Water area/type (Sources: s1–s5)	Management intent /Level of protection	MOONIE RIVER BASIN: aquatic ecosystem water quality objectives[1-3]											
		Note: WQOs for indicators are primarily shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g. 3–4–5). WQOs may also be shown as single values to be achieved as the 50th percentile (median) of test data or as lower and upper limits (e.g. pH: 7.2–8.2). HEV: high ecological value; SD: slightly disturbed; MD: moderately disturbed – refer accompany maps for details Sources: S1: HWMP; S2: MDB Plan targets; S3: Local datasets/reporting (e.g. DSITI); S4: ANZECC and ARMCANZ (2000) AWQG; S5: other sources											
		Ammonium N (µg/L)	**Oxidised N** (µg/L)	**Total N** (µg/L)	**Filterable Reactive P** (µg/L)	**Total P** (µg/L)	**Chlorophyll-a** (µg/L)	**Dissolved Oxygen** (% saturation) (mg/L)	**Turbidity** (NTU)	**Suspended Solids** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L) **Alkalinity** (mg/L CaCO3)
HEV and SD waters	**HEV**	Maintain/achieve effectively unmodified water quality (20th, 50th and 80th percentiles of HEV waters), habitat, biota, flow and riparian areas. In many instances there is insufficient information available to establish effectively unmodified water quality 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.											
UPPER MOONIE catchment waters (s3)	**MD**	**LOW FLOW <2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton**											
		25 (s3)	25 (s3)	1740 (s3)	25 (s3)	375 (s3)	ID	60-110% (s2)	205 (s3)	85 (s3)	7.0-7.6 (s3)	165 (s3)	SO_4: 2 A: 50 (s3)
		HIGH FLOW >2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton											
		ID	ID	ID	ID	ID	ID	60-110% (s2)	275 (s3)	ID	6.0-7.2 (s3)	130 (s3)	ID
	HEV	**LOW FLOW <2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton**											
		ID	ID	1490-1740-2245 (s3)	ID	205-375-490 (s3)	ID	60-110% (s2)	115-205-400 (s3)	60-85-215 (s3)	7.0-7.5-7.6 (s3)	130-165-230 (s3)	SO_4: 2-2-3 A: 40-50-65 (s3)
		HIGH FLOW >2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton											
		ID	ID	ID	ID	ID	ID	60-110% (s2)	170-275-1405 (s3)	ID	6.0-6.9-7.2 (s3)	85-130-165 (s3)	ID
MIDDLE MOONIE catchment waters (s3)	**MD**	**LOW FLOW <2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton**											
		25 (s3)	25 (s3)	1905 (s3)	25 (s3)	470 (s3)	ID	60-110% (s2)	385 (s3)	120 (s3)	7.1-7.6 (s3)	150 (s3)	SO_4: 4 A: 55 (s3)

Water area/type (Sources: s1–s5)	Management intent /Level of protection	**MOONIE RIVER BASIN: aquatic ecosystem water quality objectives[1-3]** **Note:** WQOs for indicators are primarily shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g. 3–4–5). WQOs may also be shown as single values to be achieved as the 50th percentile (median) of test data or as lower and upper limits (e.g. pH: 7.2–8.2). HEV: high ecological value; SD: slightly disturbed; MD: moderately disturbed – refer accompany maps for details Sources: S1: HWMP; S2: MDB Plan targets; S3: Local datasets/reporting (e.g. DSITI); S4: ANZECC and ARMCANZ (2000) AWQG; S5: other sources											
		Ammonium N (µg/L)	**Oxidised N** (µg/L)	**Total N** (µg/L)	**Filterable Reactive P** (µg/L)	**Total P** (µg/L)	**Chlorophyll-a** (µg/L)	**Dissolved Oxygen** (% saturation) (mg/L)	**Turbidity** (NTU)	**Suspended Solids** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L) **Alkalinity** (mg/L CaCO3)
		HIGH FLOW >2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton											
		ID	ID	ID	ID	ID	ID	60-110% (s2)	ID	ID	ID	ID	ID
	HEV	**LOW FLOW <2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton**											
		ID	ID	1575-1905-2320 (s3)	ID	345-470-580 (s3)	ID	60-110% (s2)	265-385-910 (s3)	80-120-395 (s3)	7.1-7.3-7.6 (s3)	130-150-180 (s3)	SO_4: 2-4-5 A: 50-55-65 (s3)
		HIGH FLOW >2.1 m³/s (cumecs) at gauge 417205A – Moonie River at Flinton											
		ID	ID	ID	ID	ID	ID	60-110% (s2)	ID	ID	ID	ID	ID
LOWER MOONIE catchment waters (s3)	**MD**	**LOW FLOW <3.3 m³/s (cumecs) at gauge 417201B – Moonie River at Nindigully**											
		25 (s3)	25 (s3)	1700 (s3)	25 (s3)	425 (s3)	ID	65-110% >5.0mg/L (s2)	400 (s3)	200 (s3)	7.1-7.7 (s3)	145 (s3)	SO_4: 3 A: 55 (s3)
		HIGH FLOW >3.3 m³/s (cumecs) at gauge 417201B – Moonie River at Nindigully											
		15 (s3)	415 (s3)	1660 (s3)	35 (s3)	315 (s3)	ID	65-110% >5.0mg/L (s2)	320 (s3)	465 (s3)	6.8-7.5 (s3)	95 (s3)	SO_4: 3 A: 35 (s3)
	HEV	**LOW FLOW <3.3 m³/s (cumecs) at gauge 417201B – Moonie River at Nindigully**											
		12-25-35 (s3)	18-25-90 (s3)	1465-1700-2005 (s3)	18-25-40 (s3)	300-425-605 (s3)	ID	65-110% >5.0mg/L (s2)	265-400-790 (s3)	110-200-340 (s3)	7.1-7.4-7.7 (s3)	115-145-190 (s3)	SO_4: 2-3-5 A: 40-55-70 (s3)

Water area/type (Sources: s1–s5)	Management intent /Level of protection	**MOONIE RIVER BASIN: aquatic ecosystem water quality objectives[1-3]**											
		Note: WQOs for indicators are primarily shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g. 3–4–5). WQOs may also be shown as single values to be achieved as the 50th percentile (median) of test data or as lower and upper limits (e.g. pH: 7.2–8.2). HEV: high ecological value; SD: slightly disturbed; MD: moderately disturbed – refer accompany maps for details Sources: S1: HWMP; S2: MDB Plan targets; S3: Local datasets/reporting (e.g. DSITI); S4: ANZECC and ARMCANZ (2000) AWQG; S5: other sources										
		Ammonium N (µg/L)	**Oxidised N** (µg/L)	**Total N** (µg/L)	**Filterable Reactive P** (µg/L)	**Total P** (µg/L)	**Chlorophyll-a** (µg/L)	**Dissolved Oxygen** (% saturation) (mg/L)	**Turbidity** (NTU)	**Suspended Solids** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L) **Alkalinity** (mg/L CaCO3)
		HIGH FLOW >3.3 m³/s (cumecs) at gauge 417201B – Moonie River at Nindigully											
		13-15-19 (s3)	175-415-475 (s3)	1560-1660-1700 (s3)	35-35-45 (s3)	265-315-470 (s3)	ID	65-110% >5.0mg/L (s2)	125-320-1035 (s3)	225-465-890 (s3)	6.8-7.1-7.5 (s3)	70-95-130 (s3)	SO_4: 2-3-3 A: 25-35-40 (s3)

Water area/type (Sources: s1–s5)	Management intent /Level of protection	**MOONIE RIVER BASIN: aquatic ecosystem water quality objectives[1-3]** **Note:** WQOs for indicators are primarily shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g. 3–4–5). WQOs may also be shown as single values to be achieved as the 50th percentile (median) of test data or as lower and upper limits (e.g. pH: 7.2–8.2). HEV: high ecological value; SD: slightly disturbed; MD: moderately disturbed – refer accompany maps for details Sources: S1: HWMP; S2: MDB Plan targets; S3: Local datasets/reporting (e.g. DSITI); S4: ANZECC and ARMCANZ (2000) AWQG; S5: other sources											
		Ammonium N (µg/L)	**Oxidised N** (µg/L)	**Total N** (µg/L)	**Filterable Reactive P** (µg/L)	**Total P** (µg/L)	**Chlorophyll-a** (µg/L)	**Dissolved Oxygen** (% saturation) (mg/L)	**Turbidity** (NTU)	**Suspended Solids** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L) **Alkalinity** (mg/L CaCO3)
		TOXICANTS, PESTICIDES											
HEV and SD waters: Toxicants (s4)	**HEV and SD**	WQGs for all toxicants and pesticides in these waters as per ANZECC and ARMCANZ (2000) AWQG, to protect species at the HEV level of protection. • Toxicants in water: refer to AWQG volume 1 section 3.4—'water quality guidelines for toxicants' (including tables 3.4.1, 3.4.2, and Figure 3.4.1), and AWQG volume 2 (section 8). AWQG values for the HEV level of protection typically correspond to protection of 99% of species. • Toxicants in sediments: refer to AWQG volume 1 section 3.5—'sediment quality guidelines' (including Table 3.5.1, Figure 3.5.1), and AWQG volume 2 (section 8)											
Other waters: Toxicants (s4)	**MD**	WQGs for all toxicants and pesticides in these waters as per ANZECC and ARMCANZ (2000) AWQG, to protect species at the MD level of protection. • Toxicants in water: refer to AWQG volume 1 section 3.4—'water quality guidelines for toxicants' (including tables 3.4.1, 3.4.2, and Figure 3.4.1), and AWQG volume 2 (section 8). AWQG values for the MD level of protection typically correspond to protection of 95% species (in a small number of cases where bioaccumulation may occur, the AWQG recommends 99% species protection level). • Toxicants in sediments: refer to AWQG volume 1 section 3.5—'sediment quality guidelines' (including Table 3.5.1, Figure 3.5.1), and AWQG volume 2 (section 8)											
		TEMPERATURE[3] (s2)											
Fresh waters		Between the 20%ile and the 80%ile of natural monthly water temperature. (Based on Basin Plan schedule 11 target value for zones B2 – Border Rivers, Gwydir and Namoi valley upland; A2 - Border Rivers, Gwydir and Namoi valley lowland)											

Water area/type (Sources: s1–s5)	Management intent /Level of protection	MOONIE RIVER BASIN: aquatic ecosystem water quality objectives[1-3]											
		Note: WQOs for indicators are primarily shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g. 3–4–5). WQOs may also be shown as single values to be achieved as the 50th percentile (median) of test data or as lower and upper limits (e.g. pH: 7.2–8.2). HEV: high ecological value; SD: slightly disturbed; MD: moderately disturbed – refer accompany maps for details Sources: S1: HWMP; S2: MDB Plan targets; S3: Local datasets/reporting (e.g. DSITI); S4: ANZECC and ARMCANZ (2000) AWQG; S5: other sources										
		Ammonium N (µg/L)	**Oxidised N** (µg/L)	**Total N** (µg/L)	**Filterable Reactive P** (µg/L)	**Total P** (µg/L)	**Chlorophyll-a** (µg/L)	**Dissolved Oxygen** (% saturation) (mg/L)	**Turbidity** (NTU)	**Suspended Solids** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L) **Alkalinity** (mg/L CaCO3)
		MACROINVERTEBRATES (s1, s3)											
Fresh waters	**HEV, MD**	Insufficient data to derive water quality guidelines. Will be updated if information becomes available.											
		FISH (s3)											
Fresh waters	**MD**	Insufficient data to derive water quality guidelines. Will be updated if information becomes available.											
		RIPARIAN, WETLANDS, SPP											
Riparian	**All**	Refer to section 14.1 of this report.											
Wetlands	**All**	Refer to section 14 of this report (Also note Section 17.2).											
State Planning Policy	**All**	Refer to section 17.3.											

Abbreviations: ID: insufficient information

Notes:

1. Nutrients:

Oxidised N = NO_2 + NO_3. Dissolved inorganic N (DIN) = Ammonium N + Oxidised N.

Except where specified for event conditions, nutrient guidelines do not apply during high flow events in fresh and estuarine waters. During periods of low flow and particularly in smaller creeks, build-up of organic matter derived from natural sources (e.g. leaf litter) can result in increased organic N levels (generally in the range of 400 to 800µg/L). This may lead to total N values exceeding the WQGs. Provided that levels of dissolved inorganic N remain low, then the elevated levels of organic N should not be seen as a breach of the WQGs, provided this is due to natural causes. See QWQG (section 5 and Appendix D) for more information on applying guidelines under high flow conditions.

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

3. Temperature: Temperature varies both daily and seasonally, it is depth dependent and is also highly site specific. It is therefore not possible to provide simple generic WQGs for this indicator for fresh or estuarine waters. (In open coastal/marine waters a WQG based on GBRMPA WQGs is provided.) The recommended approach is that local WQGs be developed. Thus, WQGs for potentially impacted streams should be based

on measurements from nearby streams that have similar morphology and which are thought not to be impacted by anthropogenic thermal influences. From an ecological effects perspective, the most important aspects of temperature are the daily maximum temperature and the daily variation in temperature. Therefore measurements of temperature should be designed to collect information on these indicators of temperature and, similarly, local WQGs should be expressed in terms of these indicators. There will be an annual cycle in the values of these indicators and therefore a full seasonal cycle of measurements is required to develop guideline values.

4. Fish: Fish metrics are a tool used to score or describe the health of an ecosystem based on the composition of the fish fauna. Scores may be compared against an expected or average condition derived from existing data sets or expert opinion. Tables 15-18 display fish metrics developed to score native fish species richness against an expected mean condition; non-native fish richness against an expected mean condition; native fish abundance against non-native fish abundance; an index of rarity (scoring for presence of rare species at a site); a recruitment index for both native and non-native fish species, and for upper catchment sites, a cold water species index. Some of the metrics rely on data from derived tables for electrofishing combined with fyke netting. These methods are important to implement in order to compare catch data to fish metrics. For a good score, native fish metrics should score high and non-native fish metrics score low (For further information refer to Hutchison, 2014).

References:

ANZECC & ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (AWQG)*.

Hutchison, M (2014), *Fish assemblages as indicators of ecosystem health in the Condamine-Balonne River system – A guide prepared for the Department of Science, Information Technology, Innovation and the Arts,* Department of Agriculture, Fisheries and Forestry, Queensland.

Queensland Government (EHP; 2009, as amended) *Queensland Water Quality Guidelines*. (Refer to section 5 and Appendix D of the QWQG for more detail on compliance assessment protocols.)