# An overview of the proposed scope of work for the Phase 2 revision of the NWQMS Document 4: *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* and NWQMS Document 7: *Australian Guidelines for Water Quality Monitoring and Reporting*

## Aim of this paper and request to stakeholders

The aim of this paper is to provide an overview of the key proposed revisions for Documents 4 and 7, specifically those to be undertaken during Phase 2 of the revision period, for dissemination amongst stakeholders for comment and feedback prior to undertaking Phase 2.

The intention is to provide stakeholders with the opportunity for input on the revisions already identified, and/or identify (and justify) any additional aspects that warrant inclusion or revision.

The focus of stakeholders' feedback needs to be on the broader over-arching and cross-cutting revision aspects for Phase 2, rather than on specific details (e.g. revision/derivation of trigger values for a specific toxicant), as there will be separate consultation on these revisions as drafts become available.

**With this context in mind, stakeholders are requested to provide feedback via email to hmiddleton@ephc.gov.au by 3 December 2010.**

## Background

In 2009, Australian and New Zealand Environment and Natural Resource Ministers gave approval to revise the National Water Quality Management Strategy (NWQMS) *Document 4: Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (the Water Quality Guidelines) and consequential amendments to *Document 7: Australian Guidelines for Water Quality Monitoring and Reporting 2000* (the Monitoring & Reporting Guidelines). These documents are key resources for managing water quality and protecting environmental values, including aquatic ecosystems, in Australia and New Zealand.

Since finalising the last revision of the Water Quality Guidelines in 2000, substantial new data and techniques for establishing guideline values and for monitoring and assessment have become available. The revised Documents 4 and 7 will incorporate updated guidelines based on this new data and assessment methods for a wide range of physico-chemical and biological indicators.

A high-level Joint Steering Committee has been established to oversee the current revision process. The Joint Steering Committee is chaired by Mr Graeme Milligan, from the Queensland Government's Department of Environment and Resource Management and is supported by six Technical Working Groups responsible for specific revision tasks.

## Stakeholder consultation

An initial stakeholder consultation process was held during 2008, involving consultation with key user groups in both Australia and New Zealand, including government agencies, peak industry bodies, scientific and professional associations, research bodies, and non government organisations. Feedback received from over 45 written submissions and a stakeholder workshop held in Canberra, identified a variety of reasons for the timely revision of the Guidelines. The stakeholder feedback formed the basis for defining the scope of the revision.

There will now be a number of further opportunities for stakeholders to be engaged during the revision process and also to formally comment on drafts of the revised Documents 4 and 7, or aspects thereof. There are a number of technical issues to be addressed which require targeted engagement with specific audiences. These stakeholders will be targeted because of their expertise and will be identified by Australian and New Zealand governments, and the Technical Working Groups as necessary.

Further broader stakeholder engagement process will also be undertaken at the end of Phase 1 and during Phase 2 (Phases explained below) to seek input on more general issues such as confirming user needs with the outcomes of previous consultations, and delivery and useability. This overview paper forms a part of this process.

## Philosophical basis and delivery of the revised Guidelines

Whilst numerous significant revisions will be undertaken, the over-arching philosophical basis and guiding principles of the Guidelines will remain generally unchanged. Thus, they are intended to provide technical guidance only and some management guidance as appropriate (i.e. are not to be used to set policy), are not intended to be used as standards (with management decisions remaining with jurisdictions, albeit potentially informed by the Guidelines), are devoid of any legal / regulatory status (in their own right), are risk-based, and users are encouraged to either derive or modify guidelines and establish water quality objectives for the local (site-specific) situation (taking into account local economic/social/cultural aspirations). Jurisdictions and regulatory agencies will continue to be encouraged to provide clear statements of limitations and caveats to ensure informed use.

Ministers agreed that the primary vehicle for dissemination for the Guidelines will be on the web. This will require a transition away from conventional, linear thinking about the Guidelines as a sequential set of chapters. This delivery mechanism will (potentially) greatly facilitate and provide improved, holistic, whole-of-catchment and integrated water quality assessments – see below.

## Overall scope of work

The scope of the revision is to:

- update water quality guideline trigger values for toxicants in water and sediment – based on additional toxicity data published since the last revision
- update trigger values for physical and chemical stressors – based on more comprehensive regional ‘reference’ water quality data acquired since the last revision and, in some cases, availability of biological effects data (e.g. for dissolved oxygen, salinity, turbidity)
- provide more detailed guidance on how to develop local/regional water quality guidelines
- Update guidance on biological assessment of water quality with emphasis on inclusion within an integrated assessment framework
- revise the Guidelines for Monitoring and Reporting, including statistical procedures, across all elements of the Guidelines
- improve the Guidelines useability and understanding.

The revision is being undertaken in three phases, as follows:

- Phase 1: A number of high priority and relatively straightforward revisions identified during initial stakeholder consultations are being undertaken, together with definition of activities to be undertaken in Phases 2 and 3. It is anticipated that Phase 1 will be completed within 18 months of its commencement (i.e. by April 2011).
- Phase 2: Represents the major revision period. It is anticipated to take a further 18 months to complete (i.e. by October 2012).

- Phase 3: represents a formal mechanism for regular maintenance and updating of the Guidelines on an on-going basis, following the current revision (i.e. post 2012). This will ensure that the Guidelines remain current and continue to address significant changes in technology, water source management techniques, and end-user requirements as these emerge. Phase 3 revisions may be agreed and managed in blocks of two to three years.

**Key Phase 1 revisions**

The main Phase 1 revision activities include:

- Initial scoping and drafting of revisions for Chapters 1 and 2 of Document 4.
- Collation of reference data to be used to derive regional physical and chemical stressor trigger values for New Zealand waters.
- Correction/revision/derivation of toxicant water quality trigger values for nitrate, zinc, boron, manganese (marine) and salinity (marine; i.e. desalination plant brine).
- Revision/derivation of trigger values for a number of toxicants in sediments.
- Revision of guidelines for pathogens in aquaculture foods for human consumption, focusing on a discussion on the suitability (or otherwise) of indicators.

**Proposed scope of Phase 2 revisions**

Phase 2 will represent the major revision period. Key aspects of the Phase 2 revisions are overviewed below by way of primary over-arching or cross-cutting issues, as well as other section- or indicator-specific revisions.

***Over-arching / cross-cutting revisions***

*Web-based delivery*
On the direction of Ministers, both Documents 4 and 7 will become predominantly web-based products, although it is expected there will still be considerable downloadable (to print) information. The move to web-based delivery was in response to overwhelming stakeholder feedback during the initial consultation period to make the Guidelines more user-friendly and easier to update. Web-based delivery will mean that the current structure of the existing Guidelines, which was developed with hard copy publication in mind, will be markedly modified. The entry point to, and navigation through, the Guidelines may be based around a "user type" or "problem / issue" interface. The full details of the web-based structure will be initially scoped through a consultancy in Phase 1, with continued development through Phase 2. The web pages will then be populated with content during Phase 2 and the ensuing Phase 3.

*Revised decision framework and incorporation of conceptual modelling*
Users of the Guidelines need to make a series of important decisions before applying the guidelines (e.g. developing a water quality management plan), and undertaking a water or sediment quality assessment. These decisions form the front end of the management framework for applying the Guidelines (e.g. the first few boxes/steps in Figures 2.1.1 and 3.1.1 of the 2000 Guidelines), and their nature and context will need to be critically linked to the structure of the web-based delivery of the Guidelines (e.g. how and where a user enters the Guidelines' web space and where he/she is subsequently directed). Thus, the management framework for applying the water quality guidelines will be refined and improved to be clearer to users and to suit web-based delivery, as informed by stakeholder feedback.

A component of the decision framework that was not well developed or formalised in the 2000 Guidelines was the use of conceptual models to create an understanding of the issue/s to be assessed. This will be formalised and embedded in the revised Guidelines, and will include improved guidance

on the development of conceptual models, case studies of exemplar conceptual models (and how they informed the process) and a library of exemplary conceptual models. Stakeholder feedback will be used to refine this information.

*Integrated monitoring and assessment*

The 2000 Guidelines promote an integrated monitoring and assessment paradigm, but do not provide sufficient guidance on how to implement and interpret the results of an integrated program that would strengthen conclusions drawn from monitoring and assessment results. The revised Guidelines will further formalise and embed integrated monitoring and assessment as a key feature of the water quality management framework (and link this to the use of conceptual models). The emphasis will be on the use of a mix of physico-chemical and biological (including toxicological) indicators in a weight of evidence (WoE) approach to assessing an issue. This recognises that, in many cases, the use of a single line of evidence (LoE), for example, comparing water quality monitoring data to default trigger values, is insufficient, and that the use of additional (typically biological) lines of evidence will lead to more robust and confident assessments of water quality issues. The framework for integrated monitoring and assessment will become a component of the revised decision framework described above.

*Improved regionalisation and ecosystem classification*

The current Guidelines recommend the derivation of site-specific guidelines wherever possible. This is because water quality assessments will always be more accurate the more (geographically) localised and ecosystem-specific the derived guideline trigger value is, and the associated advice for which monitoring and assessment are relevant to. The revised Guidelines will provide updated guidance on how to derive local/regional water quality guidelines. Where local guidelines are not available, the Guidelines provide default values derived for different regions of Australia and New Zealand (physical and chemical stressors, and some biological assessment methods). For the current revision, additional data and information gathered since 2000 will enable improved spatial resolution of guidelines and associated assessment advice for a number of regions and indicators, by considering more natural (and hence relevant) ecological and environmental boundaries or conditions. This will be provided through improved ecosystem classification methods (New Zealand streams), availability (since 2000) of catchment-specific physical and chemical stressor trigger values for some jurisdications, improved (better-defined) ecoregional boundaries for the setting of guidelines at higher (regional) spatial scales, and expanded ecosystem types to those recognised in the current Guidelines.

*Improved definition of reference sites / condition*

Assessments of water and/or sediment quality are often dependant upon comparison of monitoring data to a reference condition. Selection of reference sites or a reference condition may be difficult for vast areas of Australia and New Zealand that have been substantially modified over time by human activities. New advances to deriving a reference condition in the absence of ‘ideal’ reference sites, have arisen, including predictive modelling, (environmental) gradient analysis that may be linked to biological condition of sites, or prescribing a condition ‘desired’ by stakeholder values. These approaches will be developed (in consultation with end users) and described so that users are best informed about selection of a reference condition and about interpreting subsequent monitoring outcomes.

*Increased use of case studies*

Stakeholders have commented on the complexities of, and difficulties in, applying the Guidelines. In addition to the other revisions that will simplify the application of the water quality management framework, the Guidelines will incorporate more case studies for a range of aspects/issues.

***Section-specific revisions***

*Chapters 1 (Introduction) and 2 (A framework for applying the Guidelines) and 3.1 (Issues for all indicator types)*
The up-front chapters of the Guidelines will be revised to (re-)emphasise and better articulate, where necessary, the underlying philosophical principles (from above), accommodate the relevant over-arching / cross-cutting revisions (from above), and acknowledge and link to other relevant, recently revised NWQMS (and non-NWQMS) documents. In addition, they will be restructured as necessary for web-based delivery.

As part of the framework for applying the Guidelines, management-related guidance will be developed that explains the use of the technical guidelines for different user-types (e.g. developing a water quality management plan, undertaking a water or sediment quality assessment) and in different situations (e.g. short term exceedances, occasional large exceedances, small data sets, deriving local guideline applications, when approaching or at limits of detection, statistical protocols and processes, and mitigation measures). The nature of this advice, and its location in the NWQMS Guideline series, needs to be considered, but could be included within the increased use of case studies described above.

*Primary industries – Water quality for irrigation and general water use and livestock drinking*
Toxicity guidelines will be updated using more recent data and regional values where appropriate (e.g. cyanobacteria). The method for deriving new values will be robust and will reflect the level of protection required for the different activities (e.g. to protect soil from contamination or to ensure commerical viability of primary industry – e.g. crop and livestock). For this reson no-observed-effect (NOE) is likely to be the basis of guidelines. In the absence of robust data, the level of confidence in the guideline value will be presented and management guidelines will provide data on mitigation measures. Reference will be made to extant Guidelines for Water Reuse and new guidleines developed if there are no appropriate ones.

*Primary industries – Aquaculture and human consumption of aquatic foods*
The focus of the guidelines will be on protecting commerical aquaculature species using species-specific data, or if absent, rationale for adopting a more pragmatic guideline with an indication of the level of confidence in the guideline and management, which may include mitigation measures. Guidelines are likely to be based on NOE to maximise commerical gains. Updated methods for assessing risk from consumption of aquatic foods will be developed for the risk factors (e.g. bioaccumulation of pathogens and toxins – in conjunction with the *Toxicants and sediments* Working Group).

*Biological indicators/assessment*
Key revision requirements for this section include:

- Novel/additional indicators and their measurement (viz protocols), and improved guidance on indicator selection and rationale. Included here may be new biological assessment techniques (e.g. genomics) that support the revised sediment (and other non-biological indicator) quality guidelines.
- New information for eco-regions and additional aquatic ecosystems (i.e. providing users with bio-regional and ecosystem-specific advice on biota and monitoring and assessment for more accurate and relevant assessments).
- Improved design and statistical analysis for biological assessment. This includes: (i) reconciling Chapter 7 of the Guidelines (Monitoring & Assessment) with Guideline document 7 (Monitoring and Reporting) with the result that advice for design, analysis and reporting are provided through a common statistics group covering both sets of Guidelines; and (ii) new advice on multivariate analysis.

- Inclusion of case studies as examples of useful / appropriate biological assessments and general monitoring approaches.
- Linking the Guidelines to other relevant national documents and programs (eg. Monitoring River Health).
- Incorporating biological assessments in an integrated (with physical/chemical approaches) monitoring and assessment framework based upon conceptual models and multiple LoE and WoE.

*Physical and chemical stressors*

Key revisions to physical and chemical stressors will include:

- For some stressors, biological-effects data have become available since 2000 and trigger values based upon this information need to be incorporated.

For the most part, however, trigger values based upon the reference condition will still apply. To this end:

- Since the 2000 Guidelines, Queensland, Victoria and the Murray-Darling Basin Authority have produced catchment-specific trigger values for key physico-chemical stressors. The revised Guidelines will link to these trigger values (in addition to providing other regions with guidance on how to derive local/regional trigger values.)
- Otherwise and in the absence of catchment-specific information, revised default physical and chemical stressor trigger values will be derived, where data allow, based on the revised (eco)regionalisation or ecological characterisation, and expanded ecosystem classification, described above.
- For the task described in the dot-point above, new advice on selection of the reference condition will be provided.

Additional guidance will be provided on:

- How to assess water quality in ephemeral streams and when and how to apply load-based trigger values.

*Toxicants and sediments*

For trigger value revisions in Phase 2 and thereafter, there will be a number of changes to the derivation method, including:

- a move away from the use of No-Observed-Effect-Concentration (NOEC) data initially to low effect/inhibitory concentration (IC/EC) data (for new or revised trigger values), and ultimately to no effect concentrations (NEC);
- introducing a preferable sample size requirement of ≥8 for trigger value derivation;
- for sample sizes of 5–7, specifying the use of the 2-parameter log-logistic distribution to derive the trigger value as being more statistically appropriate than the 3 parameter Burr distribution, for small data sets;
- Allowing the use of datasets with both (converted) acute and chronic data to be used for trigger value derivation where there are insufficient chronic data (<8) or where the data fit is poor;
- Where possible, including unpublished toxicity data from industry commercial-in-confidence reports, where the data can be appropriately quality checked; and
- Improving the functionality and flexibility of the trigger value derivation statistical software.

Toxicants for which trigger values will be derived will be prioritised using a formal process focusing on existing data gaps and stakeholder importance. These prioritisation processes are currently underway for both organic and inorganic toxicants.

Additional key revisions to the toxicants sections will include:

- additional discussion of uncertainties associated with all aspects of trigger value derivation (toxicity testing, species sensitivity distributions, etc.), and more guidance on toxicity test design, statistics and interpretation.
- The web presentation and publication of stand alone "fact sheets" for individual toxicant trigger values and associated background data and information.
- Guidance on issues related to the use and interpretation of trigger values for groundwater ecosystems, including several case studies.
- The maintenance of the toxicants database.

For the sediment quality guidelines, a new formal WoE approach will be introduced, consistent with the over-arching integrated monitoring and assessment framework, whereby sediment quality is assessed based on scores assigned to various LoE assessments (e.g. chemical, toxicological and biological). Updates on trigger values for selected toxicants are also included.

*Guidelines for Monitoring and Reporting*

Numerous aspects of Document 7 will be revised, in line with the major revisions to Document 4, described above. For example, additional/improved guidance will be provided on conceptual modelling, indicator selection, statistical approaches and risk assessment. Also, advances in assessment approaches and tools over the past decade will be evaluated and where appropriate, incorpoated, and case studies will be used to illustrate their application. Attention will be given to improving general advice on reporting, modes of reporting, and strengthening links with design and analysis of monitoring programs.