Environmental Protection (Water and Wetland Biodiversity) Policy 2019

Burdekin River (upper) Sub-basin

Environmental Values and Water Quality Objectives

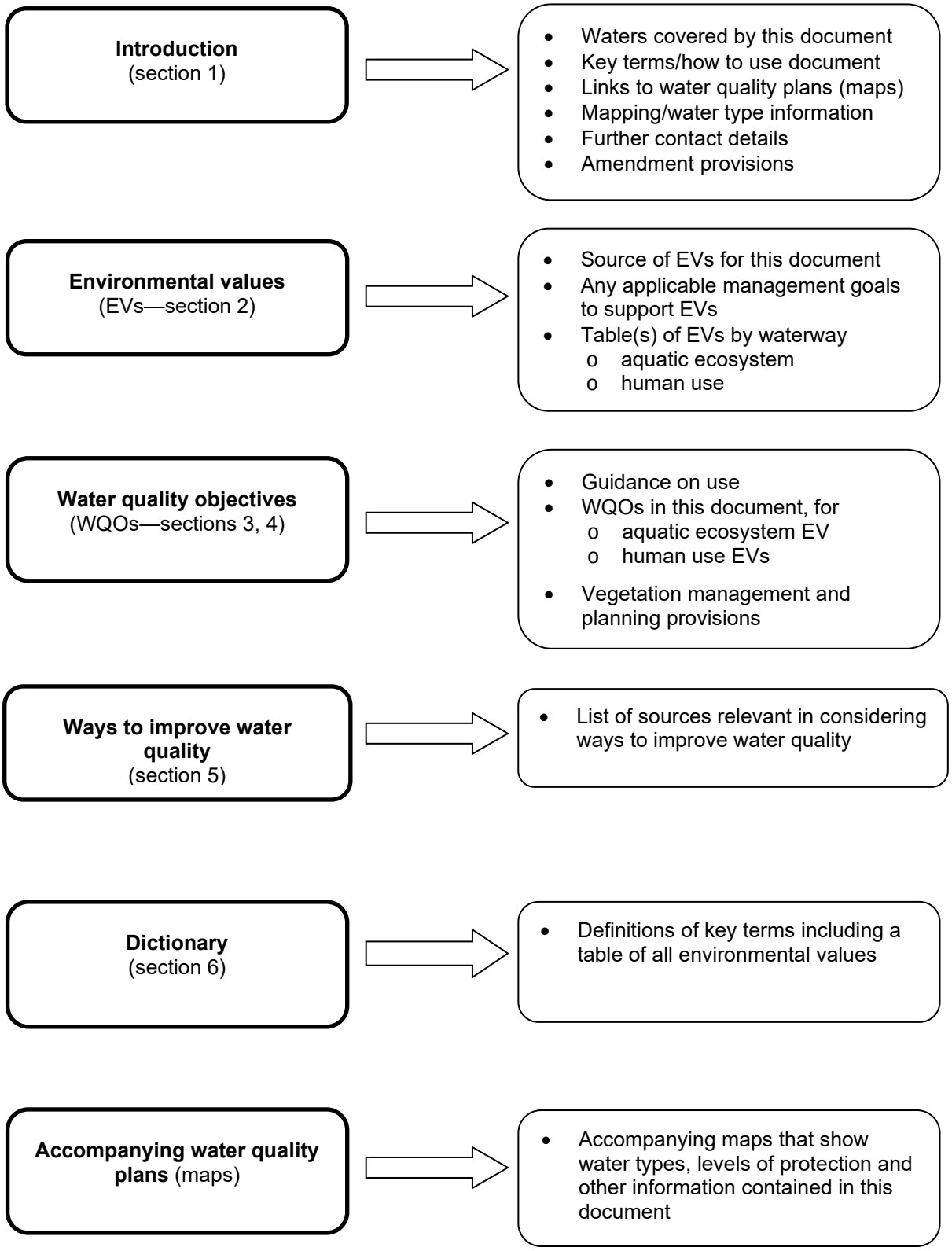
Part of Basin 120, including all surface waters of the Upper Burdekin River Sub-basin, including Burdekin Falls Dam

Queensland Government

Prepared by: Environmental Policy and Planning Division, Department of Environment and Science

June 2022

Main parts of this document and what they contain



Contents

List of tables

1 Introduction

This document is made pursuant to the provisions of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP [Water and Wetland Biodiversity]), which is subordinate legislation under the *Environmental Protection Act 1994*. The EPP (Water and Wetland Biodiversity) provides a framework for:

- identifying environmental values (EVs) for Queensland waters and wetlands
- identifying the management intent for waters
- identifying management goals for waters
- stating water quality objectives (WQOs) to protect or enhance EVs for waters (WQOs are long-term goals for receiving waters, not individual point source emission objectives.)
- including the identified EVs, management goals and WQOs for waters under Schedule 1 of the EPP (Water and Wetland Biodiversity).

This document contains EVs and WQOs for surface fresh waters in the Upper Burdekin River Sub-basin, and is listed under schedule 1 of the EPP (Water and Wetland Biodiversity). For information on wetland EVs, refer to section 7 of the EPP (Water and Wetland Biodiversity). The accompanying plan (refer below for details) identifies the EVs, water type and management intent for the different waters covered by this document.

1.1 Purpose

The purpose of this document is to identify locally relevant environmental values (EVs) and water quality objectives (WQOs) for surface fresh waters in the Upper Burdekin River Sub-basin, pursuant to section 12 of the EPP (Water and Wetland Biodiversity) for inclusion in Schedule 1 of the EPP (Water and Wetland Biodiversity). EVs and WQOs are used to help set development conditions, influence local government planning schemes, and underpin report card grades for ecosystem health monitoring programs. Aquatic ecosystem water quality objectives have, where possible, been established using local data, and present a truer picture of the physico-chemical water quality of local waterways than national and state water quality guidelines. The adoption of local water quality monitoring data in deriving WQOs ensures the values the community holds for its waterways can be maintained and improved.

1.2 Queensland waters to which this document applies

This document applies to surface fresh waters draining the Upper Burdekin River Sub-basin (within Basin 120[1]), as indicated in the accompanying plan (WQ1201—Upper Burdekin Sub-basin surface waters)[2].

Queensland waters covered by this document include:

- Upper Burdekin, Dry, Clarke, Basalt, Kirk, Fanning, Star and Running rivers
- Gray, Allingham, Lolworth, Hann, Keelbottom, Douglas and Camel creeks
- wetlands, lakes and reservoirs

For other waters of the Burdekin River Basin (including surface waters, groundwaters, and adjacent coastal and marine waters), refer to separate documents under schedule 1 of the EPP (Water and Wetland Biodiversity).

[1] Australia's River Basins 1997—Product User Guide. Published by Geoscience Australia. Canberra, ACT (3rd edition, 2004).

[2] This document and the accompanying plan are available from the department's website. The boundaries in the accompanying plan WQ1201 are indicative only. Schedule outlines, EVs, water types and aquatic ecosystem management intent (level of protection) depicted in the accompanying plans are available on Queensland Globe (qldglobe), and the GIS datasets can be downloaded from the Queensland Spatial Catalogue (QSpatial). For further information, email the department at epa.ev@des.qld.gov.au.

1.3 Great Barrier Reef end-of-basin load objectives

Annual end-of-basin load water quality objectives covering all Great Barrier Reef mainland basins have been established pursuant to section 11 of the EPP (Water and Wetland Biodiversity) for dissolved inorganic nitrogen and fine sediment across all mainland basins draining to the Great Barrier Reef. These are included in a separate document titled 'Great Barrier Reef River Basins End-of-Basin Load Water Quality Objectives', published by the department in September 2019, and available from the department's website.

1.4 Guidance on using this document

1.4.1 Key terms (refer to dictionary for additional terms)

ADWG means the Australian Drinking Water Guidelines, published on the National Health and Medical Research Council (NHMRC) website.

ANZG (previously ANZECC) means the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, published on the Australian Government's Water Quality Australia website.

Environmental values (EVs) for water means under section 6 of the EPP (Water and Wetland Biodiversity) the EVs specified in the EVs tables of this document for the corresponding water, or for other waters the EVs stated in subsection 6(2) of the EPP (Water and Wetland Biodiversity). EVs for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use. Particular waters may have different EVs. The range of EVs that can potentially apply is listed below, and further details are provided in the dictionary.

List of EVs and applicable waters

Environmental value (EV)	Potentially applicable to:	
	Tidal waters	Fresh (non-tidal) waters
Protection of aquatic ecosystems (aquatic ecosystem EV)		
Protection or enhancement of aquatic ecosystem values, under four possible levels of ecosystem conditions: • high ecological value (effectively unmodified) waters • slightly disturbed waters • moderately disturbed waters • highly disturbed waters. (Suitability for seagrass and wildlife habitat have also been specifically identified for some Queensland waters as a component of this EV).	✓	✓
EVs other than aquatic ecosystem EV (called human use EVs)		
Suitability for drinking water supplies		✓
Suitability for primary contact recreation (e.g. swimming)	✓	✓
Suitability for secondary contact recreation (e.g. boating)	✓	✓
Suitability for visual (no contact) recreation	✓	✓
Suitability of water for producing or taking aquatic foods (such as fish, shellfish and other plants and animals) that are safe and suitable for human consumption	✓	✓
Protection of cultural and spiritual values, including traditional owner values of water	✓	✓
Suitability for industrial use (including mining, minerals refining/processing)	✓	✓
Suitability for aquaculture (e.g. red claw, barramundi)	✓	✓
Suitability for crop irrigation		✓
Suitability for stock watering		✓
Suitability for farm supply/use		✓

GBRMPA WQG means the *Water Quality Guidelines for the Great Barrier Reef Marine Park, Great Barrier Reef Marine Park Authority 2010*, published at the GBRMPA website.

Level of protection for a water (aquatic ecosystem EV) means the level of aquatic ecosystem condition specified for waters in the Aquatic Ecosystem water quality objectives tables of this document that the corresponding WQOs for that water are intended to achieve (refer to management intent definition below for further information).

Management goal means the goal/s (if any) stated in this document to support the EVs for waters identified in the EVs tables.

Management intent for a water (aquatic ecosystem EV) is defined in s.15 of the EPP (Water and Wetland Biodiversity). It is the management intent for the waters that the decision to release waste water or contaminant to waters must ensure that:

- for high ecological value (HEV) waters—the measures for the indicators for all EVs of water are maintained;
- for slightly disturbed (SD) waters—the measures for the slightly modified physical or chemical indicators are progressively improved to achieve the water quality objectives for high ecological value water;
- for moderately disturbed (MD) waters:
  - if the measures for indicators of the EVs achieve the water quality objectives for the water—the measures for the indicators are maintained at levels that achieve the water quality objectives for the water, or
  - if the measures for indicators of the EVs do not achieve the water quality objectives for the water—the measures for indicators of the EVs are improved to achieve the water quality objectives for the water;
- for highly disturbed (HD) waters—the measures for the indicators of all EVs are progressively improved to achieve the water quality objectives for the water.

QWQG means the Queensland Water Quality Guidelines, published on the Department's website.

Water quality guidelines means under section 8 of the EPP (Water and Wetland Biodiversity)**,** numerical concentration levels or statements for indicators that protect a stated environmental value. Under the EVs setting process contained in the EPP (Water and Wetland Biodiversity), water quality guidelines are used as an input to the development of WQOs.

Water quality indicator (for an EV) means under section 8 of the EPP (Water and Wetland Biodiversity)**,** a property that is able to be measured or decided in a quantitative way. Examples of water quality indicators include physical indicators (e.g. temperature), chemical indicators (e.g. nitrogen, phosphorus, metals), and biological indicators (e.g. macroinvertebrates, seagrass, fish).

Water quality objectives (WQOs) means under section 11 of the EPP (Water and Wetland Biodiversity), the WQOs specified in tables of this document to support the corresponding EVs for waters identified in the EVs table.

WQOs are long-term goals for water quality management. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and protect the stated EVs for those waters. Water quality objectives are not individual point source emission objectives, but the receiving water quality objectives.

WQOs are derived from scientific criteria or water quality guidelines but may be modified by consideration of economic and social impacts of protecting the EVs for the waters.

Examples of WQOs for the aquatic ecosystem EV (which should not be directly adopted for use) include:

- total phosphorus concentration less than 20 micrograms per litre (µg/L)
- chlorophyll *a* concentration less than 1 µg/L
- dissolved oxygen between 95 per cent and 105 per cent saturation
- taxa richness of macroinvertebrates greater than 12 families

Water type means groupings of waters with similar characteristics, as shown in the accompanying plan. Water types can include fresh waters (lowland, upland, lakes/reservoirs), wetlands and groundwaters, estuarine waters (lower, middle and upper estuaries), tidal canals, constructed estuaries, marinas and boat harbours, and coastal/marine waters (enclosed coastal, open coastal, midshelf, offshore). WQOs applying to different water types are outlined in this document.

1.4.2 Use of this document

Section 2 lists the identified EVs for protection for particular waters. EVs are mapped in the accompanying plans. The aquatic ecosystem EV is a default applying to all Queensland waters. Reference to tables in sections 3–4 provides the corresponding WQOs to protect the aquatic ecosystem EV, and human use EVs.

Where more than one EV applies to a given water, the adoption of the most stringent WQO for the identified EVs applies to each water quality indicator in order to protect all identified EVs.

Example (Note that this is an example only and should not be directly adopted for use):

For freshwater streams with aquatic ecosystem and drinking water EVs, the respective sulfate WQOs are:

- aquatic ecosystem freshwater stream: less than 25 mg/L
- drinking water: less than 250 mg/L.

In this case the aquatic ecosystem WQO is the more stringent, and its adoption therefore supports both the freshwater aquatic ecosystem and drinking water EVs.

This document also refers to a number of guidelines, codes and other reference sources on water quality. In particular, the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) and the QWQG provide more detailed information on water types, water quality indicators, derivation of local water quality guidelines, application during flood events, monitoring, and other matters.

1.5 Information about mapped areas and boundaries

The boundaries in the accompanying plan WQ1201 are indicative only. Schedule outlines, EVs, water types and aquatic ecosystem management intent (level of protection) depicted in the accompanying plans are available on Queensland Globe (qldglobe), and the GIS datasets can be downloaded from the Queensland Spatial Catalogue (QSpatial). For further information, email the department at epa.ev@des.qld.gov.au.

1.6 Water types and basis for boundaries

1.6.1 Water types

Water types are groupings of waters with similar characteristics. Waters in this document have been classified into different water types, as shown in the relevant tables and accompanying plans. The range of applicable water types is listed below (note that not all water types are present in all areas):

- freshwater streams and rivers, including where applicable water types based on catchment or sub-catchment boundaries
- freshwater lakes/reservoirs
- wetlands

The water types are based on local water quality studies (refer to the source documents listed after the tables), mapping and definitional rules contained in the QWQG, and the ANZG. Further detail on water types is contained in these sources.

1.6.2 Water type boundaries

The boundaries of different water types have been mapped using relevant attributes, including:

- geographic coordinates
- catchment or sub-catchment boundaries
- surveyed terrestrial boundaries
- altitude
- boundaries based on technical investigations.

Boundaries are shown on the accompanying plan. The boundaries of water types may be confirmed or revised by site investigations.

1.7 Matters for amendment

Amendments of the following type may be made to this schedule 1 document (and accompanying plans) for the purposes of replacement under section 13(2)(b) of the EPP (Water and Wetland Biodiversity):

- changes to EVs
- changes to management goals
- changes to WQOs
- changes to management intent (level of protection) categories
- changes to waterway or water type boundaries/descriptions
- updates to information/data sources, websites and email contact details, agency/departmental names, other institutional names, references.

ENVIRONMENTAL VALUES AND MANAGEMENT GOALS

2 Environmental values and management goals

2.1 Environmental values

Environmental values (EVs) for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses (refer dictionary to this document for further details). EVs for waters covered by this document are shown in Table 1 and the accompanying plan (WQ1201).

Table 1 Environmental values: Upper Burdekin River Sub-basin surface fresh waters

UPPER BURDEKIN RIVER SUB-BASIN (Refer plan WQ1201)	Environmental values[1–6]											
	Aquatic ecosystem	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer [5]	Primary recreation [5]	Secondary recreation[5]	Visual recreation [5]	Drinking water [5]	Industrial use	Cultural and spiritual values
Water (listed alphabetically after defence properties)												
Defence - Greenvale Training Area (GVTA)	✓			✓			✓	✓				✓
Defence - Townsville Field Training Area (TFTA)	✓						✓	✓				✓
Allingham Creek	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Basalt River	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Burdekin Falls Dam / Lake Dalrymple	✓	✓				✓	✓	✓	✓	✓		✓
Burdekin River (above dam)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Burdekin River (above dam: outside Defence TFTA)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Burdekin River (Blue Range: outside Defence GVTA)	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Camel Creek	✓		✓	✓					✓			✓
Clarke River (outside Defence GVTA)	✓			✓			✓	✓	✓	✓	✓	✓
Douglas Creek	✓			✓					✓			✓

UPPER BURDEKIN RIVER SUB-BASIN (Refer plan WQ1201)	Environmental values[1–6]											
	Aquatic ecosystem	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer [5]	Primary recreation [5]	Secondary recreation[5]	Visual recreation [5]	Drinking water [5]	Industrial use	Cultural and spiritual values
Water (listed alphabetically after defence properties)												
Dry River	✓			✓					✓		✓	✓
Fanning River (outside Defence TFTA)	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Gray Creek (outside Defence GVTA)	✓			✓					✓			✓
Hann Creek	✓		✓	✓			✓	✓	✓		✓	✓
Keelbottom Creek (outside Defence TFTA)	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
Kirk River	✓	✓		✓		✓	✓	✓	✓		✓	✓
Lolworth Creek	✓			✓		✓	✓	✓	✓	✓		✓
Running River	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Star River (outside Defence TFTA)	✓			✓		✓	✓	✓	✓	✓		✓
Upper Burdekin River	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes:

1. Refer to the accompanying plan WQ1201 for locations of EVs. EVs shown relate to waters within each unit (for example 'Clarke River') as shown on the plan. Note, EVs applying to waters in national parks or other conservation estate may, depending on local management context, represent a subset of those selected (e.g. excluding industrial, irrigation, stock watering.). Further information on park management, including allowable uses and activities in parks, is available from the department's Parks and Forests website.

2. ✓ means the EV is selected for protection. Blank indicates that the EV is not chosen for protection.

3. Refer to the dictionary for further explanation of EVs.

4. Refer to sections 3–4 for WQOs applying to the EVs in this table.

5. The selection of recreational and other human use EVs for waters does not mean that these waters are free of dangerous aquatic organisms, for example venomous organisms (e.g. marine stingers including box jellyfish, irukandji jellyfish), crocodiles, and sharks. Direct contact with dangerous aquatic organisms should be avoided. Refer to DES Crocodiles, council, Queensland Health, Beachsafe, marine stingers, and other information sources for further details on swimming safety and information on specific waters. Access restrictions may apply in certain locations (e.g. water storages, ports, defence, Traditional Owner lands), or at certain times of the year. Restrictions on certain activities (e.g. fishing, camping) may also apply in particular areas. Check with relevant authorities.

6. The selection of EVs for waters does not mean that these are currently free of toxicants (including bioaccumulative toxicants). Information about contaminated land can be accessed by searching the Environmental Management and Contaminated Land Registers. For information on per and poly-fluoroalkyl substances (PFAS), including alert areas and links to further health advice on water use in such areas, refer to PFAS in Queensland.

References:

Department of Science, Information Technology and Innovation (2017) *Draft environmental values and water quality guidelines: Burdekin River Basin fresh and estuarine waters, draft for consultation*, March

NQ Dry Tropics (2016) *Burdekin Region Water Quality Improvement Plan*, NQ Dry Tropics, Townsville

NQ Dry Tropics (2013) *Community draft environmental values for the waters of the Burdekin Dry Tropics Region*, June (Ed: R Kerr)

2.2 Management goals to support environmental values

2.2.1 Management intent for waters

It is the management intent for Queensland waters that the decision to release waste water or contaminant to waters must ensure the following:

- for high ecological value (HEV) waters—the measures for the indicators for all EVs of waters are maintained
- for slightly disturbed (SD) waters—the measures for the slightly modified physical or chemical indicators are progressively improved to achieve the water quality objectives for high ecological value water
- for moderately disturbed (MD) waters:
  - if the measures for indicators of the EVs achieve the water quality objectives for the water—the measures for the indicators are maintained at levels that achieve the water quality objectives for the water, or
  - if the measures for indicators of the EVs do not achieve the water quality objectives for the water—the measures for indicators are improved to achieve the water quality objectives for the water
- for highly disturbed (HD) waters—the measures for the indicators of all EVs are progressively improved to achieve the water quality objectives for the water.

Note 1 — refer to accompanying plan for locations of waters and level of protection/management intent

Note 2 — see the Environmental Protection Regulation 2019, section 35

Note 3 — see the EPP (Water and Wetland Biodiversity), section 15.

Aquatic ecosystem WQOs are provided in section 3 of this document.

2.2.2 Reef water quality improvement plan

The Reef 2050 Water Quality Improvement Plan 2017–2022 (Reef 2050 WQIP) is a joint commitment of the Australian and Queensland governments that seeks to improve the quality of water flowing from the catchments adjacent to the Great Barrier Reef. The plan identifies how catchment water quality outcomes under the broader Reef 2050 Long-Term Sustainability Plan will be delivered. The long-term (2050) outcome under the Reef 2050 WQIP is that 'Good water quality sustains the outstanding universal value of the Great Barrier Reef, builds resilience, improves ecosystem health and benefits communities'. The Reef 2050 WQIP includes the following commitment, identified as contributing to the delivery of Reef 2050 action 1.2: *Review and update water quality objectives and water quality guidelines at regionally relevant scales under the Environmental Protection Policy (Water) 2009* [remade to become the EPP (Water and Wetland Biodiversity) in 2019].

The Reef 2050 WQIP contains end of basin annual load reduction targets for dissolved inorganic nitrogen and fine sediment across mainland basins draining to the Great Barrier Reef. These have been reflected in the document titled 'Great Barrier Reef River Basins End-of-Basin Load Water Quality Objectives' (September 2019), pursuant to section 11 of the EPP (Water and Wetland Biodiversity), and are available from the department's website.

The Reef 2050 WQIP also contains targets for pesticides such that end of catchment concentrations of pesticides protect 99% of aquatic species. This corresponds to a high ecological value level of protection. Further information is available from the reef plan website.

2.2.3 Management goals for human use environmental values

Management goals for human use EVs are provided below. WQOs to support these goals are provided in section 4 of this document.

2.2.3.1 Irrigation water quality

The management goal for irrigation water is that the quality of water, when used in accordance with the best irrigation and crop management practices and principles of ecologically sustainable development, does not result in crop yield loss or soil degradation (noting that water quality requirements may differ by crop type).

2.2.3.2 Farm supply use

The management goal for farm supply use is that the quality of water is suitable for produce preparation and domestic uses other than drinking. (Drinking and other human uses outlined below.)

2.2.3.3 Stock water quality

The management goal for stock watering is that the quality of water provided to stock does not cause deterioration in stock health or condition (noting that water quality requirements may differ by stock type).

2.2.3.4 Aquaculture

The management goal for aquaculture is that the quality of water provided for aquaculture does not cause deterioration in stocked species health or condition (noting that water quality requirements may differ by species).

2.2.3.5 Human consumers of aquatic foods

The management goal is that the water quality is suitable for producing or taking aquatic foods that are safe and suitable for human consumption.

2.2.3.6 Recreational water quality

The management goal for recreational water quality is to achieve a low risk to human health from water quality threats posed by exposure through ingestion, inhalation or contact during recreational use of water resources.

2.2.3.7 Raw water for drinking water consumption

The management goal is to:

- minimise the risk that the quality of raw water taken for treatment for human consumption results in adverse human health effects
- maintain the palatability rating of water taken for treatment for human consumption at the level of ‘good’ as set out in the ADWG
- minimise the risk that the quality of raw water taken for treatment for human consumption results in the odour of drinking water being offensive to consumers.

2.2.3.8 Industrial use

The management goal for industrial use is that the quality of water provided to industry is, with an appropriate level of treatment, suitable for industrial use. Industries usually treat water supplies to meet their specific needs, accordingly no WQOs are specified in this document for industrial use.

2.2.3.9 Cultural and spiritual values and uses of water

The management goal is that water is suitable to support identified cultural and spiritual values of waters, including those of Aboriginal people or Torres Strait Islanders. Management goals and objectives specified for aquatic ecosystems and other human water uses (including recreation, human consumption of aquatic foods, and drinking water) will assist in supporting some aspects of cultural and spiritual values of water.

WATER QUALITY OBJECTIVES TO PROTECT ENVIRONMENTAL VALUES

3 Water quality objectives to protect aquatic ecosystem environmental values

Water quality objectives (WQOs) are long-term goals for water quality management. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and protect the designated EVs for those waters. Water quality objectives are not individual point source emission objectives, but the receiving water quality objectives.

Where more than one EV applies to a given water, the adoption of the most stringent WQO for the identified EVs applies to each water quality indicator in order to protect all identified EVs.

3.1 Aquatic ecosystem water quality objectives

This section provides physical, chemical and where available, biological water quality objectives (WQOs) to support and protect the aquatic ecosystem EV. (Human use EVs, including recreation, stock watering etc, are addressed in section 4).

The aquatic ecosystem EV is a default applying to all Queensland waters, and therefore the WQOs for aquatic ecosystems form the minimum WQOs for all waters. Where no human use EVs are identified, the WQOs identified for aquatic ecosystem protection remain applicable.

WQOs for specified indicators (including nutrients, algal, water clarity) are listed in Table 2 by water type/catchment, management intent, and flow regime/season where indicated.

Details on management intent are included in the table and supporting notes. Links to wetland, riparian and State Planning Policy (state interest – water quality) mechanisms are provided in and after the table. Sources used in deriving WQOs are provided in and after the table.

3.1.1 Comparison of test data with WQOs

The following protocols are recommended when comparing fresh, estuarine or coastal/marine water quality (at a 'test' site) with the corresponding aquatic ecosystem water quality objective (WQO). For concentration-based indicators (e.g. nutrients) and turbidity (NTU), the intent is for test site water quality value to be less than or equal to the corresponding WQO. For WQO indicators where a range is specified (e.g. pH, DO), the intent is that the test site water quality median value falls within the specified WQO range. For Secchi and silicate (typically used in estuarine, coastal and marine waters), the intent is for the test site water quality value to be greater than or equal to the stated WQO. Further detail on protocols for assessing test data against WQOs is provided in the QWQG.

For HEV and SD waters:

- Where the WQO is expressed as a 20^{th}–50^{th}–80^{th} percentile range of values (e.g. Total N: 65–100–125 µg/L), the 20^{th}–50^{th}–80^{th} percentile distributions of the test data should meet the specified range of values. The sample number is a minimum of 24 test values over the relevant period (12 months if a continuous activity or alternatively a shorter period for activities where discharge occurs for only part of the year).
- For DO and pH, the median value of preferably five or more independent samples at a monitoring (test) site is compared with, and should fall within, the specified percentile range.
- Where a single WQO value is provided, the median value of preferably five or more independent samples at a monitoring (test) site should be compared with, and should be less than or equal to, the corresponding aquatic ecosystem WQO (except where otherwise indicated).

For MD and HD waters:

- The median value (e.g. concentration) of preferably five or more independent samples at a monitoring (test) site should be compared with, and should be less than or equal to, the corresponding aquatic ecosystem WQO (except where otherwise indicated).
- For DO and pH, the median value of preferably five or more independent samples at a monitoring (test) site is compared with, and should fall within, the specified percentile range.

For toxicants in water: unless otherwise stated, WQOs for toxicants are derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) default guideline values for the corresponding level of species protection. The ANZG recommends that the 95^{th} percentile of test data is compared against the default guideline value. As the proportion of test values that is required to be less than the default guideline value is high, the ANZG indicates that a single observation greater than the default guideline value is considered an exceedance.

For comparisons of toxicants in sediments, refer to ANZG.

Further information: Refer to the QWQG, the Queensland Monitoring and Sampling Manual (2018), and ANZG for more details.

AQUATIC ECOSYSTEM WATER QUALITY OBJECTIVES

Table 2 Aquatic ecosystem water quality objectives – Upper Burdekin River Sub-basin freshwater low flow and high flow

Water area/type (Source: s1–s4)	Management intent /Level of protection	Amm N (µg/L)	Oxid N (µg/L)	Total N (µg/L)	FRP (µg/L)	Total P (µg/L)	Chl-a (µg/L)	DO (% sat)	Turb (NTU)	TSS (mg/L)	pH	Conductivity (µS/cm)	Sulfate (mg/L as SO_4^{2-})
UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] **Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow)** **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources												
Note: Information on lakes, wetlands, toxicants, temperature, and State Planning Policy (water quality state interest) provided at end of table.													
BURDEKIN RIVER SUB-CATCHMENTS (refer plan WQ1201)													
HEV and SD waters (national parks, etc)	**HEV**	Maintain/achieve effectively unmodified water quality (20th, 50th and 80th percentiles of HEV waters), habitat, biota, flow and riparian areas. There is insufficient information available to establish effectively unmodified water quality objectives for these waters. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local 20th, 50th and 80th percentiles.											
Burdekin River (above Dam) sub-catchment waters (s1, s2)	**MD**	**LOW FLOW <175.9 m^3/s (cumecs) at gauge 120002C – Burdekin River at Sellheim <0.8 m^3/s (cumecs) at gauge 120014A – Broughton River at Oak Meadows (CLOSED)**											
		10 (s1)	10 (s1)	240 (s1)	10 (s1)	30 (s1)	5 (s2)	85–110 (s2)	7 (s1)	10 (s1)	6.5–8.5 (s1, s2)	290 (s1)	2 (s1)
		HIGH FLOW ≥175.9 m^3/s (cumecs) at gauge 120002C – Burdekin River at Sellheim ≥0.8 m^3/s (cumecs) at gauge 120014A – Broughton River at Oak Meadows (CLOSED)											
		10 (s1)	25 (s1)	690 (s1)	25 (s1)	180 (s1)	ID	85–110 (s2)	190 (s1)	280 (s1)	6.5–8.5 (s1, s2)	80 (s1)	2 (s1)

Water area/type (Source: s1–s4)	Management intent /Level of protection	UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow) **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources											
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**TSS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L as SO_4^{2-})
Burdekin River (Blue Range) sub-catchment waters (s1, s2)	**MD**	**LOW FLOW <175.9 m³/s (cumecs) at gauge 120002C – Burdekin River at Sellheim <35.8 m³/s (cumecs) at gauge 120107B – Burdekin River at Blue Range <62.2 m³/s (cumecs) at gauge 120110A – Burdekin River at Mount Fullstop <121.4 m³/s (cumecs) at gauge 120122A – Burdekin River at Gainsford**											
		10 (s1)	10 (s1)	180 (s1)	18 (s1)	30 (s1)	5 (s2)	85–110 (s2)	10 (s1)	10 (s1)	6.5–8.5 (s1, s2)	370 (s1)	1 (s1)
		HIGH FLOW ≥175.9 m³/s (cumecs) at gauge 120002C – Burdekin River at Sellheim ≥35.8 m³/s (cumecs) at gauge 120107B – Burdekin River at Blue Range ≥62.2 m³/s (cumecs) at gauge 120110A – Burdekin River at Mount Fullstop ≥121.4 m³/s (cumecs) at gauge 120122A – Burdekin River at Gainsford											
		10 (s1)	25 (s1)	690 (s1)	25 (s1)	180 (s1)	ID	85–110 (s2)	190 (s1)	280 (s1)	6.5–8.5 (s1, s2)	110 (s1)	2 (s1)
Upper Burdekin River sub-catchment waters (s1, s2)	**MD**	**LOW FLOW <35.8 m³/s (cumecs) at gauge 120107B – Burdekin River at Blue Range <8.9 m³/s (cumecs) at gauge 120123A – Burdekin River at Valley of Lagoons <25.7 m³/s (cumecs) at gauge 120111A – Burdekin River at Lucky Downs (CLOSED) <10.2m³/s (cumecs) at gauge 120118A – Burdekin River at Lake Lucy station (CLOSED) <12.8m³/s (cumecs) at gauge 120121A – Burdekin River at Lake Lucy (CLOSED)**											
		10 (s1)	10 (s1)	180 (s1)	18 (s1)	30 (s1)	5 (s2)	85–110 (s2)	10 (s1)	10 (s1)	6.5–8.5 (s1, s2)	160 (s1)	1 (s1)
		HIGH FLOW ≥35.8 m³/s (cumecs) at gauge 120107B – Burdekin River at Blue Range ≥8.9 m³/s (cumecs) at gauge 120123A – Burdekin River at Valley of Lagoons ≥25.7 m³/s (cumecs) at gauge 120111A – Burdekin River at Lucky Downs (CLOSED) ≥10.2m³/s (cumecs) at gauge 120118A – Burdekin River at Lake Lucy station (CLOSED) ≥12.8m³/s (cumecs) at gauge 120121A – Burdekin River at Lake Lucy (CLOSED)											
		10 (s1)	25 (s1)	690 (s1)	25 (s1)	180 (s1)	ID	85–110 (s2)	190 (s1)	280 (s1)	6.5–8.5 (s1, s2)	110 (s1)	2 (s1)

Water area/type (Source: s1–s4)	Management intent /Level of protection	UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow) **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources											
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**TSS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L as SO_4^{2-})
EASTERN SUB-CATCHMENTS: Camel Creek, Douglas Creek, Fanning River, Keelbottom Creek, Kirk River, Running River, Star River													
HEV and SD waters (national parks, etc.)	**HEV**	Maintain/achieve effectively unmodified water quality (20th, 50th and 80th percentiles of HEV waters), habitat, biota, flow and riparian areas. There is insufficient information available to establish aquatic ecosystem water quality objectives for these waters. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local 20th, 50th and 80th percentiles.											
Camel Creek, Douglas Creek, Fanning River, Keelbottom Ck, Kirk River, Running River, Star River sub-catchment waters (s1, s2)	**MD**	**LOW FLOW <175.9 m³/s (cumecs) at gauge 120002C – Burdekin River at Sellheim <3.7 m³/s (cumecs) at gauge 120102A – Keelbottom Creek at Keelbottom <35.8 m³/s (cumecs) at gauge 120107B – Burdekin River at Blue Range <10.9 m³/s (cumecs) at gauge 120112A – Star River at Laroona <7.7 m³/s (cumecs) at gauge 120120A – Running River at Mount Bradley <5.6m³/s (cumecs) at gauge 120114A – Douglas Creek at Kangaroo Hills (CLOSED) <1.9 m³/s (cumecs) at gauge 120119A – Fanning River at Fanning River (CLOSED)**											
		10 (s1)	10 (s1)	280 (s1)	10 (s1)	15 (s1)	5 (s1)	85–110 (s2)	3 (s1)	4 (s1)	6.5–8.5 (s1, s2)	110 (s1)	2 (s1)
		HIGH FLOW ≥175.9 m³/s (cumecs) at gauge 120002C – Burdekin River at Sellheim ≥3.7 m³/s (cumecs) at gauge 120102A – Keelbottom Creek at Keelbottom ≥35.8 m³/s (cumecs) at gauge 120107B – Burdekin River at Blue Range ≥10.9 m³/s (cumecs) at gauge 120112A – Star River at Laroona ≥7.7 m³/s (cumecs) at gauge 120120A – Running River at Mount Bradley ≥5.6m³/s (cumecs) at gauge 120114A – Douglas Creek at Kangaroo Hills (CLOSED) ≥1.9 m³/s (cumecs) at gauge 120119A – Fanning River at Fanning River (CLOSED)											
		10 (s1)	10 (s1)	270 (s1)	10 (s1)	20 (s1)	5 (s1)	85–110 (s2)	4 (s1)	5 (s1)	6.5–8.5 (s1, s2)	55 (s1)	2 (s1)

Water area/type (Source: s1–s4)	Management intent /Level of protection	UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow) **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources											
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**TSS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L as SO_4^{2-})
WESTERN SUB-CATCHMENTS: Allingham Creek, Basalt River, Clarke River, Dry River, Gray Creek, Hann Creek, Lolworth Creek													
HEV and SD waters (national parks, etc.)	**HEV**	Maintain/achieve effectively unmodified water quality (20th, 50th and 80th percentiles of HEV waters), habitat, biota, flow and riparian areas. There is insufficient information available to establish aquatic ecosystem water quality objectives for these waters. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local 20th, 50th and 80th percentiles.											
Allingham Creek, Basalt River, Clarke River, Dry River, Gray Creek, Hann Creek, Lolworth Creek sub-catchment waters (s1, s2)		**LOW FLOW <175.9 m^3/s (cumecs) at gauge 120002C – Burdekin River at Sellheim <4.4 m^3/s (cumecs) at gauge 120106B – Basalt River at Bluff Downs <44 m^3/s (cumecs) at gauge 120107B – Burdekin River at Blue Range <62.2 m^3/s (cumecs) at gauge 120110A – Burdekin River at Mount Fullstop <3.4m^3/s (cumecs) at gauge 120108B/C – Fletcher Creek at Fletchervale (CLOSED) <9.5 m^3/s (cumecs) at gauge 120113A – Clarke River at Wandovale (CLOSED) <3.3m^3/s (cumecs) at gauge 120115A – Gray Creek at Carter's Mill (CLOSED <0.4 m^3/s (cumecs) at gauge 120116A Maryvale Creek at Maryvale (CLOSED) <2.4m^3/s (cumecs) at gauge 112117A – Wyandotte Creek at Wyandotte (CLOSED) <12.8m^3/s (cumecs) at gauge 120121A – Burdekin River at Lake Lucy (CLOSED)**										
		10 (s1)	10 (s1)	290 (s1)	10 (s1)	40 (s1)	5 (s2)	85–110 (s2)	5 (s1)	6 (s1)	6.5–8.5 (s1, s2)	530 (s1)	2 (s1)
		HIGH FLOW ≥175.9 m^3/s (cumecs) at gauge 120002C – Burdekin River at Sellheim ≥4.4 m^3/s (cumecs) at gauge 120106B – Basalt River at Bluff Downs ≥44 m^3/s (cumecs) at gauge 120107B – Burdekin River at Blue Range ≥62.2 m^3/s (cumecs) at gauge 120110A – Burdekin River at Mount Fullstop ≥3.4m^3/s (cumecs) at gauge 120108B/C – Fletcher Creek at Fletchervale (CLOSED) ≥9.5 m^3/s (cumecs) at gauge 120113A – Clarke River at Wandovale (CLOSED) ≥3.3m^3/s (cumecs) at gauge 120115A – Gray Creek at Carter's Mill (CLOSED ≥0.4 m^3/s (cumecs) at gauge 120116A Maryvale Creek at Maryvale (CLOSED) ≥2.4m^3/s (cumecs) at gauge 112117A – Wyandotte Creek at Wyandotte (CLOSED) ≥12.8m^3/s (cumecs) at gauge 120121A – Burdekin River at Lake Lucy (CLOSED)										
		10 (s1)	75 (s1)	900 (s1)	20 (s1)	270 (s1)	ID	85–110 (s2)	ID	10 (s1)	6.5–8.5 (s1, s2)	140 (s1)	ID

Water area/type (Source: s1–s4)	Management intent /Level of protection	UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow)											
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources											
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**TSS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L as SO_4^{2-})
Lakes / reservoirs including Burdekin Falls Dam (Lake Dalrymple)	**MD**	Note: there is insufficient information available to establish local aquatic ecosystem objectives for lakes/reservoirs. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local water quality objectives. The following are sourced from the QWQG (Central region) regional guidelines.											
		10 (s2)	10 (s2)	350 (s2)	5 (s2)	10 (s2)	5 (s2)	90–110 (s2)	1–20 (s2)	ID (s2)	6.5–8.0 (s2)	270 (s2: Burdekin Bowen zone)	ID

Water area/type (Source: s1–s4)	Management intent /Level of protection	UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow) **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources											
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**TSS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L as SO_4^{2-})
		TOXICANTS (INCLUDING METALS, BIOCIDES)											
HEV, SD fresh waters: **Toxicants** (s3, s4)	**HEV**	• Toxicants (including metals, biocides) in water: refer to 99% species protection values contained in: o ANZG (2018) 'toxicant default guideline values for water quality in aquatic ecosystems', as amended o The following sources, where their guideline values post-date the specified ANZG guideline value, or where there is no ANZG value specified for a toxicant (Note: the ANZG specifies the date of guideline development for each toxicant): ▪ Biocides: King et al (2017, as amended) (vol 1 and 2) *Proposed aquatic ecosystem protection guideline values for pesticides commonly used in the Great Barrier Reef catchment area* (available from Queensland Government publications) • Toxicants in sediments: refer to ANZG 'toxicant default guideline values for sediment quality' • Anti-fouling: Comply with *Anti-fouling and in-water cleaning guidelines* (2015, as amended)										
Fresh waters not mapped as HEV, SD: **Toxicants** (s3, s4)	**SMD**	• Toxicants (including metals, biocides) in water: o Refer to 95% species protection values contained in sources below. Note: refer to 99% species protection values where indicated by ANZG (including for toxicants with bioaccumulation, toxicity effects): ▪ ANZG (2018) 'toxicant default guideline values for water quality in aquatic ecosystems', as amended ▪ The following sources, where their guideline values post-date the specified ANZG guideline value, or where there is no ANZG value specified for a toxicant (Note: the ANZG specifies the date of guideline development for each toxicant) - Biocides: King et al (2017, as amended) (vol 1 and 2) *Proposed aquatic ecosystem protection guideline values for pesticides commonly used in the Great Barrier Reef catchment area* (available from Queensland Government publications) • Toxicants in sediments: refer to ANZG 'toxicant default guideline values for sediment quality' • Anti-fouling: Comply with *Anti-fouling and in-water cleaning guidelines* (2015, as amended)										

Water area/type (Source: s1–s4)	Management intent /Level of protection	UPPER BURDEKIN RIVER SUB-BASIN – FRESH WATERS (refer plan WQ1201) [1–4] Aquatic ecosystem water quality objectives: physico-chemical (low flow and high flow)											
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. 15). For single value WQOs, medians of test data should be less than or equal to the WQO, unless otherwise indicated (refer to section 3.1.1 for more details). HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed. Refer to accompanying plan for details; ID – insufficient data **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: QWQG guidelines and /or data; S3: ANZG (2018); S4: Other sources											
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**TSS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L as SO_4^{2-})
		TEMPERATURE											
Fresh waters (s2)	**All**	Temperature varies daily and seasonally, is depth-dependent and highly site specific. Refer to QWQG for details on how to establish a temperature range (20th – 80th percentiles) based on local waterways not impacted by anthropogenic thermal influence. From an ecological effects perspective, daily maximum temperature and daily variation in temperature are key indicators, and seasonal variations also need to be identified.											
		STATE PLANNING POLICY, RIPARIAN, WETLANDS											
State Planning Policy	**all**	Refer to section 3.2											
Riparian	**all**	Refer to section 3.2											
Wetlands	**all**	Refer to section 3.2 Note: there is insufficient information available to establish local WQOs for wetlands. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local 20th, 50th and 80th percentiles.											

Abbreviations: ANZG – Australian and New Zealand guidelines for fresh and marine water quality; QWQG – Queensland water quality guidelines; ID – insufficient data. Will be updated if information becomes available; HEV – high ecological value; SD – slightly disturbed; MD – moderately disturbed.

Indicators: Amm N – ammonia nitrogen**;** Oxid N – oxidised nitrogen; Total N – total nitrogen; FRP – filterable reactive phosphorus; Total P – total phosphorus; Chl-a – chlorophyll-a; DO – dissolved oxygen; Turb – turbidity; TSS – total suspended solids.

Units: µg/L – micrograms per litre; % sat – percent saturation; NTU – nephelometric turbidity units; mg/L – milligrams per litre; µS/cm – microsiemens/centimetre; m^3/s – cubic metres per second ('cumecs')

Management intent:

Refer to section 2.2.1 of this document for information on management intent. Waters identified as high ecological value (HEV) and slightly disturbed (SD) are identified in column 1 of the table and shown in accompanying plans. WQOs for these waters are provided in the table (where data available). Identification of waters as HEV or SD does not preclude the need for management actions to address historical or

ongoing threats to those values. The management intent (level of protection) for waters other than HEV or SD is to achieve a 'moderately disturbed' (MD) condition, for which corresponding WQOs are shown in the table. For some indicators and water types, WQOs correspond with a 'slightly to moderately disturbed' (SMD) level of protection, based on management intent categories specified in source technical guidelines, in particular the Australian water quality guidelines (ANZG, 2018). This document and accompanying mapping include these within the MD level of protection. For some MD waters a higher level of protection is provided for toxicants (e.g. pesticides) where indicated.

Notes:

1. Nutrients: Ammonia N comprises both un-ionised ammonia (NH_3) and ionised ammonium (NH_4^+). Oxidised N = NO_2 + NO_3. Ammonia N + Oxidised N = Dissolved inorganic N (DIN).

During periods of low flow and particularly in smaller creeks, build-up of organic matter derived from natural sources (e.g. leaf litter) can result in increased organic N levels (generally in the range of 400 to 800µg/L). This may lead to total N values exceeding the WQOs. If levels of inorganic N (Ammonia-N and Oxidised N) remain low, then high values of Total N, due to elevated levels of organic N, should not be seen as an exceedance of the WQOs, provided this is due to natural causes. See QWQG (section 5 and Appendix D) for more information on applying guidelines under high flow conditions.

2. Dissolved oxygen (DO): DO objectives apply to daytime conditions. Lower values will occur at night in most waters. In estuaries, reductions should only be in the region of 10–15 per cent saturation below daytime values. In freshwaters, night-time reductions are more variable. Following significant rainfall events, reduced DO values may occur due to the influx of organic material. In estuaries, post-event values as low as 40 per cent saturation may occur naturally for short periods but values well below this would indicate some anthropogenic effect. In freshwaters, post-event DO reductions are again more variable. In general, DO values consistently less than 50 per cent are likely to impact on the ongoing ability of fish to persist in a water body while short term DO values less than 30 per cent saturation are toxic to some fish species. Very high DO (supersaturation) values can be toxic to some fish as they cause gas bubble disease. DO values for fresh waters should only be applied to flowing waters. Stagnant pools in intermittent streams naturally experience values of DO below 50 per cent saturation.

3. Flow splits (where indicated): WQOs are provided for sub-catchment waters by flow condition (low or high flow) where indicated. Flow thresholds (cubic metres per second: cumecs) for low and high flow WQOs are provided in the table based on nearest available gauging stations to the sub-catchment. If a sample site is located at distance from a gauging station or in an un-gauged sub-catchment, local assessment of flow condition may be required if the provided flow thresholds do not represent local conditions. Further information on determining flow thresholds for WQOs derivation is available from the DES guideline *Deciding aquatic ecosystem indicators and local water quality guidelines,* available from the department's website.

4.Temperature: Temperature varies both daily and seasonally, it is depth dependent and is also highly site specific. It is therefore not possible to provide simple generic WQOs for this indicator for fresh or estuarine waters. (In open coastal/marine waters a WQO based on GBRMPA water quality guidelines is provided.) The recommended approach is that local WQOs be developed. Thus, WQOs for potentially impacted streams should be based on measurements from nearby streams that have similar morphology and which are thought not to be impacted by anthropogenic thermal influences. From an ecological effects perspective, the most important aspects of temperature are the daily maximum temperature and the daily variation in temperature. Therefore measurements of temperature should be designed to collect information on these indicators of temperature and, similarly, local WQOs should be expressed in terms of these indicators. There will be an annual cycle in the values of these indicators and therefore a full seasonal cycle of measurements is required to develop guideline values.

Sources / references:

ANZG (2018, as amended) *Australian and New Zealand guidelines for fresh and marine water quality*.

Australian Government (2015) *Anti-fouling and in-water cleaning guidelines*, Department of Agriculture, Canberra. CC BY 3.0

Department of Environment and Heritage Protection (2009) *Queensland Water Quality Guidelines*, Version 3, ISBN 978-0- 9806986-0-2 (republished July 2013).

Department of Environment and Science (2022) *Guideline: Environmental Protection (Water) Policy 2019 - Deciding aquatic ecosystem indicators and local water quality guidelines*. March.

Department of Environment and Science (2021) *Guideline: Environmental Protection (Water and Wetland Biodiversity) Policy 2019 - Deciding aquatic ecosystem indicators and local water quality guidelines.* April.

Department of Science, Information Technology and Innovation (2017) *Draft environmental values and water quality guidelines: Burdekin River Basin fresh and estuarine waters, draft for consultation*, March

King et al (2017, as amended) Proposed aquatic ecosystem protection guideline values for pesticides commonly used in the Great Barrier Reef catchment area (Parts 1 and 2). Department of Environment and Science. Brisbane, Queensland, Australia (available from Queensland Government publications)

NQ Dry Tropics (2016) *Burdekin Region Water Quality Improvement Plan*, NQ Dry Tropics, Townsville

Unpublished water quality datasets

3.2 Vegetation management and planning provisions

This following is provided for information on habitat management and planning matters. While it is current at time of publication, readers should refer to relevant Queensland websites and legislation to ensure they are referring to current materials.

3.2.1 Riparian vegetation

The clearing of native vegetation in Queensland is regulated by the *Vegetation Management Act 1999*, the *Planning Act 2016* and associated policies and codes. This includes the regulation of clearing within a defined distance of watercourses and drainage features.

For vegetation management relating to waterways, reference should be made to:

- State Development Assessment Provisions (SDAP) State Code 16: Native vegetation clearing. This code requires clearing of native vegetation to meet performance outcomes relating to the protection of wetlands, watercourses and drainage features. The code outlines buffer areas where clearing cannot occur within a specified distance of watercourses or drainage features. If clearing within these buffers cannot be reasonably avoided, an offset must be provided to counterbalance any significant residual impact to a wetland, watercourse or drainage feature. For more information on SDAP State code 16, refer to the Queensland's Planning System website.
- SDAP State Code 9: Great Barrier Reef wetland protection areas
- The relevant Accepted Development Vegetation Clearing Codes (ADVCC) under the *Vegetation Management Act 1999*. These codes allow self-assessable clearing for certain purposes in particular land tenures and regional ecosystems. It is a requirement across all codes for landholders to use best practice methods when clearing vegetation to prevent soil erosion and instability and to prevent increased sediment run-off entering a wetland, watercourse or drainage feature. The codes also contain riparian protection zones to prevent clearing within a defined distance of a wetland, a stream ordered watercourse or a drainage feature. Where a code permits clearing within these areas, there are additional requirements to rehabilitate the area or (for clearing of regulated regrowth vegetation) to legally secure an exchange area to counterbalance the impact. For more information on the ADVCCs and guidance material, refer to the Queensland Government vegetation management and Department of Resources websites.

Clearing of native vegetation in a watercourse may also require a riverine protection permit under the *Water Act 2000*. Further information is available at www.business.qld.gov.au.

Local Government Planning schemes under the *Planning Act 2016* may also specify riparian buffers (for example under catchment protection or waterway codes). Refer to the Queensland's Planning System website and relevant local government websites for further information about planning schemes.

3.2.2 Wetlands

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 defines environmental values for wetlands.

The State assesses impacts from earth works that may have impacts on freshwater wetlands of High Ecological Significance in Great Barrier Reef Catchments against State Development Assessment Provisions (SDAP) State Code 9: Great Barrier Reef wetland protection areas.

This includes performance requirements to ensure:

- adverse effects on hydrology, water quality and ecological processes of a wetland are avoided or minimised
- any significant adverse impacts on matters of state environmental significance and on riparian areas or wildlife corridors in strategic environmental areas are avoided.

3.2.3 Waterways providing for fish passage

Waterway barrier works may inhibit the free movement of fish along waterways and onto floodplains, injure fish or affect fish health and habitat. Many native fish need to access a range of habitats for food, breeding and refuge and move or migrate to complete their lifecycle.

Adequate fish passage must be provided at any proposed waterway barrier. Operational work that is to construct or raise a waterway barrier is assessable development for which a development approval is required under the *Planning Act 2016,* or is accepted development under the *Fisheries (General) Regulation 2019.* Work types that are described as accepted development must comply with the relevant Accepted Development Requirements in all respects. If all requirements are not met, then the development is assessable and must be applied for. The State assesses development applications that may have impacts to fish passage using the State Development Assessment Provisions (SDAP) State code 18: Constructing or raising waterway barrier works in fish habitats. For more information on SDAP State codes, refer to the Queensland's Planning System website.

Performance outcomes for all development include (but are not limited to):

- development does not increase the risk of mortality, disease or injury, or compromise the health, productivity, marketability or suitability for human consumption of fisheries resources, having regard to (but not limited to)
  - biotic and abiotic conditions, such as water and sediment quality
  - substances that are toxic to plants or toxic to or cumulative within fish
- sufficient water exchange and flow is maintained and provided to sustain and where necessary restore, water quality and the health and condition of fisheries resources, ecological functions and fish passage
- development likely to cause drainage or disturbance to acid sulfate soils, prevents the release of contaminants and impacts on fisheries resources and fish habitats.

A waterway providing for fish passage is a matter of state environmental significance under the *Environmental Offsets Act 2014* and an environmental offset may be required for any significant residual impact that is approved.

The Department of Agriculture and Fisheries website contains further information on approvals, accepted development requirements and other aspects relating to waterway barrier works and fish passage.

3.2.4 State planning policy – (state interest – water quality)

The State Planning Policy (SPP) defines the Queensland Government's policies about matters of state interest in land use planning and development (a state interest is defined under the *Planning Act 2016*).

Water quality is a state interest. The SPP (state interest – water quality) seeks to ensure that 'the environmental values and quality of Queensland waters are protected and enhanced'. It includes provisions relating to receiving waters, acid sulfate soils and water supply buffer areas.

The provisions of the SPP are applied through their 'integration' into local government planning schemes. Planning schemes adopt measures prescribed in the SPP that ensure development is planned, designed, constructed and operated to manage stormwater and wastewater in ways that support the protection of environmental values and meet the water quality objectives identified in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019.

This is achieved by compliance with the policy provisions of the SPP (state interest – water quality).

Stormwater management design objectives for construction include developments using measures to manage the velocity of stormwater flows and prevent erosion, sediment, litter and other contaminates entering waterways while construction is occurring. Post construction stormwater management design objectives generally apply to lots over 2500m^2 that results in six or more dwellings or lots. The objectives seek to limit the amount of nutrients and litter, including nitrogen, phosphorus and suspended sediments, entering waterways from the operation of the development.

The SPP is supported by guidance materials which include Integrating state interests in a planning scheme – guidance for local governments (by Department of State Development, Infrastructure, Local Government and Planning). These and other SPP materials are available from the State Planning Policy website. Supplementary guidance is available from the Department of Environment and Science website on post construction phase stormwater management (phase 5b).

WATER QUALITY OBJECTIVES
for
HUMAN USE ENVIRONMENTAL VALUES

4 Water quality objectives for human use environmental values (EVs)

This section outlines water quality objectives (WQOs) to protect human use environmental values (EVs), which comprise those EVs (e.g. recreation, stock watering, aquaculture and crop irrigation) other than the aquatic ecosystem EV. The table in section 2 of this document outlines the EVs that have been identified for different waters. Where a human use EV has been identified, the following tables can be used to identify the WQOs to support that EV. Where more than one EV applies to a given water (for example aquatic ecosystem and recreational use), the adoption of the most stringent WQO for each water quality indicator will then protect all identified EVs. Note that human use WQOs tables in this section are provided for all potentially applicable human use EVs. As the range of human use EVs varies by water, reference to section 2 is required to identify the human use EVs stated for a particular water, from which the corresponding human use WQOs tables in this section can then be identified.

WQOs in this section are, unless otherwise specified, based on relevant national water quality guidelines including ANZG (2018, as amended) and the Australian Drinking Water Guidelines (ADWG). Where national guidelines or other codes remain the primary source for WQOs, reference to those national guidelines or codes is necessary to obtain comprehensive listings of all indicators and corresponding WQOs.

Note that requirements relating to recycled water (e.g. for drinking water and irrigation) are addressed under the *Public Health Act 2005*, Public Health Regulation (2018) and *Water Supply (Safety and Reliability) Act 2008*. Further information, including guideline on low exposure recycled water schemes, is available from the Queensland Health and Business Queensland websites.

4.1 Human use EVs water quality objectives

The following table summarises WQOs for human use EVs. More details are provided in subsequent sections by human use EV.

Table 3 Human use EVs water quality objectives

Environmental value	Water type/area	Water quality objective to protect EV (refer to specified codes and guidelines for full details)
Suitability for drinking water supply	All fresh waters including groundwaters	The Australian Drinking Water Guidelines (NHMRC, 2011, as amended) provides a framework for catchment management and source water protection for drinking water supplies. Quality of raw water (prior to treatment) should consider the requirements of water supply operators, and their capacity to treat the water to make it safe for human consumption. Also refer to Table 4. Whether water is drawn from surface catchments or underground sources, it is important that the local catchment or aquifer is understood, and that the activities that could lead to water contamination are identified and managed. See the *State Planning Policy 2017* and the interactive mapping system for assessment benchmarks around development in water supply buffer areas. Effective catchment management and source water protection include development of a catchment management plan, with the commitment of land use planning authorities to prevent inappropriate development and to enforce relevant planning regulations. Note: For water quality after treatment or at point of use refer to legislation and guidelines, including: • *Public Health Act 2005* and Regulation (2018), • *Water Supply (Safety and Reliability) Act 2008*, including the relevant drinking water quality management plan and, where applicable, the recycled water management plan for augmenting a drinking water supply under the Act and the published Drinking Water Quality Management Plan Guideline • *Water Fluoridation Act 2008* and Regulation (2020) • *Australian Drinking Water Guidelines* (ADWG, 2011, as amended). • Safe Water on Rural Properties (Queensland Health, 2015)

Environmental value	Water type/area	Water quality objective to protect EV (refer to specified codes and guidelines for full details)
Protection of the human consumer for oystering	Estuarine and coastal waters	As per ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended. (refer Food Standards Australia New Zealand website)
Protection of the human consumer	Fresh waters, estuarine and coastal waters	As per ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended. (refer Food Standards Australia New Zealand website)
Protection of cultural and spiritual values	Fresh waters (including groundwaters), estuarine and coastal waters	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.
Suitability for industrial use	Fresh waters, estuarine and coastal waters	None provided. Water quality requirements for industry vary within and between industries. The ANZG do not provide guidelines to protect industries, and indicate that industrial water quality requirements need to be considered on a case-by-case basis. This EV is usually protected by other values, such as the aquatic ecosystem EV.
Suitability for aquaculture	Fresh waters, estuarine and coastal waters	As per: • Tables 5–7 • ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended
Suitability for irrigation	All fresh waters including groundwaters	Pathogens and metal WQOs are provided in Tables 8 and 9 (based on ANZG). For all other indicators, such as salinity, sodicity, sodium adsorption ratio (SAR), and herbicides, refer ANZG.
Suitability for stock watering	All fresh waters including groundwaters	As per ANZG, including median faecal coliforms <100 organisms per 100 mL. For total dissolved solids and metals, refer Tables 10 and 11, based on ANZG. For other indicators, such as cyanobacteria and pathogens, see ANZG.
Suitability for farm supply/use	All fresh waters including groundwaters	As per ANZG. Also refer to Safe Water on Rural Properties (Queensland Health, 2015)
Suitability for primary contact recreation	Fresh waters, estuarine and coastal waters	Note: at time of publication the NHMRC guidelines for recreational water quality were under review, and updates may supersede the following. Refer to NHMRC website for latest information and updated guidelines. As per NHMRC (2008 – refer NHMRC website) including: • water free of physical (floating and submerged) hazards. Where permanent hazards exist (e.g. rips and sandbars), appropriate warning signs should be clearly displayed. • temperature range: 16–34°C • pH range: 6.5–8.5 • DO: >80% • faecal contamination: designated recreational waters are protected against direct contamination with fresh faecal material, particularly of human or domesticated animal origin. Two principal components are required for assessing faecal contamination: - assessment of evidence for the likely influence of faecal material - counts of suitable faecal indicator bacteria (usually *enterococci*) These two components are combined to produce an overall microbial classification of the recreational water body. • direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of, or protected from, venomous organisms (e.g. box jellyfish and bluebottles) • waters contaminated with chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable for recreational purposes. Also refer to Safe Water on Rural Properties (Queensland Health, 2015)

Environmental value	Water type/area	Water quality objective to protect EV (refer to specified codes and guidelines for full details)
Suitability for primary contact recreation	Fresh waters	Note: at time of publication the NHMRC guidelines for recreational water quality were under review, and updates may supersede the following. Refer to NHMRC website for latest information and updated guidelines. • cyanobacteria/algae: Recreational water bodies should not contain: - level 1[1]: ≥ 10 µg/L total microcystins; or ≥ 50 000 cells/mL toxic *Microcystis aeruginosa*; or biovolume equivalent of ≥ 4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume or - level 2[1]: ≥ 10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present - where *Cylindrospermopsis caciborskii* is the dominant species present, advice should be sought for an appropriate guideline for cylindrospermopsin or - cyanobacterial scums consistently present. Further details are contained in NHMRC (2008) and section 4.6 (Table 12). Also refer to Safe Water on Rural Properties (Queensland Health, 2015)
	Estuarine, coastal waters	• cyanobacteria/algae: Recreational water bodies should not contain ≥ 10 cells/mL *Karenia brevis* and/or have *Lyngbya majuscula* and/or *Pfiesteria* present in high numbers[2]. Further details are contained in NHMRC (2008) and section 4.6 (Table 12).
Suitability for secondary contact recreation	Fresh waters, estuarine and coastal waters	As per NHMRC (2008), including: • intestinal enterococci: refer primary recreation above • cyanobacteria/algae—refer primary recreation, NHMRC (2008) and section 4.6 (Table 12).
Suitability for visual recreation	Fresh waters, estuarine and coastal waters	As per NHMRC (2008), including: • recreational water bodies should be aesthetically acceptable to recreational users. The water should be free from visible materials that may settle to form objectionable deposits; floating debris, oil, scum and other matter; substances producing objectionable colour, odour, taste or turbidity; and substances and conditions that produce undesirable aquatic life. • cyanobacteria/algae—see, NHMRC (2008) and section 4.6 (Table 12).

Notes:

1. Level 1 recognises the probability of adverse health effects from ingestion of known toxins, in this case based on the toxicity of microcystins. Level 2 covers circumstances in which there are very high cell densities of cyanobacterial material, irrespective of the presence of toxicity or known toxins. Increased cyanobacterial densities increase the likelihood of non-specific adverse health outcomes, principally respiratory, irritation and allergy symptoms. (NHMRC, 2008; 8).
2. The NHMRC states that its guidelines are concerned 'only with risks that may be associated with recreational activities in or near coastal and estuarine waters. This includes exposure through dermal contact, inhalation of sea-spray aerosols and possible ingestion of water or algal scums, but does not include dietary exposure to marine algal toxins.' (NHMRC, 2008; 121).

Sources:

The WQOs were determined from a combination of sources, including:

- Technical review and advice from Queensland Health and Department of Regional Development, Manufacturing and Water (2020-2022)
- Australian Drinking Water Guidelines (NHMRC, 2011, as amended), available from NHMRC website
- Australia New Zealand Food Standards Code (Australian Government: Food Standards Australia New Zealand), available from Food Standards Australia New Zealand website
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018, as amended)
- Guidelines for Managing Risks in Recreational Water (NHMRC, 2008, as amended), available from NHMRC website. At time of publication the NHMRC guidelines were under review. Refer to NHMRC website for latest information and updated guidelines.
- Safe Water on Rural Properties (Queensland Health, 2015)

4.2 Drinking water EV water quality objectives

Table 4 Drinking water EV: Priority water quality objectives for drinking water supply in the vicinity of off-takes, including groundwater, before treatment

Indicator	Water quality objective [1]
Giardia	No guideline value set due to the lack of a routine method to identify human infectious strains in drinking water. A multiple barrier approach from catchment to tap is recommended to minimise the risk of *Giardia* contamination. Protection of catchments from human and animal wastes is a priority. Operation of barriers should be monitored to ensure effectiveness (ADWG). If *Giardia* is detected in treated drinking water then the Water Supply Regulator, DRDMW must and Queensland Health should be notified immediately and an investigation of the likely source of contamination undertaken.
Cryptosporidium	No guideline value set due to the lack of a routine method to identify human infectious strains in drinking water. A multiple barrier approach from catchment to tap is recommended to minimise the risk of *Cryptosporidium* contamination. Protection of catchments from human and animal wastes is a priority. Operation of barriers should be monitored to ensure effectiveness (ADWG). If *Cryptosporidium* is detected in treated drinking water then the Water Supply Regulator, DRDMW must and Queensland Health should be notified immediately and an investigation of the likely source of contamination undertaken.
E. coli	Well designed treatment plants with effective treatment barriers and disinfection are designed to address faecal contamination. *E. coli* or thermotolerant coliforms should not be present in any 100 mL sample of (treated) drinking water (ADWG). If *E. coli* is detected in treated drinking water, the Water Supply Regulator, DRDMW must and Queensland Health should be notified immediately and an investigation of the likely source of contamination undertaken.
Algal toxin	<1.3 µg/L Microcystin (ADWG)
pH	6.5–8.5 (ADWG)
Total dissolved solids (TDS)	<600mg/L The concentration of total dissolved solids in treated drinking water should not exceed 600 mg/L (ADWG, based on taste considerations).
Sodium	General [2]: The concentration of sodium in reticulated drinking water supplies should not exceed 180 mg/L (ADWG, based on threshold at which taste becomes appreciable). At-risk groups (medical) [2]: The concentration of sodium in water supplies for at-risk groups should not exceed 20 mg/L (ADWG).
Sulfate	The concentration of sulfate in drinking water should not exceed 250 mg/L (ADWG), based on taste/aesthetic considerations. ADWG health guideline: <500mg/L
Dissolved oxygen	>85% saturation (ADWG)
Pesticides	With good water quality management practices, pesticides should not be detected in source waters used for drinking water supplies (ADWG). Raw supplies: Refer to ADWG. Treated drinking water: Refer to ADWG.

Indicator	Water quality objective [1]
PFAS	Per- and poly-fluoroalkyl substances (PFAS) are manufactured chemicals that do not occur naturally in the environment. PFAS chemicals include perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) amongst a large group of other compounds. PFAS are persistent in the environment, show the potential for bioaccumulation and biomagnification, and are toxic in animal studies (potential developmental, reproductive and systemic toxicity). (ADWG)
PFOS+PFHxS	<0.07 µg/L (ADWG health guideline).
PFOA	<0.56 µg/L (ADWG health guideline).
Other indicators (including physico-chemical indicators)	Refer to ADWG.

Source: Australian Drinking Water Guidelines (NHMRC, 2011, as amended). Technical review and advice from Queensland Health and Department of Regional Development, Manufacturing and Water (2020-2022).

Notes:

1. This table outlines WQOs for water **before treatment**, unless otherwise stated (e.g. ADWG). For water quality after treatment or at the point of use, refer to relevant legislation and guidelines, including *Public Health Act 2005* and Regulation, *Water Supply (Safety and Reliability) Act 2008 and* Regulation, including any approved drinking water management plan under the Act, *Water Fluoridation Act 2008*, the Australian Drinking Water Guidelines (ADWG, 2011, as amended), and the Safe Water on Rural Properties guideline (Queensland Health, 2015).
2. The ADWG notes that 50 mg/L is a '*typical value*' in reticulated supplies. The ADWG value for sodium is 180 mg/L (based on level at which taste become appreciable) however '*sodium salts cannot be easily removed from drinking water*' and '*any steps to reduce sodium concentrations are encouraged'*. It further notes that '*medical practitioners treating people with severe hypertension or congestive heart failure should be aware if the sodium concentration in the patient's drinking water exceeds 20 mg/L*' (ADWG; sodium factsheet).

4.3 Aquaculture EV water quality objectives

The following tables outline WQOs for aquaculture, depending on water type and species.

Table 5 Aquaculture EV: General water quality objectives for tropical aquaculture

Water parameter	Recommended range		Water parameter	Recommended range
	Fresh water	Marine		General aquatic
Dissolved oxygen	>4 mg/L	>4 mg/L	**Arsenic**	<0.05 mg/L
Temperature	21–32˚C	24–33˚C	**Cadmium**	<0.003 mg/L
pH	6.8–9.5	7–9.0	**Calcium/Magnesium**	10–160 mg/L
Ammonia (TAN, total ammonia-nitrogen)	<1.0 mg/L	<1.0 mg/L	**Chromium**	<0.1 mg/L
Ammonia (NH_3, un-ionised form)	<0.1 mg/L	<0.1 mg/L	**Copper**	<0.006 mg/L in soft water
Nitrate (NO_3)	1–100 mg/L	1–100 mg/L	**Cyanide**	<0.005 mg/L
Nitrite (NO_2)	<0.1 mg/L	<1.0 mg/L	**Iron**	<0.5 mg/L
Salinity	0–5 psu	15–35 psu	**Lead**	<0.03 mg/L
Hardness	20–450 mg/L	ID	**Manganese**	<0.01 mg/L
Alkalinity	20–400 mg/L	>100 mg/L	**Mercury**	<0.00005 mg/L
Turbidity	<80 NTU	ID	**Nickel**	<0.01 mg/L in soft water <0.04 mg/L in hard water
Chlorine	<0.003 mg/L	ID	**Tin**	<0.001 mg/L
Hydrogen sulphide	<0.002 mg/L	ID	**Zinc**	0.03–0.06 mg/L in soft water 1–2 mg/L in hard water

Indicator: psu – practical salinity unit, NTU - nephelometric turbidity units, ID – Insufficient data

Note: The table provides indicative water requirements for a range of aquaculture species (fresh and/or marine), recognising that not all listed species will occur in a given area, and that potential exists for changes in species under culture.

Source: Department of Primary Industries and Fisheries—Water Quality in Aquaculture—DPI Notes April 2004 (as amended) and DAF 2019-2020 technical review and advice.

Table 6 Aquaculture EV: Water quality objectives for optimal growth of particular freshwater species

WATER QUALITY TARGET VALUES FOR AQUACULTURE						
Water parameter	Barramundi	Eel	Silver perch	Jade perch	Sleepy cod	Red-claw
Dissolved oxygen	4–9 mg/L	>3 mg/L	>4 mg/L	>3 mg/L	>4.0 mg/L	>4.0 mg/L
Temperature	26–32˚C	23–28˚C	23–28˚C	23–28˚C	22–31˚C	23–31˚C
pH	7.5–8.5	7.0–8.5	6.5–8.5	6.5–8.5	7.0–8.5	7.0–8.5
Ammonia (TAN, Total ammonia–nitrogen)	ID	<1.0 mg/L	ID	ID	<1.0 mg/L	<1.0 mg/L
Ammonia (NH_3, un–ionised form)	<0.46 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Nitrate (NO_3)	ID	ID	<100 mg/L	ID	ID	ID
Nitrite (NO_2)	<1.5 mg/L	<1.0 mg/L	<0.1 mg/L	ID	<1.0 mg/L	<1.0 mg/L
Salinity (extended periods)	0–35 psu	ID	<5 psu	<5 psu	ID	<4 psu
Salinity bath (short term treatment)	0–35 psu	ID	5–10 psu for 1 hour	ID	max. 20 psu for 1 hour	ID
Hardness ($CaCO_3$)	50-100 mg/L	ID	>50 mg/L	>50 mg/L	>40 mg/L	>40 mg/L
Alkalinity	>50 mg/L	ID	100–400 mg/L	100–400mg/L	>40 mg/L	>40 mg/L
Chlorine	<0.04 mg/L	ID	ID	ID	<0.04 mg/L	ID
Hydrogen sulphide	<0.3 mg/L	ID	ID	ID	<0.3 mg/L	ID
Iron	<0.1 mg/L	ID	<0.5 mg/L	<0.5 mg/L	<0.1 mg/L	<0.1 mg/L
Spawning temperature	marine	ID	23–28	23–28	>24 for more than 3 days	ID

Indicator: psu – practical salinity unit, ID – Insufficient data

Note: The table provides indicative water requirements for a range of aquaculture species (fresh and/or marine), recognising that not all listed species will occur in a given area, and that potential exists for changes in species under culture.

Source: Department of Primary Industries and Fisheries—Water Quality in Aquaculture—DPI Notes April 2004 (as amended) and DAF 2019-2020 technical review and advice.

Table 7 Aquaculture EV: Water quality objectives for optimal growth of particular marine species

Water parameter	Barramundi		Black tiger prawn (*Penaeus monodon*)	
	Hatchery	**Grow out**	**Hatchery**	**Grow out**
Dissolved oxygen	saturation	>4 mg/L	>4 mg/L	>3.5 mg/L
Temperature	28–30˚C optimum 25–31˚C range	28–30˚C optimum	28-30˚C	26–32˚C
pH	approx. 8	approx. 8	7.8-8.2	7.5–8.5
Ammonia (TAN, total ammonia-nitrogen)	ID	0.1–0.5 mg/L	ID	<3 mg/L
Ammonia (NH_3, un-ionised form)	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Nitrate (NO_3)	<1.0 mg/L	<1.0 mg/L	<1.0 mg/L	<1.0 mg/L
Nitrite (NO_2)	<0.2 mg/L	<1.0 mg/L	<0.2 mg/L	<0.2 mg/L
Salinity	28–31psu	0–35psu	30-35psu	10–25 psu optimum
Alkalinity	ID	105–125 mg/L $CaCO_3$	ID	>80 mg/L
Clarity	ID	<10mg/L	ID	30–40cm secchi disk
Hydrogen sulphide	ID	<0.3 mg/L	<0.1 mg/L	<0.1 mg/L
Iron	ID	<0.02 mg/L	<1 mg/L	<1.0 mg/L
Spawning temperature	ID	28–32˚C	ID	27–32˚C

Indicator: psu – practical salinity unit, ID – Insufficient data

Note: The table provides indicative water requirements for a range of aquaculture species (fresh and/or marine), recognising that not all listed species will occur in a given area, and that potential exists for changes in species under culture.

Source: Department of Primary Industries and Fisheries—Water Quality in Aquaculture—DPI Notes April 2004 (as amended) and DAF 2019-2021 technical review and advice.

4.4 Irrigation EV water quality objectives

The following tables outline WQOs for irrigation, based on relevant national guidelines. The tables relate to water sourced from Queensland waters, rather than a potable water source or from a treated effluent source, for which a range of national and state guidance material is available. Note that requirements relating to recycled water are addressed under the *Public Health Act 2005*, Public Health Regulation (2018) and *Water Supply (Safety and Reliability) Act 2008*. Further information on recycled water is available from the Queensland Health and Business Queensland websites.

Specific guidelines for irrigation of public spaces with water sourced from Queensland waters are not available, though guidance on microbial quality and managing risks can be taken from the 'Guideline for low-exposure recycled water schemes' (available from the Queensland Health website).

Note that at time of publication of this document, national irrigation water quality guidelines are under review as part of ANZG (2018, as amended), and readers should refer to the ANZG website for the most up-to-date version.

The values in the following tables pertain to water suitability for irrigation with regard to criteria such as maintaining soil quality, plant phytotoxicity, minimisation of toxic metal update into food crops, and impact on farm infrastructure (ANZECC 2000, Section 9.2.5.1). These guideline values are not set to account for effects on aquatic ecosystems in source waters, or human health impacts of contact with the water. For these, reference should be made to relevant WQOs for aquatic ecosystem protection, and WQOs for other human use EVs elsewhere in this document. For safety of food for human consumption, refer to Food Standards Australia New Zealand.

The water quality objective values for thermotolerant coliforms in irrigation water are sourced from Section 4.2.3 of ANZECC 2000 Vol 1. As values may have been updated since time of publication, readers should refer to the ANZG 2018 website for the most up-to-date values to be applied as objectives.

Table 8 Irrigation EV: Water quality objectives for thermotolerant (faecal) coliforms in irrigation waters used for food and non-food crops[1]

Intended use	Median values of thermotolerant coliforms (colony forming units—cfu)[2]
Raw human food crops in direct contact with irrigation water (e.g. via sprays, irrigation of salad vegetables)	<10 cfu/100 mL
Raw human food crops not in direct contact with irrigation water (edible product separated from contact with water, e.g. by peel, use of trickle irrigation); or crops sold to consumers cooked or processed	<1000 cfu/100 mL
Pasture and fodder for dairy animals (without withholding period)	<100 cfu/100 mL
Pasture and fodder for dairy animals (with withholding period of five days)	<1000 cfu/100 mL
Pasture and fodder (for grazing animals except pigs and dairy animals, such as cattle, sheep and goats)	<1000 cfu/100 mL
Silviculture, turf, cotton, etc. (restricted public access)	<10 000 cfu/100 mL

Notes:

1. Adapted from ARMCANZ, ANZECC and NHMRC (2000).
2. Refer to ANZECC (2000), Volume 1, Section 4.2.3.3 for advice on testing protocols.

Source: ANZECC (2000), Volume 1, Section 4.2.3.3, Table 4.2.2. Refer to ANZG (2018, as amended) for updates to irrigation guidelines.

Table 9 Irrigation EV: Water quality objectives for heavy metals and metalloids in agricultural irrigation water— soil cumulative contamination loading limit (CCL), long-term trigger value (LTV) and short-term trigger value (STV)[1]

The water quality objectives for heavy metals and metalloids for soil cumulative load and irrigation water quality provided in the following table are sourced from Section 9.2.5 of ANZECC 2000 Vol 3. As values may have been updated since the time of publication, readers should refer to the ANZG 2018 website for the most up-to-date values to be applied as objectives.

Element	Soil cumulative contaminant loading limit (CCL)[2] (kg/ha)	Long-term trigger value (LTV) in irrigation water (up to 100 years) (mg/L)	Short-term trigger value (STV) in irrigation water (up to 20 years) (mg/L)
Aluminium	ND[2]	5	20
Arsenic	20	0.1	2.0
Beryllium	ND	0.1	0.5
Boron	ND	0.5	Refer to ANZECC, Vol 3, Table 9.2.18
Cadmium	2	0.01	0.05
Chromium	ND	0.1	1
Cobalt	ND	0.05	0.1
Copper	140	0.2	5
Fluoride	ND	1	2
Iron	ND	0.2	10
Lead	260	2	5
Lithium	ND	2.5 (0.075 for citrus crops)	2.5 (0.075 for citrus crops)
Manganese	ND	0.2	10
Mercury	2	0.002	0.002
Molybdenum	ND	0.01	0.05
Nickel	85	0.2	2
Selenium	10	0.02	0.05
Uranium	ND	0.01	0.1
Vanadium	ND	0.1	0.5
Zinc	300	2	5

Notes:

1. Concentrations in irrigation water should be less than the trigger values. Trigger values should only be used in conjunction with information on each individual element and the potential for off-site transport of contaminants (refer ANZECC, Volume 3, Section 9.2.5).

2. ND = Not determined; insufficient background data to calculate CCL.

Source: ANZECC (2000), Volume 1, Section 4.2.6, Table 4.2.10. Refer to ANZG (2018, as amended) for updates to irrigation guidelines.

4.5 Stock watering EV water quality objectives

The following tables outline WQOs for stock watering, according to stock type (cattle, sheep etc.) for salinity (Table 10) and metals and metalloids (Table 11). These are sourced from sections 4.3.3 and 4.3.4 of ANZECC 2000 Vol 1. The source material should be referred to for additional relevant water quality parameters and guideline values for stock watering. Note that at time of publication of this document, national stock watering guidelines are under review as part of ANZG (2018, as amended), and readers should refer to the ANZG website for the most up-to-date values to be applied as objectives.

Table 10 Stock watering EV: Water quality objectives for tolerances of livestock to salinity, as total dissolved solids, in drinking water[1]

Livestock	Total dissolved solids (TDS) (mg/L)		
	No adverse effects on animals expected.	Animals may have initial reluctance to drink or there may be some scouring, but stock should adapt without loss of production	Loss of production and decline in animal condition and health would be expected. Stock may tolerate these levels for short periods if introduced gradually
Beef cattle	0–4000	4000–5000	5000–10 000
Dairy cattle	0–2500	2500–4000	4000–7000
Sheep	0–5000	5000–10 000	10 000–13 000[2]
Horses	0–4000	4000–6000	6000–7000
Pigs	0–4000	4000–6000	6000–8000
Poultry	0–2000	2000–3000	3000–4000

Notes:

1. From ANZECC (1992), adapted to incorporate more recent information.

2. Sheep on lush green feed may tolerate up to 13 000 mg/L TDS without loss of condition or production.

Source: ANZECC (2000), Volume 1, Section 4.3.3.5, Table 4.3.1. Note that a review of stock watering tolerances under the ANZG (2018) may lead to revised values from those in this table. Refer to ANZG (2018, as amended) for further details.

Table 11 Stock watering EV: Water quality objectives (low risk trigger values) for heavy metals and metalloids in livestock drinking water

Metal or metalloid	Trigger value (low risk)[1,2] (mg/L)
Aluminium	5
Arsenic	0.5 (up to 5[3])
Beryllium	ND
Boron	5
Cadmium	0.01
Chromium	1
Cobalt	1
Copper	0.4 (sheep), 1 (cattle), 5 (pigs), 5 (poultry)
Fluoride	2
Iron	not sufficiently toxic
Lead	0.1
Manganese	not sufficiently toxic
Mercury	0.002
Molybdenum	0.15
Nickel	1
Selenium	0.02
Uranium	0.2
Vanadium	ND
Zinc	20

Notes:

1. Higher concentrations may be tolerated in some situations (further details provided in ANZECC (2000), Volume 3, Section 9.3.5).
2. ND = not determined, insufficient background data to calculate.
3. May be tolerated if not provided as a food additive and natural levels in the diet are low.

Source: ANZECC (2000), Volume 1, Section 4.3.4, Table 4.3.2. Note that a review of stock watering tolerances under the ANZG (2018) may lead to revised values from those in this table. Refer to ANZG (2018, as amended) for further details.

4.6 Recreation EV water quality objectives - cyanobacteria

When cyanobacteria are present in large numbers they can present a significant hazard, particularly to primary contact users of waters. Water quality guidelines for cyanobacteria in recreational waters are provided below. Monitoring and action requirements relative to cyanobacteria 'alert' levels are summarised below, and are explained more fully in the Guidelines for Managing Risks in Recreational Water (NHMRC, 2008). Further details on the process to determine suitability of waters for recreation, relative to historical cyanobacterial levels and susceptibility to cyanobacterial contamination, are contained in sections 6 and 7 of the NHMRC guidelines.

Note: at time of publication the NHMRC guidelines for recreational water quality were under review, and updates may supersede the following. Refer to NHMRC website for latest information and updated guidelines.

Table 12 Recreational waters: Alert levels and corresponding actions for management of cyanobacteria

Green level surveillance mode[1]	Amber level alert mode[1]	Red level action mode[1]
Fresh waters		
≥ 500 to <5000 cells/mL *M. aeruginosa* or biovolume equivalent of >0.04 to <0.4 mm^3/L for the combined total of all cyanobacteria.	≥ 5000 to <50 000 cells/mL *M. aeruginosa* or biovolume equivalent of ≥ 0.4 to <4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume[2]. or[3] ≥ 0.4 to <10 mm^3/L for the combined total of all cyanobacteria where known toxin producers are not present.	Level 1 guideline[4]: ≥ 10 µg/L total microcystins or ≥ 50 000 cells/mL toxic *M. aeruginosa* or biovolume equivalent of ≥ 4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume. or[3] Level 2 guideline[4]: ≥ 10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present. or cyanobacterial scums are consistently present[5].
Coastal and estuarine waters		
Karenia brevis		
≤ 1 cell/mL	> 1– < 10 cells/mL	≥ 10 cells/mL
Lyngbya majuscula, Pfiesteria spp.		
History but no current presence of organism	Present in low numbers	Present in high numbers. (For *Lyngbya majuscula* this involves the relatively widespread visible presence of dislodged algal filaments in the water and washed up onto the beach)
Nodularia spumigena: See NHMRC, Chapter 6 (Cyanobacteria and algae in fresh water) for details.		

Notes:

1. Recommended actions at different alert levels are outlined below (based on NHMRC, 2008, Table 6.6—fresh waters. Similar actions are outlined for coastal/estuarine waters in NHMRC Table 7.6):

   a. **Green**: Regular monitoring. Weekly sampling and cell counts at representative locations in the water body where known toxigenic species are present (i.e. *Microcystis aeruginosa, Anabaena circinalis, Cylindrospermopsis raciborskii, Aphanizomenon ovalisporum, Nodularia spumigena*); or fortnightly for other types including regular visual inspection of water surface for scums.

   b. **Amber**: Notify agencies as appropriate. Increase sampling frequency to twice weekly at representative locations in the water body where toxigenic species (above) are dominant within the alert level definition (i.e. total biovolume) to establish population growth and spatial variability in the water body. Monitor weekly or fortnightly where other types are dominant. Make regular visual inspections of water surface for scums. Decide on requirement for toxicity assessment or toxin monitoring.

   c. **Red**: Continue monitoring as for (amber) alert mode. Immediately notify health authorities for advice on health risk. ('In action mode the local authority and health authorities warn the public of the existence of potential health risks; for example, through the media and the erection of signs by the local authority.' NHMRC, 2008; 114). Make toxicity assessment or toxin measurement of water if this has not

already been done. Health authorities warn of risk to public health (i.e. the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).

2. The definition of 'dominant' is where the known toxin producer comprises 75 per cent or more of the total biovolume of cyanobacteria in a representative sample.
3. This applies where high cell densities or scums of 'non toxic' cyanobacteria are present i.e. where the cyanobacterial population has been tested and shown not to contain known toxins (mycrocystins, nodularian, cylindrospermopsin or saxitoxin).
4. Health risks and levels: Level 1 is developed to protect against short-term health effects of exposure to cyanobacterial toxins ingested during recreational activity, whereas the Level 2 applies to the circumstance where there is a probability of increased likelihood of non-specific adverse health outcomes, principally respiratory, irritation and allergy symptoms, from exposure to very high cell densities of cyanobacterial material irrespective of the presence of toxicity or known toxins (NHMRC, 2008;114).
5. This refers to the situation where scums occur at the recreation site each day when conditions are calm, particularly in the morning. Note that it is not likely that scums are always present and visible when there is a high population as the cells may mix down with wind and turbulence and then reform later when conditions become stable.

Source: Based on NHMRC (2008) Guideline for Managing Risks in Recreational Water (tables 6.2, 6.6, 7.3).

5 Ways to improve water quality

The following sources are relevant in considering ways to improve water quality. The list below is additional to the plans, guidelines and other sources referred to in previous sections, **and is provided for information only**.

Local plans, studies

- Council planning schemes and supporting codes, policies, available from council websites

Regional plans, studies

- North Queensland Regional Plan
- Burdekin Region Water Quality Improvement Plan (WQIP, 2016), available from the NQ Dry Tropics

State plans, policies, guidelines, agreements

- Burdekin Basin Water Plan
- State Planning Policy (state interest – water quality)
- Queensland Coastal Management Plan
- Reef 2050 Long-term Sustainability Plan
- Reef 2050 Water Quality Improvement Plan

Water quality guidelines

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)
- Queensland Water Quality Guidelines (QWQG)
- Queensland Monitoring and Sampling Manual
- Water quality guidelines for the Great Barrier Reef Marine Park 2010, available on the Great Barrier Reef Marine Park Authority's website

Other supporting technical information

- Information on PFAS in Queensland, including access to PFAS national environmental management plan
- Salinity Management Handbook – available on the Queensland Government Publications website
  - Chapter 10 – Waters
  - Chapter 11 – Water Quality
- Soil conservation guidelines for Queensland – available on the Queensland Government Publications website
  - Chapter 10 – Land management on flood plains
  - Chapter 11 – Stream stability
  - Chapter 13 – Gully Erosion
- Fish habitat guidelines available from the DAF website, including Design of stream crossings (FHG 001), Restoration of fish habitats: Marine areas (FHG 002), Fish habitat buffer zones (FHG 003), and Mangrove nurseries: Construction, propagation and planting (FHG 004)
- Department of Environment and Science, Queensland (2021) Treatment systems, Wetland*Info* website, accessed 18 June 2022
- Farming in the Great Barrier Reef catchments | Business Queensland
- Healthy Waterways Incorporated – Water by Design: resources and information available on the Water by Design website, including content on the Reef Urban Stormwater Management Improvement Group (RUSMIG)

6 Dictionary

AMTD means the adopted middle thread distance which is the distance in kilometres, measured along the middle of a watercourse, that a specific point in the watercourse is from the watercourse's mouth or junction with the main watercourse (definition based on Water Regulation 2002).

ANZECC means the Australian and New Zealand Environment and Conservation Council.

ANZECC Guidelines mean the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (recently updated to become ANZG, 2018), prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

Aquatic ecosystem (defined in the ANZG) any watery environment from small to large, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment.

Aquatic ecosystem (defined in the EPP (Water and Wetland Biodiversity)) means a community of organisms living within or adjacent to water, including riparian or foreshore areas.

Basin means the basin name and number provided by Geoscience Australia, Canberra (3rd edition, 2004).

Biological Integrity (defined in the EPP (Water and Wetland Biodiversity)) for water or a wetland, means the ability of the water or wetland to support and maintain a balanced, integrative, adaptive community of organisms having a species composition, diversity and functional organisation comparable to that of the natural habitat of the locality in which the water or wetland is situated.

Catchment means the total area draining into a river, creek, reservoir or other body of water. The limits of a given catchment are the heights of land (such as hills or mountains) separating it from neighbouring catchments. Catchments can be made up of smaller sub-catchments.

Ecological integrity (health) (defined in the ANZG) means the 'health' or 'condition' of an ecosystem. The ability of an ecosystem to support and maintain key ecological processes and organisms so that their species compositions, diversity and functional organisations are as comparable as possible to those occurring in natural habitats within a region.

Environmental value (EV) means:

(a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or

(b) another quality of the environment identified and declared to be an environmental value under an Environmental Protection Policy or Regulation (e.g. water suitable for swimming in or drinking).

The EVs for water that can be identified for protection are outlined in the accompanying table.

Highest astronomical tide (HAT) (defined in Marine Parks (Declaration) Regulation 2006) means the highest level of the tides that can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.

High water mark (defined in *Coastal Protection and Management Act 1995*) means the ordinary high water mark at spring tides.

Mean high water spring refer high water mark.

Queensland waters (as defined in *Acts Interpretation Act 1954*): means all waters that are a) within the limits of the state; or b) coastal waters of the state.

Sub-basin means part of a basin.

Sub-catchment means part of a catchment.

Toxicant (defined in the ANZG): means a substance capable of producing an adverse response (effect) in a biological system, which may seriously injure structure or function or produce death at sufficiently high concentration.

Table 13 Environmental values that can be identified for protection

Environmental values and definitions	ICON (as shown on plans)
Aquatic ecosystem 'A community of organisms living within or adjacent to water, including riparian or foreshore area.' (EPP (Water and Wetland Biodiversity), schedule 2 - Dictionary) The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species (such as turtles, platypus, seagrass and dugongs) and their habitat, food and drinking water. Waterways include perennial and intermittent surface waters, groundwaters, tidal and non-tidal waters, lakes, storages, reservoirs, dams, wetlands, swamps, marshes, lagoons, canals, natural and artificial channels and the bed and banks of waterways. (This EV incorporates the 'wildlife habitat' EV used in the South East Queensland Regional Water Quality Management Strategy). See below for more details on aquatic ecosystems, based on the EPP (Water and Wetland Biodiversity).	
High ecological/conservation value waters 'Waters in which the biological integrity of the water is effectively unmodified or highly valued.' (EPP (Water and Wetland Biodiversity), schedule 2).	None
Slightly disturbed waters 'Waters that have the biological integrity of high ecological value waters with slightly modified physical or chemical indicators but effectively unmodified biological indicators.' (EPP (Water and Wetland Biodiversity), schedule 2).	None
Moderately disturbed waters 'Waters in which the biological integrity of the water is adversely affected by human activity to a relatively small but measurable degree.' (EPP (Water and Wetland Biodiversity), schedule 2).	None
Highly disturbed waters 'Waters that are significantly degraded by human activity and have lower ecological value than high ecological value waters or slightly or moderately disturbed waters.' (EPP (Water and Wetland Biodiversity), schedule 2).	None

Environmental values and definitions	ICON (as shown on plans)
Irrigation Suitability of water supply for irrigation, for example, irrigation of crops, pastures, parks, gardens and recreational areas.	
Farm water supply/use Suitability of domestic farm water supply, other than drinking water. For example, water used for laundry and produce preparation.	
Stock watering Suitability of water supply for production of healthy livestock.	
Aquaculture Health of aquaculture species and humans consuming aquatic foods (such as fish, molluscs and crustaceans) from commercial ventures.	
Human consumers of aquatic foods The suitability of the water for producing aquatic foods (fish, shellfish, other animals, plants) that are safe and suitable for human consumption; and having aquatic foods that are safe and suitable for human consumption taken from it.	
Primary recreation Means a use that involves the following types of contact with the water—full body contact, frequent immersion by the face and trunk, frequent contact with spray by the face where it is likely some water will be swallowed or inhaled, or come into contact with ears, nasal passages, mucous membranes or cuts in the skin. Examples–diving, swimming, surfing (EPP (Water and Wetland Biodiversity), section 6).	
Secondary recreation Means a use that involves the following types of contact with the water—contact in which only the limbs are regularly wet, and other contact, including the swallowing of water, is unusual (examples—boating, fishing, wading) or occasional inadvertent immersion resulting from slipping or being swept into the water by a wave. (EPP (Water and Wetland Biodiversity), section 6).	
Visual recreation Means a use that does not ordinarily involve any contact with the water—for example angling from the shore, sunbathing near water (EPP (Water and Wetland Biodiversity), section 6).	
Drinking water supply Suitability of the water for supply as drinking water having regard to the level of treatment of the water.	

Environmental values and definitions	ICON (as shown on plans)
Industrial use Suitability of water supply for industrial purposes, for example, food, beverage, paper, petroleum and power industries, mining and minerals refining/processing. Industries usually treat water supplies to meet their needs.	
Cultural and spiritual values Means scientific, social or other significance to the present generation or past or future generations, including Aboriginal people or Torres Strait Islanders (EPP (Water and Wetland Biodiversity)), section 6), for example: • custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities • symbols, landmarks and icons (such as waterways, turtles and frogs) • lifestyles (such as agriculture and fishing).	

46