DISCUSSION PAPER ON

CROSS-SECTOR POLICY OBJECTIVES FOR CONSERVING SOUTH AFRICA'S INLAND WATER BIODIVERSITY

Report to the
Water Research Commission
by

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Name	Organisation*	Cross-sector meetings	
		8 Sep 2005	22 Feb 2006
Ms Alétia Albertus	DWAF	✓	
Dr Harry Biggs	SANParks		✓
Mr Alex Botha	DLA		✓
Mr Thys Botha	DoA	✓	
Dr Geoff Cowan	DEAT	✓	
Mr John Dini	SANBI		✓
Ms Amanda Driver	SANBI		✓
Mr Koos du Plessis	DoA	✓	
Dr Quentin Espey	DWAF	✓	
Mr Llewellyn Foxcroft	SANParks		✓
Dr Howard Hendricks	SANParks	✓	
Ms Mamogala Kadiaka	DWAF	✓	✓
Mr Ahmed Khan	DWAF		✓
Mr David Kleyn	DoA	✓	
Dr Neels Kleynhans	DWAF		✓
Dr Stanley Liphadzi	WRC	✓	
Ms Wilma Lutsch	DEAT	✓	✓
Mr Freddy Mamuremi	DPLG	✓	
Dr Steve Mitchell	WRC	✓	✓
Mr Edward Netshithothole	DEAT	✓	✓
Mr Harrison Pienaar	DWAF	✓	✓
Mr Bill Rowlston	DWAF	✓	✓
Ms Barbara Schreiner	DWAF	✓	✓
Ms Leseho Sello	DEAT	✓	
Mr Keith Taylor	DoA	✓	✓
Mr Johan van Rooyen	DWAF	✓	✓

*see list of acronyms

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EXECUTIVE SUMMARY

INTRODUCTION

In South Africa, the responsibility for conserving inland water ecosystems is shared between several segments or sectors of society and departments of government, with the result that there is often a considerable overlap of mandates. Departments that are responsible for water resource protection and management, biodiversity conservation, land use management, and integrated development planning are all key role players and their cooperative actions are necessary if inland water ecosystems and their biodiversity are to be managed effectively.

A central feature of this project has been its focus on facilitating cross-sector engagement. To this end, a first cross-sector meeting was held on 8 September 2005. Representatives of various departments of national government and other organs of state (see acknowledgements) deliberated a set of policy objectives contained in a draft discussion paper. The policy objectives were revised to incorporate the comments, discussion and recommendations arising from the meeting of 8 September 2005. The revised discussion paper was circulated to a number of national and international specialists and conservation practitioners for review. The comments and additions received from these reviewers (see acknowledgements for names) were incorporated into a further draft of the discussion paper. This draft was then tabled for consideration by the cross-sector representatives during a second meeting that was held on 22 February 2006. The contents of this final version of the discussion paper have been approved by the representatives (see acknowledgements) that attended the February meeting.

The primary purpose of this discussion paper is to support the development of shared (i.e. inter-departmental) policy objectives and guiding principles that will promote the practical conservation of inland water biodiversity across multiple sectors and spheres of government. The paper contains detailed discussions of both the policy and scientific contexts that underpin the conservation of freshwater biodiversity, in order to inform and support a process of shared learning and decision-making in this field. The paper reflects the outcomes that have been achieved to date from the processes of analysis, consultation and deliberation that have taken place amongst the representatives of the main agencies that have primary responsibility for conserving freshwater biodiversity. Ideally, this should lead to consensus on a common policy statement and a cooperative implementation plan for the conservation of inland water biodiversity in South Africa.

BIODIVERSITY SCIENCE AND MANAGEMENT

Loss of biodiversity inevitably leads to ecosystem degradation and subsequent loss of important ecosystem services. Moreover, this loss tends to harm poor rural communities more directly, since they have limited assets and infrastructure and are more directly dependent on common property resources for their livelihoods. In contrast, the wealthy are buffered against loss of ecosystem services by being able to purchase basic necessities and scarce commodities. Our path towards sustainable development, poverty alleviation and enhanced human well-being for all, is therefore dependent on how effectively we are able to manage and protect natural resources including biodiversity.

The value of and need for biodiversity conservation is summarised by The Paris Declaration on Biodiversity (see Section 3.9) as follows: "*Biodiversity, as the natural heritage and a vital resource for all humankind:*

- *Is a source of aesthetic, spiritual, cultural, and recreational values;*
- *Provides goods that have direct use values, such as food, wood, textiles and pharmaceuticals;*
- *Supports and enhances ecosystem services on which human societies depend often indirectly, such as plant and animal production, crop pollination, maintenance of water quality and soil fertility, carbon sequestration, nutrient cycling, protection against pathogens and diseases, and resistance of ecosystems to disturbances and environmental changes; and*
- *Provides opportunities for human societies to adapt to changing needs and circumstances, and discover new products and technologies*."

Biodiversity is an umbrella term that refers to the variety of all life on Earth, and encompasses genetic, species and ecosystem (including habitat) diversity. Today's biodiversity is the result of millions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. While some two million species have been identified and described to date, scientists estimate that there are between three and 100 million species on Earth.

Because of its broad scope and multi-dimensional nature, biodiversity studies have the potential to serve a unifying role that transcends different disciplines. For example, biodiversity integrates ecology with evolution and biogeography. At the ecological scale, biodiversity integrates structure with function and biotic variables with abiotic variables. It also links spatial and temporal phenomena across hierarchical scales and levels of biological organisation (Ward and Tockner, 2001).

A central tenet of biodiversity conservation is to set aside representative examples of ecosystems to act as "biodiversity banks" as a proactive protection against potential future modifications. Such conserved areas become heritage resources for sharing the current biodiversity heritage with future generations, as well as benchmarks against which human modification of ecosystems can be measured in the long-term. Several international agreements address this issue at global and regional levels, and there is a range of relevant policy and legislation in place in South Africa (see Chapters 4 and 5 of this discussion paper).

International as well as local studies confirm that inland water biodiversity is generally in a poorer state and more endangered than terrestrial biodiversity. Two factors make the conservation of inland water biodiversity particularly challenging in comparison to efforts aimed at conserving terrestrial biodiversity. Firstly, while protected areas can support partial cessation of inland water habitat degradation and associated biodiversity loss, the design of protected areas is generally biased towards terrestrial biodiversity features, with inland water ecosystems being addressed only incidentally as part of their inclusion within terrestrial reserves. Even where inland water systems are included in such planning exercises, this is typically done to serve terrestrial conservation goals.

Secondly, the longitudinal nature of rivers and the relatively large size of most river basins makes it difficult to include whole catchments or the entire length of a river (e.g. greater than third order) within formally protected areas. In addition, rivers are often used as a convenient way to designate the boundaries of parks or protected areas. This partial inclusion in a protected area is no guarantee for protection, since impacts that take place outside park boundaries can still have negative

consequences for riverine biodiversity within the park. A good example of this can be seen in the Kruger National Park, South Africa's flagship national park. Rivers in the region of the Kruger National Park flow in an east-west direction, whilst the park spans the landscape in a north-south direction. This means that all the larger rivers flow through the park, rather than being contained within the park.

Experiences around the world confirm that *ad hoc* conservation efforts have failed to conserve the diversity of our biodiversity heritage. Without the adoption of a new management philosophy and approach, this trend is likely to continue. To address the need for a more proactive and systematic focus on inland water biodiversity, a relatively new discipline of "freshwater conservation planning" has emerged. This requires truly trans-disciplinary approaches, and draws on insights from the fields of systematic conservation planning, ecology and conservation biology, aquatic ecology (including hydrology, biology, geomorphology), water resources planning and management, and spatial information technology.

Conservation planning began as a discipline that was developed specifically for the purposes of selecting formal protected areas, with a focus on terrestrial biodiversity. Over the years this narrow focus has broadened in two significant ways that have made the field more accessible to conservation planning for inland water ecosystems. First, the process of selecting conservation areas began to consider a full range of conservation management options – as opposed to focusing on formal protected areas only, thereby supporting the concept of maintaining and utilising biodiversity within a multiple use landscape. This paradigm shift is more appropriate in the context of conserving inland water ecosystems, as conserving these ecosystems requires management of whole catchments, and it is seldom feasible to incorporate entire catchments into protected areas. Secondly, it became clear that representing a sample of all biodiversity patterns needed to be supplemented with explicit incorporation of biodiversity processes. This notion is particularly applicable to conserving inland water ecosystems, which rely heavily on the maintenance of processes that depend on longitudinal, lateral, and vertical connectivity.

Conservation planning also requires that biodiversity should be depicted in some operational way, generally requiring the use of biodiversity surrogates that can serve as proxies for biodiversity pattern. The derivation of meaningful surrogates for inland water biodiversity has been one of the main challenges in this newly developing field. There are inherent problems when using species data as biodiversity surrogates, primarily because these data are even less complete than the data available for terrestrial species. Problems with incomplete data, collection bias and incomplete taxonomic understanding can drive conservation planners to select areas that are well sampled, whilst ignoring areas that might be important but have no data. Terrestrial conservation plans have circumvented this by classifying the landscape according to vegetation types or broad habitat types and using this as the primary biodiversity surrogate in selecting areas (although ideally this should be supplemented with species data). However, classifying inland water ecosystems across the landscape has remained elusive, mainly because it is more difficult to depict inland water ecosystems in a spatially explicit manner because of the highly dynamic nature of water resources in both time and space. It is only in recent years that hierarchical procedures for systematically classifying inland water ecosystems have been developed (see Section 8). Deriving such classifications to depict biodiversity has provided further impetus for the application of conservation planning principles and tools to inland water ecosystems.

INTERNATIONAL, REGIONAL AND NATIONAL POLICY CONTEXTS

An extensive body of international, regional and national policies and treaties exists that relate to the conservation of inland water ecosystems. These treaties and policies reflect certain societal norms, values and aspirations; the nations that subscribe to them are legally and morally bound to give effect to their principles and objectives.

Where South Africa is a signatory to an international treaty or convention, all organs of state should embrace the associated responsibilities and implications. In the cascading down of policy from international to national contexts, and especially where an issue of concern may involve more than one sector, it is critically important to pay close attention to policy coherence. Policy coherence has two dimensions, namely vertical coherence and horizontal coherence. Vertical policy coherence entails ensuring that local and provincial authorities pursue policies that are aligned with and support, and do not undermine, national policies; and that individual nations pursue policies that support regional and / or international policies and treaties. Horizontal policy coherence entails achieving a complementary consistency of policies across related sectors at any particular level. As an example, the policy interests of this discussion paper would require coherence in the expression of objectives regarding land use and ecosystem protection across the water, industry, health, biodiversity, environmental management and agricultural sectors.

International biodiversity governance

South Africa has been, and continues to be, involved in international efforts related to biodiversity governance to different degrees and in different ways. The nature of this involvement has influenced the development of national policy and legislation, as described in more detail in Section 4 of this document. The mandates, obligations and responsibilities arising from the following international conferences, governance bodies, treaties and conventions are considered in Section 3 of the discussion paper:

- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (also known as the Ramsar Convention), signed in Ramsar, Iran in 1971;
- The United Nations Conference on the Human Environment (5-9 June 1972, Stockholm, Sweden) and United Nations Environment Programme;
- The Brundtland Report published by the World Commission on Environment and Development in 1987;
- The United Nations Conference on Sustainable Development or “Earth Summit” (3-14 June 1992, Rio de Janeiro, Brazil) and its Agenda 21;
- The Convention on Biological Diversity (1994);
- The Cartagena Protocol on Biosafety (2003);
- The United Nations Millennium Summit (6-8 September 200, New York, USA) and its eight Millennium Development Goals;
- The World Summit on Sustainable Development (26 August to 4 September 2002, Johannesburg, South Africa); and
- The International Conference on Biodiversity Science and Governance (24-28 January 2005, Paris, France) and its Paris Declaration on Biodiversity.

Regional and national policy context

The most relevant regional initiatives for achieving coherence at regional level are the New Partnership for Africa’s Development (NePAD) and the Southern African Development Community (SADC). NePAD spells out the vision of African leaders to eradicate poverty and to place their countries, individually and collectively, on a path

of sustainable growth and development. It provides the overarching trans-national strategy that will influence future development and management of Africa's natural resource base. It has been recognized that a healthy and productive environment is a prerequisite for the success of NePAD, together with the need to systematically address and sustain ecosystems, biodiversity and wildlife. SADC (with member states Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe) aspires to achieve development and economic growth, alleviate poverty, enhance the standard and quality of life of the people of southern Africa, and support socially disadvantaged groups through regional integration. Article 5(g) of the SADC Treaty aims to achieve the sustainable utilization of natural resources and to effectively protect the environment.

At the national level, South African environmental policies and legislation have been influenced by international trends in the environmental field, and by South Africa's obligations as a Contracting Party to several multi-lateral environmental agreements. In addition, domestic priorities have been equally significant in catalysing changes in policies. Since 1994, South African government policy has focused on equitable and sustainable social and economic development for the benefit of all South Africa's people. At the time (1994), many of South Africa's existing laws were not appropriate to achieving these objectives. Therefore, the policy and legal framework in South Africa has been thoroughly reviewed and re-aligned with the new direction set out by government. In the water and environmental sectors, previously fragmented policies have been consolidated and re-formulated in accordance with principles of sustainable development and equitable access, to allow all South Africans to benefit from improved access to and use of these resources.

Section 4 presents an overview of the major post-1994 developments that took place, often concurrently, in the water, environmental, agricultural and land planning sectors. Several of these developments are convergent in the sense that they share a common philosophy, and support the development of cross-sector policy for the conservation of inland water biodiversity. However, the necessary next step is to develop shared operational plans, objectives and approaches that are in accordance with the common philosophy – it is this step that is the focus of this discussion paper.

In order to achieve horizontal alignment and agreement on the conservation of inland water biodiversity in South Africa, it is essential to build common understanding of terminology, key concepts and strategic intent across the water resource management, environmental and biodiversity management, land use, agriculture and integrated development planning sectors. For this purpose, a concerted effort was made to highlight those issues that are embedded in relevant national policy and legislation and that are fundamental to the conservation of inland water biodiversity.

NATIONAL CONSERVATION GOAL

From a purely practical perspective, it is simply not possible to allocate a high level of protection to all resources throughout the country without prejudicing social and economic development. Equally, it is not desirable for all resources to be classified at a uniformly low level of protection that would permit them to be used and exploited to the maximum extent possible. For water resources, this aspect has been addressed through the water resource classification system, which provides for the development of a framework for assessing and managing water resources in terms of their selected class, level of protection, or "ecological state". Each ecological state has

implications for the way and extent to which that water resource is utilised (see Section 4.3.1).

This discussion paper is concerned with the identification of those water resources that should receive a high level of protection in order to serve the objective of effectively conserving inland water biodiversity. The water resource classification system provides the primary rationale and implementation tool in this respect, and in applying the system it is necessary to address questions such as:

- How many inland water ecosystems should be maintained in the "natural class", or in other words, should be awarded a high protection status?
- Which inland water ecosystems are best suited to being designated as a natural class?
- How should inland water ecosystems with a high protection status be integrated or linked into an overall (national) conservation design to provide optimal efficiency and benefit?
- Should rehabilitation targets be set for inland water ecosystems that may be heavily used / impacted or that are unacceptably degraded, but are critical for achieving overall inland water conservation targets?

The above questions can only be answered if we know what we would like to achieve; i.e. we need a shared vision or goal statement. In line with the aspiration of modern society to sustain the diversity of life on earth, the goal that was adopted by the cross-sector representatives for inland water conservation is:

to conserve a sample of the full variety or diversity of inland water ecosystems that occur in South Africa, including all species as well as the habitats, landscapes, rivers and other water bodies in which they occur, together with the ecosystem processes responsible for generating and maintaining this diversity, for both present and future generations.

CROSS-SECTOR POLICY OBJECTIVES

While it may be relatively easy to share a common philosophy and goal, little will be achieved in reality unless the common goal is cascaded down into a comprehensive set of common operational objectives, where all agree on what must be done, and who will take responsibility and accountability for certain tasks. These operational objectives must be clearly understood by all, collaboratively developed, and cooperatively implemented.

A set of five core objectives and associated implementation principles are presented in Sections 7 to 11 of this document as imperatives to achieving the inland water biodiversity conservation goal stated above. Objectives one to three deal with planning and design issues, while objectives four and five deal with implementation issues. Each objective is covered in a separate section. First, a statement and brief description of the objective is provided; this is then supported by a summary of the associated implementation principles. Secondly, since the implementation principles are necessarily quite technical in nature, in each case a considerable amount of information is provided on the scientific basis and rationale for the implementation principles. Thirdly, a set of cross-sector policy recommendations is presented. These recommendations were discussed and agreed at the meetings of cross-sector representatives on 8 September 2005 and 22 February 2006.

The five objectives and their supporting recommendations are repeated here for convenience.

Objective 1: Set and entrench quantitative conservation targets for inland water biodiversity

This objective addresses the setting of minimum requirements for inland water biodiversity conservation in order to: allow an evaluation of whether existing conservation efforts represent the biodiversity of a region adequately; provide guidance for planners who are balancing a number of competing demands for natural resources in a region; and provide water resource management and biodiversity conservation agencies with common quantitative measures for which to aim.

There are three implementation principles associated with this objective. The first implementation principle is to ***set and endorse national targets for conservation of inland water biodiversity***. To support this principle, the following policy recommendations were agreed to:

- The quantitative target for inland water biodiversity conservation in South Africa should be to maintain (and restore where necessary) at least *20 % of each inland water ecosystem type* (determined at the appropriate scale – see Section 8.2) in a Natural Class, where Natural Class refers to the highest level of protection afforded by DWAF's Water Resource Classification System.
- The national government departments responsible for water resources, biodiversity, land management and integrated planning should officially endorse the national conservation target for inland waters and integrate this target into their respective policy and strategic processes.
- National government is, and should remain, accountable for achieving the 20 % conservation target. However, all spheres of government (national, provincial and local) should have a role in prioritising inland water ecosystems for conservation, and share a responsibility for achieving effective conservation of identified systems. National government should be responsible for driving the process of harmonising conservation prioritisation and implementation between national, provincial and local spheres of government.
- The conservation of inland water ecosystems that are shared with neighbouring countries should be addressed through the development of bi-national or multi-national agreements.

The second implementation principle is to ***cascade the national targets differentially to sub-national implementation levels***. To support this principle, the following policy recommendations were agreed to:

- The national inland water conservation target should be cascaded down as sub-national targets to correlate with the 19 WMAs set out by the NWRS.
- Where specific inland water ecosystems are shared between two or more WMAs, the national target need not necessarily be met uniformly across these areas of administrative responsibility. Rather, the constitution of the national target through sub-national component targets may reflect variation in the richness of inland water biodiversity as well as achievability due to present levels of ecological transformation across the landscape. Overall, a fair and equitable distribution of responsibility regarding biodiversity conservation should be achieved; and responsibilities should be matched with appropriate resources (in terms of skilled staff, equipment, information and funding).
- Sub-national targets should be set in collaboration with the relevant sub-national government agencies; ideally, these should be juxtaposed with biodiversity

assessment and conservation planning exercises. It should be the overall responsibility of national government, and specifically DEAT (primarily through SANBI), to facilitate and oversee the spatially nested processes of biodiversity assessment, conservation planning and target setting.

- It should be the responsibility of DWAF, primarily through its CMAs and the practice of integrated water resource management (IWRM), to implement the conservation targets at sub-national level. CMAs should be responsible for fostering horizontal and vertical coherence and coordination of conservation actions. For example, planning for the conservation of inland water biodiversity should engage with the National Biodiversity Framework and its responsible parties, the relevant Catchment Management Strategy(s) and its responsible parties, and local development planning and decision-making structures including municipalities within the jurisdiction of the relevant Catchment Management Agency (or DWAF Regional Office where a CMA has not been established).

The third implementation principle is to ***improve and refine national and sub-national targets over time***. To support this principle, the following policy recommendations were agreed to:

- The national conservation targets for inland water ecosystems should be subject to review every five years. Review should be coordinated by SANBI, with inputs from all of the relevant national custodians and stakeholders of these targets, for example DWAF, DEAT, NDA, DPLG, and SANParks.
- The national custodians of the inland water conservation targets should identify and support the research needed to enable informed revision of the national targets over time.

Objective 2: Plan for representation of inland water biodiversity

The objective of representing inland water biodiversity is to ensure adequate representation of the full spectrum of inland water biodiversity, based on the systematic description and depiction of the inland water biodiversity within the region of concern. A key objective of conserving representative examples of inland water biodiversity is the promotion of a systematic approach to the identification, prioritisation and conservation of inland water ecosystems, as opposed to a focus on well-studied, relatively unmodified, or biologically more diverse systems. Three implementation principles inform the achievement of this objective. The first implementation principle is to ***use surrogate measures as indictors to describe and classify inland water biodiversity***. To support this principle, the following policy recommendations were agreed to:

- As a pragmatic consideration, landscape or ecoregion-level measures of heterogeneity in inland water ecosystems may be used as surrogates for achieving representation of inland water biodiversity features in conservation planning;
- Surrogates should be tested and validated through proper hypothesis testing to ensure their scientific rigour; and
- Ecoregional surrogates (as coarse filters of biodiversity) should be supplemented wherever possible with fine filter surrogates (such as species or community level data).

The second implementation principle is to ***define the appropriate scale***. To support this principle, the following policy recommendations were agreed to:

- Conservation planning should follow a spatially nested approach with coordination and alignment between at least three scales:
    - National planning: The CBD calls for the development of ***countrywide*** conservation plans and conservation of representative samples of all ***major ecosystem types***. As such, the delineation, analysis and representation of inland water biodiversity at a national scale should be viewed as a priority.
    - Sub-national planning: Since planning and allocation of water resources takes place at a sub-national and catchment level, catchment-based biodiversity representation and planning should be closely aligned with and complement national-level plans.
    - Regional planning: The regional significance (e.g. uniqueness) of inland water ecosystems should also be considered. In this regard the region of the Southern African Development Community (SADC) becomes a relevant planning unit. At present, there are serious data discrepancies between South Africa and its neighbouring countries. This should be addressed through the development of minimum data and monitoring requirements for the region, and by spelling out shared responsibilities and time frames for generating basic and uniform data layers for the region.

The third implementation principle is to ***incorporate local ecological knowledge***. To support this principle, the following policy recommendation was agreed to:

- People with local ecological knowledge – whether experts that have worked in the area or local inhabitants such as farmers or community members – should be involved wherever possible to point out areas of special interest and to review planning outputs; this is especially important for fine-scale inland water conservation plans. To facilitate its use in conservation planning, this knowledge must be recorded in a spatially explicit manner with clear explanations as to why each mapped feature is important, and options for how they could be managed in a conservation-friendly manner.

Objective 3: Plan for persistence of inland water biodiversity

The objective of planning for biodiversity persistence addresses the need to conserve the ecological and evolutionary processes that generate and maintain inland water biodiversity. Conserving species and habitats, as considered under biodiversity representation, provides a snapshot of the biodiversity that currently exists. If we wish this biodiversity to persist and naturally evolve over time, we also need to make sure that: populations, communities or ecosystems that are both viable and of high ecological integrity are selected; natural ecological processes (functional elements) and disturbance regimes such as floods, droughts and fires continue to operate within their natural ranges of variability; and the size of a conservation design is sufficient to allow a system to recover from natural disturbances.

There are four implementation principles associated with achieving this objective, the first of which is to ***select inland water ecosystems of high integrity***. To support this principle, the following policy recommendations were agreed to:

- Only ecosystems that reflect a present ecological state of A or B will contribute to achieving inland water conservation targets; and
- Where necessary, and subject to feasibility, ecological restoration or rehabilitation should be undertaken to achieve the set conservation target.

The second implementation principle is to ***ensure connectivity***. To support this principle, the following policy recommendations were agreed to:

- In many instances it is virtually impossible to find an un-dammed, or un-regulated river system. Given that virtually all of South Africa's main rivers have been dammed or regulated in some way, longitudinal connectivity for selected rivers should be enhanced as far as possible, for example through construction of appropriate fish ladders and adoption of water release regimes that adhere to environmental flow requirements.
- In order to optimise the protection of the functional elements of inland water ecosystems, adjacent river reaches rather than isolated reaches should, wherever possible, be selected for contributing towards conservation targets. Where this is not attainable, river ecosystems that are designated for conservation (in an A or B ecological state) should, where relevant, be connected through river ecosystems that are in an ecological state that will support ecological connectivity. This functionality commonly concurs with ecological assessment category C. However, this relationship should not be seen as a given and each potential connecting river should be assessed carefully, based on process attributes such as its ability to allow the migration of a key species.
- Where ecosystems are in an ecological state that is lower than A or B but are deemed important for providing connectivity, such ecosystems should be considered part of an overall design for inland water conservation. The maintenance of their ecological state will be necessary for achievement of the overall conservation target. However, they should not contribute towards satisfying the quantitative conservation target.
- The management and conservation of inland water ecosystems must address maintenance or re-establishment of environmental gradients along longitudinal, lateral and vertical dimensions.
- The need for lateral connectivity emphasises the importance of aligning land and water biodiversity priorities and management strategies. Similarly, the need for vertical connectivity emphasises the importance of aligning surface and groundwater management strategies.

The third implementation principle is to ***include large-scale ecosystem processes*****.** To support this principle, the following policy recommendations were agreed to:

- Where appropriate (in catchments that are designated for conserving inland water biodiversity), natural disturbance regimes, such as floods, droughts and fires, should be allowed to operate within their natural ranges of variability; and
- There are few places in the world where completely unaltered environmental regimes and natural disturbances currently exist. Therefore the potential to restore regimes and disturbances through active management (e.g., releases from dams according to in-stream flow requirements, including floods) should be evaluated when selecting conservation areas.

The fourth implementation principle is to ***select areas of sufficient size***. To support this principle, the following policy recommendations were agreed to:

- Inland water conservation actions should cover multiple spatial scales, from local (e.g. small-patch ecosystems) to large landscapes. At least some larger scale efforts should interface with terrestrial and marine conservation plans.
- Since administrative boundaries are often smaller than, or poorly aligned with, the span of ecological processes, a national conservation planning framework should provide clear guidance regarding the conservation of ecological and evolutionary

processes at sub-national levels. Such a planning framework for conserving inland water processes should form part of South Africa's National Biodiversity Framework (discussed in Section 4.3.2-e).

Objective 4: Establishing a portfolio of inland water conservation areas (IWCAs)

The objective of establishing inland water conservation areas addresses the incorporation of the first three objectives into spatial configurations that will constitute the portfolio of inland water conservation areas (IWCA) of South Africa**.** There are five implementation principles associated with achieving this objective. The first implementation principle is to ***legislate IWCAs through complementary legal mechanisms*****.** To support this principle, the following policy recommendations were agreed to:

- Departments responsible for biodiversity conservation, water resource management, land use (agriculture) and integrated development planning should promote coherence between their respective policies and strategies. Coherence can be enhanced by actively incorporating the policy objectives and principles of this document into their future policy and strategy processes.
- Inland water conservation priorities should be linked to appropriate legal mechanisms for implementation.

The second implementation principle is to ***strive for optimal land-use efficiency***. To support this principle, the following policy recommendations were agreed to:

- Integrated planning and management of natural resources (both aquatic and terrestrial) should be regarded as a priority for achieving efficient conservation of inland water ecosystems. Appropriate mechanisms for achieving this, for example the appointment of natural resource management coordinators at district levels, should be carefully investigated.
- Since the conservation of inland water ecosystems is dependent on an ability to achieve appropriate land management practices within associated drainage areas, the least conflicting cross-sector options should be sought wherever possible; i.e. to steer away from allocating inland water conservation priorities in catchment areas designated for types of development that conflict with conservation objectives.
- Ideally, inland water conservation plans should be carried out in parallel to terrestrial, and marine conservation plans and all plans should be well-integrated.
- Inland water conservation planners should design, in collaboration with terrestrial and marine conservation planners, one or two large conservation areas that would focus on integrating conservation objectives for terrestrial, inland water, estuarine and marine ecosystems.
- Prioritisation systems that consider biodiversity together with social and economic realities should be developed and tested.

The third implementation principle is to ***prioritise and initiate conservation actions timeously***. To support this principle, the following policy recommendations were agreed to:

- The allocation of resources for conserving inland water biodiversity should be guided by (a) an assessment of the vulnerability of each inland water ecosystem to threats or resource use pressures; and (b) an assessment of the options available for conserving each inland water ecosystem.

- Investigative research should be initiated to improve our understanding of the vulnerability of inland water ecosystems.

The fourth implementation principle is to ***conserve first where appropriate, rather than restore later***. To support this principle, the following policy recommendations were agreed to:

- Inland water ecosystems that are ecologically intact should receive priority in the selection for achieving representation (this relates to the implementation principle of "selecting ecosystems of high integrity").
- In instances where the sub-national conservation target cannot be met owing to past or current over-utilisation of certain inland water ecosystems, the restoration of these ecosystems should be considered on the basis of ecological feasibility and affordability.

The fifth implementation principle is to ***provide explicit selection options and management guidelines***. To support this principle, the following policy recommendations were agreed to:

- When prioritising inland water ecosystems for conservation, explicit information should be provided about the biodiversity features contained by these ecosystems as well as the regional significance of these features, e.g. are they endemic to the Water Management Area or to the country.
- For each potential selection, some information should be provided on the main pressures on biodiversity and how best to mitigate these.
- Catchment zoning, in which the most deleterious activities for the resource are relegated to the furthest part of the catchment, should be investigated as a management option in instances where whole catchments cannot be conserved.
- All selected catchments should have management plans for the removal and management of alien species.

Objective 5: Enable effective implementation

Acknowledging that the value of a conservation design is only realised through its effective application, the objective of effective implementation addresses the creation of an institutional environment that can ensure sustained conservation actions for all designated inland water conservation areas.

There are five implementation principles underpinning this objective. The first implementation principle is to ***facilitate stakeholder adoption of inland water conservation targets and priority areas*****.** To support this principle, the following policy recommendations were agreed to:

- Stakeholders (key decision makers and water user groups) should be engaged at the outset of the planning process, and at various stages through the planning process rather than only at the end of the process.
- Conservation plans for inland water ecosystems need to be aligned with the frameworks and terminology used by the targeted resource managers, e.g. Bioregional Plans and Catchment Management Strategies.

The second implementation principle is to ***reflect the conservation of inland water ecosystems as an explicit function in institutional design***. To support this principle, the following policy recommendations were agreed to:

- Every sub-national implementation agency responsible for conserving inland water biodiversity should plan for and acquire internal capacity for effectively executing their responsibilities in this regard. Capacity implies both the skills to facilitate networking and collaboration among relevant agencies, as well as sufficient depth of knowledge in aquatic ecology and conservation science to harness external knowledge in this regard and to effectively apply such knowledge.
- CMAs, provincial conservation departments / agencies, and district and local municipalities should plan and budget for the financial and human resource implications associated with effective implementation of their agreed component of the inland water conservation objectives and targets in their geographic areas of responsibility.

The third implementation principle is to ***enable cooperative governance in the conservation and management of inland water biodiversity***. To support this principle, the following policy recommendations were agreed to:

- Performance management in a cooperative governance setting should be promoted through the development, testing and demonstration of suitable quantitative and qualitative indicators.
- The establishing of regular interaction with counterparts in cooperative agencies should be encouraged. Regular and quality interactions are necessary for building personal and professional relationships; especially where stakeholders are geographically dispersed.

The fourth implementation principle is to ***facilitate a science-management continuum***. To support this principle, the following policy recommendation was agreed to:

- National custodian departments should institute and support suitable mechanisms and processes that will promote an adaptive management framework for conservation of inland water biodiversity.

The fifth implementation principle is to ***promote discovery, inventory and improved understanding of inland water biodiversity***. To support this principle, the following policy recommendations were agreed to:

- Clear responsibilities should be established regarding biodiversity collections and inventories, as well as the means to coordinate actions and responsibilities at national level.
- Priority monitoring gaps and limitations should be identified, responsible parties should be identified, and appropriate interventions should be developed.
- A protocol for the systematic collection and curation of species data should be drawn up to guide museums and other collectors.

CONCLUSIONS

The discussions and decisions reported in this paper provided the basis for several important conclusions. These were presented in Section 12 and are repeated here for completeness.

Water is a cross-sector issue that affects every level and activity of society and life on Earth. Therefore, water policy must also be cross-sectoral in character if it is to correctly reflect the complex nature of water management. As a result, the successful

achievement of water policy goals requires close and sustained cooperation and coordinated effort amongst all of the agencies that are responsible for policies and activities that affect, or are influenced by, water (MacKay and Ashton (2004). In a similar way, biodiversity issues span several different sectors and biodiversity policy therefore also qualifies as cross-sectoral policy. Importantly, where the area of management focus is inland water biodiversity, the overlapping sectoral roles and responsibilities of both water and biodiversity must apply. In this situation, it is extremely important to ensure that the respective sets of policies and management instruments are both coherent and properly aligned with each other, in order to avoid the confusion that could arise as a result of conflicting objectives and contradictory management approaches.

Acknowledging the above complexity, the development of this discussion paper was based on a process of searching for and negotiating a shared understanding of key concepts related to the conservation of inland water biodiversity. An important part of this process was to make explicit all those issues or characteristics that are fundamental to future visions that exist within the respective sectors that share responsibility for the conservation of inland water biodiversity. A broad cross-section of representatives from the different sectors, organizations and government departments that have line responsibilities for water resource management, environmental and biodiversity management, agriculture and land use planning, were brought together to engage in a wide-ranging set of debates regarding cross-sector policy objectives for inland water biodiversity conservation.

The convergence in thinking that emerged from these debates was quite remarkable – particularly in the way that a shared vision was achieved for the conservation and management of inland water biodiversity. Most importantly, special attention was paid to ensuring that the recommended policy instruments were coherent and practical, and could be implemented effectively by the different organizations and agencies responsible for specific issues. This focus on the effective ***implementation*** of policy instruments will help to avoid the type of situation where consensus-seeking approaches ignore important management realities and create policy instruments that are either difficult or impossible to implement. In such situations, the respective end-users or operational managers become frustrated by their inability to implement the respective instruments and are likely to revert to older, “tried and trusted” operational methods.

In this study, an effort was made to address the philosophical aspects of policy whilst also ensuring that practical recommendations could be made for the effective implementation of this policy. For this reason, a carefully structured, hierarchical approach was followed. First, a high-level national goal was formulated, followed by clear and unambiguous statements of the five necessary conditions or broad policy objectives that underpin the achievement of this goal. These key objectives were then linked to 20 implementation principles that characterize effective policy implementation. Finally, approximately 50 policy-related recommendations were made to support the practical implementation of the principles.

Several bold decisions were made by the participating government departments, for example to set a quantitative target of conserving 20 % of each major inland water ecosystem type. The uncertainty and lack of scientific validation around this and some other decisions were noted, as well as the need for directed research and the establishment of appropriate feedbacks between research and conservation practice.

Several of the policy recommendations that are made in this paper have institutional and capacity implications. For example, Catchment Management Agencies were

identified as primary agencies responsible for achieving conservation targets at the level of a Water Management Area. This will require significant coordination of activities and resources within provincial and local spheres of government; which in turn can only happen if these agencies have an appropriate level of internal knowledge and capacity in the fields of conservation science and aquatic ecology. There is also the intricate issue of coordinating biodiversity assessment, conservation planning and target setting between a national and various sub-national scales; where river catchment and water management area boundaries are not aligned with provincial and district municipality boundaries. The overall responsibility for ensuring this kind of spatial alignment has been allocated to DEAT, primarily through SANBI.

In South Africa, DWAF is the government department with line function responsibility for dealing with water management, while DEAT has the overall line function responsibility to deal with biodiversity management. However, it is clear that neither of these departments can effectively manage inland water biodiversity on its own. The conservation of inland water biodiversity can only be achieved through a comprehensive analysis and understanding of the areas of overlap and the effective sharing of expertise and resources. In fact, while these two departments may be the primary role players representing national government, there are a number of secondary role players that also need to be engaged, including: DoA, DME, DPLG, and DLA. In addition, provincial and local government authorities, conservation agencies such as SANParks, and research facilities such as SAIAB, also need to form an integral part of growing a national capability for the effective management of our biodiversity resources associated with inland waters.

A most important finding, and critical for taking the recommendations in this paper forward, is the need for cooperation across sectors (horizontal) and spheres (vertical) of governance. Conservation planning and the governance of inland water biodiversity takes place in a complex environment where decision-making is typically associated with low levels of certainty and potentially high levels of disagreement among stakeholders. In this environment, active and respectful negotiations are required to ensure that organisations, departments and agencies with different professional identities and mandates can successfully agree to and achieve shared objectives related to the conservation of inland water ecosystems.

Ironically, with the current focus of government on service delivery and tangible outcomes, effective cooperation requires intangible inputs; for example, people need to spend time together developing relationships and learning to communicate with, respect, and trust one another. An overall recommendation of this paper is, as a matter of urgency, to develop a clear understanding of cooperation as a strategy: when is it appropriate; what does it cost; what conditions are necessary for it to exist; what benefits can it realistically generate.