THE ROLE OF ENVIRONMENTAL ETHICS IN SOCIAL-ECOLOGICAL SYSTEMS AND WATER RESOURCE MANAGEMENT

Report to the
Water Research Commission

by

Oghenekaro Nelson Odume and Chris de Wet
Unilever Centre for Environmental Water Quality
Institute for Water Research, Rhodes University

WRC Report No. 2342/1/16
ISBN 978-1-4312-0743-5

April 2016

Obtainable from

Water Research Commission
Private Bag X03
Gezina, 0031

orders@wrc.org.za or download from www.wrc.org.za

EXECUTIVE SUMMARY

Despite developments in water resource policy, law, monitoring, regulation, management and research, the health and functionality of South African aquatic ecosystems continue to deteriorate (CSIR, 2010). At the same time, there is a growing recognition that humans are integral components of complex social-ecological systems; as such, their beliefs, values and actions have direct implications, whether intended or unintended, for the environment (Folke, 2006; Pollard and du Toit, 2011; Rogers and Luton, 2011).

This project on the role of environmental ethics in social-ecological systems and water resource management arises out of the fact that we are increasingly confronted by the complex and interwoven nature of the complex situations in which we, as humans – indeed, as all life on earth – find ourselves. Our location and role (as humans), as integral components of social-ecological systems, including our particular and far-reaching powers to impact upon those systems, is critical to the functioning and well-being – and indeed, the potential survival – of those systems. This raises the implication that we (as humans) may reasonably be seen to have responsibilities to the broader environment, which responsibilities go beyond our own species and individual personal and social welfare. The nature of this responsibility, and the principles upon which it is argued, is the domain of environmental ethics.

This project is concerned to arrive at the conceptualisation of an approach to, a framework for, environmental ethics, which is appropriate to water resource management in South Africa. In seeking to develop such a framework, a basic distinction needs to be made between ethics and values/morals. In this project, we take ethics to refer to: a systematic concern with the principles by which we seek to distinguish between right and wrong, to negotiate values, in our behaviour towards other people and towards nature (de Wet, 2009: 78). For example, I might on principle believe that only human beings have moral standing, and that the rest of nature has no moral stature, and that it is therefore acceptable to kill and consume non-human forms of life. Or I may believe that people have the right to choose their own values – whether I agree with them, or not; or I may believe that this applies in only certain cases – such that, e.g., abortion or euthanasia or gay marriage, is not acceptable for anybody, under any circumstances. In this project, we take morals and values to refer to what specific individuals or groups of people believe to be good or bad, such as polygyny, or vegetarianism, or accumulation of wealth at the price of inequality, or whatever. We can thus

look to the development of agreed ethical principles for water resource use, protection and management, which will provide guidance in accommodating a plurality of individual and group morals/values.

This is particularly important in South Africa, where our historical context has its own ethical imperative to effect transformation towards social justice. In a highly plural society, the needs and desires of people will differ widely. Each choice and action that is carried out, tends to preclude other choices and actions and values; particular actions inevitably open out and close down specific options in respect of access to the benefits of water use and/or protection, and will often be contentious. Trade-offs may occur between values (e.g. between equity and sustainability), or a compromise in standards for reasons of affordability or efficiency may result in water that is sometimes not safe to drink.

In terms of the above considerations, the central aim of this project has been to review, analyse and recommend ways by which environmental ethics can constructively contribute to water resource management in the context of social-ecological systems in South Africa. The specific objectives of the project include:

1) To review the subject of environmental ethics and its application to integrated water resource management, and aquatic ecosystems use and protection.

2) To investigate local and international case studies, showing the impact of environmental ethics on water resource management and aquatic ecosystems, paying particular attention to best practice cases and identifying the ethics related factors in these cases.

3) To identify opportunities for applying and improving environmental ethics for constructive socio-ecological systems and water resource management in South Africa.

   3.1 To identify ways in which environmental ethics can constructively be applied in South Africa and the institutional and other foundations that need to be laid and/or changes to be made in this regard.

   3.2 To analyse how environmental values and ethical systems operate at different scales: local, regional and national – and the problems and possibilities of integrating

them across these scales.

4) To propose future research directions in environmental ethics and values relating to social-ecological research and management.

A combination of desk top study and project team meetings were used in the course of this project. All of the information provided in this report has come out of an analytical review of written sources. The project team met regularly to analyse, critique and raise pertinent issues related to the material and the task at hand.

The desk top research has involved three key research based deliverables, as follows:

i) The literature review provided an overview of the major theoretical approaches to environmental ethics, and also of key legislative and administrative provisions in the South African water sector, as well as of the main values (including equity, sustainability and efficiency) driving these provisions.

The literature review identified the following major themes which are important to any further theorisation and application of a viable approach to environmental ethics in relation to water resource management:

- The role (central or otherwise) of human beings, and the ethical implications of that role in the human-natural environmental relationship.

- The usefulness (or otherwise) of the idea of intrinsic value in considering the ethical status of, and ethical behaviour towards, components of the environment.

- That the socio-ecological environment may be seen as an integrated unit, in which the various components parts all have inherent value, and in which human beings do not have primary status, but in which all aspects are interrelated, and support each other.

- That water and other components of the aquatic ecosystem may thus be seen as having intrinsic value in their own right, as well as instrumental value. This requires a considered ethical – and managerial – balancing act.

ii) A detailed analytical review of the application of environmental ethics in water management in four different case studies in Bangladesh, India, South Africa and the USA.

This allowed for a comparison of a range of ways of thinking and underlying approaches to environmental ethics – with very different outcomes in terms of, e.g., being able to accommodate constituencies with different values, and in terms of the overall aquatic ecosystem.

In the cases we considered, such application and implementation of environmental ethics may be conscious or unconscious, intentional or unintentional, explicit or implicit, mentioned in the text, or not. Where we have identified such environmental ethical practices, we have surfaced them, and highlighted their specific contribution. Four case studies have been reviewed. The first case study is based in the United States of America and concerns the tension between the (seemingly) opposed possibilities of the protection of specific groups of aquatic animals (salmon) and the existence or removal of several dams in a local river system. The second case study is about managing wetland resources through community co-management in Bangladesh, showcasing the importance of a holistic approach to wetlands management. The third case study concerns the review of the Green-Drop programme in South Africa. Implicit environmental ethical thinking and practices in the programme are surfaced and articulated. The last case study relates to an environmental flow assessment exercise in the Ganga River system in India. The case studies have been carefully selected to reflect diverse issues and practices in water resource management. Only one case study was selected from an industrialised country, because we considered that we needed to focus on other developing countries that share similar realities with South Africa.

In two of the four cases, the wider social-relational perspective seems to have been compromised – in one case, in an anthropocentric way (emphasising a human-oriented value preference) and in the other, in a potentially non-anthropocentric way (emphasising the priority of nature). The other two cases have sought to emphasise the wider social-ecological system and its interrelationships – although in interestingly different ways.

These case studies show us a range of ways in which thinking about environmental ethics manifests in actual situations. This is seldom in a consciously articulated and thought-through manner, because we are considering practical people who are busy dealing with practical problems, within a narrowly defined brief, and who do not necessarily look for the fuller picture. Environmental ethical theories also do not manifest themselves in such a manner that one finds only one strand of thinking about environmental ethics manifesting itself, to the

total exclusion of others. This is because much of our thinking is contextual, and we, as human beings, are not naturally given to consistency. The more case studies we are able to learn from, the better we will understand how environmental ethics (actually) works – often below the surface – to influence the ways in which planners and implementers go about their business. If we better understand the working out of environmental ethics in practice, then we are better placed to open out that process.

iii) An investigation of the relationship between environmental ethics and aquatic ecosystem health. Our key finding is that ecosystem health – while it is a human construct – needs to be seen within the context of the social-ecological system as a whole. The social-ecological system may be understood as consisting of two major components, i.e. the biophysical and the social-economic. If both parts are integral to the ecosystem, then the health of each is integral to the overall health of the ecosystem. Inherent in the concept of ecosystem health, are the notions of human dependence on aquatic ecosystems, as well as human capacity to alter ecosystem properties. Sustainability can therefore only be achieved if a working balance is struck between human uses of ecosystems, and the protection of these ecosystems. The management of this interrelationship needs to be done in an integrated, holistic manner, which is sustaining to both components.

Any ethical approach, inasmuch as it involves principles in terms of which values (and categories related to those values) are to be related to each other, would seem to involve an inescapable element of ranking and trade-off of values, and by implication, of rights related to those values. The nature of such trade-offs would seem to relate to hierarchies in terms of which principles of evaluation may be related to each other, or to the levels of incorporation at which the system boundaries are drawn. For example, whether non-humans are attributed moral value or not. This in turn would variously influence whether particular people or creatures or plants are classified as being 'insiders', i.e. as 'moral members', or 'as aliens' – and what kinds of rights they are seen to have. In this regard, whether water is seen as having inherent and/or only instrumental value, would be influenced by the taxonomic scope and scale, and criteria, being employed to draw system categories and boundaries.

We have argued that ecosystem health needs to be conceptualised and managed in terms of an approach to the ecosystem as an integrated unit, in which the health of the biophysical and the social-economical aspects are seen as mutually sustaining and interdependent. In our

understanding, this calls for a systemic-relational approach to environmental ethics, in which we move towards locating the central value in the overall systemic health, rather than in its components, e.g. humans (i.e. anthropocentric view) or nature (i.e. non-anthropocentric view). This implies taking the potentially difficult step – certainly from a policy and administrative perspective- of decentring the human component, which has hitherto been prioritised. Instead, we need to redirect our focus to the social-ecological system as an integrated whole, to see it as the unit of worth, towards which decision-making, and developmental and preserving action, is directed.

The cumulative progression of information, analysis and understanding throughout this project, has enabled us to gain a clearer perspective of the aquatic ecosystem as an integrated social-ecological system, and of the concomitant need for a systemic-relational approach to environmental ethics – and so to move towards a theoretical, methodological and ethical (and potentially policy) synthesis in the project.

We argue for the need for a systemic-relational ethical approach, in the light of the fact that social-ecological systems are best understood as integrated complex systems. We then put forward a set of principles which we see as essential to a systemic-relational environmental ethical framework. Since this was one of the aims of the project, it is worth setting out these principles in full here in the Executive Summary.

Principles informing a systemic-relational environmental ethical framework

We here provide a summary of the basic orienting principles that we regard as necessary for a systemic-relational environmental ethical framework to operate as a coherent overarching and coordinating perspective informing the use of values in the integrated management of water resources. These principles are more fully expounded in Chapter 5.

The systemic-relational (SR) perspective considers the social-ecological system as an integrated unit as the central good, or value, to be pursued in seeking to interpret, evaluate or manage the social-ecological system. This requires the active decentring (i.e. de-prioritising) of any particular component of the social-ecological system, including the human being. The consequence of such decentring of components, is an extension of the concept of ‘equity’ from its conventionally human reference, to apply to the wider, systemic, social-ecological system. All components of the socio-ecological system (i.e. human and non-human) should

therefore be regarded as having both intrinsic and instrumental value. Each component has intrinsic value, inasmuch as it is an expression and an enabler of the ultimate value, which is the system as such; each component also has instrumental value, inasmuch as it upholds both the system and other components of the system. Inasmuch as each component of the system may be seen as having both intrinsic and instrumental value, each component is worthy of respect. Worthiness of respect implies that, in any decision-making situation – which usually involves having to make preferential/differential allocations, due to limited resources and other contextual factors – the intrinsic qualities and claims of all involved components and parties must be held open for as long as possible. And that this must be a deliberate management strategy, which derives from the principle of the upholding of the overall socio-ecological system as being the ultimate positive value being pursued. This has the implication that the attitude of inclusiveness must be consciously adopted as both a moral and as a managerial practice. Different – and potentially conflicting – values (such as, e.g., equity, efficiency and sustainability) require to be balanced and accommodated in the management of water resources. Relational ethics needs to be sensitive to the context, including not only the biophysical, but also the historically and socio-economically entrenched factors influencing water resource management in particular situations. Relational ethics promotes the active search for, and management of, the interconnectedness of the components of the social-ecological system. However, the systemic-relational framework of environmental ethics by itself will be inadequate to achieve such a protection of the primacy of the social-ecological system, and of its health and functionality. This will require, inter alia, a range of policy, institutional and training measures. We, as human beings, cannot have a complete understanding of the full range of interactions, processes and complexities of a social-ecological system. An attitude of provisionality and humility is therefore central in seeking to understand and manage such a complex social-ecological system.

The above principles guide thinking about and application of specific values. In this Report we accordingly outline and discuss key values operating in the water sector (such as equity, sustainability, efficiency, inclusivity, and health of the aquatic ecosystem) as well as more practical factors which influence the way that these values play out in on the ground situations.

This enables us to move forward in the Conclusion to consider policy and management issues, and to make some suggestions relevant to the realisation of a systemic-relational set of

environmental ethics, and a social-ecological approach to water resource management. These include the enabling policy, institutional and managerial conditions necessary for realising the aims of ethically grounded water resource management. Such enabling conditions include:

- Realising the aquatic ecosystem as a healthy, integrated unit
- Achieving greater democratisation and participation (inclusiveness) in water management institutions
- Polycentric governance of social-ecological systems.
- Balancing /trade-off of values within water resource management.

Recommendations are also made with regard to training needs to enable the systemic-relational approach to be taken up in water management in South Africa, as well as for future research directions in this regard.

In practical terms, how is this to be done, and by whom? Who is to take forward the fruits of this research and reflection? It needs to be taken up by the range of decision-makers and implementers across the water resources sector. This extends from policy makers, to managers, notably at municipal and CMA level. For this to be possible, three things are necessary.

- Firstly: a conscious policy decision needs to be taken across the Department of Water and Sanitation, to adopt a social-ecological systemic approach to water resource management and to systematically incorporate environmental ethics into water resource management.
- Secondly: for policy makers, decision-makers, managers and implementers to be able to put the ideas, ethics and values around social-ecological systems as complex systems into planning and practice, will require conscious and focused training programmes for relevant personnel in DWS and elsewhere.
- Thirdly: enhanced cooperation in relation to governance is necessary between various governmental and non-governmental institutions, both across different hierarchical levels (e.g. national, regional/provincial, and local/municipal) as well as across the same level of (polycentric) governance.

ACKNOWLEDGEMENTS

The authors would like to thank the Water Research Commission for funding this project (K5/2342), thereby making possible the research, together with the findings, analyses and recommendations flowing from it. The authors would, however, like to emphasise that the Water Research Commission should not in any way be held responsible for any of the data presented or views expressed in this Report, or for any deficiencies in this Report. For these, the authors assume sole responsibility.

The authors would like to thank particularly the following Reference Group members of this project (K5/2342) for their constructive engagement and feedback throughout the course of this project:

Dr Stanley Liphadzi	Water Research Commission (chair)
Professor Willem Landman	Ethics SA (member)
Mr Duncan Hay	Institute of Natural Resources (member)
Ms Shanna Nienaber	Department of Science and Technology (member)
Mr Sibusiso Majola	Department of Water and Sanitation (member)
Mr Sazi Mthembu	Department of Water and Sanitation (member)
Mrs Noloyiso Mbiza	Department of Water and Sanitation (member)
Mr Tsungai Zengeya	South African National Biodiversity Institute (member)

We also gratefully acknowledge the valuable input of Professor CG (Tally) Palmer of the Unilever Centre for Environmental Water Quality, Institute for Water Research, Rhodes University.

LIST OF ACRONYMS

CC	Catchment Committee
CMA	Catchment Management Agency
CMF	Catchment Management Forum
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EIS	Ecological Importance and Sensitivity
E-flow	Environmental Flow
ESA	Endangered Species Act of 1973 (USA)
GPC	Green Drop Certificate
IWRM	Integrated Water Resource Management
KPA	Key Performance Area/s
MACH	Management of Aquatic Ecosystems through Community Husbandry project (Bangladesh)
NEMP	National Eutrophication Monitoring Project
NGO	Non- Governmental Organisation
NWA	National Water Act, No 36 of 1988 (South Africa)
NWP	National Water Policy
NWRS	National Water Resource Strategy
PES	Present Ecological State
PhAC	Pharmaceutically Active Compounds
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RMO	Resource Management Organisation/s (Bangladesh)
RQO	Resource Quality Objectives
RUG	Resource User Group/s (Bangladesh)
SAM	Strategic Adaptive Management
SASS	South African Scoring System
SDC	Source Directed Controls
SES	Social-Ecological System
SOS	Save Our Wild Salmon (USA movement)

SR	Systemic-Relational
VSTEEP	Values, Social, Technical, Environmental, Economic and Political factor analysis
WRC	Water Research Commission
WUA	Water Users Association/s
WWF-India	World Wildlife Fund India
WWTW	Wastewater Treatment Works

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CHAPTER 1: INTRODUCTION TO THE PROJECT

1.1 Motivation

Despite developments in water resource policy, law, monitoring, regulation, management and research, the health and functionality of South African aquatic ecosystems continues to deteriorate (CSIR, 2010). At the same time, there is a growing recognition that humans are integral components of complex social-ecological systems; as such, their beliefs, values and actions have direct implications, whether intended or unintended, for the environment (Folke, 2006; Pollard and du Toit, 2011a, 2011b; Rogers and Luton, 2011).

In South Africa, considerable advances have been made in the inclusion of human values in the strategic adaptive management of natural resources (Roux and Foxcroft, 2011), where values are a central aspect of the established VSTEEP (values, social, technical, environmental, economic and political) analysis (Rogers and Luton, 2011). In this project, we have sought to provide a thorough review of the field of environmental ethics within the context of trans-disciplinary research methods, so as to link ethical thinking and practice to current and emerging practices in integrated water resource management (IWRM).

The first distinction to be made, is the difference between morals or values, and ethics. We take morals and values to refer to what specific individuals or groups of people believe to be good or bad, such as, e.g., polygyny, or abortion, or vegetarianism. We take ethics to refer to: a systematic concern with the principles by which we seek to distinguish between right and wrong in our behaviour towards other people and towards nature (de Wet, 2009: 78) For example, I may believe polygyny is wrong for my own moral purposes, but, as a matter of ethical principle, I may also believe that people should have the right to choose how they wish to conduct their own relationships for their own purposes. Thus we can look to the development of agreed ethical principles for water resource use, protection, and management – in terms of which to provide guidelines that point to accommodating a plurality of individual and group morals/values with regard to water.

This is extremely important in South Africa. Our historical context has its own ethical imperative to effect transformation towards social justice. In a highly plural society, the needs, desires and values of people will differ widely. Each choice and action that is made

tends to implicate other choices and actions, so that particular actions tend to open out and close down specific options in respect of access to the benefits of water use and/or protection, and will often be contentious. Trade-offs between values (e.g. between equality and liberty) or a compromise in standards for reasons of affordability (for example, resulting in water that is not always safe to drink) are not always meaningful or suitable, and there often will be winners and losers.

We review, research and present options for consciously developing ethical thinking and practice in IWRM that will assist us in navigating a journey, in a complex world, where all the outcomes of actions cannot be foreseen, towards the more effective realisation of values, including those of equity, sustainability and efficiency (which relate to social and environmental justice) enshrined in the National Water Act No 36 of 1998.

1.2 Key issues and the need for environmental ethical considerations in water resource management

In as much as human beings ascribe value to nature, and do so in different kinds of ways, the discipline and practice of environmental ethics could provide a useful guide towards our thinking about, and attitude and behaviour towards, the environment. An emerging ethical practice would reflect the way in which we value and relate to the environment, and help to make explicit the values that guide us – and that should guide us.

Within the context of water resource management, environmental ethics are already implicit in water policies, regulations and laws. For example, the DWS slogan 'Some for all, forever' speaks to the fact that it is seen as ethical to see water as a public good, not to be owned by a few wealthy individuals in the society, and to manage it sustainably. The revolutionary National Water Act (Act No. 36 of 1998), which shifted from the conventional 'command-and-control' approach, to an ecological basis for managing water resources, has an explicitly environmental ethical consideration, clearly captured in the notion of the Reserve, whereby rights accrue to the natural environment, as well as to people, for their basic needs for drinking, cooking and cleanliness. In providing water by right for both ecological and basic human needs, the Reserve serves social and environmental justice. All other water is administratively allocated for other uses. It is the decision-making around the amount and quality of water secured for resource protection, and the amount and quality of water allocated to various users with various levels of

security, which makes real the notions of social and environmental justice. It is these practices to which we seek to make a positive contribution, through an explicit consideration and development of a framework of environmental ethics relevant to water resource management in the context of social-ecological systems in South Africa.

The ecological Reserve concept, though difficult to implement, has led to some successful cases of improving water resource management, for example in the Sabie River (Pollard and du Toit, 2011a). Consequently, the development, adoption and embedding of environmental ethics, at different spatial and temporal scales, among a plurality of water resource users, and in specific contexts, has the potential to encourage best water and ecosystem management practices.

This brings us to the consideration of whether the environment has an intrinsic value of its own, and whether this should be the basis of its respect and protection; or whether environmental protection should simply ensures sustainable access by humans to ecosystem services (i.e. the environment as an instrumental value). Discourses on environmental ethics in the context of water and ecosystem management could be located in several domains including, but not limited to, the water-user sector, the institutional-governance domain, and/or environmental ethics in relation to environmental law. These various domains should not be seen in isolation from each other, but as aspects of a complex interconnected system. They can be viewed through the lenses of the different approaches to environmental ethics, such as whether the environment is seen as having intrinsic or instrumental value. An anthropocentric instrumentalism places human beings in the centre of the moral universe, viewing humans as intrinsically valuable, as the only moral agents, and seeing nature as having moral value in only an instrumental sense, i.e. in as much as it serves human beings, their needs and purview (Kronlid and Ohman, 2013:24). Placing an intrinsic value on the whole social-ecological system decentres human beings, and sees ecosystems as such – of which humans are part – as having an intrinsic moral value (Kronlid and Ohman, 2013:25). Using these perspectives and related questions from environmental ethics, we can then interrogate what is meant by the role and application of values in relation to water resource protection and sustainability.

Water and aquatic ecosystems goods and services have several potentially competing (i.e. human) stakeholders/users, e.g. domestic, industrial and agricultural users. Perspectives

from environmental ethics have the potential to make players in each of these user sectors more aware of the issue of values in relation to ecosystems, and of the need for their protection in terms of water resource management. Therefore, within the water user domain, environmental ethics could provide the framework and insights for interrogating pertinent questions such as:

- What are the moral obligations of the various water user sectors to protect and use water resources sustainably?
- Why should people invest in protecting aquatic ecosystems, even when this is not in their immediate financial interest?
- In the context of industrial discharge into a water resource, for example, why should an industry stop discharging into a water resource just because it is obvious that the resource has exceeded its receiving capacity – even when the legal discharge limits are not being violated?

Environmental ethics offers valuable additional perspectives for analysing the relationships between the biophysical aquatic ecosystems and their many users, with potential for improving ecosystems management through the recognition that these systems are part of large complex social-ecological systems, in which values and interests play a significant role.

Within the institutional-governance domain, perspectives and practices from within environmental ethics could potentially contribute to a framework for reforming water policies and governance, management practices, and existing institutions, through a systematic investigation of the value systems, beliefs, and moral affiliations of people living within a catchment, both in time and space. In this regard, a concern with environmental ethics may infuse greater awareness and transparency into water policy formulations – better enabling adaptive responses to changing conditions. A rigorous and systematic analysis of values underlying present water policies and institutions will help expose existing deficiencies and provide for opportunities to guide a system that further embraces the vision of the bio-physical world as having rights, rather than limiting moral and ethical concerns to human beings only (Hoffman, 1991; Groenfeldt, 2010).

If we are to take seriously one of the foundational concepts on which this project is based, i.e. that of social-ecological systems, we need to consider ways in which value relates to, and/or derives from, the notion of a system – of which human and non-human components are part. It is then not only various kinds of components that may be seen to have intrinsic value. Value is seen to derive also from the relationship between the components, and, in a dynamic system, from the emergent, and complexity-generated, properties of such a dynamic, interactive system (adapted from Pignatti, 2013:91).

This takes us into the heart of IWRM and the issues facing contemporary water managers – and the ways that values enter centrally into these matters. There are however, potential tensions between the component (intrinsic or instrumental) and relational approaches to value, with the former approach seeking to ascribe value to specific components of the social-ecological system, and the latter approach seeking to decentre components and to locate value in the system itself. This tension is explored in the context of IWRM as a system, and of the role of environmental ethics in relation to it.

Transformation and redress are at the heart of post-apartheid South Africa, especially in relation to resources seen as common goods, such as the nation's water resources. Transformation and redress could meaningfully be addressed by giving voice to, and listening to, voices from all sections of our society. A critical analysis and presentation of ideas and approaches from environmental ethics in the context of social-ecological systems, and how they could be applied to water resource management, could potentially contribute to transformation. These perspectives could be used to channel the value systems, beliefs, cultural and moral affiliations of all sections of society, particularly those of historically disadvantaged local communities, into policies and governance systems, in both ethical and effective ways.

Thus a central aim of this project has been to review, analyse and recommend ways by which environmental ethics can constructively contribute to water resource management in the context of social-ecological systems in South Africa.

The specific objectives of the project include:

1) To review the subject of environmental ethics, and its application to integrated water resource management, and aquatic ecosystems use and protection.

2) To investigate local and international case studies, showing the impact of environmental ethics on water resource management and aquatic ecosystem health, paying particular attention to best practice cases and identifying the ethics related factors in these cases.

3) To identify opportunities for applying and improving environmental ethics for constructive socio-ecological systems and water resource management in South Africa.

4) To identify ways in which environmental ethics can constructively be applied in South Africa, and the institutional and other foundations that accordingly need to be laid and/or changes made.

5) In this regard, analyse how environmental values and ethical systems operate at different scales: local, regional and national and the problems and possibilities of integrating them across these scales.

6) To propose future research directions for the implementation of environmental ethics and values in social-ecological research and management.

1.3 Methodology

1.3.1 General approach

The project adopts a trans-disciplinary approach. This is in an important sense inductively derived, proceeding from the increasing recognition that the world (including aquatic ecosystems) comprises of complex social-ecological systems, characterised by components, relationships, processes, non-linearity, and feedbacks, within contexts that can be selected and described (Cilliers, 2000; 2001). This trans-disciplinary approach is also derived from an understanding of the complexity of the issues involved in the interface between environmental ethics and water management. We seek to demonstrate that that a trans-disciplinary approach and a systemic – relational approach to environmental ethics are necessary to deal with these complexities.

We find MaxNeef's (2005) approach to trans-disciplinarity helpful in understanding how knowledge is developed across disciplines, through a structured understanding of the kinds of questions to which different disciplines contribute. MaxNeef sees knowledge-building as developing over four phases, which he discerns through four guiding questions: 1) the empirical (what is the case?), 2) the pragmatic (what can be done?), 3) the selective (of the things we can do, what do we want to do?) and 4) the normative (what should we do?). This fourth step, which focuses on values and ethics, has generally been neglected. This project analyses the literature to glean information on theoretical approaches to environmental ethics, as well as its application in practice-based case studies world-wide, including current policy practice, in South Africa, in order to clarify and develop the issues and problems pertaining to this normative dimension with regard to water resource management.

In this project, ethics is seen as a systematic concern with the principles in terms of which humans hold values and act in terms of them. In this project, the central principle guiding the environmental ethical framework in terms of which we approach water resource management is that the aquatic ecosystem constitutes an integrated social-ecological unit. This means that the unit/system itself, and its preservation – as opposed to any of its (therefore subsidiary) components – is the primary value unit in the system.

1.3.2 Acquisition and formulation of knowledge

A combination of desk top study and project team meetings were used in the course of this project. All of the information provided in this report has come out of analytical review of written sources. However, the project team met regularly to analyse, critique and raise pertinent issues related to the task at hand.

The desk top research has involved three key research based deliverables, as follows: i) The Literature Review provided an overview of the major theoretical approaches to environmental ethics, as well as of key legislative and administrative provisions in the South African water sector, and of the main values (including equity, sustainability and efficiency) driving them. A provisional set of ethical principles for drawing up an appropriate approach to environmental ethics in the context of water resource management and associated ecosystems, was presented at the end of the Literature Review.

ii) A detailed analytical review of the application of environmental ethics in water management in four different cases in Bangladesh, India, South Africa and the USA allowed for a comparison of a range of ways of thinking and underlying approaches to environmental ethics – with very different outcomes to, e.g., being able to accommodate constituencies with different values, and to the overall aquatic ecosystem. From a policy perspective, it is instructive to note how such approaches manifest themselves in actual situations- although seldom in a consciously articulated and thought through manner.

iii) An investigation of the relationship between environmental ethics and aquatic ecosystem health. Our key finding is that ecosystem health – while it is a human construct – needs to be seen within the context of the social-ecological system as a whole. The social-ecological system may be understood as consisting of two major components, i.e. the biophysical and the social-economic. If both parts are integral to the ecosystem, then the health of each is integral to the overall health of the ecosystem. Inherent in the concept of ecosystem health, are the notions of human dependence on aquatic ecosystems, as well as human capacity to alter ecosystem properties. Sustainability can therefore only be achieved if a working balance is struck between human uses of ecosystems, and the protection of these ecosystems. The management of this interrelationship needs to be done in an integrated, holistic manner, which is sustaining to both components.

CHAPTER 2: LITERATURE REVIEW ON ENVIRONMENTAL ETHICS AND ITS LINK TO WATER RESOURCE MANAGEMENT IN THE CONTEXT OF SOCIAL-ECOLOGICAL SYSTEMS

2.1 Introduction

This project, on the role of environmental ethics in social-ecological systems and water resource management, arises out of the fact that we are increasingly confronted by the complex and interwoven nature of the situations, of the systems, in which we, as humans – indeed, as all life on earth – find ourselves. Our location and role (as humans) as integral components of social-ecological systems, including our particular and far-reaching powers to impact upon those systems, is critical to the functioning and well-being – and indeed, the potential survival – of those systems. This raises the implication that we (as humans) may reasonably be seen to have responsibilities to the broader environment that go beyond our own species and individual personal and social welfare. This is the domain of environmental ethics, which we here see as concerned with the complexities of – at a minimum – respecting the natural environment, such that it is not seen simply as a source of supply for human benefit.

The aim of this chapter is to provide a brief analytical and critical overview of the subject of environmental ethics, and its link to water resource management in the context of social-ecological systems. We begin by introducing environmental ethics and argue for its importance in water resource management. Following the analytical framework of Kronlid and Öhman (2013), we present a brief review of recent (western) approaches to environmental ethics. A brief account of African environmental ethics is then provided. Water resource management in South Africa is briefly reviewed and related to environmental ethics. We then move more widely to consider perspectives which are globally considered as important, such as contextual value-based approaches to water management, as well as the relationship between environmental ethics and water resource management in the context of social-ecological systems.

2.2 Environmental ethics – the need for environmental ethical considerations in water resource management

Despite positive developments in relation to equity, sustainability and efficiency in water resource policy, as well as in law, monitoring, regulation, governance, management and research, it is the case that the health and functionality of South African aquatic ecosystems continue to deteriorate (CSIR, 2010). The situation is exacerbated by the prevailing socio-economic inequalities in South Africa. The consumerist lifestyle of the wealthy and the high resource-dependency of the poor are perhaps at the heart of the natural resource over-exploitation and degradation that now threatens the sustainability of water for aquatic ecosystems, and for future generations (Hohls et al., 2002; King and Pienaar, 2011). These growing environmental challenges therefore present difficult trade-offs for decision makers, and thus raise the need for environmental ethical consideration in decision-making processes.

Human behaviour, attitudes and action in relation to water are significantly informed by value systems, which value systems may be more or less coherent, may be more or less consciously held by different actors, and may be shared to a greater or lesser degree by a community of actors. Values have considerable implications for what we here call the human-water relationship, as well as for the degree to which people are willing to take responsibility for the sustainable management of water resources (Harman and Arbogast, 2004; Gaard, 2010; Pradhan and Meinzen-Dick, 2010). The willingness to take responsibility for sustainable freshwater resource utilisation – and the scope of such responsibility – depends to a large extent on how the aquatic ecosystem is seen in relation to human society and welfare; e.g. whether it is seen predominantly as a means to the end of human welfare, or as a value- cum-end in its own right, or in a relationship of systematic complementarity with human society (Vandeveer and Pierce, 2003; Ehrlich 2009).

Ethics and values pervade all aspects of water management, including water use allocation, social ordering, pollution control and the notion of healthy ecosystems (Brown and Schmidt, 2010a). Therefore, explicit consideration of different value systems and distillation of sets of environmental ethical principles and criteria by which such values can be negotiated in relation to each other, can contribute to sustainable freshwater resource management. This can be achieved by helping to clarify the implications of different claims and claimants and courses of actions, and by addressing the concerns of claimants within what are effectively pluralistic and polycentric institutional frameworks of water governance and management

(Brown and Schmidt, 2010a; Pradhan and Meinzen-Dick, 2010). These claims may range from calls for fair and equitable water allocation, to consensus around the ordering of social relationships and place-based values, such as cultural and spiritual beliefs around water (Brown and Schmidt, 2010a; Groenfeldt and Schmidt, 2013). Ethics, in seeking to establish broader principles to consider specific cases, plays an important balancing role between such claims and between claimants (Brown and Schmidt, 2010a).

Ethics is considered in this project as the systematic searching for and invocation of principles by which we reflectively seek to distinguish between right and wrong, good and bad, within ourselves and in our behaviour and attitude towards other people, and towards nature – it is an inquiry into the nature and grounds of morality, value judgements, rules, standard and norms and their implications (Morris et al., 1996; Minteer et al., 2004; de Wet, 2009). Thus, environmental ethics deals with the constitution of principles in the relationship between humans and nature and in the attribution of value to nature (Palmer, 2003; Minteer et al., 2004). Ethics is fundamentally different from morals and values because morals and values refer to what specific individuals or groups. mostly at an unreflective level, believe and consider to be good or bad, right or wrong – without deep reflection of the implications of such claims.

2.3 Approaches to western-derived environmental ethics

2.3.1 Value-oriented environmental ethics

Based on Kronlid and Öhman's (2013) framework, environmental ethics, as generated by various western thinkers, can be divided into two broad categories, i.e. value-oriented and relation-oriented (relational) environmental ethics. Western environmental ethics has been primarily concerned with the intrinsic value discourse, i.e., what/who in terms of humanity and (the rest of) nature has intrinsic value (i.e. value in and of itself, for its own sake) and who/what should therefore be considered as part of the 'moral circle' (e.g. Goodpaster, 2003; O'Neill, 2003). Based on the intrinsic value argument, two environmental ethical approaches – the anthropocentric and non-anthropocentric – have assumed prominence, and these two approaches have been considered as disparate in their moral consideration of the environment (Kronlid and Öhman, 2013).

Anthropocentric environmental ethics

Anthropocentrism holds the general view that only humans have intrinsic value and only humans thus qualify for being admitted into the moral circle (Light and Rolston, 2003). Non-human life forms, including aquatic ecosystems, have no such intrinsic value. Their value is seen as instrumental, in terms of the value which humans derive from such non-human entities. In the context of water resources, aquatic ecosystems and associated resources can therefore only be considered valuable and deserving of protection if they are of instrumental value to humans and to human well-being. Thus, the relationships between humans, and the relationships between humans and the environment, are underpinned by different notions of value attribution (Kronlid and Öhman, 2013). For example, between humans, an important environmental ethical question, which may shape water resource policies and programmes and the notion of environmental justice, is: who among humans/humanity has intrinsic value and thus moral standing? Values and moral standing could be ascribed to i) only living humans (intragenerational); ii) living and future generations of humans (intergenerational); iii) dead, living and future generations of humans (transgenerational); iv) humans that are closely connected in some ways, e.g. socially, mentally, culturally, geographically, etc. (local anthropocentrism), or; v) all humans, irrespective of their relative closeness (global anthropocentrism) (Kronlid and Öhman, 2013).

From an anthropocentric perspective, an explicit consideration of the question raised above (who should be part of the moral circle?) is therefore important in water resource management. For example, the principle of equity, which is enshrined in the NWA (Act No. 36 of 1998),and which refers to fairness to present generations, is underpinned by an intragenerational value judgement, and by the recognition of catchments as water resource management units (Pollard and du Toit, 2008), where effectively only people within such catchments are considered in catchment-based issues. It could therefore be seen as being underpinned by a local anthropocentric value position. For an effective implementation of intergenerational environmental equity, government and relevant institutions must be seen as stewards of the present generation and of resources for future generations (Mclntyre-Mills, 2013). This requires solidarity with present environmental concerns and the will to act to prevent unnecessary exploitation of natural resources. Intergenerational consideration in relation to water resources is addressed in the South African National Water Act through the principle of sustainability. The question that arises is that of effective implementation of

policies and programmes that ensure the continuation of the biophysical resources needed by future generations of people.

The role of trans-generational solidarity in promoting inter-generational environmental equity is discussed later in the context of African environmental ethics (Behrens, 2012). This involves taking intergenerational responsibility seriously in all aspects of water resources, underpinned by collective solidarity with the 'concerns' of, and respect for, the well-being of, future generations.

An important aspect within anthropocentrism is the nature of the relationship between humans/humanity and the environment. Although anthropocentrism has traditionally been considered as human-centred and thus potentially un-eco-friendly, several authors (e.g. Hargrove, 2003; Norton, 2003) have argued that, depending on the conceptualisation of the relationship between humans and the environment, anthropocentrism can provide a strong basis upon which people can act to protect the environment. For example, the human-water relationship can be conceptualised based on the kind of value people obtain from water resources, as well as based on geography, history, and constructed social discourses. According to Kronlid and Öhman (2013), instrumental valuation of the environment can be categorised into demand values, transformative values, constitutive values and need values. In most cases, both demand values that satisfy human preference as well as need values, which are necessary for human survival and well-being, are economically and socially driven. Transformative values relate to our experience of water that is capable of transforming our relationship with it, whereas constitutive value is our experience of water as an integral part of what it means to be human.

From the above, in relation to how people relate to and derive value from the natural environment, an important question becomes: can resource managers and policy makers identify values concerning water developed by local people within a specific context, which can enable them to protect the environment? For example, in some rural African communities, certain rivers/parts of certain rivers are considered sacred because they are regarded as places where the ancestors manifest themselves. In most such communities, people act to protect such rivers and to keep them clean – hence ecologically healthy. Such indigenous practices that lead to the protection of water resources are worth considering and exploring in formulating programmes aimed at protecting water resources within the specific

context. Since people usually act in their own interest, identification of such values can become incentives for people to act voluntarily to protect the environment, either individually or collectively – i.e. a form of self-regulation. In so doing, however, it is important that demand values, which are basically for mere preferences, are accorded low priority. Thus, value systems shaping the notion of people's conception and experience of water, become crucial considerations in managing water.

Place-centred aspects of the human-environment relationship are important to anthropocentrism. It has been argued that people with strong emotional, physical, spiritual and social connections with their environment, often have a stronger sense of obligation towards the protection of the environment (e.g. Murove, 2009). Strong connection with the environment could arise out of culture, history and identity. Societies with strong connections to their places in terms of dwelling and ecological understanding, usually develop ecological consciousness that tends to lead to resource protection and conservation (e.g. Gaard, 2010). An important aspect of such place-based human-environment relationships is consideration of sacred sites, features and attributes (Raine, 2001). In many African cultures, the attribution of the value of sacredness to the environment, which is usually underpinned by ancestral and historical practices, has resulted in the development of a strong sense of environmental stewardship and guardianship (Bernard, 2010). On the other hand, a sense of 'placelessness', conceived here as a lack of rootedness and an inability to connect with the society and the natural environment in which one dwells, can lead to a sense of lesser obligation towards the environment, and thus to its exploitation.

Biological, evolutionary and ecological connections between people and the environment provide another dimension to viewing the human-environmental relationship (Norton, 1987). All species, humans and non-humans, depend on the external environment for survival. An understanding of these interconnections provides the potential for an attitude of care and stewardship towards the natural environment, with the realisation that the survival of our own species is inextricably linked with the functionality and health of the environment with which we are biologically, evolutionarily and ecologically connected.

All of these different aspects of the way we understand the human-environmental relationship, and the ethics appropriate to this relationship, relate to and are reflected in our conception of the natural environment, and our narratives of our experience of nature and of

what it means to be human within the broader context of nature (Klaver, 1995; Kronlid and Ohman, 2013). However, in anthropocentrism, this places the human being at the centre of the human-environmental equation, and with only the human being having moral status and intrinsic value in the context; while the environment needs to be looked after, it is basically seen as of a morally 'secondary status', and as there to supply human needs .

Non-Anthropocentric environmental ethics

Critics of anthropocentrism have argued that restricting intrinsic value to only humans could lead to uncontrollable and unnecessary exploitation of natural resources (Devall and Sessions, 2003). Environmental crises confronting humanity and the planet as a whole, such as global warming, freshwater pollution, land degradation, species extinction, etc., have been attributed to an anthropocentric moral outlook concerning the environment (Stone, 2003). Non-anthropocentrism holds the view that non-human beings, whether collectively or individually, have intrinsic value over and above their instrumental value to human well-being (Stone, 2003; Taylor, 2003). Within the non-anthropocentric movement, the object of intrinsic value, depending on one's ethical position, may be seen in individualistic or holistic terms.

An individualistic moral outlook presupposes that individual non-human beings fulfilling certain criteria, for example sentience, communicative capacity, society and socialisation, or having a sense of self, etc., should be considered as having intrinsic value (Vandeveer and Pierce, 2003) and thus, as having a good/moral worth of their own. On the other hand, within a holistic approach, bio-centrism regards all living organisms as holders of intrinsic value, because their flourishing and existence is a good in its own right that must be maintained (Taylor, 2003). An eco-centric non-anthropocentric outlook views the organic whole, i.e. ecosystems and species, as holders of intrinsic value because they sustain life and, because their functionality, integrity, resilience, stability and beauty can be recognised (Taylor, 2003 Callicott, 2002). Systemic value, which is an emergent property of interactions between the components of a system, is often associated with eco-centric environmental ethics (Taylor, 2003).

From the non-anthropocentric perspective, accepting the notion of intrinsic value in the natural environment (e.g. water resources), raises the implication that intrinsic value as such – whether located in humans or non-humans – needs to be protected. This is a central claim of non-anthropocentric ethics. This raises the further implication that humans – as the only

morally responsible being (i.e. agents that can be held accountable for their actions) – have an obligation to protect and consider the interest of the non-human living beings and the associated ecosystems of which those creatures are part. In this regard, Taylor (2003) argues for the attitude of respect for nature, which hinges primarily on the principle of inherent worth, and advocates the recognition of the intrinsic value of nature as an end in itself. Although the attitude of respect as articulated by Taylor (2003) has the potential to halt further degradation of the natural environment, taking the attitude of respect as an ultimate belief system underpinned by a set of personal and institutional norms, standards and rules, to promote the 'good' of all, including the non-human component of the ecosystems, would require a fundament shift in the way in which water resources are managed, both globally and in South Africa. We will return to this issue later.

The attitude of intrinsic-type respect for nature may call into question the approach to ecological categories (i.e. Categories A-F), in South African water resource management, in which ecosystems considered heavily degraded in categories E and F may not be restored to pristine conditions (DWAF, 2008; Kleynhans and Louw, 2007; DWA, 2010). That is, the 'good' of such ecosystems is no longer considered as the key value, but ecosystems are seen as instrumental to a water management system and its way of classifying ecosystems. The ethical question thus becomes: how are we, in the context of water resource management in South Africa, to respect the non-human environment? How will water resource management ethics move beyond anthropocentric approaches, and, even so, what is the limit of respect for nature – especially from the perspective of resource and other practical constraints?

Another question that relates to the ethics of respect as constructed above, is that of potential trade-offs between, e.g. human rights, and the rights of the environment, and between different evaluations of aquatic ecosystems. Trade-offs can exist between taxonomic diversity (e.g. rarity, vulnerability, richness, etc.), functional diversity, biotic welfare and environmental fidelity (e.g. water quality, sustained hydrology, riparian and geomorphological integrity), as well as ecosystem services and security (e.g. production, regulation, provisioning and cultural services) (Sarkar, 2013). In the face of limited resources, which of these environmental values deserve respect and attention, is an ethical question that must be deliberated upon, taking account of the specific social-ecological context. Where the human right to water (e.g. the human Reserve) and environmental right to water (e.g. the ecological Reserve) are at odds, how should such a trade-off be treated, and what ethical

criteria should be used in the underlying value judgement of the final decision? Alternatively, should there be limits for the respect for nature and/or for humans within the social context?

The attitude of respect would also require conferring legal or other rights onto the natural environment, and respecting these rights. Stone (2003) suggests that conferring rights on to the natural environment involves two dimensions: i) the legal-operational aspects and ii) the psychic and socio-psychic aspects. To promote the virtue of environmental inherent worth and dignity through operationalising environmental rights, i) the environment should be able to institute a legal action, ii) the injury or degradation to the environment must be taken into account in granting of the legal relief and iii) the relief must run to the benefit of the environment, and not humans who are associated with the environment (Stone, 2003).

Since rights are also about relationships, and they become important only when respected, the question that arises is: what happens when the environmental right impedes on human rights? This is one of the reasons why the ecological Reserve has proved difficult to implement (King and Pienaar, 2011). An environmental ethical framework is therefore needed to address the issue of human-environment rights trade-offs. Although rights conferred on the environment through a legal system could help reduce environmental degradation, a reconceptualization of the human-environment relationship, involving a social re-ordering in which humans become more conscious of our inextricable link with nature, is needed to enable the attitude of respect for environmental rights. The implication here is that legal rights alone are not sufficient as the basis by which people would act voluntarily to protect the natural environment. Institutional change, that actively seeks to encourage the attitude of respect for nature by practically demonstrating various ways by which people are inextricably connected to the natural environment, is also required.

2.3.2 Relational environmental ethics

Value-oriented environmental ethics has been criticised for its emphasis on the intrinsic value debate, and for moral extensionism (i.e. ascribing moral status to non-human things), and thereby bringing about a dichotomy between humans and the rest of nature (Gruen and Gaard, 2003). Ascribing intrinsic value does not recognise the inextricable link between humans and the rest of nature in the context of both being part of social-ecological systems (Berkes and Folke, 1998; Constanza et al., 2001 and Folke et al., 2005). Value-oriented ethics has also been criticised for not taking human societal context sufficiently into account in its

prescription of ethical principles that should guide our relationship with the rest of nature, and thereby disregarding the complexity of the interrelationship between environmental problems and policy engagements (Minteer et al., 2004). The top-down application of a single principle or set of principles in the defence/or otherwise of the intrinsic value of nature may not help resolve environmental issues without taking account of the specific social context, or without asking whether all practical environmental decisions are in fact equally well-served by a single ethical principle (Minteer et al., 2004).

Therefore, relational environmental ethics holds the view that value relates to and derives from the notion of a system and the relationships between its component parts and processes, and that accordingly, the justification of behaviour, and the prescription of moral principles must take into account the specific systemic context (Minteer et al., 2004; Gaard, 2010). Relational ethics views life as relational, and in the context of social-ecological systems, decisions around natural resource management must consider the social and ecological aspects as inextricably connected components. Pragmatist environmental ethics (Minteer et al., 2004), deep ecology (e.g. Naess, 2003), ecofeminism (e.g. Karen and Cheney, 2003), and most African environmental ethics (e.g. Kelbessa, 2005; Murove, 2009), could be considered as varieties of relational environmental ethics.

Pragmatist environmental ethics

Environmental pragmatists argue that environmental ethics should be more concerned with practical everyday situations in which environmental and societal needs come into conflict, and with how such conflicts could/should be resolved (Minteer and Manning, 2003). The specific context needs to be understood and reflected upon; in so doing, one evolves ethical principles which can be revisited and revised on an on-going basis, reflecting the specific environmental context (Light and Katz, 1996; Minteer, 2001; Minteer et al., 2004).

Applying preconceived sets of ethical principles to all environmental situations compromises the possibility of a relevant response to social-ecological problems (Minteer et al., 2004). Social-ecological systems are complex and are characterised by unpredictability, which factors require contextual and adaptive engagement (Folke et al., 2005). Thus, the justification of an ethical principle depends on whether it contributes meaningfully in resolving specific environmental issues. Emergence is a property of complex social-ecological systems, which may give rise to new experience and insights (Folke, 2006; 2007;

Pollard and du Toit, 2011; Pollard et al., 2011). Ethical approaches which focus on intrinsic value may not be flexible enough to respond to the dynamics and unpredictability associated with social-ecological systems. Thus, an adaptive ethical system, reflecting actual circumstances, new insights and experiences, needs to be mainstreamed to manage water resources in the context of complex social-ecological systems. The practical implication of this pragmatists' view point is that norms, rules, principles and standards would continuously undergo some form of revision and re-interpretation to reflect the existing social-ecological context, while taking account of pluralism of environmental values and valuations in a democratic deliberative process.

In reality, this is, however, likely to raise problems in relation to the issue of power, as different actors with different ethical approaches are likely to be differently situated in terms of power in relation to each other, and the deliberation process around establishing the dynamics of the adaptive ethical system as it progresses, is not necessarily likely to be all that 'democratic'. There also needs to be some measure of continuity and understanding in institutions, and the dynamics of the water management system's adaptive ethical system cannot be too flexible in practice.

Ecofeminist environmental ethics (ecofeminism)

Ecofeminist environmental ethics holds the view that the exploitation of nature is a feminist concern because it relates to the twin domination of women and nature by a patriarchal society underpinned by value systems that promote such discrimination (Gaard and Gruen, 2003; Warren, 2003). Value dualism (where values associated with the 'self' are considered superior to those associated with 'others', usually women and nature), and the cultural evolutionary separation of men from women and nature (in which muscularity is seen as an indicator of superiority and as a means to dominate both women and nature), are issues that ecofeminists have advanced as to why environmental problems are feminist concerns (Gaard and Gruen, 2003; Warren and Cheney, 2003; Gaard, 2010). The implication of the ecofeminist analysis is that it surfaces a global world view in which (it is claimed) arrogance, domination, and conquest have replaced an ethics of harmony, reverence and respect for all components of the social-ecological system. The twin domination of nature and women could be seen as an outcome of value systems that seek to ignore the interconnected, interdependent and mutually re-inforcing nature of the components of a social-ecological system. Thus, the

ecofeminists' position is that environmental decision- making processes must take account of the interests of the most vulnerable in human society, and of the interests of non-human communities (Warren and Cheney, 2003). How do we formulate an ethical framework where all value systems and moral claims are given equal voice and consideration in the broader sense of water resource management and aquatic ecosystems? We will return to this question later in the section on environmental ethics and social-ecological systems.

Ecofeminism therefore advocates and seeks to promote an attitude, belief system and moral values that enhance respect for both the most vulnerable human constituencies and the environment. Ecofeminism emphasises the importance of contextualising environmental issues, taking account of history, the present, as well as the future, and avoiding a reductionist view to resolving environmental problems (Warren and Cheney, 2003). That is, it emphasises the recognition of differences as well as commonalities, and promotes a systemic approach to addressing the twin domination of women and nature.

The principle of inclusivity – i.e. beyond only gender inclusivity – is an important aspect of ecofeminism. To avoid perpetuating inequalities and historical injustices in environmental issues and policies, ecofeminism emphasises inclusivity, paying particular attention to the perspectives, insights and views of the marginalised (Stephens et al., 2010). It avoids the notion of a universal context-free practice, and seeks to evolve practices that are best suited for resolving specific contextual environmental issues. For example, ecofeminists insist that the perspectives of indigenous people, women and other marginalised groups must be considered on an equal footing with other approaches, so as to avoid prejudice – unless (like any other approach) proven through rigorous debates, engagements and scientifically defensible methods and approaches to be environmentally damaging (Warren and Cheney, 2003; Stephens et al., 2010).

Deep ecology

Central to the deep ecological approach, is the view that environmental crises arise because of social-economic, cultural and other value systems that elevate humans above non-humans. Deep ecology subscribes to the intrinsic value of nature and to the equal moral worth of both human and non-human entities. It advocates an ethic of respect for nature that translates into harmony rather than rivalries between human and non-human species (Fox, 2003). (Deep ecology would however, seem to have to accept competition and rivalry within the non-

human environment). Devall and Sessions (2003) argue that self-realisation and biocentric egalitarianism are the two ultimate norms of deep ecology. The first norm, self-realisation, emphasises the embedding of humans within the ecological system and thus discourages the narrow view of 'self' and of the social-cultural values that separate humans from the rest of nature. Self-realisation is therefore the mature experience of oneness in diversity – diversity that includes both other humans as well as non-human biological communities (Naess, 2003). The second norm, biocentric egalitarianism, emphasises the intrinsic value of all living things and associated life- supporting systems (e.g. water, land, air, etc.), and the principle of the equal moral worth of all living things (Devall and Sessions, 2003).

From a practical perspective, deep ecology seeks to promote environmental health through deep ecological consciousness based on self-reflection on the role and position of humans within the organic social-ecological whole (Devall and Sessions, 2003). Deep ecology can contribute to water resource management via the development of policies that see humans as part of the social-ecological system, rather than the notion of human superiority and dominance. However, quite how deep ecology would handle the problem of trade-offs and compromises being central to the domain of policy and its application, and how this would be accomplished when all components of the social-ecological system are to be seen as having intrinsic (i.e. non-compromisable) value, is not clear.

2.4 African environmental ethics

African environmental ethics emphasises relationships, that is, the notion that life is relational, as opposed to most western environmental ethical movements, which are mostly concerned with issues of intrinsic value and moral extensionism (Kelbessa, 2005; Bujo, 2009). Central to the relationality of African environmental ethics, is the notion of mutual respect between all components of the system, because it is believed that destroying perceived lower components of the (hierarchical) system may alter the unity and intactness of the whole (Bujo, 2009). According to Bujo (2009), whenever the system is altered, reconciliation is sought between its components – for example, through religious means, in order to maintain the unity or intactness of the whole. Consequently, the rationale for environmental conservation from an African environmental ethical perspective, relates to the maintenance of this unity/ intactness of the organic whole.

Ubuntu and Ukama are two well-known African concepts that emphasise the importance of relationships, not just between humans, but between humans and the environment (Murove, 2009**;** Ramose, 2009). Insights from these two ethical concepts can contribute towards achieving social and environmental sustainability (Murove, 2009; Prozesky, 2009). While *Ubuntu/Batho* implies shared humanity or humanness and presupposes that meaningful existence in one's life depends on mutual and caring relationships with other members of humanity – poor and rich alike, *Ukama* on the other hand*,* extends this concept to the natural environment (Murove, 2009**;** Ramose, 2009). Although on the surface, *Ubuntu* seems anthropocentric, its affirmation of care for other humans indirectly leads to care for the environment on which other humans depend (Ramose, 2009).

The practice of *Ukama* implies recognising the interrelatedness and interdependency between humans, and between humans and the rest of nature (Murove, 2009). *Ubuntu and Ukama* provide a strong basis for relational ethics from an African perspective through their promotion of ecological consciousness and moral obligation towards future generations (Murove, 2009; Behrens, 2012). The two ethical concepts recognise the intrinsic value of all components of the social-ecological system through personal and cultural experience, as well as their instrumental value through interrelatedness, in which each component of the social-ecological system is understood to serve the entire system, and each component is served by the entire system (Prozesky, 2009). In the last chapter of this report, we draw from the concept of interrelatedness in formulating the principles underpinning our proposed systemic-relational ethical perspective for social-ecological systems. The *Ubuntu/Ukama* thought system is helpful in this regard as it appears to combine aspects of both intrinsic and instrumental value.

The environment is viewed as a common resource, and a trans-generational value system becomes a key motivation for preserving its integrity (Murove, 2009; Behrens, 2012). The environment as a common resource belongs to the past (ancestors), present and future generations and, as such, it ought to be treated with utmost respect and care. This invokes moral obligation on the present generation to preserve it for future generations as a way of showing gratitude, solidarity and respect to the ancestors who have left behind an environment capable of supporting the needs of the present generation (Behrens, 2012).

Thus, in the African context, the object of moral consideration is viewed with the lenses of a trans-generational value system in which the dead, the living and future generations are all included in the moral circle (Wiredu, 1994). Many Africans, for whom their indigenous culture is still important, hold the view that the environment is an inherited commons from past generations, which must be taken care of for future generations, as a way of showing respect and gratitude to their predecessors. Maintaining such value systems underpinned by trans-generational solidarity, could contribute to the sustainable utilisation of freshwater resources because, even if we do not know the lifeform of future generations, as a way of showing respect to the ancestors, we can preserve the environment and maintain it the way we found it. An important question becomes whether such a value system might restrict development. However, there are different views as to how respect and gratefulness to one's ancestors might relate to moral obligation toward future generations (Behrens, 2012).

A critical central question concerns the extent to which relational ethics incorporates efficiency/functionality as a core tenet, as ethics is also about implementation. This raises questions around, e.g. efficiency/functionality, according to whom? How are short and long term considerations balanced in relation to each other? How are interests of different components of the social-ecological system reckoned and represented? How is liability for payment reckoned?

This review has sought to outline the basic aspects of the major approaches to environmental ethics, in terms of the main issues that they raise. These include:

- The role (central or otherwise) of human beings and its ethical implications in the human-natural environment relationship.
- The usefulness of the idea of intrinsic value in considering the ethical status of, and ethical behaviour towards, components of the environment.
- That the socio-ecological environment may be seen as an integrated unit, in which the various components parts all have inherent value, and in which human beings do not have primary status – but in which all aspects are interrelated, and support each other.
- That water and other components of the aquatic ecosystem may thus be seen as having intrinsic value in their own right, as well as instrumental value. This requires a considered ethical – and managerial – balancing act.

2.5 Water resource management in South Africa and environmental ethics

The National Water Act (NWA, Act No. 36 of 1998) is the overarching legal instrument that speaks to water resource management in South Africa. The three key values that underpin water resource management in the Republic of South Africa are equity, sustainability and efficiency. These values form the cornerstone of all strategies, programmes, policies and plans related to managing South Africa's water resources.

In the context of the NWA, the value of equity could be interpreted as fairness in meeting the socio-economic needs of all people, and fairness in meeting the needs of the environment. The value of equity appears in Principles 12, 13, 14 and 25 of the 1997 White Paper on National Water Policy (NWP) (DWAF, 1997). Although the value is fundamental in addressing historical injustices in South Africa, equity in the policy was conceived mostly in terms of access. Indeed, the three aspects of equity that were recognised in the policy include

1) Equity in **access** to water services
2) Equity in **access** to water resources and
3) Equity in **access** to benefit from water resource use

Access should however be seen as only one of the various components of equity – which involves a range of environmental, political and socio-economic concerns related to water resources. For example, equity in the active participation of involved interest groups/stakeholders – particularly the economically and politically marginalised – in debating divergent value systems and in decision-making processes related to water resources, must be upheld at all times.

The second value, sustainability, is vital to the subject of environmental ethics because it speaks to the right of aquatic ecosystems to water, reflected in Principle 9 of the NWP (DWAF, 1997). This value is given effect in the ecological Reserve (DWAF, 1997; DWA, 2013). In the NWA and NWP, environmental sustainability is conceived in terms of resilience, acknowledging the capacity of water resources to recover when disturbed, and the importance of ensuring that human activities that do impact, do not limit their capacity to recover to their natural, or near natural, conditions (DWAF, 1997). The third value of efficiency relates to the prudent use of water resources in their management, protection, conservation, and all related activities.

The three values are stressed in protecting, using, developing, conserving, managing and controlling water resources (NWA, 1998). While the NWA is hailed as progressive, it is important to note that it was significantly influenced by the thinking in Integrated Water Resources Management (IWRM). In fact, the NWA speaks to the overarching principles of IWRM, taking cognisance of inequitable distribution of water, water vulnerability, and the social (including gender), economic and environmental dimensions of water, as well as the need for co-operation and coordination (DWA, 2013). From an ethical perspective, it is crucial to note that IWRM is not value-neutral, as it entails value judgements that influence the way in which water resources are governed, managed and allocated (Brown and Schmidt, 2010a). For example, issues around the equity of constituencies relating to water for development could raise serious ethical questions – who is to benefit from water-based development and what/who determines such development? While the principle of equity seeks to address these questions, the underlying value judgements for such decisions are not explicitly expressed. An emphasis on sustainable equity that stresses the importance of sustaining all components of social-ecological systems has significant implications for decentring humans within the social-ecological system, thus placing emphasis on relationships and systems rather than on the components of the system.

Achieving IWRM involves several strategies outlined in the National Water Resource Strategy (NWRS) (DWA, 2013). The Resource Directed Measures (RDM) and the Source Directed Controls (SDC) are the two complementary strategies aimed at working towards the achievement of two of the founding principles of the NWA, i.e. equity and sustainability. The RDM are directed at the water resource base to ensure that use is sustainable (DWA, 2013). The RDM components include water resource-classification, determining the Reserve, and the setting of Resource Quality Objectives (RQOs) (DWA, 2013). The Reserve provides for the quality, quantity and reliability of a supply of water required for basic human needs (the human Reserve), and for aquatic ecosystem functioning (ecological Reserve) (King and Pienaar, 2011; DWA, 2013). The Constitution of South Africa guarantees the right of people in the Republic to have access to sufficient water of good quality. Although the Constitution and the NWA affirm the right of people to a basic water supply, the policy position is to charge users the costs of providing water services, including infrastructure development and catchment management activities (DWAF, 1994; DWA, 2014). The underlying value judgement of this policy position is the principle of economic efficiency, and several authors

have noted that with water services institutions being required to recover costs, economic efficiency may in the long-term undermine the achievement of equity and sustainability (Pollard and du Toit, 2008). This involves a clash of values, and the potential of the Department of Water and Sanitation developing an inconsistent and unsustainable ethical framework.

The ecological Reserve relates to the quality, quantity and reliability of water supply required to protect and maintain aquatic ecosystems (DWAF, 2008; King and Pienaar, 2011). The NWA (Act No 36 of 1998) thus confers legal right of access to adequate water of appropriate quality on the aquatic ecosystem. The NWA, through the ecological Reserve, recognises the legal right of aquatic ecosystems. Nevertheless, since rights are about relationships and respect, what remains unclear is whether the way in which the ecological Reserve is operationalised in practice promotes the 'good' of non-human biological communities and the associated aquatic ecosystems. If the 'good' here is taken as involving the capacity to function healthily and flourish so that the aquatic ecosystem has an overall optimum state of well-being (Taylor, 2003), then we should be striving towards restoring and/or maintaining all water resources to/in this optimum condition – which must be measurable if such restoration or maintenance is to take place.

In reality however, the operationalization of the Reserve and RQOs as well as of the classification systems, places limits on the ability to respect the rights of aquatic ecosystems. For example, since the RQO may not provide measurable objectives that ensure returning water resources in management Class III to their natural or near natural conditions, the 'good' of such ecosystems is no longer the ultimate end of the exercise. In the face of limited resources, there will always be a trade- off between respecting the rights of the aquatic ecosystem and the realisation of other legitimate rights (e.g. social-economic development) – thus balancing the need for development and protecting the functionality of the aquatic ecosystems. How and by whom this balance of rights in realisation is determined, remains an issue.

In operationalising the rights of aquatic ecosystems, it is important to ensure that the aquatic ecosystem is able to institute a legal action in its own right, that degradation to the environment is considered in granting the legal relief, and that the relief runs to the benefit of the aquatic environment which has been impacted (Stone, 2003). To operationalise this relief

effectively, it is also important to invest in relevant environmental re-education of the society about human-environment relationships. However, trade-offs often exist between allocating water for ecosystem use and for human socio-economic development. It is important to assess these trade-offs systematically (Figure 2.1). Figure 2.1 indicates benefits of allocating water to maintain aquatic ecosystems in their 'natural' condition, and of modifying them for socio-economic benefits. As the figure suggests, maintaining aquatic ecosystems in good condition has long-term benefits to humans compared to the uncertainty surrounding the long-term sustainability of modified systems (Wallace et al., 2003). Therefore, a multi-criterion system that incorporates the benefit of allocating water to the aquatic ecosystem and to human use should be consciously applied to guide the decision-making process, balancing both environmental needs and socio-economic developmental requirements (Wallace et al., 2003). Fairness (as in application to human and non-human constituencies, and as across the human constituency, i.e. a comprehensive approach to equity) as well as sustainability over time (which will have economic as well as environmental components) will need to be clear principles in the environmental ethical approach to water resource management in South Africa.

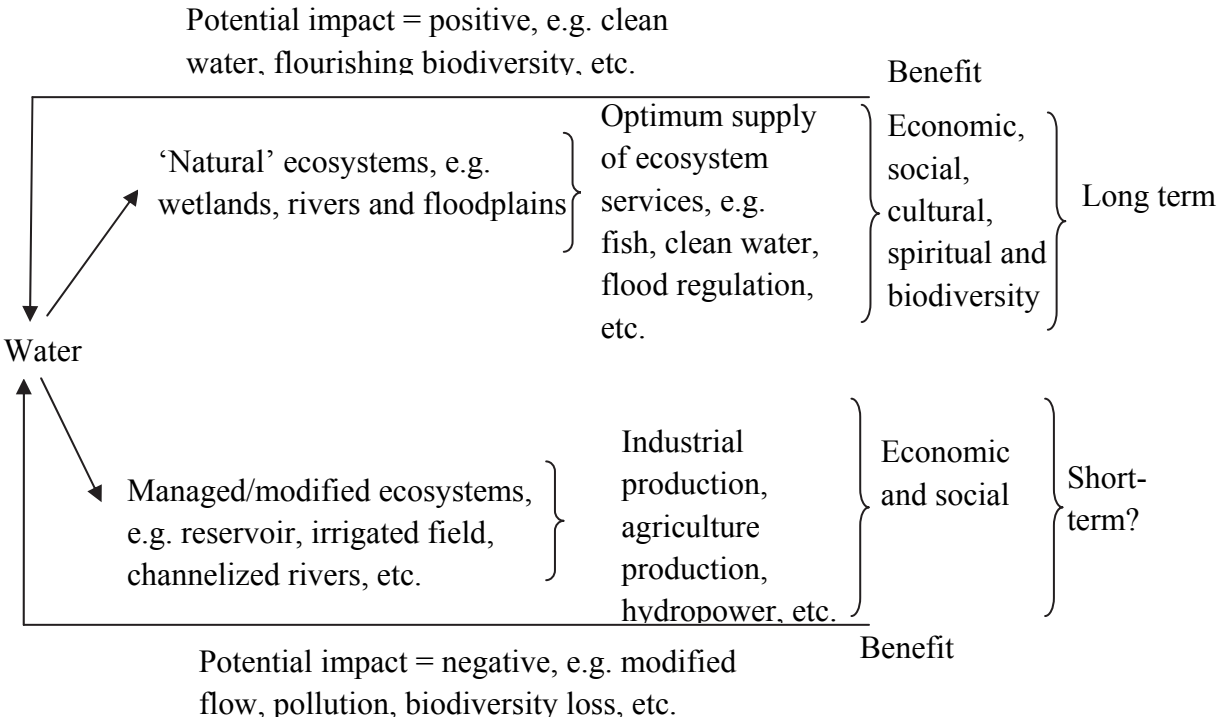


Figure 2.1: A simple model showing the benefits associated with natural and managed/modified aquatic ecosystems (Modified from Wallace at al. 2003).

The Source Directed Controls (SDC) is the second complementary strategy for managing water resources in South Africa. The SDC uses tools such as general authorisation, licenses, registrations and permits to define, impose limits on, and restrict the use of water resources to achieve the desired levels of protection, thus ensuring water resource sustainability (DWA, 2013). Equity is also an important consideration in the SDC as water allocations through licenses and permits take account of historical injustices and gender in/equity (DWAF, 2004). While access to water is undoubtedly a crucial aspect of the principle of equity, from an ethical perspective, democratic decision-making processes, public engagements and enabling concerned parties to effectively and efficiently participate in water allocation processes and other aspects of the SDC, are equally important aspects of equity.

Water resource management in South Africa has broadened its vision of environmental ethics, by broadening its vision of the environment in terms of the way it now thinks more comprehensively in terms of the social-environmental system as a unified complex system. The way it (water resource management) now uses the three key principles of equity, sustainability and efficiency has accordingly taken on a central role in the interface between management and ethics of the environment.

2.6 Contextual value-based considerations

It is important to stress that thinking around water is itself value-laden, and thus, if the goal of managing water sustainably is to be achieved, values associated with water must be taken into account and clarified in every decision- making process (Brown and Schmidt, 2010a). Water cuts across every aspect of human endeavour, as do the ways in which water is valued. Depending on the context, e.g. the spiritual value of water may be given higher priority by local communities over other values, and thus recognising and clarifying value systems that influence people and institutional behaviour towards water should be an important consideration in managing water (Groenfeldt and Schmidt, 2013).

One of the key principles of IWRM that was adopted in 1992 was the recognition of water as a finite, scarce resource that has economic value in all of its different use contexts (UN, 2008). The principle of the economic value of water has been very divisive because it relates to in/equity of values. Since water cuts across every aspect of human life, the value one attaches to it at any given time and place is influenced by several factors including religion, ecological orientation, social group, culture, customs, emotions, etc. Thus, the seeming

promotion of the economic value of water over other kinds of values raises a range of ethical questions about how to clarify and reconcile values associated with water, such as intrinsic and instrumental approaches to water.

Since values are not static, and in many cases are context-dependent, ethical considerations can play a critical role in value clarification during water resource management decisions (Pradhan and Meinzen-Dick, 2010). Figure 2.2 illustrates the potential role of ethics in the overlapping domain of selected factors likely to influence value-judgements in water resource management. It is important to note that re-interpretation and clarification of values are an integral part of ethical consideration, as values are dynamic and emerge out of social-ecological systems.

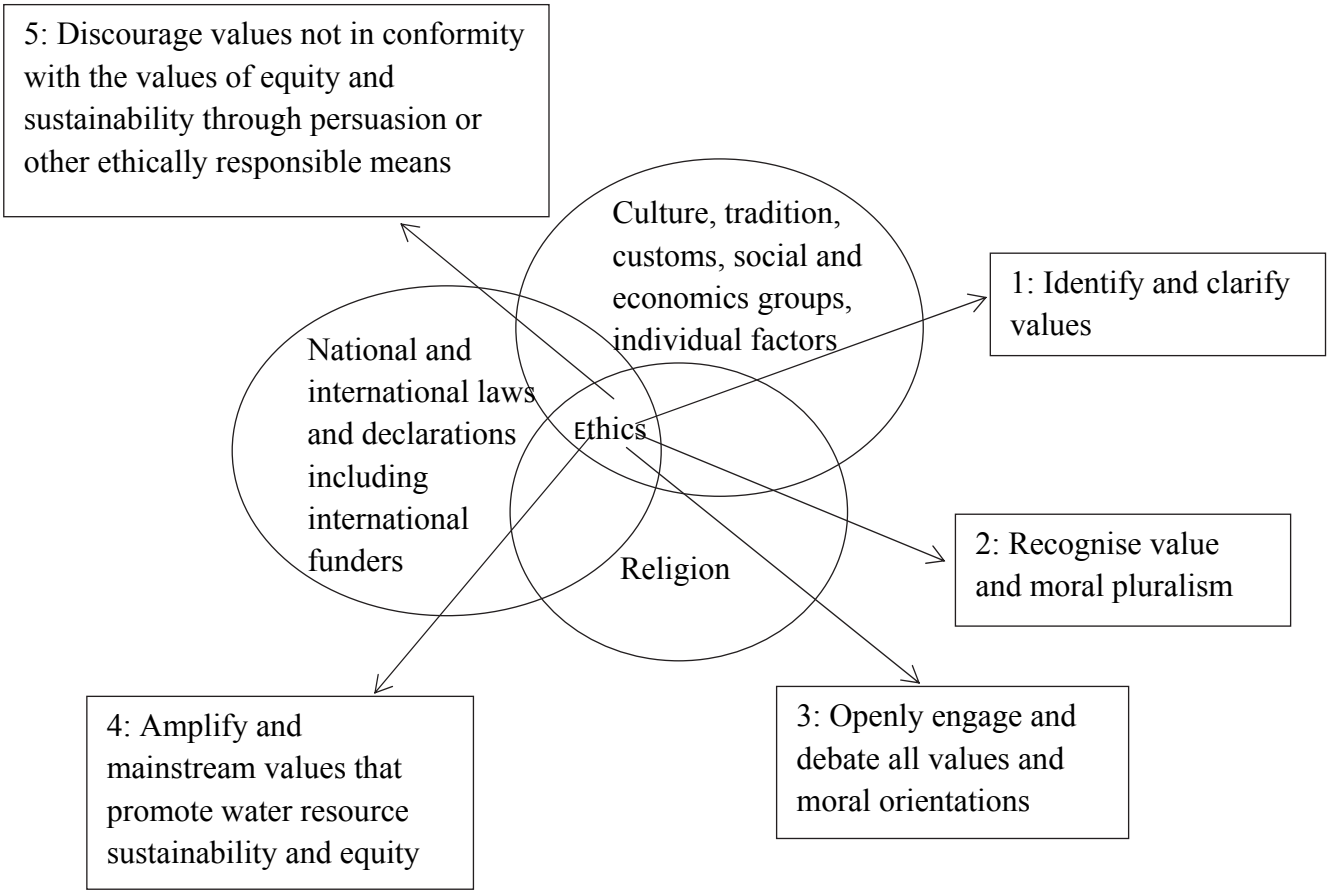


Figure 2.2: Overlapping of selected factors influencing values associated with water resources, and the potential role of environmental ethics in water resource management. The intention is to draw attention to explicit value considerations in water resource management, rather than to enumerate all factors that influence people or institutional value systems.

The South African constitution speaks to legal and value pluralism with its recognition of international treaties/declarations and customary law (SA Constitution, Act No. 108 of 1996). It thus creates room for multiple legitimising institutions to water claims, e.g. state institutions, village councils (including customary law). In addition to the law and its defining principles, water claims and people's behaviour towards water may be justified based on norms, traditions, custom and wider social organisation (Pradhan and Meinzen-Dick, 2010). For example, in most African religions, water is seen as a purifying agent that washes way sins and as a mediating factor between the living and the dead (Bernard, 2010; Janzen, 1991; Chiuta, 1995). Human behaviour towards water cannot be wholly understood and interpreted under conventional/ secular legal systems. Thus, enabling flexible polycentric institutions that are sensitive to and take account of value pluralism in water resource management can provide leverage to empower marginalised groups through thorough value analysis that provides opportunity for the values of marginalised groups to be held and debated. Central to explicit value consideration is providing enabling frameworks for conflict and dispute resolution that do not only account for the economic value of water, but also recognise all other sources of water values (Soderbaum, 2008).

The value-based perspective is vital in the South African context with regard to transformation and redress. Perspectives and ideas from ecofeminism could be particularly useful as the importance of equality and equity in value-based analysis is stressed. By giving voice to and listening to all sections of the society, and by allowing the values of marginalised sections of the society to be heard and debated, perspectives from all sections of the society are thus channelled into relevant policies and governance systems, in both ethical and effective ways. Value-based analysis could be used as an instrument to stimulate support for water resource protection by contextualising and linking relevant management arguments with local communities' values. Values could be historical, heritage-based, cultural, social, economic or spiritual. Over the years, economic values, promoting utilitarianism, have taken centre stage, but careful consideration of other value emphases, as envisioned in the NWA, can stimulate local support for water resource protection

2.7 Relating environmental ethics to water resource management in the context of complex social-ecological systems

There is a growing recognition that humans are integral components of complex social-ecological systems, sharing the biophysical environment with non-human communities

(Berkes and Folke, 1998). The concept of social-ecological system recognises the tightly coupled and integrated nature of social and ecological systems, and therefore represents a departure from the notion of two separate independent systems (Berkes and Folke, 1998; Constanza et al., 2001 and Folke et al., 2005). Social-ecological systems are complex, and are characterised by unpredictability, non-linearity, cross-scale dynamic interactions and multiple feedback mechanisms (Folke, 2007). Managing water resources within the framework of complex social-ecological systems would require a careful consideration of management decisions on both the social (human societal aspects) and the ecological (non-human aspects) levels, with an explicit recognition of their inter-dependence on multiple spatial and temporal scales.

Folke (2007) argues that interconnection and co-evolution, non-linearity, and cross-scale dynamic interaction, are the three most prominent characteristics of social-ecological systems. Complexity analysis arose in part because, in natural systems, it is limiting to use conventional, reductionist, single cause-effect relationship-based analysis as a basis for managing systems that are inherently complex, with many linkages and interactions (Pollard et al., 2011). For example, deteriorating water quality of a water resource which is receiving effluent from a treatment plant could be attributed to failure of the plant from a reductionist perspective. In reality however, other factors, including demography, politics, and socio-economics, etc. could also be contributing to the water quality problem. Thus, complexity challenges the notion of linearity in complex systems, and instead proposes that systems be viewed holistically (Pollard and du Toit, 2008; Pollard et al., 2011). Accepting social-ecological systems as being fundamentally complex would lead to a rethink about resource management (Berkes et al., 2003). For example, Berkes et al. (2003) argue that qualitative analysis must complement quantitative approaches, as the latter alone is inadequate to deal with complex systems (Berkes et al., 2003), and multiple perspectives must be considered as sources of data and analysis in managing resources within complex systems.

Managing water resources in the context of social-ecological systems would thus require a fundamental shift in the way the relationship between humans and the rest of nature is conceived and interpreted. Western approaches promoting a utilitarian ethic have dominated water resource management in most parts of the world (McGee, 2010). Since utilitarianism is defined with reference to only the human component of social-ecological systems, a new kind of ethic is required that re-assesses the relationship between humans and the rest of nature.

Even one of the most widely cited definitions of IWRM, which also appears in the South African National Water Resource Strategy (NWRS), is utilitarian in emphasis, where the envisaged outcome is to maximise economic and social welfare, while ensuring environmental integrity (DWA, 2013).

Brown and Schmidt (2010b), in arguing for a new water resource management ethic, which they refer to as the '*ethic of compassionate retreat',* suggest the human relationship with water is not only underpinned by science and technology, but also by factors such as customs, beliefs, values, emotions, morals, and religion. An appropriate ethic should therefore recognise the multiple values influencing our relationship with water, and strive to incorporate them.

The ethic of compassionate retreat requires the humility to acknowledge our incomplete understanding of complex, dynamic social- ecological systems, and to accept that this acknowledgment must guide water resource management. It also emphasises the redefinition of the place of humans within the social-ecological system, appealing for the decentring of humans with regard to water resource management, as well as for an incorporation of wider practical wisdom, rather than using only science and technology in water resource management.

2.8 Conclusion

As already noted, although the South African NWA is progressive, with its recognition of the intrinsic value of water and the associated aquatic ecosystems, the health and functionality of South African aquatic ecosystems continue to degrade (CSIR, 2010). To minimise further degradation of aquatic ecosystems, a fundamental shift in our relationship with other people and with water is required, and an ecologically genuinely interactive process is needed, in which government and associated institutions are not only accountable to people, but also to the rest of nature. Such interactive practices would, in addition to recognising and respecting human rights, promote the rights of the biophysical components of aquatic ecosystems and place responsibility on all people, as morally responsible agents, to respect those rights. This would entail balancing the intrinsic and the instrumental value of both the human and the biophysical components of the aquatic ecosystem as a social-ecological system. In this project we seek to provide an enabling systemic perspective and relational environmental

ethical framework that can enable water resource management more meaningfully to bring together the diverse values and constituencies it has to accommodate (see Chapter 5).

CHAPTER 3: ANALYTICAL OVERVIEW OF CASE STUDIES OF THE APPLICATION OF ENVIRONMENTAL ETHICS IN WATER RESOURCE MANAGEMENT, IN SOUTH AFRICA AND GLOBALLY

3.1 General Introduction

This chapter focuses on the investigation of case studies concerning the application and implementation of environmental ethics, both in South Africa and internationally. In the cases we consider, such application and implementation of environmental ethics may be conscious or unconscious, intentional or unintentional, explicit or implicit, mentioned in the text, or not. Where we identify such environmental ethical practices, we surface them, and highlight their specific contribution. We analyse four case studies, which we carefully selected to reflect diverse issues and practices in water resource management. Of the case studies, only one has been selected from an industrialised country, United States of America, because we have needed to focus on other developing countries that share similar developmental realities with South Africa.

Bringing out the problems and best practices with regard to the implementation and application of environmental ethics in the case studies considered in this chapter will enable us to move ahead to identify opportunities for the refining and applying of environmental ethics in South Africa for constructive socio-ecological systems and water resource management – and for the more positive integration of environmental ethics into the institutional frameworks of water management in South Africa.

3.2 CASE STUDY 1: CONTESTING PRIORITIES – INDIGENOUS PEOPLE, SALMON AND SOCIAL-ECONOMIC GROWTH: THE CASE OF THE LOWER COLUMBIA-SNAKE RIVER SYSTEM, USA.

3.2.1 Case study summary

The Snake River system is one of the major tributaries of the Columbia River in the United States of America (Rogers, 2009). Within the catchment of the Columbia-Snake River system were indigenous tribal Americans who led a relatively simple life, interwoven with nature –

respecting nature, and importantly, the seasonal migration of salmon upriver from the Pacific Ocean (Hart, 2002). Prior to the arrival of the Euro-Americans, the indigenous people depended largely on salmon as a source of livelihood, and salmonid species were fished and traded among the people. Salmon had spiritual, emotional, material, nutritional and cultural value to the indigenous tribal Americans who lived within the catchment (Hart, 2002; Gaard, 2010).

The annual salmonid migration from the Pacific into the river systems not only signified spiritual rebirth and renewal of all life-forms, but echoed an obligation on the part of the indigenous people to respect and protect the salmon and the water ecosystems upon which they depended (Hart, 2002; Gaard, 2010). The indigenous tribal Americans believed that their existence and continuous survival depended on the salmon, which the 'Creator' had given to them. There was thus a sense of divine obligation to care for, nurture and protect the salmon and to live respectfully with nature (Lichatowich, 1999).

However, with the arrival of the non-indigenous Americans on the Columbia-Snake River catchment, and with the rapid social-economic development that heralded the 19th and 20th centuries, many dams were built on the Colombia River and its tributaries to generate hydro-electric power, to provide water for irrigation, and for navigation and domestic uses (Rogers, 2009). These periods also coincided with growing industries in the catchment and saw over-fishing with modern fishing technology. While the dams, industries, commercial fishing, and irrigation provided social-economic benefits, they also impacted negatively on water quality, river flow, habitat integrity, salmon population and the value systems of indigenous tribal Americans, whose lives have been historically interwoven with those of the salmon (Lichatowich, 1999; Hart, 2002; Rogers, 2009). The apparent inability to reconcile the two goods of the social-economic benefits on the one hand, and of the environment, together with the livelihoods and values of the indigenous people, on the other hand, presented an ethical dilemma for both state and federal decision makers, as well as key stakeholders including farmers, scientists, activists and the general public. They could – or so it seemed to them – have only one of these goods at a time.

3.2.2 Environmental ethical dilemmas in the development of the Lower Columbia-Snake River system

The Columbia River, which was once home to the largest salmon runs in the world, is now home to only about one-tenth of the original runs (Meadows, 2004). The decline in the salmonid population has been attributed to several factors, but the construction of dams on the Columbia River and its tributaries has been implicated as the greatest culprit in this regard (Rogers, 2009). The focus of the analysis presented here is centred on the effects of the dams on the salmonid population and as it relates to the indigenous people. In the lower Snake River are four dams that have generated the greatest controversy, as the Snake River historically accounted for about 40% of total Columbia River salmon runs (Rogers, 2009). The four dams have a combined generating capacity of about 3 030 megawatts of electricity (US Corps of Army of Engineers, 2002). The dams also aid the transportation of about 3.8 million tons of goods and the supply of both irrigation and domestic water (SOS, 2005; Rogers, 2009)

Although the four dams provide social-economic benefits, salmon could no longer reach their spawning ground, resulting in significant reduction of salmonid population, with about 26 species of salmon regarded as either endangered or threatened (Rogers, 2009). Several efforts, including the provision of fish ladders to enable the salmon to move past the dams, trucking of the juveniles past the dams, and developing seed hatchlings of salmon, were put in place by both the federal and state government, to restore the salmonid population (Rogers, 2009). However, the population of the salmon continued to decline. This continuing decline prompted the USA federal government to commission a study to investigate and recommend ways in which the salmon could be saved (Hart, 2002). Their recommendation in 1998 was for the complete removal of the four dams to allow the salmon free and uninterrupted access to and from their breeding grounds. However, this promoted stern opposition from stakeholders and politicians who benefited from the status quo.

In 2002 the US Army Corps of Engineers conducted an environmental impact study on the most effective options available for resolving the intractable issues between the interest groups around the salmon and the four dams (US Army Corps of Engineers, 2002). Cost-benefit analyses of four options were undertaken:

Option 1: maintain status quo: This involves doing nothing about the dams and allowing the continuation of the social-economic benefits of the dams and their negative effects on salmon, indigenous people and other environmental concerns;

Option 2: Involves maximising breeding and transportation of juvenile salmon across the dams to aid their migration to and from their breeding grounds;

Option 3: Involves systemic modification of the dams to allow the migration of the salmon past the dams;

Option 4: Involves the complete removal or breaching of the dams so that the salmon can migrate un-hindered.

After a thorough social-economic benefits analysis of the dams and the costs of undertaking each of the options, the US Army Corps recommended that Option 2 was the most preferred and Option 4 the least desirable. However, an independent study (SOS, 2005) undertaken by a group of NGOs led by the Save Our Wild Salmon (SOS) grouping recommended the complete removal of the four dams, arguing that their removal would save American taxpayers and Northwest ratepayers between $2 billion and $5 billion over 20 years, and would also lead to the generation of new revenue of over $ 8 billion (SOS, 2005).

The discrepancies in the two studies have been attributed to methodological differences, with the SOS study focusing on costs and the US Army Corps of Engineers focusing mostly on the social-economic benefits of the dams, while seeking a 'cost-effective' means of achieving the goal of protecting the salmon (US Army Corps of Engineers, 2002; SOS, 2005). The NGOs, whose main aim was to ensure the protection of the salmon, produced figures tilting towards the dam removal, whereas the figures of the Army Corps supported maintaining the dams, as their removal would result in significant loss of economic and social revenue. These methodological differences may reflect deeper differences of interest.

The dams have not been completely removed – although alterations have been made to accommodate the salmon (Rogers, 2009). While the "Dams or no Dams" debate has not been resolved, these attempts to accommodate the salmon signalled the increasing recognition of the intrinsic value of the salmon in the human-nonhuman or the salmon vs dams showdowns in the lower Snake River system.

3.2.3 Environmental ethical dilemmas and legal instruments

In most water resource development projects, as in the case of the lower Snake River system, there is often a perceived conflict of interest between social-economic benefits and environmental concerns (Lenton and Muller, 2009). Integrated Water Resource Management (IWRM) seeks to balance the social, economic and environmental concerns related to water resource management. In the lower Snake River system, the plight of the salmon became a matter of national interest, where the cause of the fish was advanced by their association with indigenous tribal Americans' value systems and culture, which are intertwined with the migration of the salmon (Hart, 2002). Environmental and indigenous people's rights advocacies thus intertwined and re-enforced each other. In an attempt to balance economic and social benefits of the four dams[1] with the need to allow salmon to migrate to their spawning grounds, it was recommended that the dams should be managed in such a way as to allow the migration of the salmon, without impacting on other users and uses (SRSRB, 2006). This would constitute a pragmatic environmental ethical approach, where, instead of engaging environmental issues from one or more fixed principles, one seeks a practical solution in terms of the demands of the specific context. However, relying on the Endangered Species Act of 1973 (ESA, 1973) a federal judge faulted that approach, arguing that it did not adequately address how salmon, which are listed as an endangered and threatened species in the Act, would be recovered and protected, and the judge urged the responsible agencies to develop an appropriate plan (including the complete removal of the four dams) that adequately addressed the plight of the salmon (Rogers, 2009).

The Endangered Species Act of 1973 (ESA, 1973), hereafter referred to as 'the Act' in this chapter, is the legal instrument that sought to provide for the conservation and protection of endangered and threatened wildlife species in the United States of America. The Act is revolutionary, not only because of its ascription of rights (of which the right to life is basic to any other right) to non-human life-forms – and specifically to endangered species – but it also prohibits federal and state agencies from engaging in activities that further threaten such species (ESA, 1973). From an advocacy point of view, the law gives ordinary citizens the

[1] This makes the contestable assumptions that i)all four dams can be treated equally for purposes of calculating socio-economic costs and benefits ii) socio-economic costs and benefits would be equal across all constituencies for each dam . This looks like classic cost-benefit analysis, where context is effectively abstracted, and all numbers and all people in them, are treated as context -free.

right to sue the state to implement its provisions. From an environmental ethical perspective, it seems that the Act recognises the intrinsic value of endangered and threatened species, and thus confers on such species greater legal rights to existence. Overall, the Act recognises the need to balance economic and social benefits with environmental concerns. It may even be considered to favour environmental concerns, given its specific mandate.

In the lower Snake River system, citizens have relied on the provisions of the Act to sue several government agencies to either remove the dams or alter them to allow for the migration of the salmon (Rogers, 2009). While they have succeeded in having alterations made to the dams to accommodate the salmon, neither, they, nor the judge who invoked the Endangered Species Act, have thus far succeeded in having the dams removed completely.

What this case shows is, that the two major parties, i.e. those who want to keep the dams for socio-economic reasons, and those who wish to do away with the dams for the sake of the salmon, have been unable to find either a practical compromise that suits them both, or a set of ethical principles they can both work with. They accordingly have not been able to work out an idiom in which to negotiate the rights and wrongs of the matter. They have therefore found it necessary to make an institutional shift in their quest for that idiom, for that set of principles, to an institution which will provide – but at the same time impose – a set of principles for deciding what is right or wrong in the situation: i.e. a court of law. This appears to be a situation that goes further than a simple human conflict between two parties with conflicting interests. A common sense, cum pragmatic contextual, ethic does not seem to suggest itself. Salmon and socio-economics are both important – that is recognised by all sides. How are we to tie the relational web together? Going to court does not signal a failure of ethics, but rather an attempt to clarify the principles underlying the daily decisions we make- and the recognition that we make these decisions in the context of a social contract – the ultimate set of principles – to which we all ultimately and voluntarily subject ourselves.

3.2.4 Indicators of the implementation and application of environmental ethics – successes and failures

Based on this case study, the following can be seen as indicators pointing to the implementation and application of environmental ethical thinking:

- Respect for other people's value systems by itself, as this case study illustrates, is not enough to effectively implement environmentally responsible practices and behaviours. People tend only to respect each other's value systems provided that, in doing so, their own values and benefits are not impeded. In difficult situations such as in this case study, where people are unable to reach agreement, there needs to be a legal framework that becomes the last option for conflict resolution. However, it is important to highlight that legal resolutions do not necessarily promote friendly and harmonious relationships between parties.
- Several efforts, including breeding of salmon and transportation of the salmon, have been undertaken to restore the population of the salmon. These activities aimed at restoring the salmonid population signal the increased prioritisation of environmental concerns, but perhaps only after social-economic benefits have been met. In an ideal situation however, both environmental concerns and social-economic development need to be prioritised concurrently. However, in practical term, the social-ecological system is dynamic, and the emphasis within the system would continuously shift, depending on the context, as this case illustrates.
- Although concerted efforts have been made to recover the population of the salmon, they are still far from their original population prior to the development of the Snake River basin. The dams still stand and the costs of removing them, and their contribution to social-economic development, are the major factors hindering their complete removal (Rogers, 2009). Environmental concerns must be balanced with realistic social-economic benefits. This raises concerns about the importance of synergies between all tiers of government, courts and civil society organisations, all of which influence decision-making at different levels and contexts.

3.2.5 Conclusion

This case study highlights the challenges of water resource management that seeks to balance social, economic and environmental concerns. It shows that an appropriate legal instrument for helping facilitate environmental ethical thinking is needed, especially in an intractable situation where negotiation and dialogue may fail to yield outputs that balance social-economic benefits with environmental concerns. It also highlights the importance of mainstreaming a value system that recognises the concept of a social-ecological system – in

which humans ought to seek to live in harmony with nature. This case study highlights the difficulty of balancing social-economic development and environmental sustainability, as well as the associated trade-offs, and the difficulty of achieving a compromise between parties. It also shows the re-awakening of the public towards environmental issues, as social-economic goals are met over time.

3.3 CASE STUDY 2: ENVIRONMENTAL ETHICS, LIVELIHOODS AND WETLANDS – THE CASE OF MANAGEMENT OF AQUATIC ECOSYSTEMS THROUGH THE COMMUNITY HUSBANDRY (MACH) PROJECT, BANGLADESH

3.3.1 Case study summary

Wetlands are important aquatic ecosystems in Bangladesh, supporting the livelihoods of about 70 million rural people who are natural resources- dependent (Renwick and Joshi, 2009). About 4 million hectares of lands in Bangladesh are considered wetlands (Thompson and Choudhury, 2007). These wetlands support important plant and animal species and are thus regarded as among the most important wetlands in the world in terms of biodiversity. However, over- dependence on wetland resources for livelihoods and income, pollution, landscape alteration, poor management regimes and lack of coordination among relevant stakeholders have led to deterioration of wetlands ecosystems (Ali, 1997; MACH, 2004; Renwick and Joshi, 2009).

This case study showcases the Management of Aquatic Ecosystems through Community Husbandry (MACH) project, which was initiated and implemented to restore the integrity and productivity of selected wetlands in Bangladesh, while providing for the livelihoods of those who depend on them (Thompson and Choudhury, 2007; Renwick and Joshi, 2009). The MACH project adopted a community-based co-management of aquatic ecosystems approach that viewed water resources from a social-ecological perspective, taking explicit account of the inextricable links between people, land, water, biodiversity and livelihoods (Renwick and Joshi, 2009). Through the evolution of innovative institutional arrangements, stakeholder participation, social-economic empowerment of communities, awareness raising and giving community members a sense of ownership of wetland resources, the project was able to make a significant contribution towards improving wetland health and improving on the living standard of those who depend on wetlands for livelihoods (Thompson and Choudhury, 2007; Renwick and Joshi, 2009). The project highlights the importance of establishing and

strengthening on-the-ground local institutions that enable clear linkages between people's value systems and the resources that are being managed, in a relational ethical manner that seeks to promote equity, efficiency and sustainability, underpinned by trust, respect and harmony (between people, and between people and nature).

3.3.2 Brief overview of wetlands in Bangladesh

Wetlands cover a vast amount of land in Bangladesh and during periods of high precipitation, half of the country is usually submerged (Ali, 1997). Bangladesh's wetlands support a vast diversity of fauna and flora including fish species, migratory birds, reptiles, and rare species of plants and animals (Rahman, 1989; BirdLife International, 2004; Thompson and Choudhury, 2007). Besides supporting rural livelihoods, the wetlands provide important ecological services including flood regulation, waste purification, carbon sequestration, and medicinal plants, as well as serving as recreational and spiritual sites (Thompson and Choudhury, 2007). However, industrial activities, deforestation, pollution, unsustainable fishing practices, inappropriate management practices and government policies, as well as over-dependence on wetlands, have negatively impacted on Bangladesh's wetlands, and have caused a decline in fish stock, loss of habitat and river connectivity (Ali, 1997; Muir, 2003; Renwick and Joshi, 2009). Thompson and Choudhury (2007) report that, due to wetland degradation, 40% of fish species have been classified as threatened in Bangladesh by the IUCN. In addition, since 1985, declining health of wetlands habitat has led to decreases in fish catch, fish consumption, household income, and general loss of biodiversity. The MACH project uses a community-based natural resource co-management approach to address some of these challenges (Ferdous, 2014).

3.3.3 Environmental ethics and the MACH project

There is a growing recognition that, to achieve sustainable aquatic ecosystem management, a social-ecological approach is needed (Folke et al., 2005; Folke, 2007). Such an approach must recognise the inextricable connections between the social and ecological aspects as one coherent inter-related and inter-dependent system (Folke, 2006). The MACH project effectively took a social-ecological approach to the management of the aquatic ecosystem (MACH, 2006; Renwick and Joshi, 2009).

An important aspect that contributed significantly to the success of the project was the establishment of two new institutions: the Resource Management Organisations (RMOs) and

Resource Users Groups (RUGs) (Thompson and Choudhury, 2007). The RMOs, which were formed around the selected wetlands, comprised of all stakeholders, including community members from both poor households and a few members of the elite, as well as local government representatives. The RMOs were charged with the responsibility of protecting the wetland resources by ensuring their sustainable utilisation. Members of the RMOs were trained in aquatic ecosystem management. The RUGs comprised of representatives of mostly indigent households who depended largely on wetland resources for their livelihoods. The aim of the RUGs was to empower members of indigent households to diversify their sources of income and reduce their overall dependence on wetlands, while also participating fully in the entire range of decision-making processes concerned. In developing countries, it is almost impossible to guarantee resource protection without livelihood security for the poor – and, in that regard, South Africa may usefully learn from this project in Bangladesh. Through the creation of the RUGs, the MACH project took cognisance of the importance of livelihood security, as a catalyst to resource protection and conservation. Specific measures such as micro-financing through revolving loan schemes, and skills acquisition in small businesses, were put in place to diversify the income of indigent households.

Using well-guided participatory and collaborative approaches, community members identified key problems including erosion, siltation, loss of biodiversity, dwindling fish catches, pollution, fish leasing systems, etc. (Thompson and Choudhury, 2007; Ferdous, 2014). Creation of wetland sanctuaries, norms and regulations on seasonal fishing and fishing gears, re-afforestation, habitat rehabilitation, restoring stream connectivity for fish migration, were among the measures put in place to restore wetland health.

Heightened awareness of the importance of wetland resources among the local people increased the levels of advocacy, holding major industrial polluters to account and consequently forcing industries to take practical measures to reduce pollution. For example, Thompson and Choudhury (2007) reported that the community had their own water quality monitoring programmes, had entered into agreement with the government to enforce stricter measures against polluters, and were implementing the polluter pays principle.

The newly established institutions, i.e. the RMOs and RUGs, were strengthened by formally linking them, horizontally and vertically, to already established local statutory institutions at local government level. This gave local community members a voice, not only to share their

ideas and express their feelings, but also to influence decisions that affected them, as well as the wetlands. A significant outcome was the transferring of fishing rights from private commercial fishers to communities, and ensuring the sustainability of community-based institutions after the project's lifespan (Renwick and Joshi (2009). Figure 3.1 shows the institutional arrangement of the MACH project.

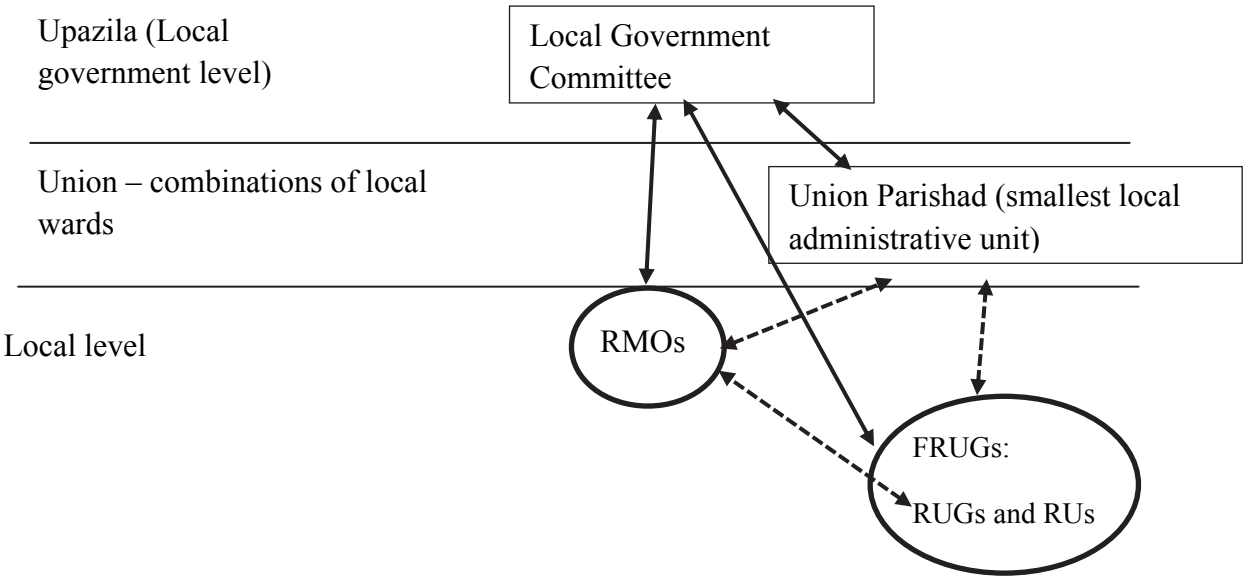


Figure 3.1: Institutional arrangement of the MACH project, enabling community-based co-management of wetland resources. The dash arrows are informal links, whereas the non-dash arrows are formal links (Source: Thompson and Choudhury, 2007). FRUGs (federation of resource users groups), RUGS (Resources users groups), RUs (Resource users not part of the formal RUGs), RMOs (Resource management organisations).

Through the local government committee, issues regarding the wetlands were discussed in an inclusive and participatory manner (Thompson and Choudhury, 2007). By establishing the local government committee, members of the RMOs and RUGs were able to expand their social networks and capital, and also strengthen their decision-making processes – and this led to the acceptance of their decisions by those in authority at the local level (Thompson and Choudhury, 2007)

Specific outcomes of the MACH project include:

- **Improved wetland ecosystem health and functioning** through better management of water bodies' connectivity, erosion and siltation control measures, breeding and restocking of locally endangered fish species, creation of wetland sanctuaries, norms and standards on fishing and fishing gears, and on pollution control and mitigation measures.
- **Improved livelihoods security** through improved fish catches, fish consumption, alternative income sources, and improved agricultural produce from re-afforestation, siltation and erosion control measures.
- **Social equity and inclusivity** through emphasis on real participation by all stakeholders, and ensuring the achievement of distributive justice by reversing old fishing rights that were in the hands of a few members of the elite.

3.3.4 Indicators of the implementation and application of environmental ethics – successes and failures

Pragmatic environmental ethics emphasises the importance of taking account of context and enabling adaptive management that involves learning by doing (Minteer et al., 2004). In the case of the MACH project, the institutional arrangement of the project has not only empowered the locals, but it has also helped change their attitude and behaviour towards the wetlands, resulting in willingness to freely participate in measures aimed at restoring, protecting and conserving the wetland resources (Thompson and Choudhury, 2007; Renwick and Joshi, 2009). The MACH project mainstreamed a flexible adaptive moral system that reflected actual circumstances, new insights and experiences. During the lifespan of the project, norms, rules, standards and principles were continuously revised and re-interpreted as new information became available. The wetlands management plans were reviewed on an annual basis and adjusted as required, based on new information and previous experiences (Renwick and Joshi, 2009).

Balancing powers between actors in mainstreaming a flexible adaptive moral system in a way that allows for democratic deliberation, as pragmatism does, seems essential to achieve success. The MACH project consciously included the values of all major stakeholders, including local elites, to avoid sabotage, and those of the poor, to improve their living

standard. However, the benefits of management processes were skewed in favour of the poor to ensure and sustain equity. In this regard, the MACH project seemed to take an ecofeminist position, which argues that environmental decision- making processes must take into account the interest of the most vulnerable in human society, as well as the interest of the non-human communities (Warren and Cheney, 2003). Nevertheless, from an ecofeminist perspective, the institutional arrangements employed in the MACH project have not uncritically adopted all aspects of local prevailing cultural systems, such as those that bar women from undertaking certain enterprises – with the result that women members of the RUGs find it difficult to use their newly acquired skills in other businesses because of cultural hindrances that prevent them from doing so (Renwick and Joshi, 2009). The creation of wetland sanctuaries, planting of trees, and establishing of norms that restrict all-year-round fishing in sanctuaries, as well as restrictions on fishing gear most dangerous to fish and other wildlife, suggest that the MACH project conferred some rights to existence on the non-human species within the project jurisdiction. Since rights are all about relationships, and can only be respected in as much as they do not impede on other rights – in this case the right to livelihoods by locals – providing alternative livelihood measures may have helped the local people to respect the norms and rules that seek to protect the wetlands ecosystems. That is, the project used social-economic incentives as a way of minimising people's reliance on wetland resources and hence, once people could secure alternative livelihoods, it was easier to work towards protecting and conserving the wetland resources Overall, from an environmental ethical perspective, the MACH project stressed the importance of context-based institutions that prioritised the needs and aspirations of local people as a way of achieving a balance between social, economic and environmental priorities – and demonstrates that these three aspects of sustainability are not necessarily at odds when viewed holistically.

3.4 CASE STUDY 3: IS THE GREENDROP PROGRAMME ENVIRONMENTAL ETHICS IN ACTION? – TOWARDS IMPROVING THE HEALTH OF SOUTH AFRICA'S RIVER ECOSYSTEMS

3.4.1 Case study summary

South Africa's riverine ecosystem health continues to deteriorate, despite the significant investment in policy development, research, monitoring programmes and regulatory

frameworks (CSIR, 2010). Effluents from wastewater treatment works (WWTWs) are among the chief culprits responsible for the deteriorating health of freshwater ecosystems in South Africa (de Villiers and Thiart, 2007; Odume, 2014). In the past, as part of the Source Directed Measures (SDC), regulation of wastewater treatment works focused mainly on the physico-chemical and microbiological quality of discharged effluents. However, with the introduction of the incentive-based Green Drop regulatory framework, a comprehensive assessment of the entire value chain of the wastewater treatment process is now undertaken, using sets of criteria ranging from management processes to the final effluent quality (DWA, 2011a). Implicit in the Green Drop programme is its intention to elicit responsible behaviour and attitudes towards the environment on the part of water services authorities/providers, and to re-awaken members of the public to the responsibility of protecting the environment by holding municipalities to account in terms of the functionality of municipal WWTWs. This is the domain of environmental ethics: the norms, standards and principles that guide our behaviour and attitude towards the environment. We believe that the achievement of Green Drop status (and what it implies) by all WWTWs in South Africa would contribute significantly to reducing pollution and improving the health of freshwater ecosystems.

3.4.2 Overview of the Green Drop programme

The right of the environment to water of appropriate quality and quantity, as well as to reliability of supply, is legally guaranteed in the form of the ecological Reserve (NWA, Act No 36 of 1998). A major water use that is threatening the realisation of the legally guaranteed aquatic ecosystems' right to water, is the discharges of wastewater effluent from wastewater treatment works (de Villiers and Thiart, 2007; Odume, 2014).

The then National Department of Water Affairs (DWA), currently the Department of Water and Sanitation (DWS), introduced the incentive-based regulation to ensure effective and efficient management of both drinking water quality (Blue Drop certification programme) and wastewater quality (Green Drop certification programme) (DWA, 2011a). The Green Drop certification (GDC) programme departs from previous initiatives, based on its emphasis on a holistic and comprehensive assessment of all factors likely to influence the overall quality of the final treated effluent. At the inception of the programme in 2008, 11 criteria referred to as key performance areas (KPAs) were established, and water services

authorities/providers were assessed based on these criteria. However, the intention was to progressively reduce these KPAs from 11 to five stricter KPAs by the 2016/17 assessment cycle (DWA, 2011a; Table 3.1).

Table 3.1: Key performance areas of the Green Drop programme, showing progressive reduction from 11 KPAs to 5 KPAs. (Source: Muller, 2013).

Key performance areas (KPAs)	2010/2011	2012/2013	2014/2015	2016/2017
1	Adequacy of control, maintenance and management skill: 10%	Process control, maintenance and management skills: 10%	Wastewater quality process management and Control: 15%	Wastewater quality process management and Control: 15%
2	Wastewater quality monitoring programme: 10%	Wastewater quality monitoring programme efficiency: 15%		
3	Wastewater sample analysis (credibility): 5%			
4	Submission of wastewater quality results: 5%	Submission of wastewater quality effluent result: 5%	Wastewater effluent quality compliance: 35%	Wastewater effluent quality compliance: 40%
5	Wastewater effluent quality compliance: 30%	Wastewater effluent quality compliance: 30%		
6	Wastewater quality failures response management: 10%	Wastewater quality risk management: 15%	Wastewater risk abatement: 25%	Wastewater risk abatement: 20%
7	Storm water and water demand management: 0%			
8	Local regulation: 5%	Local regulation (by-laws): 5%	Local regulation and planning: 10%	Local regulation and planning: 10%

9	Wastewater treatment facility capacity: 10%	Wastewater treatment capacity: 5%	Wastewater asset management and performance: 15%	Wastewater asset management and performance: 15%
10	Publication of wastewater management performance: 0%			
11	Wastewater asset management: 15%	Wastewater asset management: 15%		

Based on these KPAs, Green Drop scores are calculated for each water service authority/provider and a compliance status of 90% has been set as the minimum, to be awarded a Green Drop status. The programme promotes the conscious use of incentives to encourage and reward excellence (DWA, 2011a).

In addition to assessing the functionality and performance of the wastewater service value-chain, the GDC programme also stipulates that a risk analysis of each WWTW be undertaken to identify specific areas likely to pose a risk to the environment. The risk analysis is also comprehensive, taking account of several criteria, including the ecological sensitivity and present ecological state of the effluent- receiving environment (DWA, 2011a). The identified risks then determine priority areas needing remedial intervention. During the risk profiling process, key steps have been identified, which must be followed to ensure transparency, accountability and credibility. The risk-based approach seeks to identify, analyse and reduce risks that are likely to have negative impact on effluent- receiving environments (DWA, 2011a). Enforced through the provision of the Water Services Act (Act No 108 of 1997), the approach seeks to ensure that proactive management actions are continuously taken to reduce the likelihood of wastewater services having a detrimental effect on the aquatic environment. Since its inception, the GDC programme has, to some extent, induced transparency, accountability and credibility in the wastewater services sector (DWA, 2011b). Municipalities are required to submit and publish their compliance status. The programme has provided an avenue for members of the public to be equipped with the necessary information about the performance of the wastewater service value-chain.

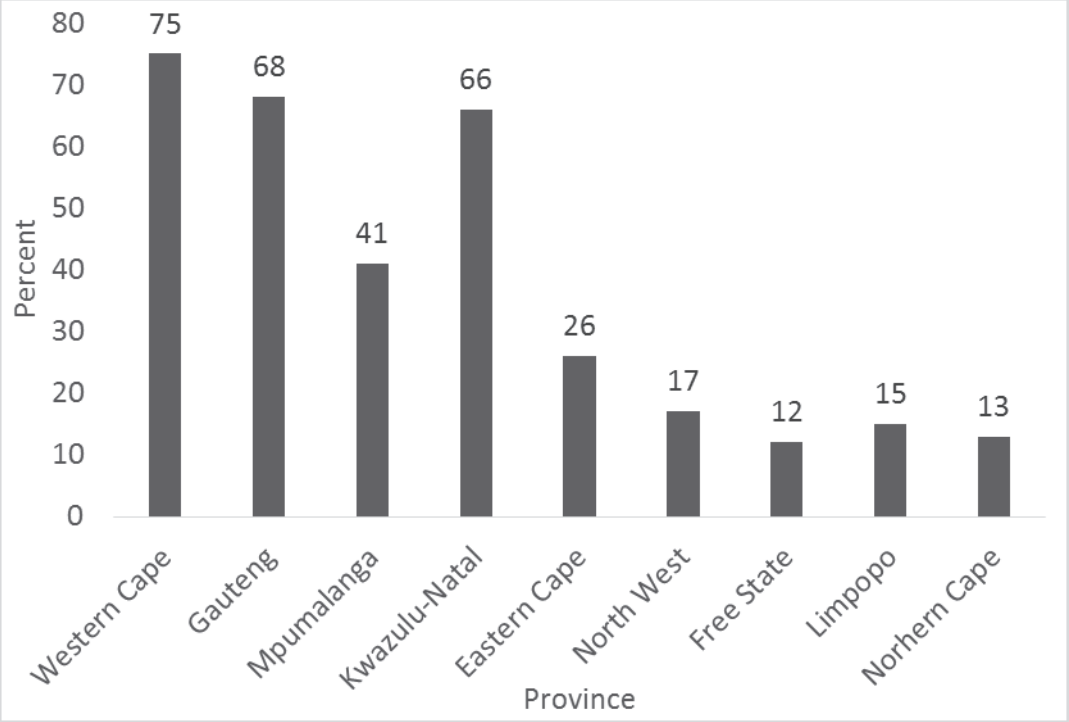
Target setting and monitoring to assess the achievement of the set targets are critical to the success of any programme. At the inception of the GDC programme, DWS set the target of

assessing all wastewater treatment facilities and ensuring that an average Green Drop score of 90% is reached by the year 2015 (Table 3.2). The question that remains becomes whether these targets are being achieved and whether their achievement has translated into improved quality of effluent- receiving aquatic ecosystems. If targets are not being met, the DWS places a premium on creating an enabling environment that can facilitate the process of achieving excellence, rather than on punitive measures. Punitive measures in the forms of fines and litigation are the last resort enforcement options (DWA, 2011a).

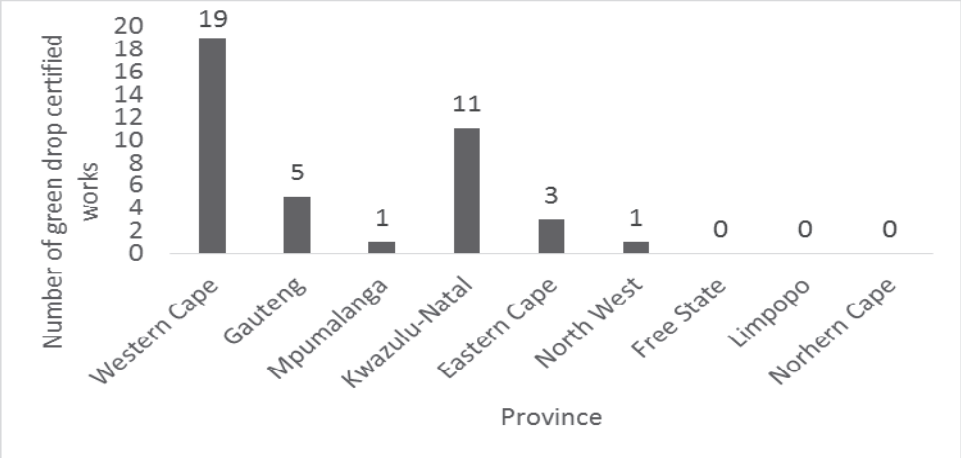
Table 3.2: Targets set by the Department of Water and Sanitation for the Green Drop certification.

Year	WWTWs assessed (%)	Average Green Drop score	% of WWTWs with GD score>50%	% of WWTWs captured on Green Drop system (GDS)	% of WWTWs with GD score 90-100%	% of WWTWs with GD score 80-90%	% of WWTWs with GD score 50-79%	% of WWTWs with GD score 31-49%	% of WWTWs with GD score 0-30%
2010	65	45	55	35	**10**	15	30	10	35
2011	74	56	60	55	**15**	25	20	18	22
2012	82	67	65	75	**17**	35	13	22	13
2013	90	78	75	87	**20**	42	13	17	8
2014	95	85	85	92	**23**	55	7	12	3
2015	100	90	90	95	**25**	60	5	9	1

While considerable efforts have gone into the Green Drop process, and while progress has been made, the targets set in 2008 at the inception of the programme remained largely unmet (DWA, 2011b). For example, apart from the Western Cape, Kwazulu-Natal and Gauteng Provinces, over 50% of wastewater treatment systems in the rest of the provinces had a Green Drop score either equal to or less than 50% (Figure 3.2). Based on the information on the website of DWS as at 26 November 2014, only 4.87% of WWTWs had Green Drop scores between 90% and 100%, revealing that the targets were largely not met. The implication is that throughout the country, the functionality of WWTWs remains below optimal, with the potential of discharging effluent that could be detrimental to the health of the aquatic environment, as indicated in the number of Green Drop certified WWTWs (Figure 3.3).



3.2: Percentage of wastewater systems that achieved more than 50% Green Drop score, based on updates on the DWS website as at 26 November 2014 (source: DWS website www.dwa.gov.za, Green Drop home page). Numbers on each column are the actual percent of wastewater systems achieving more than 50% Green Drop score.



3.3: Number of Green Drop certified wastewater treatment works in the nine provinces of South Africa during the 2011 Green Drop assessment cycle (source: DWS website www.dwa.gov.za, Green Drop home page).

3.4.3 Indicators of the implementation and application of environmental ethics – successes and failures

A major barrier to the achievement of the right of the aquatic ecosystems to water of appropriate quality and quantity, as well as guaranteed reliability of supply, is effluent discharges from both municipal and industrial treatment works. Since environmental ethics seeks to raise questions about our behaviour and attitude towards the environment and the value systems that underpin this human-environment relationship (Kronlid and Öhman, 2013), it is therefore important to analyse the GDC programme with a view to surfacing the value systems underlining the programme, as well as their implications for aquatic ecosystems.

From an environmental ethics perspective, the GDC programme seeks to minimise detrimental effects of effluent on the environment through a value system that takes the 'well-being' of the environment into account. The GDC programme promotes efficient and effective wastewater services through transparent and credible processes that raise environmental profiles. The willingness to take responsibility for sustainable freshwater resource management – in this case, the treatment of effluents to reduce negative impact on the environment – depends to a large extent on how the aquatic ecosystem is seen in relation to human social-economic needs; i.e. whether/or not the environment is accorded rights, independent of human needs (Harman and Arbogast, 2004; Gaard, 2010). The Green Drop

programme's emphasis on effluent quality compliance, being the criterion with the highest weighting and progressively increasing in weighting (Table 3.1), suggests that a value system that has environmental health at its core is mainstreamed in the GDC programme. In the context of social-ecological systems, the GDC process encourages the following environmental ethical practices:

- **Human-environment co-dependence:** : The GDC programme recognises the interdependence between humans and the aquatic environment, hence the promotion and monitoring of practices that reduce detrimental effects on the receiving aquatic environments;
- **Stewardship**: It promotes the value and practice of stewardship – water is seen as an enabler of all life-forms, hence the need to care for it and to minimise activities that could impact on the well-being of aquatic-dependent life-forms;
- **Participation and transparency**: It recognises the importance of encouraging and promoting stakeholder participation by making available credible information to members of the public;
- **Eco-right:** The quality and quantity of water needed by the aquatic environment is partly determined by the sensitivity of the environment and, in this this regard, the GDC programme takes account of the eco-right of the natural environment through a risk analysis that includes the sensitivity of the effluent-receiving natural environment. The concept of eco-right implies the right of aquatic ecosystems to water that enables them to sustain their biophysical properties, attributes, organisation and functionality;
- **Mandatory information gathering:** The GDC programme recognises the importance of accurate and credible data that can enable the relevant authorities to track trends regarding the functionality and performance of WWTWs, and thus their likely impacts on the aquatic environment.

The GDC programme must also incorporate an ethical framework that emphasises the importance of constructive engagement with members of the public on the implications of their activities on WWTWs and the receiving environment. That is, the programme must now move beyond end-of-the pipe value chain assessment, to include members of the public as active stakeholders. There has been a growing international concern about the emergence of non-conventional pollutants such as pharmaceutically active compounds (PhACs) in the

aquatic environment through WWTWs (Murray et al., 2010). Conventional wastewater treatment systems, such as activated sludge systems, which are widely used in South Africa, have proved inefficient in removing PhACs from the waste streams. An ethically responsible position therefore, is to invoke the precautionary principle, and to engage with members of the public with a view to raising awareness around generating waste that ultimately ends up in municipal WWTWs. Engagement and education is therefore the first step in this regard.

Inherent in the South African wastewater services system is the polluter pay principle (DWA, 2011a). However, in some instances, when cost benefit analysis revealed that 'polluting' is less costly than the operational and services costs involved in preventing the pollution, polluters might opt for the former option. Furthermore, this principle assumes that all ecological damages can be computed (and by implication, offset) in economic terms – thus monetising nature. From an ethical perspective, the question remains how to compensate nature.

3.4.4 Conclusion

Effective implementation of the GDC programme would make a significant contribution to reducing the effects of wastewater effluents on the aquatic environment. The GDC programme promotes several ethical principles that recognise the interrelatedness and interdependence between the human and the aquatic environment and aquatic-dependent life-forms. Although some strides have been made in terms of improving service delivery in the wastewater sector, there is still more to be done, including ways in which the broader society can be held responsible for the kind of waste that is discharged into the environment and ways by which contaminants of emerging concern can be managed.

3.5 CASE STUDY 4: ENVIRONMENTAL FLOW ASSESSMENT IN THE UPPER GANGA RIVER – ENVIRONMENTAL ETHICS AND VALUE-JUDGEMENTS

3.5.1 Case study summary

The Ganga River is an important socio-economic, spiritual, cultural and ecological resource in India (Rao, 2001; WWF-India, 2012). In India alone, this trans-boundary river supports the livelihoods of about 500 million people in its catchment (WWF-India, 2012). Socio-economically, about 70% of the river's water is allocated for irrigational purposes, supporting a vast agri-business and providing jobs for both farmers and employees (WWF-India, 2012).

The mighty Ganga is worshipped and revered by millions of people (Shiva, 2002). Ecologically, the river is the home to the iconic, endangered and nationally important Ganges river dolphin (*Platanista gangetica)*.

However, because of socio-economic development and a growing human population, the Ganga River has become extremely threatened, ranking among the most used and polluted rivers in India (Shiva, 2002; Lokgariwa et al., 2014). As an initial holistic step to saving the River, WWF-India commissioned a study to undertake an environmental flow (E-flow) assessment of the river, with a view to balancing the use of the river, and protecting its vital ecosystem functions (WWF-India, 2012). Undertaking an E-flow assessment in such an economically, social-culturally and ecologically important river is not only a significant technical endeavour, but also one that involves both moral choices and value-judgements. Thus, this case study presents decision makers and water resource managers with potential ethical dilemmas in the context of balancing a range of values.

3.5.2 A brief overview of the Ganga River – multiple values within one river system

The 2525 Km long river has its origin in Gangotri and flows through several Indian States before entering Bangladesh and discharging into the Bay of Bengal (Rao, 2001). The river is a very important spiritual and social-cultural asset to the Hindu community (Shiva, 2002). The Ganga River witnesses the annual influx of millions of devout Hindus who come to take 'holy baths', which are believed to have healing, saving and purifying powers (Shiva, 2002). In addition, the Ganga River is also associated with soil fertility by Hindu devotees who fetch the river water and keep it on their farms at the beginning of the planting season (Shiva, 2002).The Ganga is worshipped, deified and revered, both as a sacred river and as the goddess Ganga. Thus, in a world in which economics largely dictates the values of resources, the question that arises is: can the spiritual, social and cultural value of the Ganga River be accurately and reliably quantified in economic terms?

The Ganga River supports vast social-economic activities on and beyond its catchment. Water is abstracted for irrigational, domestic, industrial and hydroelectric uses (WWF-India, 2012). Several barrages and dams are constructed along the course of the river, mostly to supply water for irrigation. Ferrying and fishing also take place in the Ganga. The river is thus the social-economic life-line for about 500 million people in India.

The Ganga River catchment is highly urbanised and industrialised in some of its sections. The river has become a sewer for both domestic and industrial wastewater effluents. According to the WWF-India (2012) report, about 12,000 million litres (ML) of domestic wastewater effluents are generated per day on the catchment of the Ganga and these are usually either directly or indirectly emptied into the river, either after being (in)adequately treated, or un-treated. The Ganga River also receives about 286 ML of industrial effluent per day (CPCB, 2009). By being used as a sewer for both industrial and domestic effluents, the Ganga River has in some ways become commodified, both by industries and municipal authorities, at great cost to both human health and vital ecosystem functionality.

The river is of high ecological and biodiversity significance (Rao, 2001; WWF-India 2012). It supports the unique Ganga river dolphin and the gharia (freshwater crocodile *Gavialis gangeticus)* (Ravindra and Kannan, 2014). The iconic river dolphin has been designated a national aquatic animal by the government of India and is found only in the Ganga-Brahamaputra-Meghna and Sangu-Karnaphuli river ecosystems (Sinha and Kannan, 2014).

However, social-economic developments, particularly the construction of dams on the river course, effluents from domestic treatment works and industries, as well as water abstraction for other uses, have all negatively impacted on both the quantity and quality of the Ganga River water. These have led to biodiversity loss, loss of habitat integrity and loss of vital ecosystem function (WWF-India, 2012). In particular, over 45 dams and barrages have been constructed in areas where the Ganges river dolphin is distributed; these constructions have obstructed their movement and even isolated them into several sub-populations that are now unable to exchange genetic materials (Sinha and Kannan, 2014).

In the past few decades, the population of the Ganges river dolphin has been severely depleted, such that it is now designated as endangered (IUCN, 1996). Thus, the value systems that underpinned past social-economic development have undermined the protection and sustainability of the Ganga River ecosystems. Therefore, to balance the use and protection of the Ganga River, WWF-India initiated a study to undertake an E-flow assessment, with a view to making policy recommendations that can achieve both sound use and protection.

3.5.3 Environmental flow assessment of the Upper Ganga River

Determining the environmental flow necessary for the protection of vital ecosystem processes, function and structure in a river such as the Upper Ganga, is a complex exercise that takes account of both economic and social-ecological realities and priorities (WWF-India, 2012). At the centre of an E-flow assessment are societal choices and value-judgements regarding what society expects from a river and the kind of services expected of it over and above the protection of its resource base (Acreman and Dunbar, 2004). Therefore, choices are often made and compromises reached regarding these priorities. It therefore means that there are no hard-and-fast rules regarding what is an acceptable E-flow (Acreman and Dunbar, 2004), with 'acceptable' being very much context-specific and -dependent.

In the case of the Upper Ganga River, moral choices and value judgements have to be made regarding several priorities, e.g., economics and livelihoods, spiritual and cultural, ecology and biodiversity, in participatory and inclusive processes. Since all values may not be accorded the same priority, the role of environmental ethics involves clarification of principles by which choices and value judgements are made, as well as the basis for prioritising some values (e.g. social-economic) over, for example, ecological and biodiversity values, or vice- versa, or, e.g., concurrently pursuing all values to a point when we are forced to make choices.

In the E-flow assessment of the Ganga River, the objective was not only the protection of important biodiversity and ecological functions of the river, but also of ensuring that the river continues to provide both goods and services needed by society, without compromising vital ecosystem function, processes and structures – thereby continuing to balance multiple values. Seven specialist teams were assembled for the E-flow assessment. The flow variations at different reaches of the river were assessed by the hydrology group, and the hydraulics group determined the river's depth, width, flow velocities and discharges (WWF-India, 2012). The fluvial geomorphology group made recommendations regarding the flows needed to transport, sort and deposit various sizes of sediments in the river. The biodiversity group focused on habitat characteristics including water quality, quantity, flow velocity, riparian vegetation, etc. needed to support and maintain the life cycle of important aquatic species. The livelihood group made recommendations recording important river characteristics including water depth, flow, quantity and quality needed to support livelihood activities of

people who depend on the Ganga River. The spiritual/cultural group focused on river characteristics including water depth, flow and quality required by people to fulfil their spiritual and cultural rites. The water quality group provided water quality guidelines in order to meet with the requirements and objectives recommended by other specialist groups.

The WWF-India study highlights the importance of taking social-ecological context into account in arguing for the protection of biodiversity (WWF-India, 2012; Lokgariwa et al., 2014). According to WWF-India (2012) and Lokgariwa et al. (2014), an important finding of the study was the close correspondence between cultural water requirements (i.e. water needed to fulfil important cultural and spiritual obligations) with those of the ecological requirements necessary to maintain the flourishing of the resource base.

The study thus suggested that cultural values may not always be at odds with environmental values – and that their integration can provide a socially responsible and ethically acceptable basis for biodiversity protection. Nevertheless, the question arises as to what would happen if cultural/ other social water requirements were at odds with those of ecological requirements? A relational environmental ethical perspective seemed to be mainstreamed in the study; its core principle that stresses complementarity in a complex social-ecological system seems to have been taken up as motivation for the E-flow assessment.

3.5.4 Indicators of the application and implementation of environmental ethics – successes and failures

Understanding people's value systems that shape their conception and experience of water is crucial if water resource management policies are to achieve their intended purposes, and if people are to act voluntarily to protect the environment, without being coerced to do so through state regulation. The case study analysed in this section incorporates people's values relating to the Ganga, not only from an economic perspective, but also from cultural and spiritual perspectives – values often neglected by water resource managers and policy makers. It thus incorporated key principles of inclusivity and participation advocated in relational environmental ethical systems, which stress the importance of paying particular attention to the perspectives, insights and views of the marginalised – in this case spiritual and cultural views that are often not considered in water policies. A key environmental ethical aspect of the case study is the consideration of the requirements of the non-human species involved. In this case study, specific detailed attention was paid to the bio-physical

requirements of flagship species such as the Ganga river dolphins, gharial, otter, etc. and other species considered very sensitive to flow conditions (WWF-India, 2012). Furthermore, the fluvial geomorphological study, which recommended flow conditions needed to maintain the transportation and deposition of various sediments as well as the maintenance of channel morphology, recognised the value of non-living components of the Ganga River.

3.5.5 Conclusion

Environmental ethics is not simply concerned with the protection of biological species and, the associated ecosystems that support them. To be able to do so in the first place, it is concerned with establishing principles for integrating diverse value systems and perspectives for ensuring environmental sustainability in a way that places both human and non-human life-forms together in a co-dependent, even co-responsible, inter-relationship within the socio-ecological system. In that sense, ethics is not just a 'would-be-nice- to- have optional extra'. It becomes a *sine qua non* if we are to survive. As this case study illustrates, this kind of E-flow assessment and its implementation, provides a good starting point along that road.

3. 6 GENERAL CONCLUSION AND LESSONS

In a sense, any environmental ethical system which promotes the unity and sustainability of the ecosystem as its chief value, could be seen to be promoting a relational ethical kind of perspective, in terms of which it is argued that one should not be pushing for the intrinsic (in the sense of exclusive) value of any of its components -such as human beings, or of the natural environment. One should rather see the system as a whole (i.e. the ecosystem) as ultimately valuable, with value not residing so much in the individual components, but in the relationship between them. In as much as there are very few environmental ethical systems which would take a 'fundamentalist' kind of approach, arguing that "humans must take priority and nature must simply fit in" or that "environment must take priority and humans must fit in as best they can" – most environmental ethical systems have a significant relational component to them; this relational thinking was most explicit in the case of the MACH project and the E-flow assessment of the Ganga River.

These case studies show us a range of ways in which different kinds of environmental ethical thinking manifest themselves in actual situations. This is seldom in a consciously thought through manner, because we are dealing with practical people who are busy

dealing with practical problems, within a narrowly defined brief, and who do not necessarily look for the fuller picture. These environmental ethical theories also do not manifest themselves in such a manner that one finds only one strand of thinking about environmental ethics manifesting itself, to the total exclusion of others. Thus is because much of our thinking is contextual, and we, as human beings, are not naturally given to consistency. The more practical case studies of environmental ethics in action that we are able to learn from, the better we will understand how environmental ethics (actually) works – often below the surface – to influence the ways in which planners and implementers go about their business. The better we understand the working out of environmental ethics, the better we are placed to open out that process. However, what is clear from the four case studies reviewed, is that when there is an attempt to impose a monolithic view of the way values are seen in the situation, and compromises are unable to be reached by the various parties to the contest, as in the case of the Lower Snake River, it is often difficult to achieve long term sustainability of the social-ecological system as an integrated unit. The MACH project and the E-flow assessment of the Ganga River, where a range of ways of balancing values and reaching compromises were emphasised, illustrate clearly that maintaining the health of the overall social-ecological system requires a relational ethical thinking that emphasises the whole, and the relationships between its components.

CHAPTER 4: ENVIRONMENTAL ETHICS AND AQUATIC ECOSYSTEM HEALTH

4. 1 Aquatic ecosystem health and integrity

South Africa's ground-breaking water law provides for an ecosystem approach to managing water resources (NWA Act No 36 of 1998). Several ecosystem-based monitoring programmes have been established to provide relevant ecosystem-based data to provide for the overall condition of ecosystem health, in order to inform the management direction of aquatic ecosystems (DWA, 2013). These programmes include the National Eutrophication Monitoring Programme (NEMP), the National Microbial Monitoring Programme (NMMP), the National Toxicity Monitoring Programme, the National Chemical Monitoring Programme (NCMP) and the National Aquatic Ecosystem Health Monitoring Programme (NAEHPM) (Sekoko et al., 2006; DWAF, 2002; Rossouw et al., 2008). Each of these programmes is aimed at monitoring aspects of the quality of surface water resources in order to ensure their sustainable utilisation. The National Aquatic Ecosystem Health Monitoring Programme is aimed at monitoring the ecological condition of aquatic ecosystems, and seeks to generate the needed information to manage aquatic ecosystem health. The overall underlying assumption of the use of resident biota for aquatic ecosystem health assessment is that a systematic characterisation of the distribution, diversity, abundance and health of biota within the system can provide an indication of ecosystem disturbances vis-à-vis the ecosystem health condition (Rosenberg and Resh, 1993). Thus, globally, this approach, often referred to as 'biomonitoring', has become widespread in the management of the health of aquatic ecosystems.

However, to proceed with the investigation of the relationship between environmental ethics and aquatic ecosystem health, and to identify ways in which ethics can constructively be applied in managing aquatic ecosystem health in the context of social-ecological systems, it is important to clarify what is meant by aquatic ecosystem health, and how it is different to aquatic ecosystem integrity.

Aquatic ecosystem integrity refers to a state or condition in which the natural processes, structure, dynamics, activities, functions and all related biophysical attributes, are maintained with no human or with minimal human influence, and are only influenced by natural evolutionary and biogeographical factors (Scrimgeour and Wicklum, 1996; Karr, 1999).

Ecosystem integrity is thus constrained by only evolutionary and biogeographical factors, so that what constitutes ecosystem integrity becomes context-specific, since evolutionary and biogeographical characteristics vary between regions and local conditions. Furthermore, ecological integrity therefore can be seen as a concept that allows for no or minimal human alteration vis-à-vis social-economic development (Vugteveen et al., 2006).

On the other hand, ecosystem health is a human construct (i.e. value-laden), describing a preferred or an acceptable condition of an ecosystem that has been influenced by humans (Karr, 1999; Jian et al., 2007). The concept of ecosystem health recognises that humans are an integral component of the ecosystem and that continuing supply (sustainability) of ecosystem services is necessary for sustainable human development (Vugteveen et al., 2006). The implication is the likelihood of multiple claimants to ecosystem services at any given time and place, and thus the need to identify criteria by which values underpinning claims can be judged – not only between societal constituencies, but also between societal constituencies and the natural environment. Ecosystem health can therefore be viewed as having two components: the biophysical component (referring to the state of the biological, physical and chemical condition of the ecosystem) and the social-economic component, which refers to the continuing supply of vital ecosystem services to meet human social-economic development (Figure 4.1). The continuing supply of the ecosystem services is dependent on the maintenance and functionality of the processes, organisation, structure and function of the biophysical component of the ecosystem (Jian et al., 2007). Thus, a healthy aquatic ecosystem can be referred to as a system that has the capacity to provide social-economic services while still able to sustain its ecological functioning (i.e. vigour and resilience) and its organisation (Vugteveen et al., 2006). That is, while supplying social-economic services, a healthy ecosystem should be able to maintain system attributes such as activity and metabolism, energy flow and species diversity, as well as retaining the capacity to resist disturbance or bounce back when perturbed (Rapport et al., 1998; Kleynhans and Louw, 2007). Therefore, in determining ecosystem health, consideration is given to both the biophysical or ecological health, and the social-economic health of the system. From a sustainability perspective, the concept of ecosystem health thus offers the opportunity to meet the three pillars of sustainable development, i.e. the social, the economic and the environmental (Vugteveen et al., 2006).

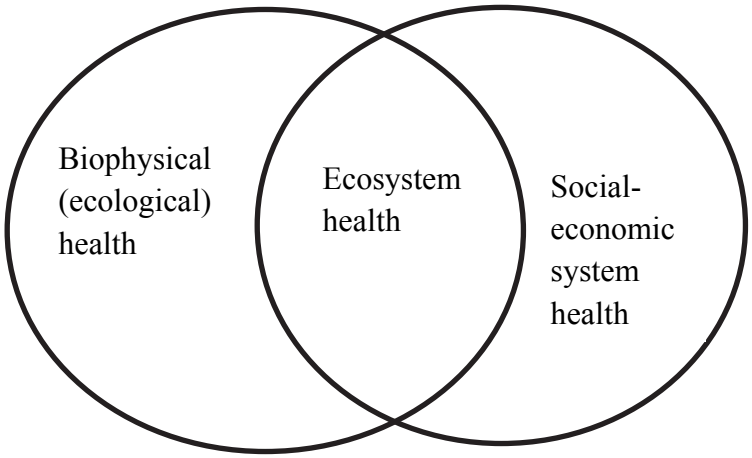


Figure 4.1: The concept of ecosystem health recognises that the human is an integral part of the ecosystem and therefore ecosystem health is a measure of both biophysical (ecological) and social-economic health.

For a holistic view of ecosystem health, both components should be assessed and evaluated in order to determine what is acceptable or not, and this is usually underpinned by societal values and value systems (Groenfeldt and Schmidt, 2013), which should be discussed and negotiated according to agreed upon ethical criteria and principles. For example, an ethical position that locates value in the system as a whole as well as in its components, (i.e. a systemic-relational ethic) will be guided by respect, fairness and equity for all system components (ecological and social-economic) in order to maintain a state in which the system is able to sustain its functionality. Aquatic ecosystem health therefore can be seen as a continuum, at one end of which is ecosystem integrity, and at the other end of which is a situation in which the biophysical and associated ecosystem conditions have been critically modified (degraded) as a result of human influences (Figure 4.2). Along this continuum, what constitutes an acceptable (healthy) condition is thus a value judgement that must be made by society. The question that arises is: who/what in society makes these value-judgements, and whether or not the implications of such judgements are fully understood? It is important that such value-judgements be made in a consultative, engaged and participatory manner, emphasising ethical principles such as respect for all societal and environmental values, underpinned by systemic thinking. The term ‘acceptable’ also raises implications as to whether or not – and in which ways – society/sections of society value the ecosystem structure, processes, function and services that are lost or impaired, and whether or not the

consequences of impairment and eventual loss in this connection are fully understood. Clarifying questions such as these**,** in terms of values invoked and how they are brought into relation with each other, is the domain of environmental ethics.

Inherent in the concept of ecosystem health, are the notions of human dependence on aquatic ecosystems, as well as the capacity of human activities to alter ecosystem properties, so that sustainability can only be achieved if a balance is struck between human uses of ecosystems and their protection, i.e. ensuring the continuing supply of ecosystem services. The achievement of this balance must be guided by ethical considerations, taking into account the distribution of costs and benefits between all stakeholders (both present and future generations) and environmental costs, as well as environmental externalities. This would involve selecting and invoking criteria to relate values such as equity and efficiency to each other, and to determine the relative value given to human and non-human components of the ecosystem, as well as to shorter and longer term sustainability agendas**.**

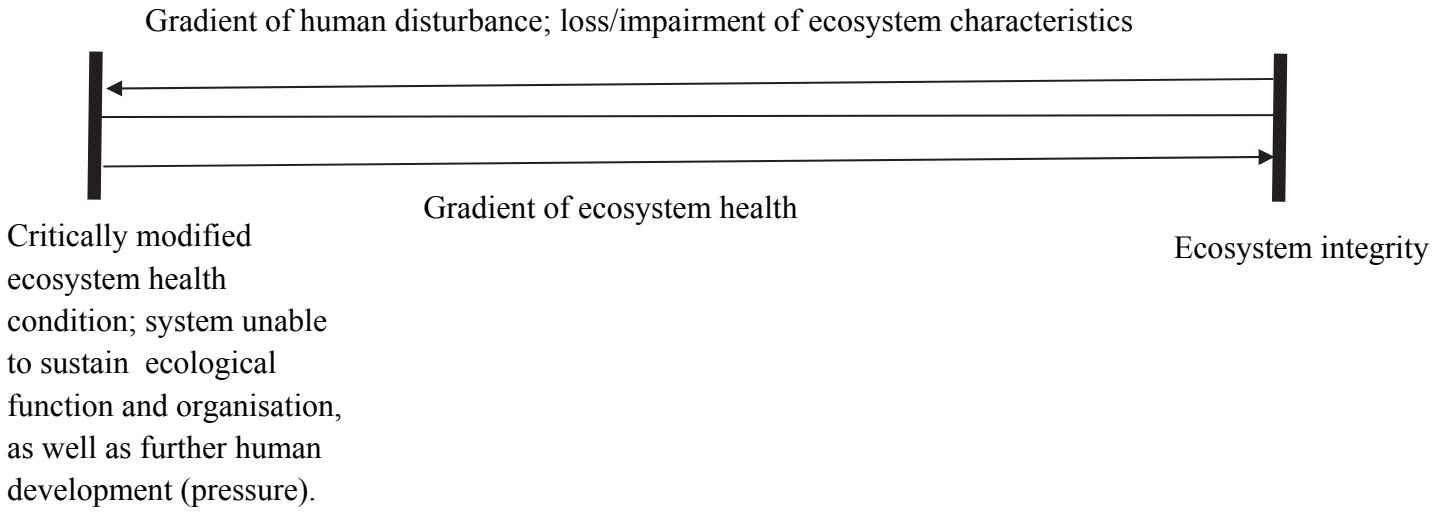


Figure 4.2: Conceptual representation of ecosystem health continuum indicating that at one extreme end of the continuum is ecosystem integrity, and at the other end is a critically modified health condition, where human impact is severest and the system is unable to sustain its function and organisation, as well as further human pressure vis-à-vis human development (adapted from Karr, 1999).

4.2 Assessing and monitoring aquatic ecosystem health in South Africa

Determining and monitoring aquatic ecosystem health is a core component of sustainable water resource management in South Africa (DWA, 2013). Aquatic ecosystem health is usually assessed in South Africa, based on the biophysical component of the ecosystem, and using biological, physical, hydrological, geomorphological and chemical indicators and characteristics (Kleynhans, 2008; Kleynhans et al., 2008; Thirion, 2008; Odume and Muller, 2011). On completion of a comprehensive aquatic ecosystem health determination, the results are usually expressed in terms of ecological categories/states along a continuum ranging between Ecological Categories A and F, where A is an ecological state with little or no human modification, i.e. a state of naturalness or near naturalness; and F represents an ecological condition in which human activities have critically modified the aquatic ecosystem (Dallas, 2007; Kleynhans and Louw, 2008).

It is thus clear that the assessment of ecosystem health in South Africa is currently based purely on the biophysical component of the aquatic ecosystem. Implicit in this approach is that continuing supply of aquatic ecosystem services is dependent upon a 'healthy' biophysical component of the ecosystem.

While this conventionally assumed relationship may hold for a number of ecosystem services, this may not necessarily always be the case. For example, an invasive alien species could alter the functionality of a riverine ecosystem to a point where the system could be considered biophysically degraded, but the system still supports the optimum viability of such an invader. However, if such an invader is considered socio-economically important based on operating contextual social-economic and institutional value systems, then it could be argued from a social-economic perspective that such an ecosystem is 'healthy' because of its capacity to supply an important ecosystem service. Nevertheless, if the invader destroys the overall system to a point where its viability as a system is threatened, e.g. through the loss of the social-economic benefit derived from the invader, then the ecosystem could be considered 'unhealthy', both from a biophysical and social-economic perspective. This illustration raises pertinent questions about ecosystem health and ethics:

- Ecosystem health has a temporal dimension. Both the biophysical and social-economic components of aquatic ecosystems vary health-wise, over time, in response to the impact of human values – but in different ways. Biophysical variation is

influenced by the frequency, magnitude and type of human activities, arising out of the expression of human activities on the landscape over time. Such activities do not consciously seek to bring about biophysical variation – and in that sense, resultant biophysical variation arising out of the expression of human values – such as seeking to increase wealth or access to resources – is more indirect in nature. On the other hand, ecosystem services are consciously designed in response to societal value systems, and in that sense, are a more direct consequence of the expression of human and societal values.

- Social-economic indicators of ecosystem health need to be developed and used alongside biophysical indicators for the assessment of aquatic ecosystem health. Developing appropriate social-economic ecosystem health indicators would require a consideration of the type of the ecosystem service, the spatial-temporal context, and the users of the service and their operating value systems. Depending on societal value systems, the 'unhealthy' biophysical component of ecosystems does not always necessarily translate into unhealthy social-economic outcomes – hence the need for careful value system consideration during policy formulation aimed at balancing human use of ecosystem services and protection of the ecosystem. Careful consideration of value systems would involve using a set of ethical principles to decide between values, both in the context of the good of the environment and the good of society – taking into account scales both in time and space. For example, within a local context, a biological invader could be considered to be of high social-economic importance, but its negative effects at the broader catchment scale could make it undesirable. The final value-judgments thus involve trade-offs, but these must be debated and then agreed upon.

4.3 Aquatic ecosystem health and environmental ethics in social-ecological systems: towards a conceptual framework for constructively applying ethics in aquatic ecosystem management

The concept of the social-ecological system views the human/societal and the ecological components as a coupled and integrated system characterised by multiple feedback loops, cross-scale dynamics, non-linearity and unpredictability (Berkes and Folke, 1998; Constanza et al., 2001 and Folke et al., 2005). Within any given social-ecological system, human use of

aquatic ecosystem services impacts on the ecosystem structure, function and processes, as well as the services they provide (Figure 4.3). The trajectory of human use of ecosystem services and societal attitudes towards aquatic ecosystems are largely driven by societal value systems and rationality (Groenfeldt and Schmidt, 2013). Societal value perspectives in relation to the environment, though not always explicitly considered during negotiation of environmental policies, implicitly guide the use of aquatic ecosystem services. Human alteration of ecosystem integrity leads to a particular state of aquatic ecosystem health and associated ecosystem services (Figure 4.3). In this regard, the role of ethics is to ensure equitable, fair and negotiable distribution of benefits and costs associated with access to ecosystem services. As we have tried to show throughout this project, this raises a host of issues to be considered and, as far as possible, reconciled. These include: natural environmental and human rights; biophysical and social-environmental costs and benefits; anthropocentric and non-anthropocentric foci – and the claim that "Our [i.e. South Africa] new water policy is unashamedly anthropocentric" (Sherwill et al., 2003); short and long terms approaches to sustainability; narrower and more inclusive conceptualisations of the overall complex system with which we consider ourselves to be grappling.

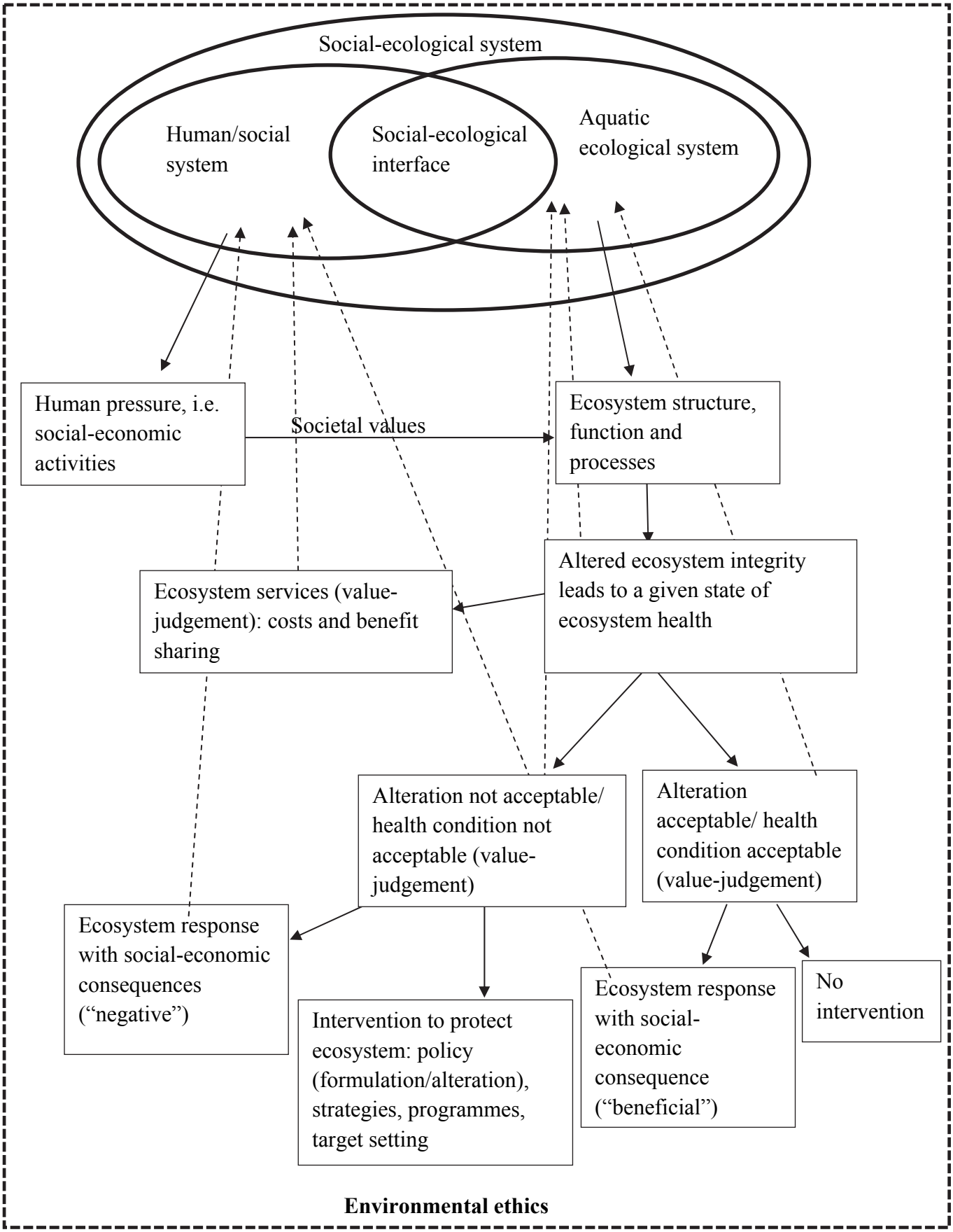


Figure 4.3: Conceptual framework linking environmental ethics to aquatic ecosystem health within the broader social-ecological system, indicating that ethics is all- encompassing and

that value-judgements pervade all aspects of the use and protection of aquatic ecosystems. Dash arrows are feedback loops, while non-dash arrows indicate progressive directions.

The National Water Act ushers in an interest-based, consensus-seeking approach to negotiating access to aquatic ecosystem services (van Wyk et al., 2006). However, the ethical challenge is not only to ensure equal participation by all interested and affected stakeholders, e.g. the historically privileged and the marginalised, the weak and the strong, the urban dwellers and the rural dwellers, the informed and the uninformed. That is, the challenge is not only a matter of facilitation to bring out the various viewpoints in spite of 'unequal starting blocks'; it is how to reconcile different principles for taking account of differing viewpoints in taking matters further, such as allowing for those unequal starting blocks, trade-offs between different value positions, efficiency (which can be a potentially undemocratic consideration), etc. This is a fundamental ethical challenge that faces resource managers, policy and decision makers. How do we enable the good intentions of the Water Act to be realised? In this regard, a distinction between practical and ethical challenges needs to be made. With good facilitation skills, managers can ensure that all stakeholders air their views, and all values are documented and accommodated. But beyond this facilitation process, what is done with the multiple views and values and how values are traded off and by what principles and criteria these are done, are fundamental ethical challenges that needs to be addressed.

By access to the decision- making process, we mean the creation of an enabling environment that empowers all stakeholders to have equal voice and influence over decision-making around resource use and allocation, as well as the sharing of costs and benefits. A place at the table does not, however, guarantee effective participation in negotiations about a project's outcome. The danger remains that "participatory approaches may mask different levels of power and influence, exaggerate the level of agreement reached, and expose disadvantaged groups to manipulation and control by more powerful stakeholders" (World Bank 2003: 81). Ensuring all stakeholders equal access to the negotiation table would require the recognition and appreciation of diverse value systems operating within the same contexts, so as to build consensus towards shared visions (Rogers and Luton, 2011), and consciously balancing these values in the final decisions around resource use and allocation.

An important implication for recognising diverse value systems, is the appreciation of diverse ways in which people benefit from and value aquatic ecosystems (van Wyk et al., 2006; Farad et al., 2015). People living in the catchment area of a particular aquatic ecosystem may attach higher value to a particular set of ecosystem services, such as provisioning services for food, whereas other services, e.g. carbon sequestration that helps in mitigating climate change, could be of higher value to people at the continental scale. Therefore, ensuring equity in access to and use of ecosystem services requires a management approach that takes account of the multiple scales at which people derive benefits and incur costs from the use of ecosystem services.

Strategic adaptive management (SAM) has been proposed as a reliable framework for implementing integrated water resource management to ensure a sustainable development trajectory in access to and use of aquatic ecosystem resources (Rogers and Luton, 2011). SAM processes view the catchment as a complex V-STEEP (value-social-technological-economic-environmental-political) system requiring management practices that are stakeholder-centred and consensus-driven, enhancing cooperative actions towards shared visions and objectives (Rogers and Luton, 2011). Because SAM emphasises shared values and value-systems, consensus-seeking, cooperative action and adaptive monitoring, its implementation in the Inkomati Catchment Management Agency (ICMA) has yielded some positive outcomes (Rogers and Luton, 2011). However, from an ethical perspective, emphasis on equity in terms of voice, access, sharing of power and responsibility would require a new form of management approach to natural resources. The systemic-relational ethical perspective argued in the final chapter of this report provides some guidance in moving toward this direction, with regard to water resource management in South Africa.

4.4 Aquatic ecosystem integrity and ecosystem health – towards an 'acceptable' ecosystem health condition

It is clear that human activities alter aquatic ecosystem integrity, resulting in the ecosystem being in a particular health condition. While science can provide evidence of the magnitude, frequency and nature of alteration to aquatic ecosystems, it is society that ultimately has to judge what constitutes an acceptable alteration and whether or not the resulting ecosystem health condition is sustainable in perpetuating vital biophysical structure, function and processes and the continuing supply of associated ecosystem services (Su et al., 2010). Thus, the distinction between "good" and "poor" ecosystem health condition is the domain of ethics

in as much as societal and professional value-judgements are involved. Mee et al. (2008) argue that the term "goodness" is not an intrinsic property of nature, but an extension of human value systems to nature, i.e. it is a purely human construct that has no intrinsic or inherent relationship to nature. One could ask questions such as: good in terms of what? And how is goodness measured and determined, and who/what determines the goodness? In terms of what is held to determine goodness, a highly eutrophic river system with a high concentration of organic materials could be good for the larvae of the non-biting midges (chironomids), but society may argue that the system's health is very poor because species of high value to humans have disappeared as a result of eutrophication.

The practical implication is that the management of aquatic ecosystems requires trans-disciplinary cooperation between the natural and social sciences, because, while natural science can provide empirical evidence of the biophysical condition of the ecosystems, this must be evaluated against societal expectations, based on the benefits derived from the associated ecosystem services – re-emphasising the combined biophysical and social-economic nature of aquatic ecosystem health. For example, when the biophysical condition of an aquatic ecosystem is described to be in Ecological Category B for example, the social-economic correlates (i.e. the associated ecosystem services) should also be described and made explicit.

4. 4.1 What constitutes an acceptable aquatic ecosystem health condition?

There is no simple answer to this question, because of the inherent complexity of decisions that are value-laden. In South Africa, in the determination of the ecological Reserve and in the National Aquatic Ecosystem Health Monitoring Programme, a set of biophysical indicators and characteristics are used to measure the degree of deviation of the present state of a particular area from its predevelopment condition, or that condition which would be expected if human impacts/alterations were minimal (Kleynhans and Louw, 2007). Depending on the present state of the aquatic ecosystem health condition, a recommendation can then be made to restore the health condition to a 'desired' future condition; in biophysical terms, this is usually expressed between Ecological Category A-D (Kleynhans and Louw, 2007). Depending on the recommended desired future condition, several management interventions, including policy formulation/alteration, ecological target setting, designing restoration programmes and awareness raising, can be triggered.

Values, and ethical contextualisation of these values in relation to aquatic ecosystems, often underpin recommendations for the desired future condition, but this is usually not made explicit in the scientific methods and approaches used in the ecological Reserve process and in the River Health Programme. For example, in recommending the desired future condition, i.e. the Recommended Ecological Category (REC), the PES (Present Ecological State) and the EIS (Ecological Importance and Sensitivity) are both taken into account (Kleynhans, 2005). The EIS refers to the importance of the particular aquatic ecosystem in terms of sustaining critical ecological and biodiversity elements and functions, and supplying ecosystem goods and services, as well as the system's capacity to resist disturbances and/ or bounce back when disturbed (Kleynhans, 2005). Thus, aquatic ecosystems considered to be high in EIS are accorded high protection priority, i.e. a high REC, whereas those with low EIS, are accorded low protection priority (Palmer et al., 2013).

Though not necessarily made explicit, the decision to assign one ecosystem high REC over another, is a reflection of societal value judgements underpinned by various possible environmental ethical approaches, as well as the level of risk society is willing to accept in maintaining a prescribed ecosystem health condition. For example, a society with a purely anthropocentric ethical position and with a utilitarian and consumerist value system, is likely to 'fix' the threshold of acceptable limit of ecosystem alteration or ecosystem health condition at near one extreme end of the health continuum, provided vital ecosystem services are still supplied, notwithstanding the severe impact human development could be exerting on the ecosystem (Figure 4.4). A practical example is the case of the four dams in the lower Snake River system in the United States of America. The quest for social-economic development without careful consideration of environmental consequences, led to the construction of the four dams on the river – a river vitally important for salmonid annual migration and for the indigenous Indian American population (Rogers, 2009). The construction of the dams, coupled with industrialisation of the catchment, led to pollution and to the obstruction of salmonid migration and to the eventual severe depletion of the salmonid population, until they were designated as endangered. This example illustrates some of the implications of upholding a strongly anthropocentric ethical position.

On the other hand, a society with a strongly non-anthropocentric ethical position, with a value system of 'absolute respect' for nature, may allow for an acceptable limit of alteration to ecosystem integrity near the other end of the health continuum, allowing only minimal

development, while ensuring that ecosystems supply basic human needs (Figure 4.4). Again, a non-anthropocentric position may drastically undermine claims to human social-economic development. For example, the court judgement to scrap the dams on the Snake River discussed in Chapter 3. A considered balanced position may be taken by a third society whose ethical position is systemic and relational, recognising the inherent complexity and interconnectedness of social and ecological systems. For example, the case of the Ganga River discussed in Chapter 3. This position thus recognises that social-economic development must not undermine aquatic ecological health, as both the social and ecological are coupled Thus, the limit/threshold of acceptable pressure on, use and exploitation of, aquatic ecosystems vis-à-vis acceptable ecosystem health condition, would vary, depending on stakeholders' ethical standpoints.

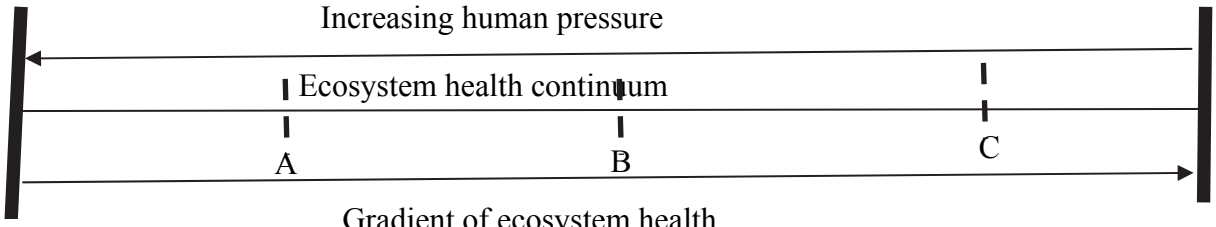


Figure 4.4: Conceptual relationship between environmental ethical positions and thresholds of acceptable ecosystem health, showing that the definition of acceptable ecosystem health is influenced by societal ethical positions: A (anthropocentric), B (relational/systemic) and C (non-anthropocentric).

From the conceptual connection between ethics, values and aquatic ecosystem health, it is clear that defining an acceptable ecosystem health condition and the threshold of alteration that triggers management actions is not straightforward, since values have both spatial and temporal dimensions (Welzel, 2006; Mee et al., 2008). In this regard, differences in attitude

towards aquatic ecosystems between countries can be stumbling blocks to negotiating political agreements for the management of transboundary river systems (Mee, 2008).

4.5 Aquatic ecosystem health, institutions and governance – a consideration of ethics across different spatial scales

South Africa is regarded as a predominantly arid country, having limited surface water resources that are unevenly distributed across the country, resulting in several domestic inter-basin transfer schemes from areas of more 'abundant' supply to areas where supply is less adequate (Pitman, 2011; DWA, 2013). The uneven distribution of water resources, coupled with the constitutionally enshrined people's right to water and the need for rapid social-economic development, call for inclusive, cooperative and efficient institutions for water resource management and to halt or reverse the trajectory of deteriorating aquatic ecosystem health. The National Water Act (Act No 38 of 1998) stresses the importance of inclusivity, representativeness and cooperation in the management of water resources and the associated aquatic ecosystems. At local and subnational levels, statutory bodies such as Catchment Management Agencies (CMAs) and Water Users Associations (WUAs) are established to facilitate cooperation, with CMAs being responsible for the protection of aquatic ecosystem health. For this to be successful, all stakeholders, including polluters and those whose livelihoods are dependent on aquatic ecosystems, would have to actively participate in crafting CMA visions and strategies at the catchment level. CMAs are required to create enabling environments through the formation of non-statutory local bodies such as Catchment Management Forums (CMFs) and Catchment Committees (CCs) for effective participation of all interested and affected parties at the catchment level. To a significant extent, the effectiveness of CMAs will be determined by the extent to which cooperation, inclusivity and participation among stakeholders is achieved. The CMF is thus the means for democratising water governance at the local scale. CMFs are the local institutions where multiple and divergent interests and value systems are accommodated and debated, and a (working) consensus is reached regarding water resource management.

Though the National Water Act brings about significant structural changes and institutional realignment regarding the management of water resources in South Africa, it has been noted that such re-alignment of institutions alone cannot bring about effective participation of all

stakeholders and redress of equity (Schreiner and van Koppen, 2002; Mirumachi and van Wyk, 2010). This raises serious ethical questions regarding effective stakeholder participation in decision-making process. For example, power disparity among stakeholders, and a history of exclusion, which could impede on trust building and differentials in empowerment, could prevent effective stakeholder participation (World Bank 2003; Mirumachi and van Wyk, 2010). The question therefore becomes: how can effective stakeholder participation be achieved when all interested and affected stakeholders do not have the requisite capacity, skills, knowledge and resources to contribute equally and to make effective representation? That is: what are the precursors to effective stakeholder participation in decision- making processes regarding water resource management at the local scale?

A lack of awareness of the value of water resources was articulated in the second edition of the National Water Resource Strategy document (NWRS2) (DWA, 2013). Thus, without heightened awareness of the value of water resources, people could engage in activities that undermine the health and functionality of aquatic ecosystems. An important vehicle for communicating the value of water and the associated ecosystem is the CMFs (DWA, 2013). However, if barriers to effective and broad-based participation are not addressed, it could be difficult to achieve such a heightened awareness level vis-a-vis good ecosystem health. Stakeholders' empowerment must be seen as a precondition for effective engagement and participation. Differences in empowerment between stakeholders can be perceived as threats to mutual cooperation, as weaker groups may feel alienated and become resistant to cooperation. Mirumachi and van Wyk (2010) note that, although relatively endowed stakeholders in the Sabie Catchment seem to cooperate about decision-making around water resources in the catchment, their appetite for sustained and broader cooperation with other stakeholders dwindled over time because of their perception of risks regarding returns on time and effort invested in cooperative deliberation – because they have no effective powers to implement decisions. This has serious implication for effective and broad-based stakeholder participation in CMFs, since CMFs do not have implementing powers (DWA, 2013). Thus, risk perception relating to the importance and value of participating in CMFs needs to be addressed as a way of broadening participation in decision-making processes and of debating and accommodating divergent environmental values in relation to local water resource management.

South Africa shares four major river systems with other neighbouring riparian states, and about 60% of South Africa's streamflow is internationally shared (DWA, 2013). The implication therefore is that transboundary river systems and their associated ecosystems are influenced by social-economic, political, legal, administrative and technological factors in the different riparian states. Cooperation is thus essential to managing transboundary aquatic systems – a provision acknowledged in the National Water Act.

Effective implementation of trans-boundary river system agreements must pay considered attention to the relevant political, environmental, and social-economic contexts in order to foster cooperation. Negotiations will need to find cross-value principles which reach across these specific contexts if the overall trans-boundary agreements are to be successful. For example, the implementation of the Lesotho Highlands Water Project (LHWP) has been hailed as a blue-print for regional cooperation and integration over water, and for having an internationally advanced resettlement compensation policy. However, it has also been criticized by several NGOs, civil society organisations and communities for violating the environmental and human rights of local people, with negative impact on their livelihoods and on aquatic ecosystem functionality. Local people displaced as a result of the project were compensated, but such compensation was deemed inadequate (Horta, 1995; Meissner, 2005).The question that arises therefore is: what mechanisms are in place to ensure that the voices of all stakeholders, including less informed rural people, are heard in the management of trans-boundary river systems? If any such mechanisms are in place, how effective are these mechanisms?

4.6 Towards holistic and integrated aquatic ecosystem health assessment and protection in South Africa – environmental ethical considerations

South Africa has made great strides in aquatic ecosystem health assessment and protection. It is one of few countries that provide legal imperatives for the protection of aquatic ecosystem health (NWA No 36 of 1998; DWA, 2013). The assessment of aquatic ecosystem health has focussed primarily on the biophysical components of the aquatic ecosystem. However, the concept of aquatic ecosystem health has both biophysical and social-economic components. The question therefore becomes: are social-economic indicators of aquatic ecosystem health monitored, and do they form part of the RDM (Resource Directed Measures) strategies, as part of ecosystem health protection? From a social-economic perspective, a healthy aquatic ecosystem is one which is not detrimental to societal well-being, and which is able to supply

basic services for social-economic development. Explicit monitoring of social-economic components of the aquatic ecosystem health is therefore needed for an integrated and holistic picture of ecosystem health in South Africa.

Cairns et al. (1993) argue for social-economic indicators of aquatic ecosystem health that provide evidence for the interrelationship between ecosystem and human health, i.e. Indicators that is economically, politically and socially informative. Broadly, social-economic indicators should evaluate two aspects of the aquatic ecosystem health: they should ascertain a) whether or not the aquatic ecosystem is detrimental to social well-being and b) whether or not the quality and quantity, as well as the reliability of supply, of ecosystem services have been compromised.

In evaluating aquatic ecosystem health from an ecosystem services perspective, ecosystem services can be classified into: provisioning services, cultural services, supporting services and regulatory services (MA, 2005). Values need to be clarified and assessed, using a clear set of ethical principles, to ascertain how values influence the use, evaluation, measurement and public perception of ecosystem services. This also has implications for the distribution of costs and benefits of accessing ecosystem services, and for relevant environmental policy regarding the management of aquatic ecosystem health.

4.7 Communicating aquatic ecosystem health

Why should aquatic ecosystems be maintained in good health? Public perception of, and attitude and behaviour towards, the natural environment, are potential catalysts that can lead to uncontrollable exploitation and degradation of aquatic ecosystems – or towards positive behaviour in relation to the environment. If the public is to relate to the aquatic ecosystem in a more humane, responsible and respectful way, then there needs to be an effective communication of the value of 'healthy' ecosystems to society, and to different constituencies within society. The continuing degradation of aquatic ecosystem conditions, despite tremendous investment in research, policy and management institutions, could be attributed to the perceived 'disconnect' between the human and the ecological systems. Communication about the inherent linkages between societal and ecological systems needs to be strengthened in the public and policy domains. People need to understand that societal well-being is explicitly linked to ecological health. Thus, from an ethical perspective, the

rationale for protecting ecosystem health becomes systemic, and needs to be underpinned by a systemic relational ethic that views both the ecological and social systems as coupled.

Furthermore, in communicating the value of protecting aquatic ecosystem health, emphasis also needs to be placed on equity between different social constituencies at the catchment and sub-catchment levels. The variety of aquatic ecosystem services, their benefits to different social consistencies (e.g. poor/wealthy, rural/urban dwellers, etc.), and a shared understanding of the multiple value systems that influence how different constituencies value ecosystem services, needs to be stressed in the public and the policy domains (van Wyk, 2006). Equally important is the appreciation and awareness of the distribution of costs and benefits associated with access to aquatic ecosystem services. Often, access to the benefits of aquatic ecosystems by one constituency could lead to costs carried by another constituency, and therefore effective communication should address equitable distribution of costs and benefits associated with the use of ecosystem services.

4. 8 Conclusion

Ecosystem health – while it is a human construct – needs to be seen within the context of the social-ecological system, or the ecosystem, as a whole. The social-ecological system may be understood as consisting of two major components, i.e. the biophysical and the social-economic. If both parts are integral to the ecosystem, then the heath of each is integral to the overall health of the ecosystem. Inherent in the concept of ecosystem health, are the notions of human dependence on aquatic ecosystems, as well as human capacity to alter ecosystem properties. Sustainability can therefore only be achieved if a working balance is struck between human uses of ecosystems, and the protection of these ecosystems. The management of this interrelationship needs to be done in an integrated, holistic manner, which is sustaining to both components.

We must take care not to equate values and ethics; ethics, in an important sense, is a meta-values exercise. Ethics is about criteria for the ways in which one relates values – which are not necessarily compatible in all contexts – to each other. Nor must not we equate ethics, or a specific set of environmental ethics, with a list of values. Thus, the values that the Water Act espouses, such as equity, efficiency and sustainability, do not by themselves constitute an approach to ethics. These values can be brought into relation in different ways. Different environmental ethical approaches, with emphases on different central principles – whether

they are anthropocentric, or non -anthropocentric, or relational, or emphasise context (e.g. as pragmatists do) – would relate such values to each other in potentially different ways.

Ethical approaches are therefore not simply interchangeable, because they may seem to express similar values. Any such ethical approach, inasmuch as it involves principles in terms of which values (and categories related to those values) are to be related to each other, would seem to involve an inescapable element of ranking and trading-off of values, and by implication, of rights related to those values. The nature of such trade-offs would seem to relate to hierarchies in terms of which principles of evaluation may be related to each other or to the levels of incorporation at which the system boundaries are drawn. This in turn would variously influence whether particular people or creatures or plants are classified as being 'insiders', moral members' or 'aliens' – and what kinds of rights they are seen to have. In this regard, whether water is seen as having inherent and/or only instrumental value, would be influenced by the taxonomic scope and scale, and criteria, being employed to draw system boundaries and categories.

We have argued that ecosystem health needs to be conceptualised and managed in terms of an approach to the ecosystem as an integrated unit, in which the health of the biophysical and the social-economical aspects are mutually sustaining and interdependent. In our understanding, this calls for a relationally oriented environmental ethics, in which we move towards locating the central value in the overall ecosystem system itself, as a set of components in interrelationship, rather than in any specific component, such as the anthropocentric or the non-anthropocentric component. This implies taking the potentially difficult step – certainly from a policy and administrative perspective – of decentring the human component, which has hitherto been prioritised; instead we need to redirect our focus to the social-ecological system as an integrated whole, to see it as the unit of worth, towards which decision-making, and developmental and preserving action, is directed.

CHAPTER 5: CONCLUSION; SYNTHESIS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, we seek to bring together the findings of the project, in the form of synthesising arguments and a set of recommendations. This is done in two sections. Firstly, we bring together theoretical and analytical issues we have been exploring throughout the project. Here we set out the

- Basic distinctions on which the analysis and argument in the project have been resting
- Argument for a systemic-relational environmental ethical approach
- Set of principles we see as informing a systemic-relational environmental ethical framework
- Key values operating within the water resource management sector
- Factors which influence the way these values play out in practice

Secondly, we consider ways in which the insights obtained from this first section can be applied in more practical ways in policy and implementation in the water resource management field. More specifically, we consider what is necessary by way of policy and institutional change, to

- Realise the aims of ethically grounded water management
- Provide the enabling conditions for the realisation of the aquatic ecosystem as a healthy, integrated unit
- Achieve greater democratisation and participation in water resource management
- Achieve greater co-ordination and integration between central, but potentially conflicting values in water resource management

We also make suggestions with regard to training requirements and future research if we are to move forward towards achieving these goals.

5.2 Synthesis of theoretical and analytical issues

Some basic distinctions

Several basic distinctions have been made in the course of this project, which are relevant to the argument in terms of which this project has been built up. They are again briefly brought out here.

i) The distinction between ethics and values: Morals or values relate to what specific individuals or groups believe to be good or bad, such as polygyny, or democracy, or whatever. Ethics relates to a systematic concern with the principles by which we seek to distinguish between right and wrong in our behaviour towards other people and towards nature.

ii)The distinction between principles and values. Principles relate to the fundamental or grounding standpoints on which moral values are based, and from which they are derived, whereas morals/values (as above) relate to what people believe to be good or bad.

iii) The distinction between the components of the social-ecological system, and the system's moral and managerial relevance. A system may be defined as "a complex whole, a set of connected things or parts" (Concise Oxford Dictionary of Current English, 1995: 1415). Within the whole, there will always be various subdivisions, or subsystems; e.g. within the social-ecological system, there are natural and social components, and within each of those, further divisions. However, we do not use the term 'subsystem', in order to make the point that what is at stake is not some potentially 'scientific' taxonomic exercise, but a morally and managerially loaded classification exercise. Thus, within an anthropocentric set of priorities, non-human nature is seen and managed in instrumental terms. Within an unequal society, resources are administered and distributed in a hierarchical fashion between social groups. Within a systemic-relational perspective, there will be a greater emphasis on equity across the various components of the social-ecological system. The nature of the distinction between, and the interaction between, the components of the social-ecological system is thus directly influenced by the set of environmental ethical principles in play, and the particular values on which they are brought to bear.

5.2.1 The argument for a systemic-relational environmental ethical approach

The health and functionality of aquatic ecosystems in South Africa, and more widely, continues to deteriorate. This situation is exacerbated by long-standing social-economic inequalities, as well as by poor service delivery in South Africa. This promotes over-exploitation and degradation of natural resources, threatening the sustainability of aquatic ecosystems. These growing environmental challenges present difficult trade-offs for decision-makers, and raise the need for environmental ethical consideration in decision-making and management processes.

Values exercise an important influence on human attitudes and behaviour, and on the human-water relationship. It is important how the welfare of the aquatic ecosystem and of human society are valued, and that they are both accorded a positive value in their own right. It is however, crucial as to how they are valued in terms of each other. This is where a systemic-relational approach to environmental ethics assumes significance. An anthropocentric approach to environmental ethics (which accords primary – or even exclusive – moral value to human beings) would accord only instrumental value to non-human components of the social-ecological system, including water. A non-anthropocentric approach (which sees non-human aspects of nature as having intrinsic value, thus ascribing intrinsic value to all of nature), does not adequately recognize the inextricable linkages between humans and the rest of nature as part of a complex social-ecological system. Value-oriented ethics (whether anthropocentric or non-anthropocentric) can therefore not adequately develop a set of principles and values to deal with the complexities of the interrelationship between humans and the rest of nature, or with situations where conflicts between values and claims arise across the social-ecological system – precisely because such approaches are not systemically oriented. We accordingly here argue for the perspective of social-ecological systems as integrated complex systems, in which the various components, i.e. natural and social (with their various sub-divisions), are mutually constitutive of the social-ecological system as an integrated unit. Water and human beings are thus to be seen as complementary and co-supportive components in the social-ecological system.

Value with regard to the social-ecological system is thus primarily located, not at the level of its constitutive components, but at the level of the system as an integrated unit. Components of the system, such as aspects of nature (e.g. water), or of the social (e.g. human beings) have

value – but not in such a way as to deprive any other component of the system of its value, e.g. by reducing water to having only instrumental value to serve the interests of human beings. Thus, a systemic approach argues that, inasmuch as the various components of the social- ecological system i) are co-constitutive of the social-ecological system – i.e. the overall source of value, and ii) are integral to each other's well-being, they iii) all have systemic, inter-relational value, and thus iv) have both intrinsic and instrumental value.

We have thus decided to adopt what we term a 'systemic-relational' approach to environmental ethics. It is systemic, inasmuch as the ecological and the social components together form an integrated and dynamic complex system. It is relational, inasmuch as these two major components (and their sub-components) are in ongoing complementary and co-supportive interaction. It is thus only a systemic-relational approach to environmental ethics – together with its enabling consequences for water resource management – that can

i) Provide a means to bring the two major components of the social-ecological system (i.e. the natural and the social) into relation to each other, without assuming any analytical or policy weighting of either component in the first instance – with any such subsequent weighting being influenced by context and agenda.

ii) Provide a means to bring different values, which may at times come into conflict, into balance and relation with each other – e.g. equity, efficiency and sustainability. This balancing will be attempted in terms of the broad principles informing the systemic – relational approach to environmental ethics (see below), and the context in which the particular tension/conflict of values occurs, taking into account the needs of the context, as well as the broad systemic approach informing the ethical as well as management orientation.

5.2.2 Principles informing a systemic-relational environmental ethical framework

We here set forth the basic orienting principles that we regard as necessary for a systemic-relational environmental ethical framework to operate as a coherent overarching and coordinating perspective informing the use of values in the management of water resources.

1) The systemic-relational (SR) perspective considers the social-ecological system as an integrated unit. It accordingly interprets, and ascribes value to, and takes action in regard to, the social-ecological system, as an integrated unit, and as a dynamic complex system.

2) The theoretical/intellectual perspective of the social-ecological system as an integrated unit, has the consequence that we also need to see the social-ecological system as an integrated unit, as the central good/ value to be pursued in seeking to interpret, evaluate or manage the social-ecological system. This requires that we actively make efforts to move away from unconsciously emphasizing our own particular values, as well as from emphasizing the value of selected or specific aspects of the social-ecological system, such as its human or non-human aspects. This means that there should be no weighting of any component of the social-ecological system in the first instance; any weighting that may become necessary should emerge from the particular context and the problem/s at hand.

3) This requires the active decentring (i.e. de-prioritising) of any particular component of the social-ecological system, including the human being. The consequence of such decentring of components, is an extension of the concept of 'equity' from its conventionally human reference, to apply to the wider, systemic, social-ecological system, such that all components of the social-ecological system need to be regarded/treated equitably in relation to each other.

4) Part of how we understand integration, is that the various components of a system express and uphold the system, and uphold and serve each other. Each component therefore has intrinsic value, inasmuch as it is an expression and an enabler of the ultimate value, which is the system as such; each component also has instrumental value, inasmuch as it upholds both the system and other components. All components of the socio-ecological system (i.e. human and non-human) should therefore be regarded as having both intrinsic and instrumental value. Water thus has intrinsic value, inasmuch as it embodies and enables life, and can be seen to have deep aesthetic and spiritual value (which is not necessarily a function of its being perceived as such by human beings). Water also has instrumental value, inasmuch as it renders many services to human beings, including enabling human life. Human beings are usually seen as having intrinsic value (valuable in their own right), but they also have instrumental value when they serve other human beings, or serve the rest of nature, e.g. through conservation work or through the return of organic matter back to nature as nutrient

after their deaths. The particular value that, e.g. water or human beings may be seen as having will thus depend on the particular context.

5) Inasmuch as each component of the system may be seen as having both intrinsic and instrumental value, each component is worthy of respect. (The English dictionary rendering of respect as 'due regard' is instructive, inasmuch as it suggests that respect is not simply/not only something unconditionally accorded to persons or things on the grounds of their having intrinsic worth, regardless of anything else – but, rather, that regard is accorded as it is 'due', or appropriate, according to context. This brings in factors in addition to intrinsic worth, such as context, relationship, behaviour, etc., into play in establishing worthiness of respect; http://www.encyclopedia.com/doc/10999 -respect.html; accessed 2/16/2016). Worthiness of respect implies that, in any decision-making situation – which usually involves having to make preferential/differential allocations, due to limited resources and other contextual factors – the intrinsic qualities and claims of all involved components and parties must be held open for as long as possible. And that this must be a deliberate management strategy, which derives from the principle of the upholding of the overall social-ecological system as being the ultimate positive value being pursued.

6) Seeking to respect all components of the social-ecological system, and to regard them as having intrinsic value for as long as possible, has the implication that the attitude of inclusiveness must be consciously adopted as both a moral and as a managerial practice. Such inclusiveness would seem to operate at, at least the following two levels for managers:
i) have I included all components/constituencies? Have I left anybody/anything out?
ii) Have I extended the same moral regard in terms of intrinsic consideration, to all parties?

7) Different – and potentially conflicting – values (such as, e.g., equity, efficiency and sustainability) require to be balanced and accommodated in the management of water resources. This needs to be done in such a way that the central value of the social-ecological system as an integrated unit, and its health/functionality, is upheld as the primary goal.

8) Relational ethics needs to be sensitive to the operating context, recognising that the various components as part of a system are in on-going systemic interaction and stand in specific relationship to each other, which varies from context to context. Relational ethics therefore needs to account for those factors which – whether for environmental, historical, political, or whatever reasons – are more entrenched factors influencing that interaction, as opposed to

those factors which are less deep-seated, and hence are more open to circumstance and change. An example of such entrenched factors is the inalienable fundamental rights to water conferred on people by the South African constitution.

9) Relational ethics promotes the active search for, and management of, the interconnectedness of the components of the social-ecological system, given that the SES as an integrated unit is the primary value driving a systemic-relational environmental ethical framework..

10) The systemic-relational framework of environmental ethics by itself will be inadequate to achieve such a protection of the primacy of the social-ecological system, and of its health and functionality. This will require, inter alia, a range of policy, institutional and training measures.

11) The above principles are all partial approaches and attempts at solutions. By definition, we, as human beings, cannot have a complete understanding of the full range of interactions, processes and complexities of a social-ecological system. An attitude of provisionality and humility is therefore central in seeking to understand and manage such a system.

5.2.3 Key values operating within the water resource management sector

Several key values may be seen to be operating in the water resource management sector. These include the three values enshrined in the New Water Act (i.e. equity, sustainability and efficiency), as well as inclusivity and health of the social-ecological system. Inasmuch as the three values of equity, sustainability and efficiency are the cornerstone values around which the NWA, as well as water policy flowing from it, are designed and organised, it makes sense to adopt the conceptualisations of these three values as expressed in the NWA and related documents. 1) Equity (which is paraphrased by the then DWA as 'fair and equal') "means that everyone must have access to water and to the benefits of using water. Decisions to allocate water must be equitable (fair) to all people".2) Sustainability "means promoting social and economic development and at the same time ensuring that the environment is protected both now and for the future" 3) Efficiency "means that water should not be wasted. Water should be used to the best possible social and economic advantage". (The above three quotations are taken from The Guide to the National Water Act (No date), page 11, issued by the (then) Department of Water Affairs). 4) Inclusiveness relates to the

comprehensive incorporation of all potential components, on at least two levels i) actual potential constituencies, such as the various components of, e.g. the social-ecological system, or of groupings in the social-economic-political system ii) the respect in which these parties are held, such that they are all regarded as having intrinsic as well as instrumental value. 5) Health of the Social-Ecological System. The overall health, in the sense of the optimal functionality, of the social-ecological system, is an important value in terms of the systemic-relational approach, which needs to be central to the way in which water resource management is pursued. At an unproblematic level, system health will be optimal when all of its components are functioning optimally, i.e. when it is possible to sustain biophysical (sub) system function and organisation, as well as human social-economic (sub) system organisation and development. However, to make explicit the moral (and therefore the political) idiom of interaction implicit in environmental ethics, the interactions within the wider social-ecological system are not always of a win-win and mutually constitutive nature. There will therefore be situations where, in order to preserve the health and functionality of the overall system (what in human politics is referred to as 'the common good'), the balance between the intrinsic value (what may be referred to as 'rights') and the instrumental value (what may be referred to as 'obligations') of the respective components (e.g. the biophysical and the human) will have to be negotiated. The optimum health of the overall social-ecological system is thus a central value to be pursued in water resource management. The actual 'blood pressure reading' of that overall health at any time, will be the outcome of the interaction of the state of health of the components of the system, as well as administrative and other wider factors at work in the situation.

5.2.4 Factors influencing the way values play out in practice

These values interact; however, the ways in which they interact, and the contexts in which they interact, may not always be conducive to their being compatible. This raises not just moral, but also managerial, problems. To illustrate this issue, let us take the three values foundational to the New Water Act of 1998, and water resources management subsequent to the passing of the NWA, i.e. equity, sustainability and efficiency. If one pursues any two of these three values simultaneously, and single-mindedly, i.e. irrespective of (without 'due regard' for, without making 'due allowance' for) the other two values in the triad of foundational values – one will land up in a situation where the two values become incompatible.

Poverty and inequity of access to services are significant reasons as to why natural resources are overexploited and degraded. This in turn threatens environmental sustainability. However, efficiency of delivery of services is directly influenced by whether or not service providers are able to afford to provide such services. This increasingly requires charging receivers for the supply of such services.

Although the Constitution and the NWA affirm the right of people to a basic water supply, the policy position is to charge users the costs of providing water services, including infrastructure development and catchment management activities. While this policy position seems to raise serious questions about equity, the policy also acknowledges that such costs could be waived, depending on the socio-economic status of the individuals. In line with this approach, the provision of 'indigent household' was introduced in the 2014 government policy position on water, and it refers to providing free basic water supply to indigent households (DWA, 2014). However, what remains unclear, is the definition of 'indigent households', as well as what/who determines who falls within these categories of households. The underlying value judgement of this policy position is the principle of economic efficiency, and several authors have noted that, with water services institutions being required to recover costs, economic efficiency may in the long-term undermine the achievement of equity and sustainability (e.g. Pollard and du Toit, 2008). This involves a clash of values, and may diminish the possibility of the Department of Water and Sanitation developing a coherent and sustainable ethical framework.

Charging for services – even if a percentage of the service delivered (such as the first 6,000 litres of water) is free, or is charged at a pro rata rate proportional to income – does not impact equitably on all households across the income spectrum. The values of equity and efficiency thus come into tension within the realities of water resource management.

Catchment Management Agencies (CMAs), which are intended to facilitate cooperation and participation among stakeholders, and to democratise water governance at the local scale, are increasingly becoming responsible for a range of water management functions, and importantly, for the protection of aquatic ecosystem health. CMAs, together with Catchment Management Forums, are thus local institutions for the promotion and realisation of the value of equity in the area of water resource management. However, this requires the conscious articulation and accommodation of multiple and divergent interests, perspectives and value

sets, with the attempt to reach a (working) consensus across such often politically charged diversity. Effective stakeholder participation also requires the requisite capacity, skills, knowledge and resources for all parties to contribute equally and to make effective representation in decision-making processes. All of which requires generous and unpredictable amounts of time – which does not fit well with the requirements of budgets, schedules, or of economic and technological constraints – all of which limit the ability to achieve the diversity-requirements of equity. In this manner, the values of equity and efficiency come into tension in water resource management.

Sustainability of the environment is contingent upon a range of factors, which call the compatibility of the value of sustainability with the values of equity and of efficiency, into question. It may plausibly be argued that people who are extremely poor are not in a position to respect the environment, because they have no option but to plunder its resources in order to survive, and that therefore inequity (as in extreme poverty) and environmental sustainability are incompatible – and that therefore the achievement of greater equity is the (long term) path to environmental sustainability. However, it is difficult to argue that the kind of economic efficiency that is necessary to achieve the kind of economic growth that would offset the inequality and inequity that is resulting in the plundering of the environment, is achievable without any further damage to the environment. So, again, the values of equity, efficiency and sustainability – for the best of reasons – do not always sit comfortably together.

The value of inclusiveness in terms of seeking to accommodate a plurality of values, approaches and constituencies in relation to water access and management, reflects the concern with equity in another kind of way. How is this to be realised in practice? Enabling, flexible and polycentric governance and management institutions would seem to be necessary to achieve this inclusiveness. However, to establish and to maintain such institutions at a viable level, with all the consultation, skilling and processual work that will be required, will require high levels of time and efficiency that, once again, do not always fit easily with the goal of equity.

The health of the social-ecological ecosystem, in the sense of its optimal functioning as a system, is – or should be – a key value of water resource management. Ecosystem health is seen in terms of an acceptable and sustainable balance between the human uses of ecosystems

and their protection and renewal. What constitutes ecosystem health (what is an acceptable /sustainable/ good balance) is therefore a human intellectual and value construct. We need criteria in terms of which to relate the various values at stake, such as equity, efficiency, sustainability, acceptability, inclusivity, balance, to each other. These criteria will come from the ethical – and more specifically, from the environmental ethical – framework that is brought to bear in relating these values to each other. It is a policy and a managerial issue as to which orienting ethical perspective will be adopted, and which will influence the way these values are brought into relation with each other.

Currently, the assessment of aquatic ecosystem health has been focused primarily on the biophysical components of the aquatic ecosystem. We see this through the measures designed to assess and protect the health of aquatic ecosystems, viz. the Resource Directed Measures (RDMs) and Source Directed Controls (SDCs), together with Resource Quality Objectives (RQOs) and various other assessment techniques, such as the South African Scoring System (SASS). These all focus on the biophysical aspects of the aquatic ecosystem – thereby implicitly adopting a non-anthropocentric environmental ethical position (even though the New Water Act implicitly adopts an anthropocentric position). However, an aquatic ecosystem does have both biophysical and social- economic components, and the health of the systemic – relational unit as a whole needs to be taken into account.

When one engages with some of the key values relating to water resource management, it thus appears that , if one pursues them in relation to each other with any rigour, one is – not surprisingly – likely to land up in situations where these values come into conflict. What is called for, is a way (or ways) to bring them into balanced interaction, even into constructive trade-offs, with each other. This project is suggesting that a framework of environmental ethics, involving an overarching set of principles, in terms of which to relate such values to each other, is the way in which to achieve such balanced interaction and to deal with such conflicts of values. The South African government's current approach to water resource management in the NWA seems to take the three values of equity, sustainability and efficiency as its Constitution-like foundation- stone values , seeing them as principles, rather than as values which require a higher level of integration . In doing so, the Government's approach, in our analysis, is lacking an explicitly formulated higher, i.e. systemic, level at which to coordinate water resources as a domain, the values relating to it, and its management (i.e. the level of the social-ecological system). Government's approach in the

NWA does not appear sufficiently thought through or coordinated to achieve that necessary level of systemic integration.

It has been argued in this project that there is a need for a systemic-relational approach to environmental ethics, which will provide an overarching perspective in relating the key values in water resource management to each other – and more chance of bringing them into balanced relationship and trade-offs, than less systemic, e.g. anthropocentric or non-anthropocentric or pragmatic approaches to environmental ethics are capable of doing.

5.3 Policy and management issues

5.3.1 An ethical framework is necessary, but not sufficient, to realise the aims of ethically grounded water resource management

Who is to take forward the research and reflection of this project? It needs to be taken up by the range of decision-makers and implementers across the water resources sector. This extends from policy makers, to managers, notably at municipal and CMA level and in some instances, through adoption of polycentric institutional arrangements, incorporating civil society organisations. These cooperative arrangements are important particularly for the provision of services.

While a grounded and coherent environmental ethical framework is necessary to provide the guidance for ethically and environmentally considered water resource management to take place, such a framework is not by itself sufficient to ensure the implementation of either its principles or values, or of sound water resource management. To implement specific values, in a coherent fashion, requires specific kinds of action, which in turn requires specific kinds of intentions, skills and personnel; this in turn requires specific kinds of managerial and therefore institutional change, and therefore budgetary and policy changes; this in turn requires political will and probably some changes of wider political policy. It is therefore no small matter, and no short term undertaking, to implement a sound environmental-ethical framework in water resource management – regardless of how important we and others have argued that this may be.

Political will to take the requisite risks to make the necessary innovative – and clearly experimental – adaptations related to adopting a social-ecological way of thinking about and administering water resources, will be required on the part of DWS personnel at a range of

managerial and decision-making levels. This will also call for institutional reform – most notably at local level, where it is important to establish on the ground local level institutions that enable clear linkages between people's values and the resources being managed.

The institutions which already seem to be moving in the direction of a systemic and participatory way of doing things are the few catchment management agencies which have started up. We need to ask how CMAs can take on a more holistic and relational approach to water resource management and what kind of institutional changes this would require at catchment level? An instructive example of something similar to catchment level organisation of water resource management that has worked well at a participatory level is the Bangladesh example: community based organisations were formally linked up to established statutory institutions at local government level. It is a case of what one might call 'context-based institutions'. (It is discussed in detail in Chapter 3 of this report, and briefly below in relation to democratisation and participation).

The Green Drop Certification programme in South Africa shows the importance and potentially significant environmental contribution of incentive- based institutions. However, to date, it has a low success rate. This teaches us about the importance of monitoring and of participation as part of monitoring – and thus, of establishing incentive-based management structures, as well as ways of empowering members of the public to access information.

This in turn emphasises the importance of the value of efficiency as an enabling value, inasmuch as it enables the realisation of other values such as equity, sustainability and inclusiveness. If the value of a social-ecological system is to be upheld, not only as a value, but also as a managerial and as an environmentally and socially sustainable reality, then the efficiency with which it is administered, is of the essence. Accurate, comprehensive and integrated assessment measures that are able to assess aquatic ecosystem health at both biophysical and at social levels, and personnel that are able to carry out and to synthesise and interpret these assessments, are foundational to the enterprise.

We discuss the need to ensure or, if necessary, provide enabling frameworks for dispute and conflict resolution (see below, under Democratisation and Participation) – but here would mention that this may possibly require institutional reform, with a conscious focus on having to balance values, also with regard to the shorter and the longer term. The Department of Water and Sanitation does currently provide the mechanism of a Tribunal, to which appeal

may be made from the level of CMAs. If this is not effective, appeal may be made to the courts. When the various parties were unable to find each other in the case of the four dams and their impact upon the migration of salmon on the Snake River in the USA, they turned to the courts (see Chapter 3 of this Report) – and no satisfactory resolution was forthcoming. If the Tribunal system does not prove to be effective in helping resolve a diversity of values and interests around water and related environmental issues, it may become necessary to develop alternative institutional mechanisms within the DWS.

Principles necessary to the promotion and application of a systemic-relational environmental ethical approach and to an integrated social-ecological approach to water resource management, as argued in this chapter, thus need to be incorporated at relevant places in institutional structures and processes.

5.3.2 Water resource policy and management need to provide the enabling conditions for the realisation of the aquatic system as a healthy, integrated unit.

Water resource management institutions at all levels need to take active steps to protect the positive health balance of the aquatic ecosystem. Such steps include:

i) a clear understanding of the aquatic ecosystem as an integrated system, in the manner in which it has been argued in this project; ii) the health of the aquatic ecosystem needs to incorporate the health of both the biophysical and the social-economic components of the ecosystem; iii) assessment structures relating to the measuring of aquatic ecosystem health have to date included only biophysical measures. Assessment structures therefore need to be expanded to include measures to assess the socio-economic components of aquatic ecosystem health. Social-economic indicators need to be developed and used alongside biophysical indicators for the assessment of aquatic ecosystem health. Relevant indicators would be those which relate to factors which directly influence the ways in which humans access, utilise and dispose of water – and which impact upon the likelihood of their doing so in ecologically and managerially positive ways or not. These would include a range of factors such as access to income, education, relevant infrastructure and services, population density of residential areas, etc. iv) To see and to administer the ecosystem as an integrated whole, in which the health of the ecosystem as an integrated whole is the priority – rather than specific parts and, accordingly, specific assessment expertise – is going to require a significant shift in water resource management institutional culture. While IWRM in principle contains the seeds of

such a truly integrated approach, anthropocentric and utilitarian tendencies, as well as a biophysical focus in ecosystems health assessment, suggest that a significant shift in mind-set, institutional culture – and in legal and administrative provisions – is still necessary in this regard. v) This will require a re-training of personnel, in at least two ways: a) in terms of acquiring the orientation to approach aquatic ecosystems as integrated social-ecological systems, and to think systemically, in terms of principles, relationships and processes, rather than only in terms of particular values or specific problems or crises; b) in terms of acquiring new skills that will be necessary to manage water resources in this regard. This will include, e.g. the ability to monitor aquatic health in a more inclusive range of ways – and to synthesise, interpret and act upon this new range of information. vi) Such new synthesizing and interpreting skills are going to place increasing demands upon water managers, making for increasing demands in efficiency of monitoring and decision-making. The value of efficiency is fundamental, as it serves as an enabling value for the realization of other values. This in turn carries clear implications for the restructuring of water resource management institutions, particularly at the local level, where most of the 'coal face' work happens. We have already looked at some of the implications for CMAs above. vii) It is however, not only government and local government structures that seem required to adapt in order to facilitate aquatic ecosystem health. It is something for which all of us, as members of the public, are ultimately responsible. The public contribution can be increased and facilitated in a range of ways. Two plausible ways include: a) 'Socialisation at the source'. Socialisation starts at home, with infancy. If parents can be encouraged to rear infants with an awareness of the value and importance of water and of treating it with respect, more people are likely to grow up with an environmentally responsible attitude and approach to water. b) 'Discount for decent behaviour'. Customers – both individuals and areas – who display identifiable behaviour that enables efficient and environmentally preserving water management practice, would be rewarded by having water charges reduced on a performance basis (e.g. paying for water related services, not vandalizing water related infrastructure, not polluting streams, etc.)

5.3.3 Plurality of values and polycentric institutions for the governance of social-ecological systems

The systemic-relational environmental ethics we are proposing has a number of policy implications. Its central principles that uphold the social-ecological system (SES) as a whole

as having primacy in terms of value, as well as the integrated view of aquatic ecosystems which we have been advancing, call for active and deliberate decentring of any of the SES components and their constituencies/subdivisions in policy. Policy should thus seek to give primacy to the management of the functionality and health of the entire system as an integrated unit in the first instance. An important policy implication of such a holistic management view is the recognition and appreciation of, and due regard for, all the components of the SES and the different ways in which they interact within the wider SES. The interaction between the different constituencies within the components are influenced largely by values that are pluralistic in nature, e.g. different constituencies within the social/human system may relate to, and value, the same subcomponent of the ecological system in different ways. For example, a rural community living next to a river may relate to the river mostly in terms of water abstraction for domestic and agricultural purposes and for supply of protein in terms of fishing. On the other hand, a more distant urban community whose sewage pipes carry effluent into the same river, may only see the river from the perspective of waste disposal.

Thus, the systemic-relational ethical approach calls for a pluralistic approach to the governance of a social-ecological system. With regard to the aquatic ecosystem, such a pluralistic approach implies that in the first instance, all values – social (whether cultural, economic, or constitutive) and ecological (diversity of life forms, or rare species) – within a system, are held in the same moral and management regard in the first instance (i.e. in terms of respect and inclusivity). Central to a viable pluralistic approach is the principle that different components or values are worthy of respect or 'due regard'. How is this to be achieved in managerial and practical terms?

In this regard, polycentric institutions flexible enough to accommodate debate and engage a plurality of values (but whose limit of flexibility is defined by the core principles of system health and by the SES as the ultimate locus of value), would seem to be a starting point for working towards the realisation of a systemic-relational ethical approach to water resource management. We understand polycentric institutions as an institutional design that allows for effective coordination and integration of power and interest horizontally across autonomous institutions, as well as vertically, through devolution of powers.

Our proposal for polycentric institutions and the accommodation of a plurality of values stresses that such institutions need to be context-sensitive, and that the sensitivity to the operating social-ecological context should subsequently determine the weighting of the SES components (and their constituencies), and associated values in their interaction with one another.

Weighting in practice implies multiple claims, claimants and plurality of values, and thus, the need to balance and trade-off values and claims within the SES. In balancing and trading off values and claims, we propose that a policy position should uphold the overall good/welfare of the social-ecological system as the ultimate locus of value. That is, in the pursuit of the good of one of the components (e.g. social or ecological, or a constituency within one of the components, e.g. allocation of water to the poor/wealthy or protection of an endemic species/species of economic importance), a policy position should strive to protect the overall system health so that the services provided by each component maintain the good of the overall system.

To give effect to polycentric institutional design and arrangements, water sector policies should take the position that emphasises cross-departmental and institutional coordination and integration across the different spatial governance scales: local, catchment and national. Such coordination and integration at the different scales can take various forms: e.g. at the national level, between government departments; at catchment and local levels, between government departments, non-governmental organisations, civil society organisations and communities. Each of these institutions (i.e. government, NGOs, civil society organisations and communities) could be regarded as management centres with regard to water resources and the associated ecosystems. Such cross-coordination and integration could help in navigating a plurality of values within a SES. For example, if we were to take poverty and inequity of access to services as significant reasons why natural resources are degraded and/or over-exploited, the pursuit of improving access to services for the poor and of securing environmentally and socially sustainable alternative livelihoods for such societal constituencies, would require cross-departmental and institutional coordination. We argue here that such coordination and integration between government departments and institutions at local, catchment and national levels, should be made more explicit in water policies.

5.3.4 Balancing and trading-off of values

Values in a social-ecological system are in constant, complex and dynamic interaction. The context of interaction and what/how the SES system boundary/ies are defined to include and exclude as moral or as claimant categories, significantly influence such interaction. We have earlier demonstrated that, when these values are pursued simultaneously, they may end up being incompatible in practice. Because values are not always necessarily compatible, there is the need to balance and trade-off values in management decisions and practice. In the first instance, the boundary/ies of the SES system with regard to value and moral pluralism, should be as open as possible. That is, as a first management action, managers should consciously reflect on the multiple values related to a SES and actively search for all inter-connections and management implications related to such value pluralism.

Such conscious reflection upon multiple values, claims and claimants (which might take place at the level of the CMAs) should at least consider the following:

- What is the SES boundary and what are its implications for who/what is considered an insider/outsider?
- Who/what define(s) the SES boundary?
- Have all values, claims and claimants within the SES been accorded the same moral and management regard?
- Have all constituencies within the SES been fairly treated, and who/what benefit(s) from management decisions – and why?

Balancing and trading off values is an exercise that lends itself to debate and engagement. The attitude of inclusiveness, defined broadly to include both social and ecological components and their various constituencies, within a social-ecological system, should be central to such debate and engagement. At operational and managerial level, managers need to reflect on whether the interests of all parties have been adequately captured in the debate and engagement process, and whether all parties have been accorded the same regard. Managers also need to consciously reflect on whether all parties have been adequately capacitated for effective participation in the engagement process. In this regard, the managerial and institutional capacity required to consciously uphold the attitude of inclusiveness becomes practically vital for balancing and trading off values within a SES. Capacitating managers and institutions in terms of technical skills, time and budget, to

embrace diversity (i.e. value pluralism, multiple claims and claimants), without sacrificing effective and efficient management, is imperative in this regard.

The context and the management agenda that inform the subsequent weighting of values, claims and claimants, may occasionally lead to difficulties in trade-offs, in which no compromise or consensus can be reached by all interested and affected parties. The case of the Lower Snake-River system in Chapter 3 of this Report is a practical example. The Lower Snake-River system study exemplifies the problems associated with the single-stranded thinking approach that is often dualistic in nature, e.g. economic development vs environment, protecting the interests of indigenous people vs the interests of development-minded people. Single-stranded thinking often makes it difficult to reach consensus or compromise, thus jeopardising the possibility of long-term sustainability of the social-ecological system. Overcoming the problem of single-stranded thinking would require training in terms of pluralistic as well as systemic thinking about relationships and connectivity within the social-ecological system, as pathways to balancing and trading off values for long term sustainability.

5.3.5 Democratisation and participation in water management institutions

Achieving democratisation and participation in water management institutions relates directly to the pursuit of the values of equity and inclusiveness, in terms of approaches as well as of constituencies. As we saw when discussing the interplay of values above, seeking to achieve this is likely to give rise to various kinds of trade-offs with other values, such as efficiency and sustainability. How are such interplays and trade-offs of values, of interest groups and of perspectives, to be achieved in practice? This would seem to require governance and management institutions that are geared and designed to such outcomes, i.e. enabling, flexible and polycentric institutions.

Let us consider the issue of the accommodation of different perspectives and the resolution of conflicts. The challenge is not only to ensure equal voice and participation by all stakeholders; it is also how to take those different voices further. There are different principles for taking account of differing viewpoints in taking matters further, e.g. majority, equity, efficiency (which can be a potentially undemocratic consideration). Beyond the initial facilitation process, in which diverse opinions are brought out and expressed, what is done

with the multiple views and values, and how values and positions are balanced, and by what principles and criteria this is done, is a fundamental ethical and managerial challenge.

This will require some re-orientation of local level water resource institutions, in terms of training and capacitation of relevant staff to be able to deal with the accommodation of such diversity, and in terms of possible changes within these institutions, to enable them to incorporate these processes of accommodating diversity more directly in their decision-making and managerial structures.

A potentially instructive example for such changes may be taken from Bangladesh, where the Management of the Aquatic Ecosystem through Community Husbandry Project adopted a community-based co-management approach to aquatic ecosystems (see Chapter 3). For our purposes, it involved the evolution of innovative institutional arrangements (involving both horizontal and vertical linkages between community and local government organisations). By developing stakeholder participation, social-economic empowerment of communities, awareness raising and giving local people a sense of ownership of wetland resources, the project was able to make a significant contribution towards improving wetland health, as well as improving living standards of those dependent upon the wetlands.

While one should always take note of the particularities of context, this kind of community – local government cooperation, polycentric institutional interaction, cooperation across diversity of values and interests, would seem to hold valuable lessons for local level water management institutions in South Africa, such as Catchment Management Agencies.

However, to establish and to maintain such institutions at a viable level, with all the consultation, skilling and processual work that will be required, will demand high levels of resources (personnel, time and money) as well as efficiency and commitment. None of which are possible without the necessary political will.

5.3.6 Training requirements

Pursuit of the overall systemic-relational approach to environmental ethics which we have been arguing is necessary for effective water resource management, gives rise to a number of policy and practical implications. These require a range of potentially new skills on the part of personnel and also from members of the public, which in turn call for the appropriate

training – which again calls for time, resources and the necessary commitment for colleagues – and ultimately, the political will from higher levels, to enable the entire process. Issues of raining have been mentioned as they have cropped up in relation to particular issues in the course of the project, so they are presented here, more by way of a listing, than of an in-depth discussion.

- One of the more fundamental issues on which water resource managers will require training, relates to overall perspective, i.e. in terms of viewing the aquatic ecosystem as an integrated social-ecological system, and to thinking in terms of system, of principles and of processes (i.e. to consider both the short term, immediate problems, as well as the longer term aspects of the aquatic ecosystems they are managing). Part of this training would involve a shift away from the perspective that SES is only an ecologically-oriented concept in a bio-physical sense.
- Taking both the social-economic and the biophysical aspects of an aquatic ecosystem into account, it is crucial to understand that effective resource protection is impossible without livelihood security for the poor, i.e. such resource protection cannot be achieved only through legal provisions. This will require not only a change of thinking within water resources circles, but also a change in water management practice, calling for cross-departmental trans-disciplinary approaches to aquatic ecosystem assessment, management and development. Here, again, training of water resource personnel will be necessary.
- This project has argued that the health of an aquatic ecosystem needs to be approached as an integrated unit, incorporating both biophysical and social-economic components. This will require incorporating social-economic as well as the current biophysical sets of indicators to assess (and thereby to protect) ecosystem health. Importantly, it will also require the ability to employ and analyse these diverse indicators – and to synthesise the different kinds of data that they bring to bear. This is going to require a significant level of interdisciplinary expertise across the human and the natural sciences – which very few people working in water resources currently hold – and for which focused training courses will need to be developed in conjunction with the Department of Water and Sanitation.
- To take the expression of diverse values and positions forward, i.e. beyond ‘talk shop’ situations, may well require institutional changes on the part of water resource

management bodies. This would seem to call for more than bringing about demographic representativeness on some committees and decision-making bodies – it calls also for an on-going reflection on the way in which values – and the principles behind them – inform water resource management on a day to day basis. For this, training would help to 'socialise' water resources officials into seeing the aquatic ecosystem as a relational system, and diversity as a positive and enabling aspect, rather than a managerial hindrance, in that regard.

- It is not only the staff of water resource management units, but also the public, that stand to benefit from training in regard to the positive outcomes of seeing the aquatic ecosystem as an integrated system which it is to everybody's mutual benefit to look after. This report has suggested ways in which the public can be encouraged to look after the environment – one of which would be various kinds of training situations, including parents orienting their young children to treat the environment with respect as part of infant socialization.

5.4 Future research

The following are suggested as important areas for future research, in order to further our understanding of what needs to be done to promote the successful uptake of a systemic-relational approach to environmental ethics and to water resource management in the context of social-ecological systems.

- A case study approach, considering how different sectors, such as agriculture, small towns, industry, etc. currently go about reconciling potentially conflicting values with relation to water, such as equity, sustainability and efficiency, in practice. In which ways do the managers and 'customers', as well as negotiation processes, in these sectors, appeal to ethical level principles in dealing with value level tensions and conflicts? Are the kinds of value tensions that arise sector – specific or more general to the water domain – or generic to the administration of resources as such? In this context, it would also be important to investigate the ethics of water research as currently practice in South Africa.
- A case study approach of the issue of payment for water, and how this is dealt with in relation to the matter of the right to water. Again, this will raise the question of whether, and in which ways, an appeal is made to ethical level principles to mediate

between values when tensions arise at the value level (as between efficiency and equity).

- An examination of current practice in water resource management with regard to aquatic ecosystems health, in terms of the possibilities and constraints for it taking on a more genuinely social-environmental approach to aquatic ecosystem health
- A case study based examination of instances of polycentric governance relating to water resource management, at various levels of governance hierarchy, e.g. national, provincial and local governance levels. This would consider how governmental and non-governmental bodies cooperate around issues of water resource governance and management, and ways in which polycentric governance seems to be working, ways in which it contributes to effective water governance – as well as the obstacles to its effective operation. It would be important to discover whether these positive and negative factors are particular to the water sector and/or to the level of governmental hierarchy at which polycentric governance/cooperation is operating – or whether they are more generic.
- A survey-cum-set of interviews, at different levels of the DWS hierarchy, to ascertain whether the relevant set of understandings, attitudes and skills necessary to implement a systemic-relational approach to environmental ethics and water resource management more generally, are present among Department of Water and Sanitation personnel.

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