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Refer to DES website for groundwater technical report and information on making a submission

Refer to accompanying DES draft groundwater technical report for details on data, methods, analyses, results

Environmental Protection (Water and Wetland Biodiversity) Policy 2019

South East Queensland

Groundwater Environmental Values and Water Quality Objectives

All groundwaters of basins 141-146 and part Basin 140

Queensland Government

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

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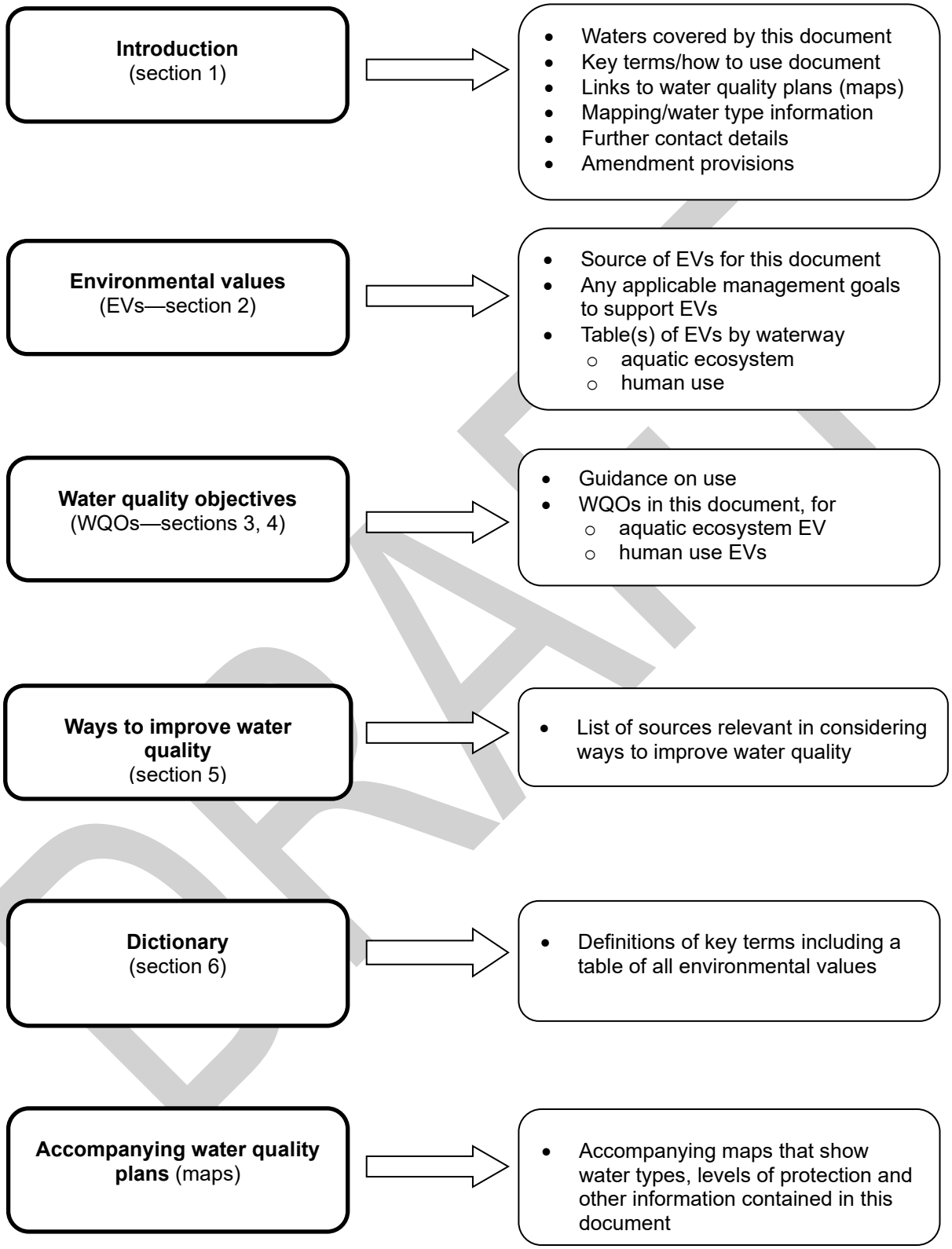
Main parts of this document and what they contain



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 South East Queensland groundwaters, 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 plans (refer below for details) identify the EVs, water type and management intent for the different waters covered by this document.

1.1 Purpose

The purpose of this document and accompanying plans is to identify locally relevant environmental values (EVs) and water quality objectives (WQOs) for South East Queensland groundwaters, 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 groundwaters 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 groundwaters of South East Queensland (basin 140 (part) and all basins 141 - 146[1]), as indicated in the accompanying plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409[2]. Queensland groundwaters covered by this document include alluvial, fractured rock, Cainozoic deposits including sediments overlying the Great Artesian Basin (GAB), lower GAB and earlier basins partially underlying the GAB. (Refer section 1.5 for more details on water types.) Groundwaters extending under coastal and marine waters have not been included in the relevant mapping or analyses, as bore and water chemistry data are not available for these waters.

For surface waters of South East Queensland (including surface fresh, estuarine and coastal waters), refer to separate documents and mapping under schedule 1 of the EPP (Water and Wetland Biodiversity), available from the Department's website.

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

[2] This document and the accompanying plans are available from the department's website. The boundaries in the accompanying plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409 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 Guidance on using this document

1.3.1 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 table of this document (Table 2) 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. Further details are provided in the dictionary.

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 section 2.2 of 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:

- electrical conductivity less than 500 microsiemens per centimetre (µS/cm)
- pH between 6.5 and 8.4
- calcium less than 50 milligrams per litre (mg/L)

Where more than one EV applies to a given water, the most stringent WQO for each water quality indicator applies, which will then protect all identified EVs.

Water type means groupings of waters with similar characteristics, as shown in the accompanying plans. This document is focussed on groundwaters, which have been classified into aquifer classes and chemistry zones within each aquifer class, as defined below, and summarised in Table 1. EVs and WQOs are provided for chemistry zones as shown in the accompanying tables and plans.

- **Aquifer class**: a classification system for major aquifer types, including division of large systems such as the GAB, to avoid difficulties in mapping overlapping units. The aquifer types occurring in Queensland have been subdivided into nine major classes for mapping purposes. Six of these classes occur in the South East Queensland region. Each aquifer class is subdivided into chemistry zones, with boundaries mapped around distributions of similar water chemistry and a consistent suite of aquifers (refer Table 1)
- **Chemistry zone**: a section of an aquifer class where the baseline water chemistry is reasonably consistent, and the bores access one or more major aquifers or other geological formations which are related in space, time and origin (refer Table 1). A chemistry zone may contain more than one aquifer, as well as other geological formations (e.g. aquitards) from the same aquifer class, but the aquifers will generally be closely related. Chemistry zones may extend across (under) surface water basin boundaries.

More details on groundwater water types are provided in section 1.5.

1.3.2 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.

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.

1.4 Information about mapped areas and boundaries

The boundaries in the accompanying plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409 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.

1.5 Water types and basis for boundaries

1.5.1 Water types

Water types are groupings of waters with similar characteristics. This document is focussed on groundwaters, which have been classified into aquifer classes and chemistry zones within each aquifer class, as defined in section 1.3 (water type) above and summarised in Table 1. EVs and WQOs are provided for chemistry zones as shown in the accompanying tables and plans.

1.5.2 Water type boundaries

The boundaries of different groundwater aquifer classes and chemistry zones have been mapped using relevant attributes, including:

- geographic coordinates
- boundaries based on technical investigations

- water quality chemistry
- lithology
- aquifer depth

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

1.6 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.

Table 1 Aquifer classes and chemistry zones summary (South East Queensland)

Aquifer class	Description, including component chemistry zones[1, 2]	GWQ plan reference
Alluvium	Recent alluvium and other recent deposits (e.g. sand dunes, deltas) divided into 23 chemistry zones based on water quality and factors such as extent of alluvium, and sub-catchment characteristics. It includes chemistry zones of low salinity such as the North Coast Alluvium, Noosa, North Stradbroke and Moreton Islands, and Northern Coastal Sands, particularly in wallum country. There are also zones of moderate to high salinity, as well as brackish zones. Dominant ions include Na, Mg, HCO_3, Cl, and NO_3. (Most of the Cooloola sandmass is in the Northern Coastal Sands zone. The western portion is in the North Coast Alluvium zone.)	GWQ1401
Fractured rock	Aquifers in hard rock with water stored in fractures or permeable sandstones other than those considered part of the GAB. Divided into 16 chemistry zones on the basis of rock type, location and water quality. Dominant ions include Ca, Mg, Na, Cl, HCO_3. Salinity is typically moderate to very high, with only two zones of low (Toowoomba Region Basalts (cont) weathered) or very low (Lamington Basalt) salinity.	GWQ1402
Cainozoic Deposits including Sediments overlying the GAB	Sediments overlying the GAB are divided into 10 chemistry zones, of which two zones had sufficient data for calculating percentiles. The Petrie Basin is typical of fine grained sediment influenced by development, whereas both Sandy Creek Saline Weathered Alluvium and Minor Weathered Tertiary Deposits are typical of the Great Dividing Range overlain by basalt. Dominant ions include Ca, Mg, Na, Cl, and HCO_3, and salinity is moderate.	GWQ1403
Lower GAB	The groundwater in the lower GAB has been divided into nine chemistry zones: Central Huttons, Laidley Creek Sandstones, Lockyer Valley Sandstones, Lockyer Valley Sandstones Headwaters, Lockyer Sandstones Recharged Area, Logan Albert Walloons, South East Walloons (cont), South Eastern Hutton Outcrop (cont), and South Eastern Marburgs. Dominant ions include Na, Ca, Cl, Mg, and HCO_3. Salinity ranges from moderate to very high, mostly typical of fine grained sediments, although the chemistry of the Laidley Creek Sandstones and the Lockyer Valley Southern Headwaters is typical of basalt.	GWQ1407
Basal GAB	Sixteen chemistry zones have been defined, however 7 of the zones did not have sufficient data for calculating percentiles. Dominant ions include Na, Ca, Cl, Mg, and HCO_3. Salinity is highly variable and ranges from low to very high. The zone of very low salinity, the Nambour Basin, is typical of wallum country.	GWQ1408
Earlier basins partially underlying the GAB	This aquifer class has been divided up into the following four groundwater chemistry zones: Brisbane Coal Bearing Beds, Ipswich Coal Deposits, Kholo Sediments and Volcanics, and Logan Coal Measures. The Logan Coal Measure zone has sufficient data for calculating percentiles (other zones insufficient). This zone has high salinity, but it can be variable. Dominant ions are Na and Cl, which is typical of fine grained sediment.	GWQ1409

Notes:

1. Groundwater assessment and classification originally prepared for South East Queensland (refer reference below and water type definitions in section 3.1 of this document).

2. Water quality characteristics of springs are expected to relate to the source aquifer from which a spring emanates, for example artesian springs (subject to local catchment and other influences).

Reference:

Department of Environment and Science (2023) *Groundwater chemistry zones in South East Queensland: Draft environmental values and water quality chemistry ranges*. Brisbane: Department of Environment and Science, Queensland Government

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 groundwaters covered by this document are shown in Table 2 and the accompanying plans (GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409).

Table 2 Environmental values: South East Queensland groundwaters

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	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)												
ALLUVIUM (refer plan GWQ1401)												
Central Lockyer Creek	✓	✓	✓	✓						✓		✓
Gatton Sandstones Saline Area	✓	✓	✓	✓						✓		✓
Glasshouses	✓	✓	✓	✓						✓		✓
Gold Coast Alluvials	✓	✓	✓	✓						✓		✓
Lockyer Southern Basaltic Headwaters	✓	✓	✓	✓						✓		✓
Logan Albert Basaltic Headwaters	✓	✓	✓	✓						✓		✓
Logan and Albert	✓	✓	✓	✓						✓		✓
Lower Bremer	✓	✓	✓	✓						✓	✓	✓
Lower Brisbane River	✓	✓	✓	✓						✓		✓
Lower Lockyer	✓	✓	✓	✓						✓	✓	✓

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
Moreton Bay Estuarine and Deltaic Area	✓	✓	✓	✓						✓		✓
North Coast Alluvium	✓	✓	✓	✓						✓		✓
North Stradbroke and Moreton Islands	✓	✓	✓	✓						✓		✓
Northern Coastal Sands	✓	✓	✓	✓						✓		✓
Northern Estuarine Deposits	✓		✓	✓						✓		✓
Northern Moreton Bay Alluvium	✓	✓	✓	✓						✓		✓
Pumicestone	✓	✓	✓	✓						✓		✓
Southern Coastal Sands	✓		✓	✓						✓		✓
Southern Deltaic and Estuarine Deposits	✓		✓	✓						✓		✓
Southwest Lockyer Tributaries	✓	✓	✓	✓						✓		✓
Upper Brisbane	✓	✓	✓	✓						✓	✓	✓
Upper Lockyer Creek	✓	✓	✓	✓						✓	✓	✓

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
Warrill and Upper Bremer River	✓	✓	✓	✓						✓		✓
FRACTURED ROCK (refer plan GWQ1402)												
Cressbrook Creek	✓	✓	✓	✓						✓		✓
Esk Trough Paleozoic sediments	✓	✓	✓	✓						✓		✓
Lamington Basalt	✓		✓	✓						✓		✓
Lower Condamine Basalts (cont)	✓	✓	✓	✓						✓	✓	✓
Lower Condamine Basalts (cont) weathered	✓	✓	✓	✓	✓					✓		✓
Mount Tamborine	✓		✓	✓						✓		✓
North Eastern Great Dividing Range	✓	✓	✓	✓						✓		✓
Northeast Mesozoic Volcanics	✓		✓	✓						✓		✓
Northern Basalts (cont)	✓		✓	✓						✓		✓
North Granite Outcrop	✓		✓	✓						✓		✓

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
Eastern Trap Rocks	✓	✓	✓	✓						✓	✓	✓
Sunnybank weathered basalt remnants	✓		✓	✓						✓		✓
Toowoomba Region Basalts (cont)	✓	✓	✓	✓	✓					✓	✓	✓
Toowoomba Region Basalts (cont) weathered	✓		✓	✓						✓		✓
Upper Condamine Basalts (cont)	✓	✓	✓	✓	✓					✓	✓	✓
Western Great Dividing Range	✓	✓	✓	✓						✓		✓

11

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
CAINOZOIC DEPOSITS INCLUDING SEDIMENTS OVERLYING THE GREAT ARTESIAN BASIN (refer plan GWQ1403)												
Amberley Basin	✓		✓	✓						✓		✓
Beaudesert Beds	✓		✓	✓						✓		✓
Central Tertiary Sediments	✓		✓	✓						✓		✓
Duricrust Main Range	✓		✓	✓						✓		✓
Minor Northern Tertiary Deposits	✓		✓	✓						✓		✓
Minor Weathered Tertiary deposits	✓	✓	✓	✓						✓		✓
Northern Tertiary Remnants	✓		✓	✓						✓		✓
Petrie Basin	✓	✓	✓	✓						✓		✓
Sandy Creek Saline Weathered Alluvium	✓		✓	✓						✓		✓
Sediments Overlying Coal Measures	✓		✓	✓						✓		✓

12

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
LOWER GREAT ARTESIAN BASIN (refer plan GWQ1407)												
Central Huttons	✓	✓	✓	✓						✓		✓
Laidley Creek Sandstones	✓	✓	✓	✓						✓		✓
Lockyer Sandstones Recharged Area	✓	✓	✓	✓						✓		✓
Lockyer Valley Southern Headwaters	✓	✓	✓	✓						✓	✓	✓
Lockyer Valley Sandstones	✓	✓	✓	✓						✓	✓	✓
Logan Albert Walloons	✓		✓	✓						✓		✓
South East Walloons (cont)	✓	✓	✓	✓	✓					✓	✓	✓
South Eastern Hutton Outcrop (cont)	✓	✓	✓	✓						✓	✓	✓
South Eastern Marburgs	✓	✓	✓	✓						✓		✓

13

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
BASAL GREAT ARTESIAN BASIN (refer plan GWQ1408)												
Albert River Woogaroo	✓		✓	✓						✓		✓
Beuaraba Woogaroo	✓	✓	✓	✓						✓	✓	✓
Clarence Moreton Nambour Connection	✓		✓	✓						✓		✓
Eastern Central Area (cont)	✓	✓	✓	✓						✓	✓	✓
Eastern Evergreen Outcrop (cont)	✓	✓	✓	✓						✓		✓
Eudlo Creek Nambour Formation	✓		✓	✓						✓		✓
Gatton Sandstone Southwestern Headwaters	✓		✓	✓						✓		✓
Gatton Sandstone Saline Area	✓	✓	✓	✓						✓		✓
Kin Kin Beds	✓		✓	✓						✓		✓
Logan Albert Sandstones	✓		✓	✓						✓		✓
Lower Lockyer Recharged Area	✓	✓	✓	✓						✓		✓

14

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
Nambour Basin	✓	✓	✓	✓						✓		✓
Noosa River Sandstone	✓		✓	✓						✓		✓
South Eastern Evergreen (cont)	✓	✓	✓	✓						✓	✓	✓
Southern Moreton Bay and Barrier Islands	✓		✓	✓						✓		✓
Tarong Basin	✓		✓	✓						✓		✓

15

GROUNDWATERS (Refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)	**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)												
EARLIER BASINS PARTIALLY UNDERLYING THE GREAT ARTESIAN BASIN (refer plan GWQ1409)												
Brisbane Coal Bearing Beds	✓		✓	✓						✓		✓
Ipswich Coal Deposits	✓	✓	✓	✓						✓		✓
Kholo Sediments and Volcanics	✓		✓	✓						✓		✓
Logan Coal Measures	✓		✓	✓						✓		✓

Notes:

1. Refer to the accompanying groundwater plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409 for locations of EVs. EVs shown relate to waters within each chemistry zone (for example 'Northern Moreton Bay Alluvium') as shown on the plans. Groundwater chemistry zones continuing across regional boundaries (e.g. to the Qld Murray Darling Basin) are identified with 'cont'.

2. ✓ means the EV is selected for protection. Blank indicates that the EV is not chosen for protection. Note in relation to connections with surface water (covered in separate schedule documents), the ANZG Application of the Water Quality Guidelines to groundwater states: "…*groundwater should be managed in such a way that when it comes to the surface, whether from natural seepages or from bores, it will not cause the established water quality objectives for these waters to be exceeded, nor compromise their designated community values"*

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. (This note applies primarily to surface waters.) 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. 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 replace the need for more detailed testing to ascertain suitability of a specific water source (e.g. bore) for a particular use (e.g. irrigation). Further, this information 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 Environment and Science (2023) *Groundwater chemistry zones in South East Queensland: Draft environmental values and water quality chemistry ranges*. Brisbane: Department of Environment and Science, Queensland Government

17

2.2 Management goals to support environmental values

2.2.1 National policy guidance on groundwaters

National guidance on the management of ground water quality is provided in the following sources.

- ANZG Application of the Water Quality Guidelines to groundwater
- Guidelines for groundwater quality protection in Australia
- Great Artesian Basin Strategic Management Plan

Extracts of relevant advice informing derivation of water quality objectives are provided in notes to Table 3. Key national policy messages include:

- protection and enhancement of groundwater quality for the maintenance of specified environmental values,
- use of scientifically defensible data/approaches, including water quality information specific to an individual groundwater system, as a basis for identifying local groundwater quality and its variability
- recognition of groundwater connectivity under surface basin boundaries and links between groundwater and surface waters, including requirements of groundwater dependent ecosystems (subterranean and surface).

2.2.2 Management goal for groundwaters (aquatic ecosystems)

The management goal for groundwaters is that groundwater quality is maintained or improved to meet requirements of groundwater dependent ecosystems (surface and subterranean).

2.2.3 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 plans 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.

2.2.4 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. Note that human use management goals in this section are provided for all potentially applicable human use EVs and water types. 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 management goals and WQOs tables (section 4) can then be identified.

2.2.4.1 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).

2.2.4.2 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.)

2.2.4.3 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).

2.2.4.4 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).

2.2.4.5 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.

2.2.4.6 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.

2.2.4.7 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.

2.2.4.8 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.

2.2.4.9 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

AQUATIC ECOSYSTEM WATER QUALITY OBJECTIVES

3 Water quality objectives to protect aquatic ecosystem environmental values

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

For surface waters of South East Queensland (including surface fresh, estuarine and coastal waters), refer to separate documents and mapping under schedule 1 of the EPP (Water and Wetland Biodiversity), available from the Department's website.

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.

3.1 Aquatic ecosystem water quality objectives

WQOs for specified indicators are listed in Table 3 (by aquifer type/chemistry zone).

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

Table 3 Aquatic ecosystem water quality objectives – groundwaters (by aquifer class and chemistry zone)

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
Note: For surface waters of South East Queensland (including surface fresh, estuarine and coastal waters), refer to separate documents and mapping under schedule 1 of the EPP (Water and Wetland Biodiversity), available from the Department's website. Toxicants included at end of table.														
ALLUVIUM (refer plan GWQ1401)														
ALLUVIUM	**1 – North Coast Alluvium** (s1)	**20th**	32	8	3	122	26	ID	ID	255	32	7.5	100.0	ID
		50th	48	15	7	240	40	17	ID	455	83	7.7	196.0	ID
		80th	370	24	26	427	200	ID	ID	1600	148	7.9	350.0	ID
ALLUVIUM	**1 – North Coast Alluvium near stream** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	370	8	4	427	200	17	ID	1600	32	7.6	350.0	ID
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
ALLUVIUM	**2 – Glasshouses** (s1, s2) - MD	**20th**	13	1	2	3	17	1	0.50	109	13	5.1	2.0	8.0
		50th	18	3	4	13	24	2	10.50	173	26	5.9	11.0	11.0
		80th	40	11	10	38	41	4	10.6 ANZG	400	69	6.5	33.8	20.0
ALLUVIUM	**2 – Glasshouses near stream** (s1, s2) - MD	**20th**	13	1	2	3	17	1	0.50	108	13	5.1	2.0	8.0
		50th	17	4	4	13	24	2	10.6 ANZG	170	27	5.8	10.5	11.0
		80th	40	11	10	38	40	4	10.6 ANZG	404	69	6.5	32.4	19.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**3 – Northern Moreton Bay Alluvium** (s1)	**20th**	42	7	5	28	52	6	0.31	317	42	6.4	26.4	12.0
		50th	160	27	35	161	149	13	1.00	1100	188	7.0	134.0	33.0
		80th	908	183	386	508	1404	81	5.68	6090	1802	7.6	429.8	66.0
ALLUVIUM	**3 – Northern Moreton Bay Alluvium near stream** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	127	37	52	508	ID	25	ID	1148	334	7.6	419.5	ID
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
ALLUVIUM	**4 – Upper Brisbane** (s1)	**20th**	47	37	21	123	114	3	0.25	626	180	6.9	107.0	28.8
		50th	65	60	33	174	190	8	2.00	958	295	7.4	146.5	36.0
		80th	130	105	65	270	393	20	8.00	1595	543	8.0	242.4	47.0
ALLUVIUM	**4 – Upper Brisbane near stream** (s1)	**20th**	48	42	22	128	126	3	0.40	642	195	6.9	107.0	29.0
		50th	63	61	33	174	192	8	2.40	945	289	7.4	144.0	37.0
		80th	120	102	59	250	384	17	8.32	1497	473	7.9	212.4	47.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**5 – Upper Lockyer Creek** (s1) - MD	**20th**	74	45	40	268	166	5	0.25	983	298	7.6	237.6	29.8
		50th	160	66	55	372	325	13	1.00	1270 a	395	7.9	311.0	36.5
		80th	269	87	73	502	445	28	5.92	1912 a	510	8.2	396.2	43.2
ALLUVIUM	**5 – Upper Lockyer Creek near stream** (s1) - MD	**20th**	83	43	38	263	191	4	0.26	968	289	7.6	228.0	29.4
		50th	171	67	53	336	351	13	1.23	1500 a	386	7.9	301.0	37.5
		80th	297	90	74	538	459	32	5.72	1958 a	532	8.2	407.8	44.0
ALLUVIUM	**6 – Central Lockyer Creek** (s1, s2) - MD	**20th**	85	54	75	189	225	7	1.00	1411	482	7.6	260.0	25.0
		50th	128	95	120	449	410	23	7.25	1850 a	727	7.8	393.0	35.0
		80th	210	132	168	570	710	69	10.6 ANZG	2500 a	987	8.1	502.0	44.2
ALLUVIUM	**6 – Central Lockyer Creek near stream** (s1, s2) – MD	**20th**	91	62	84	315	285	10	1.00	1550	537	7.6	295.4	26.0
		50th	133	98	122	461	430	28	7.25	1990 a	746	7.8	402.0	35.0
		80th	218	134	173	575	728	72	10.6 ANZG	2598 a	1039	8.1	506.6	44.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**7 – Lower Lockyer** (s1, s2) - MD	**20th**	55	37	38	296	78	5	0.50	820	266	7.6	256.0	30.0
		50th	99	60	61	442	178	10	2.50	1100 a	415	8.0	380.0	39.0
		80th	210	97	106	610	420	21	10.6 ANZG	1700 a	656	8.3	522.4	48.0
ALLUVIUM	**7 – Lower Lockyer near stream** (s1, s2) - MD	**20th**	54	37	38	296	77	5	0.50	820	266	7.6	256.0	30.0
		50th	96	60	60	440	172	10	2.50	1100 a	409	8.0	379.0	39.0
		80th	200	95	105	600	405	20	10.6 ANZG	1660 a	650	8.3	517.2	48.0
ALLUVIUM	**8 – Southwest Lockyer Tributaries** (s1, s2) - MD	**20th**	248	115	167	385	822	48	2.76	3314	959	7.3	319.0	26.0
		50th	435	202	277	524	1435	133	10.6 ANZG	4300 a	1650	7.6	428.0	34.0
		80th	690	344	435	640	2506	283	10.6 ANZG	6500 a	2650	7.9	524.8	42.0
ALLUVIUM	**8 – Southwest Lockyer Tributaries near stream** (s1, s2) - MD	**20th**	247	117	165	385	840	48	2.92	3350	961	7.3	319.0	26.0
		50th	435	210	280	519	1435	133	10.6 ANZG	4300 a	1652	7.6	423.0	34.0
		80th	690	344	435	638	2485	284	10.6 ANZG	6500 a	2662	7.9	520.0	42.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG												
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**9 – Lockyer Southern Basaltic Headwaters** (s1, s2) - MD	**20th**	44	46	47	239	88	12	1.24	770	320	7.6	227.2	23.6
		50th	86	75	72	338	245	37	4.80	1396	472	7.9	287.0	30.0
		80th	133	102	106	425	415	62	10.6 ANZG	1900	691	8.2	350.0	36.4
ALLUVIUM	**9 – Lockyer Southern Basaltic Headwaters near stream** (s1, s2) - MD	**20th**	76	70	68	276	230	35	3.0	1320	465	7.6	244.8	21.6
		50th	100	86	92	353	332	50	10.5	1700	610	7.8	291.0	33.0
		80th	144	105	116	464	446	67	10.6 ANZG	2000	728	8.2	351.0	40.8
ALLUVIUM	**10 – Warrill and Upper Bremer River** (s1) - MD	**20th**	57	46	32	243	80	2	0.10	780	264	7.3	233.4	22.0
		50th	99	66	46	427	165	5	0.95	989 a	356	7.7	371.0	38.0
		80th	243	102	83	585	411	19	5.10	1729 a	605	8.1	490.0	48.0
ALLUVIUM	**10 – Warrill and Upper Bremer River near stream** (s1) - MD	**20th**	56	46	31	210	78	2	0.10	779	255	7.4	218.4	20.0
		50th	92	67	42	409	150	5	0.90	963 a	340	7.7	350.0	38.0
		80th	225	120	83	566	409	19	5.14	1570 a	608	8.1	480.4	48.0
ALLUVIUM	**11 – Gatton Sandstones saline area** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**12 – Lower Bremer** (s1)	**20th**	171	70	76	365	441	10	0.50	2196	530	7.4	312.2	27.0
		50th	380	152	192	500	1200	27	3.55	4275	1137	7.7	425.0	36.0
		80th	755	295	338	714	2242	157	17.56	7314	2162	8.0	594.4	44.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG												
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**13 – Logan and Albert** (s1) - MD	**20th**	97	8	10	24	136	6	0.29	869	84	6.2	50.6	20.0
		50th	217	53	62	283	550	22	1.20	1699 a	415	7.3	257.0	34.0
		80th	614	205	151	533	1530	70	3.34	4100 a	1089	7.9	455.2	46.0
ALLUVIUM	**13 – Logan and Albert near stream** (s1) - MD	**20th**	157	64	57	200	370	10	0.50	1800	429	7.1	223.0	26.8
		50th	298	170	110	460	970	28	1.30	2820 a	954	7.6	390.5	36.0
		80th	709	359	188	617	2053	63	3.00	4703 a	1760	8.0	521.0	42.0
ALLUVIUM	**14 – Logan Albert Basaltic Headwaters** (s1) - MD	**20th**	53	46	34	57	75	1	0.25	809	266	7.3	280.2	25.0
		50th	112	78	50	420	171	4	1.00	990 a	396	7.7	378.5	39.0
		80th	194	131	84	540	468	10	4.30	1764 a	681	8.1	472.0	53.4
ALLUVIUM	**14 – Logan Albert Basaltic Headwaters near stream** (s1) - MD	**20th**	57	50	37	68	78	1	0.23	842	297	7.3	295.0	23.0
		50th	116	80	51	430	181	4	1.00	1050 a	411	7.8	386.0	41.0
		80th	195	134	84	545	490	11	4.40	1841 a	691	8.1	474.2	54.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**15 – Gold Coast Alluvials** (s1)	**20th**	55	14	12	28	98	17	ID	535	73	6.9	23.0	13.2
		50th	198	34	38	100	360	80	ID	1500	217	7.9	83.0	21.0
		80th	1420	100	121	279	2110	417	ID	7850	762	8.3	218.0	58.6
ALLUVIUM	**15 – Gold Coast Alluvials near stream** (s1)	**20th**	142	24	25	98	224	ID	ID	1110	215	7.1	83.0	ID
		50th	198	38	38	101	360	81	ID	1500	241	8.1	84.0	46.0
		80th	468	135	103	265	878	ID	ID	3140	762	8.4	218.0	ID
ALLUVIUM	**16 – Southern Deltaic and Estuarine Deposits** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	1193	97	173	322	3600	88	ID	12800	1018	7.6	268.5	19.0
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
ALLUVIUM	**17 – Moreton Bay Estuarine and Deltaic Area** (s1)	**20th**	36	5	4	4	45	8	0.50	403	37	3.8	8.4	13.0
		50th	185	20	26	66	465	32	0.95	1675	212	6.4	63.0	19.5
		80th	696	118	165	235	3280	140	5.12	11480	960	7.7	217.6	31.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**18 – Pumicestone** (s1)	**20th**	38	5	6	0	60	20	0.00	410	42	4.0	1.0	9.6
		50th	143	20	21	49	220	84	0.80	1100	143	6.0	48.0	14.0
		80th	425	75	122	133	690	314	5.58	2990	650	6.6	111.0	31.4
ALLUVIUM	**18 – Pumicestone near stream** (s1)	**All**	ID for all											
ALLUVIUM	**19 – Northern Estuarine Deposits** (s1)	**All**	ID for all											
ALLUVIUM	**20 – Southern Coastal Sands** (s1)	**All**	ID for all											
ALLUVIUM	**21 – North Stradbroke and Moreton Islands** (s1)	**20th**	12	0	1	2	19	2	0.02	87	7	5.2	2.0	6.0
		50th	16	1	2	6	25	3	0.30	112	9	5.8	5.0	9.0
		80th	23	2	3	18	32	5	1.10	148	16	6.6	17.0	10.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
ALLUVIUM	**22 – Northern Coastal Sands** (s1)	**20th**	15	1	2	3	24	1	0.00	132	13	4.9	2.0	8.0
		50th	30	4	5	16	47	3	0.25	258	34	5.5	14.0	10.0
		80th	55	11	8	66	86	12	0.50	426	60	6.4	55.0	14.0
ALLUVIUM	**23 – Lower Brisbane River** (s1)	**20th**	35	2	5	8	46	4	0.42	254	23	5.5	15.2	11.8
		50th	108	16	20	115	163	14	1.00	891	118	7.1	110.0	27.0
		80th	451	80	70	435	762	57	18.24	2840	471	7.8	366.0	45.0
ALLUVIUM	**23 – Lower Brisbane River near stream** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	198	31	25	163	320	9	1.40	1175	203	7.0	134.5	32.5
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
FRACTURED ROCK (refer plan GWQ1402)														
FRACTURED ROCK	**1 – Upper Condamine Basalts (cont)** (s1)	**20th**	50	18	16	293	45	0	0.00	688	123	7.6	241.6	24.0
		50th	76	46	65	513	96	3	2.50	1050	413	7.9	425.0	36.0
		80th	120	72	115	650	205	9	23.00	1500	639	8.3	535.2	45.0
FRACTURED ROCK	**2 – Lower Condamine Basalts (cont) weathered** (s1)		ID for all											
FRACTURED ROCK	**3 – Lower Condamine Basalts (cont)** (s1)	**20th**	100	17	9	265	95	7	0.00	810	90	7.6	226.0	31.6
		50th	160	57	51	410	210	16	0.70	1300	390	8.0	360.0	51.0
		80th	300	115	110	553	634	35	17.50	2600	688	8.3	468.0	60.0
FRACTURED ROCK	**4 – Toowoomba Region Basalts (cont)** (s1)	**20th**	67	16	7	179	85	4	0.25	660	83	7.5	150.0	20.0
		50th	97	52	59	356	180	10	4.70	1179	396	7.9	297.0	34.0
		80th	143	100	119	540	350	22	33.84	1809	717	8.2	450.0	46.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
FRACTURED ROCK	**5 – Toowoomba Region Basalts (cont) weathered** (s1)	**All**	ID for all											
FRACTURED ROCK	**6 – Lamington Basalt** (s1)	**All**	ID for all											
FRACTURED ROCK	**7 – Mount Tamborine** (s1)	**All**	ID for all											
FRACTURED ROCK	**8 – Sunnybank Weathered Basalt Remnants** (s1)	**All**	ID for all											
FRACTURED ROCK	**9 – Northern Basalts (cont) (**s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
FRACTURED ROCK	**10 – Northeast Mesozoic Volcanics** (s1)	**All**	ID for all											
FRACTURED ROCK	**11 – Eastern Trap Rocks** (s1)	**20th**	58	9	7	10	64	4	0.00	521	61	5.6	11.0	14.0
		50th	106	18	14	96	165	14	0.50	1000	113	6.7	88.5	28.0
		80th	327	64	34	265	474	113	1.40	1732	278	7.8	224.0	56.0
FRACTURED ROCK	**12 – Western Great Dividing Range** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
FRACTURED ROCK	**13 – Esk Trough Paleozoic sediments** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	849	126	226	727	1600	120	1.10	6005	1247	8.0	598.0	ID
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
FRACTURED ROCK	**14 – North eastern Great Dividing Range** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
FRACTURED ROCK	**15 – Cressbrook Creek** (s1)	**20th**	46	40	23	131	114	3	0.20	648	196	7.0	109.6	29.2
		50th	69	59	34	153	200	10	0.50	975	287	7.5	125.5	38.0
		80th	122	109	64	179	474	26	14.00	1800	533	8.0	148.0	46.0
FRACTURED ROCK	**16 – Northern Granite Outcrops** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
CAINOZOIC DEPOSITS INCLUDING SEDIMENTS OVERLYING THE GREAT ARTESIAN BASIN (refer plan GWQ1403)														
CAINOZOIC DEPOSITS	**1 – Petrie Basin** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**2 – Central Tertiary Sediments** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**3 – Sediments Overlying Coal Measures** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**4 – Amberley Basin** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**5 – Beaudesert Beds** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
CAINOZOIC DEPOSITS	**6 – Duricrust Main Range** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**7 – Minor Northern Tertiary Deposits** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**8 – Northern Tertiary Remnants** (s1)	**All**	ID for all											
CAINOZOIC DEPOSITS	**9 – Sandy Creek Saline Weathered Alluvium** (s1)	**20th**	114	69	77	381	271	10	0.68	1580	531	7.5	307.0	15.8
		50th	280	138	150	445	881	70	4.00	3600	1024	7.8	369.0	29.0
		80th	836	266	305	575	2501	278	13.90	7824	1938	8.2	487.8	34.4
CAINOZOIC DEPOSITS	**10 – Minor Weathered Tertiary Deposits** (s1)	**20th**	58	34	32	310	72	5	0.23	867	229	7.6	296.8	27.0
		50th	113	78	65	506	197	11	3.50	1450	461	7.9	415.0	37.0
		80th	252	121	113	656	474	60	13.00	2234	754	8.1	528.4	48.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
LOWER GAB AQUIFERS AND AQUITARDS (refer plan GWQ1407)														
LOWER GAB	**1 – Southeastern Hutton Outcrop (cont)** (s1)	**20th**	124	28	15	234	158	8	0.00	1100	145	7.5	200.0	13.0
		50th	250	66	53	420	368	20	0.80	1780	399	7.9	351.0	20.0
		80th	509	140	145	585	1035	55	3.90	3806	960	8.2	487.2	30.0
LOWER GAB	**2 – Central Huttons** (s1)	**All**	ID for all											
LOWER GAB	**3 – Laidley Creek Sandstones** (s1)	**20th**	33	39	25	265	39	11	0.20	552	200	7.8	220.8	34.4
		50th	81	51	42	430	95	26	1.80	1143	298	8.1	357.0	43.0
		80th	1561	159	126	724	2230	80	7.50	7884	968	8.3	593.8	47.4
LOWER GAB	**4 – Southeastern Marburgs** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	747	63	11	285	1100	63	0.60	4100	216	7.9	256.0	ID
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
LOWER GAB	**5 – South East Walloons (cont)** (s1) - MD	**20th**	122	10	4	278	110	4	0.05	930	49	7.7	249.6	12.0
		50th	255	43	29	455	265	14	1.00	1350 a	251	8.1	395.0	18.0
		80th	555	96	91	688	794	51	5.40	2484 a	579	8.4	589.0	31.0
LOWER GAB	**6 – Logan Albert Walloons** (s1)	**All**	ID for all											
LOWER GAB	**7 – Lockyer Valley Sandstones** (s1) - MD	**20th**	67	19	18	226	90	5	0.25	642	132	7.4	221.6	20.0
		50th	237	42	64	500	317	14	1.50	1508 a	419	8.0	425.0	32.0
		80th	1113	81	158	838	1630	58	10.82	3657 a	825	8.3	698.6	45.0
LOWER GAB	**8 – Lockyer Valley Southern Headwaters** (s1, s2) - MD	**20th**	214	83	124	380	641	20	2.00	3000	696	7.4	326.0	19.0
		50th	495	173	234	482	1380	79	10.6 ANZG	5010	1445	7.6	425.5	32.0
		80th	820	325	354	787	2156	236	10.6 ANZG	6652	2217	7.9	627.0	40.0

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
LOWER GAB	**9 – Lockyer Sandstones Recharged Area** (s1) - MD	**20th**	60	42	43	270	99	6	0.82	943	296	7.7	235.4	28.0
		50th	97	72	78	418	214	13	4.30	1250 a	495	8.0	350.5	38.0
		80th	181	121	127	548	506	68	19.80	1914 a	841	8.2	454.0	45.0
BASAL GAB (refer plan GWQ1408)														
BASAL GAB	**1 – Eastern Evergreen Outcrop (cont)** (s1)	**20th**	239	13	5	373	308	3	ID	1400	65	7.5	366.4	ID
		50th	933	20	12	523	466	11	1.00	2950	85	8.0	447.0	15.0
		80th	1507	89	150	819	1482	32	ID	5524	789	8.4	691.2	ID
BASAL GAB	**2 – Eastern Central Area (cont)** (s1)	**20th**	180	2	0	336	60	2	0.00	946	7	7.7	315.0	14.5
		50th	306	3	1	620	108	14	0.25	1260	14	8.3	548.0	20.0
		80th	397	11	5	684	191	35	1.05	1742	41	8.7	582.2	28.8
BASAL GAB	**3 – Southeastern Evergreen (cont)** (s1)	**20th**	158	10	6	202	165	1	0.00	1047	44	7.4	173.2	14.0
		50th	397	40	29	454	475	21	0.50	2325	231	7.9	382.0	26.0
		80th	721	123	87	608	959	69	3.00	3788	672	8.2	537.0	41.2

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
BASAL GAB	**4 – Beuaraba Woogaroo** (s1)	**20th**	34	8	5	37	48	2	0.25	274	41	6.5	38.0	13.0
		50th	85	22	14	137	110	7	0.25	683	116	7.4	128.0	28.0
		80th	158	52	39	354	225	13	1.40	1250	289	7.9	310.2	43.0
BASAL GAB	**5 – Gatton Sandstone Southwestern Headwaters** (s1)	**20th**	119	8	4	447	244	6	0.08	1600	36	7.4	367.4	7.4
		50th	385	26	22	530	337	20	1.10	1850	151	7.9	437.0	11.0
		80th	688	101	106	732	621	47	10.00	2920	681	8.4	651.6	20.0
BASAL GAB	**6 – Gatton Sandstone Saline Area** (s1) - MD	**20th**	215	33	17	418	310	10	0.50	2196	167	7.4	360.0	11.0
		50th	532	88	114	592	633	34	2.60	3000 a	711	7.7	494.5	23.0
		80th	1050	210	270	1310	1862	146	21.00	5100 a	1671	8.0	1066.6	37.0
BASAL GAB	**7 – Lower Lockyer Recharged Area** (s1) - MD	**20th**	68	43	45	320	110	7	0.25	980	320	7.7	274.6	31.0
		50th	110	73	86	440	287	15	3.00	1400 a	527	8.0	373.0	39.0
		80th	217	124	151	583	592	50	18.00	2205 a	911	8.2	495.4	47.0
BASAL GAB	**8 – Logan Albert Sandstones** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
BASAL GAB	**9 – Albert River Woogaroo** (s1)	**All**	ID for all											
BASAL GAB	**10 – Clarence Moreton Nambour Connection** (s1)	**20th**	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
		50th	184	19	17	5	394	14	ID	1380	239	5.9	ID	ID
		80th	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
BASAL GAB	**11 – Nambour Basin** (s1, s2) - MD	**20th**	11	1	2	3	10	2	0.72	119	16	5.1	2.0	8.0
		50th	22	4	5	23	22	2	10.6 ANZG	192	33	6.0	20.0	12.0
		80th	38	19	8	106	44	5	10.6 ANZG	369	84	6.7	90.0	34.4
BASAL GAB	**12 – Eudlo Creek Nambour Formation** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
BASAL GAB	**13 – Kin Kin Beds** (s1)	**All**	ID for all											
BASAL GAB	**14 – Noosa River Sandstone** (s1)	**All**	ID for all											
BASAL GAB	**15 – Tarong Basin** (s1)	**All**	ID for all											
BASAL GAB	**16 – Southern Moreton Bay and Barrier Islands** (s1)	**All**	ID for all											

AQUIFER CLASS Chemistry zone (Source: s1)		Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
			Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
EARLIER BASINS PARTIALLY UNDERLYING THE GAB (refer plan GWQ1409)														
EARLIER BASINS PARTLY UNDER GAB	**1 – Logan Coal Measures** (s1)	**20th**	161	16	16	44	183	14	0.05	1105	123	5.9	75.2	25.0
		50th	284	49	29	235	482	58	0.60	2150	307	7.1	244.0	35.0
		80th	1506	128	164	395	2814	250	2.50	8940	892	7.6	343.4	55.0
	2 – Brisbane Coal Bearing Beds	**All**	ID for all											
	3 – Ipswich Coal Deposits	**All**	ID for all											
	4 – Kholo Sediments and Volcanics	**All**	ID for all											
Springs		-	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.											

AQUIFER CLASS Chemistry zone (Source: s1)	Percentile	**SOUTH EAST QUEENSLAND – GROUNDWATERS** **(refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409)** [1–3] **Aquatic ecosystem water quality objectives** **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG

Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)

		TOXICANTS (INCLUDING METALS, BIOCIDES) Aquatic ecosystem toxicant WQOs are as defined below, based on relevant sources. Their adoption should not be interpreted as upper limits to which groundwater contaminant concentrations can be increased. Rather, if existing groundwater quality concentrations are below the adopted water quality guideline values, the groundwater should be maintained within the range of natural quality variations established through baseline characterisation (DES 2021; Australian Government 2013). This table relates to aquatic ecosystems. Toxicant WQOs for human use EVs (irrigation, stock watering, recreational use, etc.) are summarised in section 4 of this document and detailed in relevant sources (including national guidelines).
HEV groundwaters (all aquifers other than specified below): **Toxicants** (s2)	**HEV**	• Toxicants (including metals, biocides) in water: refer to 99% species protection values contained in: ○ 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'
Groundwaters not identified as HEV **Toxicants** (s2)	**SMD/MD**	• Toxicants (including metals, biocides) in water: ○ 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' Note: adoption of the above should not be interpreted as upper limits to which groundwater contaminant concentrations can be increased. Rather, if existing groundwater quality concentrations are below the adopted water quality guideline values, the groundwater should be maintained within the range of natural quality variations established through baseline characterisation (DES 2021; Australian Government 2013).

AQUIFER CLASS Chemistry zone (Source: s1)	Percentile	SOUTH EAST QUEENSLAND – GROUNDWATERS (refer plans GWQ1401, GWQ1402, GWQ1403, GWQ1407, GWQ1408, GWQ1409) [1–3] Aquatic ecosystem water quality objectives **Note:** Except where indicated, the level of protection/management intent for groundwaters is high ecological value (HEV), where groundwater quality should be maintained within the natural range of variability. WQOs for indicators are typically shown as a range of 20th, 50th and 80th percentiles, to be maintained (HEV) or achieved. Refer to section 3.2 for details on comparing test water quality data with the WQOs. Note that the WQOs in this table are solely for groundwater aquatic ecosystems and may not be protective of surface water aquatic ecosystems, including groundwater dependent ecosystems. Where groundwater is expressed to surface waters, readers should refer to surface water EVs and WQOs tables contained in separate schedule documents for surface waters (including aquatic ecosystem WQOs). **Sources**: S1: Local datasets/reporting (applies to all WQOs except where indicated); S2: ANZG											
		Na (mg/L)	**Ca** (mg/L)	**Mg** (mg/L)	**HCO_3** (mg/L)	**Cl** (mg/L)	**SO_4** (mg/L)	**NO_3** (mg/L)	**EC** (µS/cm)	**Hardness** (mg/L)	**pH**	**Alkalinity** (mg/L)	**SiO_2** (mg/L)
		STATE PLANNING POLICY, RIPARIAN, WETLANDS											
State Planning Policy	**all**	Refer to section 3.3											
Riparian	**all**	Refer to separate schedule documents for SEQ surface waters											
Wetlands	**all**	Refer to separate schedule documents for SEQ surface waters											

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: Na – sodium; Ca – calcium; Mg – magnesium; HCO_3 – bicarbonate; Cl – chloride, SO_4 – sulfate; NO_3 – nitrate ion ; EC – electrical conductivity, SiO_2 – silica

Units: mg/L – milligrams per litre, µS/cm – microsiemens/centimetre

Notes:

1. Management intent/ percentiles: Except where noted otherwise, the intent for groundwaters is that groundwater quality is maintained within the natural range of variability (further details in note 2 below), reflecting high ecological value (HEV) This is applied in the table for aquifer and chemistry zone by provision of 20th, 50th and 80th percentiles of water quality data, while the range of 20th, 40th and 70th percentiles is adopted for any indicators where the report *Groundwater chemistry zones in South East Queensland* identified trends in relevant indicators (marked in cells with "a"). Refer DES (2023) technical report for more details. For some indicators (e.g. toxicants), source technical guidelines use a 'slightly to moderately disturbed' (SMD) level of protection. This document and accompanying mapping include these within the MD level of protection. In some groundwaters aquatic ecosystem WQOs for nitrate are set to at least maintain water quality or, where water quality exceeds ANZG guidelines, to achieve the 95% species protection guideline values under ANZG (marked in cells with 'ANZG 10.6' , based on ANZG value of 10.6 mg/L (equivalent to 2.4 mg/L NO_3-N) at time of publication. Note ANZG is periodically updating toxicants guidelines including NO_3 and readers should refer to latest available information from the ANZG (These are identified as moderately disturbed (MD).

2. Groundwaters management - national policy: extracts from the following national groundwater sources provide policy guidance on the management of groundwater and derivation of local objectives based on local data:

Guidelines for groundwater quality protection in Australia: '*The national application of the guidelines will enable management of groundwater quality of aquifers, as well as their connected surface water systems, across traditional management boundaries. Groundwater quality protection also applies to groundwater that extends under coastal waters.*' (2013; 5). '*Protection of groundwater quality is imperative to ensure the*

protection of healthy ecosystems and maintenance of environmental values as well as for future economic and population growth' (2013; 1).' The guidelines also note that '*In some circumstances, the natural groundwater quality will exceed some of the water quality guideline values for the agreed environmental value category. In this case, the groundwater quality should be maintained within the natural range of variability. This approach would require a detailed baseline assessment to establish natural groundwater quality and variability upon which the water quality objectives and guideline values can be based.' (2013; 20).*

ANZG Application of the Water Quality Guidelines to groundwater: '*groundwater should be managed in such a way that when it comes to the surface, whether from natural seepages or from bores, it will not cause the established water quality objectives for these waters to be exceeded, nor compromise their designated community values. In addition to this, underground aquatic ecosystems and any novel fauna also need to be protected. Relatively little is still known of the lifecycles and environmental requirements of groundwater communities. Where potentially high conservation values are identified, the groundwater upon which the communities depend should be afforded the highest level of protection, at least until further knowledge is gained. Basing groundwater quality objectives on data from groundwater reference condition locations is recommended to achieve this protection. It is important to note that different biological, physical and chemical conditions and processes operate in groundwater compared with surface waters, and these can affect the fate and transport of many chemicals. This may have implications for the application of guideline values and overall management of groundwater quality*.'

The GAB strategic management plan provides a framework achieve economic, environmental, cultural and social outcomes for the Great Artesian Basin (the Basin) and its users. *'The Plan envisages that scientifically defensible limits relating to both quantity of water take and water quality will be established and adhered to*' and includes a strategic outcome to '*set out scientifically defensible water quality limits and extraction impact management measures that minimise impacts on the Basin resources, its users and dependent ecosystems'.*

3. In relation to Stygofauna, Hose et al. note that: *Stygofauna are generally adapted to stable environmental conditions, including water quality. Changes to water quality that are beyond the range of conditions normally experienced by stygofauna pose a threat to their survival*.' (2015; 40); '*Importantly, it is changes to pH away from the typical background level that are likely to be problematic for stygofauna, as they are for other freshwater invertebrates…. thus requiring understanding the local conditions in order to assess the risks associated with changed in water quality*.' (Hose et al., 2015; 42). For salinity '*Field studies…suggest that the salinity tolerance of most stygofauna is limited to salinity level (measured by water electrical conductivity) less than 5000 µS/cm…. It might be expected then that changes to salinity of groundwater above 5000 µS/cm may by (sic) toxic to stygofauna. However, this threshold does not indicate the sensitivity of stygofauna to changes in salinity; those inhabiting and adapted to relatively fresh groundwater will be potentially sensitive to changes well below this level. It is likely that stygofauna are adapted to local conditions so that changes from background salinity could be deleterious*.' (Hose et al., 2015; 41)

Sources / references:

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

Australian Government (2020) *Great Artesian Basin strategic management plan*

Australian Government (2013) *Guidelines for groundwater quality protection in Australia*: National Water Quality Management Strategy, Department of Agriculture and Water Resources, Canberra, March. 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 (2023) *Groundwater chemistry zones in South East Queensland: Draft environmental values and water quality chemistry ranges*. Brisbane: Department of Environment and Science, Queensland Government

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). *Using monitoring data to assess groundwater quality and potential environmental impacts*. Version 2. Queensland Government, Brisbane

Hose GC, J Sreekanth, Barron O, Pollino C, 2015 *Stygofauna in Australian Groundwater Systems: Extent of knowledge*. CSIRO, Australia

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)

Unpublished water quality datasets

3.2 Comparison of test data with water quality objectives

The following protocols are recommended when comparing groundwater quality (at a 'test' site) with the corresponding groundwater aquatic ecosystem water quality objective (WQO). The management intent for all groundwaters corresponds to an HEV level of protection, namely that there should be 'no change' to existing water quality, i.e. no change in the natural range of values (except in circumstances where water quality is modified and improvement is sought in relevant parameters). No change is deemed to have occurred if there are no detectable changes to the 20th, 50th and 80th percentiles of the natural distribution of values (or no change to the 50th percentile where there is insufficient data to derive a range of WQOs). A summary of procedures for comparing test data with WQOs is provided below and detailed methods are provided in the QWQG.

- Where the WQO is expressed as a 20th–50th–80th percentile range of values to be maintained (e.g. Total N: 65–100–125 µg/L), the 20th–50th–80th 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).
- Where, due to data limitations, the WQO is expressed as a single figure (50th percentile) value, the same comparison (i.e. with minimum 24 samples) is made.

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 95th 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.

3.3 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 contaminants 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 (state interest – water quality), policy 6 requires:

'Policy (6) Development in water resource catchments and water supply buffer areas avoids potential adverse impacts on surface waters and groundwaters to protect drinking water supply environmental values."

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), other than the aquatic ecosystem EV. Section 2 of this document outlines the EVs that have been identified for different groundwaters. For surface waters of South East Queensland, refer to separate documents under schedule 1 of the EPP (Water and Wetland Biodiversity), available from the Department's website. Where a human use EV has been identified in section 2 of this document for groundwater, the following tables can be used to identify the corresponding WQOs to support that EV. Where more than one EV applies to a given water, 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 firstly identify the human use EVs stated for a particular water, from which the corresponding human use WQOs in this section can then be identified.

Where human use WQOs in this section call up relevant national water quality guidelines, reference to these is necessary to obtain comprehensive listings of all indicators and corresponding WQOs. Note that additional requirements, including those relating to recycled water (e.g. for drinking water and irrigation) also exist, and 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 4 Human use EVs water quality objectives

Environmental value	Water type/area [1]	Water quality objective to protect EV (refer to specified codes and guidelines for full details)
Suitability for irrigation	Groundwaters	As per the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) published on the Australian Government's Water Quality Australia website, and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended Notes re water quality for irrigation: • ANZG irrigation water quality guidelines are subject to periodical review, and readers should refer to the ANZG website for the most up-to-date version. • the irrigation EV pertains 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. • irrigation 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 • this table relates to water sourced from Queensland waters, rather than a potable water source or from a treated effluent source: 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).

Environmental value	Water type/area [1]	Water quality objective to protect EV (refer to specified codes and guidelines for full details)
Suitability for farm supply/use	Groundwaters	As per ANZG. Notes re water quality for farm supply/use: • ANZG irrigation water quality guidelines (which include advice on general farm use) are subject to periodical review, and readers should refer to the ANZG website for the most up to date version. Also refer to Safe Water on Rural Properties (Queensland Health, 2015)
Suitability for stock watering	Groundwaters	As per ANZG. Notes re water quality for stock watering: • ANZG stock water quality guidelines are subject to periodical review, and readers should refer to the ANZG website for the most up to date version. • ANZG applicable to both groundwater and surface provided for livestock drinking water commonly found in Australia (including sheep, cattle, horses, pigs and poultry). • water quality includes biological, chemical and radiological characteristics that may affect animal health.
Suitability for aquaculture	Groundwaters	As per: • Tables 5–7 of this document (Queensland information • ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended
Protection of the human consumer	Groundwaters	As per ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended.
Suitability for primary contact recreation	Groundwaters	As per Guidelines for Managing Risks in Recreational Water (NHMRC). Also refer to Safe Water on Rural Properties (Queensland Health, 2015) Notes re water quality for recreation: • NHMRC recreational water guidelines are subject to periodical review, and readers should refer to the NHMRC website for the most up to date version. • NHMRC provides a risk management-based framework for monitoring, assessing, managing and auditing water quality for recreational activities. • the NHMRC addresses water quality requirements for recreational activity under the following categories: ○ physical hazards (floating and submerged objects, water visibility) ○ temperature ○ microbial quality (virus, parasites, bacteria - including faecal contamination from human or animal sources) ○ cyanobacteria (blue-green algae) ○ algae ○ contact with dangerous/venomous organisms ○ chemicals toxic or irritating to skin or mucous membranes ○ pH, and other physico-chemical indicators ○ aesthetic aspects including water transparency, litter, oils/films, scums, odour
Suitability for secondary contact recreation	Groundwaters	As per Guidelines for Managing Risks in Recreational Water (NHMRC). Also refer to Safe Water on Rural Properties (Queensland Health, 2015). Notes re water quality for recreation: • NHMRC recreational water guidelines are subject to periodical review, and readers should refer to the NHMRC website for the most up to date version • refer to comments under primary recreation for scope of water quality issues covered by NHMRC.

Environmental value	Water type/area [1]	Water quality objective to protect EV (refer to specified codes and guidelines for full details)
Suitability for visual recreation	Groundwaters	As per Guidelines for Managing Risks in Recreational Water (NHMRC). Also refer to Safe Water on Rural Properties (Queensland Health, 2015). Notes re water quality for recreation: • NHMRC recreational water guidelines are subject to periodical review, and readers should refer to the NHMRC website for the most up to date version • 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. • Refer to comments under primary recreation for scope of water quality issues covered by NHMRC
Suitability for drinking water supply	Groundwaters	The Australian Drinking Water Guidelines (NHMRC) provides a framework for catchment management and source water protection for drinking water supplies. 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 (NHMRC) • Safe Water on Rural Properties (Queensland Health, 2015) 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 8. 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.
Suitability for industrial use	Groundwaters	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.
Protection of cultural and spiritual values	Groundwaters	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans. The ANZG provides further context on how guidelines for other EVs can contribute to water quality for cultural and spiritual values.

Notes:

1. This table is focussed on groundwaters. For surface waters of South East Queensland, refer to separate documents under schedule 1 of the EPP (Water and Wetland Biodiversity), available from the Department's website.

Sources:

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

- Technical review and advice from Queensland Department of Agriculture and Fisheries, SEQwater, Queensland Health and Department of Regional Development, Manufacturing and Water (2020-2023)
- Australian Drinking Water Guidelines (NHMRC, 2011, as amended).
- 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).
- Safe Water on Rural Properties (Queensland Health, 2015)

4.2 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.

4.3 Drinking water EV water quality objectives

Table 8 outlines WQOs for drinking water **before treatment**, unless otherwise stated. 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 (NHMRC), and the Safe Water on Rural Properties guideline (Queensland Health, 2015).

Table 8 Drinking water EV: Priority water quality objectives for groundwater drinking water supply before treatment (except where noted: refer ADWG and relevant legislation for post-treatment)

Indicator	Water quality objective
Giardia	0 cysts/10L. No ADWG 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	0 oocysts/10L. No ADWG 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	<50cfu/100mL. 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). <1 cfu/100ml (Public Health Regulation 2018) and upstream sewage effluent discharges need to be known (catchment management). 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.
Hardness	<200 mg/L as CaCO3 (aesthetic)
Taste and Odour	<5 ng/L combine MIB and Geosmin
Total Phosphorus	<0.05 mg/L
Total Nitrogen	<0.5 mg/L
Ammonia	<0.5 mg/L
Nitrate	<10 mg/L
Specific Conductivity	<450 µS/cm
Dissolved Organic Carbon	<10 mg/L
Total Suspended Solids	<25 mg/L

Indicator	Water quality objective
Colour	<50 Hazen Units
Sodium	Refer ADWG, including advice for general and medical (at risk) populations. ADWG notes that 50 mg/L is a '*typical value*' in reticulated supplies, and that '*sodium salts cannot be easily removed from drinking water*' and '*any steps to reduce sodium concentrations are encouraged'*.
Aluminium	<0.1 mg/L
Arsenic	<0.01 mg/L
Iron (total)	<0.3 mg/L
Iron (dissolved)	<0.03 mg/L
Lead	<0.01 mg/L
Manganese (total)	<0.1 mg/L
Manganese (dissolved)	<0.01 mg/L
Pesticides	Raw supplies: Refer to ADWG. Treated drinking water: Refer to ADWG.
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	Raw supplies: <35 ng/L (half ADWG health guideline at time of publication)
PFOA	Raw supplies: <280 ng/L (half ADWG health guideline at time of publication).
Microplastics <300 µm	0 microplastics per litre
Other indicators (including physico-chemical indicators)	Refer to ADWG.

Source: Australian Drinking Water Guidelines (NHMRC, 2011, as amended). Technical review and advice from SEQwater, Queensland Health and Department of Regional Development, Manufacturing and Water (2020-2023).

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**. For surface waters of South East Queensland (including surface fresh, estuarine and coastal waters), refer to separate documents under schedule 1 of the EPP (Water and Wetland Biodiversity), available from the Department's website.

Groundwater policy references

- Guidelines for groundwater quality protection in Australia
- Great Artesian Basin Strategic Management Plan

Local and regional plans, studies

- Council planning schemes and supporting codes, policies, available from council websites
- Resilient Rivers Initiative: SEQ Catchment Action Plans
- South East Queensland Regional Plan 2017 (ShapingSEQ)
- South East Queensland Natural Resource Management Plan 2009-2031 and 2021 update report
- Development guidelines: Water quality management in drinking water catchments (Seqwater)

State plans, policies, guidelines, agreements

- *Water Act 2000* and relevant water plans including Water Plan (Great Artesian Basin and Other Regional Aquifers)
- State Planning Policy (state interest – water quality)
- Queensland Coastal Management Plan

Water quality guidelines

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) including Application of the Water Quality Guidelines to groundwater
- Queensland Water Quality Guidelines (QWQG)
- Queensland Monitoring and Sampling Manual
- Department of Environment and Science (2021). *Using monitoring data to assess groundwater quality and potential environmental impacts*. Version 2. Queensland Government, (DES) Brisbane

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
- Department of Environment and Science, Queensland (2021) Treatment systems, Wetland*Info* website, accessed 21 September 2023
- Department of Environment and Science, Queensland (2021) Aquatic Ecosystem Rehabilitation Process, Wetland*Info* website, accessed 21 September 2023.
- Queensland Government, Queensland (2016) Groundwater dependent ecosystem mapping background, Wetland*Info* website, accessed 26 September 2023./
- Healthy Waterways Incorporated – Water by Design: resources and information available on the Water by Design website.

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 9 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).	

65