

The Water Quality Protection Plan for Darwin Harbour (WQPP) aims to ensure water quality in the region is maintained and that community's values for waterways are protected.

This document is a summary of the WQPP entitled 'Developing Water Quality Objectives for the Darwin Harbour Region' (Aquatic Health Unit, 2009), and should be referred to for further details.

### Background

Continued growth of urban and rural activities around Darwin Harbour will place increasing pressure on the Harbour's waterways. Currently, the capacity of the Harbour to receive pollutants from point and non-point sources is poorly known. Increased monitoring and knowledge are required to ensure the recreational, social, environmental and economic values of our waterways are not degraded.

The National Water Quality Management Strategy (NWQMS) is a long term plan of action developed by the Federal, State and Territory Governments in 1992 to ensure a sustainable and nationally consistent approach to water quality management.

The NWQMS promotes the development of appropriate action plans for waters in regions subject to development pressures. The action plans are based on the Framework for Marine and Estuarine Water Quality Protection. These incorporate national guidelines and recommendations for monitoring and reporting approaches. Action plans aim to improve or sustain the quality of all waters in selected catchments by providing for the development of Water Quality Objectives and better management.

The resulting action plan developed for the Darwin region is called the Water Quality Protection Plan for Darwin Harbour. The aim is to ensure that Water Quality Objectives, a key component of the Plan, are maintained and that community's values for waterways are protected.

### Why do we need to protect water quality in the Darwin Harbour region?

The Darwin Harbour region is undergoing significant changes as a result of the growing population. By 2026, more than half of the NT population (around 165,000) will live in the Darwin Harbour region (ABS 2008). It is inevitable that the pressure on the Harbour's waters will intensify.

At present, waters in the Darwin Harbour region are considered to be in good condition compared to those adjacent to highly populated areas in other regions of Australia. This is reflected in the good reputation that the Top End has for its ecological diversity, recreational opportunities such as fishing and its distinctive tropical character.

There are, however, areas of concern, especially around some urbanised areas where sewage outfalls, stormwater, or pollution in the form of pathogens and nutrients, can affect the quality of the water.

It is important to recognise that the environmental quality of these waters in the future will strongly depend on the decisions we make now.

To protect the water quality in the region, Water Quality Objectives have been developed and are summarised in this document.



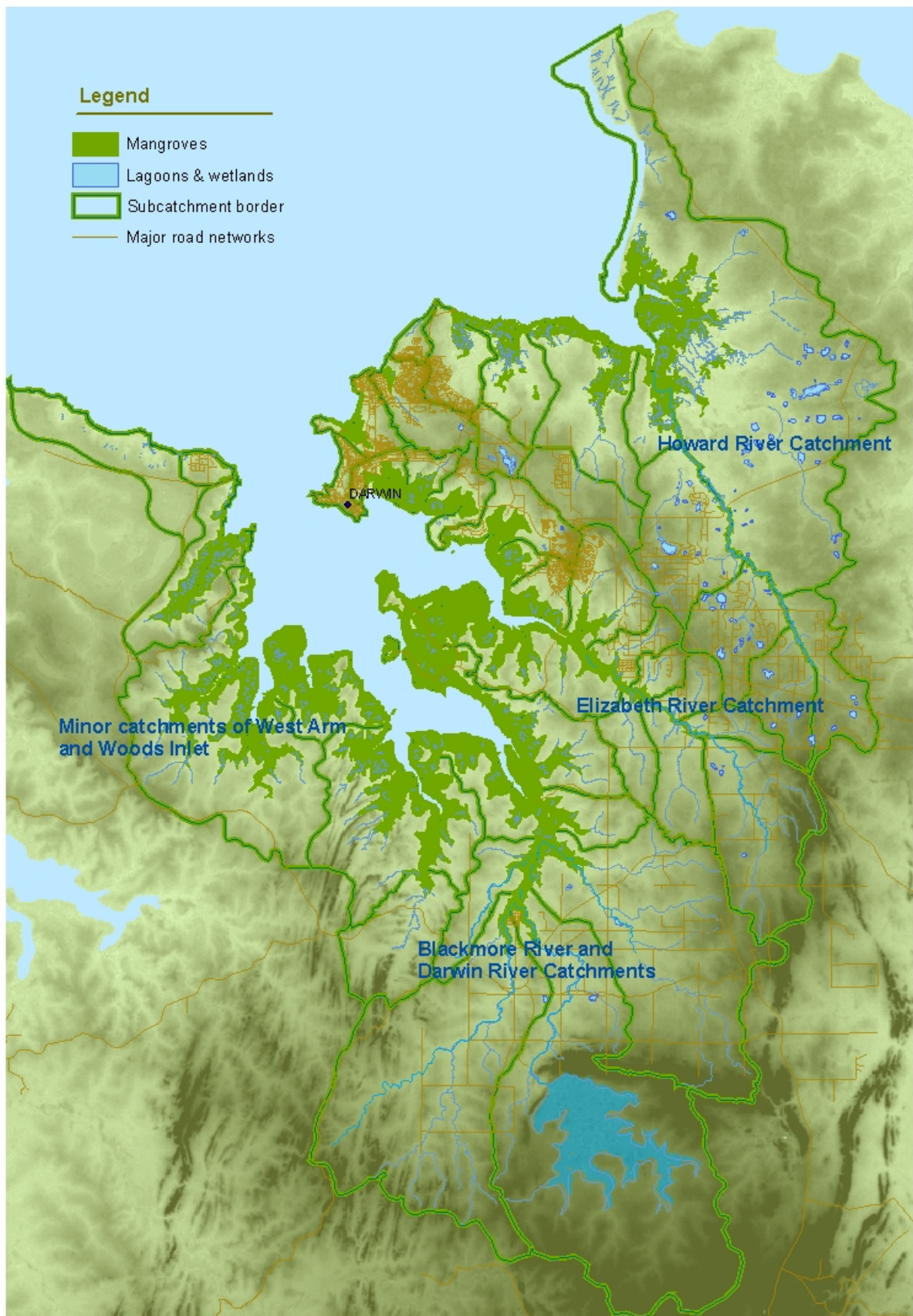


Figure 1. Major catchments of the Darwin Region.



### What are Water Quality Objectives?

The Water Quality Objectives describe the water quality needed to protect beneficial values and uses. They act as guideline and reference levels to help guide planning and management to protect the values.

The Water Quality Objectives are:

- aimed at protecting human health and the health of the aquatic ecosystems;
- for regions of relative homogeneity in water quality; and
- applied to perennial rivers and streams or recessional flow conditions for seasonal systems.

However, there are some conditions associated with their use. Water Quality Objectives should:

- not for heavily urbanised or disturbed areas.
- not to be used for event based monitoring typically associated with wet season flows for intermittent/episodic streams, lakes, wetlands, estuaries or marine waters; and
- not to be used as a value to 'pollute up to' but instead be used to limit the amount and type of discharge flushed into Harbour waters or a particular body of water.

Water quality guidelines provide a threshold to assess if a beneficial use or environmental value is being maintained. Water Quality Objectives, in contrast, are agreed between stakeholders as measures of management performance. To manage waters for their environmental beneficial use, in most waters, the Water Quality Objective will be set to equate to the water quality guideline specific to the water type.

### How can Water Quality Objectives be used?

Water Quality Objectives for the Darwin Harbour catchment are intended for the community, local councils and government agencies to use in catchment management and land use planning activities.

They are a tool for strategic planning and development assessment. For example, they will provide local planners, managers and developers with water quality guideline levels to be sustained or achieved when considering or assessing coastal developments.

The Water Quality Objectives can assist by providing:

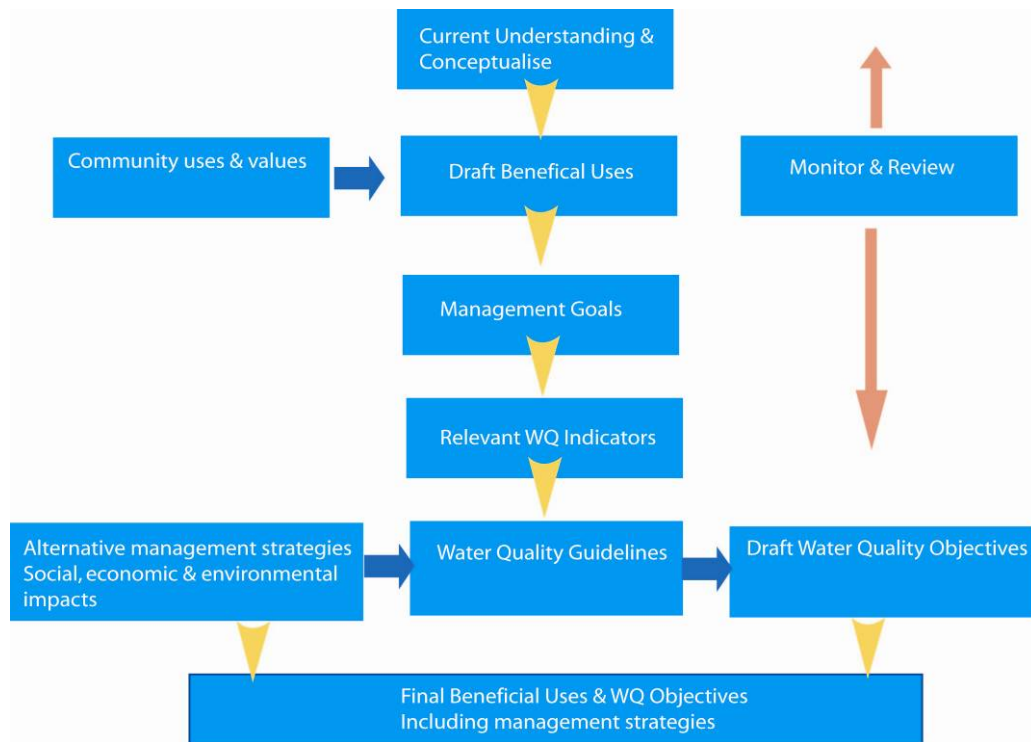
- values and uses of waters agreed to by the community;
- relevant indicators and guideline levels for assessing water quality impacts;
- a framework for decision making that is consistent and transparent; and
- a better community understanding of water quality and the potential impacts on it.

The process of developing management goals, locally appropriate Water Quality Objectives and associated beneficial uses is illustrated in Figure 2.

Water Quality Objectives will be scheduled under the Northern Territory Water Act and will enable regulators and other stakeholders to use these as benchmarks and protect important values.

















**Figure 2:** Process for developing Water Quality Objectives.

### Beneficial Uses

Environmental values are uses of water for a healthy ecosystem and/or contribute to public benefit, welfare, safety and health. These environmental values require protection from the effects of pollution. The Northern Territory *Water Act 1992* defines these values or uses as Beneficial Uses and a given water body may have none, one, several, or all of the following Beneficial Uses:

	Agriculture – to provide irrigation water for primary production including related research;
	Aquaculture – to provide water for commercial production of aquatic animals;
	Public water supply – to provide water for drinking purposes;
	Environment – to provide water to maintain the health of aquatic ecosystems;
   	Cultural and recreation – to provide water to meet aesthetic, recreational and cultural needs;
	Industry – to provide water for industry; and
	Rural stock and domestic – to provide water for specific use.

In 2007, the Department of Natural Resources, Environment, the Arts and Sport undertook public consultation to evaluate Beneficial Use declarations proclaimed in 1996. A key outcome was the community's preference for existing uses to be retained and for environment to be the highest ranking category of beneficial use for all waterways in the Harbour.

## Water Quality Objectives for the Darwin Harbour Region

Increasing nutrient (nitrogen and phosphorus) and suspended sediment contribution to the Harbour's waterways have been identified as a key management issue (Darwin Harbour Advisory Committee, 2003).

Priority indicators for Water Quality Objectives have been identified for the Darwin Harbour region by an expert panel in conjunction with a review of local data. A wider range of indicators will be developed including biological and habitat indicators.

Water Quality Objectives for physico-chemical indicators for ecosystem protection are presented in Tables 1-3. These should be used in conjunction with information provided by the ANZECC guidelines (ANZECC & ARMCANZ 2000).

For a licensed point discharge and corresponding mixing zone, the conditions and terms of the waste discharge licence (WDL) will administer requirements for water quality.

### Application of Water Quality Objectives

For Water Quality Objectives to provide effective protection of water quality, a number of conditions need to be met. A full assessment of water quality requires measurement of all relevant indicators and comparison to Water Quality Objectives. A longer term monitoring program is required, rather than 'one-off' samples.

Water Quality Objectives should only be used for evaluating ambient water quality in the Darwin region. The paucity of data to characterise the condition of waterways in the region and broader Northern Territory is a key knowledge gap.

### When local Water Quality Objectives are unavailable

The Framework for Marine and Estuarine Water Quality Protection recommends that reference values (called guidelines) should be based on locally derived data. Where local data is unavailable, NWQMS recommends that default values (national guidelines) for tropical Australia are used. Detailed procedures are described in ANZECC & ARMCANZ (2000).

Local Water Quality Objectives for the Darwin harbour region have not been derived for toxicants (such as heavy metals). Guideline values for toxicants should be sourced from ANZECC guidelines. Health related indicators in this document are sourced from the NT Department of Health and Families Guidelines and/or relevant National Guideline values.

### References

Aquatic Health Unit (2008). Developing Water Quality Objectives for the Darwin Harbour Region. Department of Natural Resources, Environment, the Arts and Sport. Darwin.

ABS (2008). Population Projections, Australia, 2006 to 2101. Cat 3222.0. Australia Bureau of Statistics. Australia.

ANZECC/ARMCANZ (2000). *Australian Guidelines for water quality monitoring and reporting*. ANZECC/ARMCANZ, Australia.

ANZECC/ARMCANZ (2000). *Australian guidelines for fresh and marine water quality*. Volume 1 The Guidelines. ANZECC/ARMCANZ, Australia.


Aquatic Health Unit (2008). Developing Water Quality Objectives for the Darwin Harbour Region. Department of Natural Resources, Environment, the Arts and Sport. Darwin.

Darwin Harbour Advisory Committee (2003). Management Issues for the Darwin Harbour Region. Department of Natural Resources, Environment and the Arts. Darwin.

Fukuda, Y. and Townsend, S. (2006). Dry season water quality resource condition targets for rivers and streams in the Darwin-Litchfield-Bynoe region. Department of Natural Resources, Environment and the Arts. Darwin.

NT Department of Health and Families (2007). Guidelines. Northern Territory Recreational Microbiological Water Quality Guidelines. Northern Territory Department of Health and Community Services. Darwin.

**Table 1:** Water Quality Objectives for priority ambient water quality indicators of the Darwin Harbour Region

Indicator for Environmental Use: Aquatic Ecosystem Protection 	Marine and Estuarine Systems			Freshwater Systems			
	Outer Estuary	Mid Estuary	Upper Estuary	Freshwater Rivers & streams <sup>b</sup>	Aquifer Fed Springs	Lagoons	Groundwater
Dissolved oxygen (DO% saturation)	80-100%	80-100%	80-100%	50-100%	TBD	TBD	-
pH	7.0-8.5	7.0-8.5	6-8.5	6.0-7.5	7.0-8.0	-	7.0-8.0
Turbidity (NTU)	-	-	-	<20	TBD	<5	-
Conductivity ( $\mu$ S/cm)	-	-	-	<200	Natural range	-	<400
Total Nitrogen (Total N) ( $\mu$ g N/L)	<440	<270	<300	<230	TBD	TBD	-
NOx ( $\mu$ g N/L)	<10	<20	<20	<8	-	-	-
Ammonia NH3-N ( $\mu$ g/L)	<20	<20	<20	-	-	-	-
Total Phosphorus (Total P) ( $\mu$ g P/L)	<20	<20	<30	<10	-	-	-
Filterable Reactive Phosphorus FRP ( $\mu$ g P/L)	<10	<5	<10	<5	TBD	TBD	-
Chlorophyll a Chla ( $\mu$ g/L)	<1	<2	<4	<2	-	<10	-
TSS (mg/L)	<10	<10	<10	<5	-	-	-
Toxicants <sup>a</sup>	Refer to ANZECC & ARMCANZ Guidelines 2000						Refer to NHMRC Drinking Water Guidelines 2004

Offshore and inshore marine refer to ANZECC (2000)


<sup>a</sup>Limited data. <sup>b</sup> Derived from Fukuda & Townsend 2006.

TBD to be determined

Notes: DO guidelines for freshwater should only be applied for flowing streams/waters. Stagnant pools in intermittent streams naturally experience low DO. DO <30% saturation are toxic to some fish species. DO guidelines apply to daylight hours/conditions. Lower values occur at night.

Guidelines do not apply during high flow events associated with wet season conditions. ANZECC (2000) guidelines suggest that this is best addressed using load-based guidelines. Further details are in the full WQPP report (Fortune & Maly 2009).

**Table 2:** Interim Recreational Guidelines and Objectives for Primary Contact.

Indicator for Protection of Cultural Use: Recreation Primary contact 	Marine and Estuarine Systems					Freshwater Systems			
	Offshore Marine	Inshore marine	Outer Estuary	Mid Estuary	Upper Estuary	Freshwater Rivers & streams	Aquifer Fed Springs	Lagoons	Groundwater
<b>Biological</b>									
Enterococci <sup>a</sup>	≤50 Enterococci/100mL								NA
<i>E. coli</i>	No single sample > 200 <i>E. coli</i> /100mL								
Pathogenic Protozoans <sup>b</sup>	<10 pathogenic protozoans/100mL								
<b>Toxicants</b>	Refer to ANZECC & ARMCANZ Guidelines (2000)								NA

Note <sup>a</sup>: Enterococci is the preferred indicator, however until a robust enterococci data base is established in the NT, the use of *E. coli* is acceptable.


Note <sup>b</sup>: There is no generic test for pathogenic protozoans, however there may need to be specific testing for the following protozoans depending on the outcomes of a specific risk assessment process: *Naegleria fowleri* (preferred testing organism in fresh waters), *Acanthamoeba* spp, *Entamoeba* spp and *Cryptosporidium*.

Primary contact: Minimum of five samples taken at regular intervals for *E. coli* not exceeding one month, with four out of five samples containing less than 600 organisms/100mL (ANZECC 2000).

The maximum number of enterococci organisms in any one sample: 450-700 organisms/100mL. According to the *Northern Territory Recreational Microbiological Water Quality Guidelines* action must be taken if Enterococci are detected above 50 organisms/100ml, but the water body remains open for swimming unless two consecutive samples within 24 hours detect >201 Enterococci/100ml.

The current National Health and Medical Research Council (NHMRC) *Guidelines for Managing Risks in Recreation Water*, do not consider waterborne infections a hazard for incidental (secondary) contact recreational use and therefore have not specified a microbiological indicator for this contact. Incidental contact is defined as boating, fishing and wading of adults, but excludes any recreational activities by children, these are always considered as primary contact.

**Table 3:** Proposed Water Quality Objectives for Consumption and Cultural Use of Aquatic Foods. To maintain water quality for the production and consumption of aquatic foods derived from aquaculture, recreational, commercial or indigenous food gathering.

Indicator for Protection Cultural Use: Aquatic Foods 	Marine and Estuarine Systems					Freshwater Systems			
	Offshore Marine	Inshore marine	Outer Estuary	Mid Estuary	Upper Estuary	Freshwater Rivers & streams	Aquifer Fed Springs	Lagoons	Groundwater
Faecal coliform in shell fishing water	Median concentration of faecal coliform should not exceed 14 MPN/100mL (no more than 10% of the samples exceeding 43 MPN/100mL)								NA
Fish consumption (edible tissue)	Fish for human consumption should not exceed a limit of 2.3 MPN E.coli/g of flesh with a standard plate count of 100 000 organisms/g.								NA
Toxicants <sup>a</sup>	Refer to ANZECC & ARMCANZ Guidelines 2000								Refer to NHMRC Drinking Water Guidelines 2004

Note <sup>a</sup>: Toxicant guidelines indicated in ANZECC and ARMCANZ (2000) has been determined for the protection of aquaculture species. To protect the health of human consumers of aquatic foods the ANZECC & ARMCANZ Guidelines are intended to be used in conjunction with the Food Standards Code (FSANZ 2005). Updates available at [www.anzfa.gov.au](http://www.anzfa.gov.au)  
MPN= Most probable number.