aligning its plans with other institutions, the CMA may have a status of a 'commenting agent' in which case it could lobby for wetland protection and conservation, or an 'authorising' (regulatory) agent' as delegated by the Minister where it would adjudicate applications for licenses for water use, some of which would have an effect on wetlands. Resource quality objectives and demands placed on the CMA by the NWRS as well as the local situation would decide how issues are handled.

CMAs need to make strategic links with other institutions around their line functions so that they can leverage their operation. There needs to be some understanding around sharing of resources, risk, and information while at the same time, the regulatory functions of respective departments are not compromised.

1. Functions of the CMA

The Act requires a CMA to:

- Investigate and advise interested persons on the protection, use, development, conservation, management and control of the water resources (including wetlands) in its water management area. However it is not recommended that CMAs necessarily get involved in the operational aspects of wetland management such as burning or harvesting where these are the responsibility of other agencies. Instead the CMA should preferably give appropriate support to the relevant responsible organisation. What is most important for the CMA is to put in place measures that will protect the ecological and hydrological integrity of wetlands from excessive and unsustainable water abstraction, waste discharges, physical destruction etc. CMAs should also contribute towards the rehabilitation of wetlands as a way to rehabilitate the entire water resource in a catchment.
- Progressively develop a Catchment Management Strategy (CMS). This strategy is a blueprint for the protection, use, development, management and control of water resources and must be in harmony with the National Water Resources Strategy. The CMS is the second critical stage at which to mainstream the protection, conservation and management of wetlands into catchment planning and management.

The strategy must include:

- the Class of water resources and Resource Quality Objectives, the requirements of the Reserve and where applicable, international obligations;
- consideration of the geology, demography, land use, climate, vegetation and waterworks within its water management area;
- Co-ordination of the related activities of water users and of water management institutions within its WMA; and
- Promotion of community participation in the protection, use, development, conservation, management and control of water resources in its WMA.

CMAs are well placed to play a role in conservation and management of wetlands as they have the mandate to protect, conserve, develop and manage water resources on a catchment scale. Successful water resources management is strongly influenced by land-based activities, and therefore CMAs have a stake in land use issues, even though they might not have the legal mandate to control and manage all land-based activities that might impact on water resources, and hence on wetlands.

National Environment Management Act (NEMA)

This Act was promulgated to implement the constitutional right to a healthy and protected environment, and thereby supports the constitutional principle of sustainable development. While the National Water Act provides for the conservation and utilisation of water resources, the NEMA is concerned with the management of all natural resources, including those that could impact on catchment management. Its objectives include the following:

- The integration of social, economic and environmental factors in decision-making;
- The integration of legislative input from all spheres of government; and
- The integration of sustainable environmental management into all development activities.

1. NEMA Principles

The principles of the NEMA, listed as (a) to (d) below, serve as a framework for decision-making by all organs of state where the decisions significantly affect the environment (including wetlands), as well as for the interpretation and administration of all laws concerned with environmental protection and management.

a. Public duty of care

A statutory onus is placed on every person who causes degradation of the environment to prevent, minimise or rectify such damage. This provision is aimed at obtaining public participation in support of the aims of sustainable environmental management. It also has the advantage of ensuring that decision-making in relation to achieving environmental goals is shared with ground-level users.

b. Cooperative governance

The constitution recognises that the government is constituted at national, provincial and local levels which are distinctive yet interdependent. A set of principles serves to foster cooperative governance within all spheres of government and organs of state (CMAs included). In line with this, NEMA sets out procedures for cooperative governance within the context of environmental management. This requires the national departments of Water Affairs and Forestry, Environmental Affairs and Tourism, Land Affairs, Housing, Agriculture, Trade and Industry, Transport and Defence, as well as provincial governments, to prepare Environmental Implementation plans (EIPs); and the national departments of Water Affairs and Forestry, Environmental Affairs and Tourism, Minerals and Energy, Land Affairs, Health, and Labour prepare Environmental Management Plans (EMPs). The purpose of these plans is to coordinate and harmonise environmental policies and management and so to minimise duplication of effort.

c. Compliance & enforcement

Although the act seeks to achieve the spirit of co-operative governance and co-regulation, it also provides for any person to seek appropriate relief in respect of any breach of the Act, or any other statutory provision concerned with the protection of the environment or the use of natural resources.

d. Integrated Environmental Management (IEM)

IEM as a tool to implement the objectives of NEMA, was developed to integrate environmental management principles into decision-making. It does this by ensuring that those activities that may have a negative influence on the environment are co-ordinated and where necessary investigated.

Conservation of Agricultural Resources Act

In terms of this Act, the Minister (Land and Agricultural Affairs) may prescribe control measures with which land users must comply, failure in which is an offence. These include measures related to the utilisation and protection of wetlands as well as other land activity, ranging from burning to the control of weeds, the prevention of pollution and of erosion.

Environmental Conservation Act

The Act promulgated in 1989, ensures that the environmental effects of developments and activities are taken into consideration before decisions are taken. Accompanying regulations are aimed at identifying and prohibiting activities that have a detrimental effect on the environment. The Act further ensures public involvement in development decision-making through the EIA regulations. The Minister is given powers through the Act to either reject or accept the proposed development after careful evaluation of the impacts. Also included in the Act is the requirement, in line with NEMA, for persons causing environmental damage to repair the damage.

International Conventions and Agreements

Some relevant conventions with a bearing on conservation and management of wetlands are introduced below.

Ramsar Convention on Wetlands

South Africa signed the Ramsar Convention on Wetlands in 1975. The convention recognises the importance of wetlands for maintaining key ecological processes, for their rich biota, and for the benefits they provide to local communities and to the human society in general (DEAT 2002).
The contracting parties note their conviction that wetlands constitute a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable. Parties furthermore express their desire to stem the progressive encroachment on and loss of wetlands now and in future and express their confidence that the conservation of wetlands and their biodiversity can be ensured by combining far-sighted national policies with coordinated international action (DEAT 2002).
The contracting parties have committed themselves to:

- Designate suitable wetlands within their territory for inclusion in a list of wetlands of international importance.

The Ramsar convention defines Wise Use as,

'the sustainable use of wetlands for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem. Sustainable utilisation is human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations'.

- Formulate and implement their planning so as to promote the conservation of wetlands included in the list, and as far as possible the wise use of wetlands in their territories.

- Integrate conservation and wise use of wetlands into national, provincial and local planning and decision making on land use, groundwater management, catchment/river basin and coastal zone planning and all other environmental management.

- Review their legal and institutional frameworks to ensure that these are generally compatible with the wise use of wetlands into national, provincial and local.

- Integrate Ramsar site management plans into public development planning and into spatial and economic planning at appropriate level. Further link with broad-scale landscape and ecosystem planning, including at the integrated river basin and coastal zone scales.

Conclusion – legal acts and conventions

Apart from being legal instruments, the conventions discussed above and in the Appendix provide an overarching framework for managing water resources and other natural resources. Although plans related to conventions such as the Ramsar Convention are set at national level, implementation needs to take place at regional level where resources are available and where people interact with resources. Conventions and Acts must therefore be translated and integrated into catchment specific strategies.

Activities supporting implementation of the Ramsar Convention in South Africa (extract from the Ramsar Briefing, Directorate Biodiversity Conservation, DEAT – 2002)

"To date South Africa has designated 17 wetlands to the Ramsar List (see Figure 2.1), in terms of article 2.1 and recommendation 1.3. Of these 17 wetlands, two are protected within National Parks, 12 are protected within proclaimed Provincial Nature Reserves or State Forests and two are on state land under the jurisdiction of a provincial nature conservation agency. The remaining wetland is partially in a proclaimed Provincial Nature Reserve and partially on privately owned land.

Four of the wetlands on the List (De Hoop, St Lucia, Blesbokspruit and the Orange River Mouth) have been threatened with ecological change, and, in accordance with the country's obligations, the Bureau has been duly advised.

Figure 2.1. South African Wetlands of International Importance

A national inventory of wetlands is being compiled. The pilot phase of the inventory has been completed, and wetland mapping has commenced under the banner of the National Land Cover 2000 mapping project. The first data on the extent, distribution and diversity of the country's wetlands will become available in 2003. In addition to a range of possible applications for this data, the inventory will form the basis for determining further potential sites for designation by South Africa to the List.

Protected areas have been established at a number of important wetlands by both the state (eg Nylsvley, Seekoeivlei and Steenkampsberg) and the private sector (eg Rietvlei and Wakkerstroom).

Training of personnel competent in wetland conservation, management and research is undertaken principally by tertiary institutions and non-governmental organisations. Funding for research is provided by sources such as the National Research Foundation and Water Research Commission. Training of staff competent in the management and wardening of wetlands requires renewed efforts, as most previous training activities have been aimed at terrestrial ecosystems."

Appendix to Book 2

This Appendix describes those Acts and Conventions which, although of great importance for wetland conservation and management, are not necessarily central to the composition, powers and functions of the CMA. Each of these Acts and Conventions may be used in a proactive or reactive way to further the protection of wetlands even where not directly related to protection of the water resource.

SOUTH AFRICAN LAW

The Biodiversity Act

This Act was established within the framework of the NEMA and provides for the management and conservation of biological diversity within South Africa and of the components of such biological biodiversity, the use of indigenous biological resources in a sustainable manner and the fair and equitable sharing of benefits arising from bioprospecting for genetic material derived from indigenous biological resources. This includes the drafting of conservation plans comprising threat abatement plans for threatened habitats, ecosystems and ecological communities and protected area management plans as well as listing of threatened ecosystems which includes wetlands. This Act will be of particular relevance where biodiversity issues need to be synchronized with water resource protection.

Water Services Act and Water Services Development Plans (WSDPs)

It is the duty of the water services authorities to develop draft water services development plans for their areas of jurisdiction and to prepare a summary thereof. It is also the responsibility of the water services authority to involve all the stakeholders in the development of the plan and to ensure that the plan is incorporated into any integrated development plan contemplated in the Local Government Transition Act. CMAs being the delegated authorities for management of water resources at regional level, could play a crucial role in aligning these plans with the national water resources strategy and other important sector plans. Important issues that are likely to arise include water conservation and demand management, pollution prevention and water resources development. All these issues have a direct link to the protection, conservation and management of wetlands as explained in Book 1, which makes it necessary for the CMAs and municipalities to work together in addressing these issues.

Municipal Systems Act & Municipal Structure Act

The Municipal Structures Act defines functions and powers assigned to municipalities and makes reference to provision from the constitution around this subject. The act calls for district municipalities to seek to achieve the integrated, sustainable and equitable social and economic development of their areas. In doing so, the Municipal Systems Act requires a Municipality through its council, to promote a safe and healthy environment in the municipality and contribute together with other organs of state, to the progressive realisation of the fundamental rights contained in the Constitution. There is thus a direct link to the protection of wetlands.

Municipal Integrated Development Plans (IDPs)

The IDP process provides a suitable foundation for cooperative governance through section 24 of the Municipal Systems Act. It provides for planning to be undertaken by a municipality to be aligned with, and complement the development plans and strategies of other municipalities and organs of state so as to give effect to the principles of cooperative government contained in the constitution. Equally important is the need for other organs of state to align implementation of their legislation with the provisions of the Municipal Systems Act and so to consult with the affected municipality. Under this arrangement, municipal IDPs will collectively inform the development of Provincial Development Frameworks and other plans such as catchment management plans.

Municipalities have a mandate to develop plans and implement Local Economic Development (LED). This is effected through their IDPs by playing a coordination role, facilitating, stimulating and developing in line with plans from other spheres of government. The LED may thus have a positive or negative influence on wetland resources via poor planning, over utilization of resources and ill-defined institutional arrangements.

INTERNATIONAL CONVENTIONS AND AGREEMENTS

UN Convention on Climate Change

The Convention on Climate Change aims to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system (UNICED). The convention is based on inter-relatedness of systems at a global scale and the need for local actions. This initiative has a link towards protection of water resources, notably wetlands, for with adverse climatic conditions, wetland resources would be negatively affected. Water resources managers need to be aware and lobby for developmental plans that minimise climate change.

UN Convention to Combat Desertification

The UN Convention on Desertification focuses on improving land productivity and rehabilitation, conservation and sustainable management of land and water resources. In this convention desertification-affected parties/countries are obliged to:

- Give priority to combating desertification and drought by allocating adequate resources in accordance with their capabilities;
- Establish strategies to combat desertification and drought; and
- Provide an enabling environment through appropriate laws, policies and action programmes. The rehabilitation and protection of wetlands is considered as a key means of combating desertification (WfWetlands, 2003).

World Summit on Sustainable Development

This conference brought together different member countries, NGOs, and various stakeholders to discuss global environment issues of which most are driven by political and economic situations. Some of the important outcomes from the Rio de Janeiro were Agenda 21 (UN framework for action on sustainable development) and conventions on climate change and biodiversity.

The Johannesburg Summit was important because formal resolutions arising from this meeting explicitly recognise the 'environment as the resource', in line with the South African National Water Act philosophy that aquatic ecosystems are the resource base from which water is derived. The Johannesburg Summit also generated a plan of implementation, which provides further perspective on the potential for wetland rehabilitation to provide benefits on a large scale. The plan emphasises that actions are required at all levels to reduce the risks of flooding and drought in vulnerable countries by, inter alia, promoting wetland and watershed protection and restoration (WfWetlands, 2003).

SADC Water Protocol

The overall objective of this protocol is to foster closer co-operation for judicious, sustainable and co-ordinated management, protection and utilisation of shared watercourses and advance the SADC agenda of regional integration and poverty alleviation. The protocol among other things seeks to:

- Advance the sustainable, equitable and reasonable utilisation of the shared water courses;
- Promote, coordinated and integrated environmentally sound development and management of shared watercourses; and
- As part of the general principles, the states have committed to maintain a proper balance between resources development for a higher standard of living for their people and conservation and enhancement of the environment to promote sustainable development.

NEPAD

The African Union through its New Partnership for Africa's Development (NEPAD) proclaims that sustainable use of available and finite water resources is essential for the socio-economic development of the continent and eradication of poverty. The draft strategy and action plan under the initiative for environment on the one hand puts forward the following vision: "African countries and their people have healthy and productive wetlands and watersheds that can support fundamental human needs in a healthy and productive environment" (WfWetlands, 2003).

There has also been realisation that in order to accelerate the development of Africa's water resources, effective national and regional policies and institutional frameworks based on the principles of integrated water resources management must be adopted.

Convention on Biological Diversity

The convention aims to effect international cooperation in the conservation of biological diversity and to ensure the sustainable use of living natural resources. It also aims to bring about the sharing of benefits arising from the utilization of natural resources. Article 6 refers to general measures for conservation and sustainable use which calls for contracting parties to:

1. Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this convention relevant to the contracting party concerned; and
2. Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.
3. Article 8 (f) states that each contracting party shall, as far as possible appropriate, rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies.

Local Agenda 21

The United Nations Conference on Environment and Development re-affirmed the Stockholm Declaration in Rio de Janeiro by adopting Local Agenda 21, which forms the blueprint for sustainable development and co-operation around management of resources. Some of the relevant principles published by the United Nations Department of Economic and Social Affairs include:

- Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.
- In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
- States shall co-operate in the spirit of global partnership to conserve, protect and restore the health and integrity of the earth's ecosystem.

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Book 3. Wetland mapping and inventory

In order to be able to protect a catchment's wetlands and ensure that the wetlands work optimally for the catchment, it is essential to begin by stock taking the wetlands in your catchment. This stock taking exercise is referred to as a baseline wetland inventory. Maps are an important tool for displaying information from wetland inventories. The level of detail of the data and maps will vary according to the purpose of the inventory. For catchment management purposes, a baseline wetland inventory should allow you to answer the following questions:

- How many wetlands are there?
- How extensive are they?
- Where are they?
- What type are they?
- What are their natural features such as their landform, fauna and flora?
- What water resource functions do they perform?

Much of the information required for a baseline inventory can be obtained without having to visit all of the wetlands in the catchment. Useful data can be gathered from remote sources, notably aerial photos or satellite images. Wetland boundaries and other features can usually be reliably seen on aerial photos. Some field visits will be necessary to verify the interpretations made from remote sources.

Mapping wetlands

Before mapping the wetlands in your catchment, carry out the following:

- Obtain wetland data from the National Wetland Inventory, undertaken as part of the National Land Cover (NLC) 2000 initiative to provide a broad overview of the wetlands in the catchment. Contact the Department of Environmental Affairs and Tourism in Pretoria or through their website www.environment.gov.za. This inventory is at a coarser resolution than may be required for detailed catchment scale planning. It does not show small wetlands (i.e. wetlands less than about 1 ha) nor does it provide any details on the wetlands (e.g. wetland type).

- Prioritise areas of the catchment where more detailed inventories are required. Priority areas should include important water supply catchments, water stressed catchments, areas of the catchment where non-point source pollution levels are generally high, areas where rates of land transformation (due to rapidly expanding urban areas or intensive agriculture) are high or any other areas deemed important based on catchment objectives. You may consider an entire catchment a high priority, though.

- Check for existing detailed inventories and other sources of information such as soil maps, local knowledge, for example Wetland Forums, consultants, extension officers, societies and conservation agencies within the catchment.

- Where no detailed inventories exist for the identified priority areas, commission a wetland inventory at a scale of at least 1: 50 000 or finer. Stereoscopic interpretation of black and white 1: 30 000 aerial photos is generally the most effective means of providing the required detail. Satellite imagery is not suitable for the mapping of this detail (Thompson et al. 2002) but can provide useful supplementary information.

- To map the wetlands of your area follow the guide in Information Box 3.1.

Information Box 3.1. Wetland mapping

Effective management and conservation of South Africa's wetlands requires accurate information on where the wetlands and their boundaries are located. The need for this information is highlighted by the Convention on Wetlands (Ramsar Convention 1971) and the Convention on Biological Diversity (Cowan 1999). As one of the first steps in South Africa's commitment to collecting this information, the National Department of Environmental Affairs and Tourism commissioned a project to develop tools for a cost-effective and comprehensive National Wetland Inventory (Thompson et al. 2002). This National Wetland Inventory has been linked with the 1: 50 000 scale National Land Cover (NLC) 2000 project (Thompson et al. 2001). It is based on satellite remote sensing and uses Landsat TM and ETM+ imagery.

A key issue in any inventory or map is the resolution at which the map was produced. A rule of thumb is that the smallest feature that can be reliably mapped from a given image would be 10 times larger than the resolution of the image. In the case of Landsat TM and ETM+, which have a resolution of 30 m the minimum mappable unit would be 0.9 ha. To obtain black and white photos contact the Surveyor General and for satellite images contact the CSIR, Environmentek, remembering that these are costly to purchase and that certain images may also be available from DWAF and perhaps other agencies.

Another key factor is that of the contrast between the feature that one wishes to map, in this case a wetland, and the surrounding landscape. In certain wetlands, notably pans and wetlands which remain permanently flooded, the contrast is high. However, in other wetlands, particularly those which are only temporarily saturated/flooded, this contrast is low, making it very difficult to locate the wetlands and their boundaries. This is particularly so where the land has been transformed by agriculture or other developments.

Given the reasonably low resolution of the National Wetland Inventory, it cannot be used for a detailed wetland inventory at catchment level, particularly in areas where wetlands are small and boundary contrasts low. In the KwaZulu-Natal Drakensberg, for example, 85% of wetlands identified in a pilot survey were less than 1 ha in size (Dely et al. 1999).

For detailed inventories, Thompson et al. (2002) recommend the use of a combination of stereoscopic black and white photos at an intermediate scale of 1: 30 000 and digital black and white photo mosaics. The black and white photos are observed through a stereoscope which provides high resolution and three-dimensional detail. The boundaries of the photos are then digitized directly onto the digital photo mosaic, which is of a lower resolution and does not provide a three-dimensional view. It nevertheless overcomes the time consuming step of manually transferring the boundaries from the black and white photos into a digital format.

Field verification is required for both broad-scale and detailed inventories, although the amount of field verification per unit area mapped will be greater in the case of detailed inventories.

These recommendations are based on the situation in 2004. New technologies may allow affordable and much higher resolution images to be generated from satellite sources, reducing the need for aerial photos.

Mapping of wetland functions

It is useful to differentiate wetlands according to benefits of particular significance to catchment management. This will enable the water resource manager to prioritise expenditure and effort applied to the management of wetlands. For example, a marsh situated below a town that is purifying water year round may be more important than a seasonal seep that is only supplying water during the rainy season and is dry the rest of the year. Benefits that may be usefully mapped include:

- Water supply
- Flow regulation and flood control
- Erosion control
- Sediment removal and/or retention
- Nutrient removal
- Toxicant removal

It would be necessary to distinguish levels of performance and thus importance for each of the above. This could be simply categorised into high, medium and low performance levels. Once mapped onto GIS, it is possible to link the data so that those wetlands providing the greatest overall functionality can be highlighted for management attention. (Tools for this purpose may be found in Book 7).

Types of wetlands influencing water resources

Although wetlands are most extensive in areas where the land surface is generally flat and rainfall is high, wetlands are found across the full range of climatic and landform variability represented in South Africa. Consequently, wetlands are very diverse, and are found in settings ranging from the broad, flat coastal plain of northern KwaZulu-Natal to the highlands of the eastern escarpment, and from the semi-arid Kalahari and Karoo regions, to the cool, wet southern coast. Knowing the types of wetlands you have in your area is important as they perform different functions in the water cycle and may need different management attention. Moreover, at least some representatives of each type (Table 3.1.) should be afforded a higher level of protection so that the unique biodiversity attributes that they exhibit are not permanently lost.

Wetlands in the same climatic zone and with the same landform setting (Table 3.1.) are likely to support similar vegetation and to function in a broadly similar way. Thus, in order to characterise wetland type at a broad scale, it is acceptable to rely primarily on describing climate zone using an existing map such as an Ecoregion map, and landform setting based on interpretation of maps and remotely sensed images with limited ground verification. Soil types, vegetation and animal life may also, if necessary, be used to separate wetlands of different type.

1. Different wetland types due to Ecoregion

A recent move has been to divide aquatic ecosystems into broad regions of ecological similarity called Ecoregions. Any wetland found within a single Ecoregion will generally have some shared physical and biological characteristics which will help the water resource manager to set priorities. Ecoregion maps are derived from an amalgamation of primarily physical characteristics such as altitude, rainfall, temperature and geology and include the distribution of various fauna and flora. These maps are in the process of being developed so the reader should seek out the latest version from either DWAF or DEAT.

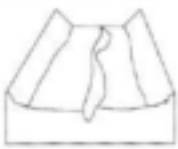
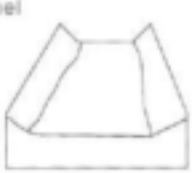
2. Different wetland types due to landform setting

The type of wetland is determined largely by local climate and the landform setting (Table 3.1). These aspects interact to influence three critical factors:

- The sources of water entering the wetland (inputs)
- How the water passes through the wetland (throughputs)
- How the water exits the wetland (outputs).

These factors in turn largely determine the type of vegetation growing in the wetland.
The landform types in Table 3.1. can be identified on stereoscopic interpretation of black and white photos backed up by 1: 50 000 topographic sheets which means that wetland types can be identified without having to do field visits. Mapping wetland types will help in assessing the functions wetlands perform - for example Hillslope seepage wetlands play an important role in nutrient retention, but less of an important role in flood attenuation.

Table 3.1. Wetland landform (hydrogeomorphological) settings typically supporting inland wetlands in South Africa (modified from Brinson, 1993; Kotze, 1999, Kotze et al, 2004). The photographs below also show these different wetland types. For a more detailed characterisation see Marneweck and Batchelor, 2002.

Hydrogeomorphological setting	Description	Water Resource Function
Hillslope seepage 	Slopes on hillsides which are characterised by the colluvial (transported by gravity) movement of materials. Water inputs mainly from subsurface flow.	Seepage wetlands regulate the flow of shallow groundwater, releasing it slowly over extended periods. In this way they regulate the supply of water to streams. The potential is high for these wetlands to trap nitrogen and other pollutants, as water moves downslope within the upper layers of the wetland's soil. The vegetation in these wetlands is important in binding soil and preventing erosion.
Valley bottom with a channel (includes Floodplains) 	Valley bottom areas with a well-defined stream channel, usually gently sloped and characterised by the alluvial transport and deposition of material by water. May have steeper slopes and more limited sediment deposition. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	Valley bottom wetlands may contribute significantly to slowing down flood waters (and therefore reducing the severity of floods), trapping sediment and removing nutrients and other pollutants washing from upstream. The vegetation in these wetlands is generally important in binding soil and preventing erosion.
Valley bottom without a channel 	Valley bottom areas of low relief, alluvial sediment deposition and having no clearly defined stream channel. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	As above although there is no incised channel. Indeed, one of the wetlands main functions is to stabilise the valley bottom so that incision of a channel does not take place. This results in the greater retention of water on the land and consequent water regulatory functions.
Depression (includes Pan) 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is upward draining). It may also receive sub-surface water. An outlet is usually absent.	Depression wetlands act to effectively collect water during wet periods and store this water. Although much is lost through evapotranspiration, this stored water may aid in groundwater recharge. Depressions may be effective in trapping nutrients but if isolated from the stream network they are unlikely to have a significant positive contribution to water supply and quality in the catchment.

**Precipitation is an important water source and evapotranspiration an important output in all of the above settings.*

Hillslope Seep
Bulwer in the KZN Midlands
Photo: M. Graham

Valley Bottom with channel (floodplain)
Photo: KZN Wildlife

Valley Bottom no channel
Franklin Vlei
Photo: M. Graham

Depression (pan)
Crane tarn
Photo: KZN Wildlife

Other useful characteristics of wetlands

Where more information about the characteristics of wetlands is required, a variety of wetland characteristics can be examined. The soils associated with wetlands are useful for delineating the actual boundary of a wetland, even one that has been highly transformed. The vegetation present will provide all sorts of information about the hydrology of the wetland and its overall health. Details of the soils and vegetation and also pointers to other types of information that may be useful follows.

Wetland soil

A variety of soil types are found within South Africa's wetlands. These vary from: (1) those soils almost always found in wetlands, (2) those that usually occur in wetlands (depending on the depth of the particular horizons) and (3) those that may occur in wetlands depending on the occurrence of signs of wetness. Soil type can be used to assist in describing the location and extent of wetlands and assist in determining the management potential of the wetland (see Information Box 3.2.).

Information Box 3.2. Reading the soil: its usefulness from an inventory and management point of view

Soil provides an indication of the long-term hydrology of an area - that is how naturally well-drained or poorly drained it is. The water regime - how the wetness of an area changes over time - has a strong effect on the colour patterns of the soil. For example, a permanently saturated soil or very poorly drained soil will generally appear uniformly grey, while a seasonally saturated soil will have mottles of orange and yellow within the grey matrix. One could say that the water regime leaves its signature on the soil, and that different water regimes leave different signatures. These signatures reflect 'the average condition' of the soil over a long time. This means that we can indirectly determine the water regime for a particular area by interpreting the area's soil colour patterns or by reading its signature from a single site visit instead of taking long-term measurements.

When a wetland is drained and the water regime is changed, the soils retain some of the characteristic features such as colour and mottles. Thus, used in combination with the oldest available air photos, soils are useful for indicating if a drained area used to be a wetland. Soil maps are particularly helpful in working out the historical extent of wetlands. A soil map of the Thukela catchment, for example, shows that historically the wetlands comprised 16.5% of the catchment, far greater than is found today (Begg, 1986).

It is also useful that the management potential of different soil types has been determined. Particularly important is the erodibility of the soil. Certain soil types commonly associated with wetlands, such as the Rensburg and Estcourt soil forms, have very high erodibility and should therefore be treated with caution.
See Kotze (1997) and Kotze et al (1996) for more information about wetland soils. DWAF (2003) provides a practical procedure for identification and delineation of wetlands and riparian areas.

Wetland vegetation

A wide variety of vegetation types are associated with wetlands and are sometimes very distinct. Wetland vegetation is generally also quite distinct from other terrestrial vegetation and as such can provide a clue as to the extent of the wetland and the conditions that prevail. At a broad-scale baseline inventory level, it will generally not be feasible to identify wetland vegetation types unless selected wetlands are visited on the ground during the ground verification process, or where more detailed investigations have to be undertaken.

Information Box 3.3. Some wetland vegetation types occurring in the summer rainfall areas of South Africa

- *Phragmites australis* (common reed) marsh, *Typha capensis* (bulrush) marsh, *Cyperus fastigiatus* marsh. These are widespread except in very arid and high altitude (i.e. >2000 m) areas.
- Temporarily inundated grassland, characterised by species such as *Cynodon dactylon*, *Stenotaphrum secundatum* (buffalo grass) and *Eragrostis planiculmis*.
- *Carex spp.* marsh and tussocked wet meadow largely confined to mid- to high altitude areas in the eastern parts of the country.
- *Cyperus papyrus* swamp. Confined to the KwaZulu-Natal coastal plain.
- Swamp forest characterised by species such as *Barringtonia racemosa* and *Ficus trichopoda*. Confined to northern latitudes and low altitudes and species such as *Syzigium chordatum* (Umdoni, Water Berry) which extend to more southerly latitudes and higher altitudes.

Other natural features and information

Table 3.3 outlines further information that you may wish to gather at a more detailed level of inventory.

Table 3.3. Examples of useful information and possible sources

Data Type	Source
Geology	Council of Geoscience
Soils	Agricultural Research Council
Climate	Weather Bureau
Hydrology	DWAF Gauge Station Data, WR90, Rainfall Runoff Modelling, DWAF Geohydrological Data
Physiography, Topography, Drainage, Catchment boundaries, Land use	Surveyor General
Wetland Geomorphology	Field or Aerial Survey
Water quality	DWAF, Field Survey, Local authorities, Industry, Literature
Vegetation	Acocks and Low & Rebelo and the new NBI map soon to be available, Field Survey, Literature, PRECIS – National Botanical Institute
Invertebrates, Butterflies, Amphibians, Reptiles, Fish, Birds, Mammals	Field Survey, Literature, Regional Museum, Regional Conservation Authority, National Red Data Books, CWAC Survey, Frog Atlas Project, Bird Atlas Project

Carrying out an assessment of wetland benefits (goods and services)

There has been a strong push in environmental reporting to measure the benefits the ecosystem provides. An assessment can be done at a desktop level and linked with the broad-scale inventory. Desktop assessment of benefits relies on generalising results from other catchments and known wetland sites, taking into account the particular situation in the catchment. For example, all wetlands on a floodplain can be assumed to perform a flood attenuation service, while it can be assumed that wetlands on hillslope seepages provide a water quality enhancement service, particularly where activities associated with non-point source pollution are present in the catchment. At the desktop level, it is generally possible only to indicate whether or not a particular good or service is being supplied. Using currently available methods these benefits cannot be quantified.

Definition of wetland benefits

Those functions, products, attributes and services provided by the ecosystem, which have a value to humans in terms of worth, merit, quality or importance. These benefits may derive from outputs that can be consumed directly; indirect uses which arise from the attributes or functions occurring within the ecosystem; or possible future direct outputs or indirect uses.

More detailed assessment of the benefits provided by the wetlands should be undertaken for priority areas within the catchment, based on rapid field assessments of individual wetlands.

Where wetlands are of a similar type and in a similar land-use context (e.g. seepage slope wetlands in commercial beef production farm lands) a field assessment is not necessary for every wetland in the particular grouping. However, at least a third of the wetlands in the grouping should be assessed in the field and the results interpolated across the other wetlands in the grouping. The greater the variety of land-use contexts and the greater the variety of wetland types, the more fieldwork required.

There is no standardised procedure for assessing the supply of benefits by individual wetlands in South Africa. However, techniques such as WETLAND-ASSESS (Kotze et al. 2004) are designed specifically for the rapid assessment of benefits supplied by individual wetlands. At the broad-scale and intermediate levels, it is generally not possible to quantify these benefits but they are given a simple rating. In many cases, a more detailed assessment may be required.

Storing of wetland information

Once the survey of wetlands has been completed and you have located and determined the type of wetlands in your area, it is necessary to store in a database the specific wetland sites and their context. 'The housing and dissemination of wetland information is a vital component of the overall wetland inventory in that a well-structured, reliable, and accessible database lays the foundation for appropriate analysis, monitoring, and decision making of wetlands in South Africa' (Thompson et al 2002). Before setting up a wetland database, contact the National Wetland Inventory Initiative at the Department of Environmental Affairs and Tourism to ensure that your database is as compatible as possible with the national level database. Your database should also be compatible with the overall IT systems used by the CMA for its activities to effectively integrate your wetland data into the operations and decisions made by the CMA. The structure of such database has not yet been finalised, but Thompson et al. (2002) recommend that at a national level a relational database (Oracle, Informix or SQL Server) be used to deal with the anticipated extremely large volume of records. At the level of a province, a CMA or a municipality, a database such as MS Access is probably sufficient to deal with the volume of data.

Action Summary Box 3.1. A wetland inventory

1. Obtain broad-scale information from the National Wetland Inventory.
2. Check on existing inventories and sources of information.
3. Prioritise areas according to importance for water resource management using information at an appropriate level of resolution.
4. Map the location and size of wetlands in an area.
5. Determine (desktop only) and map the functions of the wetlands.
6. Use the (landform) types that occur in the area to further differentiate wetlands.
7. If necessary, incorporate information such as soil types, vegetation, birds etc to clarify an issue.
8. Store the data in a well-designed database with outputs via GIS.

Case-study 3.1. Wetland inventory in the upper uMngeni Catchment: a tool for catchment planning

The uMngeni catchment in KwaZulu-Natal is one of South Africa's most developed catchments and is home to approximately 45% of the province's population. The need to manage the catchment's water resources, including its wetlands, is great. A detailed inventory of the upper catchment's wetlands was undertaken in 1996. A soil map of the area at a scale of 1: 50 000 was used as the basis for determining the historical distribution and extent of the catchment's wetlands. The boundaries of all of those areas with soil types characteristic of wetlands were digitised and incorporated into Umgeni Water's GIS, managed as part of their catchment management information system.

Picture: The uMngeni Vlei – the source of the river

In order to gather information on wetland type and condition, a data sheet was compiled with input from Stakeholders. Descriptors on the data sheet included:

- Landform setting and hydrological zones
- Current land-cover within and surrounding the wetland
- Extent of degradation through factors such as artificial drainage, damming and alien plant infestation

Of the 169 wetlands in the catchment, 60 were described in the field, and the remainder were described using recent 1: 30 000 air photos. Wetlands cover 6227 ha (6%) of the catchment, with 66% of this area having been lost due to man induced causes. Drainage, cultivation and flooding by dams have been the most important contributors. The loss of wetland varies according to catchment zones: 73% (loss) in the lower zone, 67% in the mid-altitude zone, and 47% in the high altitude zone. This situation will be further exacerbated with the imminent loss of a further 60 ha of wetland in the lower zone as a result of the raising of Midmar Dam. The only wetlands formally conserved are the uMngeni Vlei and four small adjacent wetlands in the uMngeni Vlei Nature Reserve, which fall in the high altitude zone. In order to maintain catchment integrity it is considered a priority to conserve and rehabilitate wetlands in the lower zones. This case study highlights the value of wetland inventory and assessment data for catchment planning. Whether this translates into significant actions on the ground, however, depends on effective working relationships with landholders and commitment from developers (e.g. major storage dams) to achieving priorities for the catchment. For more information see Jewitt and Kotze (2002).

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Book 4. Measuring, monitoring and reporting on wetland health

The health or condition of a wetland is assessed by the direct measurement of its ecological health. This data is then compared with the characteristics of the wetland had it been in pristine condition, the difference giving an indication of how far the wetland's health has changed. The National Water Act and regulations and guides emanating from this, and the River Health Programme, set the framework for measuring of wetland health (see www.csir.co.za/rhp).

Measuring the ecological health of individual wetlands

Assessing the health of a wetland should be undertaken within the context of DWAF's Resource Directed Measures (RDM) for the Protection of Water Resources, referred to in Book 6. The RDM process requires that the Present Ecological State (health) of a wetland be determined according to six different Categories (see Table 4.1)

Table 4.1. Definition of Present Ecological Status Categories (DWAF 2002)

Category	Description
A	**Natural;** • The resource base has not been decreased; • The resource capability has not been exploited.
B	**Largely natural with few modification;** • The resource base has been decreased to a small extent; • A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	**Moderately modified;** • The resource base has been decreased to a moderate extent; • A change of natural habitat and biota has occured, but the basic ecosystem functions are still predominantly unchanged.
D	**Largely modified;** • The resource base has been decreased to a large extent; • Large changes in natural habitat, biota and basic ecosystem functions have occurred.
E	**Seriously modified;** • The resource base has been seriously decreased and regularly exceeds the resource base; • The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	**Critically modified;** • The resource base has been critically decreased and permanently exceeds the resource base; • Modifications have reached a critical level and the resource has been modified completely with an almost total loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible.

Categorising a wetland into Present Ecological Status is done by using a variety of ecological methods to produce what, in South Africa, are commonly called Ecospecs. Ecospecs are "measurable specifications of ecological attributes (e.g. water quality, indigenous vegetation removal) which define the Class (Natural, Good, Fair or Poor)" (DWAF 2002) and in this case the Category (A-F) of the Present Ecological State. The Ecospecs are used to set the upper and lower boundaries of each Category. For example, an assessment of the status of the vegetation may appear as follows:

Table 4.2. Example of possible Scores representing indigenous vegetation removal and forming the boundaries between different Categories of wetlands.

Category	Extent of indigenous vegetation removal
A	< 3% (of the total area of the wetland)
B	4-10%
C	11-20%
D	21-40%
E	41-75%
F	>75%

Note: the upper and lower limits given above are given merely as an illustrative example and do not come from an as yet accepted method.

In practice, it may be found that the Present Ecological State of the water quality, for example, differs from that of the vegetation, which in turn differs from a hydrological index. The data may therefore appear confusing and it is difficult for management to deal with a list of contradictory indices when trying to prioritise efforts to manage wetlands. To arrive at a single figure representing all aspects of the wetland, the central tendency of the scores or the Ecostatus can be determined. This is a subjective 'averaging' exercise where the most important indices carry more weight. Good examples of the use of indices for reporting can be found in the various "State of the Rivers" reports which have been published in South Africa (WRC 2002; River Health Programme 2003).

Measuring the collective health of the wetlands in a catchment

From a catchment management perspective, it is necessary to know the collective state of health of the wetlands in the overall catchment. It should be expected that the Catchment Management Strategy will contain collective objectives for these wetlands. One such objective might be to maintain at least 50% of the wetlands in a catchment in a natural or good state. To assess whether these objectives are being met requires measuring the individual wetlands in the catchment in order to build up an overall picture. As a catchment may contain thousands of wetlands, expense would prohibit a detailed assessment of each wetland. To overcome this, you can either do a rapid desktop-based assessment of all wetlands, with some field verification, or a detailed field-based assessment of a sample of wetlands, chosen by firstly stratifying (dividing) the catchment into reasonably homogenous areas and then randomly selecting wetlands from within each stratum. It may be necessary to sample more intensively in areas of the catchment with a high level of human activity, given that impacts on wetlands are likely to be greater here than in other areas.

Available methods for the measurement of Present Ecological Status

Methods for deriving ecological health are many and varied and range from techniques that target a single species, to broad techniques that summarise complex ecological data into indices. The choice of method will be driven by the objectives of the measurement. Currently few methods are operational in South Africa. In the Appendix to this Book several methods are presented one of which is of local origin but most come from the US EPA and other foreign agencies and are included as an indication of the type of methods that are out there. Over the next few years this is likely to become a new research activity in South Africa, so the reader should refer to the Water Research Commission, DWAF and DEAT for the latest developments.

Throughout the world the focus of wetland assessment has largely been on the physical (wetland area, soil types) and functional aspects of wetlands (how much water, wetting regime etc.) and the health of wetlands has been neglected. One of the best indicators of an aquatic ecosystem's health is its biological integrity or its ability to support and maintain a balanced community of organisms having a species composition, diversity, and functional organisation comparable to that of natural habitats within a region. The biological community of a wetland integrates the entire spectrum of physical, chemical and biological stressors affecting the wetland. The most meaningful measure of wetland health is to examine the integrity of one or more of the wetland dependant communities, such as the macroinvertebrates, benthic diatoms or vascular plants. International and local experience from stream bioassessment programs have also found that bioassessments are less expensive than many chemical measurements.

Wetland bioassessment is currently poorly developed in South Africa and in its infancy elsewhere. A number of possible techniques nevertheless hold promise for adaptation to South African conditions. Algae, amphibians, birds, fish, invertebrates and plants assemblages all hold varying degrees of promise but the most developed techniques are those based on plants, invertebrates and amphibians.

Measuring or monitoring wetland health over time

In any catchment management programme, it is important to describe how the health of the wetland/s changes over time. Monitoring involves regularly collecting information over time so as to measure the extent of variation from a predetermined standard or position, specified in the management objective/s. Resources need to be allocated for monitoring in the overall planning and budgeting stage. Monitoring will help you identify the need for corrective action and allow you to be more effective in meeting targets.

Monitoring does not automatically need sophisticated technology or high investment as it can be carried out at different levels of intensity and frequency. Specific individual wetlands such as an ecologically important wetland subjected to pollutant input may require weekly monitoring with the gathering of detailed information such as comprehensive water chemistry data. For the overall catchment, however, due to the very extensive areas that need to be covered and the broad-scale objectives being measured, monitoring is likely to be less frequent - every 5 to 10 years - and the wetlands can be described at a rapid assessment level. At whatever scale, however, a structured approach should be followed, as given in Table 4.3.

Table 4.3. A summary framework for monitoring (adapted from Findlayson, 1996 and Ramsar 2000)

Framework component	Key points
Identify the problem/s & issue/s	Extent, scale and most likely causes of problems/s (a key source of this information for the catchment is the baseline inventory described in Book 3).
Define the management objectives (see Book 6)	Precise and specific; attainable and achievable (e.g. maintain at least 50% of a catchment's wetlands in a natural or good state of health). Provides a basis for collecting the data.
Establish an hypothesis	Supports the objective and can be tested (e.g. >50% of the wetlands in a catchment are in natural or good state of health).
Choose variables and appropriate methods	Specific to the problem; the variables chosen need to provide the information to test the hypothesis.
Collect data	Data collection, whether desktop or field data, should be carried out by persons skilled and preferably qualified/accredited to do so. Data collected is documented with a known level of confidence and at a frequency designed to capture the rate of change due to catchment activities. Accordingly, pristine wetlands may only require monitoring once in 10 years, while those in stressed areas may even need weekly or monthly monitoring.
Analyse and interpret data and report results	Use rigorous and tested methods; timely and concise reporting.
Integrate results into actions	A critical final step that needs to be planned ahead.

A catchment management programme should also include project activities such as awareness raising events, the construction of rehabilitation structures and so on. This is dealt with in Step 6: Getting on with the job – the transition from planning to implementation.

Reporting on wetland health

Proper reporting of the results of wetland monitoring is crucial as efforts in collecting information about the environment can be wasted if the transition to an easy-to-read report is not made. The success of the National River Health Programme is evidence of how useful creative reporting can be.

Reporting of wetland health should be done at two levels:

- The health of the collective wetlands in the catchment or area.
- The health of individual important wetlands.

Figure 4.1 provides an example of the type of report that can be produced for an entire catchment. This map representation would need to be accompanied by text explaining the status quo. Figure 4.2 on page 54 gives another example of a useful report on the health of an individual wetland confined to a single page per wetland.

Figure 4.1. This map shows the health of wetlands in the xxx Catchment (based on fictitious data).

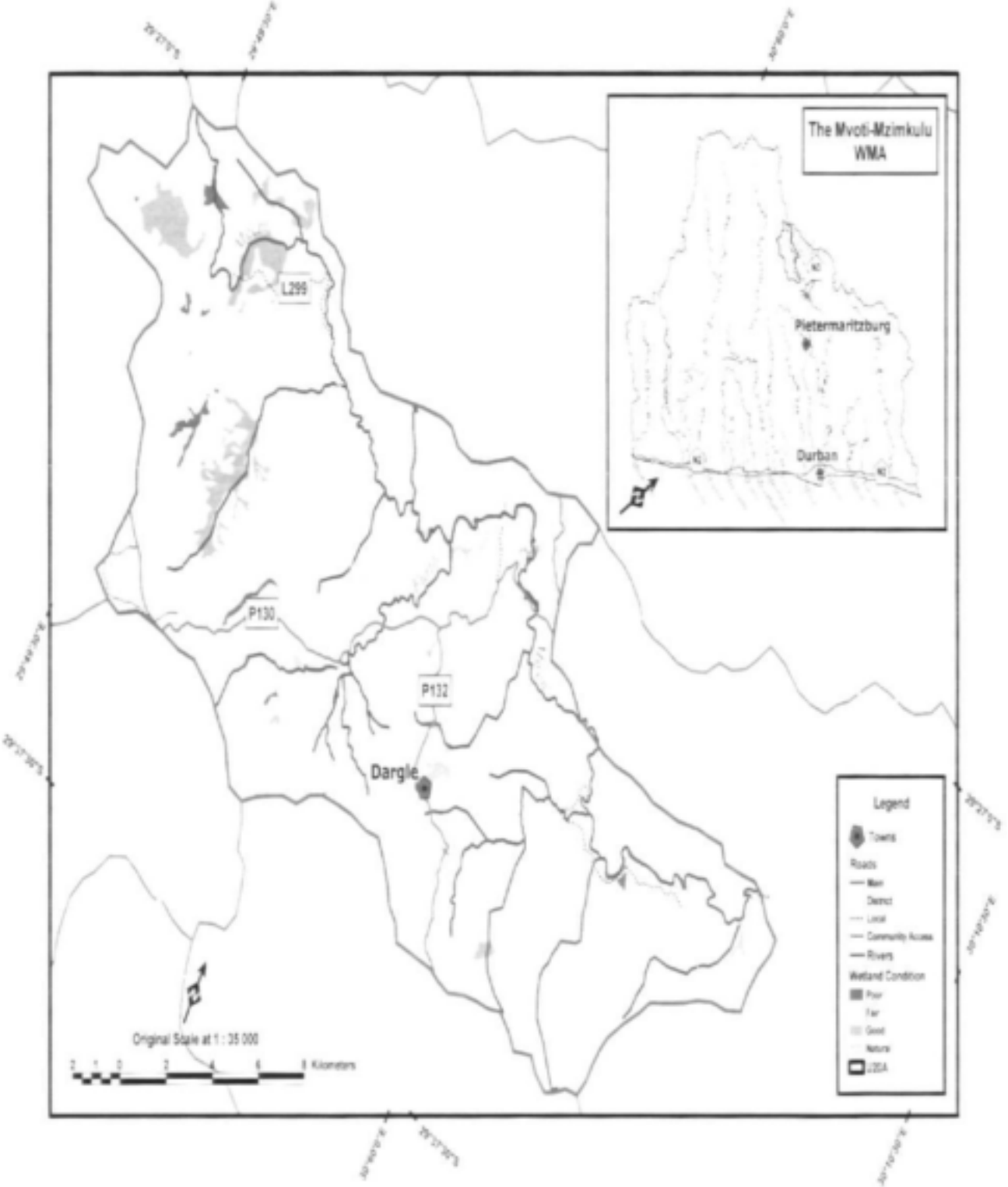

Figure 4.2. A hypothetical report for the XX Catchment State of Wetlands Report (using fictitious data and methods)

Photo of wetland	Photo of impacts
	
Photo: M. Graham 5/11/2003 – Wetland main basin facing North	**Photo:** M. Graham 5/11/2003 – Encroachment into wetland of exotic Eucalypts

Site Code	U90B-UBZVL
Site Name	XXI Vlei
CATCHMENT	XX
Quat. Catchment	U20A
Map	2929 BD Nottingham Rd
Latitude (S)	:29.48
Longitude (E)	30.83
Altitude (m)	1798
Ecoregion Lev 1	Eastern uplands
Ecoregion Lev 2	??
Wetland type/ classification	Mountain Headwater sponge
Landowner	Private/KZN Wildlife

Description: A relatively pristine wetland of critical importance to water supply in the uMngeni catchment. This has been well maintained over the years with little impact or change in structure and function. Some development of irrigation dams and commercial afforestation has occurred.

Map: Location

Legend							
Date	Hydrologic	Water Quality	Hydraulic/Geomorphic	Biota			Ecostatus
24/3/03	Inundation	WQ Index	Hydro/Geomorphic index	Vegetation	Fauna	Aliens	
	85% for 113 days	15	<65	79	7.2	>13	Fair

OBJECTIVES / THRESHOLDS OF POTENTIAL CONCERN (TPCs)
1: Hydrological Maintain >75% free standing water, over extent of wetland, for >3 months during summer (October-February)
2: Water Quality Index (WQI) >10
3: Hydraulic/Geomorphic to remain <65
4: Biota: Wetland Index of Biological Integrity (WIBI) >7

IMPACTS AND THREATS
This wetland currently has few impacts or threats. Alien weed infestation, primarily American bramble (*Rubus cuneifolia*) on the temporary wetted margins of the wetland (see photo above). Wattled crane populations under threat from inappropriate burning regime.

MANAGEMENT PRIORITIES
Restrict further development in this upper catchment wetland
Restrict further wetland inundation with continued farm dam construction.
Implement proper burning strategy.
Implement proper weed control strategy.
Locate source of pollutants entering the wetland and causing deterioration of the water quality.

TPCs THAT HAVE BEEN EXCEEDED
WQI has risen above 10
Urgent attention is needed to locate source of pollution

Action Summary Box 4.1. – Measuring, monitoring and reporting on the health of wetlands

- Consult with DWAF to see if Reserve assessments have been done for any of the wetlands in the area as these will provide valuable information on wetland health.
- Check on existing sources of information and data, both recent and historical. Historical reports can provide data describing the Reference or Natural state of any of the wetlands in the area.

Assess wetland health for:

- the wetlands of a catchment
- for individual important wetlands
- Use methods such as those described in the Appendix to generate Ecospecs. Methods used should include hydrogeomorphological and biological criteria.
- Use the Ecospecs to set the upper and lower boundaries of the Ecological Categories.
- Determine the Present Ecological State in relation to the Categories.
- Where different indices of Present Ecological State are in different Categories establish the central tendency or Ecostatus. The Ecostatus represents the overall health of the wetland.
- Also monitor the provision of benefits by the wetlands.
- Report on the health of the wetlands in the catchment or of individual wetlands in relation to objectives that have been set (see Book 6).

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Appendix to Book 4

The method below is a South African tool for assessing the integrity of wetlands that has been applied but still requires further testing.

Wetland Habitat Integrity

The Wetland Habitat Integrity method described below (Table 4.4) may be used for cursory, high level, low confidence assessment of a wetland.

Its limitation is that it involves a largely subjective method of assessment. Furthermore, it produces no raw ecological data (such as species inventories etc) and is thus difficult to revisit later when the need arises. Nevertheless, this type of method receives much support mainly due to its ease of application, rapidity and thus low cost.

Table 4.4. Score sheet for assessing Habitat Integrity of Palustrine Wetlands (adapted from Kleynhans 1996 and 1999 appearing in DWAF 1999).

Criteria and attributes	Relevance	Score	Confidence
Hydrologic			
Flow modification	Consequence of abstraction (surface and groundwater), regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floristic changes, incorrect cues to biota and altered geochemistry of soils, often resulting in reduced soil organic carbon levels and possible release of trapped pollutants.		
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.		
Water Quality			
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland. Specific impacts depend on the particular pollutants but increased nutrient and solute loads generally change vegetation and faunal composition, often reducing species richness.		
Sediment load modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.		
Hydraulic / Geomorphic			
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.		
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, rail tracks and other substrate disruptive activities which reduces or changes wetland habitat directly or through changes in inundation patterns.		
Biota			
Terrestrial encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.		
Indigenous vegetation removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion because of reduced vegetation cover. Reduced roughness of the vegetation reduces the attenuating affect of the wetland on storm flows.		
Invasive plant encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading). Some alien plants are also less effective in binding soil and controlling erosion.		
Alien fauna	Presence of alien fauna affecting faunal community structure.		
Over utilisation of biota	Consequence of overgrazing, Over-fishing/hunting, disturbance by human presence. Results in reduction of species populations and possible localized extinctions.		
TOTAL MEAN			

Scoring guidelines per attribute:
Natural, unmodified = 5; Largely natural = 4, Moderately modified = 3; Largely modified = 2;
Seriously modified = 1; Critically modified = 0.
Relative confidence of score:
Very high confidence = 4, High confidence = 3, Moderate confidence = 2, Marginal/low confidence =

Interpretation of Mean* of Scores for all Attributes: Rating of Present Ecological Status Category (PES Category)
WITHIN ACCEPTABLE RANGE
CATEGORY A >4: Unmodified, or approximates natural condition.
CATEGORY B >3 and <=4: Largely natural with few modifications, but with some loss of natural habitats.
CATEGORY C >2 and <=3: moderately modified, but with some loss of natural habitats.
CATEGORY D =2: largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
OUTSIDE ACCEPTABLE RANGE
CATEGORY E >0 and <2: seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
CATEGORY F 0: critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.
If any of the attributes are rated <2, then the lowest rating for the attribute should be taken as indicative of the PES category and not the mean.

International Wetland Health Assessment Tools

In order to introduce the possibilities for wetland health assessments, a selection of possible methods and their key features are presented below.

The Minnesota Pollution Control Agency – Wetland Index of Biological Integrity (WIBI).

www.epa.gov/volunteer/spring98/pg15.html

A number of metrics (or indices) are recorded and used to assess the wetland health. For example:

ETSD: This metric stands for the pollution-sensitive groups Ephemeroptera (mayflies) and Trichoptera (caddisflies); commonly also found in streams and two pollution sensitive groups common in wetlands: fingernail clams, or Sphaeriidae ("S"), and dragonflies ("D"). A higher ETSD indicates a healthier site.

Amphibians: A metric measuring evidence of successful amphibian reproduction i.e., tadpoles, or young newly metamorphosed frogs. A high score indicates a healthy site.
Bugs: The relative abundance of Corixidae (water boatman) to the total number of true bugs and aquatic beetles. The boatmen are herbivorous; the other bugs and beetles are predators. A higher percentage of boatmen can indicate a disturbed or over-enriched site with lower water quality.

Another four metrics used are leech diversity, dragonfly-damselfly diversity, snail diversity, and total taxa. The scores for the seven metrics are summed to arrive at an overall score of wetland health, called the Invertebrate Wetland Index of Biological Integrity (WIBI).

New England Biological Assessment of Wetlands Work Group (NEBAWWG) Index of Biological Integrity (IBI);

http://www.epa.gov/region1/eco/wetland/

The New England approach to monitoring freshwater wetland health requires identification of aquatic macro invertebrates to family level. It uses 11 metrics, for example:

EOT Richness: Total number of families of Ephemeroptera (mayflies), Odonata (dragonflies and damselflies), and Trichoptera (caddisflies). A greater number of families indicate better conditions.

Community Taxa Similarity Index: Shows the degree of similarity between the project site and the reference site. More similarity indicates a healthier site.

% Tolerant/ % Intolerant: The ratio of pollution-tolerant to pollution-intolerant organisms. A high ratio is indicative of impairment.

Other metrics included are EOT/ Chironomidae Ratio, Percent Composition of Dominant Group, Family Biotic Index, and others. The metrics are summarised into an overall "Invertebrate Community Index."
Ohio Rapid Assessment Method for Wetlands
www.epa.state.oh.us/dsw/401/orarn50sf.pdf

Within this programme various wetland indices of biological integrity (IBI) are being considered. Some of these are as follows:
Vegetation IBI, Amphibian IBI, Macroinvertebrate IBI.

HGM - Hydrogeomorphic Approach

Brinson, M.M., F.R. Haner, L.C. Lee, W.L. Nutter, R.D. Rheinhardt, R.D. Smith, and D. Whigham. 1995. A Guide book for Application of Hydrogeomorphic Assessment to Riverine Wetlands. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS, USA. Technical Report WRP-DE-11 http://www.wes.army.mil/el/wetlands/hgmlit.html.

The Hydrogeomorphic Approach (HGM) is a type of functional assessment approach that provides a foundation for assessing hydrology, biogeochemical, plant community, and faunal support/habitat functions of wetlands. It is a rapid assessment tool that applies to specific geographic regions and classes of wetlands.

Book 5. Mainstreaming wetlands into the Catchment Management Strategy and involving stakeholders

Management of wetlands poses unique challenges. Because wetlands are ecosystems spanning both land and water, wetland management requires the input and collaboration of a range of organisations, agencies, groups and individuals. To put this in perspective, wetlands are water resources (managed by water authorities) inextricably associated with land owned or occupied by a person or organisation whose ideas about its management may be in conflict with the water resource objectives. Furthermore, wetlands are generally sources of high biodiversity and valuable natural resources, and so are viewed in yet another light by conservation authorities and rural communities. Working together is essential if wetlands are to be managed properly, and this leads to the necessity for cooperative governance in planning and implementation.

Development of a Catchment Management Strategy (CMS) that adequately addresses wetlands

Management of the water-related aspects of wetlands has to take place in accordance with a Catchment Management Strategy, based on principles and objectives set by stakeholders. CMAs are required in terms of section 9 of the National Water Act to establish a Catchment Management Strategy in a participatory manner, being mindful of equity and gender issues. The strategy must be in line with the National Water Resources Strategy which provides a framework for the management of water resources for the country as a whole. The CMS will ultimately direct the manner in which a CMA will manage water resources, and thus wetlands, within its WMA.

Various steps in the DWAF guideline Development of a Generic Framework for a Catchment Management Strategy (DWAF 2001b) are highlighted below as a means of incorporating wetlands into catchment planning. These are as follows:

Situation assessment

This component of the CMS entails a description of the characteristics of the WMA, including a profile of water resources (including wetlands), physical attributes, hydrogeological characteristics and vegetation as well as a land use profile and several other attributes. Based on a high-level assessment, CMAs need to develop a discussion document that will form part of the information package sent out to stakeholders when inviting them to workshops or consultation forums. The purpose of this discussion document is to invite stakeholders to participate in the process of the development of the CMS, to give them background on the water resource situation, and to provide a guide to the process. The intent is to facilitate participation and an understanding of the process of the CMS development and not to impose the CMA's ideas on stakeholders. Appropriate tools for Stakeholder participation must be used to ensure maximum participation and equity in the process. For a detailed guide, see DWAF's recently published documents Guidelines for Public Participation (DWAF 2001c).

In order to ensure their inclusion in the planning process from the beginning, wetlands need to be given due attention in the situation assessment conducted for the CMS. Books 3 and 4 of this Guideline give guidance on how to go about conducting the situation assessment for wetlands. Template-style terms of reference for the appointment of service providers are also included in Book 8.

The situation assessment is important as it indicates the amount of work that needs to be done to manage wetlands in a catchment (e.g. identifying wetlands to be rehabilitated, stressed or over-exploited water resources, pollution problems, etc). This further forms the basis for how stakeholders could prioritise issues, set objectives and advise on allocation of financial, human and natural resources. Book 6 provides guidance in the setting of objectives as well as specific actions for the protection and management of wetlands.

Workshopping the CMS

Once the background information has been presented to stakeholders, a vision for the state and use of wetlands in the catchment needs to be formulated. This may be a lengthy process as stakeholders will have different concerns that may either be ill informed or have a sound basis. Stakeholders will want to know how the incorporation of wetlands into catchment planning could help to meet their economic, social and environmental needs. Their needs may have to be brought into line with the management of the wetland water resource and explanations and solutions given to them where possible. In some cases, investigations into the specific issues of stakeholders may be necessary. It is important to build trust and to impress on stakeholders that wetlands are an integral part of the water resource and need to be managed through an integrated and co-operative approach.

Communication

Integrated planning for the management of water resources, including wetlands, requires ongoing communication among stakeholders and authorities. Communication can only be effective when it is a two way process: dialogue should be encouraged and the stakeholders' views included in planning the way in which water resources will be managed. A communication plan needs to be developed that encompasses the characteristics, for example the socio-economic and geographical circumstances, of that particular WMA. The main components of this communication plan and guiding principles may be adopted from the DWAF Communication Strategy (DWAF 2001a).

Foundation strategies

Foundation strategies, which are components of the CMS, provide a guide within which water management strategies can be drafted and implemented.
The document on Development of a Generic Framework for Catchment Management Strategy (2001b), introduces these Foundation Strategies, including those that relate to the protection and management of water resources (including wetlands). These Foundation Strategies form the building blocks of the CMS, and wetlands issues should be incorporated into them in an appropriate manner.

- Resource Directed Measures (RDM) aim at developing management classes and resource quality objectives. RDM provide stakeholders with an outline for setting priorities that will eventually inform the way in which wetlands will be managed. See Book 6 for more details.
- The National Water Resources Strategy- NWRS (DWAF 2002) is intended to set out how DWAF and CMAs will work towards meeting the requirements of the Reserve, water availability, water balance, international obligations and strategic uses of water resources. It is a useful reference document that contains important information for use in a high-level situation assessment for a catchment or WMA. In turn, the insights and information about wetland management gathered by CMAs may be incorporated in and contribute to the regular review of the NWRS.
  Institutional Development and Cooperative Governance strategies deal with existing institutional frameworks and the development of new ones, and also set out guidelines to smooth the path for cooperative governance.
- Spatial / Landuse Planning Strategy influences water related aspects of land-use planning at regional and local levels. This is an important component as land-based activities have a significant bearing on wetlands. Municipal Land use schemes need to be taken into consideration as well.
- An appropriate Data Collection and Information Management Strategy for the CMA should be designed to develop a centralised, relevant, and updated database for planning and strategy formulation. This will contain information related to the state of water resources, wetland types and ecoregions, types of wetlands influencing water resources, wetland mapping and so on. Books 3 and 4 contain more detail about how to conduct studies to generate this kind of data.
- Financial Strategy - as a legal requirement and in line with good management practice, CMAs or institutions involved in wetlands conservation must plan, control and report on their financial performance. Equally important is knowledge of the different financing mechanisms available and the conditions that apply. Full details can be found in Pegram (2001).

Supporting Strategies

These strategies would reflect the current management issues in a WMA and the future or desired state of the water resources in a catchment, agreed upon through the stakeholder participation process. The level of detail required for each strategy will vary depending on particular WMA circumstances. The development of wetland-specific elements of these strategies has been covered in Books 1, 3, 4 and 6 of this Guideline.

Some key supporting strategies include:

- Water Resource Protection Strategies – part of RDM and relate to compulsory licensing for water use, water conservation and demand management and issues of cooperative governance around land use planning and impact assessment;
- Water Use Strategies – relate to the situation assessment, wetlands inventory, water pricing strategy and licensing;
- Water Resource Management Strategies – relate to the class and objectives for water resources including wetlands and implementing the Reserve; and
- Water Resource Control Strategies - relate to measuring the ecological health of water resources, carrying out assessments of water resource benefits and habitat integrity.

Working with stakeholders

The components of the CMS given above provide a framework for the planning component of integrated water resources management. CMAs however need to follow the necessary administrative processes for establishing a CMS and draw other institutions into strategic partnerships. In developing the CMS, the CMA must consult with:

- The Minister through DWAF;
- Any organ of state which may have interest in the content, effect, or implementation of the CMS; and
- Any persons/organisations whose activities may affect the WMA, or have an interest in the content, effect, or implementation of the CMS;

The CMA needs to know what institutions are involved in wetlands and general water resources management at National and Provincial level and who to talk to when they start this task (Table 5.1). The CMA must understand the roles and responsibilities of these institutions and how they can engage them in developing and implementing a CMS. A summary of those interested in wetlands is provided below.

Stakeholders with mandated & legal/statutory responsibilities

1.1 Landowner or user

As most wetlands are under private or communal tenure, setting objectives for these wetlands will primarily interest landowners and users, who will provide the first line of implementation on the ground. Landowners and landusers are required by the Public Duty of Care principle contained in NEMA, to take reasonable measures to prevent environmental damage on their property. Be they large-scale commercial farmers, small-scale subsistence farmers, timber companies or factory owners, these are the people who make the day-to-day decisions most affecting the wetlands on their land. Thus, while high-level decison-makers have some influence over the state of a catchment and its wetlands, the condition of individual wetlands is largely determined by the cumulative effect of the countless decisions taken by the many different land users. For this reason, any strategy or plan developed for wetlands in a catchment is only as good as the extent to which it links in with and affects individuals and organisations involved in land based activities which impact on wetlands in a catchment. Thus, procedures, participatory approaches, learning tools and incentives are essential to strengthen ties with these stakeholders. The approach should be practical with a sound understanding of the Stakeholders and involve the use of key role-players such as extension workers, local government, rural water committees and other CBO's (see Case Study Box 1). The CMA is in a good position to initiate or facilitate broad-scale planning processes, and these plans need to be in harmony with the objectives of landholders. This can be ensured at catchment level, by tailoring objectives to the circumstances in the catchment. In other words, the objectives should be relevant to the users while taking into account the threats to wetlands. For example, if the land-use in a catchment is mostly subsistence agriculture, objectives are likely to focus on the strengthening of community-based natural resource management and the involvement of extension workers to promote Best Management Practices (BMPs) for cultivation (see Book 7). If however land use is mostly for commercial timber production, then the objectives are likely to focus on harmonising the timber companies environmental and social auditing procedures with catchment objectives and promoting Best Management Practices.

For individual land holdings and individual wetlands, BMPs and the application of these through cooperative governance will be critical. Incentives might be necessary to encourage landholders to develop management plans for the wetlands they hold. This is already taking place within the commercial forestry sector, supported by market driven mechanisms such as the Forestry Stewardship Council.

1.2 National Government

In a spirit of Cooperative Governance, national departments who have some responsibility for wetlands' management need to be involved in drafting the CMS. Table 5.1 is a summary of departments and other stakeholders who play an important role in the protection and management of wetlands within a framework of integrated water resources management.

Book 2 of this Guideline provides more information on the legislation and regulatory provisions which govern the activities and determine the mandates and responsibilities of these government departments.

Table 5.1. Key stakeholders and their roles and responsibilities (WfWetlands 2003)

Stakeholder	Responsibilities
Dept of Environmental Affairs and Tourism (DEAT)	Lead agent for the development of a national strategy for sustainable development. Lead agent for relevant international agreements (e.g. Ramsar Convention on Wetlands, Convention on Biological Diversity). Coordinating function for areas of joint competence with provinces. Focal point regarding ecological integrity and biodiversity. Legal responsibility in terms of environmental Acts (e.g. NEMA, ECA). Lead agent in terms of cooperative governance under NEMA. Importance of wetlands in combating desertification.
Dept of Water Affairs and Forestry (DWAF)	Lead agent regarding water security (quantity and quality). Legal responsibility for protecting aquatic and associated ecosystems and their biodiversity in terms of National Water Act and National Water Resource Strategy. Linkage to streamflow reduction practices impacting upon wetlands. Regulation of impact of water resource management activities on ecological integrity of wetlands.
National Dept of Agriculture (NDA)	Lead agent for productive use of land. Regulation of sustainable use of agricultural natural resources. Impact of agriculture on wetlands (use, pollution, extraction, etc). Legal responsibility in terms of own legislation (especially CARA). Develop policy, norms, standards and guidelines for the conservation of agricultural resources (including wetlands); Manage a conservation Geographic Information System; and Reclaim and rehabilitate highly degraded land (including declared weeds and invasive plants).
Working for Water (WfW)	Implementation of a programme for control and eradication of alien invasive plants. Development of capacity to manage and rehabilitate wetlands. Strengthening of knowledge of links between wetlands and alien invasive plants. Integration of closely related programmes.
Dept of Provincial & Local Government (DPLG)	Coordination of disaster management. Integration of rehabilitation objectives and actions into Integrated Development Plans (IDPs).
Land owners	Duty of care for management and sustainable use of wetlands. Responsibility and accountability for health of wetlands. Sustainability of land use practices tied to wetlands.
Private sector	Opportunities for public-private partnerships and funding.

Case-study Box 1: Linking livelihoods and wetlands in the Sand River Catchment, Limpopo Province

The Sand River catchment,1 910 km2 in area, falls within the Sabie River basin. The Save the Sand Project was initiated four years ago as a national pilot project for Integrated Catchment Management (ICM) designed to restore the productive potential of the Sand River Catchment based on sustainability, equity and efficiency. It includes an alliance of organisations, individuals, communities and interested and affected parties working in, with, or using water from the Sand River Catchment. It is coordinated by the Association for Water and Rural Development (AWARD), an NGO working with water and rural development within the catchment area.

Several catchment focus groups have been set up, including local government, traditional leaders, water committees, DWAF extension officers, community development fora and the Bushbuckridge Water Board. Action projects, mediated learning programmes and development of resource materials have been initiated in order to build the capacity of these different groups.

One of the key principles of the Save the Sand Project is that of equity. This, together with the belief that for the project to succeed the residents of the catchment need to be involved, means that ICM initiatives cannot be divorced from the developmental needs of people. Any attempts to improve land and water management will bear little fruit if people are struggling to secure their minimum livelihood needs. Thus, the project works towards realising better lives for all.

The wetlands of the Sand River catchment are under increasing pressures (e.g. through extensive small-scale cultivation) and the need for rehabilitating degraded wetlands in the catchment was identified. It was recognised that an integrated approach was required to place wetland rehabilitation soundly in a catchment and livelihoods context. Thus, before any rehabilitation was undertaken, an understanding was developed of the importance of the catchment's wetlands to the livelihoods of local people as well as the importance of wetlands within the catchment.

This case study illustrates the critical role that an NGO, in this case AWARD, can play in integration across: (1) different role-players in the catchment; (2) different scales, from the individual household to the overall catchment; and (3) different areas of expertise, including social facilitation, hydrology, ecology, etc. NGOs often have a relatively high level of flexibility to work readily across different organisational boundaries that government organisations find more difficult to cross.

1.3 Provincial Agencies

Below are listed some of the key role-players that CMAs need to partner with to share responsibilities in conservation and management of wetlands.

Bearing in mind the political climate of the country, the legacy of service backlogs, municipalities faced with capacity problems, and the fact that non-developmental areas such as conservation of natural resources are low-priority, the management of wetlands may not be adequately resourced by the responsible agencies. The onus then falls on institutions such as DEAT, CMAs, and NDA to initiate processes, to talk to municipalities and to plan with them in order to achieve service delivery while ensuring the sustainable use of wetland resources.

a. Conservation

The various provincial conservation and environment departments have responsibilities covered in the list below:

- Management and regulation of provincial biodiversity (in collaboration with other provincial agencies with this mandate);
- Management and regulation of activities impacting on wetlands (through application and enforcement of EIA regulations);
- Rehabilitation of wetlands - coordinated through partnerships e.g. DEAT/WfW;
- Management of Ramsar-listed sites;
- Designation and management of World Heritage Sites.

b. Provincial Departments of Agriculture

- Conduct inspections in terms of Conservation of Agricultural Resources Act; and
- Reclaim and rehabilitate degraded land.

The provincial departments of Agriculture, in most cases, have the technical expertise and relevant legal instruments to support protection and management of the land-related aspects of wetlands. These institutions can play an advisory role and support individual landowners, as well as being empowered to issue directives in cases of non-compliance with regulations. CMAs need to work with these departments to prioritise wetlands of strategic importance that may need rehabilitation or special measures for enforcement.

c. Municipalities

- Municipalities are obliged to promote a safe and healthy environment and deliver services in an environmentally sustainable manner. In terms of the new Land Use Bill, municipalities will play the most direct role in spatial planning, land use management and land development. They will be responsible for formulating the planning frameworks upon which all the decisions on land development should be based.

d. Water User Associations (WUA)

Water User Associations are cooperative associations of individual water users who undertake water related activities for their mutual benefit. They derive their mandate, powers and functions from the National Water Act. These institutions are actively involved in the water resource and present an excellent opportunity for putting into action those plans laid out by CMAs and Stakeholders in the interest of wetlands.

The functions that the WUAs may perform include:

- Protecting water resources;
- Preventing any unlawful use;
- Removing or arranging to remove an obstruction unlawfully placed in a watercourse;
- Preventing any unlawful act likely to reduce the quality of water in any water resource;
- Regulating the flow of any watercourse by clearing the channel, reducing the risk of damage to the land in the event of floods, and changing a watercourse back to its previous course where it has been altered through natural causes; and
- Supervising and regulating the distribution and use of water from water resources according to the relevant water entitlements, by erecting and maintaining devices for measuring and dividing, or controlling the diversion of the flow of water.

All of these functions have a bearing on the management of wetlands and need to happen within a framework set by the CMA, through a process of consultation and involvement of Stakeholders.

Stakeholders voluntarily involved in promoting wetland management

a. Provincial Wetland Fora

Provincial Wetland Fora play a crucial role in promoting cooperative governance and networking among a diverse group of role-players. They can play a valuable role in assisting CMAs in integrating wetlands into catchment management. As a first step, Fora provide a useful means for the CMA to engage key Stakeholders.
Most Provincial Wetland Fora have a formal constitution and meet regularly every few months. While the activity level of individual fora and the way in which they operate vary, fora generally facilitate and provide a favourable environment for the following:

- Networking among diverse groups of role-players, including government departments, user-group representatives (e.g. forestry), universities and NGOs.
- Information sharing among stakeholders.
- Input to the prioritisation of wetlands for the purposes of rehabilitation.
- Providing comment on and input to the development of policy, planning and BMPs.
- Appointment of task-teams, for example a task-team for coordinating World Wetlands' Day events.
- Clarification of the specific mandates of different organisations/groups, in this way promoting cooperative governance.

Note: The Northern Cape does not presently have a Wetland Forum and in the Western Cape the Forum is currently not active. Wetland Fora are active in the other provinces.

b. South African Wetland Action Group (SAWAG)

The South African Wetland Action Group (SAWAG) is primarily an informal network open to any organisations or individuals interested and involved with wetland issues. Communication is facilitated by:

- An annual three-day meeting, involving presentations and open discussion groups, with the meeting being held in a different province each year.
- An email server list, which provides the means by which events, training courses & awareness raising material and other information are advertised. Any individual can post a question about a wetland issue they are facing.
- SAWAG is a valuable means through which any CMA can keep abreast of recent developments and issues regarding wetlands at a national level, as well as exchanging experiences with other initiatives across the country.

c. Community Participation in Wetland Management

Wetlands provide communities and other Stakeholders with opportunities for harvesting food, medicinal plants, construction materials, grazing livestock, fishing, bird-watching and eco-tourism. In some cases, society has taken to heart the protection and conservation of wetlands as was evident by the public outcry to the proposed mining of the St. Lucia Eastern Shores. Similarly, NGO groups such as the Wildlife and Environment Society (WESSA) play an important role in motivating public opinion and support for this cause.
The participation of local communities, traditional leaders and stakeholders such as farmers and land developers in the management of wetlands is crucial for improving the conservation status of wetlands and sustaining the livelihoods of people. While CMAs play a central role in wetland management, they must accept a participatory approach that balances social, environmental and economic objectives. Identifying and consulting community Stakeholders at the earliest possible stage of planning is crucial for strengthening commitment to the implementation of conservation objectives. Capacity building programmes and community awareness campaigns should aim at improving stakeholder participation and empowerment. As part of the social plan within the CMS, conservation measures should also look at creating markets and business opportunities.

Security of tenure, offered as an incentive, is a good inducement to a community to invest their time and resources in wetland management. Through cooperative governance among different spheres of government and realising people's secondary rights, land use planning and implementation should allow equitable claim to resources. The Ramsar guidelines (Ramsar Conventions Bureau 1999) for establishing and strengthening local communities' and indigenous people's participation in the management of wetlands present a case for involvement when:

- Local Stakeholders have historically enjoyed customary/legal rights over the wetland;
- Local interests are strongly affected by the way in which the wetland is managed;
- Decisions to be taken are complex or controversial;
- The existing management regime has failed to produce wise use;
- Stakeholders are ready to collaborate and request to do so; and
- There is sufficient time to negotiate among stakeholders in advance of management decisions being made. The DWAF published guideline on Generic Public Participation (2001c) is an important reference document in this respect.

d. Sectoral Interests

Many sectors carry out their own planning and development and may overlook environmental and socio-economic issues despite the availability of supporting legislation as outlined in Book 2. In some cases, conservation of natural resources such as wetlands may be seen as another 'green' issue and this adds to the administrative complexities and challenges facing the sector concerned. The CMA needs to be aware of this and be prepared to facilitate a direction that would result in harmonisation of planning to ensure protection, conservation and management of wetlands. Other organisations have taken their social responsibilities to heart and already have plans that fit well with potential CMA strategies. There are companies such as those in the forest industry, Water Boards and others, that have played a strong supportive role, contributing both personnel and finances to the protection of wetlands. CMAs will need to nurture relationships with these institutions to direct their inputs where they are most needed.

The following issues are common in South Africa and other developing countries and may require appropriate action plans as a part of the CMS:

- Planners and businesses often perceive sustainable development to be in conflict with large-scale economic growth and personal survival. The need for development needs to be balanced with environmental rights and resource conservation if there is to be sustainability.
- Integrated environmental management (IEM) objectives need to be placed high on the agenda for development of catchment management strategies. There has to be an understanding by all sectors that IEM and integrated catchment management are complementary approaches to resource management and that one is not superior to the other.
- Trade-off between economic development and resource conservation cannot be left up to industries to decide on their own. CMAs and other organs of state need to play a bigger role in this regard.

Appropriate institutional arrangements present an opportunity for organisations that want to plan for the protection and management of water resources to get to know the players who could become potential partners, their obligations to do so and the strengths and resources they bring to the table. This is important information for planning and CMAs need to lobby such partners and share benefits.

Linking with institutions

A CMS that is credible and defensible must be based on ongoing Stakeholder support and involvement. Relationships with stakeholders could take different forms depending on the strategic objectives, the nature of the Stakeholders and the level of their commitment.
The following are examples of how relationships may operate:

Mutual agreement – CMA and local communities work in partnership on rehabilitation and ongoing management projects. The agency may make funds available or help to source funds, while communities may contribute with indigenous knowledge and 'sweat equity'. Other useful role players such as WWF-SA, Nature Conservation Services, Mondi Wetlands Project, various research institutions, conservancies, etc need to be enlisted.

Regulatory – When applications for land development are received, the municipality and/or other responsible agencies consult with the CMA and other organs of state before approval. For rehabilitation work on private land, the responsible authority must seek agreement from landowners before work commences.

Contractual arrangement – The CMA contracts (on a commercial basis) a professional service provider to undertake and oversee rehabilitation and management of wetlands of strategic importance.

Where to now?

Once the situation assessment is complete, a communication plan is in place, and there has been adequate Stakeholder consultation, a clear vision for the catchment and a plan to establish strategic partnerships is in place then the relevant foundation and supporting strategies may be used as vehicles to mainstream the protection, conservation and management of wetlands into the high-level catchment strategy. This will then lead to setting strategic objectives and action plans to address problems identified or take advantage of opportunities available. Book 6 gives details of this process.

Management planning must be regarded as a continuous, long-term process. Planning should begin by producing a skeleton plan that meets, as far as resources allow, the requirements of the area and of the organisation responsible for managing the area. The planning process should be adaptable and dynamic, allowing for the ongoing development of detail as more information and knowledge becomes available during the implementation phase. It is essential for the plan to evolve to meet the changing features, factors and priorities, both within and outside the area concerned (Ramsar 2002 Conventions Bureau).

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Book 6. Setting priorities and management objectives for wetlands on a catchment basis

Once the number and location of wetlands of different types, the benefits that they provide and their health have been established, the catchment or water resources management agency, together with land-use and conservation agencies and local stakeholders, needs to set priorities and objectives for the future protection, conservation and management of these wetlands. This is perhaps the most important step in mainstreaming wetlands into the Catchment Management Strategy, since it firmly establishes water resources management objectives and activities which relate to wetlands, in an official document (the CMS) to which the responsible agencies must adhere.

The National Water Act of 1998 provides a powerful set of tools under Chapter 3 (Resource Directed Measures), which are applied within a very structured process of consultation, data collection, scientific assessment and decision-making (DWAF, 1999). The outcome of an RDM determination process should be a set of measurable, verifiable, quantitative objectives which provide management goals for the water-related aspects of wetlands (specifically water quantity and water quality). Ideally, a concurrent process of setting landuse-related objectives for wetlands should be integrated with the RDM process of setting water-related objectives.

The RDM determination process requires that the following questions are answered for wetlands, to an appropriate level of detail and degree of confidence:

- how many (the number of wetlands that exist in the catchment),
- or what portion (i.e what area of wetlands),
- of what type (ranging across the geography of the WMA so that maximum diversity is catered for)
- of the wetlands should be maintained...
- in what condition?

The desired state of health of a wetland(s) needs to be described as a Class, ranging from Natural, Good or Fair (see Table 6.1), according to the national classification system for water resources. To cater for biodiversity targets, a certain minimum percentage of each type of wetland should be maintained in their Natural Class, while others can be exploited to an increasing extent, depending on their sensitivity and importance in catchment and regional contexts.

This section provides a guide for the setting of priorities and objectives for wetlands. In setting these objectives, there needs to be careful consideration of who needs to do this together with what needs to be done.

Who needs to do this?

One agency, group or organisation cannot set the objectives for wetlands in isolation. While setting objectives for the water resource may be an obligation of the CMA, the landowner/holder may have objectives in mind, or may already have set objectives, that may legitimately be different and may conflict with those of water resource management. Likewise other government agencies may also have objectives that are apparently in conflict. It is only by working together that it becomes possible for wetlands to be properly managed on a catchment basis.

When working together different objectives need to be in harmony so that all individual parties recognize that the best way to achieve what you need is to help others achieve what they need. For a common understanding all parties need to lay their values, needs and problems on the table at the start of the exercise so that parties are exposed to all possible solutions to problems before implementing a solution (Calero and Oskam, 1983). This is expanded in a useful framework for goal setting in multi-party systems by Rogers and Bestbier (1997). Some details of the responsibilities of various government departments and also the participation of voluntary organisations, are given in Book 5. The Class assigned to a water resource or to a wetland represents the agreed vision for the future desired state of the wetland and the benefits that people wish to enjoy from the wetland.

What needs to be done? - setting priorities and management objectives for wetlands

The setting of priorities and objectives for wetlands should be carried out at different levels:

- For the collective wetlands in the overall catchment, in relation to wetlands in other regions or catchments, taking into account issues such as regional biodiversity, migration routes, and subsistence livelihoods.
- For the collective wetlands in priority areas of the catchment, for example in headwater zones.
- For key individual wetlands (e.g. Natural Heritage Sites or Ramsar Sites or wetlands providing critical water resource benefits).

Priorities should be set within the framework of the Resource Directed Measures for the Protection of Water Resources (National Water Act 1998, and Information Box 6.1). The philosophy for protection of water resources (including wetlands) is that for any aquatic ecosystem, the amount and quality of water, the timing and pattern of flow and chemical concentrations, must be appropriate and allow healthy ecosystem functions to be sustained. Central to this philosophy is the concept of the Ecological Reserve. The Ecological Reserve is designed to provide for the water quantity and quality that wetlands, rivers and other aquatic ecosystems need in order to continue providing benefits in a sustainable way. Determination and implementation of the Ecological Reserve should ensure:

- Enough water of acceptable quality to maintain the structure and function of aquatic ecosystems and provide habitats for plants and animals.
- Water in the right season so that plants and animals can complete their life cycles.
- Variability of flow/inundation so that groups of animals and plants that prefer either wetter or drier conditions can be maintained.
- Enough water in droughts so that naturally permanent/perennial systems remain wet/flowing all year, and seasonal systems do not dry up for much longer than they would naturally.

More information can be found on this subject in the easy-to-read booklet Water Ecosystems and People compiled by Palmer et al. (2002). The book also describes the implications of DWAF's slogan "Some, for all, forever" for water ecosystems. Although rivers are the focus of this book, its principles are relevant to palustrine wetlands.

Information Box 6.1. Resource Directed Measures (RDM) and the Reserve (adapted from DWAF 1999)

The concept of the protection of water resources presented in Chapter 3 of the National Water Act 1998 is innovative and countries across the globe have adopted similar approaches. Essentially, the law requires that all water resources (including wetlands) be protected so that they can be used sustainably by current and future generations of our society. The Act sets out the following steps that need to be taken in the protection of water sources:

1. A National classification system for water resources (currently under development in DWAF).
   As part of this a system of management classes for water resources will be established. Each class will have certain rules attached to it, relating to the level of protection afforded to a water resource to which a specific class is assigned. The system may also
   set out rules for the regulation or even prohibition of certain activities in order to protect the resource and to maintain it in a designated class.
2. The class of water resources, the Reserve and Resource Quality Objectives must be established for every resource of significance.

The Reserve is one of the most innovative provisions of the National Water Act and covers two specific aspects:

- "The basic human needs Reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, for food preparation and for personal hygiene.
- The ecological Reserve relates to the water required to protect the aquatic ecosystems of the water resource.
- The Reserve refers to both the quantity and quality of the water in the resource, and will vary depending on the class of the resource."

The Resource Quality Objectives set out to establish measurable, quantitative or narrative targets relating to the quality of the resource, while maintaining a balance between the need to protect and sustain water resources on the one hand, and the need to develop and use them on the other.

3. Once the RDM have been determined, the Act requires "the Minister, the Director-General of Water Affairs and Forestry, an organ of state and a water management institution" (such as the CMA) to give effect to the class, Reserve and resource quality objectives. (NWA, 1998)

The development of procedures for determination of RDM for resource protection is far from complete. The procedure for rivers has received the most attention and is now in its second phase of development. The procedure for wetlands lags behind and was initially adapted from the rivers procedure and published in draft form in 1999 by the Department of Water Affairs and Forestry (DWAF 1999). In addition, guidelines related to environmental water allocations for wetland ecosystems have recently been published by Ramsar (MacKay et al. 2002; Ramsar Convention Bureau 2002).

The Action Box below summarises the process necessary for the prioritisation and setting of management objectives for wetlands in a catchment, in accordance with the National Water Act. The box is followed by more detail on this process. Due to refinement of the Reserve/RDM procedure taking place at the time of writing this Guideline, the reader is advised to seek out the latest procedure on the DWAF website www.dwaf.gov.za or enquire with the Directorate: Resource Directed Measures in DWAF.

Action Summary Box 6.1. Step procedure for setting priorities and objectives (adapted from DWAF 1999 together with more recent drafts)

1. Together with Stakeholders, decide on the desired Class for wetlands as a whole in the catchment (how many/what area in a Natural condition, how many in a Good condition etc. (see Table 6.2)
2. Decide on the desired Classes for special wetlands and prioritise these wetlands in order of importance and/or urgency. (NB Recommendations and decisions made in steps 1 and 2 may need to be refined once more detailed information on the Reserve and the water resource conditions in the catchment becomes available, since permanent structural changes to the hydrological system may make it impossible to practically achieve the desired classes for some wetlands)
3. Decide on the level of assessment required for determination of the Reserve and resource quality objectives:

a. Rapid or comprehensive
b. Low or high confidence

4. Measure the benchmarks :
   Collect physical and biological characteristics of the wetlands (see Book 4)

i. determine what the wetland's Natural characteristics would have been under unimpacted conditions
ii. determine the Present Ecological State
iii. determine the importance and sensitivity of the wetlands

5. Determine the Reserve associated with the desired class for each wetland
6. Describe the ecospecs associated with the class and Reserve for each wetland (ecological specifications), and integrate these into the Resource Quality Objectives (RQOs).
7. Set Thresholds of Potential Concern – measurable attributes of the wetland, the exceedence of which would serve as a red flag for initiating a management response to mitigate a deteriorating situation.

Note: all of the above is done from a Protection of Water Resource point of view and is within the jurisdiction of the CMA, even though close partnership with other agencies, including landowners, will be necessary (see Book 5 for details).

PROCEDURE FOR SETTING PRIORITIES AND OBJECTIVES FOR WETLANDS

1. Decide on strategic objectives for the wetlands as a whole in the catchment

In other words, decide on how many or what area of the wetlands in the catchment should be managed to be in a Natural condition, how many or what area should be managed in a Good, Fair or Poor condition and so on.

Collective management objectives for the wetlands of a catchment need to be general and reflect mainly the levels of acceptable transformation of wetlands within the catchment. This will depend on the circumstances in the catchment and the particular development objectives that exist for the catchment. The minimum amount of wetland area in a catchment that should be maintained in a soundly functional state (Natural or Good) should be determined in collaboration with experienced specialists. Given that in several catchments such as the uMfolozi and uMngeni catchments, it is estimated that more than 50% of the wetlands are already in a Poor condition (Begg, 1989; Jewitt and Kotze, 2000), there is no room for complacency and rehabilitation may need to take place to meet the Resource Quality Objectives. Wetlands in Poor health will have lost their functionality although they could be rehabilitated.

Specific objectives may need to be set for collective wetlands in areas of the catchment identified as high priority. Again, the objectives will depend on the circumstances. If, for example, the area is characterised by extensive hard surfaces (such as roofs, streets and paving) leading to aggravated floodpeaks and non-point source pollution, then an objective may be to maintain a relatively high proportion of the remaining wetlands in a fair or better state. The priority function of wetlands in this case would thus be to dampen floodpeaks and assimilate pollutants, and wetlands in Fair or better condition are effective in performing these functions. It may thus not be necessary to have all the wetlands in their Natural class. Rather the objective here would be to optimise the extent of wetland in reasonable condition. By contrast, there may be catchments where wetlands are considered of less importance. This will mean that lower classes of wetland will be accepted with less maintained in a Good or Better ecological state.

It will also be necessary to ensure that sufficient areas of the different wetland types in the catchment are maintained in a Natural state to meet biodiversity conservation objectives. In the process it is unacceptable to protect one type of wetland while over-stressing others. The objective here would be to secure a diversity of representative pristine or Natural class wetlands. The principle mandate for promoting representation of different habitat types lies with the conservation planning section of the relevant Provincial Nature Conservation Organisation.

2. Decide on desired Classes for key individual wetlands

Prioritise these in order of urgency based on importance and sensitivity and level of threat. The first step is to identify the important wetlands. Management of Ramsar listed sites needs to be planned and implemented in consultation with DEAT and the landowner, generally the provincial nature conservation authority. Other wetlands may already be formally protected in conservation areas, or may be Natural Heritage Sites. To identify further important wetlands it is recommended that individual wetlands also be screened for the benefits that they provide in relation to the threats they face (see Book 3 and Table 6.2).

Those wetlands which deliver high levels of benefits and are facing a high level of threat are considered to have the highest priority from a catchment management intervention point of view. The actions required at the particular wetland will depend on the nature of the threat, for example cultivation by small-scale farmers or urban development, and the particular context within which the wetland is placed - communal land, for example.

Table 6.2. Matrix for prioritising the importance of individual wetlands based on the benefits provided by the wetland and the threat facing the wetland

		Benefits	
		Low	High
Threat	Low	Low importance	Intermediate importance
	High	Intermediate importance	High importance

3. Decide on the level and confidence required for the assessment

One of the first decisions that must be made by DWAF or the CMA is the level of investigation that is needed. This may vary from a superficial desktop assessment for wetland resources that are either not important or are not being impacted, for a high-level survey, to a very detailed investigation for important wetlands that require intensive management. For wetlands, the primary difference between these levels of assessment will be in the detail of information collected and confidence in the assessment.

DWAF (1999) recommends high confidence assessments if the wetland fulfils one of the following criteria and the anticipated impact is large:

- Listed Ramsar wetlands or wetlands with potential Ramsar status;
- Wetlands with national or provincial protected status;
- Those wetlands which play a vital role in the provision of water related services that may be important to a catchment;
- Large wetlands with complicated hydraulics (Phongola floodplain, Nylsvlei, uMkuze swamps);
- Large freshwater lakes;
- Wetlands fed by water sources on which major developments are planned which could cause irreversible damage to the wetlands; and
- Wetlands supporting endangered species where there are threats to the species.

If the impact of proposed water uses is not large and the wetland does not fulfil the above criteria, then an intermediate or lower confidence determination is done. No Reserve determination is generally necessary for endorheic wetlands (pans) unless they occur in areas where streamflow reduction activities are planned, where the pans themselves are subjected to surface water abstraction or waste discharges (DWAF 1999), or where the pans are hydraulically connected to groundwater resources which are or will be exploited.

4. Measure the benchmarks

Collect physical and biological characteristics of wetlands in order to:

- determine what the wetland's characteristics would have been under Natural conditions.
- determine the Present Ecological State.
- determine the importance and sensitivity of the wetlands.

To adequately describe the characteristics and thus the need to maintain functionality of wetlands, RDM studies typically include investigations of the following:

- Delineation of the historical and present boundaries of the wetland;
- Delineation of inundation, saturation and vegetation zones within the wetland;
- Bathymetric (Lakes and large Pans) and cross-sectional surveys (floodplains and small pans) to determine geomorphology for hydraulic modelling purposes (usually in conjunction with the above);
- Appropriate studies of the invertebrates, reptiles and amphibians, fish, birds and mammals of the wetland;
- An assessment of anthropogenic impacts on the wetland;
- Hydrological and/or gechydrological and hydraulic modelling to determine water requirements; and
- Water quality studies.

5. Determine the Ecological Reserve

The biological, socio-economic and water resource information collected as described above is analysed to determine the state of each of the physical and biological components that will keep the wetland in a particular Class as defined in Table 6.1. This is translated to water quantity and quality requirements, captured in the specification of the Reserve. Once the wetland Reserve has been determined, it is integrated with the groundwater, river and estuary components of the Reserve as appropriate.

6. Ecospecs and Resource Quality Objectives

Describe the specifications for each attribute that will maintain the wetland in the Classes described above. These specifications are called Ecospecs, and are "measurable specifications of ecological attributes (water quality, biological integrity) which define the Class (natural, good or fair) and serve as an input to the Resource Quality Objectives" (DWAF 2002). These need to be considered alongside other issues such as economic and social issues, and included in the Resource Quality Objectives (RQOs).

Table 6.1 Wetland Health Classes and their attendant Ecological and Management perspectives (summarised from DWAF 2002).

Wetland Health Classes	Ecological perspective	Management perspective
Natural	**Natural Wetlands** • Modifications to the natural abiotic template and the characteristics of the biota are undetectable.	**Protected wetlands** No negative impacts allowed.
Good	• Modifications to the natural abiotic template and the characteristics of the biota may vary from small to moderate.	Low impact is permitted.
Fair	• Modification to the natural abiotic template and the characteristics of the biota may vary from moderate to large. Wetland continues to perform functions.	Multiple disturbances associated with need for socio-economic development is acceptable.
Poor	• Modifications to the natural abiotic template and the characteristics of the biota may vary from large to completely dominant. Wetland functioning severely compromised.	Management intervention is needed to improve wetland health.

7. Implementing the Reserve - setting Thresholds of Potential Concern

Rogers and Bestbier (1997) introduced the concept of developing measurable points that would describe the Desired State of a resource. The idea behind this is that, having decided on the desired state, it is necessary to set measurable goals that would indicate if the state has been achieved or if the system is slipping to a state lower than desired. The boundaries between acceptable and unacceptable are termed the Thresholds of Potential Concern. Once a TPC is exceeded, management needs to give urgent attention to whatever actions are required to restore the desired state of the wetland.
Note: ecological TPCs may form part of the Resource Quality Objectives, which will include TPCs that deal with social and economic aspects. TPCs supplement the Ecospecs, in providing agreed "early-warning indicators" for checking whether Ecospecs are or will be violated.

As it is preferable and more cost-effective to 'catch' a system before it slides into a degraded state than to try and bring it back from this state through rehabilitation, it is useful to include early warning indicators in any monitoring programme.

"The underlying concept of early warning indicators (which relates to the concept of TPCs) is that effects can be detected, which are in fact, precursors to, or indicate the onset of, actual environmental impacts. While such early warning may not necessarily provide firm evidence of larger scale environmental degradation, it provides an opportunity to determine whether intervention or further investigation is warranted" (Ramsar Convention Bureau, 2000h).

In many cases we do not understand the links between cause and effect of different factors affecting the state of health of a specific wetland. Therefore, it may not be entirely clear exactly what actions or how much water is required to keep a wetland in a particular Class or move it from one Class into another. Another key factor to also remember when dealing with desired states of wetlands and setting Thresholds of Potential Concern is that wetlands are naturally dynamic. The faunal and floral composition may change dramatically from year to year in response to climatic fluctuations particularly in arid and semi-arid regions. The challenge is to separate out these natural changes from those caused by human impacts. Specialist expertise is likely to be required.

Table 6.3. Below is an example of what a table of Thresholds of Potential Concern for a wetland could look like

Criteria (entity to be measured)	Spatial & temporal scale of measurement	Sampling method	Threshold of Potential Concern (TPC)	Rationale
Indigenous vegetation species diversity	5 sites 3-5 year intervals	Vegetation index	Decrease in diversity (e.g. a decrease of >10%). Increasing dominance by a few species	A diversity index may be used to represent this with a single number
Inundation of soil by water	75% cover by water 4 times during wet season (November to March)	Fixed point depth of freestanding water	Water level does not reach required depth. Water level does not remain at required depth for more than two months	This is a measure to ensure that the hydrological conditions of the wetland are maintained
Extent of cultivated land	Mapped every 3 years	Air photo interpretation with ground verification	Extent reaches greater than 25% of overall wetland; any cultivated lands present in areas of the wetland having a high sensitivity to erosion	Cultivation may have potentially severe impacts on wetland integrity particularly where sensitive areas are cultivated leading to excess erosion

Action Plans for achieving management objectives

It is all well and good to formulate objectives for the catchment's wetlands and their state of health, but what are the specific actions required to achieve these objectives? In other words, we know where we are going but how do we get there? This entails building wetland management activities into the Catchment Management Strategy (see Book 5). The specific set of actions will be determined very much by the circumstances in the catchment, including the following:

- The vision and objectives for management of the catchment as a whole (see previous sections of this book).
- The nature of the catchment's wetlands (as described in the wetland inventory Book 3).
- The land-use and land tenure contexts of the catchment's wetlands (privately owned farmland, rural communal land, etc).
- The current state of health of the catchment's wetlands in relation to the intended target state of health of the wetlands, as specified in the management objectives (the current state of health may be substantially below the target).

Most management programmes should cover action plans for the following:

- A plan for ensuring that catchment objectives and actions remain aligned and linked to national and international policies and initiatives (see Ramsar Convention Bureau, 2000b).
- A plan for ensuring effective enforcement of legislation, which targets specifically those pressures such as industrial effluent discharge that impact upon the catchment's wetlands (see Ramsar Convention Bureau, 2000c).
- A plan of action for improving the level of significance and protection afforded important wetlands in the catchment through procurement of land by the state or environmental conservation-based NGOs/trusts or programmes such as the Natural Heritage Site Programme which provide added recognition or red-flagging of sites under existing ownership that may be private, communal or state owned (see Ramsar Convention Bureau, 2000c,d&e).
- A plan of action for promoting the rehabilitation of wetlands, targeting specifically those areas of the catchment and those wetland types which have been subject to high levels of cumulative impact and which would yield the greatest returns in terms of improved state of the catchment's wetlands and resulting water quality and quantity/ and or meeting wetland RQO. (see Ramsar Convention Bureau, 2000d).
- A plan of action based on incentives for landholders/owners to improve or maintain the state of health of their wetlands on private, communal and state-held land through for example, state-funded support from the Working for Wetlands Programme (see Ramsar Convention Bureau, 2000d).
- A plan of action for promoting the active participation of local communities to ensure that the programme is not predominantly top-down, and without meaningful contribution of landowners/holders (see Ramsar Convention Bureau, 2000e).
- A communication, education and public awareness programme, which targets stakeholders, and those sectors and users who influence both directly and indirectly the state of health of the catchment's wetlands (see Ramsar Convention Bureau, 2000f).
- A monitoring and reporting plan to ensure that the progress of implementation (outputs) is tracked so that necessary adjustments can be made to ensure that you stay on track for achieving your management targets. This should be integrated with the monitoring of the health of the wetland as described in Book 4 (see Ramsar Convention Bureau, 2000d).

Each of these plans should have operational milestones, with budgets and clearly defined roles and responsibilities to ensure accountability. Potentially strong synergies exist between the different items given above (e.g. between providing incentives and promoting wetland rehabilitation). These synergies need to be identified and strengthened (see Case Study Box 6.1) in order to support and facilitate implementation.

Case Study 6.1. Silvermine Project (Julia Wood, 2003)

The Silvermine River rises in the Cape Peninsula National Park (CPNP), running eastwards through a relatively pristine landscape until it enters the urban area of Clovelly / Fish Hoek (City of Cape Town). It is considered to be one of the few relatively pristine rivers on the Cape Peninsula and thus is worthy of a high level of conservation effort along its entire length.

The lower reaches of the river were originally unconfined and known to move across the floodplain on the valley floor. As was the situation for much of the Cape Flats and the Peninsula, this area would have been covered by a matrix of small seasonal pans and vleis.

The movement of the outlet was curtailed in the 19th century when the road and rail bridges were constructed and the town of Fish Hoek expanded across the floodplain, resulting in ongoing efforts to stabilise the dunes and drain the wetter areas. Until recently, the Lower Silvermine River still posed a flooding problem to large parts of urbanised Fish Hoek. This was until the Lower Silvermine Flood Control Scheme was constructed, which utilised gabions and widened the floodplain / wetland. During the design, detailed studies provided information on how the river would have previously functioned. Although it was impossible to restore the river back to its original state, it was decided to create a functioning system with a diversity of habitats as near as possible to the original habitats.

One of the most important successes of the project was the effective involvement of both the engineering and environmental disciplines, as well as the local community throughout the entire project. After the project was completed a very successful partnership was formed between the Riverine Rovers (a subcommittee of the Friends of Silvermine) and the City of Cape Town. The Riverine Rovers took up the day-to-day maintenance challenge, ensuring that the area is kept free of litter and alien vegetation.

The Riverine Rovers also provide general surveillance of the area and environmental education for local schools. The City of Cape Town ensures that excess silt is removed (the mechanical maintenance is kept to a minimum); major alien vegetation and reed clearing is undertaken; footpaths and signage are kept in good working order; and a general back up (including scientific expertise) is provided.

A challenge will be to ensure that the variety of habitats remain as they are and are not overgrown with reeds such as Typha and Phragmites.

A Catchment and River Management Plan has been drawn up for the whole of the Silvermine River (including the rehabilitated wetlands), thereby ensuring integrated catchment management for the whole system. One of the actions in the plan is to obtain formal conservation status for the Silvermine River from Source to Sea.

Partnerships that were formed in rehabilitation and maintenance of the Silvermine River have resulted in a sustainable project into the future.

Figure 6.1. Wetlands of the Lower Silvermine Flood Control Scheme

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Ramsar Convention Bureau. 2000d. Ramsar handbooks for the wise use of wetlands. Handbook 4: Integrating wetland conservation and wise use into river basin management. Ramsar Convention Bureau, Gland, Switzerland.

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Book 7. Useful Resources and further reading

The catchment water resource manager, landowner or landholder, faced with the management of the wetlands in an area, has numerous tools that can be used to aid the process. Some of these may be appropriate for one agency but less so to another. In many cases it will not be the water resource manager who needs to implement these tools, but one of the stakeholders in wetland management. The wetland manager needs to be familiar with what is available to be able to influence the activities of others for the ultimate good of the water resource
(Note: these tools are provided for information and their inclusion in this Guideline in no way endorses their use.)

Some available tools are as follows:

1. Ramsar, via their website (www.ramsar.org) provide many tools for wetland management. Unfortunately due to the shear volume of information on this site, information may be difficult to locate. Ramsar documents available as downloads, on CD or in hard copy, include the following (also see the list of references with Book 6.):

a. Wise Use Handbooks (Ramsar Convention Bureau 2000).

b. Framework for Wetland Inventory (Ramsar Convention Bureau 2002a).

c. Principles and guidelines for wetland restoration (Ramsar Convention Bureau 2002b).

d. Guidelines for the allocation and management of water for maintaining the ecological functions of wetlands (Ramsar Convention Bureau 2002c).

e. Guidelines for integrating wetland conservation and wise use into river basin management (Ramsar Convention Bureau 1999a)

f. Guidelines for establishing and strengthening local communities' and indigenous people's participation in the management of wetlands (Ramsar Convention Bureau 1999b)

2. Best Management Practices - A new set of guidance tools that is rapidly developing is the "Best Management Practices (BMPs) for Wetlands" (Kotze and Breen 2000). These set out to alert any person about the issues that should be considered when managing wetlands. These would apply particularly to working wetlands. Below is a summary of the issues in relation to wetlands and urban, forestry and agricultural development.

a. Issues contained in BMPs to minimise the impacts of urban and infrastructural developments on wetlands:

i. The location of infilling, excavation, artificial drainage and hardened surfaces in wetlands and immediately adjacent to wetlands.
ii. Specifications for delimiting a wetland buffer and possible linkages to other natural areas.
iii. Specifications for storm water entering the wetland (e.g. dispersal and buffering of water before it enters the wetland).
iv. Specifications for roads adjacent to and traversing the wetland.
v. Mitigation measures where impacts are unavoidable.
vi. Controls to prevent unnecessary disturbance and compaction during construction.
vii. Mitigation of the impacts of extensive hardened surfaces in the catchments of wetlands maintained by predominantly groundwater inputs.

b. Issues contained in BMPs to minimise the impacts of plantation forestry on wetlands:

i. Buffer requirements around the wetlands – a buffer of 20 m beyond the boundary of the wetland should be provided.
ii. Minimising impacts of burning practices, notably extensive early winter burning should be limited by practicing rotational burning.
iii. Specifications for roads adjacent to and traversing the wetland.
iv. Control of alien plants.

c. Issues addressed in BMPs designed to minimise the impacts of agriculture taking place within wetlands:

i. Addition of any agrochemicals should be severely restricted given the generally close association that wetlands have with the river system.
ii. Extent and frequency of disturbance should be limited (e.g. by limiting the extent of cultivated lands to less than 30% of the surface area of a wetland).
iii. Nature of the disturbance cultivation should be by hand in preference to with heavy machinery.
iv. Choice of crop types – crops with a tolerance of waterlogging should be chosen in preference to intolerant crops, thereby minimising the need for artificial drainage.
v. In the cases of urban developments, plantation forestry and agriculture, consideration must be given to the cumulative impacts on wetlands in both catchment and Ecoregion. The greater the level of cumulative loss or impacts on wetlands in a particular catchment/sub-catchment or Ecoregion, the more critical it becomes to limit further developments/impacts on wetlands.

3. WETLAND-USE, a wetland management decision support system for South African freshwater palustrine wetlands. Kotze and Breen (2000)

The overall goal of WETLAND-USE is to assist extension workers in providing sound land-use advice and encouraging wetland users/owners to give consideration to the impacts on indirect benefits provided by wetlands. The system enables non-specialists to undertake wetland assessments provided they have introductory training and they seek the input from specialised disciplines where required. WETLAND-USE comprises 2 parts, the first dealing with the biophysical aspects of wetland management and planning and the second with the social and organisational aspects.

WETLAND-USE Part 1 is a rapid assessment system with three main components:

- INFO-COLLECT. Guides the user in collecting useful information about the wetland and its catchment, cumulative loss context and the downstream service area.
- IMPACT-ASSESS. Assists in selecting appropriate land-use alternatives for a given wetland area by predicting the likely impacts of the proposed land-uses on the indirect benefits of the wetland area.
- LAND-USE-RECOMMEND. Recommends how the wetland area be managed for the chosen land-use. Recommendations are provided for several land-uses including livestock grazing, burning, crop production, pasture production, small farm dams, etc. Particular emphasis is given to agricultural uses. In planted pastures, for example, recommendations are provided concerning choice of pasture species, minimising impacts on the hydrological regime and minimising leaching of nutrients. The assumptions on which WETLAND-USE Part 1 is based and the scientific support for these are also provided.

WETLAND-USE Part 2 assists in:

- Describing the social, land tenure and policy contexts of individual wetlands.
- Establishing and maintaining organisational arrangements required for wetland management.
- Providing a structure for local wetland users and managers to plan the management of their wetland.

4. WETLAND-ASSESS, a rapid assessment procedure for describing wetland functions and values. Kotze *et al.* (in development).
The overall goal of WETLAND-ASSESS is to assist decision-makers, government officials and educators in undertaking rapid assessments of wetlands and revealing these benefits, so as to highlight their importance and allow for more informed planning and decision-making. The system includes the following benefits: flood attenuation, streamflow augmentation, the trapping of sediments nitrates phosphates and toxicants, erosion control, biodiversity support and the provision of resources (e.g. grazing plants for crafts, etc.).
WETLAND-ASSESS is not designed to (1) assess the specific level of impact of a current or proposed development, (2) provide a single overall measure of value and (3) be used as a guide for designing management and rehabilitation systems.

5. WETLAND-FIX, Assessment, management, and restoration of South African Wetlands (Mondi Wetlands Project 1999)
This is an illustrated field guide for use by land agency extension services and comprises six separate booklets:

i. Introduction and wetland assessment.
ii. Wetland burning and grazing guide.
iii. Streambank stabilisation and channel plug development.
iv. Indigenious plants suitable for streambank stabilisation and channel plug development.
v. Stream source wetlands- spring protection guide.
vi. Alien plant control guide.

6. Planning, implementing and monitoring wetland rehabilitation. Kotze et al. (2001a)
The aim of this manual is to provide a firm scientific and technical foundation for the rehabilitation of wetlands within and beyond the Working for Water / DEAT programme. A manual has been developed consisting of the following five main components:

- Framework and guidelines to assist fieldworkers and practitioners in gaining an understanding of the processes underlying the formation of South African wetlands and the deposition and erosion of sediment within these systems, based on a review of the current literature.
- Protocols for prioritising wetlands for wetland rehabilitation, through assessment and comparison of the importance of their present or potential functioning.
- Protocols to be used by practitioners for describing the type and severity of erosion in a wetland and choosing and planning rehabilitation methods appropriate for the erosion problem and the wetland's catchment and management context.
- Protocols for monitoring the success of wetland rehabilitation.
- Analysis of the legislative, policy and institutional context within which wetland rehabilitation will take place.

Each component is discrete, but closely linked, and the manual provides an overall structure within which the different components are nested. The manual covers rehabilitation of palustrine (marsh/floodplain-type) wetlands across a range of landform settings. The main forms of degradation addressed by the manual are wetlands impacted by on-site erosion gullies or drainage channels. The manual provides detailed practical guidelines on the rehabilitation of these wetlands by means of management (e.g. excluding livestock), bioengineering (through the establishment of vegetation) and structures (e.g. gabions).

7. Promoting crafts woven from wetland plants: Guidelines for fieldworkers and other stakeholders. Kotze (2001).
The guidelines start by highlighting the benefits of promoting craft production from wetland plants, including:

- Incentives for local people to maintain wetlands in a natural state.
- Economic and social empowerment, particularly for rural women.
- Maintenance of traditional skills and practices.

Many wetland plant species are used for weaving crafts, and the guidelines describe some of the most commonly used species for particular crafts such as floor mats, where the plants are found, and their supply relative to the current demand.
Although tremendous potential exists for expanding craft industries based on wetland plants, several constraints are holding back the development of the craft sector in South Africa. These including, poor differentiation of products; poor access to appropriate communication, transport and infrastructure; problems with quality, volumes and deadlines; poorly developed market strategies; and lack of coordination.

These guidelines are designed especially for fieldworkers and describe examples and provide practical advice on overcoming specific constraints. Some of the guidelines include:

- Start by working with a small number of reasonably experienced crafters.
- Gain an understanding of the materials available locally, suitable types of weaves and local weavers' capabilities.
- Seek market opportunities for the particular materials and skills in the group.
- Based on the opportunities, identify specific marketable products.
- Produce prototypes of the identified products. Be strict on quality.
- Obtain feedback from buyers and refine the prototypes.
- Go into early production with small orders, again emphasising quality.

8. Development of a protocol for the definition of the desired state of riverine systems in South Africa (Rogers and Bestbier, 1997).
   Central to the protocol of Rogers and Bestbier (1997) is the concept of a "desired state", which forms the foundation for management. Although developed for riverine systems, the protocol is sufficiently generic to be applied fully to palustrine systems, and is in fact being used for management of the Kruger National Park as a whole. The protocol includes several tools.

- A theoretical context for management, encompassing the concepts of "Adaptive management"; the interaction of "managers and society and societal values" and the interaction of "managers and scientists"; and the shift in scientific understanding from the old "balance of nature" paradigm to the newer "flux of nature" paradigm.
- A goal setting protocol and procedure, which leads to an Objectives Hierarchy with acceptable and achievable operational goals (end points) which map out a future for the ecosystem.
- A Goal Maintenance System which ensures that: (a) once acceptable goals have been set they are met, revised, audited and, when necessary, reintegrated into the management process, and (b) proper documentation of decisions taken and reasoning behind them are kept to provide the "institutional memory" needed to keep management "on track".
- A hierarchical patch dynamics model of biodiversity to ensure an ecosystem approach to management. This assists management in adapting from being reactive to surprises of nature to being proactive and setting achievable goals based on a scientific understanding of the ecosystem and how it changes over time and space.
- A structured process for integrating the inputs of multiple stakeholders and their respective values into the development of the management vision and objectives, as would be required for integrated catchment management for example.

The procedure emphasises an inclusive negotiating style to ensure:

- Transparency and consensus in the development of the Objectives Hierarchy.
- The inclusion of the value systems of appropriate intra- and inter-institutional parties.
- Enthusiastic acceptance by management of new goals and modus operandi.

The objectives hierarchy begins at the coarsest level with the organisation's "vision" then provides a step-by-step process for decomposing the vision into a series of "objectives" of increasing focus, rigour and achievability. The finest level of the hierarchy is defined by achievable, on-the-ground goals. These include both targets for managing institutional structures and processes and endpoints for ecosystem management (encompassed in the concept of Thresholds of Potential Concern). The Goal Maintenance System provides an iterative internal auditing system to ensure feedback between managers and scientists.

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Rogers, K.H. and Bestbier, R. 1997. Development of a protocol for the definition of the desired future state of riverine systems in South Africa. Department of Environmental Affairs and Tourism, Pretoria, South Africa.

Useful contacts and sources of information in South Africa

Water Research Commission - Pretoria

DWAF - Department of Water Affairs and Forestry (Head Office, Pretoria)

- Directorate: Resource Directed Measures
- Directorate: Water Abstraction and Instream Use
- Directorate: Water Management and Institutional Governance

DEAT - Department of Environmental Affairs and Tourism

- Director: Biodiversity Conservation in Pretoria

Wetland Fora.

- Local fora exist in most of the provinces of South Africa and it is important to make contact with the one in your area.
- The Mondi Wetland Project and the Working for Wetlands Programme are both valuable sources of information and assistance. They work country-wide.

Book 8. Terms of Reference for project management

Contents:

1. Inclusion of the Protection, Conservation and Management of Wetlands in the xx Catchment into current and proposed stakeholder consultation and participation initiatives of the CMA
2. A survey and inventory of the Wetlands in the xx Catchment
3. Survey of the Health of the Wetlands in the xx Catchment
4. Determination of the Ecological Reserve and recommendation of Objectives and Management Priorities for the Wetlands in xx Catchment
5. Design & establish a monitoring and reporting programme for wetlands in the xx Catchment
6. Development and preparation of a Supporting Strategy that facilitates the inclusion of the protection, conservation and management of wetlands into the Catchment Management Strategy for Catchment xx
7. Implement the Protection, Conservation and Management of Wetlands in the xx Catchment

One of the main obstacles to implementing plans on the ground is where water resource managers do not have the time, nor often the capacity, to draft the necessary Terms Of Reference with which to engage contractors with specialist expertise to take on the necessary work. This Book is an attempt to provide template style Terms of Reference that can, and must be, adapted to the local situation. This list is by no means exhaustive but provides for the main areas of work in managing the water resources associated with wetlands.

TERMS OF REFERENCE

1. Inclusion of the Protection, Conservation and Management of Wetlands in the xx Catchment into current and proposed stakeholder consultation and participation initiatives of the CMA

Introduction and background

The xx CMA has recently undertaken an initial planning exercise to ensure the proper conservation and management of wetlands in the xx Catchment. A service provider is required to strengthen stakeholder participation in the effective management of the wetlands in this Catchment, through current and proposed initiatives by the CMA related to the establishment and activities of Catchment Fora.

Objectives of the Consultancy Service

To strengthen current or proposed stakeholder fora and participatory processes related to water resources management in order to ensure appropriate participation of all relevant stakeholders in planning for and implementing the protection, management and conservation of wetlands in the catchment.

Scope of Work

This project will require access to existing networks of all of those who are Stakeholders in the management of wetlands in the xx Catchment. Making use of those networks, the Consultant will gather together an effective and dynamic group of people, fully representative of the demographics of this country, who will make active and effective contributions to wetland management in the xx Catchment through current or proposed participatory water resource management processes. The project should include the following:

- Clarifying the legal environment in which Stakeholders would work to manage wetlands i.e. laws and regulations that exist that would facilitate the management of wetlands.
- Making contact, through existing Catchment Fora or CMA structures where available, with potential Stakeholders and informing them of the project(s) to plan for and manage wetlands.
- Provision of the appropriate information material to raise awareness and improve the understanding of the functions, characteristics and status of wetlands in a catchment.
- Bringing the Client and Stakeholders together in a workshop situation(s).
- Facilitating the workshop process(es) in accordance with the needs of the Client who will manage the content of the workshop(s). The consultant will also need to facilitate the development of a common vision for the wetlands in the catchment, and present this to the client in a way that it can be integrated into the developing CMS.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

- A report on the effectiveness of the Stakeholder consultation and participation.
- Evidence of and appropriate procedures and information for ensuring that existing stakeholder fora related to water resources management are also capable of participation in planning for and implementation of the protection, management and conservation of wetlands in the catchment.

Mode of Operation of the Consultant

- The Consultant will need to be an effective networker and facilitator of the workshop situation.

Time Schedule and Reporting Requirements

Assignment Duration

- The expected input is x man months over a period of x months.
- Start of the Assignment: The Assignment is expected to commence on the xxx.

Reports

Inception Report

- Within three (3.0) weeks of the commencement of the Assignment, the Consultant shall submit to the Client an Inception Report, which shall give, among other things, details of the Consultant's understanding of the Assignment and the approach to be adopted in carrying out the Assignment.

Progress Reports

- The Consultant will be required to submit a Progress Reports to the Client on the activities of the previous xx month/s in a format to be agreed with the Client. Meetings will be organized by the Consultant to present progress reports to the Client

Draft Completion Report

- At least one month before completion of the Assignment the Consultant shall be required to submit a Draft Completion Report. This report shall cover all main aspects of the work carried out and recommendations, problems experienced, etc.

Final Completion Report

- The Consultant will be expected to submit a Final Completion Report within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach or methods used in the study. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used in the baseline study must be clearly identified.
- List of references and personal communications.
- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall provide the managerial, technical, environmental and wetland expertise in support of the workshop process
- The Client shall make available any relevant reports and data in his custody

Obligations of the Consultant

- The Consultant shall provide an existing network of potential Stakeholders. Consultant staff should be adequately qualified and experienced in their fields.
- The Consultant shall be responsible for dynamic and effective facilitation of workshops and drafting of reports describing progress.

Required Consultant Expertise

The required consultant will have demonstrable competence in working with stakeholders in Catchment Management.

TERMS OF REFERENCE

2. A survey and Inventory of the Wetlands in the xx Catchment

Introduction and background

The xx CMA has recently undertaken a comprehensive planning exercise to ensure the proper conservation and management of wetlands in the xx Catchment. A service provider is required to undertake an inventory of the wetlands in this Catchment.

Objectives of the Consultancy Service

To produce an inventory of all of the wetlands greater than x hectares in the xx Catchment, together with information about their type and the benefits they provide.

Scope of Work

This project will largely be limited to a desktop exercise although some field verification will be necessary. The project should include the following:

- Link the project to the National Wetland Inventory and other existing inventory information.
- Extract wetland data for the entire catchment from the National Wetland Inventory Database.
- Prioritise those areas of the catchment where more detailed inventories are necessary.
- Work to an accuracy of 1:50 000 or finer, as required for setting of management objectives and RDM.
- Survey and delineate all wetlands greater than x hectares in a GIS environment. Link this to information detailing the type of wetland and the Level x Ecoregion that it falls into.
- Provide information about the soil type, probable vegetation type (with limited field verification) as well as any other characteristics that may influence the prioritisation and management of these wetlands.
- Where possible include wetlands that have been transformed by agriculture, forestry or other developments.
- Provide information about the water resource functions and benefits provided by the wetlands.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

- A report
- A GIS coverage illustrating the wetlands of the catchment

Mode of Operation of the Consultant

1.1 The Consultant will, during execution of the assignment, be required to:

- Fully involve identified Client members of staff as part of capacity building

Time Schedule and Reporting Requirements

Assignment Duration

- The expected input is x man months over a period of x months.
- *Start of the Assignment: The Assignment is expected to commence on the xxx.*

Reports

Inception Report

- Within three (3.0) weeks of the commencement of the Assignment, the Consultant shall submit to the Client an Inception Report, which shall give, among other things, details of the Consultant's understanding of the Assignment and the approach to be adopted in carrying out the Assignment.

Progress Reports

- The Consultant will be required to submit a Progress Reports to the Client on the activities of the previous xx month/s in a format to be agreed with the Client. Meetings will be organized by the Consultant to present progress reports to the Client.

Draft Completion Report

- At least one month before completion of the Assignment the Consultant shall be required to submit a Draft Completion Report together with a preliminary GIS map of the wetlands in the Catchment. This report shall cover all main aspects of the work carried out and recommendations, problems experienced, etc.

Final Completion Report

- The Consultant will be expected to submit a Final Completion Report and GIS coverage within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach or methods used in the study. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used in the baseline study must be clearly identified.
- List of references and personal communications.
- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall make available any relevant reports and data in his custody.
- The Client shall make available x GIS coverages.

Obligations of the Consultant

- The Consultant shall provide the hard and software necessary to carry out the work. Consultant staff should be adequately qualified and experienced in their fields.
- The Consultant shall be responsible for the production of the reports and final GIS coverages.

Required Consultant Expertise

The required consultant will have demonstrable competence, at least a xx degree in an appropriate IT field with not less than xx years of relevant practical experience in the area of GIS.

TERMS OF REFERENCE

3. Survey of the Health of the Wetlands in the xx Catchment

Introduction and background

The xx CMA has recently undertaken a comprehensive planning exercise to ensure the proper conservation and management of wetlands in the xx Catchment. This was followed by a detailed inventory and survey of all wetlands greater than x hectares and also a process to prioritise the wetlands for management action. It is now necessary to establish the condition or health of these wetlands so that management action can be properly directed. A service provider is thus required to establish the health of the wetlands in the xx Catchment.

Objectives of the Consultancy Service

To establish the health or condition of the wetlands (as a collective whole and for individual important wetlands) in the xx Catchment, and report this in such a way as to be consistent with and support the determination of Resource Directed Measures for the catchment at xx (desktop/intermediate/ comprehensive) level.

Scope of Work

This project will entail considerable fieldwork to measure the health of the wetlands in the xx Catchment. The project should include the following:

- Link the project to the requirements of the National Water Act (1998) in relation to the Protection of Water Resources and the RDM process. Identify the procedures nominated by the Department of Water Affairs and Forestry, to determine the Present Ecological State. These should include the following factors.
  - **Hydrologic factors**
    Flow modification
    Permanent Inundation
  - **Water Quality**
    Water Quality Modification
    Sediment load modification
  - **Hydraulic/Geomorphic**
    Canalisation
    Topographic Alteration
  - **Biota**
    Terrestrial Encroachment
    Indigenous Vegetation Removal
    Invasive plant encroachment
    Alien fauna
    Over utilisation of biota
- Carry out a high level investigation of the wetlands of the xx Catchment using GIS procedures to map the inferred/anticipated state of health of each wetland. Carry out sufficient field verification to establish the reliability of this assessment.
- Identify the wetlands of conservation priority including the following:
  1. Ramsar listed and strategic wetlands
  2. Wetlands in formally protected areas
  3. Wetlands known to provide important and abundant benefits
  4. Wetlands with special features
  5. Wetlands known to be under threat
  6. Other wetlands
- Obtain guidance from DWAF on the required level of assessment.
- Carry out high confidence surveys of all of those wetlands regarded as high conservation priority.
- Carry out low confidence surveys of a sub-sample of the remaining wetlands, stratified according to eco-region and hydrogeomorphological type and then randomly selected within strata
- Using historical reports and local knowledge, together with expert judgement, determine what the wetland's Natural characteristics would be
- Compile a database of the raw data describing each wetland assessed, and their interpretation into Present Ecological State Categories.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

- A report
- A database of raw data and Present Ecological State per wetland

Mode of Operation of the Consultant

The Consultant will, during execution of the assignment, be required to:

- Fully involve identified Client members of staff in all phases of the work

Assignment Duration

- The expected input is x man months over a period of x months.
- Start of the Assignment: The Assignment is expected to commence on the xxx.

Reports

Inception Report

- Within three (3.0) weeks of the commencement of the Assignment, the Consultant shall submit to the Client an Inception Report, which shall give, among other things, details of the Consultant's understanding of the Assignment and the approach to be adopted in carrying out the Assignment.

Progress Reports

- The Consultant will be required to submit a Progress Reports to the Client on the activities of the previous xx month/s in a format to be agreed with the Client. Meetings will be organized by the Consultant to present progress reports to the Client.

Draft Completion Report

- At least one month before completion of the Assignment the Consultant shall be required to submit a Draft Completion Report together with a preliminary GIS map of the wetlands in the Catchment. This report shall cover all main aspects of the work carried out and recommendations, problems experienced, etc.

Final Completion Report

- The Consultant will be expected to submit a Final Completion Report and wetland database within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach or methods used in the study. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used in the baseline study must be clearly identified.
- List of references and personal communications.
- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall make available any relevant reports and data in his custody.

Obligations of the Consultant

- Consultant staff should be adequately qualified and experienced in their fields.
- The Consultant shall be responsible for the production of the reports and database.

Required Consultant Expertise

The required consultant will have demonstrable competence, at least a xx qualification in an appropriate biological/ecological field with not less than xx years of relevant practical experience in the area of wetland assessment.

TERMS OF REFERENCE

4. Determination of the Ecological Reserve and recommendation of Objectives and Management Priorities for the Wetlands in the XX Catchment

Introduction and background

The xx CMA has recently undertaken a comprehensive planning exercise to ensure the proper conservation and management of wetlands in the xx Catchment. This was followed by a detailed inventory and survey of all wetlands greater than x hectares together with an assessment of the Present Ecological State of the wetlands in the catchment. It is now necessary to determine the Ecological Reserve and to recommend objectives for the ecological health of these wetlands so that management action can be properly directed.

Objectives of the Consultancy Service

To determine the Ecological Reserve and to recommend ecological health objectives for the wetlands (as a collective whole and for individual important wetlands) in the xx Catchment.

Scope of Work

1. Link the project to the requirements of the National Water Act (1998) in relation to the Protection of Water Resources and the RDM process.
2. Through a process of stakeholder consultation, recommend Class objectives for wetlands as a whole in the catchment – i.e. how many/what area in a Natural condition, how many in a Good condition etc.
3. Recommend Class objectives for special wetlands – prioritise these wetlands in order of urgency – based on their importance and sensitivity or the pressures that are being put on them.
4. In consultation with DWAF decide on the level of assessment
   - Rapid or comprehensive
   - Low or high confidence
5. Make use of benchmarks as described in the Guideline.
   - Give a considered description of the Natural Characteristics of the wetlands
   - Determine the Present Ecological State of individual wetlands based on existing measurements of health
   - Determine the importance and sensitivity of the wetlands
6. Once the Class has been decided by the DWAF office, determine the Reserve for each wetland as required.
7. Describe the recommended ecospecs (ecological specifications), in such a way that these can be integrated into the Resource Quality Objectives (RQOs).
8. Recommend measurable, verifiable Thresholds of Potential Concern.
9. Compile a report.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

1. A report documenting the approach and listing the objectives and priorities for wetlands in the xx Catchment
2. A report describing the recommended Ecological Reserve requirements for priority wetlands including all ecological data and analytical methods used.

Mode of Operation of the Consultant

The Consultant will, during execution of the assignment, be required to:

- Fully involve identified Client members of staff in all phases of the work.

Time Schedule and Reporting Requirements

Assignment Duration

- The expected input is x man months over a period of x months.
- Start of the Assignment: The Assignment is expected to commence on the xxx.

Reports

Inception Report

- Within three (3.0) weeks of the commencement of the Assignment, the Consultant shall submit to the Client an Inception Report, which shall give, among other things, details of the Consultant's understanding of the Assignment and the approach to be adopted in carrying out the Assignment.

Progress Reports

- The Consultant will be required to submit a Progress Reports to the Client on the activities of the previous xx month/s in a format to be agreed with the Client. Meetings will be organized by the Consultant to present progress reports to the Client.

Draft Completion Report

- At least one month before completion of the Assignment the Consultant shall be required to submit a Draft Completion Report on the wetlands in the Catchment. This report shall cover all main aspects of the work carried out and recommendations, problems experienced, etc.

Final Completion Report

- The Consultant will be expected to submit a Final Completion Report and wetland management guide within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach or methods used in the study. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used in the baseline study must be clearly identified.
- List of references and personal communications.
- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall make available any relevant reports and data in his custody.

Obligations of the Consultant

- Consultant staff should be adequately qualified and experienced in their fields.
- The Consultant will be expected to be fully familiar with previous work done on the wetlands in this catchment.
- The Consultant shall be responsible for the production of the reports and database.

Required Consultant Expertise

The required consultant will have demonstrable competence, at least a xx qualification in an appropriate biological/ecological field with not less than xx years of relevant practical experience in the area of wetland management.

TERMS OF REFERENCE

5. Design & establish a monitoring and reporting programme for wetlands in the xx Catchment

Introduction and background

The xx CMA has recently undertaken a comprehensive planning and implementation exercise to ensure the proper conservation and management of wetlands in the xx Catchment. An inventory and survey of all wetlands greater than x hectares together has been carried out together with an assessment of the Present Ecological State of the important wetlands in the catchment. Objectives for the management of wetlands in the area have also been set. In order to effectively manage the ecological health of all of these wetlands, it is necessary to conduct ongoing monitoring of their health. A Consultant is required to design and initiate a monitoring and reporting programme in order to accomplish this.

Objectives of the Consultancy Service

To design and initiate a monitoring and reporting programme that will provide ongoing information on the ecological health of the wetlands in the xx Catchment and the flows of benefits associated with utilization of these wetlands, in such a way that this information can be integrated into relevant catchment, regional and national programmes.

Scope of Work

This project will include the design of a monitoring and reporting programme, followed by the initiation of the first monitoring survey. The project should include the following:

- Continuing from projects already completed that have inventoried, set priorities and objectives and have surveyed the Present Ecological State of the wetlands in the xx Catchment, design a monitoring programme for the wetlands of high and intermediate importance.
- The monitoring programme should provide relevant information on the following aspects of the wetlands:

  1. Hydrologic factors

  Flow modification

  Permanent Inundation

  2. Water Quality

  Water Quality Modification

  Sediment load modification

  3. Hydraulic/Geomorphic

  Canalisation

  Topographic Alteration

  4. Biota

  Terrestrial Encroachment

  Indigenous Vegetation Removal

  Invasive plant encroachment

  Alien fauna

  Over utilisation of biota

  5. Socio economic considerations, uses and benefits
- Intensity of monitoring should be recommended so that optimal information can be gained in the most cost-effective way.
- Having designed the programme to the satisfaction of the Client, the Service Provider will initiate the first stages of monitoring by overseeing the appointment of a contractor who will undertake the work for a period of x months. It is to be understood that the designer of the monitoring programme will have an equal and fair opportunity to take on the monitoring through the normal tender procedure.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

- A report describing the monitoring programme, including exact location of monitoring stations; sampling and analysis protocols; reporting templates and protocols.
- A strategy and appointed implementation agent.

Mode of Operation of the Consultant

The Consultant will, during execution of the assignment, be required to:

- Fully involve identified Client members of staff in all phases of the work.

Time Schedule and Reporting Requirements

Assignment Duration

- The expected input is x man months over a period of x months.
- Start of the Assignment: The Assignment is expected to commence on the xxx.

Reports

Draft Report

- At least one month before completion of the Assignment the Consultant shall be required to submit a Draft Completion Report on the design of the monitoring programme. This report shall cover all main aspects of the work carried out and recommendations, problems experienced, etc.

Final Completion Report

- The Consultant will be expected to submit a Final Completion Report within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach or methods used in the study. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used in the baseline study must be clearly identified.
- List of references and personal communications.
- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall make available any relevant reports and data in his custody.

Obligations of the Consultant

- Consultant staff should be adequately qualified and experienced in their fields.
- The Consultant will be expected to be fully familiar with previous work done on the wetlands in this catchment.
- The Consultant shall be responsible for the production of the reports.

Required Consultant Expertise

The required consultant will have demonstrable competence, at least a xx qualification in an appropriate biological/ecological field with not less than xx years of relevant practical experience in the area of wetland management and statistical design of environmental monitoring networks.

TERMS OF REFERENCE

6. Development and preparation of a Supporting Strategy that facilitates the inclusion of the protection, conservation and management of wetlands into the Catchment Management Strategy for Catchment xx.

Introduction and background

Wetlands are an essential part of the water resources of the xx Catchment. Their protection, conservation and management is well enshrined in the legal structures of South Africa, but in order in order for appropriate management actions to take place, wetlands have to be included in the Catchment Management Strategy of the xx CMA.

Objectives of the Consultancy Service

A Consultant is required to design a supporting strategy that will become part of the overall Catchment Management Strategy that is developed for the xx Catchment. The Consultant is also required to facilitate the process of integrating this strategy with the CMS.

Scope of Work

- This project will be based on direction given in the "Guidelines for Integrating the Protection, Conservation and Management of Wetlands into Catchment Management Planning" (WRC Report No. TT 220/03. Water Research Commission, Pretoria, South Africa).
- The consultant must:

  1. promote stakeholder consultation by strengthening the existing stakeholder groupings in the catchment with regard to their understanding and appreciation of wetlands issues.
  2. Carry out a preliminary situation assessment, to identify the wetlands, their functions, benefits and state of ecological health.
  3. Consider the in-house skills available at the xx CMA – bring skills in where necessary through forming collaborative partnerships with other responsible agencies and interested stakeholders.
  4. Synchronise wetland aspects with foundation and supporting strategies that operate at both a National level and a WMA or catchment level.
  5. Together with stakeholders, develop the vision for wetlands, consolidate and expand the knowledge base, set the land and water management objectives for wetlands and develop the necessary action plans at the catchment level as well as for individual wetlands.
  6. Draft the relevant documents and integrate with the Catchment Management Strategy process.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

- A Strategy document that seeks to protect, conserve and manage the wetlands of the xx Catchment.
- Practical steps for the inclusion of this strategy into the Catchment Management Strategy.

Mode of Operation of the Consultant

The Consultant will, during execution of the assignment, be required to:

- Fully involve identified Client members of staff in all phases of the work.

Time Schedule and Reporting Requirements

Assignment Duration

- The expected input is x man months over a period of x months.
- Start of the Assignment: The Assignment is expected to commence on the xxx.

Reports

Draft Report

- At least one month before completion of the Assignment the Consultant shall be required to submit a Draft Completion Report on the design of the Strategy. A report on progress towards full integration with the Catchment Management Strategy should be appended.

Final Completion Report

- The Consultant will be expected to submit a Final Completion Report within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach to the drafting of the Strategy. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used must be clearly identified.
- List of references and personal communications.
- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall make available any relevant reports and data in his custody.

Obligations of the Consultant

- Consultant staff should be adequately qualified and experienced in their fields.
- The Consultant will be expected to be fully familiar with previous work done on the wetlands in this catchment.
- The Consultant shall be responsible for the production of the reports.

Required Consultant Expertise

The required consultant will have demonstrable competence, at least a xx qualification in an appropriate environmental management field with not less than xx years of relevant practical experience in the area of water resource management.

TERMS OF REFERENCE

7. Implement the Protection, Conservation and Management of Wetlands in the XX Catchment

Introduction and background

The xx CMA has recently undertaken a comprehensive planning exercise to ensure the proper conservation and management of wetlands in the xx Catchment. An inventory and survey of all wetlands greater than x hectares has been carried out together with an assessment of the Present Ecological State of the important wetlands in the catchment. A monitoring and reporting programme has been designed and implemented in order to effectively manage the health of these wetlands. A contractor is required to implement wetland management activities in the xx Catchment as a whole but also more intensively in a pilot study in a smaller catchment to be nominated by the contractor.

Objectives of the Consultancy Service

To implement the protection, conservation and management of wetlands in the xx Catchment.

Scope of Work

This project will implement the planning already carried out by the CMA, with the intention of protecting, conserving and managing the wetlands in the xx Catchment.

The work should include the following:

- Make use of previous surveys and preliminary work already completed by the Client.
- Implement all phases of implementation including the following:

1. Facilitation of an active Stakeholder forum, integrated with current or proposed stakeholder fora related to water resources management, that will assist with the process of wetland management
2. Actively working together with Stakeholders, in particular landowners/holders and relevant Government Departments
3. Interpretation of information arising from surveys and monitoring
4. Develop action plans to manage the wetlands in the xx Catchment.
5. Continuous monitoring of progress to meet objectives for wetland management including performance in relation to Thresholds of Potential Concern
6. Review of progress and adaptation of all relevant guides, documents and information as well as the strategy itself to improve future performance.
7. Include in this component a pilot implementation project using a sub-catchment to be nominated by the contractor. The details of this project would be determined together with stakeholders and guided by the specific management objectives of the catchment. The role of the contractor is to provide facilitation and mentorship and to check that the necessary monitoring and review of implementation are being undertaken. The pilot would be designed to serve as a catalyst for local catchment stakeholders to develop further projects, for which they take a more self-mobilising role in all aspects of planning, implementing and monitoring.

Expected Outputs

At the end of this assignment, the Consultant is expected to submit to the Client:

- A report describing progress with the implementation of wetland protection, conservation and monitoring
- A report detailing a successful pilot implementation project
- A strategy for further work.

Mode of Operation of the Consultant

The Consultant will, during execution of the assignment, be required to:

- Fully involve identified Client members of staff in all phases of the work.

Time Schedule and Reporting Requirements

Assignment Duration

- The expected input is x man months over a period of x months.
- Start of the Assignment: The Assignment is expected to commence on the xxx.

Reports

- **Inception Report**
- Within three (3.0) weeks of the commencement of the Assignment, the Contractor shall submit to the Client an Inception Report, which shall give, among other things, details of the Contractors understanding of the Assignment and the approach to be adopted in carrying out the Assignment.
- **Progress Reports**
- The Contractor will be required to submit a Progress Reports to the Client on the activities of the previous xx month/s in a format to be agreed with the Client. Meetings will be organized by the Contractor to present progress reports to the Client.
- **Draft Report**
- At least one month before completion of the Assignment the Contractor shall be required to submit a Draft Completion Report on the success and progress of implementation. This report shall cover all main aspects of the work carried out and recommendations, problems experienced, etc.
- **Final Completion Report**
- The Consultant will be expected to submit a Final Completion Report within xx months of submitting the Draft Completion Report. The Final Report will incorporate the Client's comments.
- The report must start with a summary.
- The purpose of the document and its structure, including the terms of reference.
- A description of the approach to the implementation. Assumptions, constraints and limitations, sources of information and the appropriateness of the methods used must be clearly identified.
- List of references and personal communications.

- List of tables, figures, and appendices.

Reporting

The Consultant will be responsible to the xx person in the xx CMA for the successful completion of the Assignment.

Obligations of the Client

- The Client shall make available any relevant reports and data in his custody.

Obligations of the Consultant

- Contractor staff should be adequately qualified and experienced in their fields.
- The Contractor will be expected to be fully familiar with previous work done on the wetlands in this catchment.
- The Contractor shall be responsible for the execution of these TOR.

Required Consultant Expertise

The required contractor will have demonstrable competence and at least xx years of relevant practical experience in the area of wetland management.

GLOSSARY

Catchment: all the land area from mountaintop to seashore which is drained by a single river and its tributaries. Each catchment in South Africa has been sub-divided on a map into secondary, tertiary and quaternary sub-catchments. These sub-divided units provide an important basis for planning the management of catchments.

CMA: Catchment Management Agency – an institution named in the National Water Act of 1998.

CMS: Catchment Management Strategy

Co-operative governance: as provided in Chapter 3 of NEMA and Sections 41 and 146 (3) of the South African Constitution (Act 108 of 1996), all involved are required to exercise their powers and perform their functions in a manner that does not encroach on the geographical, functional or institutional integrity of the others but promotes mutual trust and good faith by informing and consulting one another on matters of common interest and adhering to agreed procedures to avoid duplication and non performance. This ensures that the environment is managed in an effective, transparent, accountable and coherent manner.

DEAT: Department of Environmental Affairs and Tourism, Pretoria, South Africa.

Delineation (of a wetland): to determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators (see definition of a wetland).

Depression: a basin shaped area of land lacking a natural outlet for water, which collects in the depression provided that it does not drain away through the soil (= pan).

DWAF: Department of Water Affairs and Forestry, Pretoria, South Africa.

Emergent plants: Erect, rooted herbaceous hydrophytes (e.g. common reed, bulrush).

Intergated Environmental Management (IEM): a tool to implement the objectives of NEMA, designed to promote the integration of environmental management principles into decision-making by ensuring a democratic, participatory, sustainable, equitable and accountable approach.

Floodplain: a flat expanse of land bordering a river channel, formed through sediment deposition and other alluvial processes, and often exhibiting characteristic features of a meandering channel (e.g. oxbow lakes). Most floodplains are characterized by frequent flooding as a result of bank overspill from the river channel.

Hillslope: a slope situated outside a valley bottom, where the colluvial (i.e. in response to gravity) movement of materials predominate.

Hydric soil: soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).

Hydrophyte: any plant that grows in water or on a substratum that is at least periodically deficient in oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.

Hydrology: the study of water, particularly the factors affecting its movement on land.

Infilling: dumping of soil or solid waste onto the wetland surface. Infilling generally has a very high and permanent impact on wetland functioning and is similar to drainage in that the upper soil layers are rendered less wet, usually so much so that the area no longer functions as a wetland.

Inventory: wetland inventory is the process of determining and recording where wetlands are, how many wetlands are in a given area, and their characteristics.

Marsh: a wetland dominated by emergent herbaceous vegetation (usually taller than 1 m), such as the common reed which may be seasonally wet but are usually permanently or semi-permanently wet.

Mitigate: to take actions to reduce the impact of a particular proposal.

Monitoring: the systematic collection of information over time in order to measure the extent of variation from a predetermined standard or position.

Mottles: soils with variegated colour patters are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.

NWA: National Water Act (1998). Department of Water Affairs and Forestry, Pretoria, South Africa.

Palustrine (wetland): non-tidal wetlands dominated by persistent emergent plants (e.g. reeds) emergent mosses or lichens, or shrubs or trees (see Cowardin et al., 1979).

Pan: endorheic (i.e. inward draining; lacking an outlet) basins typically circular, oval or kidney shaped, and usually intermittently to seasonally flooded and with a flat bottom.

Peat: organic soil material with a particularly high organic matter content which, depending on the definition, usually has at least 30% organic carbon by weight.

Ramsar Convention: an intergovernmental treaty which provides the framework for international cooperation for the conservation of wetland habitats.

Red Data species: all those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Rehabilitation (wetland): the reinstatement of these driving ecological functions to a level close to the original system (but seldom fully attaining it) so as to improve the wetland s capacity for providing services to society.

Riparian: the National Water Act defines riparian habitat as "the physical structure and associated vegetation of areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas." Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. where alluvium is periodically deposited by a stream during floods but which is well drained).

Runoff: total water yield from a catchment including surface and subsurface flow.

Rushes: a general term usually applied to plants of the genus Juncus.

Seasonally wet soil: soil which is flooded or waterlogged to the soil surface for extended periods during the wet season, but is predominantly dry during the dry season.

Sedges: Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses. Papyrus is a member of this family.

Soil saturation: the soil is considered saturated if the water table or capillary fringe reaches the soil surface resulting in the spaces between the soil particles being filled with water.

Stakeholders: the people or organizations that have a direct interest in a particular issue (e.g. a wetland).

Sustainable use: See Wise Use.

Swamp: wetland dominated by trees or shrubs (U.S. definition). In Europe, permanently flooded reed-dominated wetlands may also be referred to as swamps.

Toxicant: an agent or material capable of producing an adverse response in a biological system, seriously injuring structure and/or function or producing death.

Temporarily wet soil: soil which is flooded or saturated close (i.e. within 50 cm) to the surface for periods > 2 weeks during the wet season in most years. However, it is seldom flooded or saturated to the surface for longer than a month.

Vlei: a colloquial South African term for wetland.

WMA: Water Management Area

Water regime: When and for how long the soil is flooded or saturated.

Water quality: the purity of the water, determined by the combined effects of its physical attributes and its chemical constituents.

Waterlogged: soil or land saturated with water long enough for anaerobic conditions to develop.

Wetland: "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils." (South African National Water Act of 1998).

Wetland catchment: the area up-slope of the wetland from which water flows into the wetland and including the wetland itself.

Wetland delineation: the determination and marking of the boundary of a wetland on a map.

Wise use (of wetlands): synonymous with sustainable use. "Wise use" is defined by the Ramsar Convention on Wetlands as "human use of a wetland that yields the greatest continuous benefit to present generations while maintaining the potential to meet the needs and aspirations of future generations." Sustainable or wise use of a specific natural resource requires that use be within the resource's capacity to renew itself, i.e. it should not be beyond the resource's biological limits.


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