

Deriving local water quality guidelines

Environmental Protection (Water) Policy 2009

Introduction

This factsheet explains the framework under which water quality guidelines and objectives are derived under the Environmental Protection (Water) Policy 2009. Water types for which guidelines can be derived include fresh (surface and ground water), estuarine and coastal/marine waters.

Further information on how environmental values and water quality objectives are used in decision making processes is provided in separate factsheets, available from the Department of Environment and Heritage (EHP) website www.ehp.qld.gov.au.

Background

The purpose of the Environmental Protection (Water) Policy 2009 is to protect Queensland's water environment while allowing for development that is ecologically sustainable.

The purpose is achieved by:

- identifying environmental values and management goals for Queensland waters
- stating water quality water quality guidelines and water quality objectives to enhance or protect the environmental values
- providing a framework for making consistent, equitable and informed decisions about Queensland waters
- monitoring and reporting on the condition of Queensland waters.

All Queensland waters (riverine, estuarine and coastal waters, groundwaters, lakes/reservoirs and wetlands) have environmental values and water quality objectives.

If the environmental values and water quality objectives are **not** listed in schedule 1 of the Environmental Protection (Water) Policy 2009:

- the environmental values are stated under section 6 (2) of the policy
- the water quality objectives are the set of water quality guidelines for all indicators that protect all the environmental values for the water. The water quality guidelines for indicators are available from the Queensland Water Quality Guidelines 2009 (QWQ Guidelines) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (AWQ Guidelines).

Where there are multiple water quality guidelines for a particular indicator to protect different environmental values, the most stringent water quality guideline applies.

PART A—Deriving local water quality guidelines

Indicators and water quality guidelines for an environmental value are decided under *the* Environmental Protection (Water) Policy 2009 (in order of preference) according to:

- site specific documents
- the QWQ Guidelines
- the AWQ Guidelines
- other relevant water quality guidelines published by a recognised entity.

The QWQ Guidelines state the method for deriving local water quality guidelines for aquatic ecosystems. There are two approaches:

- Direct measurement of biological impacts—guideline values are based on the results of direct testing of the impacts of a stressor (e.g. a toxicant) on a target organism (usually by scientific studies)
- Acceptable departure from reference condition—guideline values are based on the premise that some small departure from reference condition is acceptable.

Both approaches are important, however the focus of this factsheet will be the use of reference sites to derive local water quality guidelines. This method is especially suited to water quality parameters that indirectly affect the aquatic ecosystem health rather than parameters that are directly or acutely toxic.

Deriving local water quality guidelines—acceptable departure from reference condition

The process involves:

- identifying reference (least disturbed) sites
- defining the water types for which the local water quality guidelines are to be set
- calculating water quality guideline values based on reference site data for the relevant water type.

1. Identifying reference sites

A reference site is a site whose condition is considered to be a suitable baseline or benchmark for assessment and management of sites in similar water bodies. The condition of the site is reference condition and values of individual indicators at that site are the reference values—values that can encompass physico-chemical, biological and habitat characteristics of an ecosystem.

The QWQ Guidelines (section 4) list the criteria for reference site for physico-chemical indicators. These are summarised below. A list of sites that have been used as reference sites is published in the QWQ Guidelines. Reference sites should meet the following criteria:

- *minimal disturbance* to local environment and upstream (for example, from dense urban and industrial areas, extractive industry, or intensive livestock or cropping areas)
- *no significant point source discharges* nearby or upstream (e.g. sewage treatment plant discharges, industrial discharges, major agricultural or stormwater drains, agricultural discharges such as those from dairies)
- seasonal flow regime *not significantly altered*
- *sufficient water quality monitoring data available, and data from these sites collected, stored and analysed using approved protocols.*

Note: the best available sites will be used to derive local water quality guidelines. Where no sites are deemed suitable, alternate approaches (e.g. use of QWQ guideline values, establishment of new reference sites for monitoring, or use of different percentiles of available site data) may be required.

2. Defining water types for local water quality guidelines

Because water quality varies naturally across different water types, different guidelines need to be developed for each water type. Examples of major water types are freshwaters (upper and lower catchment riverine waters, lakes), estuarine and coastal waters. However, at a local level there can be further subdivisions of these types.

Guidelines derived from data at a particular reference site should only be applied to other similar water types. In inland areas, this often means that a reference site/s is selected in a relatively unimpacted creek and the derived guidelines are applied to similar nearby creeks. Further discussion of water types is contained in Appendix B of the QWQ Guidelines.

3. Deriving guideline values

Detailed guidance on developing local water quality guidelines is provided in section 4 of the QWQ Guidelines. The following points are a summary.

The AWQ Guidelines recommend derivation of guidelines based on monitoring at reference sites. This leads to the generation of percentiles of data that best reflect the reference data distribution (refer glossary for explanation of 'percentile'). Under the QWQ Guidelines:

- for high ecological value and slightly disturbed waters, the 20th, 50th and 80th percentiles of reference suite values are used for most physico-chemical water quality indicators (for salinity the 20th, 50th and 75th percentile of reference site data is adopted)
- for moderately disturbed waters (the most common level of protection) the QWQ Guidelines currently adopt the 80th and/or 20th percentiles of data from reference sites (for salinity the 75th percentile of reference site data is adopted). Where the best available reference sites are modified, then lower percentile values may need to be considered in derivation of guidelines.

The AWQ Guidelines note that the choice of percentiles is arbitrary and validates the use of 'an appropriate percentile of the reference data distribution to derive the trigger value' (ANZECC & ARMCANZ 2000a, Vol. 1; Section 3.3.2.4).

Ideally, local reference site data should be based on 18 samples collected at each site over 12 and preferably 24 months, in order to capture two complete annual cycles. However the best available data representing the natural variation of the system will be used to derive local water quality guidelines. Additional reference site monitoring may subsequently be required.

As part of the quality assurance procedure, data collection, storage and analysis should be consistent with the Queensland Monitoring and Sampling Manual 2009—available from the department's website.

Projects to derive local water quality guidelines have recently been undertaken in the Capricorn-Curtis Coast region (draft, 2014) and the Fitzroy Basin (2011). These are listed in the 'Further Information' section.

For toxicants (e.g. pesticides, heavy metals), in the absence of local information, refer to the relevant guideline values in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) and the Water Quality Guidelines for the Great Barrier Reef Marine Park (GBRMPA, 2010).

PART B—Water quality guidelines to protect human use environmental values

A range of national water quality guidelines provide information on water quality for human uses and values. These include:

Irrigation—AWQ Guidelines for salinity, sodicity, herbicides and other indicators

Farm supply, Stock water —AWQ Guidelines

Aquaculture—Department of Agriculture, Fisheries and Forestry regional guidelines, AWQ Guidelines and the Australian and New Zealand Food Standards Code, Food Standards Australia New Zealand

Human consumption of aquatic foods—AWQ Guidelines and Australian and New Zealand Food Standards Code, Food Standards Australia New Zealand

Primary, secondary and visual recreation—National Health and Medical Research Council (2008) guidelines

Drinking water—Australian drinking water quality guidelines and AWQ Guidelines

Industrial use—water quality requirements vary within and between industries, and

Cultural and spiritual values—enhance or protect indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.

PART C—Deriving objectives from water quality guidelines

The Environmental Protection (Water) Policy 2009 provides a framework for managing water quality that involves identifying the environmental values for waters and subsequently determining quantitative water quality guidelines and water quality objectives to enhance or protect the environmental values.

Water quality objectives apply to receiving waters, and protect environmental values from the discharge of contaminants to receiving waters. Water quality objectives are expressed as contaminant concentrations, loads or as a narrative statement.

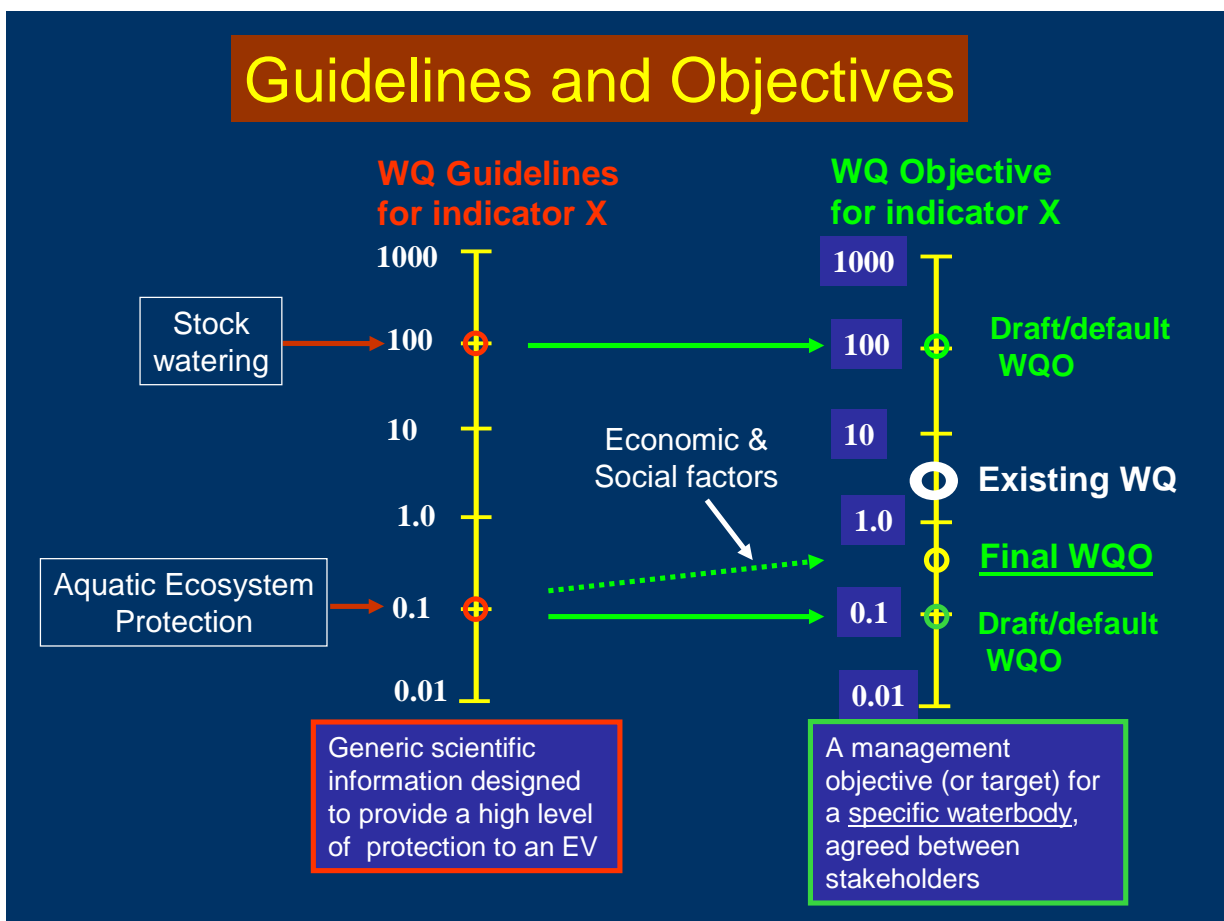
Water quality objectives are derived from water quality guidelines, however they may be modified in consideration of the economic and social impacts of protecting an environmental value.

Under the Environmental Protection (Water) Policy 2009, water quality objectives that provide a lower level of protection of the environmental values than the water quality guidelines may be decided only if:

- the adoption of the water quality guidelines would involve economic or social impact that are unacceptable to the community, and
- the water quality objectives are an improvement on existing water—water quality objectives may not provide a lower level of protection than existing water quality.

Figure 1 provides an example of the derivation of water quality objectives from water quality guidelines.

Figure 1 Water quality guidelines and objectives



Further Information

Water quality guidelines

ANZECC & ARMICANZ (2000) Australian and New Zealand guidelines for fresh and marine water quality

GBRMPA (2010) Water Quality Guidelines for the Great Barrier Reef Marine Park. Revised edition

National Water Quality Management Strategy and accompanying national guidelines (including the Framework for Marine and Estuarine Water Quality Protection, implementation guidelines)

Queensland Government (2014) Report on draft aquatic ecosystem water quality guidelines for the Capricorn Curtis Coast (Draft, March 2014)

Queensland Government (2011) Developing water quality guidelines for the protection of the freshwater aquatic ecosystems in the Fitzroy Basin, September.

Queensland Government (2009, updated 2013) Queensland Water Quality Guidelines 2009

Monitoring guidelines

Queensland Government (2013) Queensland Integrated Waterways Monitoring Framework

Queensland Government (2010) EPP Water Monitoring and Sampling Manual 2009, version 2, (July 2013 format edits).

Glossary of terms

Environmental values (EVs) for water are the qualities of the water that make it suitable for supporting aquatic ecosystems and human water uses.

Indicator for an environmental value is a physical, chemical or biological property that can be measured or decided in a quantitative way.

Percentile is a statistical term meaning the value below which a certain percent of observations fall. For example, the 20th percentile is the value (or score) below which 20% of the observations may be found, and is typically a smaller/lower value than the 80th percentile of the same dataset.

Water quality objectives (WQOs) are numerical concentration or load limits or narrative statements that have been established to enhance or protect the environmental values of water. Water quality objectives are based on water quality guidelines, but may be modified by consideration of the economic and social impacts of protecting the environmental values for the waters.

Water quality guidelines (WQGs) are the quantitative measures of indicators that protect an environmental value. These measures can be concentrations, loads or alternatively a biological measure e.g. fish diversity.