Lake Characterisation

A technique for describing and comparing lakes in the Wheatbelt

Prepared for
Department of Conservation and Land Management

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1 Executive Summary

This document presents a new tool for informing catchment-scale management decisions for wheatbelt (and possibly other) wetland systems. This technique describes the main characters of lakes in an ordinal manner that lends itself to ranking or comparing a suite of lakes. It has been termed 'lake characterisation'. The method was used in conjunction with a study of the Lake Bryde Wetland Complex.

The method is based on the assumption that the natural ecosystem within each wetland is a record of the immediate and present processes (hydrologic, chemical, biological) influencing the wetland. Changes in these characters may also be useful indicators of change, allowing a historical view of wetland processes, for example, hydroperiod change and/or salinity increases.

For the purposes of this Lake Characterisation System it was determined that each lake or wetland has eight characteristics of importance to be described. To help describe these main characteristics a range of descriptors was developed. These descriptors are scored in the field using a key, and weighted according to their importance to each wetland characteristic; for example, an obvious seep (descriptor) is a strong indicator of a groundwater discharge lake (character) and therefore would get a 'high' rating. The list of descriptors can be added to if there is additional information.

The weighted descriptor scores for each character are then summed and expressed as a percentage of the maximum possible score for that character. The higher the percentage scores for that character the stronger the characteristic for that lake.

Twenty-one lakes/wetlands in the Lake Bryde Wetland Complex were surveyed over two trips in May 2002 and the Lake Characterisation System applied to observations made during those visits. Considering many of the wetlands studied have a level of baseline information, the technique provided an excellent confirmation of currently observed patterns. When comparing Lake Bryde and East Lake Bryde for instance, Lake Bryde showed higher detention and evaporation, greater discharge and higher salinity and hydroperiod than East Lake Bryde. This lake will be among the first to indicate changes to the Catchment.

The Lake Characterisation System clearly shows that although there are some similarities between some lakes, there are quite large differences when all characteristics are considered together. The characterisation is a useful tool in that it allows managers to select wetlands with particular characteristics, such as detention and evaporation wetlands, for drainage disposal, and other with high current value against characteristics as priorities for conservation. The technique appears valuable in terms of representing a cumulative picture of processes resulting in a particular wetland type, which is useful at the community or composite group level. However, it does not, and is not intended to, detect the subtle nuances of seasonal cycles of salinity, which are clearly important determinants of composition and distribution at the individual species level.

2 Introduction

Increasing groundwater levels and the subsequent increased expression of salt on the surface of extensive areas in the Western Australian wheatbelt has put pressure on the natural wetland systems. The clearing of agricultural land has radically increased runoff, which has an impact on infrastructure, farmland and natural wetland values. The challenge for land managers is to redirect (or not as the case may be) the water and salt load into areas that minimises the impact. These areas are inevitably wetlands. The difficulty in choosing the right area to redirect water and salt is underpinned by poor understanding of the ultimate fate of the water, and the characteristics of the receiving water body. This includes hydrologic, chemical and biological aspects.

The hydrology of a wetland combines a number of different functions. These can be classified as:

1. detention of surface water,
2. recharge of surface water,
3. discharge of groundwater and
4. evaporation of water.

These functions, along with the changing environment, help define the form or character of the wetland. Some wetlands serve primarily as evaporation basins; others are predominately recharge or discharge areas.

Knowing the fate of the water/salt in a particular wetland is critical to developing appropriate catchment management strategies. Without this minimum information set, water may be redirected into a wetland with insufficient capacity, or unique conservation values for instance, generating an outcome contrary to the initial management objective.

In an ideal world catchments can be studied in detail over a number of years to better inform management decisions. Where this is not possible, the precautionary principle approach is often recommended in catchment management. However, in rapidly degrading landscapes, neither detailed long-term studies, nor precautionary approaches are practical or desirable for the protection of biodiversity conservation assets because the scale of impacts and rate of change are so significant. Therefore, another approach is required.

This document presents a new tool for informing catchment-scale management decisions for wheatbelt (and possibly other) wetland systems using a lake characterisation approach. The work is based on the assumption that the natural ecosystem within each wetland is a record of the immediate and present processes (hydrologic, chemical, biological) influencing the wetland. Changes in these characters may also be useful indicators of change, allowing a historical view of wetland processes, for example, hydroperiod change and/or salinity increases.

2.1 Lake Bryde Wetland Complex

The Lake Bryde Wetland Complex is an area including East Lake Bryde in the southeast, to Lakelands Reserve in the northwest,. The Lake Bryde Wetland Catchment starts in the northwest section of the Lake Magenta Reserve and slopes in a north-easterly direction through East Lake Bryde, Lake Bryde and a chain of numerous seasonal lakes in Lakelands Reserve. The topographic and groundwater slope does not translate to a continuous ground and surface water flow through the catchment. In general, predominant annual patterns are recharge and evaporation, rather than rapid run-off. Detailed descriptions of the hydrology, vegetation and management issues relevant to the Lake Bryde Catchment are contained in Ecoscape (2001), Farmer *et al*. (2002), and Griffen *et al*. (2002).

3 Scope

The scope of this project was to develop a system for characterising wetlands within the Lake Bryde Wetland Complex catchment (and elsewhere) and apply it to a number of wetlands within the Lake Bryde Wetland Complex. Further, if possible, the objective was to rank or map wetlands, and describe their role in the discharge/recharge/evaporation cycle in the catchment. It was not envisaged that untrained observers could use the system, as a certain amount of informed decision-making is needed when allocating values.

From this information and the existing study of surface flow in the catchment, the groundwater salinity and potential movement between the surface and groundwater could be inferred and comments made on the standing water salinity and hydroperiod in the wetland.

The main outcome intended from this study is to provide managers of the catchment with a more comprehensive conceptual model of the water movements in the catchment based on surface characteristics. This will complement hydrological studies of the surface flows and groundwater currently underway within the catchment.

4 Characterisation Philosophy

Experience has shown that in a broad sense, all wetlands function in a similar fashion. That is, they act as detention basins and evaporation basins; at different parts within the basin, and at different times they all act as groundwater recharge and discharge sites. In other words, all wetlands interact with the groundwater, surface water and the atmosphere.

The degree and form of hydrologic interaction determines the character of the wetland. These basic hydrological functions help determine two secondary characteristics, hydroperiod and salinity. Both hydroperiod and salinity introduce the temporal nature of wetlands. Finally because it is of great interest to land managers and helps determine the biology and conservation status of the wetland, the change in hydroperiod and salinity are considered major characteristics of a wetland.

All wetlands have these characters but the degree and combination varies with time, making each wetland unique. Any single dimension classification system that defines a wetland as one type runs the risk of over simplifying the nature of the wetland. For this reason the system of describing wetlands that has been developed scores a limited number of wetland characteristics.

The system developed here is still at some level an over simplification, but it does increase the number of dimensions that a wetland is described by, and does allow for expansion as the information base expands. The latter is most important as it defies the notion that wetlands can be simply classified a ‘recharge’ or ‘evaporation’ basin.

5 Method

Twenty-one wetlands in the Lake Bryde catchment were inspected over two trips in May 2002. One wetland was divided into two by a road and was treated as two wetlands. A description of each wetland was compiled that included;

- vegetation types in three or four littoral zones moving out from the lake bed,
- vegetation in the wetland bed,
- geomorphic profile across the wetland,
- presence and type of evaporite in the wetland,
- likely hydroperiod and salinity inferred from wetland vegetation type,
- soil type from existing studies,
- any other observations of interest.

The wetlands are shown in Figure 1 and Figure 2. The results of these observations have been compiled in Appendix 1 Description of Wetlands.

Figure 1. Location of surveyed wetlands in the Lake Bryde Region

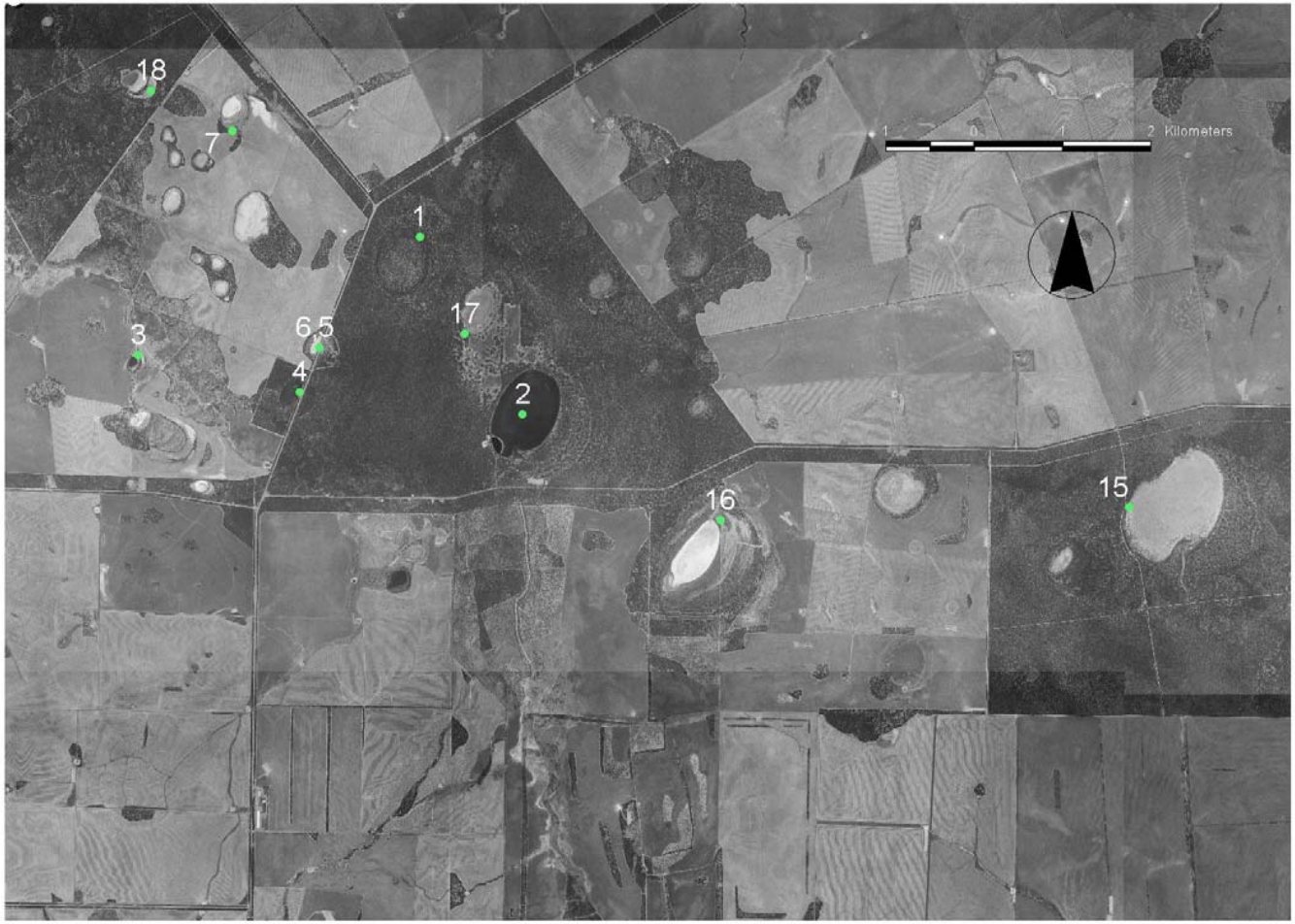

Figure 2. Location of wetlands surveyed in Lakelands region

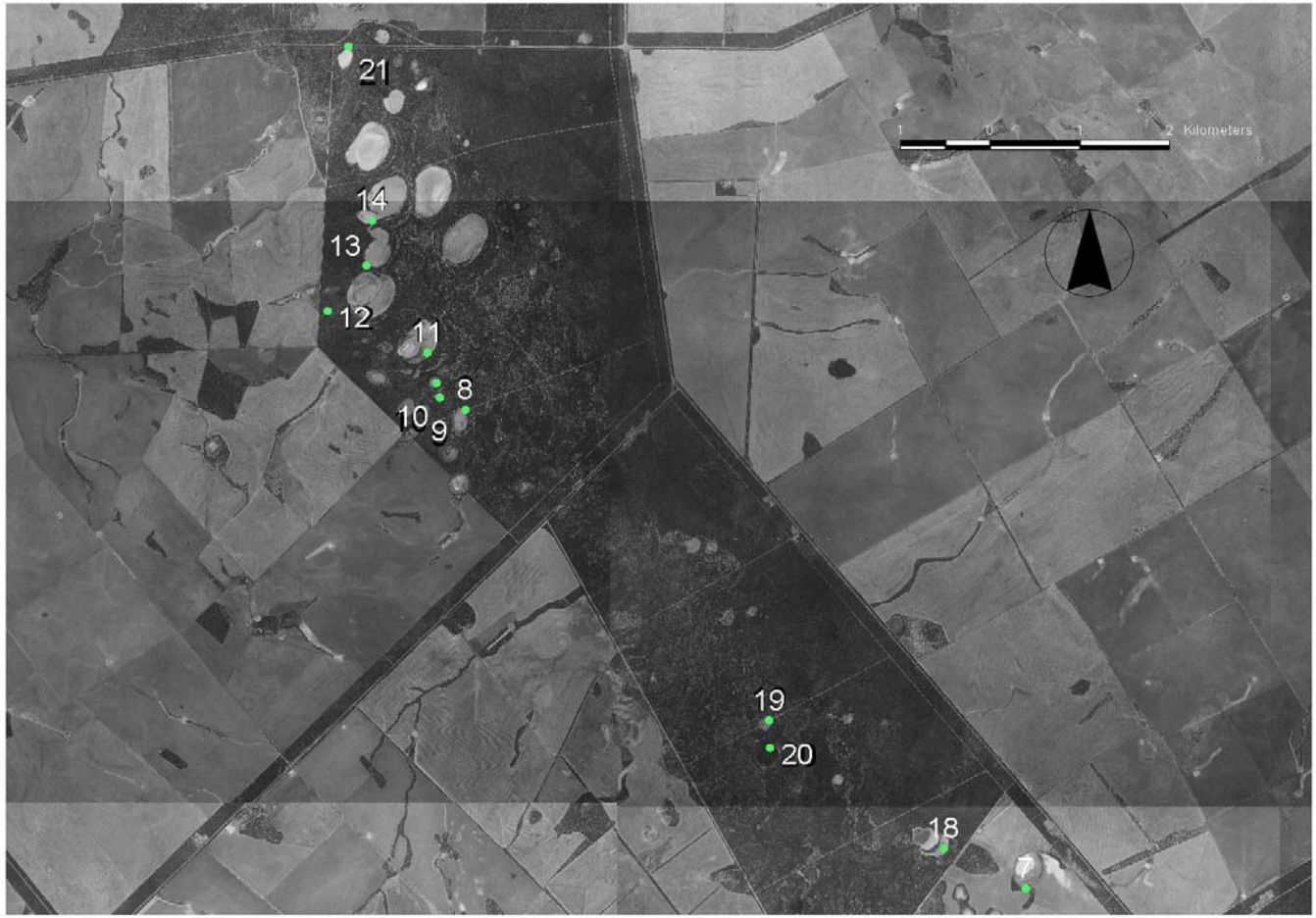

Table 1 Location and description of wetlands

Wetland	Waypoint description	Easting	Northing
1	Yate Swamp	668681	6310121
2	Lake Bryde	669845	6308139
3	Farmland	665498	6308799
4	Lake Janet	667325	6308384
5	Divided WP136W	667546	6308886
6	Divided WP136E	667546	6308886
7	Discharge Lake WP137	666561	6311308
8	Lakelands WP139	660319	6316697
9	Lakelands MCWP78	660035	6316829
10	Lakelands MCWP80	659997	6316998
11	Lakelands MCWP81	659899	6317341
12	Lakelands MCWP83	658788	6317811
13	Lakelands MCWP85	659220	6318319
14	Lakelands MCWP87	659279	6318827
15	East Lake Bryde	676706	6307096
16	Salt Lake MCWP89	672082	6306955
17	Pony Club MCWP90	669193	6309040
18	Lakelands MCWP92	665646	6311760
19	Lakelands MCWP94	663704	6313200
20	Lakelands MCWP95	663715	6312894
21	Lakelands MCWP99	659013	6320782

5.1 *Wetland Characterisation*

It was determined that for any wetland there were eight characteristics of interest, which are listed below:

1. Detention
2. Evaporation
3. Recharge
4. Discharge
5. Salinity
6. Hydroperiod
7. Change in Hydroperiod
8. Change in Salinity

A range of 'descriptors', which are given below, were used to describe these characteristics.

Detention/Evaporation/Recharge/Discharge

- Soil type
- Soil Texture
- Biofilm
- Evaporites
- Surface Outlet Height
- Surface Inlet Height
- Seeps
- Lake Bed Salt Load (kg/ha)
- Debri type
- Max Water Depth
- Min Water Depth

Hydroperiod/Salinity

- Lake bed Vegetation Type Alive
- Lake bed Vegetation Type Dead
- Lake bed Recruitment
- 0.1-0.5 Metre Contour Vegetation Type Alive
- 0.1-0.5 Metre Contour Vegetation Type Dead
- 0.1-0.5 Metre Contour Recruitment
- 0.5-1 Metre contour Vegetation Type Alive
- 0.5-1 Metre contour Vegetation Type Dead
- 0.5-1 Metre contour Recruitment
- 1-2 Metre contour Vegetation Type Alive
- 1-2 Metre contour Vegetation Type Dead
- 1-2 Metre contour Recruitment

A detailed key listing of the descriptors used to describe each wetland characteristic description is provided in Table 2 and Table 3. It is envisaged that this key, with the exception of the vegetation component, will be applicable to all wetlands, not just those inspected. The vegetation component is designed for the Lake Bryde catchment and may need modification outside of the immediate catchment.

It can be seen that the list is extensive but can be expanded with other information characteristics such as known rising groundwater levels, if they are available.

Not all descriptors are relevant to each character, and individual descriptors may be positive for one character and negative for another. For example the presence of a seep at a lake is a strong positive indicator for groundwater discharge into the lake and a strong negative indicator of a recharge lake. For this reason, each descriptor was 'keyed' to individual characters as shown in Table 2.

Table 2 Key to descriptors for characteristics (Part A)

Descriptors	Soil type	Soil Texture	Biofilm	Evaporites	Surface Outlet Height	Surface Inlet Height	Seeps	Lake Bed Salt Load	Debri	Max Water Depth	Min Water Depth
Units					Metres	Metres		g/Kg		Metres	Metres
1	Sandy	Rocky	None	None	Not present	Not present	Absent	less than 1	leaf litter	0	0
2		Sandy	Thin		2 metres plus	level with floor		1 to 5	Decapod	<0.2	<0.2
3	Lime	loam		Carbonate	1 metre plus	less than 1 metre		5 to10	*Ruppia*	<0.5	<0.5
4		Clayey Sand		Gypsum	less than 1 metre	1 metre plus		10 to 20		<1	<1
5	Clay	Clayey	Thick	Salt	level with floor	2 metres plus	Present	50 plus	None	<2	<2

Table 3 Key to vegetation descriptors used for hydroperiod/salinity characteristics (Part B)

Hydroperiod/Salinity Rank	Assemblage	Descriptors	Key Species
1	*Eucalyptus* Woodland or Mallee Woodland or Tall *Leptospermum erubescens* Shrubland	*Eucalyptus*	*Eucalyptus kondininensis, Eucalyptus phenax, Eucalyptus perangusta, Eucalyptus subgrandis ssp alipes, Leptospermum erubescens, Melaleuca brophyi, Melaleuca adnata, Melaleuca uncinata, M. acuminata, Melaleuca thyoides, Atriplex paludosa*
2	Mixed *Melaleuca* Shrubland	*Melaleuca* (mostly not paperbarks)	*Melaleuca lateriflora ssp lateriflora, Melaleuca hamulosa, M. thyoides*
3	Yate Woodland over *Melaleuca* (Paperbark) Closed Woodland	Yate/Paperbark	*Eucalyptus occidentalis, Melaleuca strobophylla, Rhagodia preissii ssp. preissii*
4	*Melaleuca* (Paperbark) Closed Woodland	*Melaleuca* (paperbarks)	*Melaleuca halmulatorum ssp cymbifolia, M. aff. brevifolium, Gahnia ancistrophylla*
5	Samphire	*Halosarcia*	*Muehlenbeckia horrida, Sarcocornia blackiana, Halosarcia indica ssp bidens, H. lepidosperma, H. pergranulata, Halosarcia syncarpa, Frankenia sp*
6	Samphire	*Halosarcia*	*Tecticornia verrucosa, H. pergranulata, Halosarcia doleiformis, Halosarcia syncarpa, Wilsonia humilis, Wilsonia rotundifolia*
7	Submergent aquatics	*Ruppia* spp, *Chara* spp.	*Ruppia, Chara, Halosarcia halocnemoides*

Table 2 Maximum values for each descriptor[1]

Location	Descriptors	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod/ Salinity
	Soil type	NA	NA	1	1	NA	5	NA
	Soil Texture	NA	5	1	1	NA	5	NA
	Biofilm	NA	5	1	NA	NA	5	NA
	Evaporites	NA	5	1	5	5	NA	NA
Surface Outlet	Cross section	1	1	1	NA	1	NA	NA
Surface Inlet	Cross section	NA	5	NA	NA	5	NA	NA
	Seeps	NA	5	1	5	5	NA	NA
	Lake Bed Salt Load (g/kg)	NA	5	1	5	5	NA	NA
	Debri	NA	5	1	1	5	NA	NA
	Max Water Depth	5	5	NA	NA	5	5	NA
	Min Water Depth	1	NA	NA	NA	NA	5	NA
Lake bed	Vegetation Type Alive	NA	NA	NA	NA	7	7	NA
0.1-0.5 Metre Contour	Vegetation Type Alive	NA	NA	NA	NA	7	7	NA
0.5-1 Metre contour	Vegetation Type Alive	NA	NA	NA	NA	7	7	NA
1-2 Metre contour	Vegetation Type Alive	NA	NA	NA	NA	7	7	NA
Lake bed	Vegetation Type Alive/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Alive	NA	NA	NA	NA	NA	NA	6
0.1-0.5 Metre Contour	Vegetation Type Alive/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Alive	NA	NA	NA	NA	NA	NA	6
0.5-1 Metre contour	Vegetation Type Alive/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Alive	NA	NA	NA	NA	NA	NA	6
1-2 Metre contour	Vegetation Type Alive/Dead	NA	NA	NA	NA	NA	NA	6
	Vegetation Type Recruitment/Dead	NA	NA	NA	NA	NA	NA	6

[1] *Max value could be either a one or a five. Where the scale is inverted, i.e. a maximum value is the lowest number, the score is inverted (a one becomes a five, a two becomes a four).*

Location	Descriptors	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod/ Salinity
	Vegetation Type Recruitment/Alive	NA	NA	NA	NA	NA	NA	6

Weighting of Characters

Individual descriptors for any one character may have greater relevance than another, so each relevant descriptor was allocated a weighting to reflect this (Table 3). The change in hydroperiod and salinity was treated slightly differently in that there was an intermediate step. The descriptor value for the alive, dead and recruited vegetation up the beach profile underwent a secondary calculation. For the following permutations, alive vs dead, recruitment vs dead and recruitment vs live, the second value was taken from the first value. This generated figure was then treated as for the other descriptors.

EXAMPLE
Lake bed: live (3), dead (2), recruitment (3)
STEP 1: live/dead = 3-2 = 1
STEP 2: live/recruitment = 3-3 = 0
STEP 3: dead/recruitment = 3-2 = 1.
STEP 4: multiply each value by table weighting for hydroperiod attribute (ie. 5).

By multiplying the descriptor ranking (allowing for inverse relationships) by the weighting, and summing the individual descriptor values for each character, a number was generated for each character for each wetland. The higher the number, the higher that characteristic dominated. This field score for the character was divided by the maximum score for each character (see Table 2) to give a percentage figure that can be compared amongst wetlands.

5.2 Validity of Method

This characterisation method or system does not include or consider nominal information; all of the analysis is ordinal. This does introduce some ambiguity, since a small wetland may have a higher ranking for a character than a much larger wetland. This is unavoidable as we are attempting to describe the character of a wetland, not to place a nominal character value that relates to the dimension and geographical location of the study area. Depending on the objectivity and experience of the observer (this is discussed later) it should be possible to compare characteristics from the eastern goldfields with those in the wheatbelt.

The weakness of the system is that the method relies on the ability of the observer to document the ‘descriptors’ correctly, and the use of the ‘descriptors’ in describing each character. The rest of the system is merely taking a numeric value and manipulating it to allow for comparisons between lakes. This numerical ranking and manipulation is a legitimate use of the data. The ability of the observer to appreciate the reason for a rank is important. It has been stated before that the allocation of a ranking is not for the untrained, and it needs the observer to appreciate the reason for the rank in order for the numeric value to be useful in the analysis. It will never be a ‘check the box’ type application. There is a certain amount of subjectivity that relies on the observer having broad experience in a range of saline wetlands. This study has been made on a limited area, and it is expected that for the system to be useful across catchments, a more descriptive methodology will be needed.

Table 3 Weighting of each descriptor for each character[2]

Location	Descriptors	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod/ Salinity
	Soil type			5	3		4	
	Soil Texture		4	5	3		4	
	Biofilm		3	5			5	
	Evaporites		5	5	4	5		
Surface Outlet	Cross section	5	3	2		2		
Surface Inlet	Cross section		3			2		
	Seeps		4	5	10	3		
	Lake Bed Salt Load		5	3	3	10		
	Debri		5	3	3	3		
	Max Water Depth	5	2			4	4	
	Min Water Depth	5					4	
Lake bed	Vegetation Type Alive					4	5	
0.1-0.5 Metre Contour	Vegetation Type Alive					3	3	
0.5-1 Metre contour	Vegetation Type Alive					2	2	
1-2 Metre contour	Vegetation Type Alive					1	1	
Lake bed	Vegetation Type Alive/Dead							5
	Vegetation Type Recruitment/Dead							5
	Vegetation Type Recruitment/Alive							5
0.1-0.5 Metre Contour	Vegetation Type Alive/Dead							4
	Vegetation Type Recruitment/Dead							4
	Vegetation Type Recruitment/Alive							4
0.5-1 Metre contour	Vegetation Type Alive/Dead							3
	Vegetation Type Recruitment/Dead							3
	Vegetation Type Recruitment/Alive							3
1-2 Metre contour	Vegetation Type Alive/Dead							1
	Vegetation Type Recruitment/Dead							1

[2] Weighting 1 to 5

Location	Descriptors	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod/ Salinity
	Vegetation Type Recruitment/Alive							1

Table 4 Maximum score for each character

	Descriptors	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod Salinity
	Soil type			25	15		20	
	Soil Texture		20	25	15		20	
	Biofilm		15	25			25	
	Evaporites		25	25	20	25		
Surface Outlet	Cross section	25	15	10		10		
Surface Inlet	Cross section		15			10		
	Seeps		20	50	50	15		
	Lake Bed Salt Load		25	15	15	50		
	Debri		25	15	15	15		
	Max Water Depth	25	10			20	20	
	Min Water Depth	25					20	
Lake bed	Vegetation Type Alive					28	35	
0.1-0.5 Metre Contour	Vegetation Type Alive					21	21	
0.5-1 Metre contour	Vegetation Type Alive					14	14	
1-2 Metre contour	Vegetation Type Alive					7	7	
Lake bed	Vegetation Type Alive/Dead							30
	Vegetation Type Recruitment/Dead							30
	Vegetation Type Recruitment/Alive							30
0.1-0.5 Metre Contour	Vegetation Type Alive/Dead							24
	Vegetation Type Recruitment/Dead							24
	Vegetation Type Recruitment/Alive							24
0.5-1 Metre contour	Vegetation Type Alive/Dead							18
	Vegetation Type Recruitment/Dead							18
	Vegetation Type Recruitment/Alive							18

1-2 Metre contour	Vegetation Type Alive/Dead							6
	Vegetation Type Recruitment/Dead							6
	Vegetation Type Recruitment/Alive							6
	Max Total	*75*	*170*	*165*	130	215	182	234

Table 7. Interpretation of character percentage

Character	High Percentage Value	Low Percentage Value
1. Detention	Retains water	Unlikely to retain water
2. Evaporation	High evaporation	Low evaporation
3. Groundwater Recharge	High recharge	Low recharge
4. Groundwater Discharge	High discharge	Low discharge
5. Salinity	Saline	Freshwater
6. Hydroperiod	Long hydroperiod	Short hydroperiod
7. Change in Hydroperiod	Increasing hydroperiod	Static hydroperiod
8. Change in Salinity	Increasing salinity	Static salinity

Table 8. Summary of steps in the evaluation process

Steps
1. Rank descriptors for each characteristic
2. Determine relevant descriptor ranking for each characteristic
3. Inverse rank where required[3]
4. Multiply descriptor ranking by unique weighting factor for wetland character
5. Total weighted rankings for all relevant descriptors for character
6. Divide total of weighted descriptor ranking by maximum potential total for that character
7. Express as a percentage
8. Repeat steps 2 to 8 for all characters

Descriptor Selection Logic

The logic for choosing individual descriptors is as follows:

- Detention Basin

The detention of water relies on the wetland being able to buffer water movements within the catchment. Therefore the main attributes of a detention wetland is to be able to allow a large amount of water to be stored quickly relative to the size of the wetland, making the depth of the filled and empty wetland important. The size of the outlet is important to restrict rapid movement out of the wetland. The area of the wetland is not a descriptor and in any case the area would need to be balanced by catchment wide statistics. Under the proposed interpretation of the detention wetland, a 'blind' ditch would have equal or better detention characteristics than a much larger lake. All other descriptors were not considered as having a scalar relationship to the detention characteristic. There is little information within the set of descriptors that helps define a detention basin so the weighting has been maximised for these three descriptors. Detention does not imply anything about the fate of the water.

- Evaporation Basin

The ability of a basin to evaporate water depends on the wetlands ability to retain the water on the surface, therefore clay sediments and the presence of a biofilm is

[3] For change of hydroperiod and salinity the alive/dead/recruitment value was generated by taking away one value from another.

important. Small outflows and large inflows imply that the water is retained in the wetland and potentially evaporated but this information is not highly significant and hence has a lower weighting. The presence of evaporites, a high salt load and the presence of aquatic organisms that live in a defined salinity range is important, indicating that evaporation has occurred, and is given the highest weighting of five. Seeps are also considered important as it implies that water is constantly being presented at the surface and having the best opportunity of evaporating.

- Groundwater Recharge Wetland

The important descriptors for determining a recharge wetland were considered to be a permeable basin (sandy), the lack of any seeps, biofilm, and evaporites. The salt load, surface outlet and any organism that may tolerate high salinity were also important indicators that the wetland may be a recharge zone but of lesser importance.

- Groundwater Discharge Wetland

There was only one important indicator of a discharge basin and that was the presence of a seep. The permeability of the floor and presence of organisms that could tolerate high salinity only infer the possibility of groundwater discharge and hence were given a lower weighting. The presence of evaporites or high salinity only implies a groundwater discharge where the groundwater is saline. The source of salinity may well be evaporation of surface water.

- Salinity

The best indicator of a saline lake is a measured salt load in the sediment, a measure of salinity or the presence of evaporites. Organisms are useful but of lesser value in determining the actual salinity. The inlet and outlet dimensions, and the presence of seeps are indicators that the wetland is characteristically saline.

- Hydroperiod

The important indicators of an extended hydroperiod are the presence of a biofilm on the wetland and lack of vegetation. The type of vegetation indicates the expected period of flooding. The vegetation on cross section profile or beach leading away from the wetland also indicates the hydroperiod to a lesser extent. The minimum and maximum water height, and soil type texture will imply the hydroperiod to a lesser extent.

- Change in Hydroperiod and Salinity

These two characters could only be evaluated on the dead, alive and recruited vegetation in the cross section profile away from the bed of the wetland. Shifts in ecotones, eg. samphires present in higher contours, indicates either an increase in hydroperiod, or salt, or both.

6 Results and Discussion

The data collection was completed over six days and each evaluation took up to four hours to complete. It was expected that the change of salinity may be determined separately from the change of hydroperiod, but it was decided that the changes seen in the wetlands were often caused by both salinity and hydroperiod, and were difficult to separate. For use in specific areas, a more detailed study may devise a technique separating salinity changes from hydroperiod changes.

The percentage scores for each characteristic for the selected Lake Bryde wetlands are shown in Table 9, and their ranked values are given in Table 10. Individual scores for each of the 21 wetlands are given in Table 11.

As may be expected the system did not show very much difference between wetlands in terms of their ability to act as detention basins; they all had a similar geomorphology. Most of the other characteristics showed a fair variation from one wetland to another.

Table 9 Characterisation percentage

	Lake	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod/ Salinity
1	Yate Swamp	100%	41%	85%	38%	37%	48%	3%
2	Lake Bryde	93%	59%	63%	32%	59%	71%	10%
3	Farmland	93%	76%	47%	32%	81%	72%	41%
4	Lake Janet	87%	61%	55%	25%	60%	70%	11%
5	WP136W	87%	71%	55%	28%	57%	51%	14%
6	WP136E	87%	61%	58%	20%	51%	54%	32%
7	WP137	73%	86%	27%	61%	88%	75%	40%
8	WP139	87%	81%	40%	30%	78%	69%	12%
9	MCWP78	93%	78%	47%	32%	75%	64%	22%
10	MCWP80	93%	77%	50%	36%	68%	60%	4%
11	MCWP81	87%	74%	39%	32%	67%	72%	9%
12	MCWP83	93%	58%	71%	32%	59%	58%	10%
13	MCWP85	73%	51%	56%	22%	49%	64%	8%
14	MCWP87	87%	56%	62%	32%	58%	63%	6%
15	E Lake Bryde	87%	53%	61%	25%	51%	65%	4%
16	MCWP89	93%	98%	23%	61%	89%	81%	24%
17	MCWP90	93%	76%	49%	36%	73%	68%	15%
18	MCWP92	80%	69%	45%	32%	73%	75%	24%
19	MCWP94	80%	52%	58%	22%	48%	62%	9%
20	MCWP95	87%	54%	59%	22%	49%	62%	0%
21	MCWP99	93%	54%	71%	32%	54%	53%	3%

Table 10. Rank for each character

Number	Lake	Detention	Evaporation	Recharge	Discharge	Salinity	Hydroperiod	Change in Hydroperiod/ Salinity
1	Yate Swamp	1	21	1	3	21	21	19
2	Lake Bryde	2	13	4	8	11	6	11
3	Farmland	2	7	15	6	3	5	1
4	Lake Janet	10	12	12	16	10	7	10
5	WP136W	10	9	11	15	14	20	8
6	WP136E	10	11	8	21	16	18	3
7	Discharge WP137	20	2	20	1	2	3	2
8	Lakelands WP139	10	3	18	14	4	8	9
9	Lakelands MCWP78	2	4	15	8	5	11	6
10	Lakelands MCWP80	2	5	13	4	8	16	17
11	Lakelands MCWP81	10	8	19	8	9	4	13
12	Lakelands MCWP83	2	14	2	8	11	17	11
13	Lakelands MCWP85	20	20	10	18	18	11	15
14	Lakelands MCWP87	10	15	5	6	13	13	16
15	East Lake Bryde	10	18	6	16	16	10	17
16	Salt Lake MCWP89	2	1	21	1	1	1	5
17	Unnamed MCWP90	2	6	14	4	6	9	7
18	Unnamed MCWP92	18	10	17	8	7	2	4
19	Unnamed MCWP94	18	19	9	18	20	14	13
20	Unnnamed MCWP95	10	16	7	18	18	14	21
21	Unnnamed MCWP99	2	17	2	8	15	19	19

The wetlands that had seeps both gave the highest value for groundwater discharge, but since seeps are a definitive indicator of discharge, it was thought that the system could be improved for this character.

It was not surprising that the natural salt lake (#16) near east Lake Bryde gave the highest evaporation, discharge and salinity result. Lakes #3 and #7 also gave a high reading for the salinity character. These two lakes have been affected by secondary salinity and had the greatest change in hydroperiod/salinity statistic, and the method was successful in separating these lakes from others.

Considering wetlands within the Lake Bryde Wetlands Complex which have a level of baseline information, the technique provided an excellent confirmation of currently observed patterns. Comparing Lake Bryde and East Lake Bryde, Lake Bryde showed

higher detention and evaporation, greater discharge and higher salinity and hydroperiod than East Lake Bryde. This Lake will be among the first to indicate changes to the Catchment.

The plant species of conservation interest in the area is *Muehlenbeckia horrida*. Extant populations of this species are only found at Lake Bryde and East Lake Bryde, which are listed as a 'threatened ecological community'. The East Lake Bryde population is in better condition than the Lake Bryde population. A dead population of this species is also present at wetland #13 within the Lakelands Reserve. If character scores are compared between this wetland and East Lake Bryde, there are no obvious differences between the Lakes, particularly in terms of key salinity and hydroperiod characters. Wetland #13 does hold water for a shorter period, but there are no clear explanations as to why *Muehlenbeckia horrida* disappeared from this wetland. The differences may relate to the annual and longer cycles of higher and lower salinity periods; that is wetland #13 may have a higher salinity for a longer period than East Lake Bryde. This may reduce the reproductive opportunities for *Muehlenbeckia horrida*. This warrants closer study.

In general, the wetlands surrounded by large tracts of bushland seemed to be less impacted from rising hydroperiod and salinity. There were a few exceptions, namely wetland #18 which was close to the heavily impacted wetland #7 that is proposed as a surface water terminal lake. An alternative interpretation of the results is that there is a divide somewhere to the north west of wetland #18 impeding ground and surface water movement in all but the biggest floods. This would explain why the wetlands to the southeast are more saline and impacted by recent hydrological changes than those in the main section in the Lakelands Reserve. This is the accepted explanation for the difference between the salt lake at #16 and Lake Bryde.

The characterisation clearly shows that although there are some similarities between some lakes, there are quite large differences when all characteristics are considered together. The characterisation is a useful tool in that it allows managers to select wetlands with particular characteristics, such as detention and evaporation wetlands, for drainage disposal, and other with high current value against characteristics as priorities for conservation. The technique appears valuable in terms of representing a cumulative picture of processes resulting in a particular wetland type, which is useful at the community or composite group level. However, it does not, and is not intended to, detect the subtle nuances of seasonal cycles of salinity, which are clearly important determinants of composition and distribution at the individual species level.

Table 5 Actual score for each of the twenty one wetlands

	Descriptors					Surface Outlet	Surface Inlet						Lake bed			0.1-0.5 Metre Contour			0.5-1 Metre contour			1-2 Metre contour		
	Wetland	Soil type	Soil Texture	Biofilm	Evaporites	Height	Height	Seeps	Lake Bed Salt Load (kg/ha)	Debri	Max Water Depth	Min Water Depth	Vegetation Type Alive	Vegetation Type Dead	Recruitment	Vegetation Type Alive	Vegetation Type Dead	Recruitment	Vegetation Type Alive	Vegetation Type Dead	Recruitment	Vegetation Type Alive	Vegetation Type Dead	Recruitment
1	Yate Swamp	2	4	2	1	1	1	1	1	1	5	1	3	3	3	3	3	3	2	2	3	1	1	3
2	Lake Bryde	5	5	3	1	2	5	1	3	2	5	1	6	5	6	4	3	4	3	3	5	2	2	2
3	Farmland	5	4	2	5	1	1	1	5	5	5	2	7	1	7	5.5	1	5	2	1	2	1	1	1
4	Lake Janet	5	5	4	1	2	4	1	4	2	4	1	5	4	5	6	4	6	2	2	2	1	1	1
5	WP136W	3	5	2	3	2	5	1	3	5	4	1	5	5	5	1	1	5	1	1	1	1	1	1
6	WP136E	5	4	2	1	2	5	1	2.5	5	4	1	5	1	5	1	1	5	2	1	2	1	1	1
7	Discharge Lake WP137	5	5	2	5	5	4	5	5	5	5	1	7	2	7	7	2	7	2	1	2	2	1	1
8	Lakelands WP139	5	5	3	5	2	3	1	5	5	4	1	6	5	6	5	4	5	2	2	5	2	2	2
9	Lakelands MCWP78	5	3	4	4	1	4	1	5	5	4	1	5	2	5	5	4	6	2	1	2	1	1	2
10	Lakelands MCWP80	3	3	5	4	1	4	1	4	5	4	1	6	5	6	2	2	2	2	2	2	1	1	1
11	Lakelands MCWP81	5	5	5	4	3	4	1	4	3	5	1	5	4	5	4	4	4.5	2	2	4	1	1	1
12	Lakelands MCWP83	2	4	2	1	2	5	1	3	3	5	1	6	5	6	4	4	5	2	2	4	1	1	1
13	Lakelands MCWP85	5	5	2	1	4	4	1	2	3	4	1	6	5	6	4	4	5	2	2	2	1	1	1
14	Lakelands MCWP87	3	4	3	2	2	2	1	3	3	4	1	6	5	6	4	4	4	3	3	4	3	3	3

	Descriptors					Surface Outlet	Surface Inlet						Lake bed			0.1-0.5 Metre Contour			0.5-1 Metre contour			1-2 Metre contour		
	Wetland	Soil type	Soil Texture	Biofilm	Evaporites	Height	Height	Seeps	Lake Bed Salt Load (kg/ha)	Debri	Max Water Depth	Min Water Depth	Vegetation Type Alive	Vegetation Type Dead	Recruitment	Vegetation Type Alive	Vegetation Type Dead	Recruitment	Vegetation Type Alive	Vegetation Type Dead	Recruitment	Vegetation Type Alive	Vegetation Type Dead	Recruitment
15	East Lake Bryde	5	5	2	1	2	5	1	2	2	4	1	6	5	6	3	3	3	3	3	3	3	3	3
16	Salt Lake MCWP89	5	5	5	5	1	4	5	5	5	5	2	7	5	7	5	1	5	2	1	2	1	1	1
17	Unnamed MCWP90	3	3	5	4	2	4	1	4	5	5	1	6	5	6	5	2	5	2	2	2	1	1	2
18	Unnamed MCWP92	5	5	3	4	3	4	1	4	3	4	1	7	4	6	6	3	6	4	1	5	1	1	1
19	Unnamed MCWP94	5	5	2	1	3	4	1	2	3	4	1	5	5	7	4	4	4	2	2	2	1	1	1
20	Unnnamed MCWP95	5	5	2	1	2	4	1	2	3	4	1	5	5	5	4	4	4	2	2	2	1	1	1
21	Unnnamed MCWP99	3	3	2	1	2	4	1	3	3	5	1	5	5	6	3	3	3	2	3	2	1	1	1

7 References

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Appendix 1 Description of Wetlands

Number 1. **Lake:** Yate Swamp WP3 **GPS:** East 668681 North 6310121 **Observer:** MC **Date:** 28.04.02

Vegetation	Size	Species	Density (coverage)	Condition	Sample
Lake vegetation:		Seedlings small Melaleuca	Thicket	Some deaths	
Vegetation at edge of playa – eg Samphires – which species?		Yate	Open Woodland	Good	
Vegetation with obvious watermark – trees etc		Yate		Good	Photos taken
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Yate		Good	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Lepidosperma 007 Hakea 008 E. oxidentalis		Good	

Comments: Freshwater Yate swamp. Series of basins

Lake: Yate Swamp

Debris	Playa	Fringe	Examples
	Trees	Trees Floor – bark, leaves	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Silty clay (no salt, gypsum)	Silty sand – Fluvial bank	sodicity gypsum organic salt other
Soil salinity	.001		
Soil moisture	1%		
Soil pH	6.5		
Colour of soil	Grey	White	
Texture of soil		Sandy	soft, hard, slimy, sandy, rocky
Shape: basin,	Undefined	Sandy ridge	multiple basins channelled, aeolian banks, islands
Describe shape			
Inflow/outflow channel Describe	From north west		
Estimated depth to vegetation fringe	0		
Contour height of basin	1m		
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 2. **Lake:** L Bryde WP 8,9,11,13,15,24 **GPS:** East669845 North6308139 **Observer:** MC **Date:** 28.04.02

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:	75cm	Ruppia seasonal Chara Muehlenbeckia Wilsonia humilis Tecticornia verrucosa	Good covering to 8cm Sporadic but thick Spread out Occasional plant Occasional juvenile	Dried Dried Mostly dead Good Good	Yes Yes No Yes No
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia pergranulata juveniles Melaleuca LB037	Sporadic	Good Some alive, mainly dead	No
Vegetation with obvious watermark – trees etc		Melaleuca strobophylla Yate		Good	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Melaleuca strobophylla Yate		Good	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Salmon Gums Pittosporum Santalum		Good	

Comments: Southern side section of Halosarcia dead yate 669678E6307580N. Under hydrological stress

Lake: L Bryde

Debris	**Playa**	Fringe	Examples
	Ruppia, Chara Decapod claws, carapaces, holes Duck dabbles, footprints	Leaf litter	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Grey clay	White sand lunettes on East	sodicity gypsum organic salt other
Soil salinity	.01 to .04		
Soil moisture	31% to 43%		
Soil pH	9+	9+	
Colour of soil	grey		
Texture of soil	hard	sandy	soft, hard, slimy, sandy, rocky
Shape: basin,	basin		multiple basins channelled, aeolian banks, islands
Describe shape	ovoid		
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe			
Contour height of basin	2m		
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity

Number 3. **Lake:** MCWP24 **GPS:** 665498 East, 6308799 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake playa vegetation:		Water in pan			
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia pergranulata H. lepidosperma Sarcocornia blackiana Mallee/Melaleuca	Around rim Around rim and in water	Good Good Good Dead	
Vegetation with obvious watermark – trees etc		Mallee/ Melaleuca Live Eucs at 200cm above water level.		Marginal	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Mallee Melaleuca sp.		Marginal	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Farming land Samphire flat to NW			

Comments: Lake appears affected by farming practices

Lake: MCWP24

Debris	**Playa**	Fringe	Examples
	None		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Salt floor 2to3cm	sandy	sodicity gypsum organic salt other
Soil salinity	.05 taken to edge		
Soil moisture	16%		
Soil pH	8		
Colour of soil			
Texture of soil		Biofilm	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Circular		
Inflow/outflow channel Describe	No obvious inflow/outflow Samphire flat to NW suggests water movement.		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
clear	100m dia	10cm	yes	7.38	282

Number 4. **Lake:** Lake Janet, WP127 **GPS:** 667325 East, 6308384 North **Observer: MC** **Date: 1/5/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Ruppia			
Vegetation at edge of playa – eg Samphires – which species?		Tecticornia verrucosa Melaleuca sp	Sporadic, juveniles at 0.3m	Good Dead	
Vegetation with obvious watermark – trees etc		Melaleuca	At 1m		
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Eucalyptus	At 1.5m		
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus			

Comments: Under hydrological stress +0.5m. WP132 high volume input.

Lake: Janet No4

Debris	**Playa**	Fringe	Examples
	Decapod claws Copepods Gastropods	Leaf litter	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Clay, no gypsum no salt	Sandy	sodicity gypsum organic salt other
Soil salinity	0.05	Edge 0.01 Mel fringe 0.002	
Soil moisture	41%	Edge 18% Mel fringe 4%	
Soil pH	9	8	
Colour of soil	Grey	White/grey	
Texture of soil	Clay	Loamy sand	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Oval		
Inflow/outflow channel Describe	No impact on playa	Possible inflow/outflow WP128 More probable inflow/outflow WP132	
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
Yes		3cm	yes	7.52	83

Number 5. **Lake: WP136W** **GPS:** 667546 East, 6308886 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Sparsely vegetated where grazed Halosarcia covered where not grazed H. halocnemoides subsp catenulata H lepidosperma H indica subsp. bidens H doleiformis H pergranulata subsp pergranulata H syncarpa H pergranulata (small pink var) Frankenia sp Disphyma crassifolium Sarcocornia blackiana	Full cover where not grazed of species mixed	Good	Photo
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia lepidosperma H. indica subsp. bidens H syncarpa Atriplex paludosa subsp baudinii	Sporadic	Good	
Vegetation with obvious watermark – trees etc		Melaleuca	At 0.5m above pan		
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Melaleuca/Eucalyptus	At 1.5m above pan		
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Farmland			

Comments: 14 Mile Road cuts pan into two sections

Lake: WP136W

Debris	**Playa**	Fringe	Examples
			Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Carbonated soil hard pan		sodicity gypsum organic salt other
Soil salinity	0.027	0.001	
Soil moisture		36%	
Soil pH		9	
Colour of soil	Grey	Grey	
Texture of soil	Clay	Sand	soft, hard, slimy, sandy, rocky
Shape: basin,	Shallow pan/basin cut in half		multiple basins channelled, aeolian banks, islands
Describe shape	Semi-circle		
Inflow/outflow channel Describe	No obvious inlet, perhaps marginally from east		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 6. **Lake:** WP136East (WP139) **GPS:** 667546 East, 6308886 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		H. halocnemoides subsp catenulata H lepidosperma H indica subsp. bidens H doleiformis H pergranulata subsp pergranulata H syncarpa H pergranulata (small pink var) Frankenia sp Disphyma crassifolium Sarcocornia blackiana	Dense samphire cover	Good	
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia lepidosperma H. indica subsp. bidens H syncarpa Atriplex paludosa subsp baudinii	Cover not so dense, becoming more sporadic up profile	Good	
Vegetation with obvious watermark – trees etc					
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Atriplex paludosa subsp baudinii			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Atriplex paludosa subsp baudinii Eucalyptus			

Comments: 14 Mile Road, cut into two sections

Lake: WP136E

Debris	**Playa**	Fringe	Examples
			Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Clay, no salt crust, some humus	Sandy loam	sodicity gypsum organic salt other
Soil salinity	WP136E (30) 0.02 WP136 (31) 0.01 WP136 (32) 0.03	WP136E (9) 0.03	
Soil moisture	WP136E (30) 30% WP136 (31) 30% WP136 (32) 30%	WP136E (9) 20%	
Soil pH	7 to 9		
Colour of soil	Grey to dark grey	Dark grey	
Texture of soil	Clay loam	Sandy clay loam	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin, cut in two		multiple basins channelled, aeolian banks, islands
Describe shape	Semi-circle		
Inflow/outflow channel Describe	Same as No5		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water – None, though soil at lowest point waterlogged

Number 7. **Lake:** Discharge Lake WP137 **GPS:** 666561 East, 6311308 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		No vegetation, silting out			
Vegetation at edge of playa – eg Samphires – which species?					
Vegetation with obvious watermark – trees etc					
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs					
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)					

Comments:

Lake: Discharge lake WP137 No. 7

Debris	**Playa**	Fringe	Examples
		Dead Melaleucas	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Salt, sulphide over clay base	Salty scalds, sodic, some gypsum Sandy	sodicity gypsum organic salt other
Soil salinity	WP137 (14) 0.03	WP137 (8) 0.04 (top of profile) WP137 (2) 0.05	
Soil moisture	WP137 (14) 38%	WP137 (8) 18% (top of profile) WP137 (2) 25%	
Soil pH	9	9 Melaleuca fringe	
Colour of soil	Light grey		
Texture of soil	sandy clay	Sandy	soft, hard, slimy, sandy, rocky
Shape: basin,			multiple basins channelled, aeolian banks, islands
Describe shape			
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
		Surface	Yes	7.45	287
Dunaliella present		20cm	Yes	7.34	102
		1m hole	Yes	7.42	66

Number 8. **Lake:** Lakelands WP139 **GPS:** 660319East, 6316697North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Mostly dead Halosarcia H. syncarpa H pergranulata H halocnemoides subsp catenulata Sarcocornia blackiana	Some recruitment	Poor	
Vegetation at edge of playa – eg Samphires – which species?		Dead Melaleuca along fringe			
Vegetation with obvious watermark – trees etc		Melaleuca			
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Eucalyptus			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus			

Comments: Relatively unaffected vegetation, farmland adjacent causing increased runoff.

Lake: Lakelands WP139 No8

Debris	**Playa**	Fringe	Examples
	Ants Biofilm		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Sodic, waterlogged, salt, gypsum, biofilm		sodicity gypsum organic salt other
Soil salinity	0.11		
Soil moisture	45%		
Soil pH	7		
Colour of soil	grey		
Texture of soil	Damp clay		soft, hard, slimy, sandy, rocky
Shape: basin,	Flat basin		multiple basins channelled, aeolian banks, islands
Describe shape	oval		
Inflow/outflow channel Describe	Vegetated inflow to east Vegetated outflow to west		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
No groundwater to 20cm					

Number 9. **Lake:** Lakelands MCWP78 **GPS:** 660035East, 6316829North **Observer: MC** **Date:** **22/05/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Samphires in centre of lake dead H indica subsp bidens Sarcocornia blackiana H syncarpa H doleiformis H halocnemoides Melaleuca sp	Nearly full, some dead Halosarcias Some dead Mels	Medium	
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia halocnemoides H indica subsp bidens H syncarpa H doleiformis Sarcocornia blackiana Melaleuca sp	 Some dead Mels		
Vegetation with obvious watermark – trees etc		Melaleuca sp	At 0.5m above playa		
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs					
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus	At 1.5m above playa		

Comments: Vegetation moving out of centre of lake – evidence that both salt and hydroperiod increasing

Lake: MCWP78 No 9

Debris	**Playa**	Fringe	Examples
	Gastropod shells		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Biofilm, very little salt on surface, thick gypsum layer	Clay, sand lunette, black organic material	sodicity gypsum organic salt other
Soil salinity	Playa 0.08, Playa edge 0.05	0.006	
Soil moisture	Playa 47%, Playa edge 17%	3%	
Soil pH	Playa 7, Playa edge 7.5	8.5	
Colour of soil	Fawn, grey	Grey	
Texture of soil	Playa soft, talc-like, Playa edge damp grey clay	Dry sandy grey clay	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Oval		
Inflow/outflow channel Describe	Runoff from farmland		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity

Number 10. **Lake: Lakelands MCWP80** **GPS:** 659997 East, 6316998 North **Observer: MC** **Date: 22/5/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:	10cm	Halosarcia halocnemoides H. indica subsp bidens H syncarpa	Complete	Medium	
Vegetation at edge of playa – eg Samphires – which species?	20cm 1.5m	Halosarcia doleiformis H. syncarpa Melaleuca	Complete	Dead on ridge	
Vegetation with obvious watermark – trees etc	1.5m	Melaleuca Halosarcia lepidosperma Sarcocornia blackiana			
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs					
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)					

Comments:

Lake: Lakelands MCWP80 No10

Debris	**Playa**	Fringe	Examples
			Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Biofilm Gypsum	Gypsum on surface Grey clay underneath	sodicity gypsum organic salt other
Soil salinity	0.07	Playa edge 0.09, fringe 0.004	
Soil moisture	42%	Playa edge 43%, fringe 2%	
Soil pH	7		
Colour of soil	Fawn	Grey	
Texture of soil	Soft, talc-like	Clay	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Oval		
Inflow/outflow channel Describe	To west – dead Eucs		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 11. **Lake:** Lakelands MCWP81, No11 **GPS:** 659899 East, 6317341 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage)	Condition	Sample
Lake vegetation:	15cm	Halosarcia syncarpa Wilsonia humilis Wilsonia rotundifolia Melaleuca sp Small portion of playa bare	Moderate Few	Medium Dead	
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia doleiformis H pergranulata H syncarpa Sarcocornia blackiana Melaleuca LB037	 Dense	 Dead on edge, otherwise OK	
Vegetation with obvious watermark – trees etc		Melaleuca Threlkeldia diffusa Atriplex paludosa			
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Atriplex paludosa subsp baudinii Halosarcia indica subsp bidens H lepidosperma Sarcocornia blackiana Eucalyptus			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus Exocarpos aphyllus LK17 & R50 LK22			

Comments: Hydroperiod stress but vegetation reasonable. Very variable floor height.

Lake: Lakelands MCWP81 No11

Debris	**Playa**	Fringe	Examples
	Copepods Gastropods Ruppia	Gastropods Ruppia	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Gypsum, no salt, wet		sodicity gypsum organic salt other
Soil salinity	0.09	0.02	
Soil moisture	54%	19%	
Soil pH	8.5	6	
Colour of soil	Black 5cm over grey clay	Yellow brown sand lunette	
Texture of soil	Very wet fine clay over coarse		soft, hard, slimy, sandy, rocky
Shape: basin,			multiple basins channelled, aeolian banks, islands
Describe shape			
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					
No seeps seen					

Number 12. **Lake:** Lakelands MCWP83 **GPS:** 658788 East, 6317811 North **Observer: MC** **Date: 22/5/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:	10cm	Halosarcia syncarpa H pergranulata Ruppia	Good 100% seedlings	Poor No dead trees but mature Halosarcia dead	
Vegetation at edge of playa – eg Samphires – which species?		H pergranulata fringe Ruppia Melaleuca	Good	Average	
Vegetation with obvious watermark – trees etc	3m	Melaleuca fringe Halosarcia lepidosperma H pergranulata Sarcocornia blackiana Threlkeldia	Continued around fringe	Good	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs	2m to 4m	Melaleuca lateriflora zone (M uncinata, thyoides) Eucs in NE zone deaths E kondininensis LK22 Alyxia buxifolia		Good NE Euc zone poor	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)	15m	Euc kondininensis woodland			

Comments: New recruitment on playa, older plants dead.

Lake: Lakelands MCWP83 No12

Debris	**Playa**	Fringe	Examples
	Copepods Ruppia	Ruppia	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Sandy clay	Sand	sodicity gypsum organic salt other
Soil salinity	0.05	0.0008	
Soil moisture	21%	1%	
Soil pH	7	6	
Colour of soil	Grey	Beige	
Texture of soil	Damp clay	Sand	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin with sandy ridge reaching in to center	Lunettes at edge	multiple basins channelled, aeolian banks, islands
Describe shape	ovoid		
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe	0.5m to Melaleucas		
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 13. **Lake:** Lakelands MCWP85 **GPS:** 659220 East, 6318319 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Meuhlenbeckia sp Tecticornia verrucosa Halosarcia pergranulata	Sporadic - 1 per 3m Many juveniles Very sporadic	Dead Good Good	
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia pergranulata H syncarpa Sarcocornia blackiana Melaleuca			
Vegetation with obvious watermark – trees etc		Melaleuca – water level 1m high			
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Eucalyptus Melaleuca			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)					

Comments: Melaleuca was growing almost at playa height - 10 to 20cm above

Lake: Lakelands MCWP85

Debris	**Playa**	Fringe	Examples
	Very small amounts of Ruppia Copepods Gastropods		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Cracked clay, some places friable		sodicity gypsum organic salt other
Soil salinity	0.02 (T verrucosa) to 0.04		
Soil moisture	19% (T verrucosa) to 11%		
Soil pH	7 (T verrucosa) to 8		
Colour of soil	Grey to grey/brown		
Texture of soil	clay		soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Waisted oval		
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 14. **Lake:** Lakelands MCWP87 **GPS:** 659279 East, 6318827 North **Observer:** MC **Date:** **22/5/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Muehlenbeckia sp Halosarcia pergranulata H syncarpa Sarcocornia blackiana	Few Sparse	Dead Medium	
Vegetation at edge of playa – eg Samphires – which species?		Halosarcia pergranulata H syncarpa Sarcocornia blackiana Melaleuca sp	Good	Medium	
Vegetation with obvious watermark – trees etc		Melaleuca sp at 0.5m above playa, 1m watermark on trees	Good	Medium	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Melaleuca			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus at 2m above playa			

Comments:

Lake: MCWP87 No14

Debris	**Playa**	Fringe	Examples
	Ruppia Copepods		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Sandy clay, sodic	Sandy	sodicity gypsum organic salt other
Soil salinity	0.03	0.03	
Soil moisture	22%	21%	
Soil pH	8	7.5	
Colour of soil	Grey	Grey	
Texture of soil	Damp clay	Dry sandy clay	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin with sandy ridge reaching towards center		multiple basins channelled, aeolian banks, islands
Describe shape	Oval		
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 15. **Lake:** East Lake Bryde **GPS:** 676706 East, 6307096 North **Observer: MC** **Date:**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Muehlenbeckia sp Tecticornia verrucosa Halosarcia doleiformis H pergranulata Disphyma crassifolium	Sporadic, some juveniles Juveniles, sporadic	Some adults alive Good	
Vegetation at edge of playa – eg Samphires – which species?		Melaleuca sp Eucalyptus sp	Moderate	Good	
Vegetation with obvious watermark – trees etc		Melaleuca sp Eucalyptus sp			
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Eucalyptus sp Salmon Gums at 2m above playa			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)					

Comments:

Lake: East lake Bryde

Debris	**Playa**	Fringe	Examples
	Decapod holes, claws		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Clay	Sand	sodicity gypsum organic salt other
Soil salinity	T verrucosa 0.005, H doleiformis 0.004		
Soil moisture	T verrucosa 17%, H doleiformis 16%		
Soil pH	T verrucosa 9, H doleiformis 7.5		
Colour of soil	grey		
Texture of soil	T verrucosa dry clay, H doleiformis dry clay, fizzed when water added		soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Waisted oval		
Inflow/outflow channel Describe			
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity

Number 16. **Lake:** Salt Lake MCWP89 **GPS:** 672082 East, 6306955 North **Observer:** MC **Date:** **23/5/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Centre of playa water and salt then very thick samphire zone			
Vegetation at edge of playa – eg Samphires – which species?		Slightly higher ground - tussock grass to 40cm high Halosarcia doleiformis H halocnemoides H lepidosperma H indica subsp bidens H pergranulata H syncarpa Frankenia sp. Eucalyptus kondininensis fringe	Dense samphires Sporadic	Good Poor – few alive	
Vegetation with obvious watermark – trees etc		Melaleuca zone – M lateriflora main sp Eucalyptus kondininensis at about 1m above playa Tussock grass Some Samphires and Frankenia Some regeneration of Eucalyptus and Melaleucas	Not dense, bushes rounded	100% 70% alive	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Melaleuca sp Eucalyptus kondininensis			
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Salmon Gums at 2m above playa Farmland beyond			

Comments: Existing vegetation in reasonable condition except for Eucs nearest the playa, which are dying out

Lake: Salt Lake MCWP89

Debris	**Playa**	Fringe	Examples
			Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Clay, salt crust of 1 to 2cm	Clay, dry	sodicity gypsum organic salt other
Soil salinity	0.07 (Playa away from water)	0.02	
Soil moisture	28%	19%	
Soil pH	7.5	7.5	
Colour of soil	Grey	Grey	
Texture of soil	Clay	Clay – fizzed when water added	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Ovoid		
Inflow/outflow channel Describe	North to East inflow. Seeps in lake		
Estimated depth to vegetation fringe	0.5m to Halosarcias	1m to Eucalyptus kondininensis, 2m to Salmon Gums	
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
Yes	1km x 500m	1 to 5cm	Yes		Saturated 373g/L

Groundwater near salt crust 207g/L – profile: Gypsum, algae, sandy clay

Number 17. **Lake:** MCWP90 Near Lake Bryde and Pony Club **GPS:** 669193 East, 6309040 North **Observer:** MC **Date:** **23/5/02**

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Samphires in centre of pan dead Frankenia sp (small soft grey) Halosarcia syncarpa H pergranulata Eucs Tussock grass	 Sporadic Common Scattered On slightly higher ground	Dead Medium Medium Medium Dead Some dead	
Vegetation at edge of playa – eg Samphires – which species?		Frankenia sp (small soft grey) Halosarcia syncarpa H lepidosperma H pergranulata Atriplex paludosa subsp baudinii Melaleuca thyoides dominant M uncinata M adnata Melaleuca LB037 M lateriflora	Melaleuca OK except bushes right beside playa – first row dead all around playa Eucs dead on playa and edge		
Vegetation with obvious watermark – trees etc		Eucalyptus kondininensis Melaleuca thyoides M uncinata M adnata Melaleuca LB037 M lateriflora	Equal numbers to Melaleucas Melaleuca species equal in numbers	Dead Alive	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Eucalyptus kondininensis Melaleuca thyoides M uncinata M adnata Melaleuca LB037 M lateriflora	Equal numbers to Melaleucas Melaleuca species equal in numbers	Alive	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Salmon Gums, no flats			

Comments: No dead trees in middle. Thick gypsum

Lake: MCWP90 No17

Debris	**Playa**	Fringe	Examples
	No fresh water species		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Biofilm overlaying 10cm plus gypsum layer		sodicity gypsum organic salt other
Soil salinity	0.09	0.05, 0.03, 0.02	
Soil moisture	45%	22%, 15%, 14%	
Soil pH	7.5	7.5, 9, 9	
Colour of soil	Fawn	Grey	
Texture of soil	Soft, talc-like	Clay, sandy clay	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Oval		
Inflow/outflow channel Describe	Potential inflow/outflow at N		
Estimated depth to vegetation fringe	0.2 dead Eucalyptus and Melaleucas 0.5m to live Melaleucas		
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 18. **Lake:** MCWP92 **GPS:** 665646 East, 6311760 North **Observer:** MC **Date:** 23/5/02

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Playa mostly bare Halosarcia pergranulata	 Sparse	 Juveniles	
Vegetation at edge of playa – eg Samphires – which species?	 1m 1m	Halosarcia lepidosperma H syncarpa Sarcocornia blackiana Melaleuca lateriflora Melaleuca LB037 Eucalyptus/ Mallees Disphyma crassifolium	Common Common Common Thick narrow Melaleuca fringe right beside playa on lunette Few Eucalyptus	Patchy, depending on height above playa 60% live Dead	
Vegetation with obvious watermark – trees etc	 1m high 1m	Eucalyptus kondininensis dead under 1m above playa Melaleuca thyoides – 2m water height M lateriflora Halosarcia lepidosperma H syncarpa Sarcocornia blackiana	Few Fringe thick Samphires sporadic	Dead 95% live Samphires healthy	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs	3 to 4m	Eucalyptus kondininensis live at 1 to 2m above playa Melaleuca sp		Live	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus Kondininensis			

Comments: Series of high and low spots and lunettes before main playa. Melaleucas healthy on high ground, dead or dying on lower ground. All Mallees and Eucalyptus dead below 1m above playa. Most Melaleucas OK at 50cm above playa.

Lake:

Debris	**Playa**	Fringe	Examples
	Ruppia Copepods/bivalves		Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Grey clay	Sand	sodicity gypsum organic salt other
Soil salinity	0.07	0.01	
Soil moisture	23%	16%	
Soil pH	7.5	7	
Colour of soil	Grey	Brown	
Texture of soil	Clay, dry on top	Sandy clay, friable	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin, split by sandy lunette, NE to SW		multiple basins channelled, aeolian banks, islands
Describe shape	800m oval		
Inflow/outflow channel Describe	Inflow sheet flow from SE farmland Possible outflow to SW/W		
Estimated depth to vegetation fringe			
Contour height of basin			
If variable, map			

Evaporites – some glitter – Gypsum?

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 19. **Lake:** MCWP94 **GPS:** 663704 East, 6313200 North **Observer:** MC **Date:** 23/5/02

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Wilsonia rotundifolia H lepidosperma	Sparse	Good	
Vegetation at edge of playa – eg Samphires – which species?	2m to 3m high	Melaleuca LB037 M thyoides M lateriflora M uncinata M hamulosa Melaleuca paperbark type at edge of pan	Dense	Good	
Vegetation with obvious watermark – trees etc		Melaleuca LB037 M thyoides M lateriflora M uncinata M hamulosa	Dense	Good	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Melaleuca LB037 M thyoides Eucalyptus kondininensis	More open	Good	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus		Good	

Comments: Fresh looking clay pan – little impacts evident

Lake: MCWP94 No19

Debris	**Playa**	Fringe	Examples
	Small amount Ruppia	Leaf litter	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Clay	Sandy	sodicity gypsum organic salt other
Soil salinity	0.02		
Soil moisture	8%		
Soil pH	7		
Colour of soil	Grey		
Texture of soil	Dry clay, hard		soft, hard, slimy, sandy, rocky
Shape: basin,	Basin, shallow		multiple basins channelled, aeolian banks, islands
Describe shape	Circular		
Inflow/outflow channel Describe	Inflow from S Outflow to North	Sill about 1m plus through Melaleuca forest	
Estimated depth to vegetation fringe	0.5m to Melaleucas, some Melaleucas on edge of playa and onto playa		
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 20. **Lake:** MCWP95 **GPS:** 663715 East, 6312894 North **Observer:** MC **Date:** 23/5/02

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:		Wilsonia humilis Halosarcia lepidosperma	Sparse Strip on W side	Good Good - juveniles	
Vegetation at edge of playa – eg Samphires – which species?	To 3m high	Melaleuca hamulosa M lateriflora M thyoides M acuminata M LB037 Melaleuca Paperbark type at pan edge	Dense	Good	
Vegetation with obvious watermark – trees etc	3m	Melaleuca hamulosa M lateriflora M thyoides M acuminata M LB037	Dense	Good	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs	3m	Melaleuca hamulosa Santalum acuminata M acuminata M uncinata Leptospermum inelegans	Not so dense, more open	Good	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)	6m	Eucalyptus kondininensis Melaleuca acuminata Dodonea ceratocarpa Lepidosperma sp Lomandra effusa	Open woodland	Good	

Comments: Vegetation does not appear to have been changed

Lake: MCWP95 No20

Debris	**Playa**	Fringe	Examples
	Gastropods Little Ruppia No copepods/bivalves	Leaf litter, moss under trees	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Hard clay	Sandy	sodicity gypsum organic salt other
Soil salinity	0.01		
Soil moisture	13%		
Soil pH	7.5		
Colour of soil	grey		
Texture of soil	Dry clay		soft, hard, slimy, sandy, rocky
Shape: basin,	Basin, shallow		multiple basins channelled, aeolian banks, islands
Describe shape	Circular, 800m		
Inflow/outflow channel Describe	No definite inflow/outflow, suggest that it 'joins' up with other lakes at 2m level		
Estimated depth to vegetation fringe	0.5m, max depth 1.5m		
Contour height of basin			
If variable, map			

Evaporites: none seen

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					

Number 21. **Lake:** MCWP99 Top of Lakelands **GPS:** 659013 East, 6320782 North **Observer:** MC **Date:** 23/5/02

Vegetation	Size	Species	Density (coverage	Condition	Sample
Lake vegetation:	15cm	Halosarcia pergranulata Tecticornia verrucosa Wilsonia rotundifolia	Many juveniles Some juveniles	Good Good	
Vegetation at edge of playa – eg Samphires – which species?	3m	Melaleuca mixture – fringe narrow (10m) but largely intact – about 60% live at edge of pan Melaleuca lateriflora M thyoides M EB31 M acuminata	Dense	Mixed	
Vegetation with obvious watermark – trees etc		Melaleuca mixture Eucalyptus	Dense Sparse	Good Dead	
Vegetation potentially affected by highest watermark – trees, shrubs, sub-shrubs, herbs		Eucalyptus EB28 E eremophila	Narrow fringe above Melaleuca fringe	Good in places, dead or dying in others	
Surrounding vegetation not necessarily affected by high water (Samphire Flats?)		Eucalyptus			

Comments: Lake has relatively narrow fringe of Melaleucas then Eucalyptus. Some Melaleucas at pan edge have died; some patches of Eucalypts have died to the East and South. Appears to be some effects from farm land runoff.

Lake: Lakelands MCWP99 No 21

Debris	**Playa**	Fringe	Examples
	Ruppia, some	Leaf litter	Decapod claws, bird's eggs, beetle carapaces, spider/beetle holes Ruppia, Chara, other algae?

Geomorphology	Playa	Edge	
Soil type	Sandy dry clay	White sand	sodicity gypsum organic salt other
Soil salinity	0.03		
Soil moisture	21%		
Soil pH	7.5		
Colour of soil	Grey	Beige	
Texture of soil	Clay	Sand	soft, hard, slimy, sandy, rocky
Shape: basin,	Basin		multiple basins channelled, aeolian banks, islands
Describe shape	Oval		
Inflow/outflow channel Describe	No defined channel. Inflow from S from farming land		
Estimated depth to vegetation fringe	0.5m Max depth 1m		
Contour height of basin			
If variable, map			

Water

Water present	Coverage	Depth	Sample taken	pH	Salinity
None					