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## INTEGRATED CATCHMENT MANAGEMENT: BALANCING RESOURCE UTILIZATION AND CONSERVATION

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### Introduction

It is widely recognized that naturally occurring water usually can only be effectively and efficiently managed within a river basin or catchment area, because of the need to manage, or at least account for, all aspects of the hydrological cycle. This "catchment-based" approach helps to achieve a balance between the interdependent roles of resource protection and resource utilization.

In addition, it is important to recognize that a water resource includes not only the water but also the structural components (morphology, riparian and instream habitat) and the biotic components of the aquatic ecosystem. The resource is an ecological system, whose sustainability is dependent on the interactions between the physico-chemical attributes and the biotic attributes of the resource. Resource protection, utilisation and management must therefore be based on ecological principles.

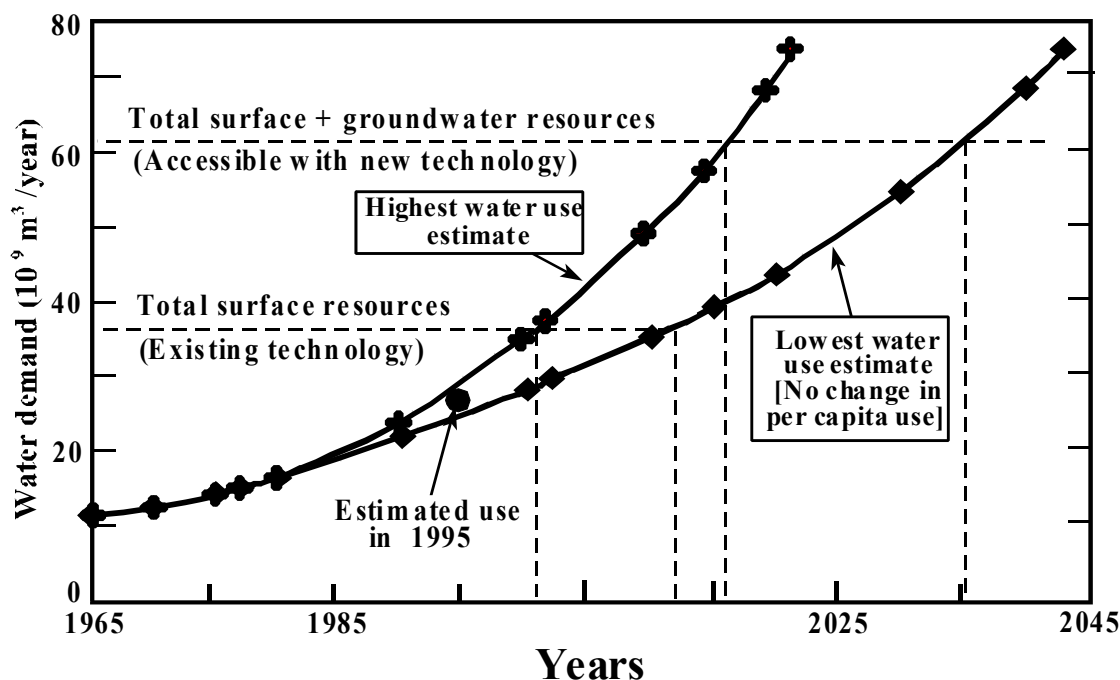
In South Africa, water is recognized as a strategic national resource, which is not equitably distributed in temporal or geographic terms. Thus, effective water resource management is crucial to the long-term development of the country and all its people. Accordingly, the protection, management and development of water resources are regarded as the responsibility of the National Government and the Department of Water Affairs & Forestry is recognized as the National custodian and trustee of the nation's water resources.

Land and water degradation, together with their subsequent impacts on land and water users, cannot easily be separated or managed independently of one another. This implies that co-ordinated and integrated planning and action is required at all levels, from national government through provincial authorities to individual landowners.

The scarcity and variability of the available water resources in South Africa, coupled with the country's need for economic growth and development, as well as social upliftment, presents water resource managers with a number of significant challenges. Typical challenges include the facts that catchments are often divided by provincial and other political or administrative boundaries, and that inter-basin transfers allow water to cross catchment boundaries. The situation is further complicated by the deterioration in the quality of South Africa's water resources as a result of both past and current developments. Predicted rates of minimum and maximum water usage illustrate the increasing pressure placed on our water resources (**Figure 1**).

Sweeping socio-economic and political changes have occurred in South Africa. Previous "command and control" approaches to water resources management, which were imposed unilaterally from a central government body, are no longer widely accepted by the general public. People now feel a growing need to participate in, and contribute to, decision-making processes, partly due to their lack of trust in previous delivery systems. In addition, the end users of any resource development project need to be closely involved in both the planning and management aspects to ensure that their concerns are taken into account and that they get appropriate delivery of the resource.

Whilst people should accept responsibility and accountability for participation in water resource management issues, the Department must also take up the responsibility for leadership and guidance, rather than control. As a consequence, water resource management processes need to become more people-oriented, rather than being dominated by purely technical considerations as in the past.



**Figure 1:** Projected highest and lowest rates of water use compared with the availability of existing ground and surface waters within South Africa, illustrating the severe time constraints imposed.

Against this background, an integrated approach to water resource management on a catchment basis entails:

- X seeing the catchment and the associated water as one system;
- X acknowledging both the direct and indirect effects that action in one part of the system, whether the land, water or atmospheric aspects, may have on other parts;
- X ensuring that actions taken by an agency or responsible body in one part (land, water or atmosphere) of the catchment are not taken in isolation from, or in conflict with, the actions of other agencies;
- X ensuring that actions are taken with due attention to the needs of other stakeholders in the catchment who may be affected, either directly or indirectly, by such actions.

### What is Integrated Catchment Management (ICM) ?

In its widest possible sense, ICM recognizes the need to integrate all environmental, economic and social issues within a river basin (or related to a river basin) into an overall management philosophy, process and strategy or plan. Thus ICM is aimed at deriving the greatest possible mix of sustainable benefits for future generations and the communities in the area of concern whilst protecting the natural resources upon which these communities rely.

Often, water resource managers have assumed that so-called "ICM" can be achieved merely through concerted efforts to control water use and protect the integrity of water resources within a catchment context. Whilst this approach has had some success, it ignores the complex issues of land use patterns and the varied roles played by stakeholders, communities and governments.

In reality, ICM focuses attention and actions on resource sustainability concepts. It is important to understand that, in its "ideal" sense, ICM is simultaneously seen as:

- X a *philosophy* or approach to resource management,
- X a "people-orientated" *management process*, and
- X a *product* or *implementation strategy* or *plan*, which seeks to achieve a sustainable balance between the utilization and protection of ALL environmental resources within a catchment, and also seeks to grow a sustainable society through stakeholder, community and Government partnerships in the management process.

In the past, these three perspectives of ICM have often been adopted individually instead of simultaneously. In some cases this has led to considerable confusion amongst groups of stakeholders who have each assumed that all other groups shared their perspective. It is only when each group understands the "true" or "ideal" characteristics of ICM, grasps the scope of the statutory and institutional structures that are required, and their individual roles within the process, that consensus is achieved and ICM can become a reality.

In practice, effective implementation of "ideal" ICM requires appropriate overarching statutory provisions, which direct attention towards the achievement of sustainable resource use. The activities of various bodies that can affect or influence water resource utilization and protection must be co-ordinated in such a way that all water and associated land-based resources can be managed in harmony so as to gain the full benefits of multipurpose use.

### Key principles and driving forces of ICM

Integrated Catchment Management (ICM) is based on five key principles or characteristics, which involve:

- X a *systems approach* which recognizes the individual components as well as the linkages between them, and addresses the needs of both the human and natural systems;
- X an *integrated approach*, rather than a comprehensive approach, in which attention is directed towards key issues of concern identified by all stakeholders in the process;
- X a *stakeholder approach* which recognizes the importance of involving individual citizens and landowners, as well as government agencies, in a participatory process to define all decisions around conservation and use of natural resources;
- X a *partnership approach* which promotes the search for common objectives, and defines the roles, responsibilities and accountabilities of each agency and individual who participates in the process of decision-making; and
- X a *balanced approach* where close attention is given to decisions designed to achieve a sustainable blend of economic development and protection of resource integrity, whilst meeting social norms and expectations.

In effect, the ICM approach seeks to maintain a balance between the competing pressures exerted by the need to maintain resource integrity in the long-term, against the compelling call for social upliftment and advancement, and the need for continuous economic growth and use of environmental resources. This concept is illustrated in **Figure 2**.

Six important characteristics have to be borne in mind for the practice of ICM to be truly effective and efficient, namely:

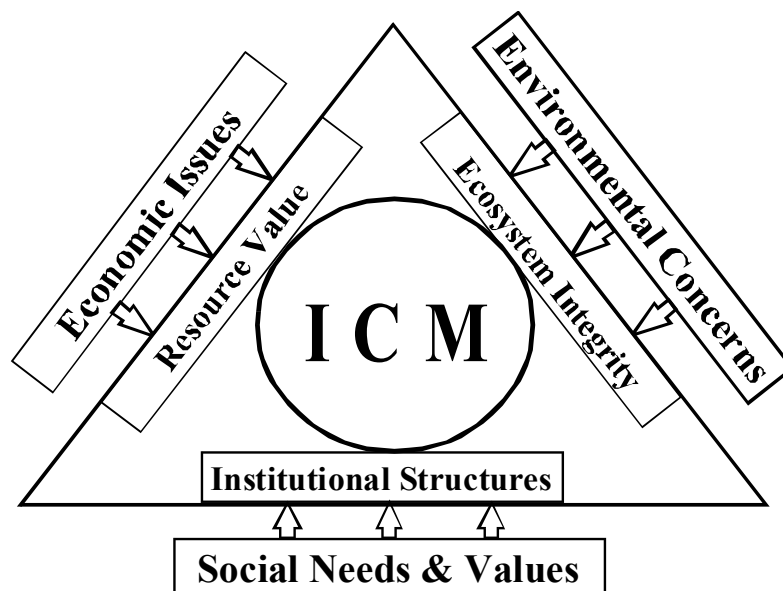
- X effective co-ordination of land and water management may have to extend beyond the normal "physical" boundaries of a single catchment;
- X all landowners and other stakeholders can and should play a significant role in ensuring effective resource management;
- X the relationships between stakeholders should be based on trust, with long-term commitment to, and continuity of, the catchment management process;
- X the definition of catchment boundaries may have to be flexible, depending on the definition of common issues of concern to stakeholders;
- X specific institutional arrangements may have to be flexible and adaptable within different catchments, to suit the particular circumstances of each situation; and
- X recognition that whilst ICM is a long-term process, realistic short- and medium-term goals are also necessary.

### Institutional and administrative requirements

The basic tenet of ICM is that responsibility and accountability must accompany any statutory power to manage a catchment. Clearly, successful execution of such responsibility requires appropriate levels of skills, expertise and judgement, whilst several important statutory and administrative requirements must be met before ICM can be implemented successfully, including:

- X a guiding "philosophy" at National level;

- X an "umbrella" or overarching National policy for ICM which bridges the line functions of different Government departments;
- X appropriate institutional and agency structures which are supported by legislation;
- X suitable mechanisms to resolve conflicts between National, Provincial and Local authorities and agencies; and
  - empowerment mechanisms for all participants.



**Figure 2:** Conceptual diagram illustrating the role of ICM in achieving and maintaining a balance between the competing pressures exerted on a water resource by environmental concerns, economic issues and social needs and values.

### The catchment management process in South Africa

The New South African Water Law strongly supports the idea that effective management of water resources encompasses management of the entire hydrological cycle. A river basin boundary would be that which includes water in all aspects of the hydrological cycle, through precipitation, into subsurface storage and along drainage lines, to the sea. The land area included in a river basin should include land through or over which water moves, and land on which human activities or disturbances create impacts that affect the quantity, quality or distribution of water in any phase of the hydrological cycle. A river basin could be made up of several catchments, either contiguous or nested within each other. An example could be the large Orange River basin, with its numerous (smaller) component catchments such as the Vaal, Modder, Senqu, Hartz, etc..

### Role of the Department of Water Affairs and Forestry

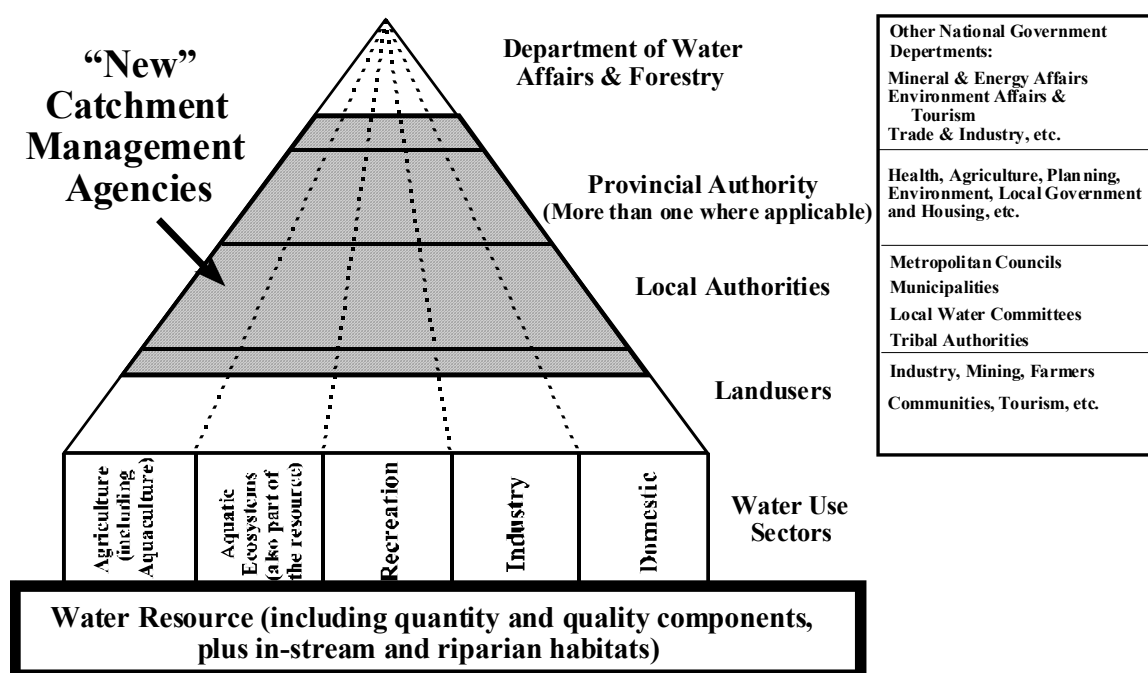
The water resource of South Africa is recognized as a critically important national asset that is under ever-increasing pressure from competing water users. Accordingly, the country's water resource must be managed effectively and efficiently so as to bring maximum long-term benefit to the country as a whole. The Department of Water Affairs & Forestry (DWAF) is recognized as the custodian of these resources and has a national responsibility to ensure that both the basic (survival) needs of the people are met, whilst ensuring that sufficient resources are available to meet the demands for additional water that is required to sustain the anticipated growth in the national economy.

The role of the Department in relation to the water sector can be segmented into two distinct, but closely related, functional areas:

- X Providing equitable access to the resource to ensure optimal economic and social development, including access to water and sanitation services for all citizens. This is the Department's main priority and takes precedence over any economic development objectives; and

- X Managing the resource, as well as the demands made on the resource, both to protect the resource and to ensure sustainable and equitable use by current and future generations. This is reflected in the Department's mission statement of "ensuring some for all, ... forever".

The Department has an important leadership role and responsibility to set in place national strategies for long-term water resource management. The Department provides leadership, technical guidance and a resource management framework, based on important principles such as minimum standards, environmental protection and waste minimization. Provincial governments and local authorities are expected to address local and regional issues and to take appropriate responsibility for decisions within this management framework (**Figure 3**).



**Figure 3:** Conceptual diagram illustrating the role of the Department of Water Affairs & Forestry and its interactions with the new Catchment Management Agencies, as well as with other role players.

### Historical context

Over the past two decades, the widespread and growing concern over South Africa's scarce water resources has been matched by a growing awareness of the complexity of the processes and interactions required to manage these resources so that they can sustain the growing demands made on them. Since the early 1980's water resource managers within the Department of Water Affairs & Forestry have come to realize and accept that effective water resource management requires an integrated approach based on logical hydrological units.

However, the relatively narrow segmentation of functions and responsibilities between different Government departments, and the lack of effective inter-Departmental collaboration, had the result that many land use activities which affect water resources and water quality were outside the influence of the Department of Water Affairs & Forestry. This confined the Department's focus purely to that of water resource management. Since there was no co-ordinated administrative or management system that allowed the catchment processes and activities which affect water resources to be addressed, the process was often ineffective.

Within the Department, the earlier lack of shared understanding of exactly what ICM really is, or could be, resulted in a rather *ad hoc* approach which focussed on specific hydrological issues, water quality modelling on a small scale and assessments of the impacts of effluent discharges. For example, the introduction and implementation of systems analysis techniques enabled water supply and risk to be evaluated stochastically on a regional or whole catchment basis. Whilst this helped to alleviate many

water supply problems, it largely ignored the critical issue of the flow and water quality requirements of aquatic ecosystems.

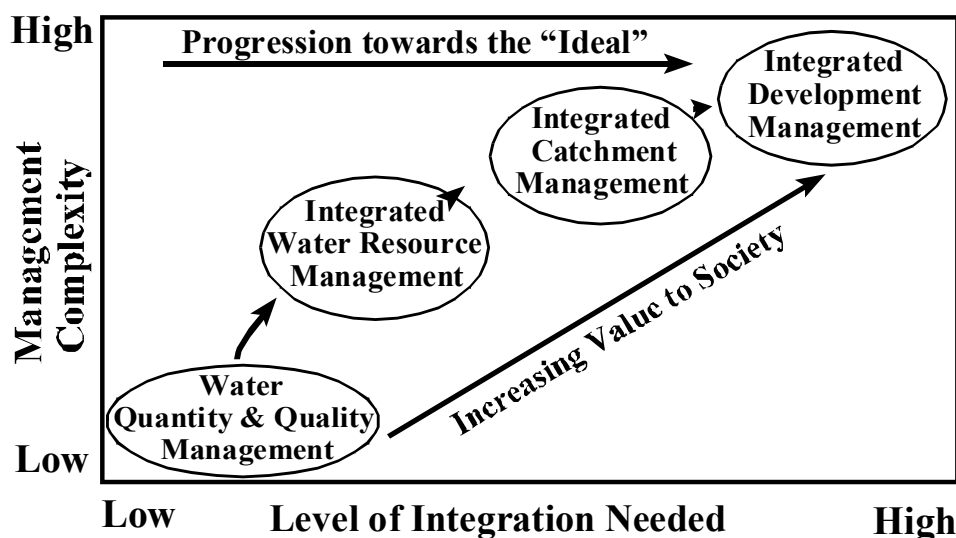
The absence of suitable institutional structures and the presence of an inappropriate legal framework also prevented adequate involvement of the public in decisions around the wider socio-economic implications of development and resource management actions. In many cases, the public were informed of impending management actions on an *ad hoc* basis, rather than participating in a management system based on shared responsibility and joint decision-making.

This lack of effective public participation was accentuated in those situations where the general public either did not understand the issues at stake or were unable to participate properly, either because they were uncertain as to their roles and responsibilities or because they lacked appropriate information. At the same time, continued rapid and uncontrolled urbanization and development, coupled with inadequate provision of water supply and sanitation systems, has led to over-exploitation of our water resources. Overall, therefore, the ICM approach to water resource management cannot be considered to have been successfully implemented in South Africa.

### Current context

Against this historical background, the status of ICM in South Africa can be summarized as follows:

- X ICM has been accepted as an "ideal" way in which natural resources can be managed in a whole catchment context. However, the absence of appropriate statutory and institutional structures means that the ICM approach is not yet feasible in South Africa;
- X the segmented line function responsibilities of the different Government departments preclude the implementation of "ideal" ICM approaches at the present time;
- X the Department has taken a decision to adopt an Integrated Water Resource Management (IWRM) approach in place of ICM. The IWRM approach is seen to be appropriate under the prevailing circumstances since it is less complicated than "ideal" ICM and can be "upgraded" towards "ideal" ICM should alternative institutional and statutory structures be developed in future (Figure 4); and
- X Suitable statutory and administrative structures have been created to enable the IWRM approach to be implemented across South Africa.
- X Nineteen Water Management Areas (WMAs) have been delineated across South Africa. One Catchment Management Agency (CMA) will be formed in each WMA with responsibility for management of all aspects of water use and conservation within that WMA.



**Figure 4:** Diagrammatic representation of the relationship between IWRM and ICM, in relation to the level of management complexity and level of integration required. In order to build on this position and achieve successful implementation of IWRM approaches to

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catchment management in South Africa, the Department needs to attain three strategic objectives:

- X a coherent national catchment management policy must be formulated to provide a common understanding of aims and approaches;
- X the IWRM approaches need to be implemented at catchment level in suitable "pilot catchments" so that water resource managers can obtain the necessary "hands on" experience which, in turn, will guide further implementation in other catchments; and
- X the IWRM approaches must be promoted at both National and catchment levels so as to provide the necessary links between National water resource management strategy, catchment management actions and other management and institutional functions.

### **Integrated Water Resource Management (IWRM)**

Integrated water resource management is the systematic use of technical and non-technical measures and activities to ensure the effective and efficient management of water resources. The primary goal of IWRM must be to optimize the relationship between the capacity of the available resources to provide sustainable services, such as water of a given quantity and quality (which must be protected because it is required to meet basic human needs), and utilization of the resource, including consumptive and non-consumptive uses and waste disposal.

The process of IWRM involves managing on a sustainable basis the complex inter-relationships and interactions between ecological systems, land use activities and water which characterize and control the water resource. The people who use the resource, as well as the people and institutions who are responsible for developing and managing the resource, have to be included in the process.

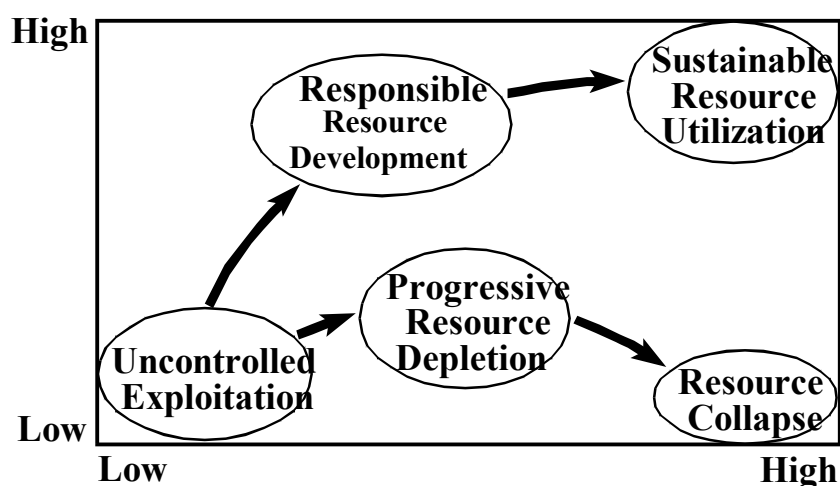
Current international trends towards policies of "sustainable development" and "sustainable resource management" reflect a growing commitment to the principle of stewardship at all levels of strategic and operational management. The principle of stewardship implies a responsibility to consider the welfare, needs and aspirations of the current generation, without prejudicing those of future generations.

Sustainable development can be defined broadly as development that meets the needs of the present without compromising the ability of future generations to meet their own aspirations and needs. Four elements comprise the key concepts embodied in sustainable development:

- X the need to take into consideration the needs of present and future generations;
- X the acceptance of limits placed upon the level of use and exploitation of natural resources, on the grounds that this is the only way to protect the capability of the resource for use and exploitation in the long-term;
- X equity principles in the allocation of rights and obligations, also imply that the access to, and use of a resource, by one user must take into account these needs of other users; and
- X the need to ensure that environmental considerations are integrated into economic and other development plans and that development needs are taken into account in setting environmental objectives.

In the context of water resources, the concept of sustainable resource use is one where, with effective management, the rate of resource withdrawal, use, consumption or depletion should always be balanced (or preferably exceeded) by the rate of resource replenishment. In the process, the selected and agreed characteristics of the resource (e.g. water quality, biological diversity, degree of resilience to external disturbance or change) should also be maintained. Failure to achieve these objectives will result in collapse of the resource base (**Figure 5**).

The general principle that the development and use of water and other natural resources should take place in a manner that ensures sustainability of the resource has become one of the central objectives of international natural resource and environmental policy since 1980. Clearly, sustainable development should not be confused with zero growth. Rather, it entails achieving a balance or compromise between protecting the ecological resource base and allowing economic growth to take place through a rational and carefully managed use of the available resources. This does not imply merely setting limits on economic activity in the interests of preserving the environment, but is instead an approach to development that emphasizes the fundamental importance of open participation and equity within the economic system.



**Figure 5:** Conceptual diagram showing the consequences for resource sustainability in terms of the level of resource management required and the vulnerability of the resource to degradation.

To develop and manage water resources effectively, it is necessary that a balance be achieved between the legitimate competing demands placed on the resource. At the same time, interference with the natural hydrological cycle, and the disruption of ecological processes, should be minimized since these are critically important to the sustainability of the resource. Whilst this is relatively simple in concept, it is far more difficult to achieve this balance in practice. Indeed, a failing with many water resource management strategies worldwide is that, whilst they are able to adequately represent the correct aspirations for management of the resource, they are often unable to deliver the product on the ground to the satisfaction of the end-users. This is most often due to the fact that the end-users, or the people who are most affected by the management decisions, have not been adequately involved in the decision-making process.

The need to protect the water resource in perpetuity whilst at the same time ensuring sustained and effective utilization of the resource can be considered to be conflicting management functions. Whilst this is often true, sustained utilization of the water resource is only possible if the level of protection afforded to the resource is adequate. This balance can only be achieved when there is good interactive dialogue between all parties so that their needs, capabilities and concerns are clearly understood at all stages of the process.

### Catchment management plans and strategies

The use of catchment management plans and strategies which have been developed by community-based or other publicly accepted participation processes will help to resolve potential conflicts through fostering a better understanding of the positions, aspirations, needs and vulnerabilities of each stakeholder. This process tends to alter the focus of negotiation and discussion away from the primary *goals* of the management plan, to one that is concerned with *how the goals will be decided and achieved*. Conflict can be reduced or resolved if the focus is placed rather on *how people decide* on the goals. World wide there is evidence that people do not support decisions in which they feel they have not been able to have some influence or participation.

### Management frameworks

In outline, a catchment management strategy or plan is based on four interlocking frameworks:

- X a *policy framework* which outlines the context and aims of the strategy or plan;
- X an *administrative framework* which describes the legal, institutional and financial arrangements which provide guidance to the strategy or plan;
- X a *regulatory framework* which specifies discrete objectives and methods for managing the catchment; and

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- X a *procedural framework* which details the specific programmes and procedures for ongoing catchment management.

### Implementation

Within the context created by these frameworks, the catchment management process consists, in essence, of seven discrete steps that are implemented iteratively and repetitively:

- X *initiation* - where all stakeholders reach consensus on the identification of key water-related issues of concern;
- X *assessment* - where technical specialists confirm any cause-effect relationships that may be associated with the issues of concern;
- X *planning* - where consensus is reached amongst stakeholders as to the appropriate plans needed to address the respective problem areas;
- X *implementation* - where the Catchment Management Agency, or other responsible authority, carries out the action plans and strategies;
- X *administration* - where the Catchment Management Agency, or other appropriate management institution, oversees the actions and refines the action plans if necessary;
- X *monitor* - the Catchment Management Agency gathers appropriate information on key aspects related to the water resource and to the problem areas of concern; and
- X *review and audit* - where Catchment Management Agency and stakeholder representatives undertake periodic assessment and review of the success or failure of the action plans.

### Preconditions

Successful implementation of the catchment management process depends on several general preconditions. The most important of these include:

- X there must be clear statutory support for catchment management in the Water Law, as well as the political will for its full implementation;
- X the Department must promote a coherent catchment management policy, which must be accepted by all stakeholders and Departmental personnel;
- X the Department should undergo appropriate restructuring at both National and Regional levels to facilitate full implementation of catchment management;
- X there must be adequate intra-Departmental (internal) communication and co-ordination to support catchment management activities;
- X adequate human and financial resources must be available within South Africa and within the Department in order to successfully implement catchment management; and
- X effective inter-Departmental (external) collaboration must be fostered if catchment management is to be implemented effectively.

### **Critical success factors**

Successful implementation of IWRM in South Africa is dependent upon several critically important factors. Briefly, these can be summarized as:

- X effective *statutory and administrative frameworks* that provide all agencies and stakeholders with an appropriate context for catchment management are in place and are upheld by National Government Departments;
- X all stakeholders are committed to *full participation* in the catchment management process;
- X *effective communication processes* are in place such that all stakeholders are fully informed of their roles and responsibilities and are empowered to participate in the process;
- X all participants share a *common understanding* of the prevailing *resource constraints* (water, time, money, personnel) and this understanding forms the consensual basis for a shared concern that resource allocation is appropriate and sustainable;
- X the principle of *equitable resource allocation* and use is the basis for all decisions around choices of preferred resource use; and
- X all participants *share the responsibility and accountability* for the outcomes of the decision-making process.

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### Institutional factors

It is also extremely important to address a series of institutional issues that, if successful, will pave the way for successful implementation of IWRM. These are:

- X agency structures and staffing profiles should be appropriate for the scale and complexity of the tasks to be undertaken;
- X appropriate administrative processes are selected to match the scale of the catchment to be managed;
- X the feasibility of the Catchment Management Agency's business structure must be assessed against appropriate technical, financial and equity criteria;
- X there should be absolute clarity around the role and responsibility of the Catchment Management Agency in terms of prevailing legislation and local regulations;
- X firm guidance should be available in the form of operational procedures and technical guidelines to facilitate implementation of IWRM; and
- X the roles and responsibilities of relevant Provincial and Local Authorities in the catchment management process have been clearly defined.

### Integrative factors

In addition to these institutional issues, staff and water resource managers of the Department of Water Affairs & Forestry will need to develop and demonstrate the following integrative abilities:

- X the ability to manage and guide multi-stakeholder decision-making processes, using appropriate technical approaches such as multi-criteria analysis where necessary, but also relying on "softer" skills in communication, negotiation, and participation.
- X the ability to undertake or manage appropriate environmental impact analysis and assessments for proposed water resource development projects;
- X competence in appropriate cost-benefit analysis techniques for the evaluation of the social, economic and environmental consequences of proposed management actions;
- X a clear demonstration of technical leadership and the ability to guide and assist others to achieve their objectives; and
- X the ability to manage multi-disciplinary teams effectively so that the outcomes of their activities can be integrated into a comprehensive and understandable product.

### **Conclusions**

Against this background discussion, the following conclusions can be drawn with regard to the situation of catchment management, and more particularly IWRM, in South Africa:

- X The new Water Act provides a firm philosophical, policy and strategic foundation for the successful implementation of IWRM in South Africa;
- X Water resource managers and a rapidly growing number of authorities, agencies and stakeholders now have a far better understanding of the implications of catchment management and agree that the IWRM approach is feasible;
- X The Department of Water Affairs & Forestry has formulated a series of guidelines and principles for the constitution of appropriate institutional structures;
- X Most of the technical strategies and "tools" required for effective implementation of IWRM have either been developed or are under development; and
- X Stakeholders within many catchments have begun to mobilize themselves to ensure effective participation in the IWRM process, though there is still room for greater participation and commitment by all parties.

Clearly, if any form of catchment management is to succeed in South Africa, there must be a far wider acceptance of the need to properly empower people so that they can participate in a transparent decision-making process. This will require a dramatic change in attitude and approach, both amongst the general public and from our water resource managers. At this crucially important time in the history of South Africa, we have the unique opportunity to facilitate this change as an integral part of the socio-economic reconstruction and development of our society. However, IWRM and, ultimately, ICM, will not succeed if suitable legal, institutional and administrative frameworks do not support the approach. Unfortunately, this

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will take both time and money to accomplish as we are still at an early stage in the development phase.

## References

Large parts of the discussion and description of ICM processes described above have been drawn from three key documents. These are:

Ashton, P.J. & H.M. MacKay (1996). *The Philosophy and Practice of Integrated Catchment Management: Implications for Water Resource Management in South Africa. A Discussion Document*. Water Research Commission and Department of Water Affairs & Forestry, Pretoria. 128 pp.

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