Aquatic Conservation Assessment using AquaBAMM for the riverine and non-riverine wetlands of the Queensland Wide Bay-Burnett Great Barrier Reef Connecting Catchments

Summary Report

Version 2.1

Queensland Government

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The Department of Environment and Science acknowledges Aboriginal peoples and Torres Strait Islander peoples as the Traditional Owners and custodians of the land. We recognise their connection to land, sea and community, and pay our respects to Elders, past, present and emerging.

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Citation

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Cover photo

Mary River. Photo supplied by Shane Chemello, © Queensland Department of Environment, Science and Innovation.

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Version history

Version	Type	Release Date	Description
1.1	riverine, non-riverine	November 2011	Aquatic Conservation Assessments (ACA) using AquaBAMM for wetlands of the Wide Bay-Burnett catchments.
2.1	riverine, non-riverine	May 2024	Aquatic Conservation Assessment using AquaBAMM for the riverine and non-riverine wetlands of the Queensland Wide Bay-Burnett Great Barrier Reef connecting catchments.

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Acronyms and abbreviations

ACA	Aquatic Conservation Assessment
AquaBAMM	Aquatic Biodiversity Assessment and Mapping Methodology
ASL	Above Sea Level
BAMM	Biodiversity Assessment and Mapping Methodology
BONN	Bonn Convention on the Conservation of Migratory Species
BPA	Biodiversity Planning Assessment
CAMBA	China–Australia Migratory Bird Agreement
CE	Critically endangered (Attributed as CR in WildNet data)
CIM	Criterion, Indicator and Measure (used in AquaBAMM)
DIWA	Directory of Important Wetlands in Australia
DESI	Department of Environment, Science and Innovation
E	Endangered
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
JAMBA	Japan–Australia Migratory Bird Agreement
NCA	*Nature Conservation Act 1992*
NP	National Park
NR	Non-riverine
NT	Near threatened
QHFD	Queensland Historical Fauna Database
R	Riverine
Ramsar	Ramsar Convention on Wetlands
RE	Regional Ecosystem
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
SOR	State of the Rivers
V	Vulnerable
WBBGBRCC	Wide Bay-Burnett Great Barrier Reef connecting catchments

1 Introduction

The Department of Environment, Science and Innovation (DESI) has undertaken a review and update of the freshwater Aquatic Conservation Assessments (ACA) for the Burnett, Mary, Kolan, Burrum, Baffle and Other Islands catchments last completed in 2010. The current combined assessments are titled – Queensland Wide Bay-Burnett Great Barrier Reef Connecting Catchments Aquatic Conservation Assessments (WBBGBRCC ACA) version 2.1. Expert panels, held in Bargara in May 2023, assessed the flora, fauna and ecology values of the study area, and also included input from various Traditional Owner representatives as to the traditional values of the area. See Attachment A for more information regarding the expert panel process and Traditional Owner values.

The Aquatic Biodiversity Assessment and Mapping Methodology (AquaBAMM) was developed in 2006 to provide a robust and repeatable method for assessing the biodiversity values of Queensland's wetlands (Clayton et al. 2006). The method uses a comprehensive set of criteria founded upon a large body of national and international literature. Criteria are combined to assign an overall biodiversity value (AquaScore) to each wetland or spatial unit assessed. The criteria, each of which have a variable number of indicators and measures, include Naturalness Aquatic, Naturalness Catchment, Diversity and Richness, Threatened Species and Ecosystems, Priority Species and Ecosystems, Special Features, Connectivity and Representativeness. The product of applying the AquaBAMM is an Aquatic Conservation Assessment (ACA) for a particular study area (usually a catchment).

Aquatic Conservation Assessments are non-social, non-economic and tenure neutral. In addition to the AquaScore, assessment results include a comprehensive set of baseline ecological information at the individual wetland scale. Assessment measures are populated with data from a range of sources including expert opinion elicited during structured expert panel workshops. Aquatic Conservation Assessments provide a powerful decision support tool that can be easily interrogated through a geographic information system (GIS) to support natural resource management decisions, policy or regulatory development and implementation. For example, Aquatic Conservation Assessment results can have application in:

- Determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems.
- On-ground investment in wetlands and other aquatic ecosystems.
- Contributing to impact assessment of large-scale development (e.g. dams).
- Water resource and strategic regional planning processes.
- Providing input to broader social and economic evaluation and prioritisation processes.

This report summarises the methods and results for the Aquatic Conservation Assessments completed for the catchments listed in Table 1. Freshwater riverine and non-riverine systems have been assessed.

This report should be read in conjunction with the accompanying expert panel report – An Aquatic Conservation Assessment for the riverine and non-riverine wetlands of the Queensland Wide Bay-Burnett Great Barrier Reef connecting catchments: Flora, Fauna and Ecology Expert Panel Report, Version 2.1. Department of Environment, Science and Innovation, Queensland Government.

Table 1. Study areas of the Wide Bay-Burnett Great Barrier Reef Connecting Catchments Aquatic Conservation Assessment

ACA study areas or catchments	Study area code	Catchment area (ha)	Number of riverine spatial units	Number of non-riverine wetlands	Area of non-riverine wetlands (ha)
Burnett	bu	3,320,997.6	386	1,636	16,951.2
Mary	my	947,832.8	165	1,313	11,238.5
Kolan	ko	290,501.3	40	394	7,116.8
Burrum	bm	335,101.1	40	1,037	13,074.3
Baffle	ba	407,765.8	321	1,120	12,604.9
Other Islands	iw	5,106.3	107	15	224.1

1.1 Queensland Wide Bay-Burnett Great Barrier Reef study regions

1.1.1 General region

This Aquatic Conservation Assessment covers five individual drainage catchments including the Burnett, Mary, Kolan, Burrum and Baffle (Figure 1). Other Islands are included in the sixth study area.

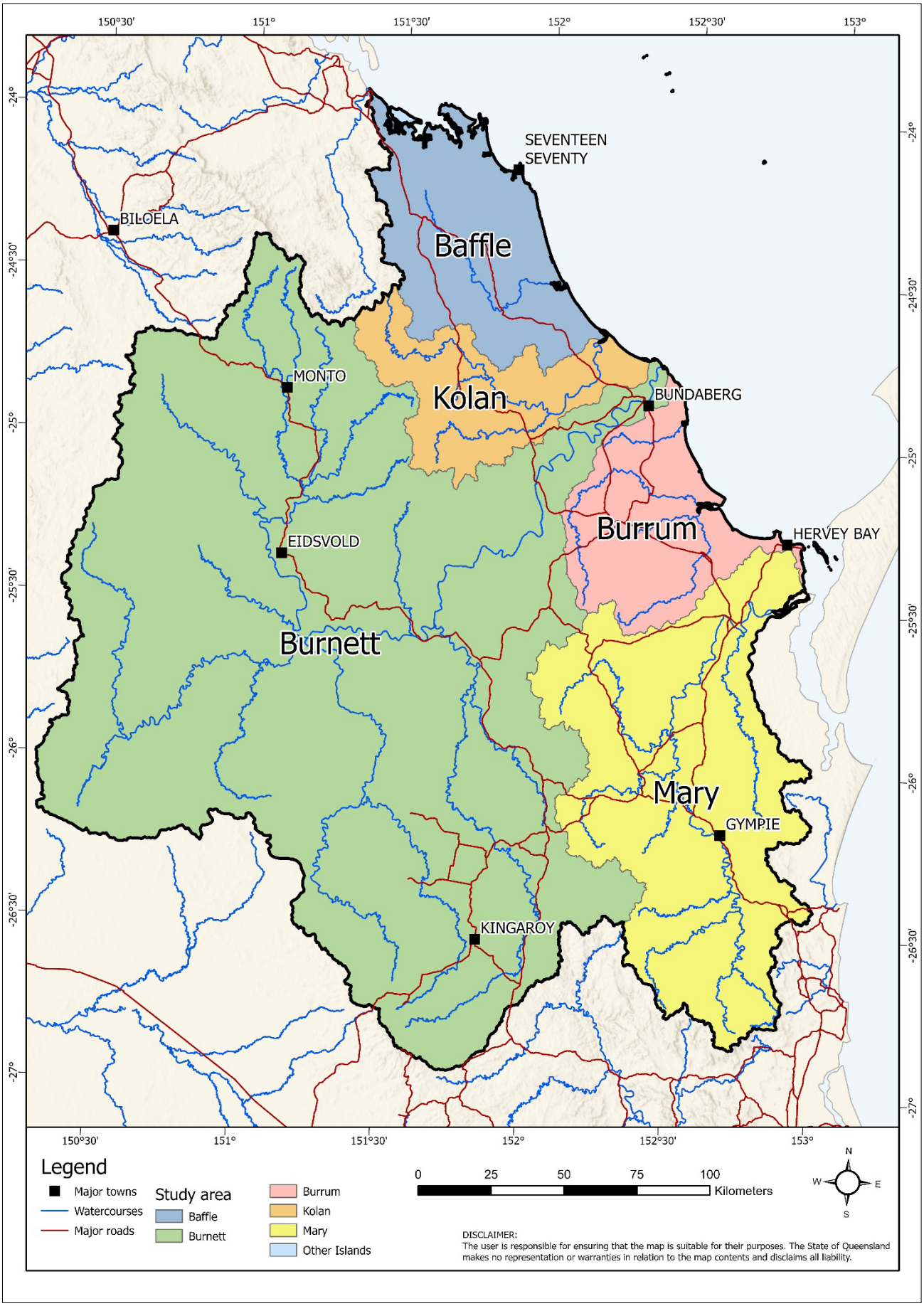


Figure 1. Study areas of the Queensland Wide Bay-Burnett Great Barrier Reef Connecting Catchments Aquatic Conservation Assessment v2.1

1.1.2 Burnett study area

The Burnett River catchment lies in the Southeast Queensland and Brigalow Belt bioregions and is located approximately 200 km north-west of Brisbane. The Burnett is the third largest river basin on the east coast of Queensland, with a catchment area of approximately 33,209 km^2 (Van Manen 1999). The Burnett River flows for 420 km from its source in the Burnett Range to its mouth at Burnett Heads. The main tributaries of the Burnett River include the Auburn, Nogo, Boyne and Stuart Rivers and the Barambah and Three Moon Creeks (Van Manen 1999). The catchment is fringed by the Burnett and Dawes Ranges in the north, the Auburn Range to the west, the Great Dividing Range to the south-west and the Cooyar and Brisbane Ranges in the south. Major urban and regional centres in the Burnett River catchment include Bundaberg, Kingaroy, Gayndah, Eidsvold, Murgon, Nanango and Monto.

The Burnett features two climates, subtropical in near the coast and through North Burnett, and temperate in the southwest of the catchment. Summer average temperatures are hot ranging from 30-35°C with cooler winter average temperatures ranging from 19-23°C. The average annual rainfall of the region is typically around 740 millimetres and rainfall is highly seasonal with both tropical and temperate weather patterns and a clearly defined wet season occurring typically between November and March. The hydrological seasonality associated with these wet and dry season flow conditions are critical to the ecological character, function and associated values of aquatic ecosystems. The dry season is also an essential part of the functioning of the system with these semi-permanent waterholes important for maintaining ecosystems.

Diverse geologies and soils in the region shape the catchment with the headwater regions steeply incised with sedimentary sandstone formations. These formations drop off as the catchment continues through interspersed areas of granite, and into alluvial floodplains that make up the lower catchment and floodplains surrounding Bundaberg and along the coastal waterways of the region. Vegetation is predominantly open dry sclerophyll forest, with isolated pockets of moist sclerophyll forest and sub-tropical vine forests. Large areas of the original native (preclear) vegetation have been cleared or partially cleared, mostly for grazing on native pastures but also cropping, residential and associated services and other minor land uses. Today, most of the region's remnant vegetation consequently exists on public lands with a large proportion identified in state forest areas.

Approximately one-third of the catchment is comprised of farming and agriculture contributing around $12 billion annually to the Queensland economy. Cattle grazing and crop production are the dominate landuse types, with the agriculturally rich lands associated with the Burnett River producing nuts, wine, citrus, macadamia and sugarcane. A number of dams are located across the catchment and include the Paradise, Cania, Wuruma, Boondooma and Bjelke-Petersen Dams. Their main purpose is to support existing urban, industrial and agricultural operations as well as to underpin further development across the region.

The Burnett catchment supports numerous threatened and endemic species, including the Mary River turtle (*Elusor macrurus*), southern (white-throated) snapping turtle (*Elseya albagula*) and the silver-headed antechinus (*Antechinus argentus*), as well as key iconic species such as koalas, quolls, dugongs, humpback whales, and loggerhead turtles. Notable wetlands within the catchment include Coalstoun Lakes and Splitters creek. Coalstoun Lakes are naturally occurring ponds located within two small volcanic crater maar formations approximated 2.7 km northeast of the town of Coalstoun Lakes. These intermittent lakes are significant because they are the best representative of a recent volcanic wetland landform in the bioregion (very few of these exist), and because they provide refuge habitat for a total of 220 plant taxa and at least 73 fauna species recorded (Environment Australia, 2001). Splitters creek is significant because it is one of the last remaining lowland, stream-based wetland complexes in the Burnett Mary region, with no weir structures to interfere with natural flows and passage of migratory fish (including the recreationally important barramundi, bass and mangrove jack). The creek comprises a diverse range of wetland forms including a tidal reach, a melaleuca swamp, a deep water lagoon and a closed canopy lagoonal section surrounded by extensive native woodlands and provides high value fish habitat for the lower Burnett River system.

Biodiversity and landscape values in the region have been impacted by threatening processes, such as habitat loss from vegetation clearing, the fragmentation of wildlife habitats from urban development and agricultural expansion, the spread of pest species, and the alteration of aquatic flow regimes and declining water quality. The environmental condition across many areas of Burnett is considered to be poor, with weed and pest species, altered aquatic flow regimes and land-use practices often leading to soil salinity, acid sulfate soils, erosion, contamination and reduced fertility and organic matter. Weeds being spread by flood waters is one of the biggest threats.

1.1.3 Mary study area

The Mary River flows from the moist, subtropical southern part of the Southeast Queensland bioregion into a drier corridor to the north, and consequently varies considerably in its character. The Mary's freshwater reaches support a distinctive fauna which is close to range limits and adapted to its episodic flood regime, and is one of two catchments supporting the iconic Australian lungfish (*Neoceratodus forsteri*). The Mary catchment is an important

source of sediment and freshwater flows for seagrass ecosystems and shorebird feeding habitat in the northern Great Sandy Strait Ramsar area and Hervey Bay. Many of its riverine and non-riverine wetlands are also scheduled as High Ecological Value waterways under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019.

While most rainfall occurs in late summer to early autumn, flood events may occur in any month but are typically episodic in occurrence (e.g. 5–10 years frequency) and may be interspersed by long dry periods. Irregular high rainfall events associated with cyclones and east coast low depressions feed the southern tributaries of the Mary. While mean annual rainfall near Maleny is 2000 mm, as much as 900 mm has been recorded in a day. Much of this elevated southern catchment falls within protected areas containing rainforest, wet and dry sclerophyll ecosystems although significant areas have been cleared. Obi Obi creek rises from a basaltic plateau in the Sunshine Coast hinterland, falling steeply through gorge country before flowing north to join the Mary River. In contrast Six Mile Creek is a low energy rainforest stream retaining large woody debris. The banks of some of the major streams, such as Obi Obi, Six Mile, Deep and Tinana Creeks, have rainforest and/or tall open (wet sclerophyll) forest riparian vegetation (e.g. *Araucarian notophyll* vine forest or mesophyll gallery forest). Riverbank erosion due to the poor condition of riparian vegetation in the Mary is also being linked to increased sediment discharge to the Great Sandy Strait (Esslemont *et al.* 2006 a, b, c, d; DeRose *et al.* 2002).

There is a need for further mapping and rehabilitation of riparian vegetation, especially rainforest, since this vegetation type is habitat for several endemic, endangered, vulnerable, near-threatened and priority species including both fauna species (e.g. Mary River cod *(Maccullochella mariensis),* Richmond birdwing (*Ornithoptera richmondia)*, the pink underwing moth (*Phyllodes imperialis* southern subspecies*)*, Coxen's fig parrot (*Cyclopsitta diophthalma coxeni)*, black-breasted button-quail (*Turnix melanogaster);* the giant barred frog *(Mixophyes iterates),* the tusked frog *(Adelotus brevis);* the cascade tree frog, *(Litoria pearsoniana)* (Fleay 1997, Mathieson and Smith 2009, Simpson and Jackson 1996, Sands & Scott 1998)) and flora species (e.g. *Xanthostemon oppositifolius, Fontainea rostrata,* macadamia nut tree (*Macadamia integrifolia*) and Gympie nut (*Macadamia ternifolia*)). The Southeast Queensland Rainforest Recovery Program describes the association between several of these species and regional ecosystem 12.3.1 (gallery rainforest on alluvial plains). While some remnant riparian vegetation mapping of 12.3.1 exists in the Mary, mapping and identification of other riparian rainforest below the mapping scale and suitable for rehabilitation may inform NRM decisions e.g. a future Mary River Recovery Plan.

Resembling those of the drier Burnett (mean annual rainfall less than 800 mm), the intermittent western tributaries of Wide Bay and Munna Creeks are moderate to high-energy sand and gravel-bed stream systems able to accommodate substantial flows within their wide flow channels. A substantial coarse sediment load from all these tributaries has resulted in distinctive pool, riffle and sand bar sequences chiefly in the main trunk of the Mary River. These areas are notable as habitat for the Australian lungfish (*Neoceratodus forsteri*) and the highest turtle diversity in Queensland (including the endemic Mary River turtle (*Elusor macrurus*)). To the east, Coondoo and Tinana Creeks sustain important riparian rainforest and wallum vegetation on sandy alluvium with natural water quality and relatively intact fauna (including endemic Mary River cod (*Maccullochella peelii mariensis*), oxleyan pygmy perch (*Nannoperca oxleyana*) and the Australian lungfish (*Neoceratodus forsteri*) populations). These creeks flow into the turbid Mary estuary at Maryborough and are joined by the unimpounded Susan River and its mangrove wetlands near the mouth of the river. The tidal delta of the Mary extends into the Great Sandy Strait, encompassing an extensive complex of mangrove islands, saltpans and sandbanks comprising the largest Fish Habitat Area in southern Queensland. Flood events from the Mary River periodically reverse the normally highly saline conditions of Hervey Bay, producing an inverse estuary (Ribbe 2008).

Presently, catchment land use in the area chiefly comprise dryland grazing, sugar cane and plantation forestry, with tree crops and dairying in the elevated south. European settlement and dairying land use resulted extensively in clearing of its upper reaches and riparian area. Land use and modifications of the freshwater reaches have produced erosion and siltation of parts of the river and sedimentation of deep pools. Excess sediment discharge into the Mary estuary, Great Sandy Strait and Hervey Bay from the Mary flood events and subsequent resuspension occasionally results in catastrophic loss of seagrass beds and dugong (e.g. 1992 – Preen *et al.* 1995) and continues to create marine water quality issues.

Within the freshwater reaches regulation of its southern tributaries for extraction of water supplies for Gympie, inter-basin transfers to the Sunshine Coast and flow releases for downstream irrigation of canelands have modified the original episodic flows to a smaller, more regular runoff regime, altering the physical structure of the channel (Department of Natural Resources and Mines 2005). Barrages on former estuarine reaches of the Mary River and Tinana Creek provide for irrigated canelands and the Maryborough water supply respectively, but also restrict the freshwater flow regime and fish passage to the estuary. Most of the floodplain wetlands have been converted to cultivated paddocks or canelands. Nevertheless, the Mary River catchment still supports a high diversity in riverine and non-riverine wetland types, including wallum wetlands, melaleuca swamps and inland freshwater swamps.

1.1.4 Burrum study area

The Burrum catchment consists of an amalgam of coastal catchments between the Burnett and Mary catchments. The catchment is dominated by the Burrum sand mass characterised by aggregations of coastal Melaleuca wetlands and heaths with connectivity in a north-south direction. The non-riverine and riverine wetlands of the Burrum play a significant role in reef resilience due to their high connectivity with adjacent estuarine salt marshes, mangroves, seagrass meadows and coral reefs of the Great Sandy Strait Ramsar area and Hervey Bay. Many of the Burrum's riverine, non-riverine and estuarine wetlands are also scheduled as High Ecological Value waterways under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019.

Of lower relief than the Mary and Cooloola-Great Sandy Strait catchments, the Burrum receives most of its rainfall as northern monsoons, cyclones or troughs occurring in late summer to autumn (averaging 1000–1200 mm per annum). The climatic variability and low freshwater discharge in combination with evaporation on expansive tidal flats have created an 'inverse estuary' in the receiving waters of Hervey Bay (i.e. strongly hypersaline; Ribbe 2008, Grawe 2010).

The catchment logically falls into five geomorphic subdivisions; the Woongarra coastal streams draining a gently-sloping, fertile Quaternary basalt deposit, the groundwater-fed Elliott River, the Coonarr to Beelbi region of extensive sandy beach ridges and swales, the Burrum, Isis, Gregory and Cherwell rivers draining into the Burrum estuary, and the O'Regan's Creek to the Mary River area, typified by short coastal streams and alluvial wetlands sloping from a ridgeline behind Hervey Bay City. In the hinterland, sedimentary rocks of the Maryborough formation formed in Mesozoic marine waters have resulted in saline-tolerant Melaleuca wetlands along drainage lines.

The Burrum Coast sits within the Directory of Important Wetlands area between Theodolite and Beelbi creeks and includes both freshwater and estuarine wetlands (mangroves and seagrass beds). As a succession of both Holocene and Pleistocene beach ridges, and swales and Quaternary freshwater swamp deposits, it represents the most significant coastal dune system north of the Cooloola sand mass. A large proportion of this dune system is conserved within the Burrum Coast National Park. Wetland types of the Burrum Coast include wallums, closed wet heath and swale wetlands dominated by Melaleuca species. These wetlands and adjacent habitats include several species approaching their geographic limits (such as *Strangea linearis*, *Callistemon pachyphylla* and *Melaleuca sieberi*) and a number of endangered, vulnerable and near-threatened plant species including the paperbark tree (*Melaleuca cheelii*), tiny wattle (*Acacia baueri* subsp. *baueri*) and an alyxia (*Alyxia sharpei*). The wallum froglet (*Crinia tinnula)* has also been recorded in the Burrum Coast National Park and other wetlands in the catchment. Inland from the coastal dune systems lie wetlands and streams of the Burrum and Cherwell. In these areas, deep weathering of Tertiary sediments has formed duricrust pans on a slightly elevated plateau, inhibiting the surface drainage. The Cherwell River has good examples of perched healthy wetlands associated with these pans as well as Melaleuca swampy drainage lines dissecting the edges of the plateau.

The Elliott River catchment, which sits within the Burrum study area, is largely groundwater-fed, containing aquifers that consist of a series of poorly interconnected sand and gravel channels and intervening clay layers sloping gently towards the coast. This area's unique hydrology, freshwater wetlands and excellent connectivity to high receiving water values (including seagrass and corals) were recognised in the Burnett Mary Region Water Quality Improvement Plan (https://www.bmrg.org.au/documents).

Dominant land uses in the Burrum catchment are irrigated cropping, grazing, coastal urban development and minor plantation forestry, with the majority of intensive land use north of the Isis River. However, extensive vegetated tracts of state land remains within the bioregional corridor in the hinterland and within protected estate on the coast. Irrigation from groundwater provides for intensive cane farming and horticulture north of the Burrum River. Lenthalls Dam on the Burrum supplies the expanding city of Hervey Bay with water. Other weirs and barrages on the Burrum and Isis Rivers also sever connectivity between freshwater areas and the estuary.

Clearing of wetlands for agriculture and fragmentation associated with coastal development has impacted on the Woongarra coast and, to a lesser extent, south of Burrum Heads. Wetland function in these catchments provides water quality protection for significant estuarine and marine values–most notably the Burrum seagrass meadow dugong nursery (Sheppard 2006), Mon Repos turtle rookery and subtropical coral reefs fringing both Woongarra and Hervey Bay coastlines.

Urban development, artificial lakes and sand extraction are increasingly impacting on the natural hydrology of wetlands and streams south of Burrum Heads, with impacts such as de-watering of heathland wetlands in adjacent protected estate. There is potential for excavation of wetland soil to mobilise acid sulphate runoff and seepage from septics to eutrophy groundwater. In other parts of Australia and the world, the importance of hydrological connectivity between groundwater and adjacent inshore marine ecosystems (Maji and Smith 2009), such as seagrass, is acknowledged (Coles *et al.* 2007; Eamus *et al.* 2006; Kamermans *et al.* 2002; Johannes and Hearn 1985) and the impacts coastal urban development has on these groundwater dependent ecosystems has been demonstrated (Carruthers *et al.* 2005, Valiela *et al.* 1990). While groundwater connectivity to seagrass is yet to be investigated for the Burrum catchment, the maintenance of intact wetland function is an important consideration for

the health of connected ecosystems.

1.1.5 Kolan study area

The Kolan catchment is a coastal catchment between the Burnett to the south and the Littabella and Baffle Creek catchments to the north. This catchment features mainly agricultural land use and water resources, but there are some wetlands of biodiversity significance in its headwaters and adjoining its estuary.

The Kolan falls within the northern half of the Southeast Queensland bioregion, and has a subtropical climate with an average rainfall of 1200 -1400 mm per annum. Most of this rainfall occurs during late summer commonly associated with cyclones and troughs, but can be sporadic. Most of the Kolan catchment is relatively flat, below 80 m above sea level (ASL). However, the headwaters arise in the rugged Many Peaks Range which rises to 700 m ASL. There are a number of different protected areas in the headwaters, notably Bulburin National Park and Bulburin Forest Reserve which feature subtropical dry rainforest with emergent hoop pines; gallery rainforest; and drier eucalypt forests. Hoop pine plantations adjoin protected estates at Bulburin.

On the south side of the Kolan, a series of parallel dunes has formed a barrier and swale system in the Moore Park area. This wetland complex of Melaleuca swamps and lakes is fragmented by the urban settlement of Moore Park Beach. However, the freshwater wetlands have reasonable connectivity to the Kolan Fish Habitat Area in the estuarine waters of the Kolan and west of Barubbra Island in the delta of the Burnett.

Agricultural and water resource land uses dominate much of the Kolan and as a result much of the catchment is cleared. Grazing dominates the upper and central catchment, while irrigated sugar cane and horticultural crops (including macadamia nut plantations) predominate in the lower catchment. The Fred Haigh Dam is a large impoundment within the central-upper reaches of the Kolan with a pipeline providing inter-basin transfers into the Burnett for irrigation. Bucca Weir and the Kolan barrage provides freshwater for agriculture in the central and lower reaches. Irrigation from the Gooburrum aquifer, which extends from the Elliott River north to the Kolan, supplements the variable rainfall experienced within the Kolan. To date, connectivity has been poor and hence environmental flows to the estuary have been low. However, the revised water resource plan covering the region is focussing more on improvements to freshwater flows in order to benefit catadromous fish.

Under its Coastal Catchments Initiative, the Australian Government funded the Burnett-Mary Regional NRM Group (BMRG) to develop the Burnett Mary Region Water Quality Improvement Plan. DERM and the BMRG have completed a joint project to establish the waterway values and uses (i.e. environmental values) and develop water quality objectives/targets to protect the values and uses consistent with the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. As part of this project High Ecological Value waterways were determined for the Kolan catchment.

1.1.6 Baffle study area

The Baffle catchment is the northernmost catchment in the Burnett Mary region. It is located to the north of Bundaberg and is within the Burnett Mary Regional Group Natural Resource Management (BMRG NRM) area. It lies adjacent to the Mackay/Capricorn section of the Great Barrier Reef Marine Park on the coast, with mountain ranges bordering the catchment in the south and west. The main waterway, Baffle Creek, captures the whole western section of the catchment, which is primarily grazing land with smaller areas of forestry and conservation. The coastal fringe is mostly used for grazing. A number of small creeks flow straight to the coast which includes seven relatively pristine estuaries.

The catchment includes Baffle Creek and its tributaries, such as Three Mile, Gorge, Banksia, Granite, Third Camp, Oyster (Euleilah) and Bottle creeks. It also includes a number of smaller coastal drainages such as Littabella, Deepwater, Blackwater, Eurimbula, Middle, Pancake, Worthington, Pine, Sandy, Seven Mile, 12 Mile and 28 Mile creeks. Baffle Creek flows into the Coral Sea near Rules Beach, and the coastal drainages flow directly to the Coral Sea. All waterways drain to the coastal waters of the Great Barrier Reef (GBR) (DES 2021).

Compared with other basins in the Great Barrier Reef catchment, the Baffle basin is relatively undisturbed with only a few smaller coastal communities within an otherwise undisturbed coastal zone. Approximately 22 per cent of the Baffle basin protected through National Parks, Conservation Parks and Protected Areas. The other main land uses are grazing (67%) and forestry.

The Baffle basin has significant natural assets and is home to many important marine, estuarine, freshwater and terrestrial species with connections to the Great Barrier Reef World Heritage Area. Forests are the dominant coastal ecosystem, and these have experienced the greatest area of loss, with around 117,937 hectares cleared. Forested floodplain ecosystems have had the greatest proportional loss, with only 38 per cent remaining. Overall, around 63 per cent of coastal ecosystems in the Baffle basin have been retained.

The Baffle Creek catchment and estuary are the least impacted in the Central Queensland region, with the freshwater waterways of the Baffle basin generally in good to very good condition. Stream banks appear mostly

stable, with bank susceptibility to erosion considered to be low to minimal. Riparian vegetation condition ranges from very poor to very good. The estuaries in the Baffle basin are largely unmodified or in near pristine condition. Of these, the Pancake Creek estuary may be the last remaining mainland estuary containing an intact and healthy coral reef system.

Riparian areas impacted from grazing are the priorities for restoration in this basin. Future urban development also needs to utilise water sensitive urban design to ensure water quality and environmental values are maintained. Coastal ecosystems located in the floodplain and coastal zone are those that are at most at risk from future development pressures such as increasing urbanisation and aquaculture. Future conservation and restoration measures need to focus on these ecosystems to prevent further loss and impacts. These areas are also at greatest risk from flooding, storm and climate change impacts so high value infrastructure, such as residential and industrial development should be avoided in these areas. Current infrastructure in these areas needs to be managed to current best practice.

1.1.7 Other Islands study area

The Other Islands study area contains a wide variety of island types and habitats, spread throughout the project area. Off-shore to the Baffle study area, are Pig Island, Bird Island, and Hummock Hill Island, one of the largest continental islands in Australia, containing the nationally important estuarine wetland Colosseum Inlet. Hummock Hill Island contains a few ephemeral palustrine wetlands, of mostly Melaleuca and Eucalypt swamps that flow into estuarine inlet. The vulnerable water mouse (false water rat) is also known to dwell on the island.

Big Woody Island is a sand island off the coast of Hervey Bay in the Great Sandy Strait. It holds near permanent palustrine wetlands that comprise mostly of Melaleuca and Eucalypt swamps.

Out in the Great Barrier Reef, there are vegetated coral cays such as Lady Elliot Island, Lady Musgrave Island, Fairfax Islands, and the Hoskyn Islands. Fairfax Island has a couple of small intermittent palustrine wetlands dominated by sedges and herbs. These coral cays are mostly populated by birds like ruddy ternstones (*Arenaria interpres*) and silvereyes (*Zosterops lateralis*) but green frogs are also found on the islands.

In addition to the larger named islands, there are dozens of smaller islands, many of which are submerged at high tide. These islands are undisturbed by anthropogenic processes, except for Lady Elliot Island which has been developed for tourism but rehabilitated after extensive damage by goats and mining.

There are a total of 107 riverine spatial units and 15 non-riverine wetlands in the study area.

2 Methods and implementation

2.1 AquaBAMM

The Queensland Wide Bay-Burnett Great Barrier Reef Connecting Catchments Aquatic Conservation Assessments were undertaken using AquaBAMM (Clayton et al 2006). The method has been updated since its development including minor changes to the AquaBAMM tool and revisions to the filter table.

2.2 Spatial Units

In implementing an Aquatic Conservation Assessment, subsections and spatial units are defined to calculate and attribute the conservation/ecological values of riverine and non-riverine wetlands. This section describes the subsection and spatial units used for each riverine and non-riverine assessment.

2.2.1 Riverine Spatial Units

Riverine spatial units and subsections are best defined by considering hydrological patterns and processes in the landscape. They are generally of a size that balances reporting needs with data availability and can be determined in several ways, including modelling.

Any results from this analysis can be applied to the riverine wetlands (or drainage lines) within the spatial unit. Riverine wetlands are known as all wetlands and deepwater habitats within a channel. Channels can be natural or artificially created, periodically or continuously contain moving water, or be connected to two bodies of standing water.

The riverine spatial units were based on those used for the WBB ACA v1.1 and the GBR riverine ACA v1.1. Please refer to the summary reports (EHP 2010, Inglis and Howell 2009) associated with these assessments for a description of how the spatial units were generated. Minor adjustments were made for the current assessment to align the spatial units with new bounding area and study area linework (see section 2.11).

The WBBGBRCC riverine assessments included 952 riverine spatial units (Table 1) derived from the methods described above. The minimum size for a spatial unit is 114 ha. The maximum size for a spatial unit is 36,098 ha. Overall, the average size for the spatial units is 5,569 ha.

2.2.2 Non-Riverine Spatial Units

The Queensland Herbarium uses the Wetland Mapping and Classification Methodology (DES 2023) to map the location, extent, and attributes of Queensland's wetlands. Linework and attribute descriptions are based on satellite derived waterbody and regional ecosystem mapping (Neldner et al. 2020). The WBBGBRCC assessments used Queensland Wetland Data Version 6.0 – Wetland Data (2019) which is based on Version 12.2 regional ecosystem mapping.

The non-riverine assessments included 5,500 spatial units derived from palustrine and lacustrine wetland waterbodies and wet regional ecosystems present in the Queensland Wetland Mapping data. All hydromodification categorised wetlands were assessed as part of this WBBGBRCC assessment, including:

- Natural: ‘H1’
- Slightly modified: ‘H2-M1', 'H2-M1-a', 'H2-M1-b', 'H2-M2', 'H2-M2-a', 'H2-M2-b', 'H2-M2-c', 'H2-M2-d', 'H2-M9', 'H2-M9-a', 'H2-M9-b', 'H2-M9-c', 'H2-M10', 'H2-M10-a', 'H2-M10-c', 'H2-M11', 'H2-M11-a', 'H2-M11-b', 'H2-M11-d', 'H2-M12', 'H2-M12-a', 'H2-M12-b', 'H2-M12-c', 'H2-M12-d'
- Highly modified: 'H2-M1-e', 'H2-M5', 'H2-M6', 'H2-M6-a', 'H2-M6-b', 'H2-M6-f', 'H2-M7', 'H2-M11-c', 'H2-M13'
- Artificial: 'H3-C1', 'H3-C1-a', 'H3-C1-b', 'H3-C4', 'H3-C5', 'H3-C5-a', 'H3-C5-b'.

Please refer to the mapping data field details in the Queensland Wetland Mapping Classification Database (DESI 2024) for more information on hydrological modifiers.

The basis of an ACA is to provide an inventory and prioritisation of freshwater wetland ecological values. Artificial wetlands, especially relatively large ones may hold some ecological value (e.g. species habitat). Expert panels in a very small number of instances, may consider artificial wetlands as playing a role in a special feature. For example, the Baffle off stream lagoons near Lowmead (ba_nr_ec_05). Artificial wetlands have been included in this ACA for the purpose of ecological comprehensiveness. The values assigned to artificial wetlands are meant to serve primarily as an ecological inventory. Their inclusion is not meant to imply any policy, protective or legislative requirements.

The minimum size for a non-riverine spatial unit within the WBBGBRCC ACA is 0.1 ha and the maximum size is 5,373 ha. Overall, the average size for the spatial units is 11 ha.

2.3 Assessment parameters

The Criteria, Indicators and Measures (CIM) implemented for each WBBGBRCC ACA are outlined in Table 2. An overview of each criterion and the types of ecological values that are being captured, are outlined in Appendix I – Criteria definitions.

These CIM lists were developed from the default list of Criteria, Indicators and Measures provided by Clayton et al. (2006). The default CIM list is not mandatory and instead provides a starter set for consideration when setting up the assessment parameters for a new ACA.

Each ACA can have a different combination of assessment parameters based on a different combination of source datasets. Implementation of these measures can be complex therefore comprehensive implementation tables are maintained throughout the assessment. A description of how each measure was implemented for both the riverine and non-riverine assessment is outlined in the tables contained in Appendix II – Riverine implementation table and Appendix III – Non-riverine implementation table.

Measure data used in an ACA come from different sources and in different data types (i.e. continuous, presence/absence, categorical, etc.). A procedure called thresholding is used to standardise measure data to a common scale so it can be compared within the database. The seven threshold types used to standardise AquaBAMM measure data include:

- Categorical
- Continuous Ascending
- Continuous Descending
- Continuous Descending (Negative)
- Presence Positive
- Presence Negative, and
- User Defined.

The threshold type chosen for a particular measure depends upon the type and distribution of the data.

Thresholding involves applying rules to assign a threshold score of 1 (i.e. Low), 2 (i.e. Medium), 3 (i.e. High), or 4 (i.e. Very High) to each spatial unit for each measure. Threshold scores do not need to be specified for measures with a threshold type of Presence Positive and Presence Negative as these are defined using code within the AquaBAMM database.

Measure scores of -999 are used for spatial units being assessed (e.g. for special features) to have no value (i.e. true-absence) for a particular measure. Using a value of -999 ensures the measure is considered as having data when calculating a spatial unit's dependability score.

Measure scores of No Data indicate there is no data available to evaluate the measure for a particular spatial unit. Measures with No Data lower a spatial unit's dependability score.

Not all measures are applied to all spatial units. For example, highly modified and artificial wetlands are not suitable for inclusion in the assessment of representativeness and were excluded from Measures 8.1.1, 8.2.1, 8.2.2, 8.2.3, 8.2.4 and 8.2.6. Also the Threatened Species and Priority Species Measures (4.1.1, 4.1.2, 5.1.1, 5.1.2 and 5.1.3) exclude artificial wetlands as their conservation values are continually being eroded by anthropogenic processes.

Table 2. Criterion, indicator, measure list used for the Queensland Wide Bay-Burnett Great Barrier Reef Aquatic Conservation Assessments

Criteria and Indicators	Measures		Riverine	Non-riverine
1 Naturalness aquatic				
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	Y	Y
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	Y	Y
	1.1.3	Presence of exotic invertebrate fauna within the wetland	Y	Y
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	Y	Y
1.3 Habitat features modification	1.3.4	Presence/absence of dams/weirs within the wetland	Y	
	1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	Y	
	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	Y	Y

Criteria and Indicators	Measures		Riverine	Non-riverine
1.4 Hydrological modification	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through DES wetland mapping and classification)		Y
2 Naturalness catchment				
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	Y	Y
2.2 Riparian disturbance	2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	Y	
	2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	Y	
	2.2.5	% area of remnant vegetation relative to pre-clear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands		Y
	2.2.9	% tree cover within the waterway corridor	Y	Y
2.3 Catchment disturbance	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	Y	Y
	2.3.12	Potential landuse pressures on water quality within a subsection.	Y	Y
	2.3.13	Potential load of anthropogenic fine sediments within a subsection.	Y	Y
2.4 Flow Modifications	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	Y	Y
	2.4.7	Potential landuse pressures on changes to natural flow water regime within a subsection.	Y	Y
3 Diversity and richness				
3.1 Species	3.1.1	Richness of native amphibians (riverine wetland breeders)	Y	
	3.1.2	Richness of native fish	Y	Y
	3.1.3	Richness of native aquatic dependent reptiles	Y	Y
	3.1.4	Richness of native waterbirds	Y	Y
	3.1.5	Richness of native aquatic plants	Y	Y
	3.1.6	Richness of native amphibians (non-riverine wetland breeders)		Y
	3.1.7	Richness of native aquatic dependent mammals	Y	Y
3.2 Communities/ assemblages	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	Y	
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. sub-section)	Y	Y
	3.3.3	Richness of wetland types within the sub-catchment	Y	Y
4 Threatened species and ecosystems				
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NC Act, EPBC Act	Y	Y
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NC Act, EPBC Act	Y	Y
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NC Act, EPBC Act	Y	Y
5 Priority species and ecosystems				
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	Y	Y
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	Y	Y
	5.1.3	Habitat for, or presence of, migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	Y	Y
	5.1.4	Habitat for significant numbers of waterbirds	Y	Y

Criteria and Indicators	Measures		Riverine	Non-riverine
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	Y	Y
6 Special features				
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	Y	Y
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	Y	Y
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	Y	Y
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	Y	Y
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	Y	Y
	6.3.4	Areas important as refugia from the predicted effects of climate change (e.g. source of species re-population)	Y	Y
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. Spring fed stream, ephemeral stream, boggomoss)	Y	Y
7 Connectivity				
7.1 Significant species or populations	7.1.4	Instream fragmentation due to anthropogenic barriers within a sub-catchment, based on an acknowledged metric.	Y	
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6 (e.g. karsts, cave streams, artesian springs)	Y	Y
7.3 Floodplain and wetland ecosystems	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.	Y	
7.4 Terrestrial ecosystems	7.4.2	Terrestrial natural area connectivity within a subsection based on an acknowledged metric.	Y	Y
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6.	Y	Y
	7.5.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist in marine or estuarine areas.	Y	
8 Representativeness				
8.1 Wetland protection	8.1.1	The percent area of each wetland type within Protected Areas.		Y
8.2 Wetland uniqueness	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)		Y
	8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the sub-catchment or estuarine/marine zone (management groups ranked least common to most common)		Y
	8.2.3	The size of each wetland type relative to others of its wetland management group within the catchment or study area		Y
	8.2.4	The size of each wetland type relative to others of its wetland management group within a sub-catchment (or estuarine zone)		Y
	8.2.5	Wetland type representative of the study area – identified by expert opinion	Y	Y
	8.2.6	The size of each wetland type relative to others of its type within the catchment or study area		Y

NC Act	*Nature Conservation Act 1992* (Queensland)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ASFB	Australian Society for Fish Biology
WWF	World Wildlife Fund
JAMBA	Japan–Australia Migratory Bird Agreement
CAMBA	China–Australia Migratory Bird Agreement

2.4 Wetland management groups

The Queensland Wetlands Program identifies attributes addressing characteristics of lacustrine and palustrine wetlands at increasingly specific scales (continental, ecosystem, landscape, and local). These attributes can be used to develop wetland typologies aimed at classifying wetlands into types or groups useful for wetland management, monitoring and regulation.

Through expert consultation, and an iterative process of reality checking with the mapping, a series of wetland habitat types has been developed that are broad enough to cover Queensland, while allowing the identification and grouping of key wetland ecological and physical processes across the broad climatic zones of Queensland (DES 2023). As wetlands are spatially and temporally diverse, this typology also allows for combining wetland habitat types which may be found within an individual wetland (e.g. a lacustrine waterbody may have a palustrine fringe). Wetland habitat types are subsequently called wetland management groups for the purposes of an Aquatic Conservation Assessment. Wetland management groups are used for AquaBAMM Measures 8.2.1, 8.2.2, 8.2.3 and 8.2.4.

2.5 Weighting of measures

AquaBAMM measures are weighted according to their importance to an indicator based on the following rules:

- At least one measure within each indicator must be weighted 10 which is the highest weighting.
- Other measures within each indicator were weighted compared to the weighting of 10 assigned in the first step.
- It was okay to have different measures with the same weight (i.e. all measures could be weighted 10).
- Some indicators only had one measure and had already been given a weighting of 10.
- Measures shouldn't be weighted down because of the quality or lack of data for that measure.

Normally expert panel members are asked to weight the measures within each indicator at the expert panel workshops. Weights from all respondents are then averaged and reviewed with particular attention to averages having a high variance.

The measure weights used for the WBBGBRCC assessments were based on the average weights derived from the workshops held for Southeast Queensland (2015), Lake Eyre and Bulloo Basins (2016), Eastern Gulf of Carpentaria (2018) and Southern Gulf Catchments (2020). If no measures within an indicator received a weight of 10, then the weights for all measures within the indicator were adjusted relative to each other to ensure that at least one measure had a weight of 10. For example, if an indicator had three measures with average scores of 9.5, 9.0 and 8.0, the adjusted weights were 10, 9.5 and 8.5 (i.e. 0.5 was added to the weights of all three measures). This is done because at least one measure within each indicator must have a weight of 10.

New measures added to this assessment that were not used in previous assessments were given a weighting of 10. They were identified to provide a better conservation value and of high importance than those within the same Indicator.

The riverine and non-riverine measure weights are outlined in Appendix IV – Riverine indicator ranks and measure weights and Appendix V – Non-riverine indicator ranks and measure weights.

2.6 Ranking of indicators

AquaBAMM indicators are ranked according to their importance in contribution to a criterion with a rank of 1 signifying the most important contribution. Indicator ranks are based on the following rules:

- At least one indicator within each criterion must be ranked one which is the highest ranking.
- The other indicators are ranked (within each criterion) relative to the ranking of one assigned in the first step.
- It is possible to have different indicators with the same ranking (i.e. all indicators may be ranked one).
- An indicator should not be ranked down because of the quality or lack of data for that indicator.

Similar to the measure weights, an indicator rank given to each indicator within a criterion was based on the ranks derived by the expert panel workshops for Southeast Queensland (2015), Lake Eyre and Bulloo Basins (2016),

Eastern Gulf of Carpentaria (2018) and Southern Gulf Catchments (2020).

For each panel workshop, ranks from all respondents were reviewed and the common rank assigned to each indicator. Where two or more ranks were most common, we used the highest rank for the indicator. For example, if an indicator was raked 1, 1, 2, 2, 3 by the expert panel, we used an indicator rank of 1.

Indicator 7.4 Terrestrial ecosystems is a new indicator for this assessment (not used in previous assessments) and was given a ranking of 1.

The riverine and non-riverine indicator ranks are outlined in Appendix IV – Riverine indicator ranks and measure weights and Appendix V – Non-riverine indicator ranks and measure weights.

2.7 Filter tables

A series of arithmetic techniques are used to bring measure data through to ratings for each criterion. Arithmetic techniques can mask important effects or insufficiently discriminate between spatial units when used to create an overall AquaScore. Authors such as Chessman 2002 discuss this issue.

Rather than a final arithmetic combination, AquaBAMM uses a criterion rating combination table (i.e. filter table) that provides an ordered series of decisions that are tested against the final criterion ratings for each spatial unit (See Appendix VI – Riverine filter table and Appendix VII – Non-riverine filter table). Each decision contains a unique combination of criterion ratings and associated AquaScore. These decisions are essentially several 'if-then' statements and are tested in sequence for each spatial unit. An AquaScore is assigned immediately when a match is achieved between the criterion rating combination of the decision and that of the spatial unit. This filtering table technique has previously been used successfully in the Biodiversity Assessment and Mapping Methodology (EPA 2014). It is important to note that, unlike previous steps through the AquaBAMM tool, the AquaScore may be one of five categories (i.e. Very High, High, Medium, Low and Very Low). This increased level of discrimination at the AquaScore level provides for a more useful conservation assessment tool and enables more informed management decisions.

2.8 Dependability and data richness

The AquaBAMM calculates a dependability score to provide an indication of the richness of data for each spatial unit. Criterion ratings and AquaScores should be interpreted in conjunction with the corresponding dependability scores, as these provide an overall indication of the amount of data available for each spatial unit.

Dependability scores range from 0 to 1 and are calculated as a fraction representing the number of measures with data for a spatial unit out of the total number of measures used in the assessment. Dependability is calculated as follows:

$$\text{Dependability} = \frac{\text{No. of measures with data (count)}}{\text{Total no. of measures (count)}}$$

Dependability scores indicate the potential for an AquaScore to change (upgrade or downgrade) with the addition of new data. For example, where subsections with Very Low AquaScore values have low dependability, the results should be used cautiously as the AquaScore may be due to the inherent lack of values or the lack of data. In the case of missing data, further survey work may add more data which may, or may not, change the AquaScore. Dependability scores can also provide an indication of where additional survey work may be required and which, once completed, may or may not change an AquaScore.

2.9 Biodiversity / Conservation value categories

The AquaBAMM calculates an overall aquatic conservation score, called an AquaScore, for each spatial unit within a study area. The AquaScore ratings can be Very High, High, Medium, Low or Very Low and are relative within a study area.

The following descriptions provide a summary of the general characteristics of each AquaScore.

Very High

Wetlands given an AquaScore of Very High generally have very high biodiversity values across all criteria (aquatic naturalness, catchment naturalness, diversity and richness, threatened species, special features, connectivity, representativeness), or Very High representativeness values in combination with Very High aquatic naturalness, catchment naturalness or threatened species values. They may also be wetlands nominated by an expert panel as containing very important special or unique features from a flora, fauna and/or ecological perspective regardless of the values across the other criterion.

High

Wetlands given an AquaScore of High are mainly those that have Very High aquatic naturalness or representativeness values in combination with High or Very High values for rare and threatened species or diversity and richness. Combinations of Very High or High values among most criteria may also result in a High AquaScore. They may also be wetlands nominated by an expert panel as containing important special or unique features from a flora, fauna and/or ecological perspective regardless of the values across the other criterion.

Medium

Wetlands given an AquaScore of Medium generally have combinations of High and Medium rating across the various AquaBAMM criteria.

Low

Wetlands given an AquaScore of Low generally have limited aquatic and catchment naturalness values and generally varied combinations of Medium and Low values across the criteria. These wetlands do not contain special or unique features.

Very Low

Wetlands given an AquaScore of Very Low generally have Low naturalness (i.e. Criterion 1 and 2) and lack any other known significant values. They may also be wetlands that are largely data deficient across the AquaBAMM measures. These wetlands do not contain special or unique features.

2.10 Transparency of results

Despite presentation as a single AquaScore, Aquatic Conservation Assessments results are available at the AquaScore, Criterion, Indicator, Measure threshold and Measure data level. All results are available to the user through the use of user-defined queries inside a Geographical Information System (GIS) or other database applications (i.e. Microsoft Excel).

Results may be interrogated at one or more levels in an almost infinite number of combinations. This transparency of results provides Aquatic Conservation Assessment end users with a unique level of flexibility for interrogation, interpretation and presentation. This data access and interrogation flexibility is important as it enables investigation of different data contributions to the overall conservation value, investigation of missing data, and an ability for users to tailor Aquatic Conservation Assessment outputs for a particular purpose. The intent of an Aquatic Conservation Assessment is not only to evaluate aquatic ecological and conservation values, but just as importantly, to identify variability in these values. Links between the Aquatic Conservation Assessment results and GIS facilitate this and constitute the complete Aquatic Conservation Assessment results release package.

2.11 Updates and differences from WBB ACA version 1.1

The previous version (1.1) of the WBB ACA was released in 2011. While the general methodology (AquaBAMM) has remained unchanged, there have been numerous changes regarding base input datasets in addition to refinements of some elements of the methodology. This makes any direct comparison to the previous version difficult.

With each successive ACA, there are refinements to input datasets and methodology implementation. Each ACA uses the most up-to-date data available at the time the project work is undertaken. These updates can alter the individual spatial units AquaBAMM scores for each criterion and overall AquaScore. Some of these updates for the WBBGBRCC ACA v2.1 include:

1. The QLD wetland mapping v2.0 was utilised for WBB v1.1 and only the natural (H1) or slightly modified (H2M1, H2M2, H2M3, H2M5) wetlands were included. While for the WBBGBRCC v2.1, the QLD wetland mapping v6.0 was utilised and all wetlands were included irrespective of hydrological modifications.
2. Refinements to the filter table is an ongoing process in which there is potential for each assessment to produce a unique combination of criteria ratings, that on a rare occasion, may not be captured at the right level in the filter table. For the current filter tables (see Appendix VI – Riverine filter table and Appendix VII – Non-riverine filter table).
3. Additional species records from survey work.
4. There has been a considerable refinement of the flora Wetland Species Indicator List, which helps guide species inclusion.
5. There have been changes in NCA species status for some Threatened and Near-threatened species. This is an ongoing process undertaken by the Species Technical Committee, coordinated by DESI.

6. The weights and ranks for measures and indicators have been reviewed and updated. With the completion of ACAs statewide, there is comprehensive information on weights and ranks, as provided by expert panels. The decision was made to utilise the overall average weight/rank score for each measure and indicator respectively as it was not possible to undertake this process with the v2.1 expert panels due to time constraints.
7. The WBBGBRCC v2.1 expert panel reports include reviewed and updated special features.. Additional special features defined at the expert panel workshops have been added to the current assessment.
8. There were many differences between assessments in the measures utilised (see Appendix VIII – Criterion, indicator, measure list comparison between WBBGBRCC v2.1 and previous versions). WBBGBRCC v2.1 only utilised measures that had available and current datasets for the entire assessment area. It is recognised that datasets may have been missed or that we are not yet aware of. In addition to updated data, new indexes were calculated that utilised new published methodologies. These include the CAFI index, natural area connectivity, landuse pressures and the Paddock 2 Reef fine sediment modelling.

Major differences that can affect the proportions (% of spatial units) of scores for each criterion and AquaScore are set out below.

9. Framework datasets, (bounding area, study area and sub catchments) have been updated to match a point of truth framework (see section 2.11.1 below).
10. WBBGBRCC v2.1 has included H3 (artificial) wetlands. There are 2,809 artificial wetlands which comprise 51% of total wetland proportion (5,500). While artificial wetlands are recognised as having some potential ecological value, they are not included in all measures (for further details see section 2.3 and the implementation tables in Appendix II – Riverine implementation table and Appendix III – Non-riverine implementation table).

2.11.1 Updates to framework datasets

A review of the framework datasets was completed to provide a contextual reference for Aquatic Conservation Assessments in relation to other data sources and projects that work with drainage basins.

Spatial data was provided by the Department of Resources which is an authoritative single point of truth for the extent of river drainage in the State of Queensland. The spatial data includes the extent and name for Drainage Divisions and Drainage Basins as defined by the Australian Water Resources Management Committee (WRMC). It also includes River Basins which were compiled by determining watersheds based on 1:100,000 topographic contours. Each of the three data layers have boundaries that are aligned to and nested with each other.

The GBRCC framework bounding areas were determined by the drainage divisions that best aligned with the Natural Resource Management regional boundaries and cut at the Queensland border. Nested within this bounding area layer are the study areas and sub-catchments. These were determined by the Drainage Basins and River Basins linework that best aligned with the original ACAs.

3 Results

3.1 Accuracy and dependability

The Queensland Wetland Mapping data is the core dataset Aquatic Conservation Assessments are built upon. This dataset is mapped at a scale of 1:100,000 with a positional accuracy of ±100 metres, except for areas along the east coast that may be mapped at a scale of 1:50,000 with a positional accuracy of ±50 metres. Wetlands smaller than 1 hectare are not delineated in the wetland data.

The dependability score is a percentage of how many measures, out of those calculated, have data. The dependability does not influence or change the final AquaScore. The Aquatic Conservation Assessment results should be interpreted in conjunction with the dependability score.

3.2 Riverine results

Aquatic Conservation Assessments were conducted for the riverine spatial units within each study area. Figure 2 and Figure 3 map the riverine AquaScores, dependability scores and criteria ratings for each riverine spatial unit. AquaScores range between Very High to Very Low, where Criteria scores range from Very High to Low.

Figures 4 to 9 provide summary statistics of the riverine AquaScores, dependability scores and criteria ratings by study area as outlined in the list below. AquaScores range between Very High to Very Low, where Criteria scores range from Very High to Low.

- Figure 4. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Baffle Study Area
- Figure 5. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burrum Study Area
- Figure 6. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burnett Study Area
- Figure 7. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Kolan Study Area
- Figure 8. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Mary Study Area
- Figure 9. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Other Islands Study Area

Key findings

- All study areas have a range of AquaScores from Very High to Very Low. The reasons behind this variation vary greatly from identified special feature decisions, the number of pest species recorded within the area, to the number of anthropogenic influences on water quality and in-stream connectivity.
- Very few spatial units rated High or greater for aquatic naturalness (Criterion 1) with nearly 80% rating Medium and Low (Figure 3). For catchment naturalness (Criterion 2) however, over 50% of the spatial units rated High.
- The reasonably low ratings for aquatic naturalness are due to the number of pest species found within the region and the very high number of anthropogenic barriers. Instream barriers included dams, weirs, overland flow barriers and road culverts. Though each barrier was weighted with a fauna ‘passability’ rating, just the shear number of barriers within the region was very high for all mainland study areas.
- Catchment naturalness is highly influenced by the retention of remnant riparian zones along many of the creeks and rivers. Some spatial units within each of the study areas had Medium to Low ratings due to agricultural landuse influences on water quality and flow.
- The diversity and richness of species (Criterion 3) and the spread of threatened species (Criterion 4) within the region, appear to be evenly distributed across all study areas. This is very dependent on the number of field surveys conducted over the years and the limitations to reach all areas for all species taxa. These limitations are reflected in the low dependability scores shown in the summary statistics.
- The limitations in available species records are also reflected in Criterion 5 (priority species and ecosystems), where many spatial units within the western areas of each study area are either Low or have No Data. The Mary study area however, has higher ratings for some spatial units in the upper reaches of the Mary River (Figure 3).
- For Criterion 6 (Special Features), two spatial units within the Burnett study area were identified by the expert panel as having a Medium rating for a special feature decision (Figure 3). All others had ratings of High or Very High. Some of the major rivers that have special features include the Mary River (Mary study area), Gregory River (Burrum study area), Granite Creek (Baffle study area) and the upper reaches of the Burnett River (Burnett study area).

- The connectivity (Criterion 7) rating looks at a mix of expert panel decisions, terrestrial natural area connections (how connected is the wetland to other wetlands via terrestrial natural areas) and in-stream connections (or the fragmentation of channels due to anthropogenic barriers) (see Figure 3 and Table 2). The in-stream connectivity measure has identified subcatchments within each study area to be more fragmented by in-stream barriers. These include the downstream regions of the Burnett River and Barker Creek of the Burnett study area. There is also Tinana Creek in the Mary study area. These areas also have lower ratings for terrestrial natural area connections due to more agricultural based landuse practices of grazing and cultivation.
- Criterion 7 (connectivity) has very low dependability scores due to a non-comprehensive review by the expert panel.
- No spatial units were identified by the expert panel to be representative (Criterion 8) of riverine wetlands for any of the study areas.
- Data limitations and wide variations within study areas are clearly visible in the Dependability scores. The Mary and Burrum study areas are rich in data with dependability scores above 0.5 for all criteria (Figure 2, Figure 5, Figure 8). The other study areas have few spatial units rich in data (Figure 2).
- Criterion 6 (special features), 7 (connectivity) and 8 (representativeness) all have 100% dependability (Figure 4 to Figure 9). This is due to how the dependability score is calculated i.e. -999 is used to represent data where a conservation value has been assessed (by the expert panel) but it is not provided (true absence). True absence is considered as data for the measure when calculating the dependability score.
- The Other Islands study area has overall lower dependability scores, reflecting that data availability on these islands is limited. Of the 107 spatial units, few have freshwater riverine wetlands and most of these would be ephemeral, filling only during wet periods. All the islands are fully vegetated with no anthropogenic influences, apart from Lady Elliot Island. However, Criteria ratings are subjective and should be read with caution due to data limitations.
- The top three filter table decisions vary for each study area. However, Baffle, Burnett, Burrum and Kolan study areas all had the same top decision of 24 (Table 3), which reflects the Very High and High ratings for endangered species and ecosystems within the spatial units. The Mary study area has decision 24 as its second top decision (26%) below decision 4 (26.7%). Decision 4 indicates the spatial unit is identified by experts to contain one or more special features (Criterion 6).

Table 3. Top three filter table decisions for each study area

Study area	First top filter table decision	% of spatial units	Second top filter table decision	% of spatial units	Third top filter table decision	% of spatial units	Total % of spatial units
Baffle	24	29.3%	4	28.4%	38	17.5%	75.2%
Burnett	24	35.5%	23a	17.1%	38	12.7%	65.3%
Burrum	24	37.5%	4	35.0%	22, 23a, 25	5.0% for all	87.5%
Kolan	24	55.0%	22	7.5%	10, 23a, 4, 9	5.0% for all	82.5%
Mary	4	26.7%	24	23.6%	23a	10.9%	61.2%
Other Islands	4	66.4%	23a	18.7%	38	11.2%	96.3%

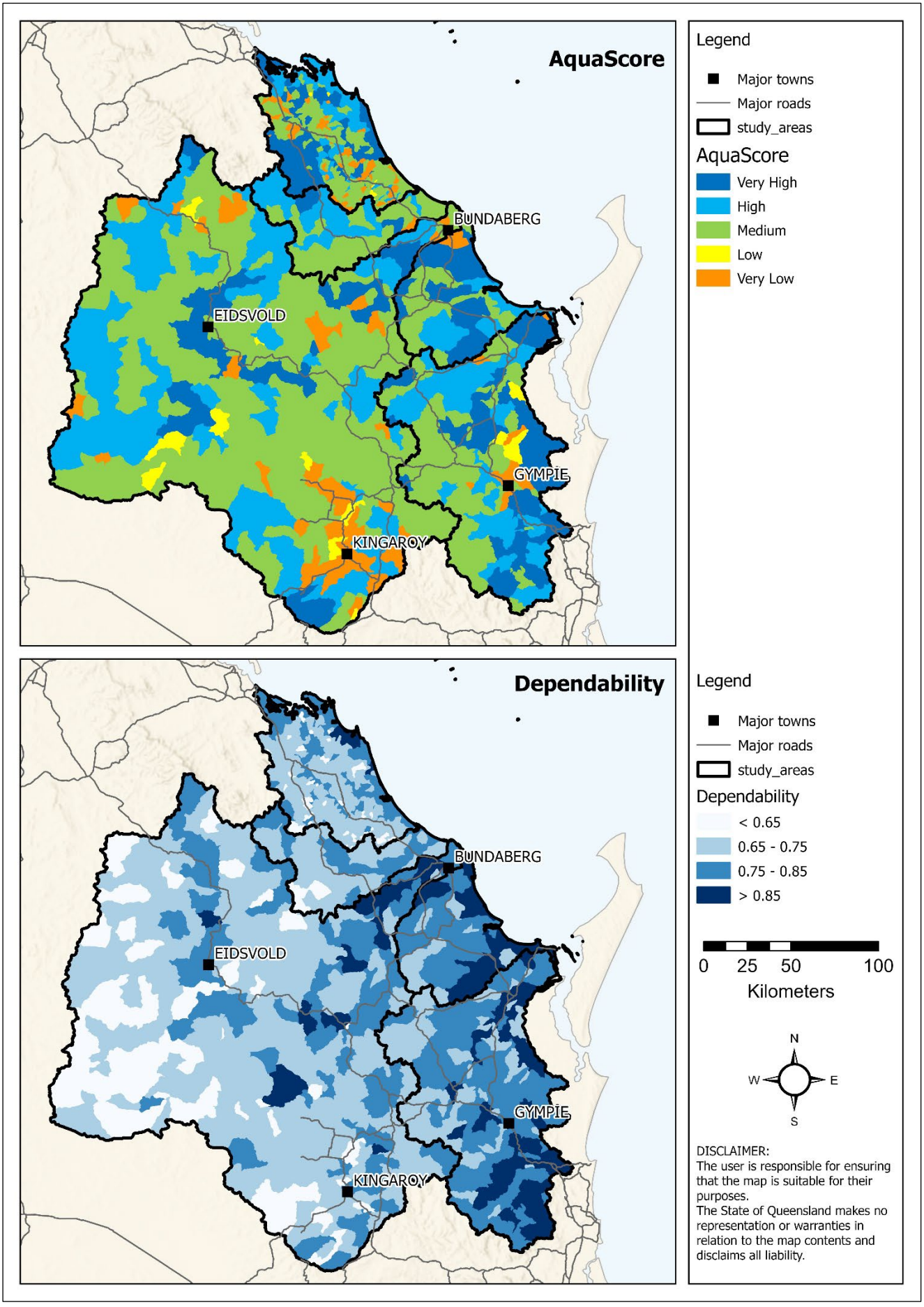


Figure 2. AquaScore and Dependability by riverine spatial unit

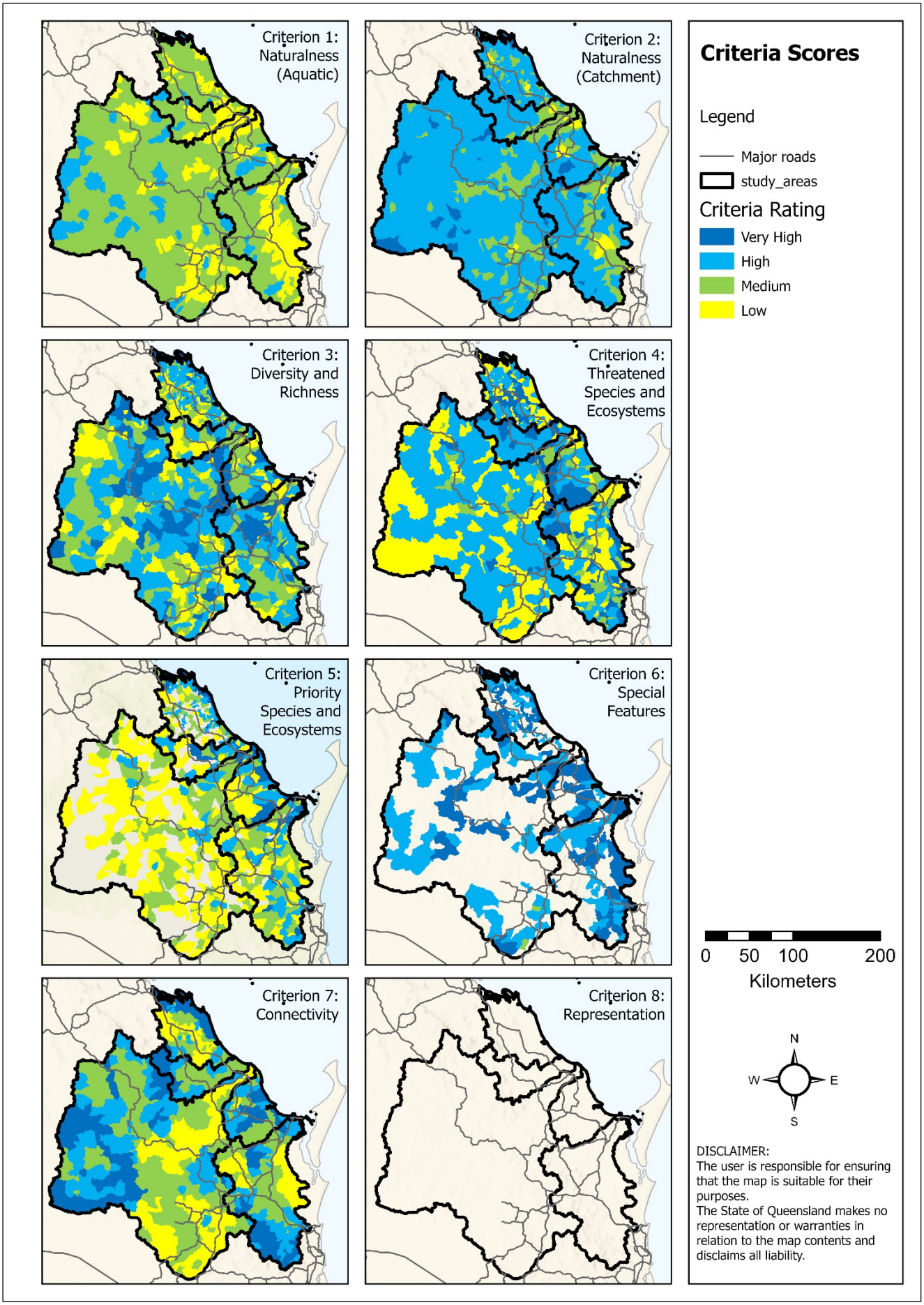


Figure 3. Ratings for Criterion 1 to 8 by riverine spatial unit

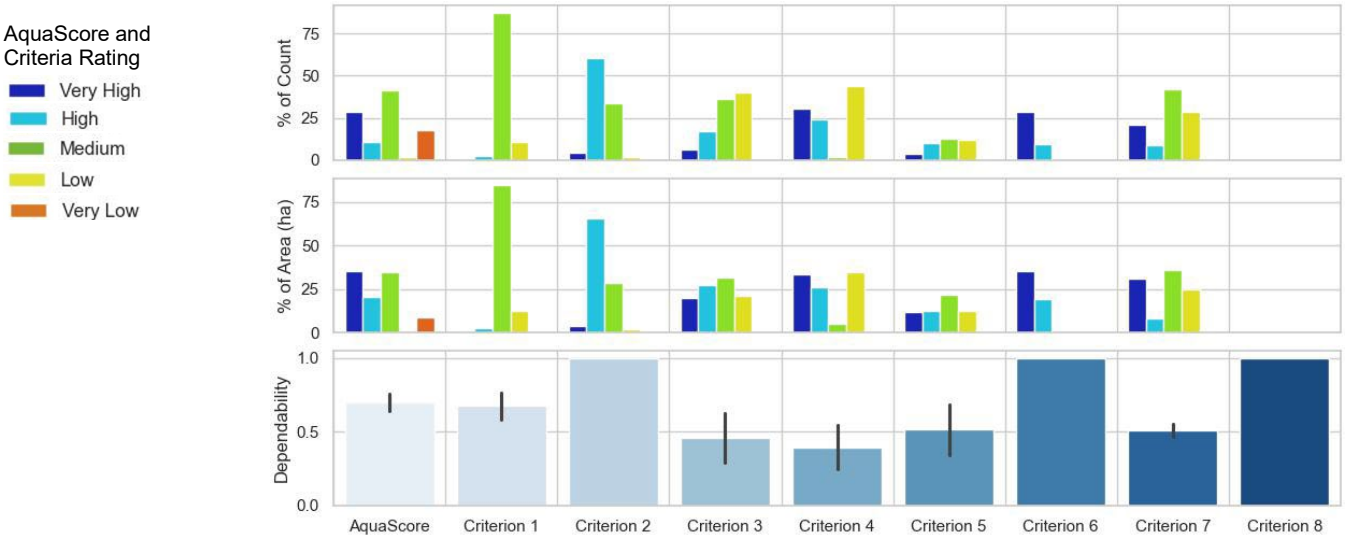


Figure 4. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Baffle Study Area

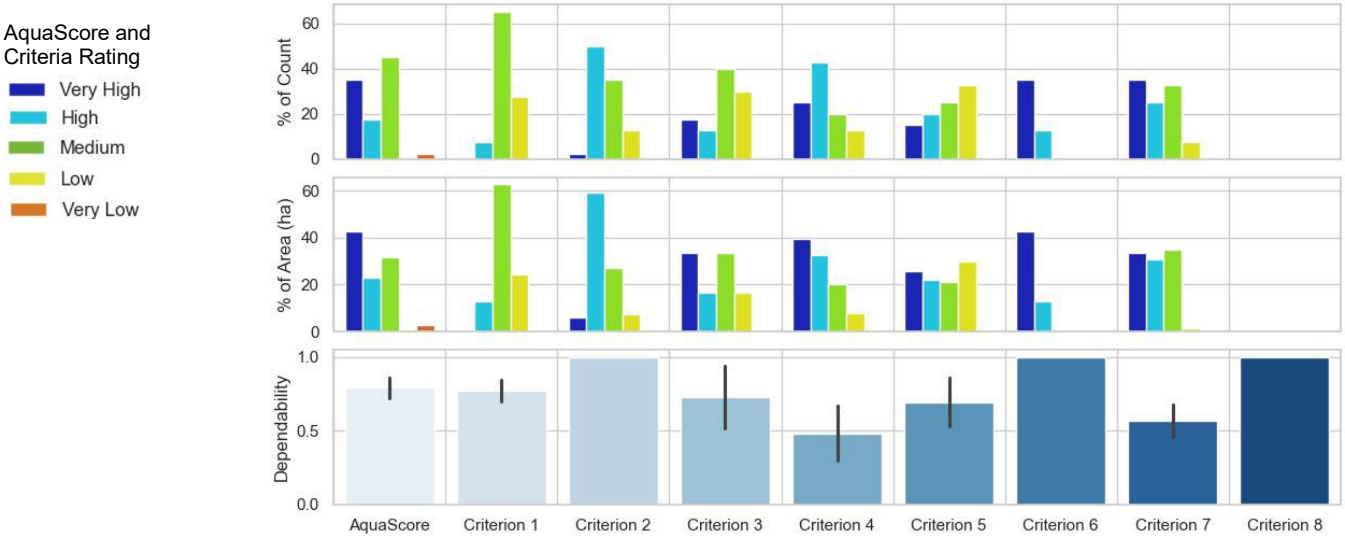


Figure 5. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burrum Study Area

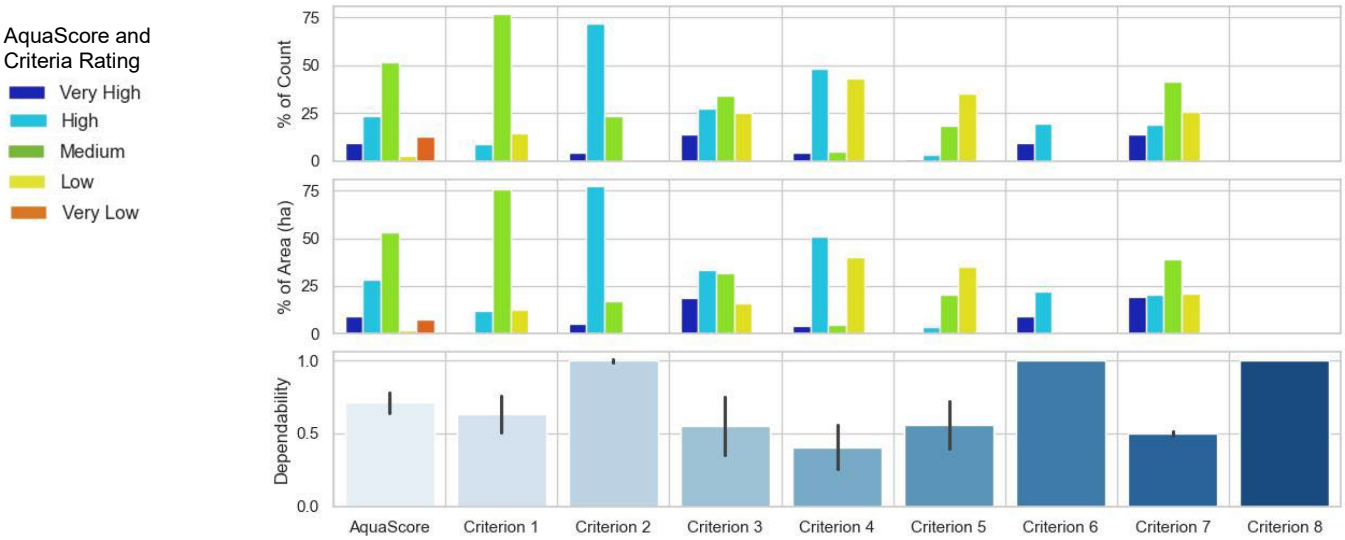


Figure 6. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burnett Study Area

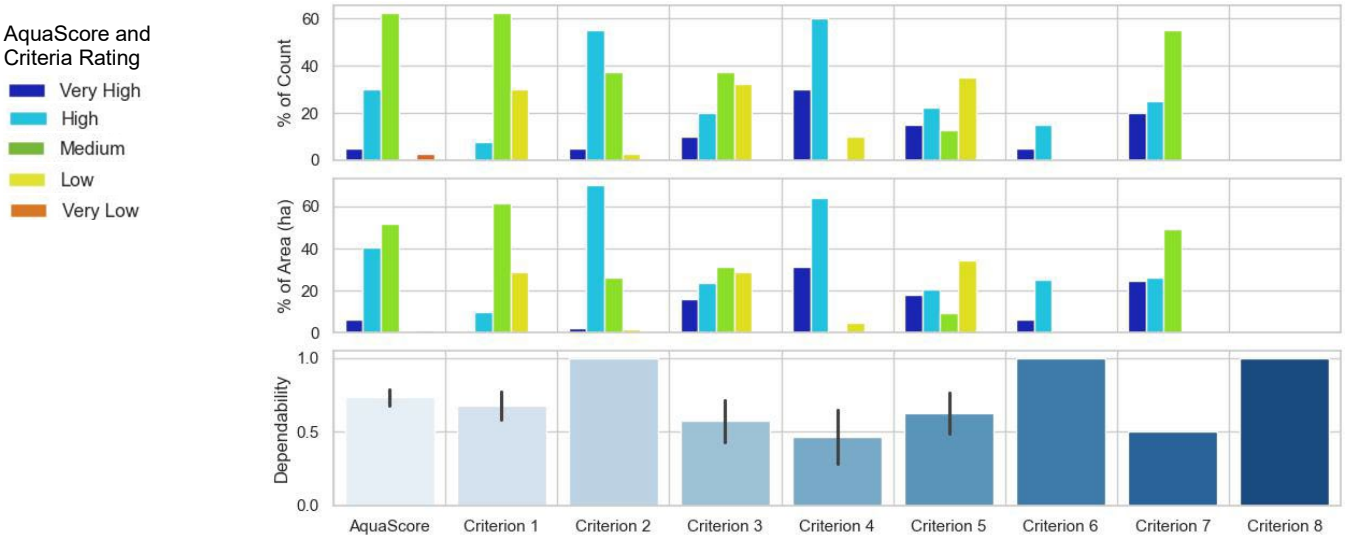


Figure 7. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Kolan Study Area

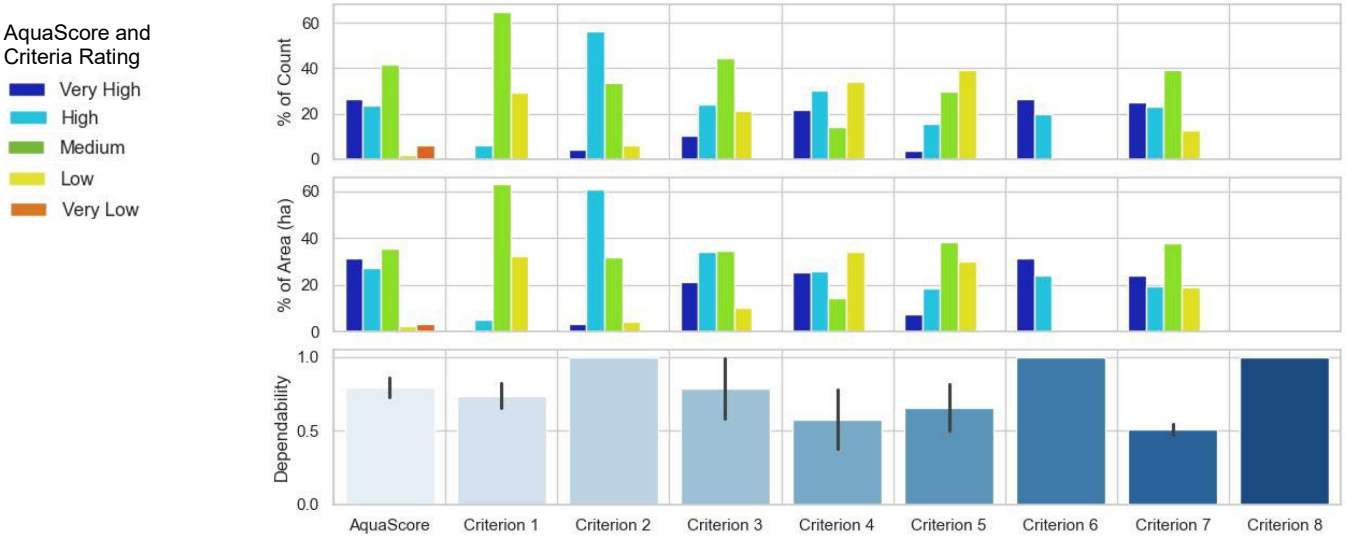


Figure 8. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Mary Study Area

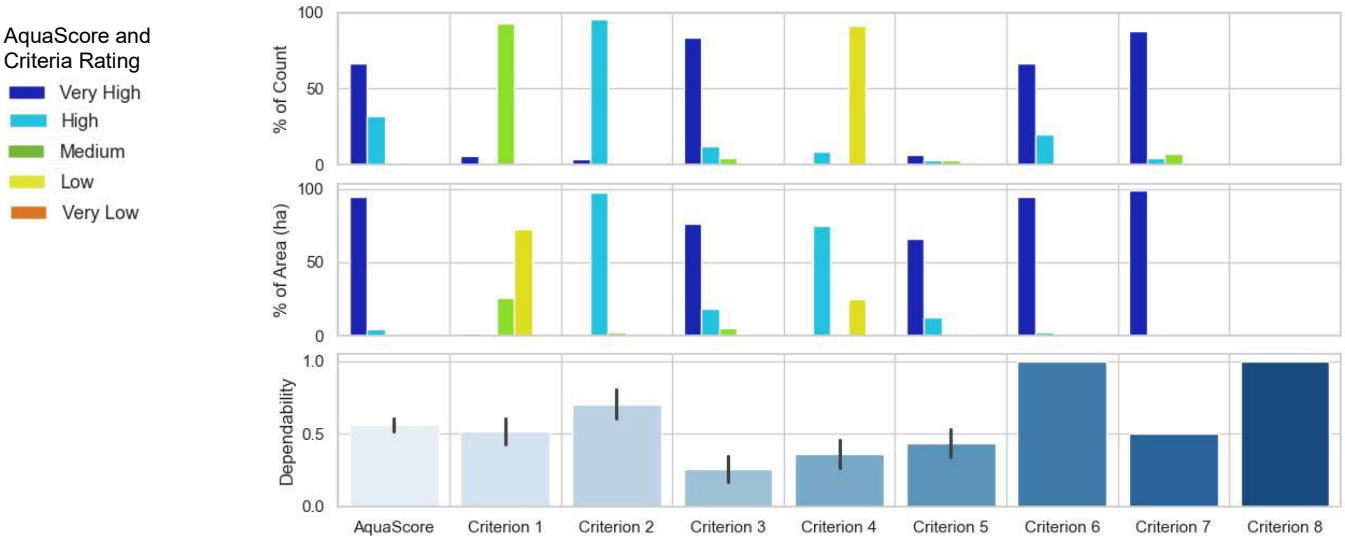


Figure 9. Proportions of riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Other Islands Study Area

3.3 Non-riverine results

Aquatic Conservation Assessments were conducted for the non-riverine spatial units within each study area. Figure 10 and Figure 11 map of the non-riverine AquaScores, dependability scores and criteria ratings for each non-riverine spatial unit.

Figures 12 to 17 provide summary statistics of the non-riverine AquaScores, criterion ratings and dependability scores by study area as outlined in the list below. AquaScores range between Very High to Very Low, where Criteria scores range from Very High to Low.

- Figure 12. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Baffle Study Area
- Figure 13. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burrum Study Area
- Figure 14. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burnett Study Area
- Figure 15. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Kolan Study Area
- Figure 16. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Mary Study Area
- Figure 17. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Other Islands Study Area

Key findings

- This assessment of the non-riverine wetlands included artificial wetlands as identified by the Qld Wetlands Mapping Program. This accounted for nearly 51% (2809 artificial in a total of 5500) of all the non-riverine wetlands within the mainland WBBGBRCC area. For each of the mainland study areas, the count of artificial by total wetlands were as follows: Baffle 395/1120 = 35%; Burnett 1109/1636 = 67%; Burrum 459/1037 = 44%; Kolan 275/394 = 69%; Mary 571/1313 = 43%.
- The Baffle and Burrum study areas contain some wetlands that are larger in area (ha). This is reflected in the different proportion values of the first two bar plots (Figure 12 and Figure 13). For example, 25% of wetlands within the Baffle study area rate High for Criterion 1, which accounts for over 60% of the area (ha). Also, 40% of wetlands have a Low rating, which only accounts for about 10% of the total area (ha).
- Criterion 1 has a dependability score of 0.5 or lower for all study areas. This is due in part to measure 1.3.7 (% area of remnant wetland relative to preclear extent) where not all wetlands contain remnant wetland ecosystems within a buffer zone (about 27% of all wetlands within WBBGBRCC). There is also a lack of aquatic and semi-aquatic pest species for each taxon group recorded within the vicinity of the wetlands.
- Less than 4% of spatial units within the mainland study areas have a rating of Very High for Criterion 1 or 2 (Figure 12 to Figure 17).
- The diversity and richness of species (Criterion 3) is reasonably well spread across all study areas and higher ratings follow the more natural areas and natural connections (Criterion 7) within the landscape (Figure 11).
- Low ratings for Criterion 7 (connectivity), identify areas of higher agricultural intensity, particularly cropping. High to Very High ratings are concentrated along the coastal fringes of Burrum and Baffle study areas.
- Criterion 7 (connectivity) has very low dependability scores due to a non-comprehensive review by the expert panel.
- The top three filter table decisions vary for each study area. However, Burnett, Burrum and Kolan study areas all had the same top three decisions of 1000, 28 and 19 (Table 4). Decision 19 indicates high levels of threatened species or ecosystems. Decision 28 allocates a Very Low AquaScore to the spatial unit and indicates that there are three or more Criteria with ratings of Low. Decision 1000 is a mixed bag where many Criteria have No Data (especially for artificial wetlands) and there are a mixture of High to Low ratings for any Criteria.
- The other top filter table decisions for the other study areas include 19, 5 and 27 for Baffle, Mary and Other Islands respectively. Decision 5 indicates the spatial unit is identified by experts to contain one or more special feature (Criterion 6). Decision 27 reflects that the spatial unit has four or more Very High Criterion ratings.

Table 4. Top three filter table decisions for each study area

Study area	First top filter table decision	% of spatial units	Second top filter table decision	% of spatial units	Third top filter table decision	% of spatial units	Total % of spatial units
Baffle	19	28.4%	28	15.8%	1000	12.1%	56.3%
Burnett	1000	31.2%	28	28.2%	19	11.4%	70.8%
Burrum	1000	18.3%	28	15.6%	19	12.1%	46.0%
Kolan	1000	41.6%	28	18.3%	19	12.2%	72.1%
Mary	5	35.8%	28	21.8%	1000	18.6%	76.2%
Other Islands	27	80.0%	5	6.7%	8	6.7%	93.4%

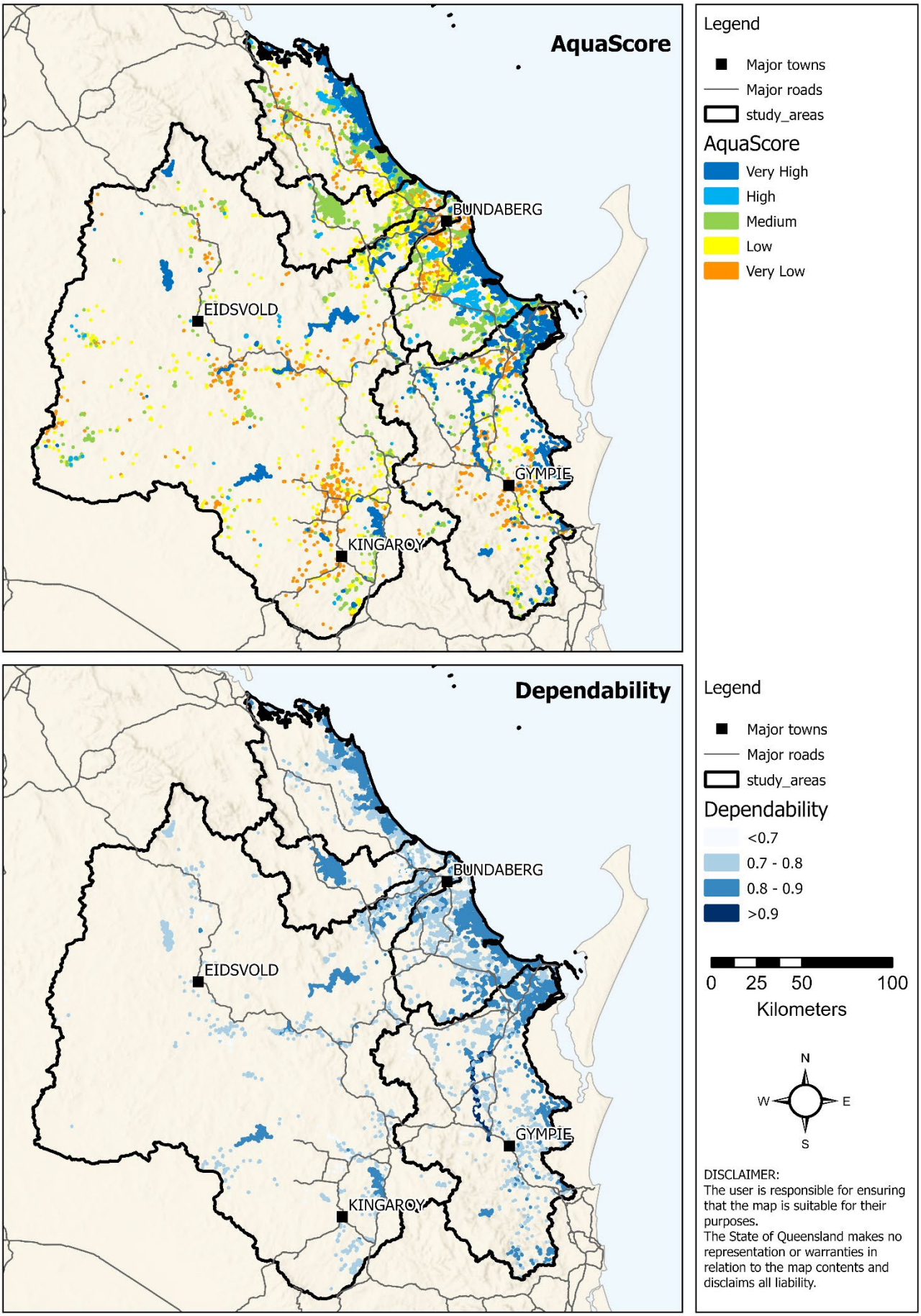


Figure 10. AquaScore and Dependability by non-riverine spatial unit

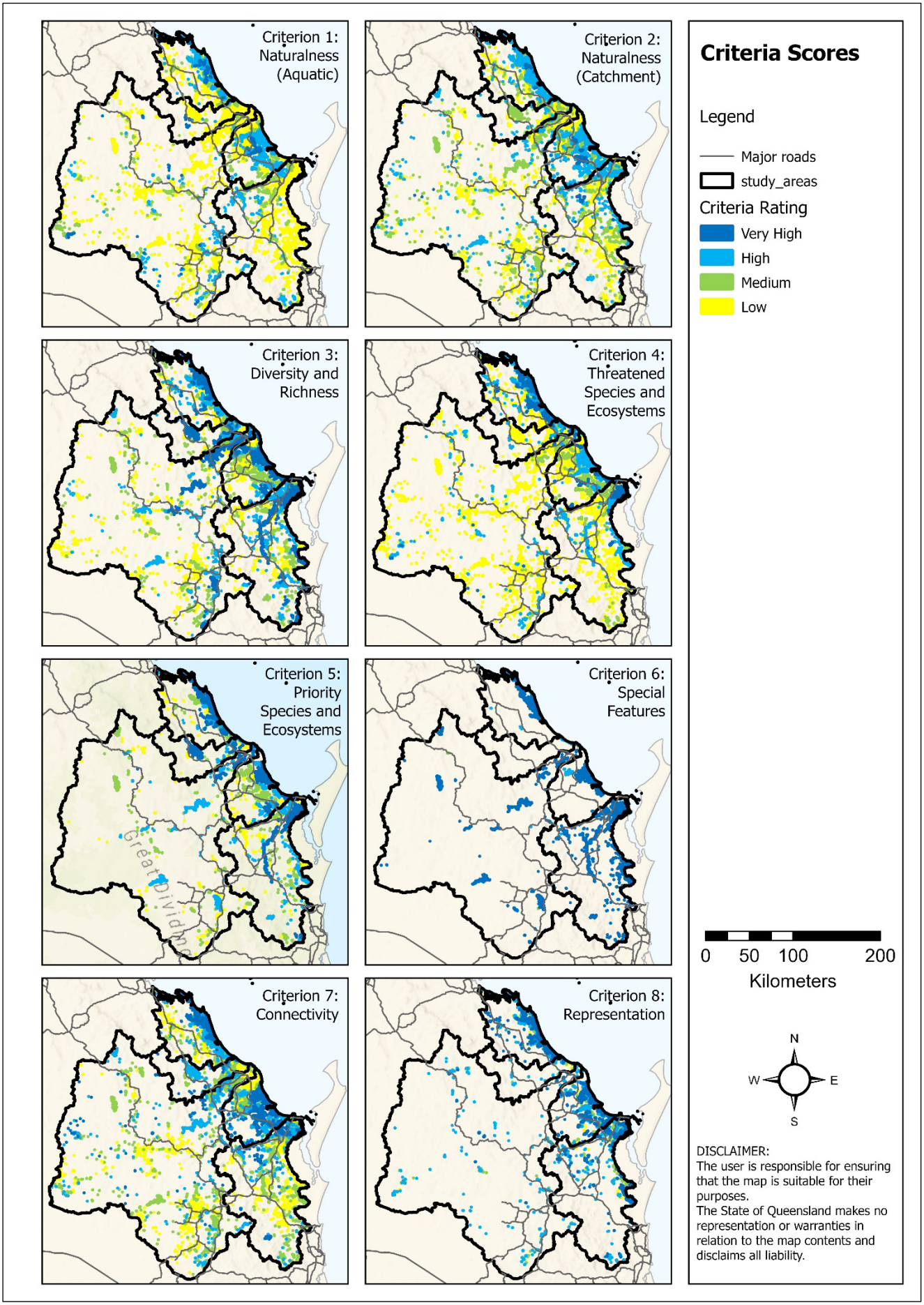


Figure 11. Ratings for Criteria 1 to 8 by non-riverine spatial unit

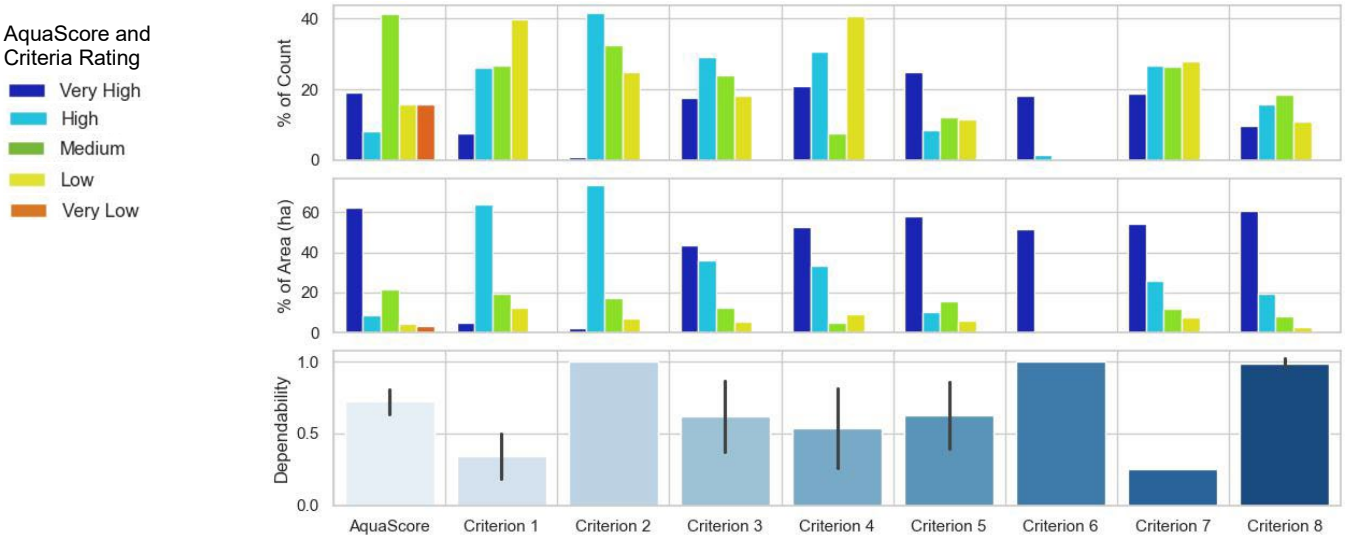


Figure 12. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Baffle Study Area

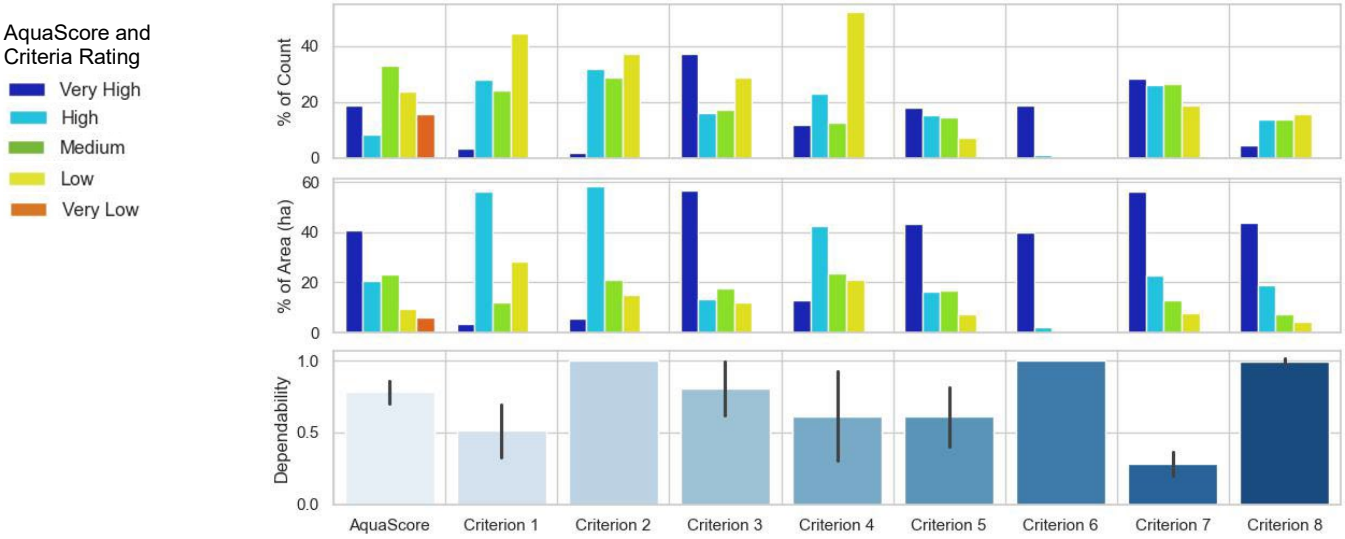


Figure 13. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burrum Study Area

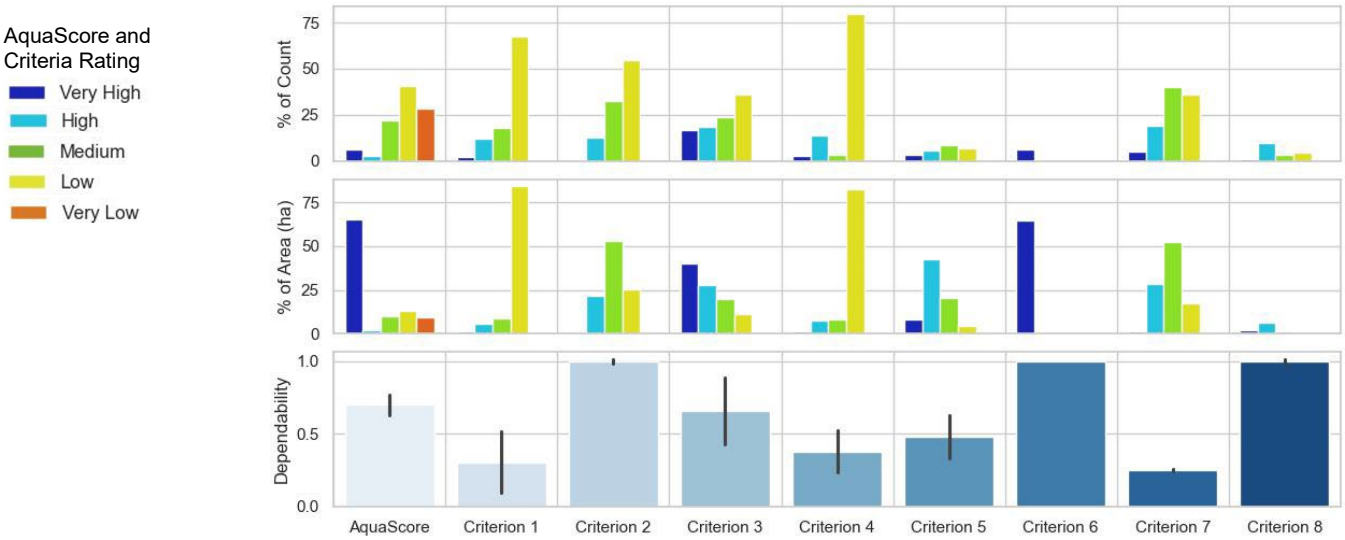


Figure 14. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Burnett Study Area

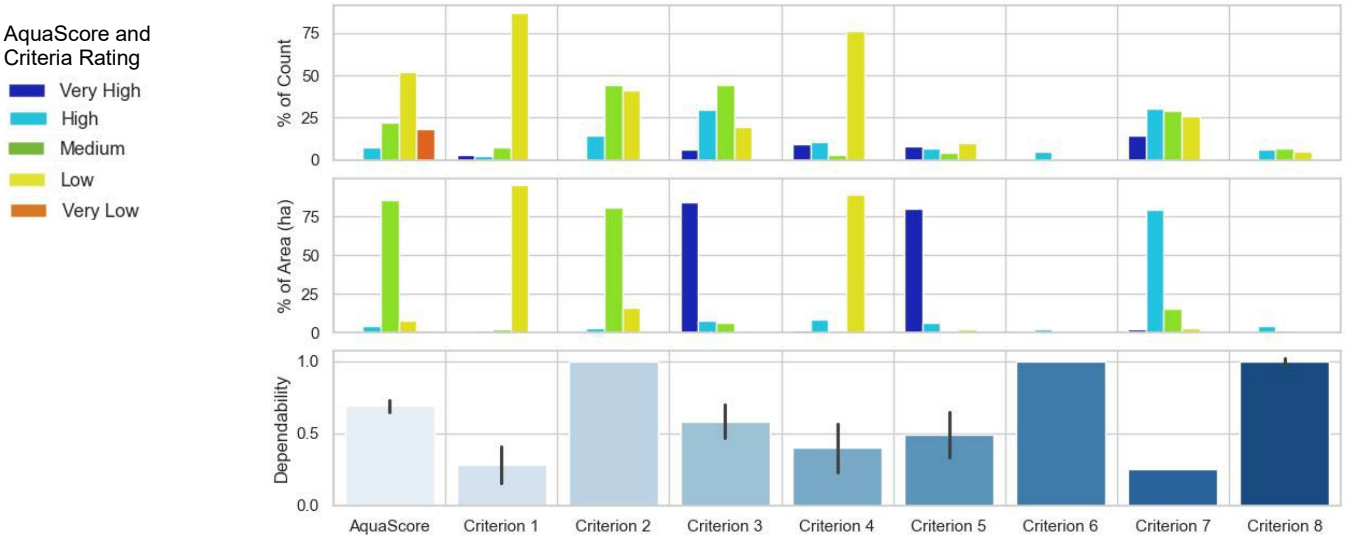


Figure 15. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Kolan Study Area

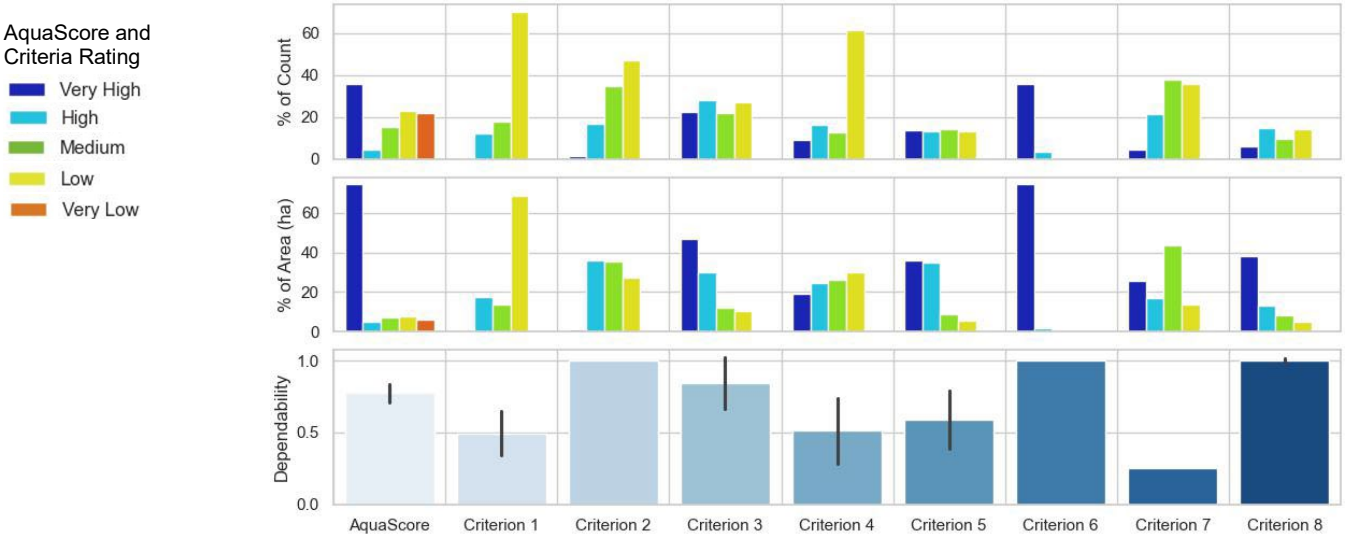


Figure 16. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Mary Study Area

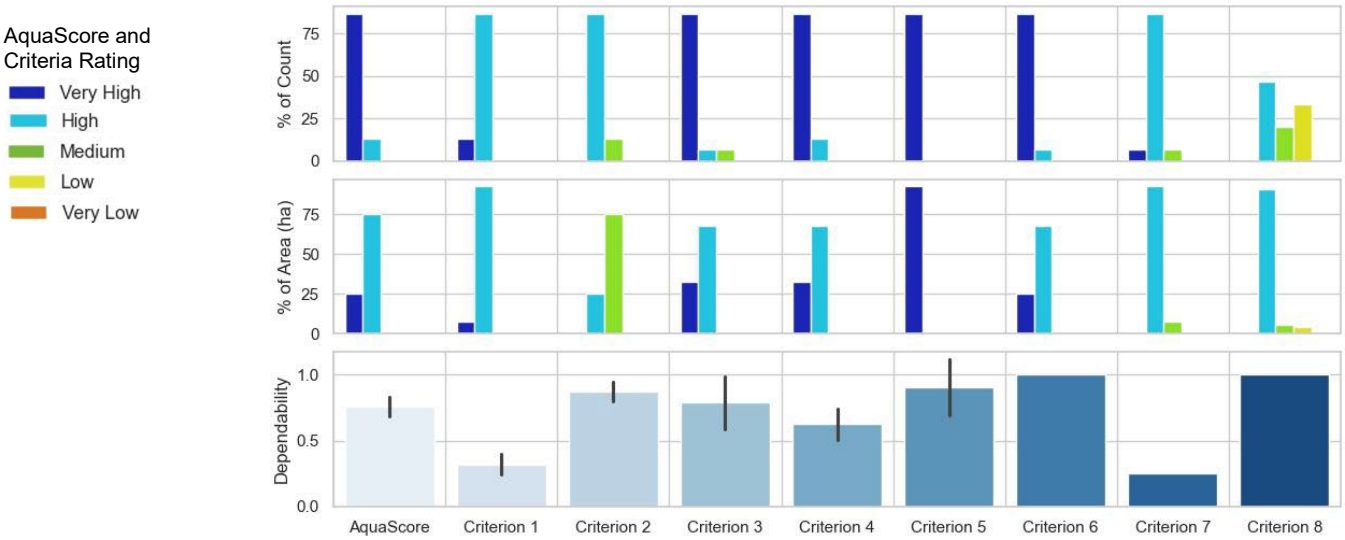


Figure 17. Proportions of non-riverine spatial units by Ratings and average Dependability with standard deviation error bars for the Other Islands Study Area

3.4 Ground-truthing

Ground-truthing by field observations is important to identify potential anomalies in assessment results or data implementation. It is an important step in any ACA and it precedes method adjustments and corrections prior to a final run of the AquaBAMM assessment tool.

The lack of available time meant that traveling into the field was unable to be undertaken for this assessment. Instead, high-resolution satellite imagery, aerial photography and other on-line ancillary data sources (including Queensland Globe, Google Earth imagery and photographs) provided a valuable resource to visually review individual wetlands and their surroundings (see section 3.4.2).

While visually interpreting the high-resolution imagery, several validation principles were used to test the validity of the implementation method. These include:

- Inspect spatial units across the range of values from Very Low to Very High. There is a focus on spatial units with Very Low, Low and Very High values as these are considered to have the most influence to reduce the potential of a false negative (type I error) or a false positive (type II error) result.
- Ascertain whether the implementation of Criterion 1 and Criterion 2 needs any adjustment with respect to measure weights and indicator ranks. Some measures or indicators may have an overpowering influence which is not consistent with observation e.g. influence of dams or weirs. This may be due to limitations and availability of relevant base datasets.
- Ascertain whether the size of subsections is adequate to discern variability in Criteria (1 and 2) scores or whether values are extrapolated too far an area.
- For non-riverine wetlands reviewed, ascertain if the Criteria values and AquaScore are logical as determined by the implementation methodology.
- Inspect wetlands with different levels of hydro-modification (i.e. H1, H2M1, H3 etc.)
- Check where scores or ratings differ markedly between adjacent wetlands.

3.4.1 Field interpretation of Aquatic Conservation Assessment results–ecological versus condition assessment

When visually assessing the assessment results there is a strong tendency for observations to be made from a condition or naturalness perspective. Wetland condition or health has been a major focus of aquatic assessment in Australia (such as the nationally agreed protocol of Monitoring River Health Initiative, Index of Stream Condition, Queensland State of the Rivers) (Dunn 2000). However, several authors make a clear distinction between river health and ecological value of a river (Dunn 2000; Bennett et al. 2002; Chessman 2002). Wetland health data may inform assessment of value, and usually does so where data are available, but is not interchangeable with it and the two are not necessarily correlated.

Aquatic Conservation Assessments are primarily focussed on aquatic ecological or conservation value, such that the condition contributes to, but does not solely determine its value. Of the measures used in these assessments, usually less than 10 per cent are related to aquatic, riparian and/or catchment condition. Consequently, when in the field or interpreting high resolution imagery, the successful interpretation of a spatial unit's conservation value is reliant on the observer viewing condition in combination with the other values (seen or unseen).

3.4.2 Examples of wetlands within the WBBGBRCC assessment study areas

Figure 18, Figure 19, Figure 20, Figure 21, Figure 22 and Figure 23 show different wetlands with their AquaScore and corresponding high-resolution imagery. The amount of woody vegetation (trees and shrubs) is clearly visible surrounding wetlands in in the high-resolution imagery, indicating levels of habitat and connections between wetlands. The imagery also clearly outlines any anthropogenic processes that are occurring within and around the wetlands, like dam wall construction for retaining overland flow. Anthropogenic landuse changes also impact the wetlands quality of water and sediments.

a) AquaScore – Very High

b) High-resolution imagery

Figure 18. Highly modified wetland in the Burnett study area

a) The AquaScore conservation value is Very High.

b) A high-resolution image of the wetland.

The wetland in Figure 18 branches off Splitters Creek in the Burnett study area. Natural vegetation surrounds most of the wetland on the west and northern edges which are connected to Splitters Creek riparian vegetation. The wetland channel is highly modified with anthropogenic bunding (Medium score for aquatic naturalness) retaining a permanent water supply. It has been identified as a special feature with a Very High rating by the expert panel for a Permanently Wet Wetlands decision (bu_nr_ec_02). Connectivity is maintained to some degree to Splitters Creek and consequently to estuarine habitats via riparian vegetation and few instream barriers. This is reflected by the Medium connectivity score. Macadamia trees line the eastern edge of the wetland and sugar cane crops grow less than 100 meters away, corresponding to the Medium score for catchment naturalness. The criteria scores calculated for this wetland appear to reflect the on-ground observations reasonably well.

Criterion	Score	Criterion	Score
AquaScore	Very High		
Dependability	0.8		
C1 Naturalness aquatic	Medium	C5 Priority species and ecosystems	Very High
C2 Naturalness catchment	Medium	C6 Special features	Very High
C3 Diversity and richness	High	C7 Connectivity	Medium
C4 Threatened species and ecosystems	Medium	C8 Representativeness	No Data

a) AquaScore – Medium

b) High-resolution imagery

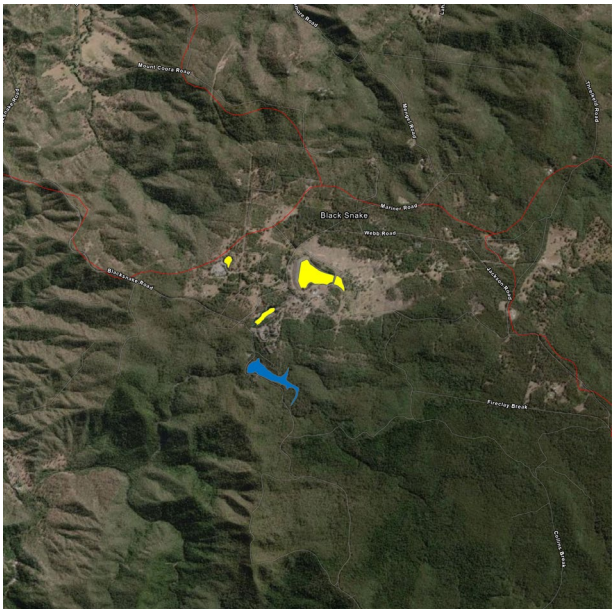
Figure 19. A group of natural ephemeral wetlands in the Burnett study area, which sit north of Toondahra State Forest and the Boyne River

a) The AquaScore conservation value for the wetlands are Medium.

b) A high resolution image of the wetlands.

The unmodified wetlands in Figure 19 are located north of the Toondahra State Forest and the Boyne River in the Burnett study area, about 30km south-west of Gayndah. The wetlands score Low for catchment naturalness (C2), and Low to Medium for connectivity (C7). The connectivity measure identifies connections to terrestrial natural vegetation that allow for fauna movement and dispersal. Two of the larger wetlands retain remnant vegetation, but the others have either been cleared or extensively thinned for grazing purposes. The three larger wetlands score a High for representativeness (C8). This is due to their large size and the type of wetland they represent within the region, which are few in number. The wetlands also appear to be important for threatened species and ecosystems within the area, corresponding to the High score for C4 (threatened species and ecosystems). Overall the criteria scores calculated for these wetlands appear to reflect on-ground observations.

Criterion	Score	Criterion	Score
AquaScore	Medium		
Dependability	0.8		
C1 Naturalness aquatic	Medium	C5 Priority species and ecosystems	Medium
C2 Naturalness catchment	Low	C6 Special features	No Data
C3 Diversity and richness	Medium	C7 Connectivity	Low/Medium
C4 Threatened species and ecosystems	High	C8 Representativeness	High



a) AquaScore – Very High and Low

b) High-resolution imagery

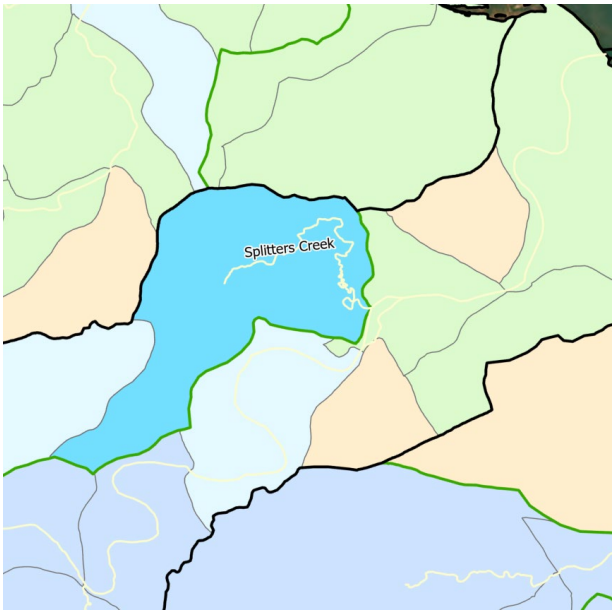
Figure 20. Natural and artificial wetlands in the Mary study area

a) The AquaScore conservation value for the wetlands are Very High and Low respectively.

b) A high-resolution image of the wetlands.

The natural and artificial wetlands in Figure 20 are located on the northern edge of Wrattens National Park in the Mary study area. The artificial wetlands are relics of mining in the area. The natural wetland has been identified as a Very High rating special feature for the permanently wet wetlands ecological decision (my_nr_ec_03). Both the natural and artificial wetlands score Very High or High in catchment naturalness (C2), but Low for aquatic naturalness, species and ecosystem diversity and richness (C1, C3, C4 and C5). Despite being surrounded by National Park, the area has a very small range of species recorded or surveyed. Connectivity is High to Very High for these wetlands, which corresponds to the extent of surrounding natural remnant vegetation that allows for fauna movement and dispersal between wetlands. Overall the criteria ratings for these wetlands appear to correspond to on ground observations and data availability (species records).

Criterion	Score	Criterion	Score
AquaScore	natural wetland: Very High artificial wetlands: Low		
Dependability	natural wetland: 0.7 artificial wetlands: 0.7		
C1 Naturalness aquatic	natural wetland: Low artificial wetlands: Low	C5 Priority species and ecosystems	natural wetland: Low artificial wetlands: No Data
C2 Naturalness catchment	natural wetland: Very High artificial wetlands: High	C6 Special features	natural wetland: Very High artificial wetlands: No Data
C3 Diversity and richness	natural wetland: Low artificial wetlands: Low	C7 Connectivity	natural wetland: Very High artificial wetlands: High
C4 Threatened species and ecosystems	natural wetland: Low artificial wetlands: Low	C8 Representativeness	natural wetland: No Data artificial wetlands: No Data



a) AquaScore – High

b) High-resolution imagery

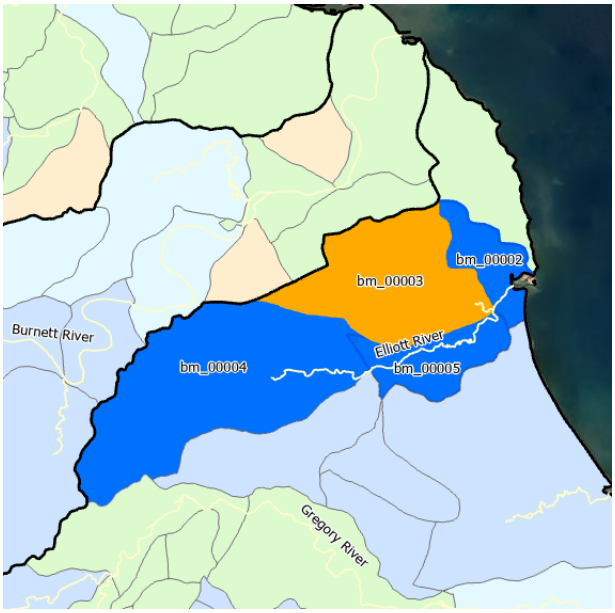
Figure 21. Upper Splitters Creek riverine wetland in the Burnett study area

a) The AquaScore conservation value for the riverine wetlands are High.

b) A high-resolution image of the wetlands.

The riverine wetlands of upper Splitters Creek in Figure 21 branch off the Burnett River upstream of the weir at Bocks Road. The creek channels are surrounded by riparian vegetation which meander through a heavily cropped and grazed landscape. The wetlands scored a High and Very High for threatened and priority species and ecosystems (C4 and C5). They also scored a High for connectivity due to its connection to estuarine wetlands, the lack of barriers within the main channel and the continuous connection of natural remnant riparian vegetation. The area was also identified as a High rating special feature for the Splitters Creek decision (bu_r_ec_03). The wetlands scored a Low for aquatic naturalness due to the number of pest species within the region. The interpretation of the imagery and data records over the area, appears to correspond to the criteria ratings.

Criterion	Score	Criterion	Score
AquaScore	High		
Dependability	0.9		
C1 Naturalness aquatic	Low	C5 Priority species and ecosystems	Very High
C2 Naturalness catchment	Medium	C6 Special features	High
C3 Diversity and richness	Medium	C7 Connectivity	High
C4 Threatened species and ecosystems	High	C8 Representativeness	No Data



a) AquaScore – High

b) High-resolution imagery

Figure 22. Elliot River riverine wetlands in the Burrum study area

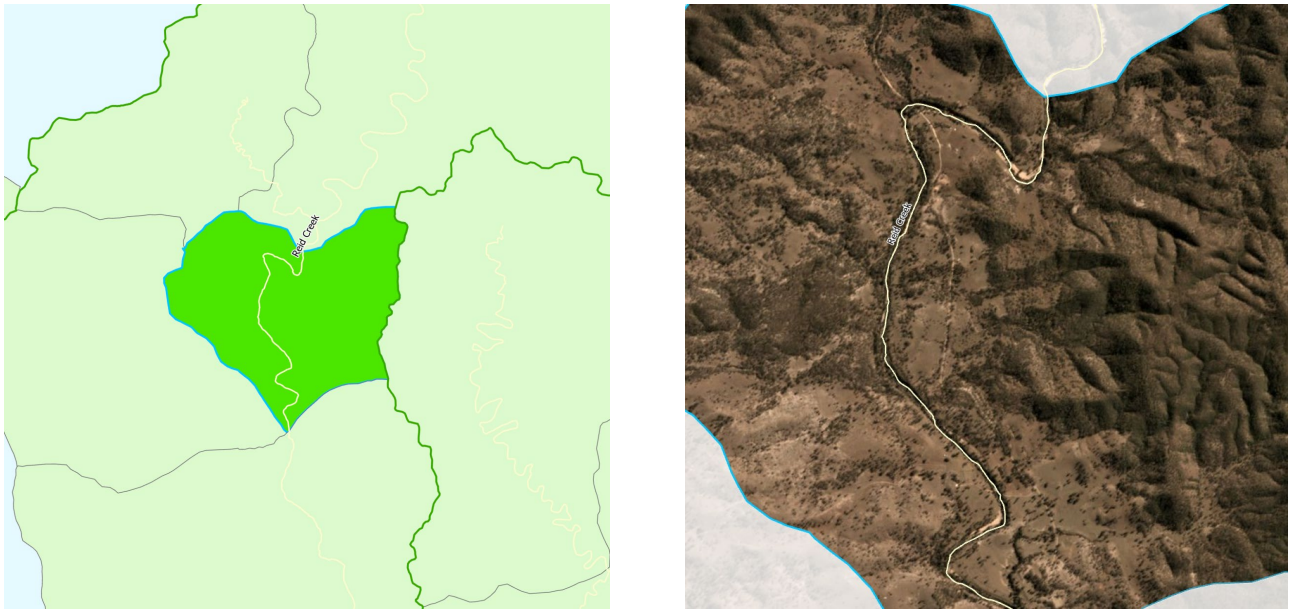
a) The AquaScore conservation value for the riverine wetlands are Very Low and Very High.

b) A high-resolution image of the wetlands.

The riverine wetlands along Elliot River in Figure 22 have very different AquaScores even though their conservation values for each criterion are relatively similar. The main difference between the spatial units is criterion 6 where three spatial units score a Very High. The expert panel has identified these areas along Elliot River as a special feature for their surface water – groundwater connectivity (bm_r_ec_01). The spatial unit bm_00003 has not been identified as a special feature and due to its Low to Medium conservation values for the other criteria, its overall AquaScore is calculated to be Very Low.

The interpretation of the imagery and data records over the area, appears to correspond to the other criterion ratings. The area is highly cultivated with very little natural vegetation within the spatial unit bm_00003, which corresponds to the Low score for C2 catchment naturalness. The other spatial units have higher proportions of riparian vegetation (C2 naturalness catchment) and species records within their boundaries, corresponding to the higher scores for C3, C4 and C5 (Diversity and richness, threatened and priority species and ecosystems). In-stream connectivity was identified to be very high for spatial unit bm_00003, however the other spatial units rated higher overall for criterion 7 due to their connections to estuarine and groundwater systems.

Criterion	bm_00005	bm_00004	bm_00003	bm_00002
AquaScore	Very High	Very High	Very Low	Very High
Dependability	0.8	0.9	0.8	0.9
C1 Naturalness aquatic	Medium	Low	Low	Low
C2 Naturalness catchment	Medium	Medium	Low	Medium
C3 Diversity and richness	Medium	Medium	Low	Medium
C4 Threatened species and ecosystems	High	Medium	Low	Low
C5 Priority species and ecosystems	Very High	High	Medium	High
C6 Special features	Very High	Very High	No data	Very High
C7 Connectivity	High	High	Medium	High
C8 Representativeness	No data	No data	No data	No data



a) AquaScore – High

b) High-resolution imagery

Figure 23. Reid Creek riverine wetlands in the Burnett study area

a) The AquaScore conservation value for the riverine wetland is Medium.

b) A high-resolution image of the wetlands.

The riverine wetlands along Reid Creek in Figure 23 have an AquaScore of Medium. This is due to the High conservation value for C4 threatened species and ecosystems. Connectivity (C7) is Very High for the spatial unit as it has a high proportion of natural vegetation cover that allows for terrestrial fauna dispersal. In-stream connectivity is also Very High, identifying very few anthropogenic barriers within the sub-catchment. The interpretation of the imagery and data records over the area, appears to correspond to the criteria ratings.

Criterion	Score	Criterion	Score
AquaScore	Medium		
Dependability	0.6		
C1 Naturalness aquatic	Medium	C5 Priority species and ecosystems	No data
C2 Naturalness catchment	High	C6 Special features	No data
C3 Diversity and richness	Low	C7 Connectivity	Very High
C4 Threatened species and ecosystems	High	C8 Representativeness	No Data

4 Summary and recommendations

The Aquatic Biodiversity Assessment and Mapping Methodology or AquaBAMM is a robust and comprehensive method for assessing the biodiversity values of Queensland's wetlands. The method assigns an overall biodiversity value (AquaScore) to each wetland or spatial unit based on a comprehensive set of criteria.

For this current assessment a series of ACAs were completed for the riverine and non-riverine wetlands of the Queensland Wide Bay – Burnett Great Barrier Reef Connecting Catchments.

For the riverine assessments all study areas displayed a range of AquaScores from Very High to Very Low. The Mary, Baffle and Burnett had the highest percentages of Very High and High AquaScores, and these results were driven largely by the special features (Criterion 6) identified through the expert panel process, but also by the presence of rare and threatened species (Criterion 4). For the Mary and Burrum, proximity to high value natural assets (i.e. special features) and higher survey effort adjacent to coasts were contributing factors.

In general, riverine AquaScores decreased away from the coast across all study areas. The exception to this was the Baffle and Kolan study areas which exhibited a predominance of Medium AquaScores in the mid-parts of the catchments, and High and Very High AquaScores in the upper parts of the catchments. Again, this result appears to have been driven largely by special features and the presence of threatened species.

Similar to the riverine assessments, all study areas displayed a range of AquaScores from Very High to Very Low for the non-riverine assessments. In general, the percentage of spatial units with Very High and High AquaScores was lower for the non-riverine assessments, and this can be attributed to the high proportion of artificial wetlands assessed as part of the non-riverine assessments. Artificial wetlands, in the context of the ACAs include waterbodies created though excavation or bunding to capture overland flow, the installation of structures such as ring tanks and canals, pumping, or a combination of these. In the context of the Queensland Wetland Mapping data, artificial wetlands only occur in locations where natural wetlands previous did not exist.

In the WBBGBRCC assessments artificial wetlands accounted for nearly 51% of all non-riverine wetlands assessed, with close to 70% of non-riverine spatial units in the Burnett and Kolan study areas currently classified as artificial. Some measures are not allocated to artificial wetlands including those in Criterion 4 and 5 (i.e., threatened and priority species, ecosystems respectively) due to their conservation value being continually eroded by anthropogenic processes. A No Data rating is allocated to these wetlands. Highly modified and artificial wetlands were also given No Data ratings for Criterion 8 (representativeness).

Like the riverine assessments, the Mary, Baffle and Burnett non-riverine assessments had the highest percentages of Very High AquaScores, and these results were driven largely by the special features (Criterion 6) identified through the expert panel process, but also by the presence of rare and threatened species (Criterion 4). The majority of spatial units with Very High AquaScores are present along the coastal fringes of the Baffle, Burrum and Mary study areas and associated with wet heath communities identified through the expert panel process. These areas were identified by experts as containing non-riverine wetlands critical to maintaining biodiversity and connectivity between wetlands for many flora and fauna taxon groups from terrestrial, freshwater and estuarine habitats. The Kolan and Burnett study areas are dominated by agricultural and settlement landuse pressures within their coastal margins, which lowers the wetland ratings to Medium and Low.

Data availability limitations and variation within study areas are visible in the riverine and non-riverine dependability scores. AquaBAMM dependability scores represent the number of measures with data out of the total number of measures used to assess each spatial unit. Dependability scores do not influence or change the Criterion or AquaScores. They provide the end-user with an indication of the potential for a Criterion or AquaScore to change (upgrade or downgrade) with the addition of data.

In general, dependability decreases inland away from the coast, and this can be attributed to lower data availability, particularly sightings records, which feature heavily in Criterion 1, 3, 4, and 5. This highlights the fact that species records can under-represent species distribution and the habitats they occupy (Laidlaw and Butler 2021, Fourcade et al. 2014), especially for threatened species listed under the NCA. Though the AquaBAMM process attempts to moderate the results, the outcomes are only as comprehensive as the range of available data and the experts who contribute their knowledge. To provide a better representation of species and their niche requirements, it is ideal to incorporate habitat suitability models where available (Fourcade et al. 2014) and appropriate for use in an ACA. The Mary and Burrum displayed the highest data richness scores indicating higher survey effort in these study areas.

Species records data for macroinvertebrates was particularly sparse for the region meaning the Criterion 3 richness of macroinvertebrates measure could not be used. Some ACAs have used maximum richness scores derived from higher-level macroinvertebrates studies undertaken using recognised survey and analysis methods (e.g. such as those used by Conrick & Cockayne 2000, Chessman 2002, and Healthy Waterways 2014). These methods estimate macroinvertebrate diversity at the broad taxonomic group level (e.g. sub-family, family, order or class) and can provide suitable representations of macroinvertebrate richness. The availability of this type of data for the

WBBGBRCC study areas would help improve the Criterion 3 results.

Data from the State of the Rivers program, which featured heavily in early ACAs, was unavailable for the current assessment. Data collection for this program ceased in the early 2000's, was incomplete for the state, and is now dated. To deal with issues of data availability, the AquaBAMM project team are developing a new implementation for Criteria 1 and 2. This new implementation aims to use more current datasets and importantly, datasets that cover the entire state. The aim is to incorporate this new implementation into future ACAs.

Another constraint is that AquaScores can be driven by high scoring measures within criteria containing few measures. This was identified as part of an independent sensitivity analysis (Robinson & Lee 2009). Data availability is never equal for all wetlands in a study area. In the same way, expert knowledge is not usually available for every wetland in a study area. Dataset completeness is influenced spatially by research effort, search effort etc.

Mapping scales also reduce available data. Non-riverine wetlands below the minimum mapping scale (i.e. 1:100,000) or polygon threshold size (i.e. 1 Ha) are not mapped as part of the Queensland Wetlands Mapping and were not assessed as part of the WBBGBRCC assessments. Furthermore, ACAs only include non-riverine wetland area features from the Queensland Wetland where palustrine or lacustrine wetlands are dominant, or the sum of subdominant palustrine or lacustrine wetland regional ecosystem area is >50%. Riverine waterbodies, such as instream rock holes, are also often well below the minimum mapping scale of the Queensland Wetland Mapping. Finer scale mapping of non-riverine wetlands would allow more precise delineation of wetland conservation values particularly special features and connectivity values.

Linear nature of many riverine wetlands means they are commonly included as subdominant wetland regional ecosystems within much larger regional ecosystem polygons. Both of these factors result in riverine wetland areas generally not being as well represented in the Queensland Wetland Mapping as their non-riverine counterparts. To address this, riverine ACAs use fine-scale riverine catchments for spatial units. These fine-scale catchments (subsections) are used to represent specific stream reaches, or groups of reaches, and are synonymous with State of the Rivers subsections or fine-scale sub-catchments of the Australian Hydrological Geospatial Fabric (Geofabric). The implications of this from an ACA perspective are two-fold. Firstly, riverine conservation values calculated as part of an ACA generally only apply to the watercourses within each riverine spatial unit. Secondly, riverine special features may only apply to specific reaches, sections of reaches, or discrete locations (e.g. rockholes) within a riverine spatial unit. Where possible, descriptions of the precise location and extent of riverine special features have been included with the riverine special feature values descriptions and this information can be used to aid interpretation. Finer scale riverine wetland area mapping similar to the non-riverine wetlands would allow more precise delineation of riverine conservation values particular special features and connectivity values.

Whenever lines are drawn on a map from the expert panels or Directory of Important Wetlands for example, there is a risk that the boundary may not be correct at the scale of the individual subsection. For these types of decisions, the boundary should always be considered at the appropriate scale. The wetlands mapping is the fundamental spatial input into this ACA and the positional accuracy of the wetlands mapping is 1:100 000, except for areas along the east coast which are mapped at the 1:50 000 scale.

Aquatic Conservation Assessment results have a wide range of applications. Well-founded ecological or conservation values for aquatic ecosystems are an important input to natural resource management and regulatory decision-making processes including, for example, regional planning, development assessment, and tenure negotiations such as those related to protected area estates. In addition to the overall AquaScore, individual Criteria, Indicators and Measures from each assessment may be used for management and planning purposes.

At its most basic level this product is an inventory of the ecological values associated with individual wetlands. It is not undertaken with any special considerations of policy, legislation or cultural values. It is up to the end user to carefully gauge suitability for their intended purpose, giving due diligence to the caveats and constraints discussed above.

The improvement of data inputs to this type of assessment is ongoing. Input data, especially for more remote areas such as the western catchments of Burnett study area, is often sparse, dated or limited in spatial extent. The use of incomplete data is unavoidable in an ecological assessment of this size and nature. Specific examples of where future data enhancements could improve the quality of output of this type of assessment include:

- The use of species habitat suitability models for Criterion 3 diversity and richness, Criterion 4 threatened species, and Criterion 5 priority species measures.
- Integration of new methods for calculating aquatic and catchment naturalness (i.e. Criteria 1 and 2) as the current implementation is limited by data availability.
- Finer scale mapping of both riverine and non-riverine wetlands would allow more precise delineation of wetland conservation values particularly special features and connectivity values.
- Future wetlands mapping may consider whether springs have a surface expression and if these should be included in the ACAs depending on their scale.

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Appendix I – Criteria definitions

Naturalness – Aquatic

This attribute reflects the extent to which a wetland's (riverine or non-riverine) state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Naturalness – Catchment

The naturalness of the broader terrestrial systems of a catchment can have an influence on many wetland characteristics including natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry and flow. The indicators utilised to assess this criterion include: presences of exotic flora and/or fauna; riparian, catchment and flow modification.

Riparian ecosystems (i.e., river bank vegetation) are important components of the landscape for water quality, biodiversity, and the overall health of a catchment. These ecosystems frequently exhibit higher species richness and abundance than surrounding habitats. They act as movement pathways along riparian systems for a number of species, especially birds (Bennet et al 2014). They can also provide critical resources for many species in terms of food, shelter and nesting sites (Lovett & Price 2007). Other important ecosystems services provided by riparian vegetation include the provision of shade, nutrient and debris inputs, bank stabilisation, and water bourn pollution reduction.

Diversity and Richness

Criterion three considers the physical and biological diversity of species and habitats. This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Ecosystem diversity refers to the variety of ecosystems within a given place. Landscapes are composed of a mosaic of interconnected ecosystems. For example, the number and size of wetlands ecosystems within an area is an indication of habitat complexity. Habitat complexity has been linked to a variety of ecosystem traits including taxonomic richness and ecosystem resilience.

Threatened Species and Ecosystems

This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Critically Endangered, Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern or Not of Concern. Biodiversity status is based on an assessment of the condition of remnant vegetation in addition to the criteria used to determine the class under the *Vegetation Management Act 1999*.

Priority Species and Ecosystems

This criterion has been restricted to species and ecosystems not currently recognised through the statutes (i.e. NCA, EPBC, VMA) and that are largely identified through expert opinion (not including physical features).

Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic or riparian species exhibiting one or more of the following traits.

For flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is an important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

For fauna species the traits include:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is a significant disjunct population.

- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent for other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

Priority ecosystems include those providing habitat for migratory species or significant water bird habitat.

Special Features

The special features criterion assimilates information that is not accessible or not in a format that is easily incorporated into the AquaBAMM. Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. The key themes in the criterion include: geomorphic features, ecological processes, special habitat (including habitat that functions as refugia or other critical purpose), refugia and hydrological regimes.

The attributes used to identify special and unique features are outlined in the Expert Panel Report.

Connectivity

This criterion identifies connections between and within aquatic ecosystems, including connections to the broader landscape.

Aquatic ecosystem connectivity is the mechanism that propagates environmental processes spatially and temporally.

This criterion is based on the concept that appropriately connected aquatic ecosystems are more likely to be healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

In its broadest meaning it incorporates hydrological processes (quantity and quality, temporal and spatial variability), organism dispersal (barriers) and disturbances from their natural state. It can be bi-directional movements within a stream, uni-directional contribution to a downstream spatial unit or special area, or lateral connectivity to floodplain wetlands or groundwater ecosystems.

Representativeness

This criterion, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas and applied primarily to non-riverine assessments. Rarity is determined by the degree of wetland protection with “protected Areas” estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group/habitat type within geographic areas such as catchment and subcatchment.

The criterion is underpinned by the CAR (comprehensive, adequate and representative) reserve design principal which aims to protect representative samples of species and ecosystem types from throughout their geographical range. This concept is designed to ensure that reserve systems represent the entire diversity of species, interactions and dependencies inherent to each ecological community.

Appendix II – Riverine implementation table

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
1.1.1	Presence of ‘alien' fish species within the wetland	An expert panel list of exotic fish species dependent on freshwater streams for all or part of their lifecycle, was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic riverine species found within a riverine spatial unit. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of ’No Data’ was allocated to any riverine spatial unit that had an absence of exotic species data.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	An expert panel list of exotic aquatic plant species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic riverine species found within a riverine spatial unit. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of ’No Data’ was allocated to any riverine spatial unit that had an absence of exotic species data.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
1.1.3	Presence of exotic invertebrate fauna within the wetland	An expert panel list of exotic invertebrate fauna species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic riverine species found within a riverine spatial unit. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any riverine spatial unit that had an absence of species data.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	An expert panel list of exotic vertebrate fauna species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic riverine species found within a riverine spatial unit. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any riverine spatial unit that had an absence of species data.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
1.3.4	Presence/absence of dams/weirs/biopassages within the wetland	For each riverine spatial unit, calculate the total number of barriers using a range of different data sources. Each barrier was weighted with a pass-ability factor (ability for aquatic fauna to pass the barrier upstream or downstream) between 1 (impassable) and 0 (fully passable). Dams, weirs and other barriers had a weighting of 1, where pass-ability is assumed to be impossible (during normal flow times). Road culverts constructed prior to 2014 had a weighting of 0.7 and the rest had a weighting of 0.3 (lower pass-ability). This is due to regulations that consider fauna movement during construction. Fish biopassages had a weighting of 0.7, as they were often restricted to certain types of fish and are still impassable for other types of aquatic fauna.	Qld government dataset include: watercourse lines, watercourse areas, road culverts, dams and weirs, water storage points, fish biopassage points, reservoirs, wetlands with barriers.	Continuous Desc
1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	The reservoir layer was intersected against the watercourses. The proportional length covered by a reservoir was then calculated for each riverine spatial unit.	DR Dams and Weirs coverage; DR watercourses; DESI QLD Wetland Mapping data v6.	Continuous Desc
1.3.7	% area of remnant wetland relative to preclear extent for each riverine spatial unit	Extract from the preclear regional ecosystems mapping polygons that contain P, L, PL, C, R, F and IR. Add to this unmodified (H1) (excluding estuarine types) and extract by the riparian mask. Overlay the riverine spatial units and dissolve. This defines the preclear wetland boundary extent. Overlay the remnant regional ecosystems and the QLD wetland mapping. Where the overlayed area is remnant and or not a highly modified or artificial wetland, add the area as connected, else if the preclear extent is unmodified, add the area as connected, else if the preclear extent is slightly or highly modified and covered in remnant, add the area as connected. Assessable wetlands with no underlying preclear extent were given a value of NO DATA.	DESI Queensland wetland mapping data v6; remnant and preclear regional ecosystem mapping v11, REDD v12.	Continuous Asc

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
2.1.1	Presence of exotic terrestrial plants in the assessment unit	An expert panel list of exotic terrestrial plant species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic riverine species found within a riverine spatial unit. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of No data was allocated to any riverine spatial units unit that had an absence of exotic species data.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	The pre-clear and remnant regional ecosystem mapping was overlayed with the riparian mask. The percentage of remnant/preclear was then calculated for each riverine spatial unit.	DESI remnant and preclear regional ecosystem mapping v11. River buffers based on DR watercourses	Continuous Asc
2.2.2	Total number of remnant regional ecosystems relative to preclear number of REs within buffered riverine wetland or watercourses	Using the pre-clear x remnant regional ecosystems x study area intersection product from 2.2.1, the numbers of distinct REs and pre-clear regional ecosystems in each riverine spatial unit was calculated. The regional ecosystems count was compared to that of the preclear extent.	DESI remnant and preclear regional ecosystem mapping v11. River buffers based on DR watercourses.	Continuous Asc
2.2.9	% tree cover within the waterway corridor	Overlayed the woody vegetation layer with the riparian mask where a percentage of woody vegetation was calculated for each spatial unit.	River buffers based on DR watercourses; DESI 2019 woody vegetation extent coverage.	Continuous Asc

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
2.3.4	% "settlement" land-use area (i.e. towns, cities, etc.)	“Settlement” land-use included (QLUMP secondary categories): manufacturing and industrial, mining, residential, services, transport and communication, utilities, waste treatment and disposal, and channel/aqueduct. These land-use types were allocated a settlement attribute and a % area was calculated for settlement areas within each riverine spatial unit.	DESI QLUMP (version GBR 2021).	Continuous Desc
2.3.12	Potential landuse pressures on water quality within a subsection.	Landuse area (QLUMP mapping) proportions within a subsection are weighted and then summed together. Weights are taken from the landscape hazard assessment, input – direct/indirect pressure category, completed by the Queensland Wetlands Program (DISTIA 2015).	DESI QLUMP (version GBR 2021).	Continuous Desc
2.3.13	Potential load of anthropogenic fine sediments within a subsection.	Fine sediment load rates compared to pre-clearing rates provided by Paddock-2-Reef project modelling. Rate proportions of landuse (based on 2019 data) for each subsection.	DESI QLUMP (version 2019).	Continuous Desc
2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	Selects all non-riverine spatial units with a HYDROMOD of H2-M6, H2-M6-a, H2-M6-b, H2-M6-c, H2-M6-e, H2-M6-f, H2-M7, H3-C1, H3-C1-a, H3-C1-b, H3-C1-c, H3-C1-d, H3-C2, H3-C2-a, H3-C2-b, H3-C4, H3-C5, H3-C5-a, H3-C5-b from the Queensland Wetland mapping. Then appends the NRM RESERVOIRS (Rural Water Storage Category only).	DESI Queensland Wetland Mapping data v6; NRM Reservoirs	Continuous Desc
2.4.7	Potential landuse pressures on changes to natural flow water regime within a subsection.	Landuse area (QLUMP mapping) proportions within a subsection are weighted and then summed together. Weights are taken from the landscape hazard assessment, changes to the water regime pressure category, completed by the Queensland Wetlands Program (DISTIA 2015).	DESI QLUMP (version GBR 2021).	Continuous Desc
3.1.1	Richness of native amphibians (riverine wetland breeders)	An expert panel list of native amphibians (riverine wetland breeders) was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each riverine spatial unit, with No Data allocated where the riverine spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
3.1.2	Richness of native fish	An expert panel list of native fish dependent on riverine wetlands for all or part of their lifecycles was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each riverine spatial unit, with 'No Data' allocated where the riverine spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
3.1.3	Richness of native aquatic dependent reptiles	An expert panel list of native reptiles dependent on riverine wetlands for all or part of their lifecycles was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each riverine spatial unit, with 'No Data' allocated where the riverine spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
3.1.4	Richness of native waterbirds	An expert panel list of native (freshwater) waterbirds fish dependent on riverine wetlands for all or part of their lifecycles was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each riverine spatial unit, with 'No Data' allocated where the riverine spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
3.1.5	Richness of native aquatic plants	An expert panel list of aquatic and semi-aquatic plants was used to calculate this measure. Records ≥1950 and a precision ≤2000m were included. Records were used to derive a count of different species for each riverine spatial unit, with No Data allocated where the associated spatial unit had an absence of species information.	Flora species records from DES databases WildNet, Herbrecs, Corveg and Expert Panel.	Continuous Asc
3.1.7	Richness of native aquatic dependent mammals	An expert panel list of native mammal dependent on freshwater streams for all or part of their lifecycles was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each riverine spatial unit, with No Data allocated where the associated spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	A count of regional ecosystems within the riparian mask was calculated for each riverine spatial unit.	DESI remnant and preclear regional ecosystem mapping v11. River buffers based on DR watercourses	Continuous Asc
3.3.2	Richness of wetland types within the local catchment (ACA subsection)	The number of different wetland habitat types (based on TYPE_RE field—a concatenation of wetland class, hydro-modifier, water regime, salinity modifier and WETRE fields from the QWM data) was calculated for each riverine subsection. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. Non-riverine spatial units with the word "None" in the TYPE_RE are data deficient and are also not valid for this measure. Also, non-riverine spatial units less than 1ha are not valid for this measure.	DESI Queensland Wetland Mapping data v6, ACA subsections.	Continuous Asc
3.3.3	Richness of wetland types within the sub-catchment (ACA sub-catchment)	The number of different wetland habitat types (based on TYPE_RE field—a concatenation of wetland class, hydro-modifier, water regime, salinity modifier and WETRE fields from the QWM data) was calculated for each sub-catchment. This number was then applied to each riverine spatial unit based on its sub-catchment membership. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. Non-riverine spatial units with the word "None" in the TYPE_RE are data deficient and are also not valid for this measure. Also, non-riverine spatial units less than 1ha are not valid for this measure.	DESI Queensland Wetland Mapping data v6, ACA sub-catchments. River buffers based on DR watercourses.	Continuous Asc

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species — NCA Act, EPBC Act	A list of rare or threatened (NCA or EPBC) riverine aquatic ecosystem dependent fauna species identified by the expert fauna panel was used to generate the records dataset. These records were intersected with the spatial units to determine species richness in each. Spatial units with an absence of records were given a value of 'No Data'.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCA Act, EPBC Act	A list of rare or threatened (NCA or EPBC) riverine aquatic ecosystem dependent flora species identified by the expert fauna panel was used to generate the records dataset. These records were intersected with each spatial units to determine species richness in each. Spatial units without records were given a value of 'No Data'.	Flora species records from DES databases WildNet, Herbrecs, Corveg and Expert Panel.	Presence (Positive)
4.2.1	Conservation status of wetland Regional Ecosystems — Herbarium biodiversity status, NCA Act, EPBC Act	The following Queensland Wetland data wetland types were assessed within buffer areas around drainage lines: R, F, IR, P, and C. The following ratings were applied based on the Queensland Herbarium Biodiversity Status and EPBC Status of palustrine and lacustrine regional ecosystems: For biodiversity status: Endangered = 4 Of Concern = 3 No Concern at Present/Least Concern = 2 For EPBC listed communities: Critically Endangered or Endangered = 4 Vulnerable = 3 Other = 2 Presence of the highest conservation status regional ecosystem in the riverine spatial unit was applied. Spatial units that contained no regional ecosystems of those type received a score of 1.	DESI Queensland Wetland Mapping data v6, REDD v12. EPBC community regional ecosystem list.	Categorical

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
5.1.1	Presence of aquatic ecosystem dependent priority fauna species (expert panel list/discussion or other lists such as ASFB, etc.)	An expert panel derived list of priority riverine aquatic ecosystem dependent fauna species was used to generate the records dataset. These records were intersected with each riverine spatial unit to determine species richness. Spatial units without records were given a value of 'No Data'.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	An expert panel derived list of priority riverine aquatic ecosystem dependent flora species was used to generate the records dataset. These records were intersected with each riverine spatial unit to determine species richness. Spatial units without records were given a value of 'No Data'.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel.	Continuous Asc
5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA/ CAMBA/ ROKAMBA agreement lists and/or Bonn Convention)	An expert panel derived list of migratory species dependent on riverine wetlands for all or part of their lifecycles was used to calculate this measure. These records were intersected with each riverine spatial unit to determine species richness. Spatial units without records were given a value of 'No Data'.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
5.1.4	Habitat for significant numbers of waterbirds	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
5.2.1	Presence of 'priority' aquatic ecosystem	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
6.1.1	Presence of distinct, unique or special geomorphic features	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 2, 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	Combine significant wetland category 4 areas (Ramsar, World Heritage) and significant wetland category 3 areas (DIWA). These were then overlayed with the riverine spatial units. Spatial units were manually selected based on an interpretation of the DIWA criteria. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	RAMSAR areas. World Heritage Areas. Directory of Important Wetlands (DIWA).	Categorical
6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Documented reports external to the ACA process.	Categorical

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
6.3.4	Climate change refugia	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. Spring fed stream, ephemeral stream, boggomoss).	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
7.1.4	Instream fragmentation due to anthropogenic barriers within a sub-catchment, based on an acknowledged metric.	The index uses the CAFI (Catchment Area-based Fragmentation Index) methodology for instream connectivity. (Jumani et al 2022) CAFI is calculated based on the Australian Hydrological Geospatial Fabric (GeoFabric) units relative within a subcatchment. A barrier pass-ability weighting (between 1 and 0, impassable and fully passable respectively) was added to each catchment area. Dams, weirs and other barriers had a weighting of 1, where pass-ability is assumed to be impossible (during normal flow times). Road culverts constructed prior to 2014 had a weighting of 0.7 and the rest had a weighting of 0.3 (lower pass-ability). This is due to regulations that consider fauna movement during construction. Fish biopassages had a weighting of 0.7, as they were often restricted to certain types of fish and are still impassable for other types of aquatic fauna.	Australian Hydrological Geospatial Fabric v2.1 2012 Qld government dataset include: watercourse lines, watercourse areas, road culverts, dams and weirs, water storage points, fish biopassage points, reservoirs, wetlands with barriers.	Continuous Desc
7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.	Expert panels identified riverine spatial units that had a conservation rating of 4 for measure 6.4.1. The spatial units were then given a conservation rating 3 or 4 for this measure.	Expert Panel	Categorical

Measure	Description	Riverine implementation	Primary data sets used	Threshold type
7.4.2	Terrestrial natural area connectivity within a subsection based on an acknowledged metric.	The original method (National Connectivity Index) was developed by the Australian Government Department of Climate Change, Energy, the Environment and Water, and has been adapted for this project to include the Remnant and Regrowth Regional Ecosystem mapping. The index uses a moving window to assess natural area connectivity at each 100m cell location within the landscape, across multiple scales or neighbourhoods (0.5, 1, 2, 4, 8, 16 and 32km). For each neighbourhood, connectivity is assessed using 3 indexes, 1. The amount of natural area, 2. The amount of core natural area and 3. The distance between natural area patches. The connectivity indexes for all neighbourhoods are combined and then rescaled from 0 – 100.	DESI Queensland Remnant and Regrowth Regional Ecosystem mapping v11.	Continuous Desc
7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6.	Expert panels identified riverine spatial units that contributed to an estuarine wetland that has a significant contribution to biodiversity values. The resulting value was given a conservation rating out of 3 or 4.	Expert Panel	Categorical
7.5.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist in marine or estuarine areas.	Expert panels identified riverine spatial units that maintained hydrological connectivity to marine or estuarine areas. The resulting value was given a conservation rating out of 3 or 4.	Expert Panel	Categorical
8.2.5	Wetland type representative of the study area – identified by expert opinion.	Expert panels identified riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical

Appendix III – Non-riverine implementation table

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
1.1.1	Presence of 'alien' fish species within the wetland	An expert panel list of exotic fish species dependent on freshwater streams for all or part of their lifecycle, was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic species found within a subsection. This was then attributed to all the non-riverine spatial units nested within it. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any non-riverine spatial unit that had an absence of species data.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	An expert panel list of exotic aquatic plant species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic species found within a subsection. This was then attributed to all the non-riverine spatial units nested within it. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any non-riverine spatial unit that had an absence of species data.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
1.1.3	Presence of exotic invertebrate fauna within the wetland	An expert panel list of exotic invertebrate fauna species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic species found within a subsection. This was then attributed to all the non-riverine spatial units nested within it. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any non-riverine spatial unit that had an absence of species data.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	An expert panel list of exotic vertebrate fauna species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic species found within a subsection. This was then attributed to all the non-riverine spatial units nested within it. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any non-riverine spatial unit that had an absence of species data.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
1.3.7	% area of remnant wetland relative to preclear extent for each non-riverine spatial unit	Extract from the preclear mapping polygons that contain P, L, PL, C. Add to this unmodified (H1) wetlands from non-riverine spatial units. Overlay the study areas and dissolve. This defines the preclear wetland boundary extent. Overlay the remnant regional ecosystems and the wetland mapping. Where the overlayed area is remnant and or not a highly modified or artificial wetland, add the area as connected, else if the preclear extent is a natural wetland, add the area as connected, else if the preclear extent is semi-modified and covered in remnant, add the area as connected. Assessable wetlands with no underlying preclear extent were given a value of 'No Data'.	DESI Queensland Wetland Mapping data v6, remnant and preclear regional ecosystem mapping v12, REDD v12	Continuous Asc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through DES wetland mapping and classification)	Score non-riverine spatial units according to their level of Queensland Wetland Mapping hydromodification: 4 = (natural): H1 3 = (semi-modified):H2, H2-M1, H2-M1-a, H2-M1-b, H2-M2, H2-M2-a, H2-M2-b, H2-M2-c, H2-M2-d, H2-M9, H2-M9-a, H2-M9-b, H2-M9-c, H2-M10, H2-M10-a, H2-M10-c, H2-M11, H2-M11-a, H2-M11-b, H2-M11-d, H2-M12, H2-M12-a, H2-M12-b, H2-M12-c, H2-M12-d; 2 = (highly-modified): H2-M1-e, H2-M5, H2-M6, H2-M6-a, H2-M6-b, H2-M6-f, H2-M7, H2-M11-c, H2-M13 1 = (artificial): H3, H3-C1, H3-C1-a, H3-C1-b, H3-C2, H3-C2-a, H3-C2-b, H3-C4, H3-C5, H3-C5-a, H3-C5-b.	DESI Queensland Wetland Mapping data v6	Categorical
2.1.1	Presence of exotic terrestrial plants in the assessment unit	An expert panel list of exotic terrestrial plant species was used to calculate this measure. Species records (year ≥1950, precision ≤2000m) were used to count the different exotic species found within a subsection. This was then attributed to all the non-riverine spatial units nested within it. The occurrence value was also used from DAF Annual Pest Distribution Survey for 2008, 2009, 2011/12, 2013/14, 2018 and 2019. Values from both records and grids were normalised between 0 and 1. Where a combination of both records and grids covered a spatial unit, the values were weighted 0.5 each. A score of 'No Data' was allocated to any non-riverine spatial unit that had an absence of species data.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel. DAF Annual Pest Distribution Surveys.	Continuous Desc (Negative)
2.2.5	% area of remnant vegetation relative to preclear extent within buffered non-riverine wetland: 500 m buffer for wetlands ≥ 8 ha, 200 m buffer for smaller wetlands	Each non-riverine spatial unit was buffered by 500m for wetlands >= 8ha and 200m for smaller wetlands. A multi-ring buffer was used as it allowed for the exclusion of the wetland itself from the analysis. The remnant and pre-clear vegetation mapping was then intersected with the area calculated. De-concatenating the RE and PERCENT, the area of each value with a valid RE vegetation code was calculated to gain the total area occupied by RE for pre-clear and remnant. The percentage of remnant to pre-clear was calculated and applied to each non-riverine spatial unit.	DESI remnant and preclear regional ecosystem mapping v11, Queensland Wetland Mapping data v5	Continuous Asc
2.2.9	% tree cover within a buffered area	Overlayed the woody vegetation layer with the buffered spatial units, where a percentage of woody vegetation was calculated for each spatial unit. A buffer distance of 2,000m was used.	River buffers based on DR watercourses; DESI 2019 woody vegetation extent coverage.	Continuous Asc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
2.3.4	% "settlement" land-use area (i.e. towns, cities, etc.)	“Settlement” land-use included (QLUMP secondary categories): Land in transition, Manufacturing and industrial, Mining, Residential, Services, Transport and communication, Utilities, Waste treatment and disposal. These land-use types were allocated a settlement attribute and a % area was calculated for settlement areas within each subsection. This value was then applied to all nested non-riverine spatial unit.	DESI QLUMP (version GBR 2021)	Continuous Desc
2.3.12	Potential landuse pressures on water quality within a subsection.	Area proportions within a subsection are weighted and then summed together. Weights are taken from the landscape hazard assessment, input – direct/indirect pressure category, completed by the Queensland Wetlands Program (DISTIA 2015).	DESI QLUMP (version GBR 2021).	Continuous Desc
2.3.13	Potential load of anthropogenic fine sediments within a subsection.	Fine sediment load rates compared to pre-clearing rates provided by Paddock-2-Reef project modelling. Rate proportions of landuse (based on 2019 data) for each subsection.	DESI QLUMP (version 2019).	Continuous Desc
2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	Selects all non-riverine spatial units with a HYDROMOD of H2-M6, H2-M6-a, H2-M6-b, H2-M6-c, H2-M6-e, H2-M6-f, H2-M7, H3-C1, H3-C1-a, H3-C1-b, H3-C1-c, H3-C1-d, H3-C2, H3-C2-a, H3-C2-b, H3-C4, H3-C5, H3-C5-a, H3-C5-b from the Queensland Wetland mapping. Then appends the NRM RESERVOIRS (Rural Water Storage Category only).	DESI Queensland Wetland Mapping data v6; NRM Reservoirs	Continuous Desc
3.1.2	Richness of native fish	An expert panel list of native fish dependent on non-riverine wetlands for all or part of their lifecycles was used to calculate this measure. Species records (≥1975, precision ≤ 2000m) were included. Records were used to derive a count of different species for each subsection. This value was then attributed to nested non-riverine spatial units. Non-riverine spatial units without records were given a value of ’No Data’.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
3.1.3	Richness of native aquatic dependent reptiles	An expert panel list of native reptiles dependent on non-riverine wetlands for all or part of their lifecycles was used to calculate this measure. Species records (≥1975, precision ≤ 2000m) were included. Records were used to derive a count of different species for each subsection. This value was then attributed to nested non-riverine spatial units. Non-riverine spatial units without records were given a value of ’No Data’.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
3.1.4	Richness of native waterbirds	An expert panel list of native (freshwater) waterbirds dependent on non-riverine wetlands for all or part of their lifecycles was used to calculate this measure. Species records (≥1975, precision ≤ 2000m) were included. Records were used to derive a count of different species for each subsection. This value was then attributed to nested non-riverine spatial units. Non-riverine spatial units without records were given a value of 'No Data'.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
3.1.5	Richness of native aquatic plants	An expert panel list of aquatic and semi-aquatic plants was used to calculate this measure. Records ≥1950 and a precision ≤2000m were included. Records were used to derive a count of different species for each subsection. This value was then attributed to nested non-riverine spatial units, with 'No Data' allocated where the associated spatial unit had an absence of species information.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel	Continuous Asc
3.1.6	Richness of native amphibians (non-riverine wetland breeders)	An expert panel list of native amphibians (non-riverine wetland breeders) was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each subsection. This value was then attributed to nested non-riverine spatial units, with 'No Data' allocated where the associated spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel	Continuous Asc
3.1.7	Richness of native aquatic dependent mammals	An expert panel list of native mammals dependent on non-riverine wetlands for all or part of their lifecycles was used to calculate this measure. Records ≥1975, precision ≤ 2000m were included. Records were used to derive a count of different species for each subsection. This value was then attributed to nested non-riverine spatial units, with 'No Data' allocated where the associated spatial unit had an absence of species information.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel	Continuous Asc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
3.3.2	Richness of wetland types within the local catchment	The number of different wetland habitat types (based on TYPE_RE field—a concatenation of wetland class, hydro-modifier, water regime, salinity modifier and WETRE fields from the QWM data) was calculated for each subsection. This number was then applied to each non-riverine spatial unit based on its subsection membership. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. Spatial units less than 1ha are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure. In addition, non-riverine spatial units with the word "None" in the TYPE_RE are data deficient and get a score of ‘No Data’.	DESI Queensland Wetland Mapping data v6, ACA subsections	Continuous Asc
3.3.3	Richness of wetland types within the sub-catchment	The number of different wetland habitat types (based on TYPE_RE field—a concatenation of wetland class, hydro-modifier, water regime, salinity modifier and WETRE fields from the QWM data) was calculated for each sub-catchment. This number was then applied to each non-riverine spatial unit based on its sub-catchment membership. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. Spatial units less than 1ha are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure. In addition, non-riverine spatial units with the word "None" in the TYPE_RE are data deficient and get a score of ‘No Data’.	DESI Queensland Wetland Mapping data v5, SGC ACA subsections	Continuous Asc
4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species — NCA Act, EPBC Act	A list of rare or threatened (NCA or EPBC) non-riverine aquatic ecosystem dependent fauna species identified by the expert fauna panel was used to generate the records dataset. Records were intersected with subsections to determine species richness in each. This value was then attributed to all nested non-riverine spatial units. The calculation was completed only for Natural, Semi-modified and Highly Modified wetlands. Artificial wetlands are not valid for this measure. Non-riverine spatial units without records were given a value of ’No Data’.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCA Act, EPBC Act	A list of rare or threatened (NCA or EPBC) non-riverine aquatic ecosystem dependent flora species identified by the expert fauna panel was used to generate the records dataset. Records were intersected with subsections to determine species richness in each. This value was then attributed to all nested non-riverine spatial units. The calculation was completed only for Natural, Semi-modified and Highly Modified wetlands. Artificial wetlands are not valid for this measure. Non-riverine spatial units without records were given a value of 'No Data'.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel.	Continuous Asc
4.2.1	Conservation status of wetland Regional Ecosystems — Herbarium biodiversity status, NCA Act, EPBC Act	The following ratings were applied based on the Queensland Herbarium Biodiversity Status and EPBC Status of palustrine and lacustrine regional ecosystems: For biodiversity status: Endangered = 4 Of Concern = 3 No Concern at Present/Least Concern = 2 For EPBC listed communities: Critically Endangered or Endangered = 4 Vulnerable = 3 Other = 2 The maximum score was applied within each non-riverine spatial unit.	DESI Queensland Wetland Mapping data v6, REDD version 11. EPBC community regional ecosystem list.	Categorical
5.1.1	Presence of aquatic ecosystem dependent priority fauna species (expert panel list/discussion or other lists such as ASFB, etc.)	An expert panel derived list of priority non-riverine aquatic ecosystem dependent fauna species was used to generate the records dataset. Records were intersected with subsections to determine species richness in each. This was then attributed to all nested non-riverine spatial units. The calculation was completed only for Natural, Semi-modified and Highly Modified wetlands. Artificial wetlands are not valid for this measure. Non-riverine spatial units without records were given a value of 'No Data'.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
5.1.2	Presence of aquatic ecosystem dependent priority flora species	An expert panel derived list of priority non-riverine aquatic ecosystem dependent flora species was used to generate the records dataset. Records were intersected with subsections to determine species richness in each. This was then attributed to all nested non-riverine spatial units. The calculation was completed only for Natural, Semi-modified and Highly Modified wetlands. Artificial wetlands are not valid for this measure. Non-riverine spatial units without records were given a value of 'No Data'.	Flora species records from DESI databases WildNet, Herbrecs, Corveg and Expert Panel.	Continuous Asc
5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA / ROKAMBA agreement lists and/or Bonn Convention)	An expert panel derived list of migratory species dependent on non-riverine wetlands for all or part of their lifecycles was used to calculate this measure. Records were intersected with subsections to determine species richness in each. This was then attributed to all nested non-riverine spatial units. The calculation was completed only for Natural, Semi-modified and Highly Modified wetlands. Artificial wetlands are not valid for this measure. Non-riverine spatial units without records were given a value of 'No Data'.	DESI QLD Historical Fauna Database (QHFD), WildNet, and Expert Panel.	Continuous Asc
5.1.4	Habitat for significant numbers of waterbirds	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
5.2.1	Presence of priority aquatic ecosystem	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.1.1	Presence of distinct, unique or special geomorphic features	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	Combine significant wetland category 4 areas (Ramsar, World Heritage) and significant wetland category 3 areas (DIWA). These were then overlayed with the non-riverine spatial units. Spatial units were manually selected based on an interpretation of the DIWA criteria. The resulting value was then given a conservation rating out of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	RAMSAR areas. World Heritage Areas. Directory of Important wetlands (DIWA).	Categorical
6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Documented reports external to the ACA process.	Categorical
6.3.4	Climate change refugia	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. Spring fed stream, ephemeral stream, boggomoss).	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6 (e.g. karsts, cave streams, artesian springs)	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4.	Expert Panel	Categorical
7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6.	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating of 3 or 4.	Expert Panel	Categorical
7.4.2	Terrestrial natural area connectivity within a subsection based on an acknowledged metric.	The original method (National Connectivity Index) was developed by the Australian Government Department of Climate Change, Energy, the Environment and Water, and has been adapted for this project to include the Remnant and Regrowth Regional Ecosystem mapping. The index uses a moving window to assess natural area connectivity at each 100m cell location within the landscape, across multiple scales or neighbourhoods (0.5, 1, 2, 4, 8, 16 and 32km). For each neighbourhood, connectivity is assessed using 3 indexes, 1. The amount of natural area, 2. The amount of core natural area and 3. The distance between natural area patches. The connectivity indexes for all neighbourhoods are combined and then rescaled from 0 – 100.	DESI Queensland Remnant and Regrowth Regional Ecosystem mapping v11.	Continuous Asc
7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6.	Expert panels identified riverine spatial units that contributed to an estuarine wetland that has a significant contribution to biodiversity values. The resulting value was given a conservation rating out of 3 or 4.	Expert Panel	Categorical

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
8.1.1	% area of each wetland type within Protected Areas.	Protected area estates (CP, FR, NC, NP, NS, RR, SF and TR) and nature refuge data was used to calculate the % area of each wetland habitat type (based on TYPE_RE field—a concatenation of wetland class, water regime, salinity modifier and WETRE fields from the QWM data) located within these protected areas. The minimum % area was used for individual wetlands with more than one wetland habitat type to account for habitats less protected. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure. In addition, non-riverine spatial units with the word "None" in the TYPE_RE are data deficient and get a score of 'No Data'.	DESI Queensland Wetland Mapping data v6, QLD protected area estate.	Continuous Desc
8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)	The frequency of each wetland management group was calculated for the study area. Where a wetland had two or more management groups, the management group with the lowest abundance was assigned to that wetland. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure.	DESI Queensland Wetland Mapping data v6, utilising the Habitat Type (HAB) field.	Continuous Desc
8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the sub-catchment (management groups ranked least common to most common)	The frequency of each wetland management group was calculated for the sub-catchment. Where a wetland had two or more management groups, the management group with the lowest abundance was assigned to that wetland. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure.	DESI Queensland Wetland Mapping data v6, utilising the Habitat Type (HAB) field.	Continuous Desc

Measure	Description	Non-riverine implementation	Primary datasets used	Threshold type
8.2.3	The size of each wetland type relative to others of its wetland management group within the catchment or study area	Each non-riverine spatial unit was ranked (quartiles) by its size relative to other non-riverine spatial units with the same management group within the study area. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure.	DESI Queensland Wetland Mapping data v6, utilising the Habitat Type (HAB) field.	Categorical
8.2.4	The size of each wetland type relative to others of its wetland management group within a sub-catchment.	Each non-riverine spatial unit was ranked (quartiles) by its size relative to other non-riverine spatial units with the same management group within the study area. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure.	DESI Queensland Wetland Mapping data v6, utilising the Habitat Type (HAB) field.	Categorical
8.2.5	Wetland type representative of the study area – identified by expert opinion.	Expert panels identified non-riverine spatial units that contained notable values associated with this measure. The resulting value was then given a conservation rating out of 4. Spatial units not identified by experts for this measure were given a known absence value of -999.	Expert Panel	Categorical
8.2.6	The size of each wetland type relative to others of its type within the catchment or study area.	Based on a concatenation of wetland class, water regime, salinity modifier and WETRE fields from the QWM data [TYPE_RE], the size distribution of each type was derived and grouped into their respective study area. A quartile threshold was then calculated. The maximum threshold was applied to each non-riverine spatial unit based on the types present. The calculation was completed only for Natural and Semi-modified wetlands. Highly Modified and Artificial wetlands are not valid for this measure. All non-valid spatial units were given a score of -999 (i.e. true-absence) for this measure. In addition, non-riverine spatial units with the word "None" in the TYPE_RE are data deficient and get a score of ‘No Data’.	DESI Queensland Wetland Mapping data v6.	Categorical

Appendix IV – Riverine indicator ranks and measure weights

Maximum weight is 10, relative to each Measure in the same Indicator.

The maximum rank is 1, relative to each Indicator in the same Criterion. If two Indicators within a Criterion are ranked 1 - they are considered of equal importance.

Indicators	Rank	Measure		Weight
1.1 Exotic flora/fauna	2	1.1.1	Presence of 'alien' fish species within the wetland	9.9
		1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	10
		1.1.3	Presence of exotic invertebrate fauna within the wetland	9.6
		1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	9.6
1.3 Habitat features modification	1	1.3.4	Presence/absence of dams/weirs/biopassages within the wetland	10
		1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	9.7
		1.3.7	% area of remnant wetland relative to preclear extent within the buffered watercourses	7.7
2.1 Exotic flora/fauna	3	2.1.1	Presence of exotic terrestrial plants in the assessment unit	10
2.2 Riparian disturbance	2	2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	10
		2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	7.9
		2.2.9	% tree cover within the waterway corridor	10
2.3 Catchment disturbance	2	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	7.8
		2.3.12	Potential landuse pressures on water quality within a subsection.	10
		2.3.13	Potential load of anthropogenic fine sediments within a subsection.	10
2.4 Flow modification	1	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	10
		2.4.7	Potential landuse pressures on changes to natural flow water regime within a subsection.	10
3.1 Species	2	3.1.1	Richness of native amphibians (riverine wetland breeders)	9.5
		3.1.2	Richness of native fish	10
		3.1.3	Richness of native aquatic dependent reptiles	8.9
		3.1.4	Richness of native waterbirds	9.3
		3.1.5	Richness of native aquatic plants	9.3
		3.1.7	Richness of native aquatic dependent mammals	8.7
3.2 Communities/ assemblages	1	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	10
3.3 Habitat	3	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	9
		3.3.3	Richness of wetland types within the sub-catchment	10
4.1 Species	1	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	9.9
		4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	10
4.2 Communities/ assemblages	2	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	10
5.1 Species	1	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	9.8
		5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	10
		5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	8.9
		5.1.4	Habitat for significant numbers of waterbirds	8.7
5.2 Ecosystems	1	5.2.1	Presence of 'priority' aquatic ecosystem	10
6.1 Geomorphic features	2	6.1.1	Presence of distinct, unique or special geomorphic features	10
6.2 Ecological processes	1	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	10
6.3 Habitat	1	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	10
		6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	9.7
		6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	9.8
		6.3.4	Areas important as refugia from the predicted effects of climate change (eg source of species re-population)	9.7
6.4 Hydrological	1	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	10

Indicators	Rank	Measure		Weight
7.1 Significant species or populations	1	7.1.4	Instream fragmentation due to anthropogenic barriers within a sub-catchment, based on an acknowledged metric.	10
7.2 Groundwater dependent ecosystems	1	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	10
7.3 Floodplain and wetland ecosystems	1	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.	10
7.4 Terrestrial ecosystems	1	7.4.2	Terrestrial natural area connectivity within a subsection based on an acknowledged metric.	10
7.5 Estuarine and marine ecosystems	1	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6	10
		7.5.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist in marine or estuarine areas.	10
8.2 Wetland uniqueness	1	8.2.5	Wetland type representative of the study area – identified by expert opinion	10

Appendix V – Non-riverine indicator ranks and measure weights

Maximum weight is 10, relative to each Measure in the same Indicator.

The maximum rank is 1, relative to each Indicator in the same Criterion. If two Indicators within a Criterion are ranked 1 - they are considered of equal importance.

Indicators	Ranks	Measure		Weight
1.1 Exotic flora/fauna	2	1.1.1	Presence of 'alien' fish species within the wetland	9.6
		1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	9.9
		1.1.3	Presence of exotic invertebrate fauna within the wetland	9
		1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	10
1.3 Habitat features modification	1	1.3.7	% area of remnant wetland relative to preclear extent within the buffered watercourses	10
1.4 Hydrological Modification	2	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through EPA wetland mapping and classification)	10
2.1 Exotic flora/fauna	3	2.1.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	10
2.2 Riparian disturbance	1	2.2.5	% area of remnant vegetation relative to preclear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands	10
		2.2.9	% tree cover within buffered area	9
2.3 Catchment disturbance	2	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	8.5
		2.3.12	Potential landuse pressures on water quality within a subsection.	10
		2.3.13	Potential load of anthropogenic fine sediments within a subsection.	10
2.4 Flow modification	2	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	10
		2.4.7	Potential landuse pressures on changes to natural flow water regime within a subsection.	10
3.1 Species	1	3.1.2	Richness of native fish	10
		3.1.3	Richness of native aquatic dependent reptiles	9.1
		3.1.4	Richness of native waterbirds	9.5
		3.1.5	Richness of native aquatic plants	9.7
		3.1.6	Richness of native amphibians (non-riverine wetland breeders)	9.5
		3.1.7	Richness of native aquatic dependent mammals	8.8
3.3 Habitat	2	3.3.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	9.3
		3.3.3	Richness of wetland types within the sub-catchment	10
4.1 Species	1	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	9.9
		4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	10
4.2 Communities/ assemblages	2	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	10
5.1 Species	1	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	9.8
		5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	10
		5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	8.9
		5.1.4	Habitat for significant numbers of waterbirds	8.6
5.2 Ecosystems	1	5.2.1	Presence of 'priority' aquatic ecosystem	10
6.1 Geomorphic features	2	6.1.1	Presence of distinct, unique or special geomorphic features	10
6.2 Ecological processes	1	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	10
6.3 Habitat	1	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	10
		6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	9.4
		6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	9.6
		6.3.4	Areas important as refugia from the predicted effects of climate change (eg source of species re-population)	9.5
6.4 Hydrological	1	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	10
7.2 Groundwater dependent ecosystems	1	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	10

Indicators	Ranks	Measure		Weight
7.3 Floodplain and wetland ecosystems	1	7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6	10
7.4 Terrestrial ecosystems	1	7.4.2	Terrestrial natural area connectivity within a subsection based on an acknowledged metric.	10
7.5 Estuarine and marine ecosystems	1	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6	10
8.1 Wetland protection	2	8.1.1	The percent area of each wetland type within Protected Areas.	10
8.2 Wetland uniqueness	1	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)	9
		8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the subcatchment or estuarine/marine zone (management groups ranked least common to most common)	8.7
		8.2.3	The size of each wetland type relative to others of its management group within the catchment or study area	8.9
		8.2.4	The size of each wetland type relative to others of its type within a subcatchment (or estuarine zone)	8.1
		8.2.5	Wetland type representative of the study area – identified by expert opinion	10
		8.2.6	The size of each wetland type relative to others of its type within the catchment or study area	8.5

Appendix VI – Riverine filter table

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
0	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data)			No data
1	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High)			Very High
2	equal to (Very High) and			equal to (Very High) and	equal to (Very High) and		equal to (Very High)			Very High
3	equal to (Very High or High)								and number of Criteria with Very High >= 4	Very High
4						equal to (Very High)				Very High
5	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low)			Very Low
6	equal to (Low) and	equal to (Medium) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low)			Very Low
7	equal to (Very High) and			equal to (Very High)						High
8	equal to (Very High) and				equal to (Very High)					High
9		equal to (Very High) and		equal to (Very High)						High
10			equal to (Very High) and				equal to (Very High)			High
11	equal to (Very High) and	equal to (Very High) and	equal to (Very High)							High
12	equal to (High) and		equal to (Very High)							High
13	equal to (Very High or High) and						equal to (Very High)			High
14			equal to (Very High) and	equal to (Very High) and	equal to (Very High)					High

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
15					equal to (Very High or High) and		equal to (Very High)			High
18	equal to (High) and	equal to (Very High) and				equal to (High)				High
16		equal to (Very High) and	equal to (Very High) and			equal to (High)				High
19		equal to (Very High) and		equal to (High) and		equal to (High)				High
20		equal to (Very High) and			equal to (High) and	equal to (High)				High
17		equal to (Very High) and				equal to (High)				High
21	equal to (High) and			equal to (High) and	equal to (High)					High
22					equal to (Very High or High) and	equal to (High)				High
23	equal to (Very High or High) and		equal to (High) and	equal to (High)						High
23a						equal to (High)				High
24				equal to (Very High or High)						Medium
25					equal to (Very High or High)					Medium
26			equal to (High) and				equal to (High)			Medium
27	equal to (Very High or High or Medium) and		equal to (Very High or High)							Medium
28	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and					equal to (High)			Medium

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
29			equal to (High) and		equal to (Medium)					Medium
30					equal to (Medium) and		equal to (High)			Medium
36	equal to (Very High or High or Medium) and			equal to (Medium) and	equal to (Medium)					Medium
36a						equal to (Medium)				Medium
37	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and				equal to (Very High or High or Medium)			Medium
37a									and number of Criteria with Very High >= 3	Medium
37b									and number of Criteria with High >= 3	Medium
37c	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)		and number of Criteria with Very High >= 2	Medium
37d									and number of Criteria with Very High >= 2	Low
37e									and number of Criteria with High >= 2	Low
37f	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)		and number of Criteria with Very High >= 1	Low
38	not equal to (Very High) and	not equal to (Very High)							and number of Criteria with Low >= 2	Very Low

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
1000	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data)			Low

Appendix VII – Non-riverine filter table

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
0	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data)		No data
1	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High)		Very High
2	equal to (Very High) and			equal to (Very High) and	equal to (Very High) and			equal to (Very High)		Very High
27	equal to (Very High or High)								and number of Criteria with Very High >= 4	Very High
3	equal to (Very High) and	equal to (Very High) and						equal to (Very High)		Very High
4	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and		equal to (Very High) and				equal to (Very High)		Very High
5						equal to (Very High)				Very High
6	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low)		Very Low
7		equal to (Medium or Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low or No data) and	equal to (Low) and	equal to (Medium or Low)		Very Low
8	equal to (Very High) and			equal to (Very High or High) and				equal to (Very High or High)		High
9	equal to (Very High) and				equal to (Very High) and			equal to (High)		High
10	equal to (Very High) and	equal to (Very High) and			equal to (Very High)					High
10a			equal to (Very High) and				equal to (Very High)			High
11			equal to (Very High) and					equal to (Very High)		High

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
11a	equal to (Very High or High) and						equal to (Very High)			High
12	equal to (Very High) and				equal to (Very High or High) and			equal to (Very High)		High
13	equal to (Very High or High) and	equal to (Very High) and		equal to (Very High or High)						High
14	equal to (High) and	equal to (Very High) and			equal to (Very High)					High
15	equal to (Very High or High) and	equal to (Very High or High) and	equal to (Very High) and					equal to (High)		High
15a						equal to (High)				High
16		equal to (Very High or High) and	equal to (Very High)							Medium
17			equal to (Very High) and					equal to (High)		Medium
18	equal to (Very High or High) and	equal to (Very High or High or Medium) and						equal to (Very High or High)		Medium
19				equal to (Very High or High)						Medium
20					equal to (Very High or High)					Medium
20b			equal to (High) and				equal to (Very High)			Medium
21	equal to (Very High or High or Medium) and	equal to (Very High or High) and				equal to (Medium)				Medium
22		equal to (Very High or High) and	equal to (High) and		equal to (Medium)					Medium

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
23		equal to (Very High or High) and		equal to (Medium) and		equal to (Medium)				Medium
24	equal to (Very High or High or Medium) and			equal to (Medium) and				equal to (Very High or High or Medium)		Medium
25	equal to (Very High or High or Medium) and	equal to (Very High)								Medium
25a	equal to (Very High or High or Medium) and	equal to (High or Medium) and					equal to (High)			Medium
26	equal to (Very High or High or Medium) and	equal to (High or Medium) and	equal to (Medium) and					equal to (Medium)		Medium
26a						equal to (Medium)				Medium
26c					equal to (Medium) and		equal to (High)			Medium
29									and number of Criteria with High >= 3	Medium
30									and number of Criteria with Medium >= 4	Medium
30a									and number of Criteria with Very High >= 3	Medium
30c	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)	and number of Criteria with Very High >= 2	Medium
30d									and number of Criteria with Very High >= 2	Low
30e									and number of Criteria with High >= 2	Low

Decision	1 Naturalness Aquatic	2 Naturalness Catchment	3 Diversity and Richness	4 Threatened Species and Ecosystems	5 Priority Species and Ecosystems	6 Special Features	7 Connectivity	8 Representativeness	Additional Criteria	AquaScore
30f	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)	and number of Criteria with Very High >= 1	Low
28									and number of Criteria with Low >= 4	Very Low
1000	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data)		Low

Appendix VIII – Criterion, indicator, measure list comparison between WBBGBRCC v2.1 and previous versions

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
1. Naturalness aquatic								
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	Y	Y	Y	Y	Y	Y
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	Y	Y	Y	Y	Y	Y
	1.1.3	Presence of exotic invertebrate fauna within the wetland	Y	Y	Y	Y	Y	Y
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	Y	Y	Y	Y	Y	Y
1.2 Aquatic communities / assemblages	1.2.1	SOR[1] aquatic vegetation condition	Y	Y				
	1.2.2	SIGNAL2[4] score (max)	Y	Y				
	1.2.3	AUSRIVAS[2] score-edge (min band)	Y	Y				
	1.2.4	AUSRIVAS[2] score-pool (min band)	Y	Y				
	1.2.9	AUSRIVAS[2] score-riffle (min band)	Y	Y				
1.3 Habitat features modification	1.3.1	SOR[1] bank stability	Y	Y				
	1.3.2	SOR[1] bed & bar stability	Y	Y				
	1.3.3	SOR[1] aquatic habitat condition	Y	Y				
	1.3.4	Presence/absence of dams/weirs within the wetland	Y	Y	Y			
	1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	Y	Y	Y			
	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit			Y			Y
	1.3.8	Presence of dredging/extraction (including for navigation) and channel modification within the wetland	Y					
	1.3.14	Aquatic habitat condition using acknowledged metric		Y				

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
1.4 Hydrological modification	1.4.1	APFD[3] score-modelled deviation from natural under full development	Y					
	1.4.2	% natural flows-modelled flows remaining relative to predevelopment	Y	Y				
	1.4.3	% no flows-modelled low flows relative to predevelopment	Y					
	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through DES wetland mapping and classification)				Y	Y	Y
	1.4.7	WRP (water resource plan) hydraulic habitat		Y				
	1.4.8	High Ecological Value (HEV) Areas	Y	Y				
1.5 Water quality	1.5.10	Water quality index/score – an acknowledged metric calculated considering local, state or national water quality guidelines		Y				
2 Naturalness catchment								
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	Y	Y	Y	Y	Y	Y
2.2 Riparian disturbance	2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	Y	Y	Y			
	2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	Y	Y	Y			
	2.2.3	SOR[1] reach environs	Y	Y				
	2.2.4	SOR[1] riparian vegetation condition	Y	Y				
	2.2.5	% area of remnant vegetation relative to pre-clear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands				Y	Y	Y
	2.2.9	% tree cover within the waterway corridor			Y			Y
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	Y	Y		Y	Y	

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
	2.3.2	% "grazing" land-use area	Y	Y		Y	Y	
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	Y	Y		Y	Y	
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	Y	Y	Y	Y	Y	Y
	2.3.12	Potential landuse pressures on water quality with a subsection			Y			Y
	2.3.13	Potential load of anthropogenic fine sediments within a subsection			Y			Y
2.4 Flow Modifications	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	Y	Y	Y	Y	Y	Y
	2.4.7	Potential landuse pressures on changes to natural flow water regime within a subsection			Y			Y
3 Diversity and richness								
3.1 Species	3.1.1	Richness of native amphibians (riverine wetland breeders)	Y	Y	Y			
	3.1.2	Richness of native fish	Y	Y	Y	Y	Y	Y
	3.1.3	Richness of native aquatic dependent reptiles	Y	Y	Y	Y	Y	Y
	3.1.4	Richness of native waterbirds	Y	Y	Y	Y	Y	Y
	3.1.5	Richness of native aquatic plants	Y	Y	Y	Y	Y	Y
	3.1.6	Richness of native amphibians (non-riverine wetland breeders)				Y	Y	Y
	3.1.7	Richness of native aquatic dependent mammals	Y	Y	Y	Y	Y	Y
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	Y	Y		Y	Y	
	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	Y	Y	Y			
3.3 Habitat	3.3.1	SOR[1] channel diversity	Y	Y				
	3.3.2	Richness of wetland types within the local catchment (e.g. sub-section)	Y	Y	Y	Y	Y	Y
	3.3.3	Richness of wetland types within the sub-catchment	Y	Y	Y	Y	Y	Y

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
3.4 Geomorphology	3.4.1	Richness of geomorphic features		Y				
4 Threatened species and ecosystems								
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCA, EPBC	Y	Y	Y	Y	Y	Y
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCA, EPBC	Y	Y	Y	Y	Y	Y
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCA, EPBC	Y	Y	Y	Y	Y	Y
5 Priority species and ecosystems								
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	Y	Y	Y	Y	Y	Y
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	Y	Y	Y	Y	Y	Y
	5.1.3	Habitat for, or presence of, migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	Y	Y	Y	Y	Y	Y
	5.1.4	Habitat for significant numbers of waterbirds	Y	Y	Y	Y	Y	Y
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	Y	Y	Y	Y	Y	Y
6 Special features								
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	Y	Y	Y	Y	Y	Y
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	Y	Y	Y	Y	Y	Y
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	Y	Y	Y	Y	Y	Y

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	Y	Y	Y	Y	Y	Y
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	Y	Y	Y	Y	Y	Y
	6.3.4	Areas important as refugia from the predicted effects of climate change (e.g. source of species re-population)			Y			Y
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	Y	Y	Y	Y	Y	Y
7 Connectivity								
7.1 Significant species or populations	7.1.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of significant species or populations, including those features identified through Criteria 5 and/ or 6	Y	Y				
	7.1.2	Migratory or routine 'passage' of fish and other fully aquatic species (upstream, lateral or downstream movement) within the spatial unit	Y	Y				
	7.1.4	Instream fragmentation due to anthropogenic barriers within a sub-catchment, based on an acknowledged metric			Y			
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6 (e.g. karsts, cave streams, artesian springs)	Y	Y	Y	Y		Y

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
7.3 Floodplain and wetland ecosystems	7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6	Y	Y				Y
	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.			Y	Y		
7.4 Terrestrial ecosystems	7.4.2	Terrestrial natural area connectivity within a subsection based on an acknowledged metric			Y			Y
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6	Y	Y	Y	Y		Y
	7.5.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist in marine or estuarine areas.			Y			
8 Representativeness								
8.1 Wetland protection	8.1.1	The percent area of each wetland type within Protected Areas.				Y	Y	Y
	8.1.2	The % area of each wetland type within a coastal/estuarine area subject to the Fisheries Act, Coastal Management Act or marine Parks Act.				Y	Y	
8.2 Wetland uniqueness	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)				Y	Y	Y
	8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the sub-catchment or estuarine/marine zone (management groups ranked least common to most common)				Y	Y	Y

Criteria and indicators	Measures		Riverine – WBB v1.1 2010 (excludes Baffle)	Riverine – GBR v1.1 2009 (includes Baffle)	Riverine – WBBGBRCC v2.1	Non-riverine – WBB v1.1 2010 (excludes Baffle)	Non-riverine – GBR v1.3 2011 (includes Baffle)	Non-riverine – WBBGBRCC v2.1
	8.2.3	The size of each wetland type relative to others of its wetland management group within the catchment or study area				Y	Y	Y
	8.2.4	The size of each wetland type relative to others of its wetland management group within a sub-catchment (or estuarine zone)				Y	Y	Y
	8.2.5	Wetland type representative of the study area – identified by expert opinion			Y	Y	Y	Y
	8.2.6	The size of each wetland type relative to others of its type within the catchment or study area				Y	Y	Y

[1] SOR – State of the Rivers
[2] AUSRIVAS – Australian River Assessment System
[3] APFD – Annual Proportional Flow Deviation
[4] SIGNAL2 – Stream Invertebrate Grade Number – Average Level

Attachment A – An Aquatic Conservation Assessment for the riverine and non-riverine wetlands of the Queensland Wide Bay-Burnett Great Barrier Reef connecting catchments - Flora, Fauna and Ecology Expert Panel Report, Version 2.1.