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REVIEW OF EXISTING WATER QUALITY GUIDELINES FOR FRESHWATER ECOSYSTEMS AND APPLICATION OF WATER QUALITY GUIDELINES ON BASIN LEVEL TO PROTECT ECOSYSTEMS

Technical background document for theme 1: "Water Quality and Ecosystem Health"



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Summary

Declining water quality has become an issue of global concern as it is causing major disturbances for water use, to ecosystems health and functioning, and to the biodiversity that ecosystems underpin. While international chemical and physical water quality guidelines and standards for drinking water and some other uses are well articulated and in place with better enforcement and reporting mechanisms for many governments and authorities, the same cannot be said of frameworks relating to water quality for the health of ecosystems. Moreover, around the world a large number of water treaties exist. However the issues in these treaties mostly deal with navigation, hydropower and water supply. Only 4% of all treaties deal with water pollution. Treaties protecting the ecosystem are very scarce. The declining water quality has become an issue of global concern as it is causing major disturbances for water use and ecosystem health. Therefore there is a strong need for water quality guidelines to protect ecosystems.

In most parts of the world water management is a public affair and the government on different levels plays an important role. In some regions functional organizations like river basin authorities, watershed authorities or aquifer authorities have a mandate to carry out water management. However there is a large diversity in the appearance of (river) basin organizations (RBOs). Also their mandate and task differ to a large extend. Most of the RBOs are established to solve problems on flooding and droughts, to improve navigation and to manage hydropower stations. Water quality problems and ecosystem protection were in most cases not the main trigger for establishing RBO's. From the eighties the role of the river basin approach in tackling water quality problems is increasing. Modern basin planning is increasingly developing ecological based objectives, related to species and ecosystems.

The purpose of this study is to identify and review existing Water Quality Guidelines (WQGs) that protect the health of (water) ecosystems and their respective mechanisms like institutional arrangements, processes, methodological approaches and reporting mechanisms. Water management regulations in some 15 states and regions were studied. The review has been focused on the objectives of the main water law and guidelines, the classes to score water quality in rivers and lakes, the indicators used to assess water quality, the institutional setting and the mandatory or voluntary use of water quality guidelines. All guidelines studied show that the objective is to protect human life and in most cases also to protect aquatic life. As most of the guidelines date from last century physical and chemical parameters are used as indicators, with a few exceptions.

The Australian/New Zealand Water Quality Guidelines, the European Union Water Framework Directive (EU WFD) and the guidelines developed by US EPA are selected for a more in-depth review, as these guidelines are based on a long-lasting experience and because they also provide most extensively new scientific-based approaches and tools for quality assessment of aquatic ecosystems.

The comparison of the guidelines provides a number of interesting findings and the following conclusions have been drawn.

- The used terminology concerning water quality guidelines, criteria and stressors is not uniform.
- The guidelines for aquatic ecosystem are mostly part of in a larger framework of

guidelines for water quality

- Quality classes for assessment of ecosystems are used for a number of reasons, e.g. to formulate present or future objectives, to present to present the ecosystem quality status in a transparent way and to create awareness by authorities and stakeholders
- The selection of indicators for water quality depends on the type of waters (lakes, rivers, wetlands, etc.), the management aims and the identified environmental concerns. Beside biological and physico-chemical indicators hydromorphological indicators are relevant for assessing ecosystem quality.
- Reference conditions play a major role in deriving biological and hydromorphological criteria. Numerical values or narrative descriptions of indicators are needed to classify the ecological status of aquatic ecosystems.
- Comprehensive guidelines are available for deriving criteria for toxic substances. It is clear that deriving water quality criteria is a complex process of integration of high-level scientific knowledge, taking into account a large number of uncertainties and of policy-definitions of protection levels. The resulting numerical criteria in the guidelines considered show sometimes large differences mainly due to differences in definition of the criteria level, the data used and safety factors applied.

WQGs need mechanisms to achieve objectives established in the guidelines. Therefore the role of (river) basin organizations in Integrated Water Recourses Management and in the application of WQGs has been reviewed. In many regions the basin organizations are the authorities to manage (river) basins and to achieve the objectives of the WQGs. Basin plans are produces and management strategies are worked out. There is a large diversity in the structure and mandate of a basin organization. The mandate varies from a legal entity as Basin Authority to a rather non-committal Advisory Board. For an effective process of application of WQGs compliance and legal mechanisms for enforcement are indispensable. Although basin organizations may play an important role in getting compliance and in enforcement of regulations, it strongly depends on the mandate, capacity and financing of the basin organization whether it will be effective. Legislation is a fundament for successful application of WQGs. However, the existing WQGs and related regulations show large differences in approaches. They may be voluntary, market based or mandatory or combinations of those approaches. However without solid enforcement the implementation of the WQG will hamper. Stakeholder participation and public participation is more and more recognized as one of the success factors for improving water quality and protecting ecosystems. In a number of WQG's the participation is strongly advised or even a legal duty.

The following recommendations for the deriving and application of water quality guidelines for aquatic ecosystems are formulated.

- Provide common terminology for water quality assessment for ecosystems
- Provide a common guideline for protection and restoration of fresh water ecosystems.
- Derive numerical water quality criteria for toxic substances on an international level.
- Acknowledge that reference values are needed to assess ecological status
- Strengthen the mandate and cooperation between authorities, stakeholders and states in basin organizations to protect and restore aquatic ecosystems.

1. Introduction

1.1. Background

Meeting growing human needs for water, food and energy without irreversibly degrading the ability of ecosystems to provide important goods and services is one of the most pressing challenges for society in the 21st century and is central to current notions of water security. Human population growth, accelerating economic activities, land use changes, and climate change increase pressures on the quality and quantity of global water resources. These factors are threatening freshwater systems as well as ecosystems in general. Declining water quality has become an issue of global concern as it is causing major disturbances for water use, to ecosystems health and functioning, and to the biodiversity that ecosystems underpin.

While international chemical and physical water quality guidelines and standards for drinking water and some other uses are well articulated (WHO 2003, WHO 2011) and in place with better enforcement and reporting mechanisms for many governments and authorities, the same cannot be said of frameworks relating to water quality for the health of ecosystems. UNEP, on behalf of the UN-Water TPA on Water Quality, and in cooperation with UNESCO, commissioned the Institute for Water Quality, Resources and Waste Management (IWAG-TU) at the Vienna University of Technology in Austria to undertake a scoping study¹ for developing water quality guidelines for aquatic ecosystems. The study provided an overview of some of the existing water quality guidelines and identified the lack of and the subsequent need for water quality guidelines for aquatic ecosystems. The scoping study recommended an international consultative, scientific process to develop and adopt the guidelines².

While acknowledging the availability of human use-oriented water quality guidelines, the UNEP Governing Council (GC) Decision 27/3 in February 2013 recognizes the absence of water quality guidelines for ecosystems. Water quality guidelines for ecosystems (WQG) are expected to serve as the basis for securing sustainable ecosystem services. It is recognized that there is a need for international water quality guidelines, which may be voluntarily used by Governments to maintain and improve the status of ecosystems to sustain the services they provide, as possible basis for managing water pollution and water quality, as they affect ecosystems.

A detailed review of existing WQGs is desirable before starting the development of international WQGs for ecosystems. In a large number of countries the protection and rehabilitation of freshwater biota is part of the water policy. It will be of importance to know which methods are used to assess the quality status of aquatic ecosystems and how quality objectives and standards are established. A further question is which approaches are used to protect freshwater ecosystems and which role WQGs play in improving the water quality. Moreover, which enforcement mechanisms are needed and available for effective

¹ Report available at: http://www.unwater.org/downloads/Scoping_study_final_report.pdf

² These recommendations were presented and discussed extensively at the 6th World Water Forum in Marseille (France) in March 2012.

implementation of the WQGs the answer to this question is needed at various scales (national, international, transboundary etc.).

1.2. Purpose

The purpose is to identify and review existing water quality guidelines that protect the health of ecosystems and their respective mechanisms (institutional arrangements, processes, methodological approaches and reporting mechanisms).

The review will focus on the following subjects:

- Identification of existing water quality guidelines which may be relevant for guidelines for freshwater ecosystems
- Analysis of water quality guidelines for freshwater ecosystems which are most upto- date, effective and innovative with special attention to used quality classes, indicators and water quality criteria for ecological assessment
- Implementation and achievements of existing water quality guidelines for freshwater ecosystems
- Experiences with platforms for implementation and enforcement, e.g. organizational and institutional structures such as (River) Basin Organization

Recommendations will be made for establishing WQGs for ecosystems, for institutional arrangements and for enforcement mechanisms.

The review is based on public internet available documents and on publications.

1.3. Structure of the study

In Chapter 2 water policies in a number of countries will be analyzed to find out whether protection of aquatic ecosystems is regulated and how. The analysis will focus on the subject of the WQG (human uses and/or ecosystems), selected indicators for assessment and classification of aquatic ecosystems, the legislative authorities (involved at national, federal, catchment levels), on the character of the guideline (voluntary or mandatory) and public participation.

Chapters 3 to 5 deal with the structures analysis of a limited number of existing WQGs for ecosystems which may provide frameworks and approaches for the development of international WQGs for ecosystems. Guidelines developed in Australia/New Zealand, in the European Union and the United States are reviewed. Chapter 3 describes classes and categories used for the qualification of aquatic ecosystems and in Chapter 4 the main biological, physico-chemical and/or hydromorphological indicators used are described. In Chapter 5 numerical and narrative criteria for ecological assessment water are reviewed, as well as integrated assessment methods. Chapter 6 deals with the application of WQGs on basin level and general mechanisms for implementation of WQGs. Conclusions and recommendations are given in Chapter 7.

2. Protection of ecosystem health in existing water quality guidelines

A comprehensive examination has been undertaken to compare existing water quality guidelines (WQGs). Water laws and WQG's of 15 countries or groups of countries using the same guideline were selected to be reviewed. Besides a short description of the main law and guidelines concerning water quality policy for each country, the review has been focused on the following items

- Are the objectives human use and/or ecosystem oriented?
- Which kinds of indicators are described to assess the water quality: physico-chemical, biological and/or hydromorphological indicators?
- Are water quality classes defined an what is the number of classes?
- Which authority and/or management organization will implement the guidelines?
- Is the WQG mandatory of voluntary?
- Is public participation an obligation in the law?

In Annex 1 an overview of the main findings is presented for the countries. An explanation for each country or international region is given below.

2.1. Existing water quality guidelines

Australia and New Zealand

The joint Australian and New Zealand Guidelines for Fresh and Marine Water Quality have been established in 2000 (ANZECC/ARMCANZ, 2000a). The main objective was to provide an authoritative guide for setting water quality objectives required to sustain current, or likely future, environmental values (uses). In Volume 1 a framework for applying the guidelines is described as well as detailed guidelines for aquatic ecosystems, primary industries, recreational water quality and aesthetics, drinking water and monitoring and assessment. Volume 2 (ANZECC/ARMCANZ, 2000b) provides the rationale and background information for the guidelines for aquatic ecosystems and Volume 3 deals with the rationale

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