PHCC Working Together
Peel-Harvey Catchment Council

Baseline Report Card
Ramsar 482 Peel-Yalgorup System

Launched December 2019

INTRODUCTION

Who is this report card for?

This report card is intended to be used as a communications tool to inform the community* of the current condition of the Peel-Yalgorup Ramsar Site (Ramsar 482) and catchment. It will be updated each year using the most current data available.

What is a Ramsar Site?

Ramsar sites are designated as "Wetlands of International Importance" under the Ramsar Convention on Wetlands. The Ramsar Convention nominates nine criteria for identifying these wetlands (see Hale and Butcher 2007) based on the rareness, uniqueness of representativeness of wetland type, its support of threatened species or ecological communities and the habitat it provides for waterbirds, fish and other animal species. The Peel-Yalgorup Wetland System was recognized as a Ramsar Site (Ramsar 482) in 1990 when it met six of the nine criteria. Since 1990, threatened ecological communities including the Lake Clifton thrombolites, the temperate and subtropical salt marshes of the Peel-Harvey Estuary and Claypans of the Swan Coastal plain have been identified in the Ramsar Site and so it now meets seven of the nine criteria.

What measures do we use to assess the condition of the Ramsar Site?

A Limit of Acceptable Change (LAC) is defined as "the variation that is considered acceptable in a particular component or process of the ecological character of the wetland without indicating change in the ecological character which may lead to a reduction or loss of the criteria for which the site was Ramsar listed" (Phillips 2006). In other words, a component or process lying outside of this limit indicates a decline in the ecological condition of the Ramsar site which, unabated, may lead to inability to meet one or more of the Ramsar criteria for the site.

The Ecological Character Description for the Peel-Yalgorup Ramsar Site (Hale and Butcher 2007) specifies 81 parameters and variables as measures of these components and processes for which LACs may be set. This report card for the Peel-Yalgorup Ramsar Site compares information collected from various monitoring programs with these LACs. The result is shown according to a traffic light system: green indicates that the measured variables meet the LAC and red indicates that the LAC has not been met. With few exceptions, the monitoring programs from which the data was collected were not designed for direct comparison against the LACS and so requires some interpretation. A yellow colour represents that the data is borderline with the LAC indicating that the LAC is met in some respects but not others. Grey indicates that there is insufficient data to assess performance against the LAC, thereby identifying gaps in the monitoring programs.

Similarly to the Ecological Character Description (Hale and Butcher 2007), this report card presents the data for the four wetlands within the site, grouped into subsystems according to geographical location and broad wetland type i.e. the Peel-Harvey Estuary; the Yalgorup Lakes Subsystem; Goegrup & Black Lakes; and the McLarty Lake Subsystem The report card differs in that it presents the abundance of waterbirds across the entire Ramsar Site rather than at each geographical location, and by considering Lake McLarty and Lake Mealup separately to acknowledge that these lakes are managed and monitored separately from each other, especially since the water replenishment of lake Mealup in 2012.

A snapshot of the most recent information for the entire Ramsar Site is shown on page 3 of the Report Card. More detailed information is presented for each of the subsystems on the subsequent pages with the LACs defined and performance against these presented for the two most recent measurements to indicate trends in wetland performance.

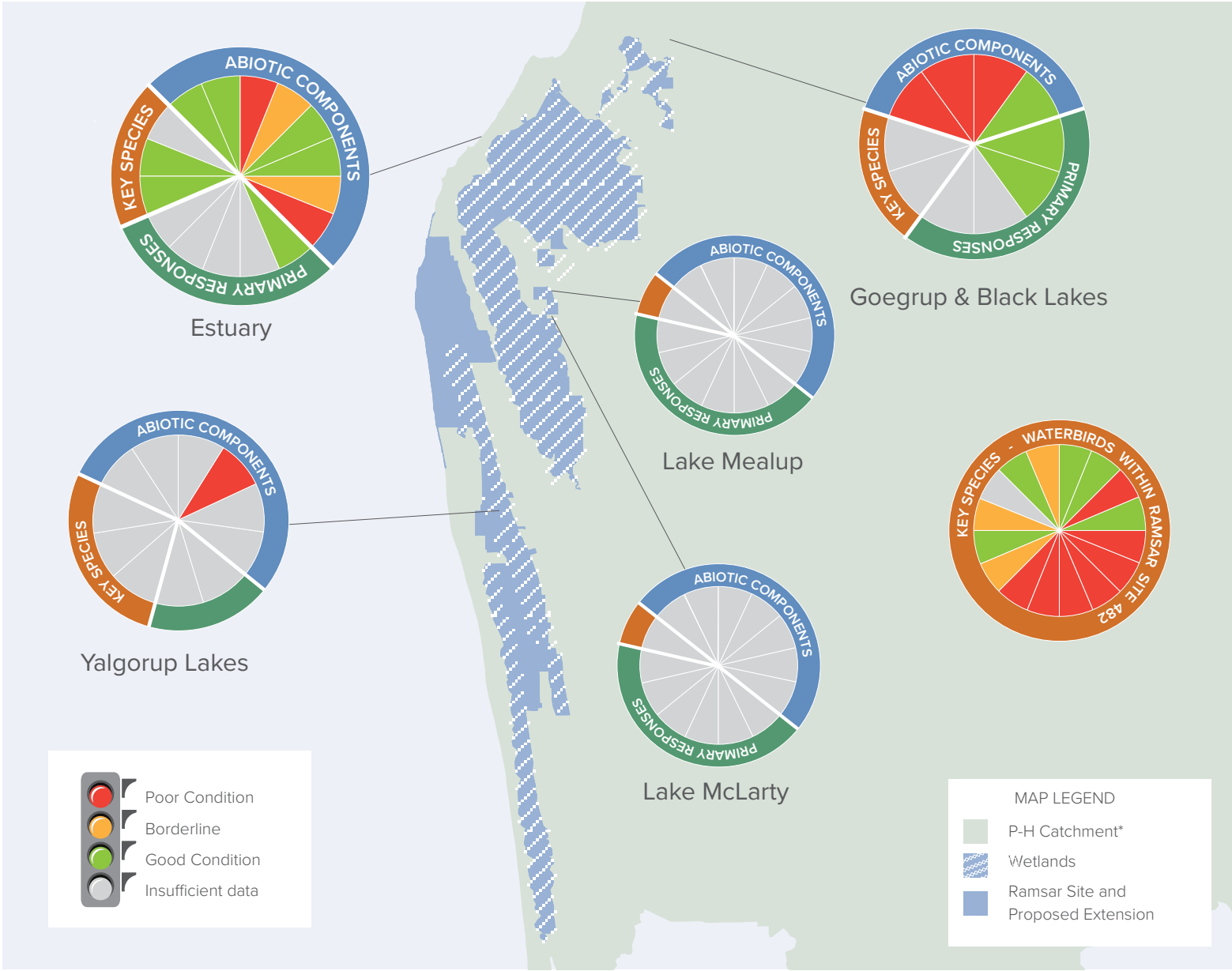
The Ecological Character Description is currently under review. As a consequence some of the the LACs, especially for the Peel-Harvey Estuary, will become Trigger Values for management actions.

What about the catchment?

The export of nutrients phosphorus and nitrogen to the estuary is one of the greatest threats to the health of the estuary. Nutrient enrichment (eutrophication) of waterways is associated with the increased growth of aquatic weeds, nuisance or harmful algal blooms and fish deaths.

The health of the Peel-Harvey Estuary is directly dependent on the quality of water flowing into it from the catchment. This report card therefore includes a summary of the information collected by the Department of Water and Environmental Regulation (DWER) for 13 sub-catchments on the coastal plain that drain into the estuary. Here we present the status and trends in the median concentrations of Total Nitrogen and Total Phosphorus leaving each catchment over the five year period from 2010 - 2014 inclusive. LACs have not been set for these parameters, but instead each has been assigned as low, medium, high or very high according to the limits set by DWER.

** NOTE: the term community is used in the broadest sense. We include all individuals and groups who have a 'stake' in the catchment, including all levels of government, businesses, industries, NGOs, Aboriginals, land owners, residents, community groups, media, etc.*



WHAT DOES IT ALL MEAN?

The information collected against the LACs for each of the subsystems and for waterbirds across the whole of the Ramsar Site is summarised here. At a glance we can see that there are information gaps for all of the subsystems, particularly Lake Mealup, Lake McLarty and the Yalgorup Lakes. The condition of these subsystems is therefore difficult to assess, however the high salinity observed for Lake Clifton is a major cause for concern.

The jury is out on the condition of the Peel-Harvey Estuary based on abiotic indicators (water quality), highlighting the need to fill the gaps in monitoring for primary responses and key species. The Serpentine River in the vicinity of, and as a surrogate for, Lakes Goegrup and Black is poor based on water quality measurements.

The site meets Ramsar Criteria 5 and 6, regularly supporting at least 20,000 waterbirds and 1% of the World Population Estimate of 4 of 14 species of waterbirds for the period 2012- 2017 inclusive. There is an emerging trend of decreasing waterbird numbers observed at the site over this period, however, we should note that this may indicate a trend affecting the entire flyway rather than just Ramsar Site 482.

WATERBIRDS

This data was obtained from the Shorebird 2020 count, which takes place at 17 locations across the Ramsar site in February each year.

W1 is a direct measure of the Ramsar site's performance in meeting Ramsar Criterion 5 of regularly supporting 20,000 waterbirds. It has met this criterion every year 2012 to 2017 inclusive although there is an apparent decreasing trend in the total waterbirds observed.

W2-15 inclusive indicate that the site has met Criterion 6 in regularly supporting 1% of the World Population Estimate (shown in brackets) of four of 14 species of waterbirds in at least three of five years 2013-2017 the same as in 2012-2016. The variation in abundance for each species relative to the World Population Estimate over the most recent 5-year period is shown in the graphs. *Green bars indicate the 1% threshold has been exceeded and red bars indicate the threshold has not been met.*

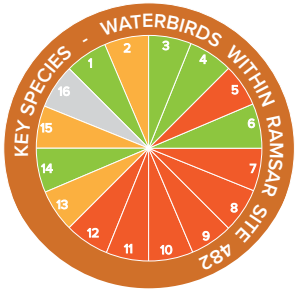
W16 we have confirmed observations of breeding for some but not all of the nominated species so have assigned a status of insufficient data.

Key Species & Communities

	LIMIT OF ACCEPTABLE CHANGE	2013	2014	2015	2016	2017	2012-2016	2013-2017
W1	Support > **20,000** total waterbirds in 4 out of 5 years	20,000						
	Support > 1 % of the population of the following birds 3 out of 5 yrs:							
W2	Banded Stilt (**3,700**)	3,700						
W3	Red-necked Stint (**3,200**)	3,200						
W4	Red-capped Plover (**950**)	950						
W5	Red-necked Avocet (**1,100**)	1,100						
W6	Fairy Tern (**120**)	120						
W7	Curlew Sandpiper (**1,400**)	1,400						
W8	Sharp-tailed Sandpiper (**1,600**)	1,600						

WATERBIRDS

Poor Condition
Borderline
Good Condition
Insufficient data



Key Species & Communities

	LIMIT OF ACCEPTABLE CHANGE	2013	2014	2015	2016	2017	2012-2016	2013-2017
W9	Musk Duck (**250**)	250						
W10	Australasian Shoveller (**120**)		120					
W11	Eurasian Coot (**10,000**)	10,000						
W12	Grey Teal (**20,000**)	20,000						
W13	Hooded Plover (**60**)		60					
W14	Shellduck (**2,400**)		2,400					
W15	Black-winged Stilt (**3,000**)		3,000					
W16	Breeding recorded for waterbird species (Pelicans, Little Pied Cormorants, Little Black Cormorants, Black Swan, Grey Teal, Darter and Black-winged Stilt) a minimum of once every three years							

PEEL-HARVEY ESTUARY

Poor Condition
Borderline
Good Condition
Insufficient data

	COMPONENT	LIMIT OF ACCEPTABLE CHANGE		2014-16	2017
Abiotic Components	Nutrients	E1	Total Phosphorus as (TP) < 0.030 mg/L	●	●
		E2	Phosphate as phosphorus (PO_4^{3-} as P) median concentrations < 0.010 mg/L	●	●
		E3	Ammonium as nitrogen (NH_4^+ as N) median concentrations < 0.010 mg/L	●	●
		E4	Nitrate and nitrite as nitrogen (NO_x^- as N) median concentrations < 0.010 mg/L	●	●
	Dissolved O_2	E5	Saturation (DO %sat) 70–80 %	●	●
	pH	E6	pH > 7 at all times	●	●
	Salinity	E7	Winter salinity in the centre of the Peel inlet and Harvey Estuary < 30 ppt for a minimum of three months	●	●
		E8	Water in the Harvey River mouth over winter < 3 ppt	●	●
Primary Responses	Phytoplankton	E9	Chlorophyll a – median concentrations < 10 µg/L	●	●
	Seagrass	E10	Baseline must be set before limits can be made	●	●
	Macroalgae	E11	Baseline must be set before limits can be made	●	●
	Samphire	E12	Baseline must be set before limits can be made	●	●
	Paperbark	E13	Baseline must be set before limits can be made	●	●
Key Species & Communities	Invertebrates	E14	Standardised annual commercial catch rates (CPUE) for blue swimmer crabs should not drop below 0.7 kg/trap lift per annum (based on commercial fishing). This level is defined as the threshold for this fishery (MSC Cert.)	●	●
		E15	Median CPUE for blue swimmer crabs should not drop below 1.0 kg/trap lift per annum (based on comm. fishing)	●	●
	Fish	E16	Baseline must be set before limits can be made	●	●

The data for the abiotic components and phytoplankton (chlorophylla a) were collected and collated by DWER as part of the regular monitoring program at 12 sites in the Peel-Harvey Estuary and estuarine reaches of the Murray and Serpentine rivers (KP-E-PHESTREACH). Nutrients (E1 to E4) are determined monthly while dissolved oxygen, pH and salinity (E5 to E7) fortnightly at the surface and bottom of the water column. Chlorophyll a (E9) is determined in samples collected from the surface and integrated over the depth of the water column.

The LACs relating to phosphorus concentrations (E1 and E2) were met for both surface and bottom water samples collected from the Peel inlet and Harvey Estuary.

The median ammonium concentrations (E3) exceeded the LAC for during summer at both the surface and bottom while nitrate and nitrite just exceeded the LAC (E4) in surface samples collected during the winter.

It should be noted that the LACs for Total Phosphorus (E1) are set from the Water Quality Improvement Plan (EPA 2008) and are equal to the ANZECC Trigger Values for South Western Australian estuaries (ANZECC & ARMCANZ 2000). The LAC for phosphate (E2, 0.010 mg/L) is greater than the ANZECC Trigger Value (0.005 mg/L) while the LAC for ammonium (E3, 0.010 mg/L) and nitrate and nitrite (E4, 0.010 mg/L) is less than the Trigger Values of 0.040 mg/L and 0.045 mg/L respectively. If the ANZECC Trigger Values were adopted all of the LACs would be met. These anomalies will be addressed in future reviews of the Ecological Character Description.

Median dissolved oxygen concentrations for both surface and bottom waters of the Peel Inlet and Harvey Estuary were between 90 % and 100 % saturation. All values in the range between the 5th and 95th percentile were between 75% and 105 %. Although the upper limit exceeds that of the LAC (E5), this has and should be interpreted as an indication of good estuarine health.

The pH of the estuarine water met the LAC (E6) with the 5th to 95th percentile of measurements greater than 7.8. Values below the LAC (i.e pH 7) might indicate the effects of acid sulfate drainage.

The LACs for estuarine salinity are set as indicators of declining flows of relatively freshwater from the rivers. The salinity at the Centre of the Peel Inlet (E7) met the LAC in Winter 2014 and was borderline in winters of 2016 and 2017 maintaining a salinity of < 30 ppt for seven consecutive fortnightly measurements (i.e. 84 days) but failing on the eighth occasion. To remove the reliance on sampling frequency, monitoring against this LAC might be better served using a data logger to record salinity.

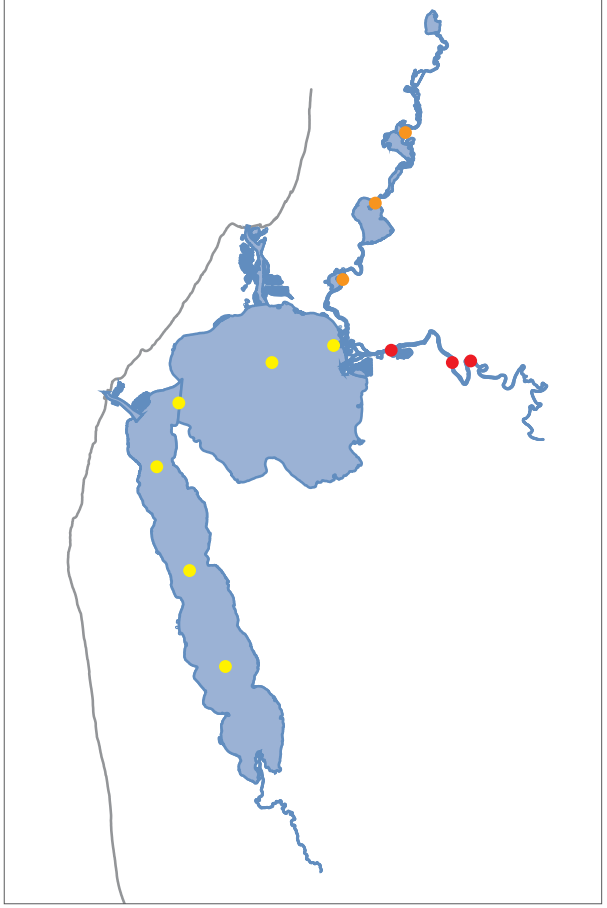
The LAC for salinity at the mouth of the Harvey River (E8) has never been met over the past 17 years of monitoring. The salinity has not dropped below 10 ppt in the six years 2012 to 2017 inclusive. This is most likely due to the location of the southern-most site in the Harvey Estuary at which this data is collected being approximately 5 km from the mouth of the Harvey River. It is unlikely that this LAC will ever be met unless a monitoring site is located close to the river mouth.

The median chlorophyll a concentrations were below the LAC (E9) for both surface samples and integrated samples. The concentrations similarly did not exceed the more stringent ANZECC Trigger Value of 3 µg/L.

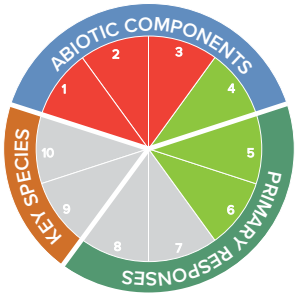
E14 and E15 are derived from the same data. The WA Department of Fisheries (DoF, 2015) set an upper threshold of 0.7 kg/trap lift/annum for a sustainable catch rate (Catch Per Unit Effort) in their harvest strategy for blue swimmer crabs by professional fishers. This has been adopted as an alternative LAC (E14) to that set out in the ECD in 2009 (E15) in the interim until the review of the ECD is completed.

There is a lack of data to assess the ecological condition against the remaining LACs. Baseline data for E10, E11 and E16 has been collected as part of the ARC Linkage Project *Balancing Societal and Estuarine Health in a Changing Environment* (Valesini et. al., 2019). LACs might be set using these investigations, however monitoring programs for each will need to be devised, funded and implemented for future comparison.

Peel-Harvey Estuary Water Quality Sampling Sites



GOEGRUP AND BLACK LAKES (SERPENTINE RIVER AS SURROGATE)



This data was aggregated from sites in the Serpentine River downstream from Lake Goegrup, upstream from Lake Goegrup and Yalbanberup Pool.

	COMPONENT	LIMIT OF ACCEPTABLE CHANGE	2012-2016	2017
Abiotic Components	Nutrients	G1 Phosphate as phosphorus (PO_4^{3-} as P) median concentrations < 0.010 mg/L	●	●
		G2 Ammonium as nitrogen (NH_4^+ as N) median concentrations < 0.040 mg/L	●	●
		G3 Nitrate and nitrite as nitrogen (NO_x^- as N) median concentrations < 0.100 mg/L	●	●
	pH	G4 pH > 7 at all times	●	●
Primary Responses	Phytoplankton	G5 Limit should be lower than current conditions, further investigations should be undertaken in order to set realistic limits (chlorophyll a <10 µg/L)	●	●
	Samphire	G6 Extent and distribution of samphire within patterns of natural variation	●	●
	Paperbark	G7 No change in the condition of paperbark communities	●	●
		G8 No loss of extent of paperbark communities	●	●
Key Species & Communities	Invertebrates	G9 Limit of acceptable change not able to be set. However, Invertebrate populations sufficient to sustain waterbird populations should be maintained	●	●
	Fish	G10 Baseline must be set before limits can be made	●	●

Nutrient concentrations exceeded the LACs G1, G2 and G3 for both surface and bottom water samples except for during Autumn 2017 when phosphate dipped below the LAC.

As for the Peel-Harvey Estuary, the LACs do not match the ANZECC Trigger Value. Unlike the estuary, however, if the ANZECC Trigger Values were adopted none of the LACs would be met.

The pH of the estuarine water met G4 with the 5th to 95th percentile of measurements greater than 7.0. The 5th percentile of pH values measured from 2012 to 2016 inclusive dipped below 7.0 and so was assessed as borderline relative to the LAC.

The median chlorophyll a concentrations were below E5 for both surface samples and integrated samples, however, they exceeded the more stringent ANZECC Trigger value of 3 µg/L in all seasons except for Spring 2017.

There is a lack of data to assess the ecological condition against the remaining LACs. Baseline data for G10 has been collected as part of the ARC Linkage Project LP150100451 (Valesini et. al., 2019). LACs might be set using these investigations, however monitoring programs for each will need to be devised, funded and implemented for future comparison. The extent and distribution of samphire was assessed by PHCC in 2018 from which a baseline might be developed.

LAKE **MCLARTY**

Poor Condition
Borderline
Good Condition
Insufficient data

Although some information relating to the ecological condition of Lake McLarty has been collected by the Friends of Lake McLarty and the Department of Biodiversity Conservation and Attractions, including salinity, pH, water levels, littoral vegetation and invertebrates, the data needs to be verified, consolidated and interpreted before comparison can be made against the LACs. All LACs have therefore been designated as having insufficient data.

	COMPONENT	LIMIT OF ACCEPTABLE CHANGE	2016	2017
Abiotic Components	Nutrients*	Mc1 Phosphate as phosphorus (PO_4^{3-} as P) median concentrations < 0.010 mg/L		
		Mc2 Ammonium as nitrogen (NH_4^+ as N) median concentrations < 0.040 mg/L		
		Mc3 Nitrate and nitrite as nitrogen (NO_x^- as N) median concentrations < 0.100 mg/L		
	Salinity	Mc4 Salinity under rush and sedge communites < 1ppt		
		Mc5 Salinity under paperbark communities < 0.5 ppt		
	pH	Mc6 pH > 7 at all times		
	Groundwater discharge	Mc7 A surrogate based on water levels in the lakes may be able to be developed		
Primary Responses	Phytoplankton	Mc8 Baseline must be set before limits can be made		
	Aquatic Plants	Mc9 > 50% of open water not covered in floating aquatic plants		
	Littoral Vegetation	Mc10 *Typha* limited to < 20% of the wetland area		
		Mc11 Freshwater sedges covering a minimum of 20% of the wetland area		
	Paperbark	Mc12 No decline in paperbark health		
		Mc13 No net loss of extent of paperbark community		
Key Species & Communities	Invertebrates	Mc14 Baseline must be set before limits can be made: invertebrate populations sufficient to sustain waterbird populations should be maintained		

** Applied only when water levels are > 500 mm deep*

LAKE **MEALUP**

Poor Condition
Borderline
Good Condition
Insufficient data

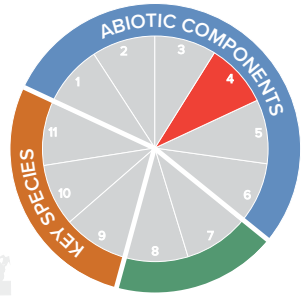
Although some information relating to the ecological condition of Lake Mealup has been collected by the Lake Mealup Preservation Society and the Department of Biodiversity Conservation and Attractions, including salinity, pH and water levels, the data needs to be verified, consolidated and interpreted before comparison can be made against the LACs.

	COMPONENT	LIMIT OF ACCEPTABLE CHANGE	2016	2017
Abiotic Components	Nutrients*	Me1 Phosphate as phosphorus (PO_4^{3-} as P) median concentrations < 0.010 mg/L		
		Me2 Ammonium as nitrogen (NH_4^+ as N) median concentrations < 0.040 mg/L		
		Me3 Nitrate and nitrite as nitrogen (NO_x^- as N) median concentrations < 0.100 mg/L		
	Salinity	Me4 Salinity under rush and sedge communites < 1ppt		
		Me5 Salinity under paperbark communities < 0.5 ppt		
	pH	Me6 pH > 7 at all times		
	Groundwater discharge	Me7 A surrogate based on water levels in the lakes may be able to be developed		
Primary Responses	Phytoplankton	Me8 Baseline must be set before limits can be made		
	Aquatic Plants	Me9 > 50% of open water not covered in floating aquatic plants		
	Littoral Vegetation	Me10 *Typha* limited to < 20% of the wetland area		
		Me11 Freshwater sedges covering a minimum of 20% of the wetland area		
	Paperbark	Me12 No decline in paperbark health		
		Me13 No net loss of extent of paperbark community		
Key Species & Communities	Invertebrates	Me14 Baseline must be set before limits can be made: invertebrate populations sufficient to sustain waterbird populations should be maintained		

** Applied only when water levels are > 500 mm deep*

YALGORUP LAKES

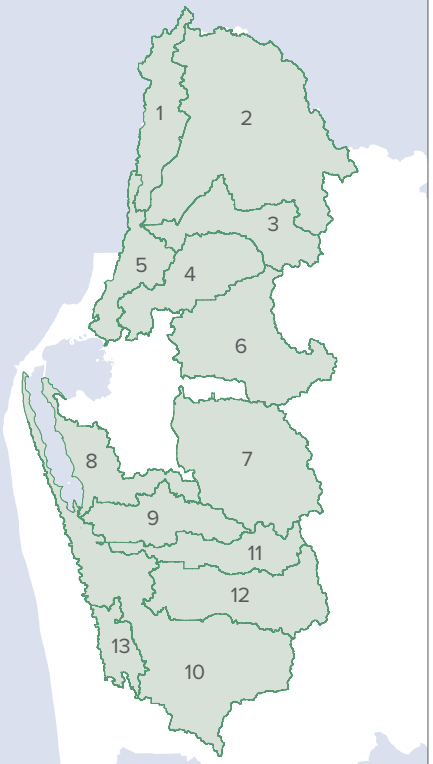
Poor Condition
Borderline
Good Condition
Insufficient data



	COMPONENT	LIMIT OF ACCEPTABLE CHANGE	2016	2017
Abiotic Components	Nutrients	Y1 Phosphate as phosphorus (PO_4^{3-} as P) median concentrations < 0.010 mg/L		
		Y2 Ammonium as nitrogen (NH_4^+ as N) median concentrations < 0.040 mg/L		
		Y3 Nitrate and nitrite as nitrogen (NOx as N) < 0.100 mg/L		
	Salinity	Y4 Lake Clifton salinity < 35 ppt maximum and < 25 ppt during winter and spring		
	pH	Y5 pH > 7 at all times		
	Groundwater discharge	Y6 A surrogate based on water levels in the lakes may be able to be developed		
Primary Responses	Phytoplankton	Y7 Baseline must be set before limits can be made		
	Macroalgae	Y8 No sustained epiphytic macroalgal growth on the thrombolites at Lake Clifton		
Key Species & Communities	Invertebrates	Y9 Limit of acceptable change not able to be set. However, Invertebrate populations sufficient to sustain waterbird populations should be maintained		
	Fish	Y10 Baseline must be set before limits can be made		
	Thrombolites	Y11 No loss of thrombolites at Lake Clifton		

The salinity of Lake Clifton has increased more than threefold over the past three decades from 14-28 g/L in 1992 to 60 - 85 ppt in 2015 (Lane, pers. comm). The salinity continues to exceed the LAC in 2016 and 2017. Some other information relating to the ecological condition of the Yalgorup Lakes has been collected by various sources, however the data needs to be verified, consolidated and interpreted before comparison can be made against the LACs.

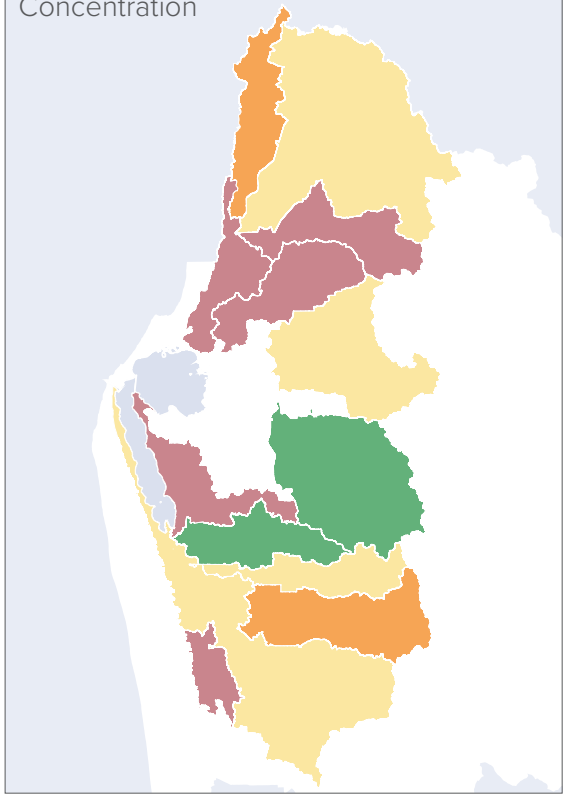
Water Catchment Boundaries



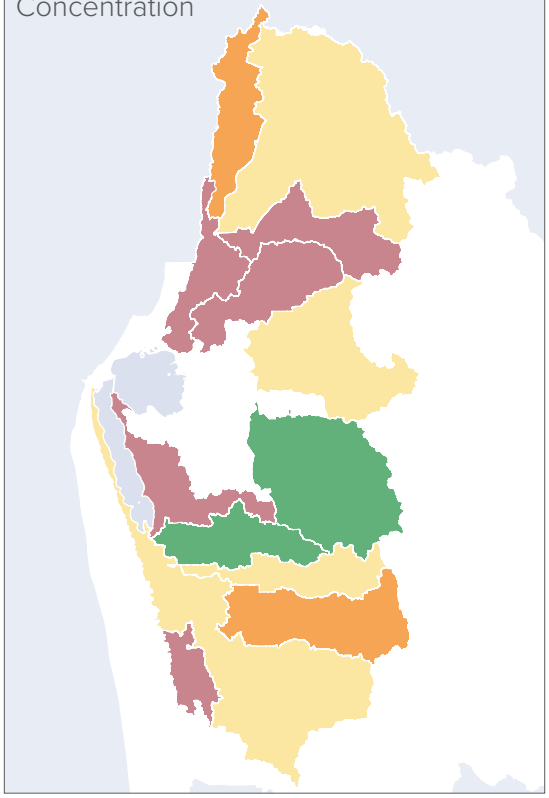
1 Peel Main Drain
2 Upper Serpentine River
3 Dirk Brook - Punrak Drain
4 Nambeelup Brook
5 Lower Serpentine River - Gull Road Drain
6 South Dandalup River
7 Mid Murray River
8 Coolup South Main Drain
9 Mayfield Drain
10 Harvey River
11 Drakes Brook - Waroona Drain
12 Samson North Drain
13 Meredith Drain

Nutrient (Nitrogen and Phosphorus) enrichment is the principal risk to the health of our wetlands. These maps are excerpts from the catchment nutrient reports (DWER, 2015) showing the status of Total Nitrogen and Total Phosphorus concentrations for the 5-year period 2010-2014. Each subcatchment has been classified into one of four status bands as shown below, with the majority classified as very high or high.

Total Nitrogen (TN) Concentration



Total Phosphorus (TP) Concentration



More detailed information regarding the land uses, trends and status of nutrient concentrations, flows and loads for each can be found at the Department of Water and Environmental Regulation website: http://www.water.wa.gov.au/water-topics/waterways/assessing-waterway-health/catchment-nutirent-reports.

These reports are reissued at 5-yearly intervals but in the interim yearly updates are produced by DWER showing the nutrient status updates.

Status	Total Nitrogen (mg/L)	No. of subcatchments	Total Phosphorus (mg/L)	No. of subcatchments
Very High	> 2.0	5	> 0.20	6
High	> 1.2 – 2.0	3	> 0.08 – 0.20	4
Moderate	0.75 – 1.2	3	0.02 – 0.08	2
Low	< 0.75	2	< 0.02	1

REFERENCES

ANZECC & ARMCANZ 2000, Australian guidelines for water quality monitoring and reporting, National Water Quality Management Strategy, Paper no. 7, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Hale, J. and Butcher, R. 2007, Ecological Character description of the Peel-Yalgorup Ramsar site, Report to the Department of Environment and Conservation and the Peel-Harvey Catchment Council, Perth, Western Australia.

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Department of Fisheries (DoF) 2015, Blue Swimmer Crab Resource of the Peel-Harvey Estuary Harvest Strategy 2015 – 2020, Version 1.0, West Coast Estuarine Managed Fishery (Area 2) and the Peel-Harvey Estuary Blue Swimmer Crab Recreational Fishery, April 2015, Fisheries Management Paper No. 273

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Valesini et al, 2019, Balancing Societal and Estuarine Health in a Changing Environment retrieved from https://github.com/AquaticEcoDynamics/Peel-ARC

Australian Government | National Landcare Program

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ROYALTIES FOR REGIONS

This project is supported by PHCC through funding from the Australian Government's National Landcare Program and the State Government's Royalties for Regions program.