Report No. 2003-06

Annual Report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project - Spring 2002 to Summer 2003.

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A Report to the Water and Rivers Commission of Western Australia

May 2003

Executive Summary

Monitoring of aquatic invertebrates and water chemistry at Gnangara Mound and East Gnangara wetlands was conducted in spring 2002 (Round 14) and where possible in summer 2003 (Round 15).

A strong correlation between wetland water levels at the time of sampling and macroinvertebrate family richness was again evident at the majority of wetlands sampled in Rounds 14 and 15. This relationship is established because higher water levels in spring increase the habitat complexity of wetlands as littoral vegetation becomes inundated, providing habitat for a greater diversity of aquatic invertebrate species.

As for previous monitoring rounds, cumulative family richness continued to increase at most wetlands in 2002/2003. Many families of aquatic macroinvertebrate were collected from wetlands where they had previously not previously found. This is a statistical aberration related to sampling frequency and intensity.

Water and Rivers Commission hydrographs show that water levels for almost all the wetlands monitored 2002/2003 continue the ongoing trend of low or diminishing spring peak water levels and/or increased frequency and length of summer drying. Prolonged drought conditions in the Wanneroo region of the Swan Coastal Plain combined with groundwater abstraction for public and private water usage will continue to result in changes to the ecological functioning of many of the Gnangara Mound wetlands monitored.

Table A1 shows a status report for each wetland in terms of level of concern across wetland management issues. Extreme concern warrants immediate management response; probable concern should trigger preventative management action. Of note is that all wetlands are currently registering some level of concern in terms of their water levels, a situation which may not have existed in previous sampling rounds and which reflects increasing aridity at these wetlands in recent years. Increased susceptibility to fire and acidification are both associated with declines in water level, these threatening processes are of probable or extreme concern at half of the wetlands respectively. All wetlands except Lake Yonderup and Loch

McNess (South) are considered to have either extreme or probable concern for one or more issues relating to wetland value.

Coogee Spring, where artificial water level maintenance has been ceased, was dry in spring 2002 and summer 2003 and it is likely this wetland will now only fill in years of above average winter rainfall. Concern for these changes must remain high until a taxonomic analysis has been conducted of macroinvertebrates found at the wetland to determine whether the occurrence or otherwise of rare and/or threatened species.

Table A1. Wetland Status Report for GMEMP wetlands (showing level of concern relative to wetland values)

Wetland	Overall Concern[1]	Water level[2]	Eutro-phication	Acidification	Susceptibility to fire[3]	Loss of vegetation	Loss of fauna	Introduced species
Coogee Spring	1	)	*	)	)	*	)	)
Gnangara	3	*	*	)	)	)	)	)
Goollelal	2	*	)	)	)	)	)	*
Jandabup	2	)	)	)	*	)	*	)
Joondalup (North)	2	*	)	)	)	*	*	*
Joondalup (South)	2	*	)	)	)	*	*	*
Lexia 86	1	)	*	)	)	)	)	*
Lexia 186a	1	)	*	)	)	)	)	*
Loch McNess (North)	2	*	)	)	*	*	*	)
Loch McNess (South)	3	*	)	)	)	)	)	*
Mariginiup	1	)	*	)	)	)	)	)
Melaleuca Park	1	)	*	)	)	*	)	)
Nowergup	2	*	*	*	)	*	*	)
Pipidinny Swamp	2	)	)	)	)	)	*	)
Wilgarup	1	)	*	*	)	)	)	*
Yonderup	3	*	)	)	)	)	)	)

) no immediate concern * possible concern * probable concern) extreme concern

[1]Priority for management action as per recommendations in this report (based on level of concern across all issues, and need for new/extra response to alleviate significant risk; **1**=highest priority)

[2] Level of concern in the absence of water level augmentation

[3]Presence of organic soils that may be flammable if dried

Due to excessive drying of sediments associated with low water levels in 2002/2003, fires at both Coogee Spring and Lake Mariginiup burnt into the organic soils of these wetlands. The burning of organic sediments may pose health risks to surround residents, are difficult to extinguish without the use of fire retardant chemicals and potentially change wetland functioning (due to nutrient release, reduced water absorption capacity, changed sediment structure).

Recommendations:

- Water levels at Lake Nowergup are currently being artificially maintained with ground water being pumped through summer and well into autumn. Nevertheless Lake Nowergup continues to suffer from excessive drying in summer and rapid water level draw down. Until a strategy is devised to return ground water to levels where organic soils remain saturated, water level augmentation should continue. Other recommendations for this wetland are given in Horwitz and Benier (2003).
- It is proposed that WRC and other relevant stakeholders urgently develop a fire management strategy for Coogee Spring, Lake Mariginiup, Wilgarup, and other Gnangara Mound and East Gnangara wetlands with organic sediments that are currently experiencing periods of excessive dryness. This would require the mapping of wetland organic sediments throughout the region.
- Several families of macroinvertebrates (eg Ceinidae: Amphipoda) excluded from Lake Jandabup subsequent to this wetland drying excessively in Round 5 (summer 1998), were collected at increasing abundance in 2002/2003 (Rounds 14 and 15). It is recommended therefore that the augmentation regime at Lake Jandabup continue until the risk of sediments becoming exposed and dried is significantly reduced.
- The continued decline in both water level and water quality at Melaleuca Park is of immediate and serious concern due to the likelihood of biodiversity loss. The possibility of a recent acidification event having occurred at this wetland needs to be investigated. A similar prognosis (loss of fauna and acidification) needs to be investigated for the Lexia wetlands.
- Physico-chemical data for 2002/2003 indicates that the potential for excessive summer drying and wetland acidification still exist, with wetlands such as Lake Mariginiup considered to be most at risk. A precautionary management approach is

recommended for Lake Mariginiup. Water level augmentation with ground water may be required for this wetland immediately.

- Invertebrate samples previously collected from Gnangara Mound wetlands require identification to the lowest taxonomic level to determine the presence of rare taxa, which may be threatened by the continued water level declines and declining water quality. These investigations will be time consuming, and should start immediately with the highest priority wetlands based on **Table A1**.

Two minor adjustments are required for this monitoring program:

- Data from only eight rounds of sampling is displayed in the macroinvertebrate data tables, so that they remain legible. Data from earlier sampling rounds are available from previous reports. A comprehensive data basing system is required for this and other wetland monitoring data.
- Consideration should be given to reviewing the location of some monitoring sites given the invasion of exotic species such as *Typha sp* at some sites and the lack of surface water at several wetlands. Both processes have fundamentally altered the habitat characteristics of some monitoring wetlands and specific sites.

Other comments are outlined on the main body of the report and the discussion section for each individual wetland.

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1 Introduction

In accordance to the contract brief "Environmental Monitoring and Investigations for Gnangara Mound Groundwater Resources, Public Environmental Review: Wetland Macroinvertebrate Monitoring" dated June 2002, this report presents a summary of the monitoring work carried out in spring 2002 (Round 14) and summer 2003 (Round15). The results are compared with data acquire from the previous thirteen sampling round between summer 1996 (Round 1) and summer 2002 (Round 13). The objective of this monitoring program is to provide information on the status of aquatic macroinvertebrates in these wetlands and their response to changes in water quality and water levels; this information is submitted in Annual and Triennial Reports to the EPA, and used in the adaptive management of groundwater resources in the Gnangara area by the Water and Rivers Commission of Western Australia (hereafter referred to WRC).

Information on previous monitoring investigations carried out as part of this project have been reported in:

- Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project: Interim report to the Water and Rivers Commission of Western Australia (Pinder and Horwitz 1997)
- Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project (Sampling Period 1996-1997) (Sommer and Horwitz 1998)
- Interim monitoring results for Gnangara Mound wetlands with low water levels (Lakes Joondalup, Jandabup, Nowergup, Gnangara and Coogee Springs) - Spring 1998 (Sommer and Horwitz 1999)
- Annual report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project – Summer/Autumn 1997/1998, Spring 1998 and Summer 1998/99 (Sommer and Horwitz 1999)
- Annual report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project – Spring 1999 to Summer 2000 (Sommer, et. al. 2000)

- Interim Report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project - Spring 2000 (Chapman and Horwitz 2001).
- Annual report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project – Spring 2000 to Summer 2001 (Chapman and Horwitz, 2001).
- Interim Report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project - Spring 2001 (Benier and Horwitz, 2001).
- Annual report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project – Spring 2001 to Summer 2002 (Benier and Horwitz, 2002).
- The Effect of Changed Hydrology on the Aquatic Invertebrate Fauna of Coogee Spring (Benier and Horwitz, 2002).
- Interim Report for the Wetland Macroinvertebrate Monitoring Program of the Gnangara Mound Environmental Monitoring Project - Spring 2002 (Benier and Horwitz, 2002).
- The Effect of Artificial Maintenance of Water Levels on the Aquatic Invertebrate Fauna of Lake Nowergup, with Notes on the Water Quality and Sediments (Horwitz and Benier, 2003).

2 Methods

2.1 Sampling protocol

In line with recommendations made in Sommer and Horwitz (1998) and with the Contract Brief dated June 2002, sampling of the wetlands is undertaken twice in a year: in the spring, when water levels are at their presumed highest, and in summer, when water levels at permanent wetlands are at their lowest, or shortly before ephemeral wetlands dry out (rather than on set dates).

2.2 Macroinvertebrates and water quality

Habitat descriptions, water quality and aquatic invertebrate sampling methodologies are outlined in Sommer and Horwitz (1998). A noted change to these methodologies is the use of DMF (N, N-Dimethylformamide) for chlorophyll *a* extraction as from Round 5 (summer 1998). See Speziale *et al*. (1984) for methods and rationale of this methodology.

2.3 Statistical analyses

Analyses of physico-chemical and macroinvertebrate data are mainly descriptive and presented in the form of graphs. Correlations (Product Moment correlation coefficient) were carried out in order to determine the relationship between macroinvertebrate family richness and water level at time of sampling.

In line with recommendations made in the 2000 annual report (Sommer *et al.* 2000), Swan Wetlands Aquatic Macroinvertebrate Pollution scores (SWAMPS - Chessman 1995; Papas *et al.* 1997) were not calculated for Rounds 14 and 15.

3 Results and Discussion

The results for aquatic macroinvertebrate composition for individual wetlands are detailed in **Appendix II**, and the water quality results from individual wetlands are outlined in **Appendix III**.

Table 3.1 lists the lakes sampled for Rounds 14 and 15, the number of habitats sampled for each lake, and dates on which each lake was sampled. Two wetlands were dry in Round 14, Lake Wilgarup and Coogee Spring. Only one habitat was sampled at Lexia 186a (excavated sump), as the wetland basin was completely dry. Four habitats only were sampled at Melaleuca Park in Round 14; Site 5 (seasonal creek line) was dry at the time of sampling. Six wetlands were dry at the time of sampling in summer/autumn 2003 (Round 15). At several wetlands (Joondalup-North, Joondalup-South, Melaleuca Park, Nowergup and Pipidinny Swamp) low water levels meant that surface water was restricted to a few habitats only and as such a restricted number of habitats was sampled at these wetlands.

Table 3.1 Number of habitats sampled for each wetland and sampling dates for Round 14 (spring 2002) and Round 15 (summer 2003). 'Dry' indicates no sites sampled, as the wetland was dry.

Wetland	No. of Habitats sampled Round 14	Sampling dates Round 14	No. of Habitats sampled Round 15	Sampling dates Round 15
Coogee Spring	Dry	28-Aug-02	Dry	15-Jan-03
Gnangara	3	11-Sep-02	Dry	24-Jan-03
Goollelal	3	9-Oct-02	3	4-Feb-03
Jandabup	5	10-Sep-02	5	6-Feb-03
Joondalup (North)	3	23-Sep-02	2	3-Feb-03
Joondalup (South)	3	12-Sep-02	1	17-Jan-03
Lexia 86	3	21-Oct-02	Dry	20-Jan-03
Lexia 186a	1	26-Aug-02	Dry	20-Jan-03
Loch McNess (North)	2	17-Sep-02	Dry	15-Jan-03
Loch McNess (South)	4	18-Sep-02	5	5-Feb-03
Mariginiup	3	11-Oct-02	0	24-Jan-03
Melaleuca Park	4	29-Aug-02	1	21-Jan-03
Nowergup	5	7-Oct-02	2	12-Feb-03
Pipidinny Swamp	5	13-Sep-02	3	22-Jan-03
Wilgarup	Dry	28-Aug-02	Dry	15-Jan-03
Yonderup	5	8-Oct-02	5	13-Feb-03

3.1 Macroinvertebrate family richness

Figure 3.1 compares the aquatic macroinvertebrate family richness (averaged from all wetlands) between summer and spring sampling rounds (1 – 15). It should be noted that the number of wetlands and habitats sampled in each round is note consistent, due to wetlands or habitats being dry or inaccessible at the time of sampling. Also, three new wetland (Lexia 86, Lexia 186 and Melaleuca Park) were incorporated into the Gnangara Mound Environmental Monitoring Program (GMEMP) as from Round 10.

Results of Rounds 14 and 15 are consistent with previous years with higher mean family richness in spring (Round 14: twenty-six families) compared to summer (Round 15: twenty-three families). The average family richness in Round 14 is the highest recorded from any sampling round. Average family richness in Round 14 represents an increase of two families on the previous three spring sampling rounds (twenty-four families). Round 15 average family richness is the highest recorded in a summer sampling round to date. **Figure 3.1** indicates a trend of increasing summer mean family richness apparent since Round 5 (1998).

The macroinvertebrate family richness of each wetland is shown in **Figure 3.2** for spring sampling rounds, and **Figure 3.3** for summer rounds. Loch McNess (South) recorded the highest family richness (thirty-eight families) of all wetlands sampled in Round 14, with this being the highest family richness recorded at any wetland during this monitoring project. There has been a significant increase in aquatic invertebrate family richness at Loch McNess (South), increasing from twenty-seven taxa in Round 10 to thirty-eight taxa in Round 14. Lexia 86 and Lexia 186a each had the lowest family richness (seven families) of wetlands sampled in Round 14, with seven families being the lowest family richness recorded at any wetland during this monitoring project. It should be noted that sampling at Lexia 86 was restricted to *Cherax* burrows as no surface water occurred within the wetland basis, and that sampling at Lexia 186a was again restricted to a small excavated sump at the Northern margin of the wetland. Coogee Spring was dry in spring for the first time in Round 14, artificial maintenance of water levels is no longer being conducted at this wetland. Of the six wetlands with the highest family richness in Round 14 Loch McNess (South), Yonderup, Loch McNess (North) and Pipidinny Swamp are all part of the Wanneroo linear chain of wetlands (WAWA, 1995).

Lake Jandabup, with thirty-four families, had the highest family richness recorded in Round 15, this being the highest family richness recorded at any wetland in a summer sampling round. Family richness has increased markedly in each summer round subsequent to water level maintenance being commenced in 1998. Melaleuca Park had the lowest family richness (ten families) in Round 15, less than half the family richness recorded at this wetland in Round 13. Surface water was shallow (3cm) and restricted to the dense *Baumea articulata* stand in Round 15. Except for Lake Joondalup (North and South) and Melaleuca Park family richness at all other wetlands sampled in Round 15 increased on that of Round 13.

Figure 3.1 Average macroinvertebrate family richness across all wetlands - comparison between spring and summer rounds.

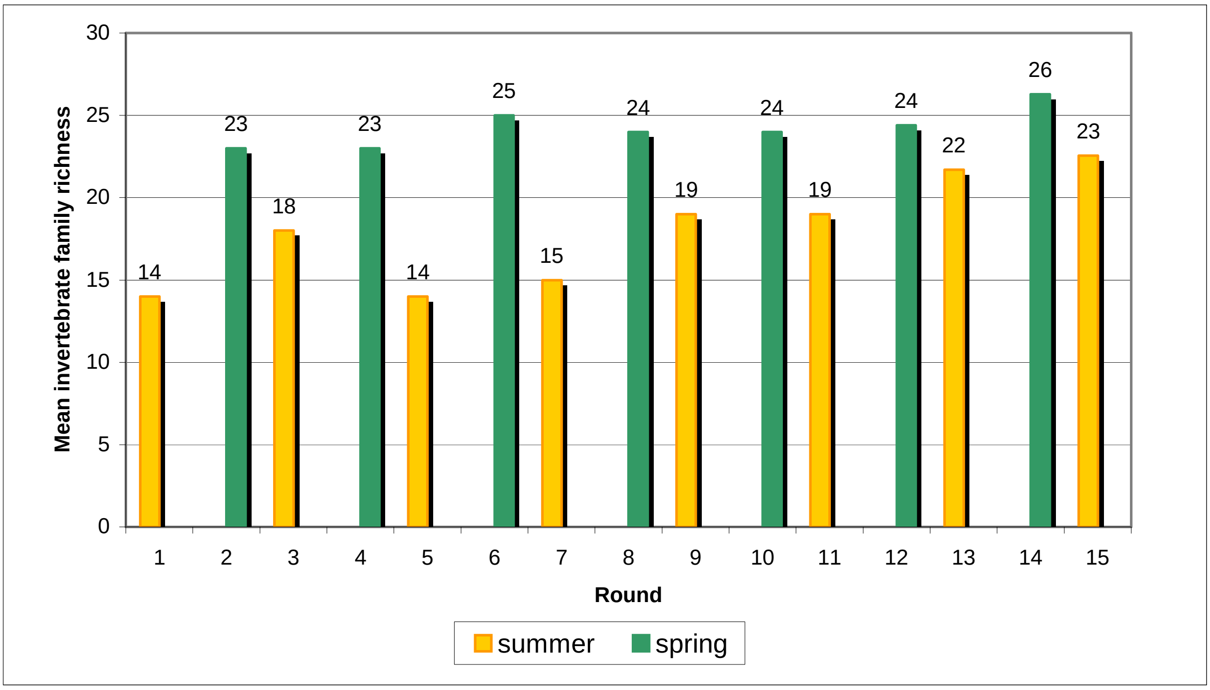


Figure 3.2 Macroinvertebrate family richness in each wetland for spring sampling rounds (2 to 14).

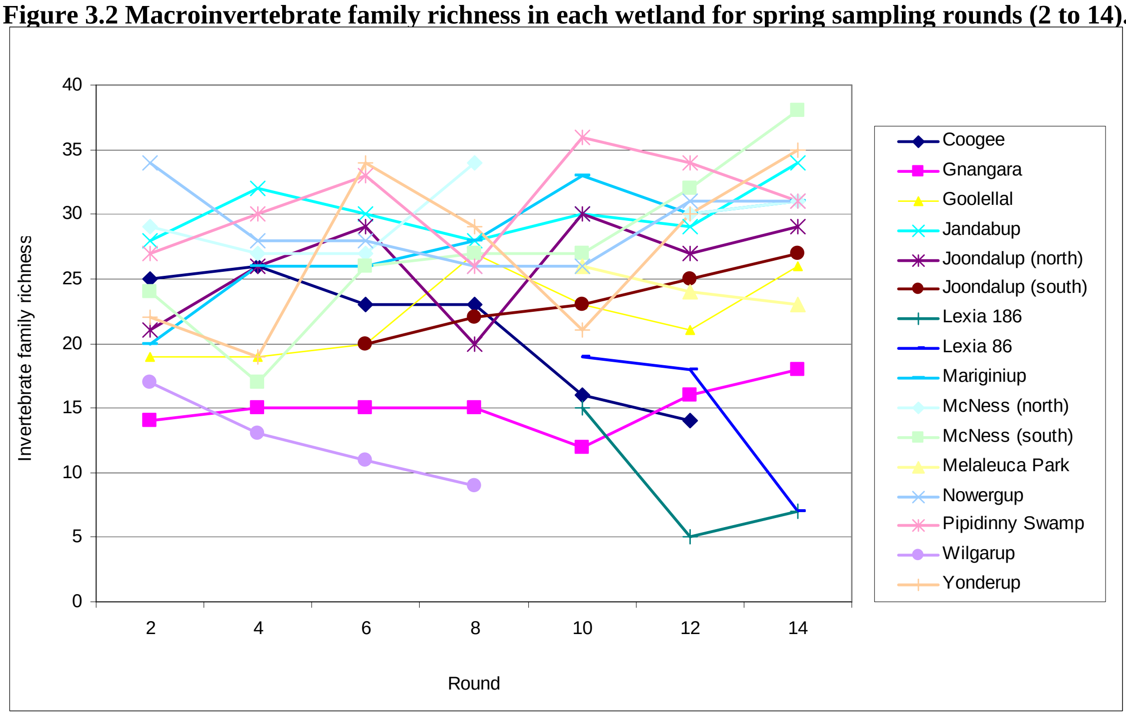


Figure 3.3 Macroinvertebrate family richness in each wetland for summer sampling rounds (1 to 15).

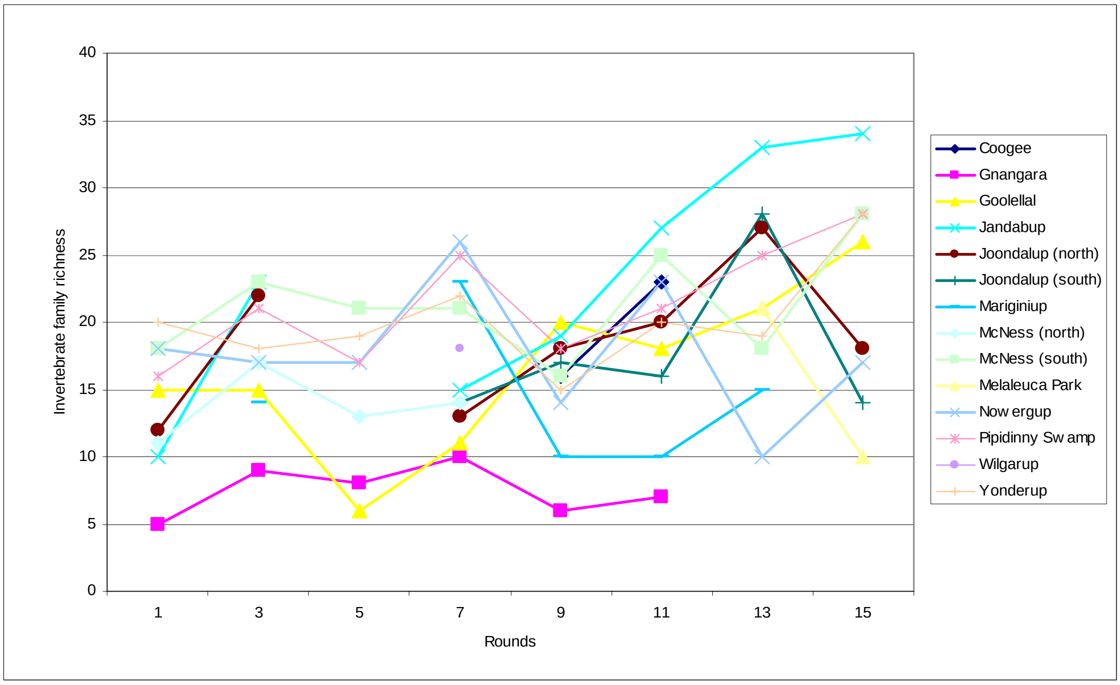


Table 3.2 gives the mean family richness of each wetland for summer and spring sampling rounds prior to Rounds 14 and 15. The percentage to which Round 14 and 15 results vary from the overall average is also shown. For spring sampling (Round 2 – 12) Lake Jandabup has the highest mean family richness (thirty families). Lakes Jandabup, Gnangara, Goollelal, Joondalup (North), Joondalup (South), Mariginiup, Nowergup, Yonderup and Loch McNess (North) and Loch McNess (South) all had higher than average aquatic invertebrate family richness in Round 14. Loch McNess (South) family richness was 49% above average in Round 14. For summer samples (Round 1 – 13) Lake Jandabup and Melaleuca Park have the highest mean family richness respectively (twenty-one families). With the exception of Lexia 86 and Lexia 186 (which have not been inundated in any summer since their inclusion in the GMEMP) Lake Gnangara has the lowest mean family richness (eight families). Of the nine wetlands sampled for aquatic macroinvertebrates in Round 15 five wetlands had above average family richness, the highest of which was Lake Goollelal (72%). Of the four wetlands that had below average family richness in Round 15 Melaleuca Park had the greatest percentage difference (-52%).

Table 3.2 Average spring and summer family richness for Gnangara Mound wetlands, and comparison with family richness values recorded for Round 12 and Round 13. N/A indicates the wetland was dry and N/S indicates not previously sampled.

Wetland	Spring				Summer			
	Average	N	Round 14	% difference	Average	N	Round 15	% difference
Coogee Spring	21	6	0	N/A	20	2	0	N/A
Gnangara	15	6	18	24%	8	6	0	N/A
Goollelal	22	6	26	21%	15	7	26	72%
Jandabup	30	6	34	15%	21	6	34	61%
Joondalup (north)	26	6	29	14%	19	6	18	-4%
Joondalup (south)	23	4	27	20%	19	4	14	-25%
Lexia 186a	10	2	7	N/A	0	0	0	N/A
Lexia 86	19	2	7	N/A	0	0	0	N/A
Mariginiup	27	6	31	14%	14	5	0	N/A
Loch McNess (north)	29	5	31	5%	14	4	0	N/A
Loch McNess (south)	26	6	38	49%	20	7	28	38%
Melaleuca Park	25	2	23	-8%	21	1	10	-52%
Nowergup	29	6	31	8%	18	7	17	-5%
Pipidinny Swamp	31	6	31	0%	20	7	28	37%
Wilgarup	13	4	0	N/A	18	1	0	N/A
Yonderup	26	6	35	35%	19	7	28	47%

3.2 Macroinvertebrate response to wetland water levels

WRC hydrographs for the depth gauged Gnangara Mound wetlands, showing changes in wetland water levels over time, are located in **Appendix I**. The majority of wetlands during the 2002/2003 sampling period (Rounds 14 and 15) had lower spring peak water levels compared to 2001/2002 (Rounds 12 and 13), continuing the trend of declining spring peak water levels apparent over the last few years at the majority of wetlands. Coogee Spring did not fill in either Round 14 or 15, Round 14 being the first spring sampling round in which this wetland has not contained surface water. Lake Jandabup had lower spring peak and summer low water levels in Round 14 and 15 respectively compared to Rounds 12 and 13, reversing the trend of increasing water levels at this wetland subsequent to artificial water maintenance. In Rounds 14 and 15 Loch McNess (South) had a continued decline in spring peak water levels and the lowest ever summer minimum water level (6.9 mAHD) recorded at this wetland, which was below the summer absolute minimum water level specified for this wetland (WAWA, 1995). The artificial maintenance of water levels at Lake Nowergup has resulted in significant variation in spring peak water levels in recent years.

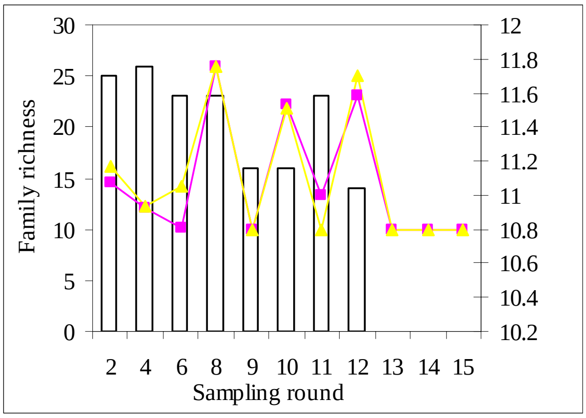
Shown on the hydrographs for Gnangara Mound wetland are the specified Environmental Water Requirements for individual wetlands (WAWA, 1995). Of the thirteen wetlands for which hydrograph data is available, during the 2002/2003 sampling period for Rounds 14 and 15, water levels at four of the wetlands were below the summer preferred minimum (Gnangara, Joondalup, Lexia 86 and Pipidinny Swamp), three were below the summer absolute minimum (Jandabup, Loch McNess and Yonderup), two were below the spring preferred minimum peak water level (Mariginiup and Nowergup) and two were completely dry (Coogee Spring and Wilgarup). Only one wetland (Lake Goollelal) had water levels that remained above the summer preferred minimum water level specified for the wetland.

The relationship between aquatic invertebrate family richness and wetland water level at the time of sampling and highest spring / lowest summer water levels is shown in **Figure 3.4** (see **Appendix I** for source data). It can be seen that the cycle of spring high aquatic invertebrate family richness and summer low aquatic invertebrate family richness is fairly predictable at most wetlands, and that this mimics the cycle of spring peak / summer minimum water levels. The water level at time of sampling is reflective of the spring peak / summer minimum water levels at the majority of the wetlands, indicating that the sampling schedule is appropriate for characterising seasonal variation in wetland ecological functioning.

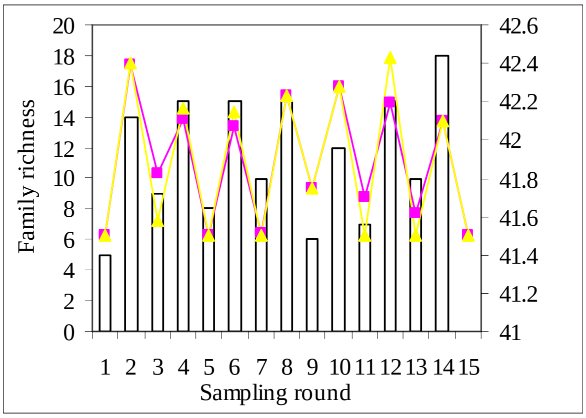
Table 3.2 presents the aquatic macroinvertebrate family richness, water level at time of sampling, the spring peak and/or summer low water levels, the number of weeks during which (the majority of) a wetland was dry, and the Pearson's Product Moment Correlation Coefficient showing the degree of association between aquatic macroinvertebrate family richness and water level at time of sampling for depth gauged Gnangara mound wetlands.

At ten of the sixteen wetlands (**Table 3.2**) there was a significant correlation between wetland water level at time of sampling and aquatic macroinvertebrate family richness. The strongest correlation exists at Melaleuca Park where 94% of the variation seen in aquatic macroinvertebrate family richness is attributable to fluctuations in water level between sampling rounds. At the six remaining wetlands there no significant correlation between wetland water level and aquatic macroinvertebrate family richness. Except for Lexia 86 and Lexia 186 (where insufficient data exists to determine the Pearson's correlation), Loch McNess (South) had the lowest correlation with 9.5% of the variation seen in aquatic macroinvertebrate family richness is attributable to fluctuations in water level between sampling rounds. This wetland has the lowest variation between spring peak / summer minimum water levels of the wetlands monitored. Following Round 14 and 15 sampling results Lake Goollelal has a none significant correlation between wetland water level at time of sampling and aquatic macroinvertebrate family richness, the only wetland at which the correlation between water level and family richness has been reversed. In 2002 and again in 2003 spring and summer aquatic macroinvertebrate family richness were equal.

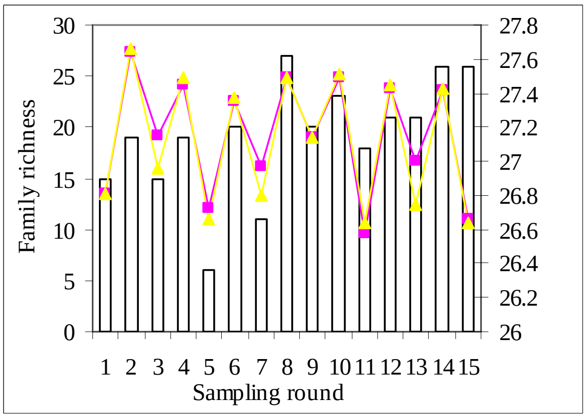
Figure 3.4 Macroinvertebrate family richness, water levels (w.l.) at time of sampling, and the lowest water levels for summer/autumn sampling (Rounds 1, 3, 5, 7, 9, 11, 13, 15) or the highest water level for spring sampling (Rounds 2, 4, 6, 8, 10, 12, 14).



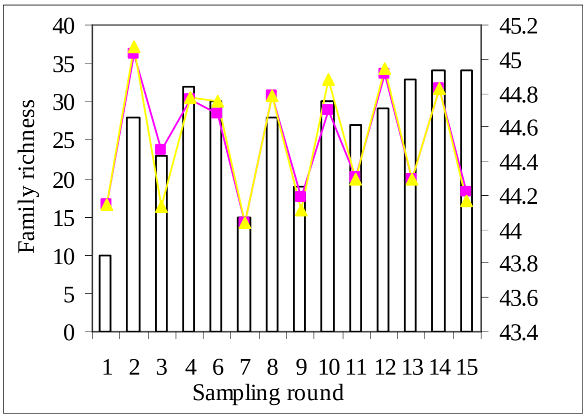
Coogee Spring



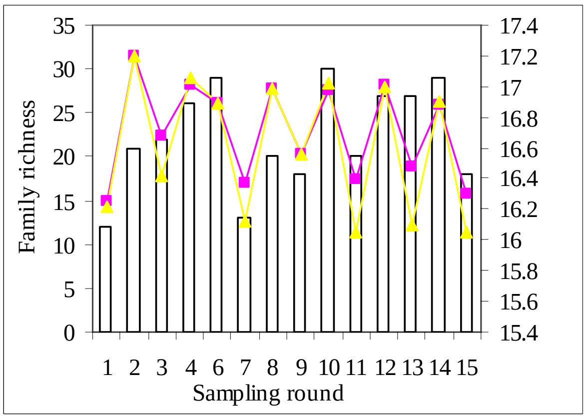
Gnangara



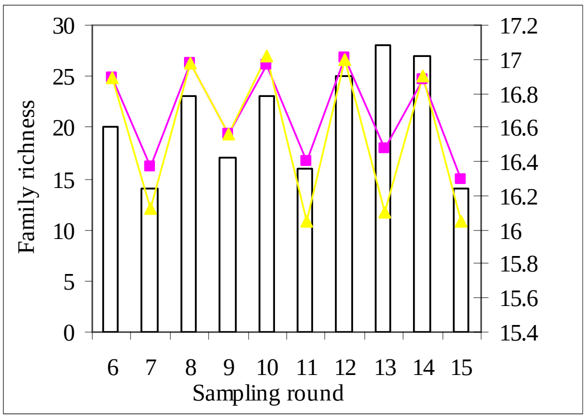
Goolellal



Jandabup

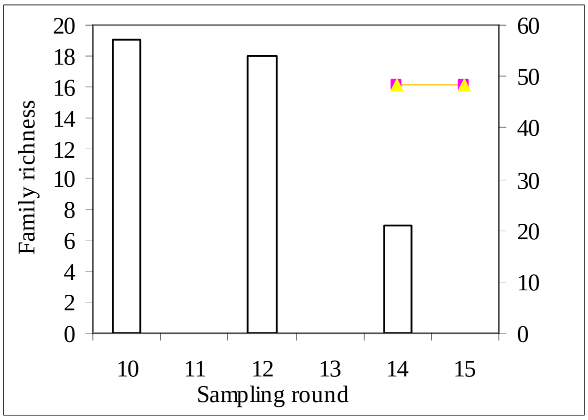


Joondalup (north)

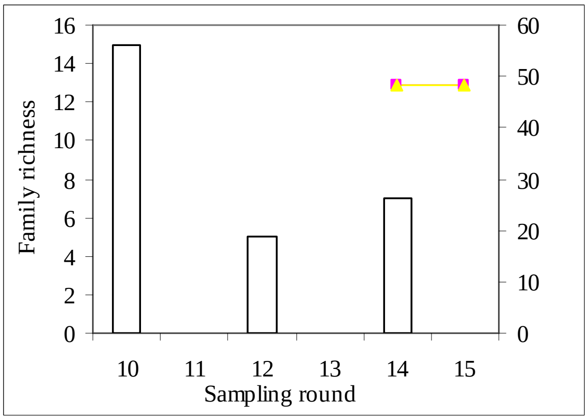


Joondalup (south)

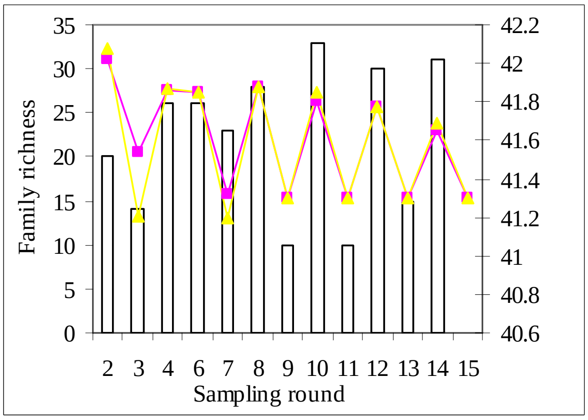
Figure 3.4: continued



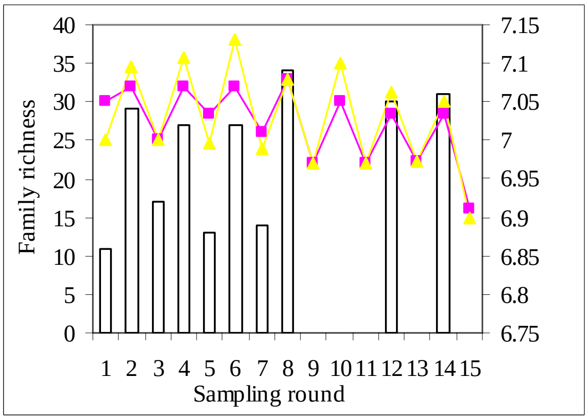
Lexia 86



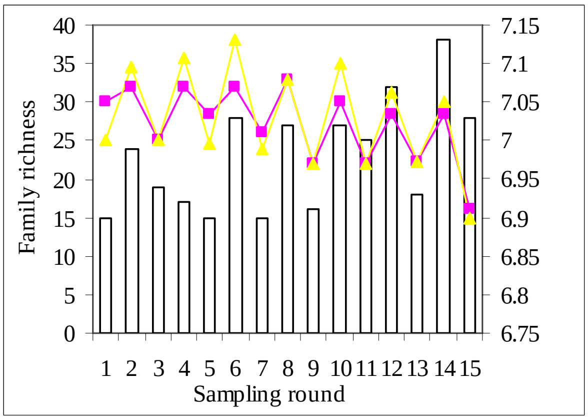
Lexia 186



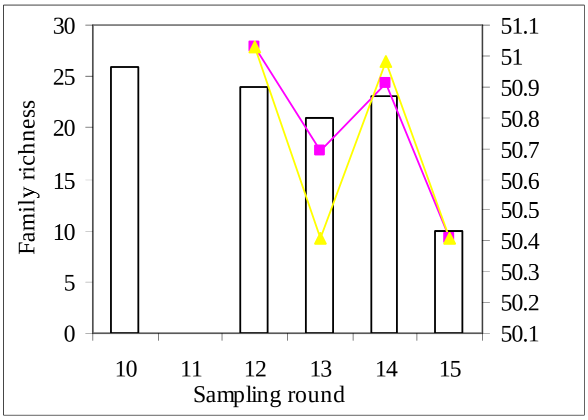
Mariginiup



McNess (north)

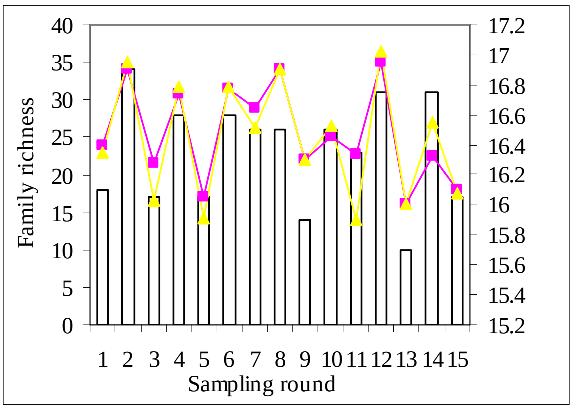


McNess (south)

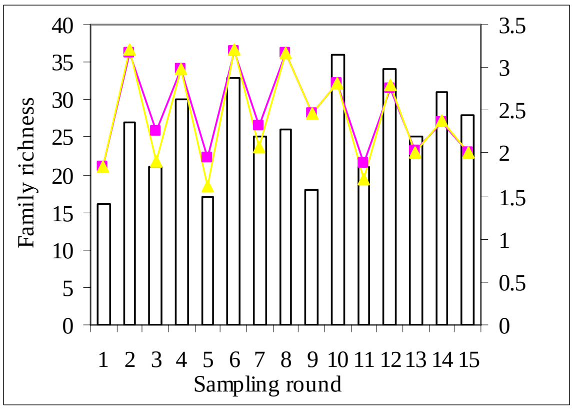


Melaleuca Park

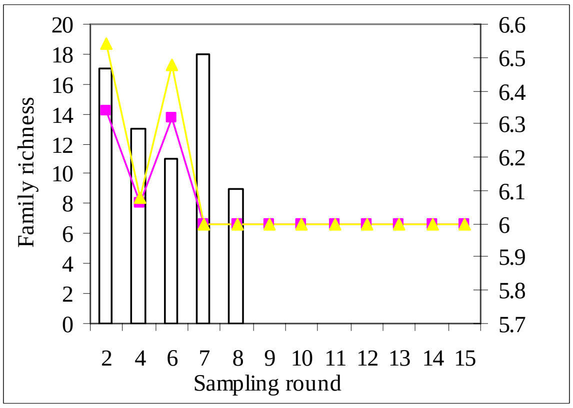
Figure 3.4: continued



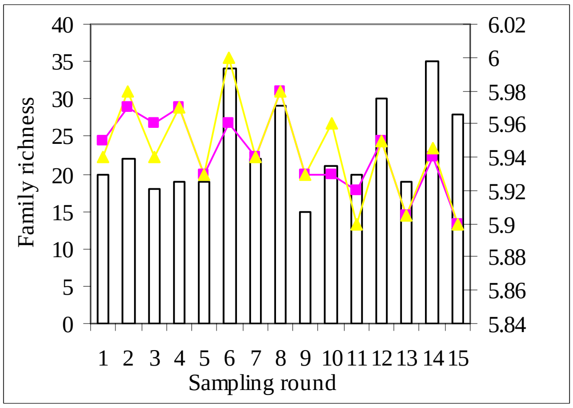
Nowergup



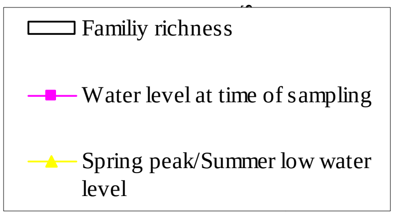
Pipidinny Swamp



Wilgarup



Yonderup



LEGEND

Table 3.3 Family richness of aquatic invertebrates, water levels at time of sampling, the highest spring and lowest summer water levels, number of weeks during which a wetland was dry (about the WAWA water level gauge) and the Pearson's product moment correlation coefficient showing the degree of association between invertebrate family richness and the water level at time of sampling for the Gnangara Mound wetlands.

Wetland	Sampling Round	Invertebrate Richness	Water level	Highest/ lowest water level	Dry period (weeks)	Correlation coefficients for family richness and water level (*=significant)
Coogee Springs	2	25	11.07	11.17	24	
	4	26	10.92	10.94	32	
	6	23	10.81	11.05	40	
	8	23	11.76	11.76	23	
	9	16	10.8	10.8	n/a	r(8)= -0.35, p>0.05
	10	23	11.53	11.51	n/a	
	11	16	11	10.8	n/a	
	12	14	11.58	11.7	3	
Loch McNess (north)	1	11	7.05	7.002	0	
	2	29	7.07	7.095	0	
	3	17	7	7	0	
	4	27	7.07	7.108	0	
	5	13	7.035	6.995	0	r(10)= 0.57, p<0.05*
	6	27	7.07	7.13	0	
	7	14	7.01	6.99	0	
	8	34	7.08	7.08	0	
	12	30	7.035	7.062	0	
	14	31	7.035	7.05	0	
Loch McNess (south)	1	15	7.05	7.002	0	
	2	24	7.07	7.095	0	
	3	19	7	7	0	
	4	17	7.07	7.108	0	
	5	15	7.035	6.995	0	
	6	28	7.07	7.13	0	
	7	15	7.01	6.99	0	
	8	27	7.08	7.08	0	r(15)= 0.095, p>0.05
	9	16	6.97	6.97	0	
	10	27	7.05	7.1	0	
	11	25	6.97	6.97	0	
	12	32	7.035	7.062	0	
	13	18	6.972	6.972	0	
	14	38	7.035	7.05	0	
	15	28	6.91	6.9	0	
Lake Jandabup	1	10	44.15	44.15	0	
	2	28	45.025	45.07	0	
	3	23	44.46	44.13	0	
	4	32	44.76	44.77	0	
	6	30	44.68	44.75	16	
	7	15	44.04	44.04	n/a	
	8	28	44.78	44.78	14	
	9	19	44.19	44.11	0	r(14)= 0.56, p<0.05*
	10	30	44.7	44.88	0	
	11	27	44.31	44.3	0	
	12	29	44.915	44.94	0	
	13	33	44.3	44.3	0	
	14	34	44.825	44.825	0	
	15	34	44.22	44.17	0	
Lake Nowergup	1	18	16.39	16.35	0	
	2	34	16.9	16.95	0	
	3	17	16.28	16.025	0	
	4	28	16.735	16.79	0	
	5	17	16.057	15.908	0	
	6	28	16.77	16.78	0	
	7	26	16.64	16.51	0	
	8	26	16.9	16.9	0	r(15)=0.81, p<0.05*
	9	14	16.3	16.3	0	
	10	26	16.45	16.53	0	
	11	23	16.34	15.9	0	
	12	31	16.95	17.02	0	

Table 3.3: continued

	13	10	16	16	0	
	14	31	16.32	16.55	0	
	15	17	16.1	16.08	0	
Lake Yonderup	1	20	5.95	5.94	0	
	2	22	5.97	5.98	0	
	3	18	5.96	5.94	0	
	4	19	5.97	5.97	0	
	5	19	5.93	5.93	0	
	6	34	5.96	6	0	
	7	22	5.94	5.94	0	
	8	29	5.98	5.98	0	r(15)=0.18, p>0.05
	9	15	5.93	5.93	0	
	10	21	5.93	5.96	0	
	11	19	5.92	5.9	0	
	12	30	5.95	5.95	0	
	13	19	5.905	5.905	0	
	14	35	5.94	5.945	0	
	15	28	5.9	5.9	0	
Lake Wilgarup	2	17	6.338	6.54	36	
	4	13	6.06	6.08	36	
	6	11	6.32	6.48	40	r(5)=0.11, p>0.05
	7	18	6	6	26	
	8	9	6	6	26	
Pipidinny Swamp	1	16	1.852	1.84	0	
	2	27	3.17	3.2	0	
	3	21	2.255	1.91	0	
	4	30	2.98	2.98	0	
	5	17	1.95	1.61	0	
	6	33	3.185	3.22	0	
	7	25	2.32	2.08	0	
	8	26	3.17	3.17	0	r(15)=0.63, p<0.05*
	9	18	2.46	2.46	0	
	10	36	2.81	2.82	0	
	11	21	1.88	1.695	0	
	12	34	2.756	2.795	0	
	13	25	2.02	2	0	
	14	31	2.365	2.38	0	
	15	28	2	2	0	
Lake Mariginiup	2	20	42.02	42.08	12	
	3	14	41.54	41.21	n/a	
	4	26	41.86	41.87	12	
	6	26	41.85	41.85	24	
	7	23	41.32	41.2	n/a	
	8	28	41.88	41.88	17	r(12)= 0.67, p<0.05*
	9	10	41.3	41.3	n/a	
	10	33	41.8	41.85	n/a	
	11	10	41.3	41.3	n/a	
	12	30	41.77	41.77	0	
	13	15	41.3	41.3	17	
	14	31	41.65	41.69	0	
Lake Joondalup (North)	1	12	16.25	16.22	n/a	
	2	21	17.2	17.2	0	
	3	22	16.68	16.415	n/a	
	4	26	17.01	17.06	0	
	6	29	16.89	16.89	17	
	7	13	16.37	16.12	n/a	
	8	20	16.98	16.98	18	r(14)= 0.64, p<0.05*
	9	18	16.56	16.56	n/a	
	10	30	16.97	17.02	n/a	
	11	20	16.4	16.05	n/a	
	12	27	17.01	16.998	0	
	13	27	16.475	16.1	0	
	14	29	16.88	16.9	0	
	15	18	16.3	16.05	8	

Table 3.3: continued

Lake Joondalup (south)	6	20	16.89	16.89	17	
	7	14	16.37	16.12	n/a	
	8	23	16.98	16.98	18	
	9	17	16.56	16.56	n/a	
	10	23	16.97	17.02	n/a	
	11	16	16.4	16.05	n/a	r(10)= 0.65, p<0.05*
	12	25	17.01	16.998	0	
	13	28	16.475	16.1	0	
	14	27	16.88	16.9	0	
	15	14	16.3	16.05	8	
Lake Goollelal	1	15	26.805	26.805	0	
	2	19	27.637	27.66	0	
	3	15	27.15	26.955	0	
	4	19	27.45	27.49	0	
	5	6	26.72	26.66	0	
	6	20	27.36	27.38	0	
	7	11	26.97	26.8	0	
	8	27	27.49	27.49	0	r(15)=0.43, p<0.05*
	9	20	27.14	27.14	0	
	10	23	27.49	27.51	0	
	11	18	26.58	26.64	0	
	12	21	27.43	27.448	0	
	13	21	27	26.75	0	
	14	26	27.42	27.43	0	
	15	26	26.66	26.64	0	
Lexia 86	10	19			0	
	12	18			0	r(3)=0.0, p>0.05
	14	7			26	
Lexia 186a	10	15	48.3	48.3	26	
	12	5	48.3	48.3	26	r(6)=0.0, p>0.05
	14	7	48.3	48.3	26	
Melaleuca Park	10	26	51.1	51.11	0	
	12	24	51.03	51.03	0	
	13	21	50.69	50.41	13	r(5)=0.94, p<0.05*
	14	23	50.91	50.98	0	
	15	10	50.41	50.41	13	
Lake Gnangara	1	5	41.5	41.5	n/a	
	2	14	42.389	42.4	16	
	3	9	41.82	41.575	n/a	
	4	15	42.105	42.16	0	
	5	8	41.5	41.5	n/a	
	6	15	42.07	42.145	18	
	7	10	41.51	41.5	n/a	r(14)=0.79, p<0.05*
	8	15	42.23	42.23	18	
	9	6	41.75	41.75	n/a	
	10	12	42.275	42.275	n/a	
	11	7	41.7	41.5	n/a	
	12	15	42.19	42.43	0	
	13	10	41.62	41.5	7	
	14	18	42.1	42.1	0	

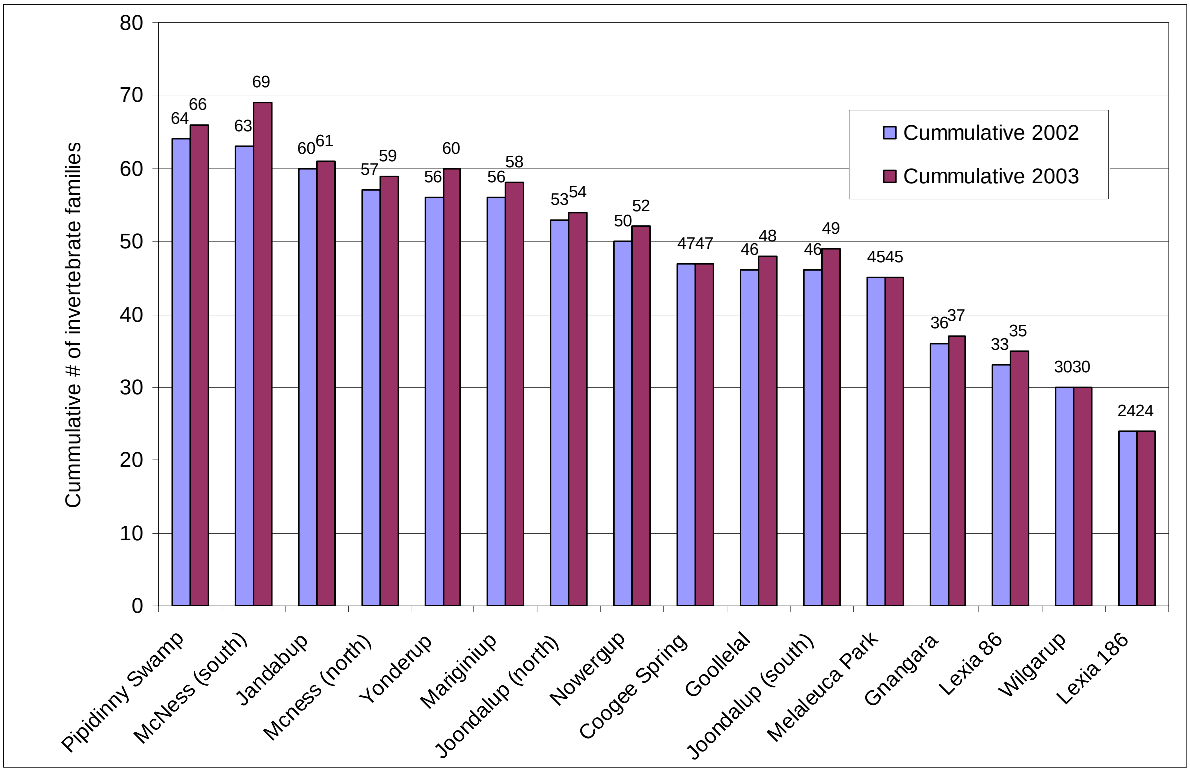
3.3 Macroinvertebrate community structure

Figure 3.5 compares the cumulative aquatic invertebrate family richness for each wetland and shows the difference between the cumulative family richness up to Round 13 (2002) versus that following Round 15 (2003). As three of the wetlands were first sampled as part of this monitoring project in spring 2000 (Melaleuca Park, Lexia 186 and Lexia 86), family richness data collected between 1995 and 1998 in a separate study conducted by Knott and Jasinska (2000) is incorporated into the scores for these three wetlands.

Of the wetlands sampled during Rounds 14 and 15 all showed an increase in cumulative family richness except for Melaleuca Park and Lexia 186a. Loch McNess (South) had the greatest increase in cumulative family richness, with six new families recorded at this wetland during Rounds 14 and 15. Subsequent to Round 15 Loch McNess (South) now has the highest cumulative family richness (sixty-nine families) of all the GMEMP wetlands. Pipidinny Swamp has the second highest (sixty-six families) and Jandabup the third highest (sixty-one) cumulative family richness. Of the six wetlands with the highest cumulative family richness, four are part of the Wanneroo linear chain of wetlands. Lexia 186a remains as the wetland with the lowest cumulative family richness (twenty-four), with no new taxa identified at this wetland in Rounds 14 and 15.

Two previously unrecorded taxa were identified in Rounds 14 and 15. Gyrinidae (Coleoptera) was collected at Lake Goollelal as an adult in Round 14 and as larvae in Round 15. According to Williams (1980) Gyrinidae occur throughout Australia, most frequently at the edges of small lakes, ponds, dams and sheltered sections of creeks. Gyrinidae adults skim on the waters surface feeding mainly on insects that have fallen or are trapped at the surface film. Gyrinidae larvae are active predators. Sisyridae (Neuroptera) was recorded from Loch McNess (South) in Round 14 as a larva. Sisyridae are known to have larvae that are fully aquatic (Williams, 1980). Larvae occur in standing freshwater and have been recorded from several Swan Coastal Plain wetlands (Davis and Christidis, 1997).

Figure 3.5 Cumulative number of invertebrate families sampled from the Gnangara Mound wetlands between summer 1996 (Round 1) and summer 2002 (Round 13).



3.4 Individual wetland discussion

The following discussion presents a summary of the ecological condition of each wetland, taken from macroinvertebrate data, water quality data, and general observations made during site visits. More detailed discussion of macroinvertebrate results and water quality data for each wetland are given in Appendices 2 and 3 respectively.

3.4.1 Coogee Springs

Coogee Spring was visited in Round 14 on the 28th August 2002; at this time the wetland basin was completely dry and covered in terrestrial grasses, this is the first occasion since monitoring began that Coogee Spring has not contained surface water during a spring monitoring round. No water level augmentation has been undertaken to date in 2002 and 2003. A report into the effects of artificial water level maintenance on the aquatic macroinvertebrate richness of Coogee Spring and reviewing the EWP's specified for this wetland, was commissioned by the WRC in 2002 (Benier and Horwitz, 2002). This report concluded that the current water level maintenance regime and EWP's applied to the wetland would not result in the maintenance of aquatic macroinvertebrate richness.

In both round 1 4 and 15 tree deaths were evident on the western margin of the wetland. A fire ignited in the Northern section of Coogee Spring approximately two weeks prior to Round 14 sampling. The fire continued to smoulder within the organic/peat soil up to at least the 17th September 2002 when the wetland was revisited. Significant loss of organic/peat soils was evident in the Northern section of the wetland, with the organic/peat soil burnt-out to the underlying sandy substrate. *Melaleuca spp* showed signs of a crown fire; also numerous *Melaleuca spp* were up-rooted due to the organic/peat soil being burnt from around their base. Anecdotal evidence from surrounding landowners indicates that Coogee Spring has previously been burnt during the winter/spring period, to remove *Typha* stands adjacent to private land, without the organic/peat soil being ignited. This anecdotal evidence would suggest that the excessive drying of the organic/peat soils of Coogee Spring, as a result of reduced ground water levels below the wetland and the halting of water level augmentation, has increased the susceptibility of the wetlands organic/peat soils to fire. The drying of organic soils also changes the water holding capacity of the sediment and will result in the release of nutrients into the water when re-inundated.

3.4.2 Lake Gnangara

The family richness of Lake Gnangara remains consistently low in comparison to most other wetlands studied as part of the GMEMP. This is due to the poor water quality of Lake Gnangara and in particular the low water pH. Lower water levels at this wetland in Rounds 14 and 15, and in recent years, has resulted in reduced inundation of littoral and fringing vegetation and therefore lower wetland habitat complexity. Habitat complexity is important to aquatic macroinvertebrate richness i.e. the more diverse the habitat complexity the more diverse the macroinvertebrate community composition of a wetland (Balla and Davis, 1993).

Dense mats of (red coloured) filamentous algae were apparent throughout the wetland in Round 14 (with associated high chlorophyll *a* and turbidity). Nitrogen concentrations at Lake Gnangara are consistently (and often significantly) higher than any other GMEMP wetland. These observations and results show that as well as being acidic, and having declining water levels, symptoms of eutrophication are evident.

3.4.3 Lake Goollelal

Water levels in sites for Round 15 were the lowest recorded during this monitoring sequence. Despite apparently good water quality in comparison to most other wetlands (**Table A3.1**) and a variety of diverse habitat types, Lake Goollelal has a relatively low cumulative family richness (forty-eight families subsequent to round 14 and 15 sampling) compared to other permanent wetlands such as Lake Yonderup, Lake Nowergup and Loch McNess (South). Consistently high chlorophyll *a* concentrations in comparison to other monitored wetlands and the presence of dense filamentous algae in both Rounds 14 and 15, indicate that this wetland is susceptible to eutrophication.

Of the wetlands sampled in Round 14 and 15 only Melaleuca Park, Lake Gnangara, Lexia 186 and Lexia 86 having lower cumulative family richness. In both Round 14 and 15 there was a high percentage (46% and 58% respectively) of taxa recorded from only a single habitat. This reflects the diverse nature of habitats at this wetland and illustrates the significance of habitat diversity to aquatic macroinvertebrate diversity. *Gambusia sp* has consistently been recorded in high abundances at sampling sites in this wetland. *Gambusia sp* are known to predate on aquatic macroinvertebrates (Pen and Potter, 1991) and are likely to be a factor in the low aquatic macroinvertebrate family richness at this wetland.

3.4.4 Lake Jandabup

Lake Jandabup had the third highest aquatic invertebrate family richness in Round 14, the highest family richness in Round 15 and has the third highest cumulative family richness of any of the GMEMP wetlands. There has been a clear trend of increasing aquatic invertebrate family richness at Lake Jandabup subsequent to artificial water level maintenance being commenced following the wetland drying in 1998, with family richness in Round 15 equal to that of Round 14. These results would suggest that while water level augmentation exists, seasonality is not the main factor driving aquatic macroinvertebrate richness at this wetland, but rather that water quality and water level (and therefore habitat complexity) are more significant to aquatic invertebrate richness. Water physico-chemistry results (especially pH and conductivity) indicate that there is less seasonal variation in water quality now than that which occurred prior to artificial water level maintenance during the summer/autumn period. High concentrations of all nutrients, high conductivity and high SO_4^{2+} concentration seem to indicate a decline in water quality in Round 15, most likely associated with the low water levels in summer 2003.

Ceinidae (Amphipoda), which were highly abundant prior to the wetland drying in 1998, again increased in abundance in Rounds 14 and 15. Ceinidae was recorded at all sites in round 15. Planorbidae (Gastropoda), which were similarly abundant prior to 1998 but disappeared following the drying event, have been collected in all sampling rounds since 2001. Macrothricidae (Cladocera), which were collected in high abundance in the two years after the 1998 drying event, have declined significantly in abundance since Round 12. These apparent changes in the aquatic macroinvertebrate community composition of lake Jandabup seem to indicate that the aquatic macroinvertebrate community of this wetland (and possibly other Gnangara Mound wetlands) has the capacity to recover from a significant acidification stress event if appropriate water level augmentation is applied (and presumably maintained).

3.4.5 Lake Joondalup (North)

High chlorophyll *a* (Rounds 14 and 15), high dissolved oxygen concentration (Round 15) and high nutrient concentrations (Round 15) are indicative of the poor water quality of Lake Joondalup (North) in 2002/2003. Filamentous green algae were abundant throughout the wetland in Round 14, an indication of eutrophic conditions. Round 15 water levels were considerably lower than in recent summer sampling rounds. Very little of the littoral and fringing vegetation of the wetland was inundated at the time of sampling contributing to the low aquatic invertebrate family richness recorded at the wetland in Round 15. The wetland dried completely in summer/autumn 2003, subsequent to sampling.

3.4.6 Lake Joondalup (South)

Low water levels in Round 15 resulted in considerably poor water quality being recorded at Lake Joondalup (South) in summer compared to Round 14 (spring). Low gilvin and high nutrient concentrations (except for NO_2^-/NO_3^-) combined resulted in high chlorophyll *a* and low dissolved oxygen concentration, indicating eutrophic conditions at this wetland in Round 15. Spring aquatic invertebrate family richness continues to increase at this wetland, with Round 14 having higher family richness than all previous spring sampling rounds. At the time of Round 15 sampling none of the littoral and fringing vegetation surrounding this wetland was inundated and therefore aquatic macroinvertebrate sampling was restricted to the open-water habitat only, contributing to the low family richness in Round 15.

Autumn observations record extensive coverage of vegetation over lake floor; if high water levels occur in spring, this vegetation will be inundated, decompose, alter water quality and possibly increase nutrient release into the water column.

3.4.7 Lexia 86

This wetland was effectively dry at the time of Round 14 sampling, no surface water was apparent within the wetland basin. Aquatic macroinvertebrate and water samples were therefore collected from three *Cherax* burrows within the wetland basin. These same burrows were completely dry in round 15. Round 14 is the first spring sampling round in which this wetland has not filled. The water physico-chemistry results obtained for this wetland are therefore more reflective of groundwater quality than they are of wetland water quality. Several aquatic macroinvertebrate taxa previous unrecorded at this wetland were collected from these unique habitats in Round 14, indicating the importance of refugial aquatic habitats when wetlands dry.
If water levels continue to decline, organic soils will be exposed, possibly dry and crack, resulting in susceptibility to acidification and fire.

3.4.8 Lexia 186

Sampling of water physico-chemistry and aquatic macroinvertebrates was again restricted to the small excavated sump in the Northern margin of Lexia 186a. No new taxa of aquatic macroinvertebrate were collected in Round 14 sampling. This habitat was completely dry at the time of Round 15 sampling. As yet Lexia 186b has not been sampled during GMEMP monitoring rounds, as the wetland has not contained surface water during any sampling round. The extensive and dense sedge vegetation of Lexia 186a (now dead) and the organic sediment of Lexia 186b are indicative of habitats that remained inundated for prolonged periods. It should there be of significant concern that these wetlands have not filled (the wetland basin of Lexia 186a has not contained surface water) during spring (the period of presumed maximum water level) since their inclusion in the GMEMP.

If water levels continue to decline, plant communities will change and macroinvertebrate aquatic assemblages will disappear, and organic soils will be exposed, possibly dry and crack, resulting in susceptibility to acidification and fire.

3.4.9 Lake Mariginiup

Water levels were low in both Rounds 14 and 15 compared to previous spring and summers respectively, continuing the trend of declining spring peak water levels and increased period of desiccation at this wetland. The pH in Rounds 14 was the lowest recorded at this wetland, and the pH in Round 15 was lowest recorded in summer sampling rounds. SO_4^{2+} was recorded at the highest concentration ever at this wetland in round 15. The low pH and high SO_4^{2+} concentration recorded at the wetland in Rounds 14 and 15 should be of serious concern to the WRC. Lake Mariginiup is located on the same acid-sulphate soil complex as Lake Jandabup, which suffered a significant acidification event following excessive drying in 1995. The susceptibility of Lake Mariginiup to acidification due to excessive drying of sediments needs to be urgently investigated and appropriate management strategies instigated if deemed necessary.

Excessive drying at Lake Mariginiup has also resulted in the exposure of organic soils on the eastern and North-eastern margin of the wetland. This drying of organic sediment effects their water holding capacity and results in nutrient release when re-inundated, therefore affecting the moisture holding potential of the wetland and water quality subsequent to filling.

The exposure of organic sediments at Lake Mariginiup resulted in susceptibility to fire, and a fire burnt some sections of the organic sediment along the eastern margin of the wetland in December 2002. This resulted in the destruction of trees (*Melaleuca spp*) and sedges along the eastern margin and the burning of organic sediments in patches.

3.4.10 Loch McNess (North)

Water levels in Round 14 were lower than previous spring sampling rounds at Loch McNess (North), and this wetland was again dry in summer (Round 15). In Round 14 conductivity was higher than previously recorded at this wetland. High chlorophyll *a* concentration and high turbidity are evidence of the large amount of filamentous algae apparent at the time of sampling. Despite this wetland being sampled on only ten occasions Loch McNess (North) has the fourth highest cumulative family richness of all wetlands sampled as part of the GMEMP. The greatest threatening processes to this wetland are reduced spring peak water levels (with associated increase in period of desiccation) and the continued spread of *Typha sp*. This invasive species has formed a monoculture throughout the wetland basin (reducing habitat complexity). The continued spread of *Typha sp* was noted in Rounds 14 and 15.

3.4.11 Loch McNess (South)

Following Round 14 and 15 sampling Loch McNess (South) had the greatest increase in aquatic macroinvertebrate cumulative family richness and now has the highest cumulative family richness of any wetland monitored. Water levels in both Rounds 14 and 15 were low in comparison to previous sampling rounds but this variation is marginal. The majority of water quality parameters were within the range recorded in previous sampling rounds, with no noticeable decline in water quality in rounds 14 and 15. Loch McNess (South) is a permanent wetland, has good water quality in comparison to other GMEMP wetlands and has a wide diversity of habitat types. These factors undoubtedly contribute to the high aquatic invertebrate family richness of this wetland. Lower water levels were apparent at Loch McNess (South) in both Rounds 14 and 15 but it is unlikely that this wetland would dry completely. During a period of reduced water levels at other Gnangara Mound wetlands, permanent lakes such as Loch McNess (South) will become important refugia for aquatic macroinvertebrate taxa that require permanent water.

3.4.12 Melaleuca Park

There was a considerable decline in water quality at Melaleuca Park especially in Round 15 when compared to previous sampling rounds. Lower water levels were evident at this wetland in both Rounds 14 and 15, with surface water in Round 15 restrict to the *Baumea articulata* stand in the centre of the wetland basin. In round 15 all nutrients concentrations, conductivity, temperature and chlorophyll *a* were recorded at their highest levels ever at this wetland. Aquatic macroinvertebrate family rich has decline in every sampling round (spring and summer respectively) since monitoring commenced at this wetland.

The presence of several unique aquatic macroinvertebrate taxa and the significant outlier population of the endemic fish *Galaxiella nigrostriata* make changes to the physico-chemistry of Melaleuca Park highly significant. Reduced spring peak water levels in spring (Rounds 12 and 14) and summer (Rounds 13 and 15), the increased water temperature and the declining pH levels in recent spring and summer sampling rounds need to be addressed. The causes of these changes need to be identified so that appropriate management strategies to preserve the ecological functioning of this wetland (and therefore the *G. nigrostriata* population) can be identified.

3.4.13 Lake Nowergup

A report (The Effect of Artificial Maintenance of Water Levels on the Aquatic Invertebrate Fauna of Lake Nowergup, with Notes on the Water Quality and Sediments by Horwitz and Benier, 2003) was commissioned by the WRC in 2003 to assess the effectiveness of the artificial water level maintenance regime currently undertaken at Lake Nowergup in maintaining aquatic macroinvertebrate richness. Aquatic macroinvertebrate family richness, and family composition, data at Lake Nowergup suggest that water level augmentation has been successful in protecting aquatic invertebrates dependent on permanent water. However, a decline in habitat diversity and a matching decline in summer family richness suggest that this success is unlikely to persist into the future. The major threatening processes to this will be the continued spread of *Typha* over the lake and the drying of organic rich sediments.

Although the water level of Lake Nowergup is artificially maintained over the summer/autumn period, the lake is currently experiencing a period of declining spring peak water levels and lower summer water levels. Spring peak water levels have fluctuated markedly in recent years due to inconsistent water level maintenance. Despite the water level being actively maintained at the time of sampling in Round 15 only two habitats were inundated (open water and fringing *Typha sp*) at the time of sampling, contributing to the low aquatic invertebrate family richness recorded in Round 15. The current water level maintenance regime is therefore considered inadequate in that it has not resulted in the inundation of previous sampled habitats at this wetland. The exposure of organic/peat soils at this wetland in recent rounds indicates a need to develop a fire management strategy for this wetland in line with that proposed for other Gnangara Mound wetlands with organic sediments.

3.4.14 Pipidinny Swamp

Following the completion of Round 14 and 15 sampling Pipidinny Swamp has the second highest aquatic macroinvertebrate cumulative family richness of the GMEMP wetlands. Due to the isolated nature of the aquatic habitats of Pipidinny swamp there were a high percentage of taxa recorded from a single habitat in both Round 14 (42%) and Round 15 (57%). There was very little variation in the aquatic invertebrate family richness between Round 14 and 15 (thirty-one and twenty-eight families respectively). There is considerable variation in the water physico-chemistry between sites due to their isolation. The continued decline in water levels was evident in both Round 14 and 15, high conductivities, associated with saline water intrusion, at several habitats is due to reduced groundwater levels. The concentration of all nutrients was high in Round 14 compared to previous spring sampling rounds. Results of rounds 14 and 15 show the high variability in water quality and invertebrate richness and composition between habitats at Pipidinny Swamp. These habitats have become spatially isolated due to continued declines in spring peak and summer minimum water levels.

3.4.15 Lake Wilgarup

Lake Wilgarup was again dry in 2002/2003 (Rounds 14 and 15). A fire, which occurred at Coogee Spring in 2002, illustrates the increased fire susceptibility of Gnangara Mound wetlands with organic sediments. The burning of organic sediments leads to subsequent changes in wetland physico-chemistry and functioning, and poses a serious health threat to local residents. Lake Wilgarup has a deep (approximately 1m depth) organic/peat sediment profile that has been dry for several years.

3.4.16 Lake Yonderup

Lake Yonderup (as with Loch McNess – South) is a permanent wetland with good water quality and diverse habitat types. Water physico-chemistry has remained relatively homogeneous throughout the duration of the GMEMP. The only change of note to the physico-chemistry of this wetland in Rounds 14 and 15 was a marginal increase in conductivity in both rounds compared to previous sampling occasions. This wetland had the second highest family richness in both Rounds 14 and 15 and harbours several species found only in the Northern most GMEMP wetlands (i.e. Pipidinny Swamp and Loch McNess). As with Loch McNess (South), during a period of reduced water levels at other Gnangara Mound wetlands permanent lakes such as this will become important refugia for aquatic macroinvertebrate taxa that must avoid desiccation.

3.5 Introduced species

3.5.1 *Gambusia sp.*

Gambusia were collected in samples from Lake Joondalup (North), Lake Goollelal, Loch McNess (North) and McNess (South), Lake Yonderup, Lake Nowergup and Pipidinny Swamp in Round 14. In Round 15 G*ambusia* were recorded at Lake Joondalup (North), Lake Goollelal, Loch McNess (South), Lake Yonderup, Pipidinny Swamp and Lake Nowergup. The presence of *Gambusia* is likely to be negatively affecting the native fish (gobies and galaxid), tadpoles and macroinvertebrate community composition at these wetlands. *Gambusia* is not known to possess mechanisms for surviving desiccation and therefore occur primarily in wetlands which are permanent, or which retain some surface water through summer. Once introduced, wetland drying is likely to be the only none chemical method for the removal of *Gambusia* from a water body.

3.5.2 *Typha orientalis*

Typha orientalis has been given the highest environmental weed rating by the Environmental Weed Strategy for Western Australia (CALM 1999), because of its ability to invade waterways and form monocultures, thereby changing the structure, composition, and function of ecosystems (Chapman and Horwitz, 2001). *Typha* has formed monocultures at Loch McNess (North), Lake Nowergup (western shore), Coogee Springs and several sites at Pipidinny Swamp. *Typha* is present in patches at Lake Joondalup (North) and Lake Joondalup (South), Lake Goollelal, Lake Mariginiup, Loch McNess (South), and several sites at Pipidinny Swamp.

It is unlikely that this introduced species can be eradicated from wetlands where it has formed large monocultures as it can reproduce from both seeds and rhizomes. Where at present *Typha* occurs only in isolated or small patches, management authorities should undertake eradication measures. Although the exact affects are not yet known, *Typha* monocultures do result in a loss of habitat diversity that will result in lower aquatic macroinvertebrate family richness.

4 Conclusions

The present report documents the monitoring work carried out on fourteen wetlands on the Gnangara Mound aquifer during spring 2001 (Round 14) and summer 2002 (Round 15). Data from Rounds 14 and 15 are compared with those from the previous eleven sampling rounds (summer 1996 – summer 2002). The objective of this monitoring program is to provide information on the status of aquatic macroinvertebrates in these wetlands and their response to changes in water quality and water levels.

Overall, the results from rounds 14 and 15 confirm the trend of higher macroinvertebrate family richness in spring rounds when wetland water levels are high, and lower family richness in summer when water levels are low. This result is supported by significant statistical correlations between family richness and water levels at the time of sampling for the majority of wetlands monitored in this project. Although aquatic invertebrate family richness remains higher in spring sampling rounds, mean summer family richness has increased in recent years. This is likely due to the effects of artificial water level maintenance at Lake Jandabup and Lake Nowergup during the summer/autumn period. Aquatic macroinvertebrate family richness was highest at Loch McNess (South) in spring 2002 (Round 14). Lake Jandabup had the highest aquatic invertebrate family in summer 2003 (Round 15).

Water levels at almost all the wetlands continue the declining trend evident in previous rounds. Coogee Spring did not fill in spring 2002, the first spring sampling round in which this wetland was dry. Currently no artificial water level maintenance is currently being undertaken at this wetland and it is therefore unlikely that Coogee Spring will contain significant surface water except in years of above average rainfall. Water quality and aquatic macroinvertebrate community structure appears to be recovering at Lake Jandabup following the wetland drying excessively in 1998 (Round 5).

The drying of organic sediments in wetlands on the Gnangara Mound was highly over the 2002/2003 periods by fires at Coogee Spring and Lake Mariginiup. In both cases the excessive drying of organic sediment resulted in the burning organic sediments at these wetlands. The exposing and drying organic sediments will change not only the water holding capacity of these sediments but also the wetland water quality following inundation.

5 References

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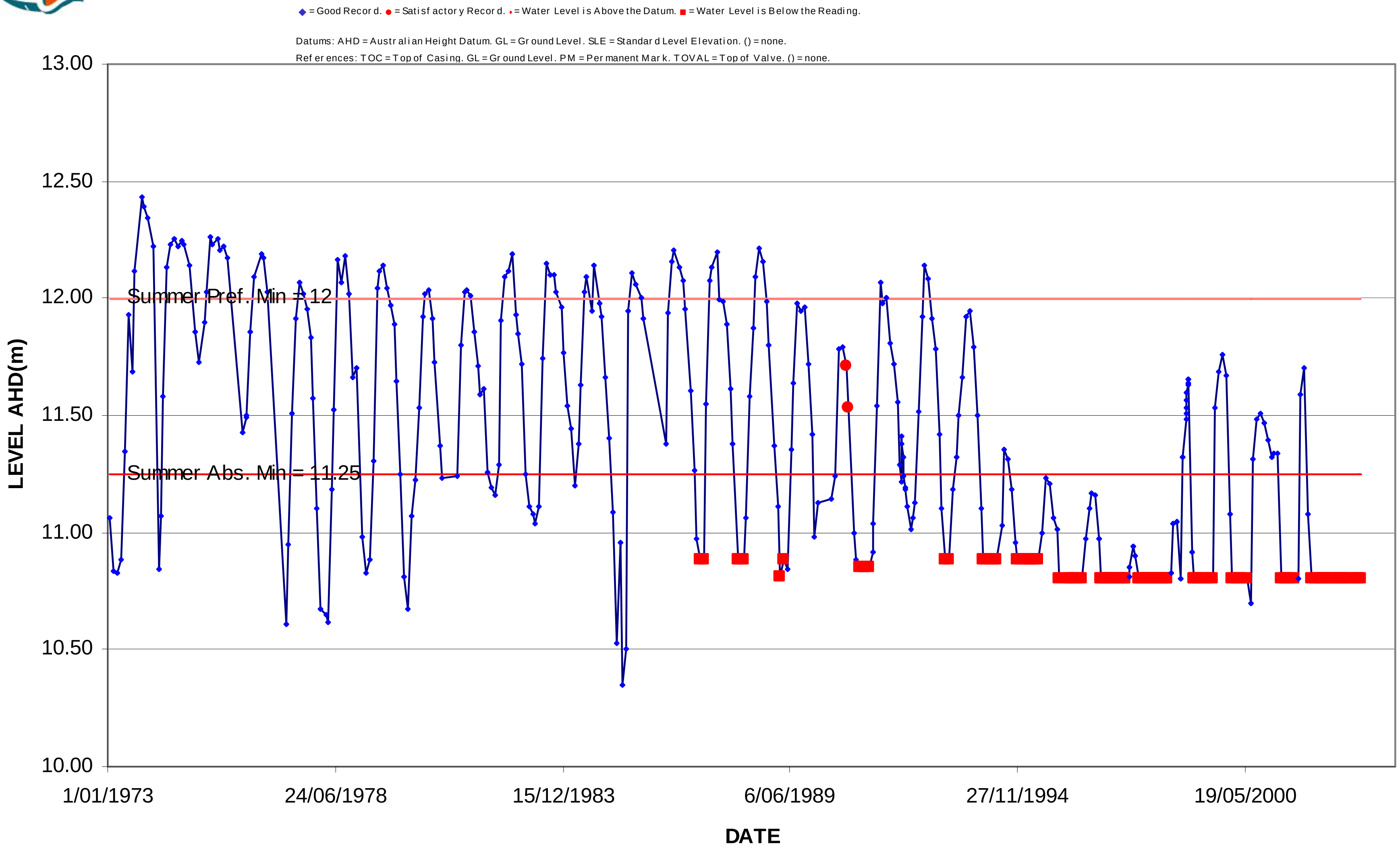
APPENDIX I: Gnangara Mound Wetland Water Levels

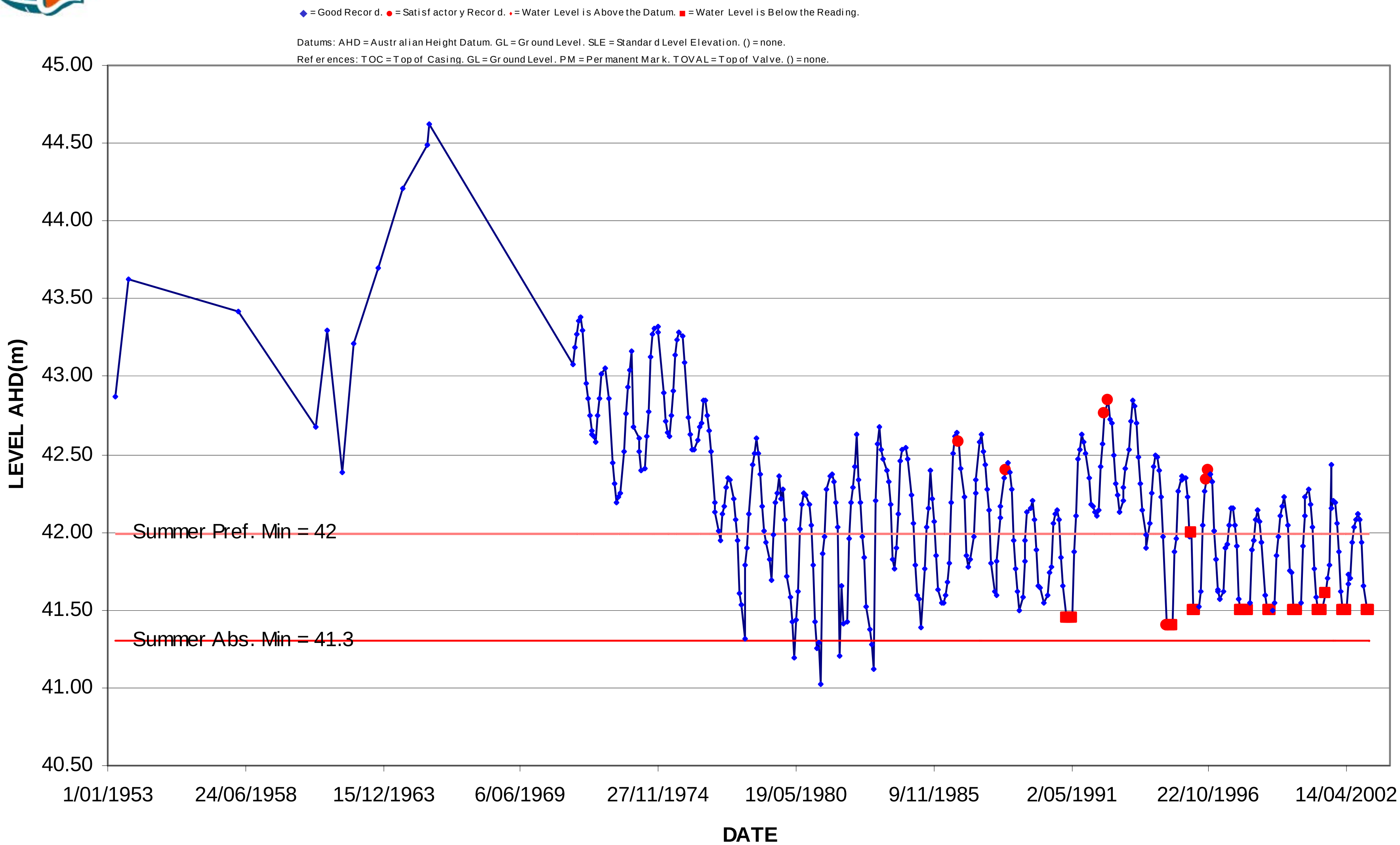
6162566 LAKES AND WETLANDS COOGEE SPRING 8755

Easting = 377475.00 Northing = 6504388.00 Zone = 50 PM = 13.116mAHD WIN SITE ID = 14587



6162591 LAKES AND WETLANDS GNANGARA LAKE 8386

Easting = 392389.00 Northing = 6482374.00 Zone = 50 PM = 45.745mAHD WIN SITE ID = 14612

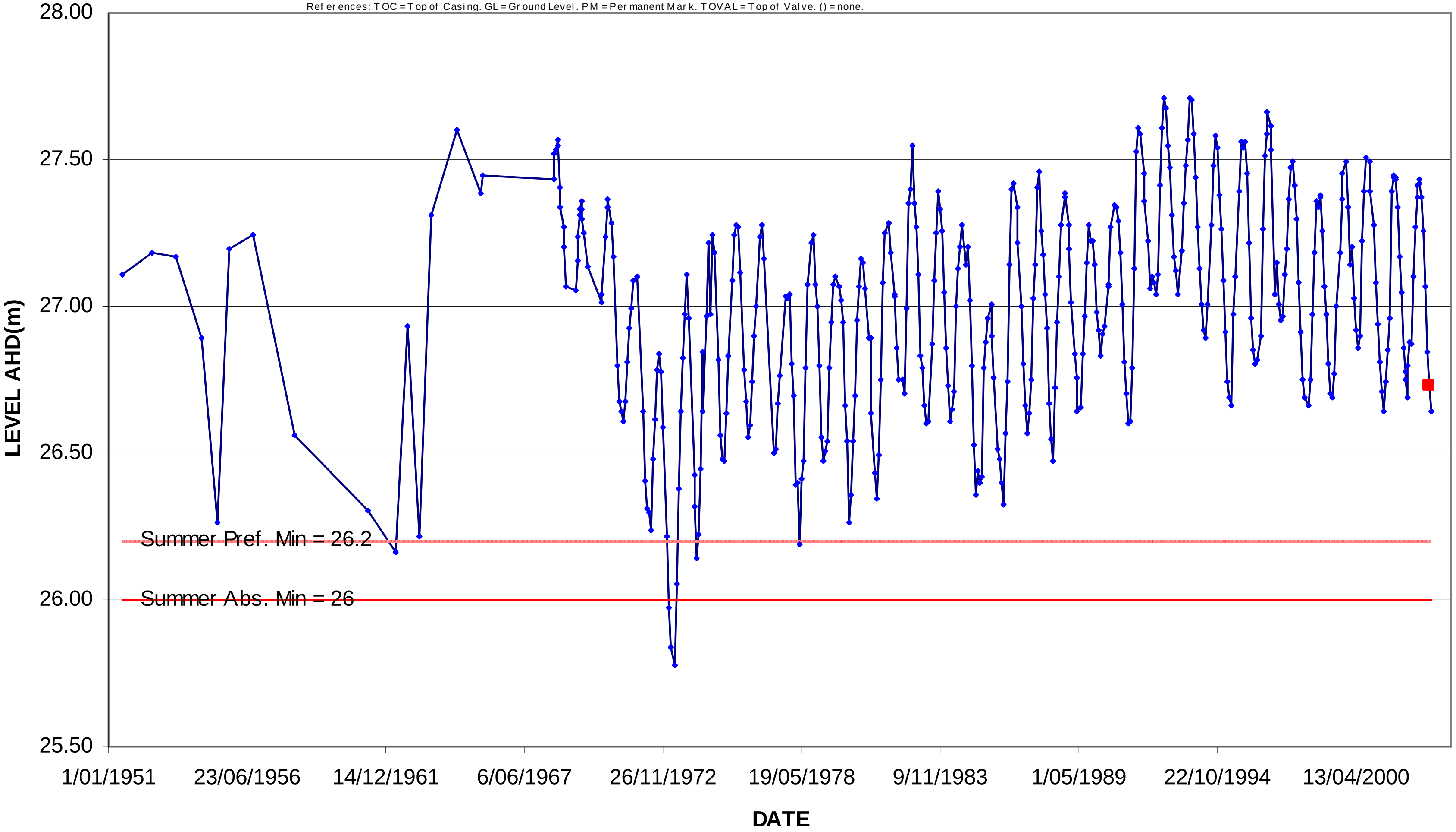


6162517 LAKES AND WETLANDS LAKE GOOLLELAL 459

Easting = 387838.00 Northing = 6479242.00 Zone = 50 PM = 29.959mAHD WIN SITE ID = 14538

◆ = Good Record. ● = Satisfactory Record. ▴ = Water Level is Above the Datum. ■ = Water Level is Below the Reading.

Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation. () = none.
References: TOC = Top of Casing. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.



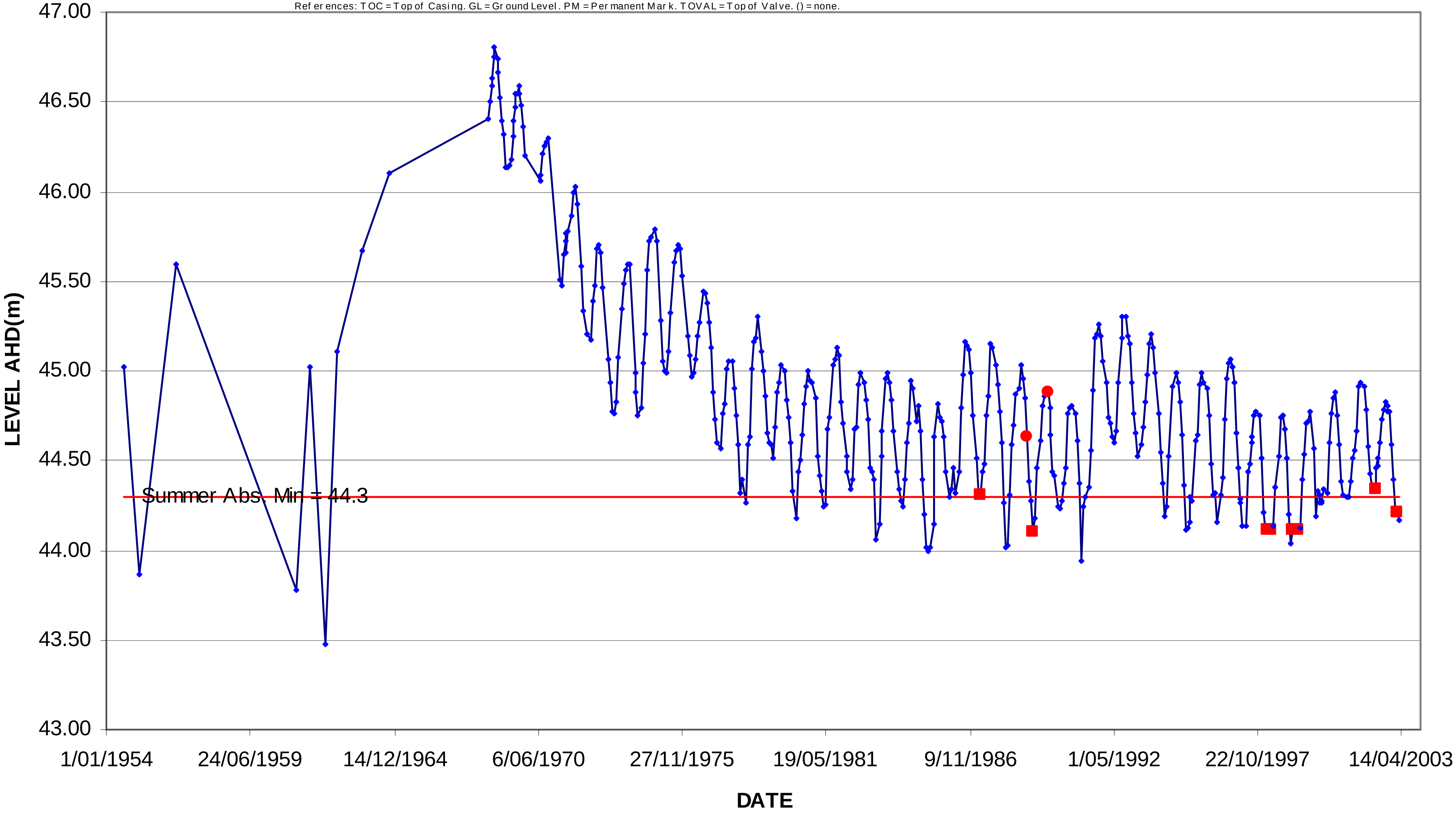
6162578 LAKES AND WETLANDS JANDABUP LAKE 1944

Easting = 390818.00 Northing = 6487087.00 Zone = 50 PM = 54.457mAHD WIN SITE ID = 14599

◆ = Good Record. ● = Satisfactory Record. ♦ = Water Level is Above the Datum. ■ = Water Level is Below the Reading.

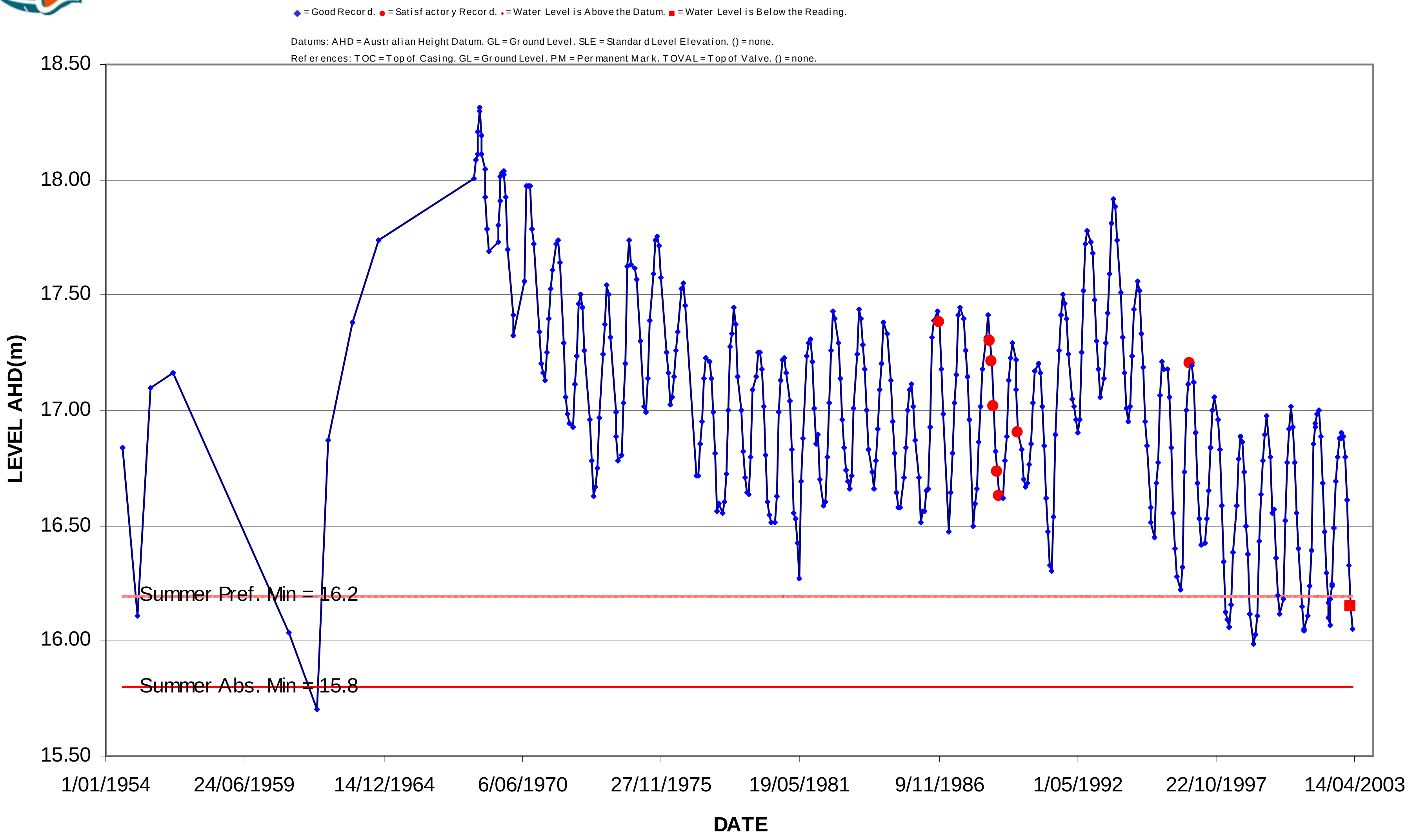
Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation. () = none.

References: TOC = Top of Casing. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.



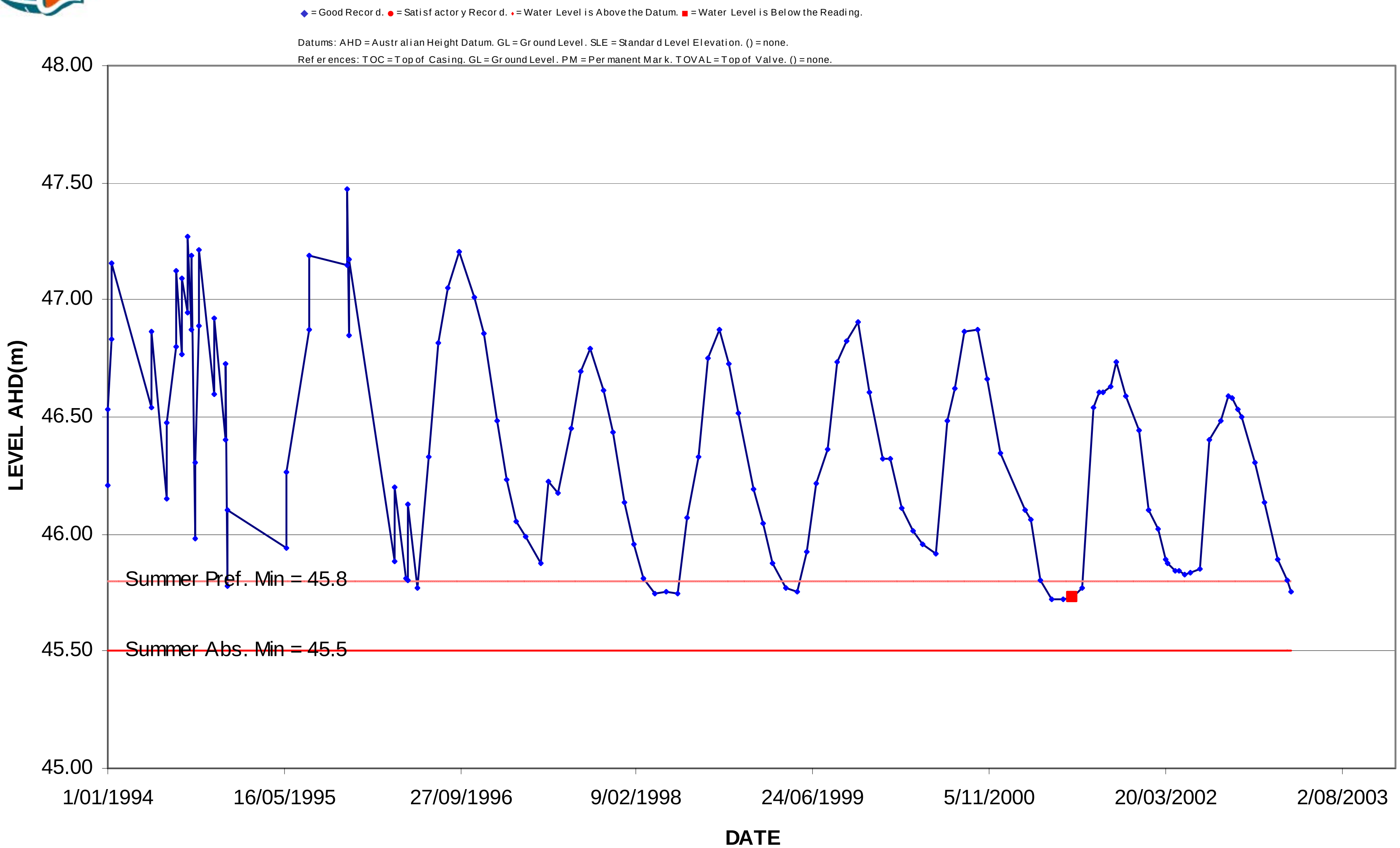
6162572 LAKES AND WETLANDS LAKE JOONDALUP 8281

Easting = 384239.00 Northing = 6487399.00 Zone = 50 PM = 32.353mAHD WIN SITE ID = 14593



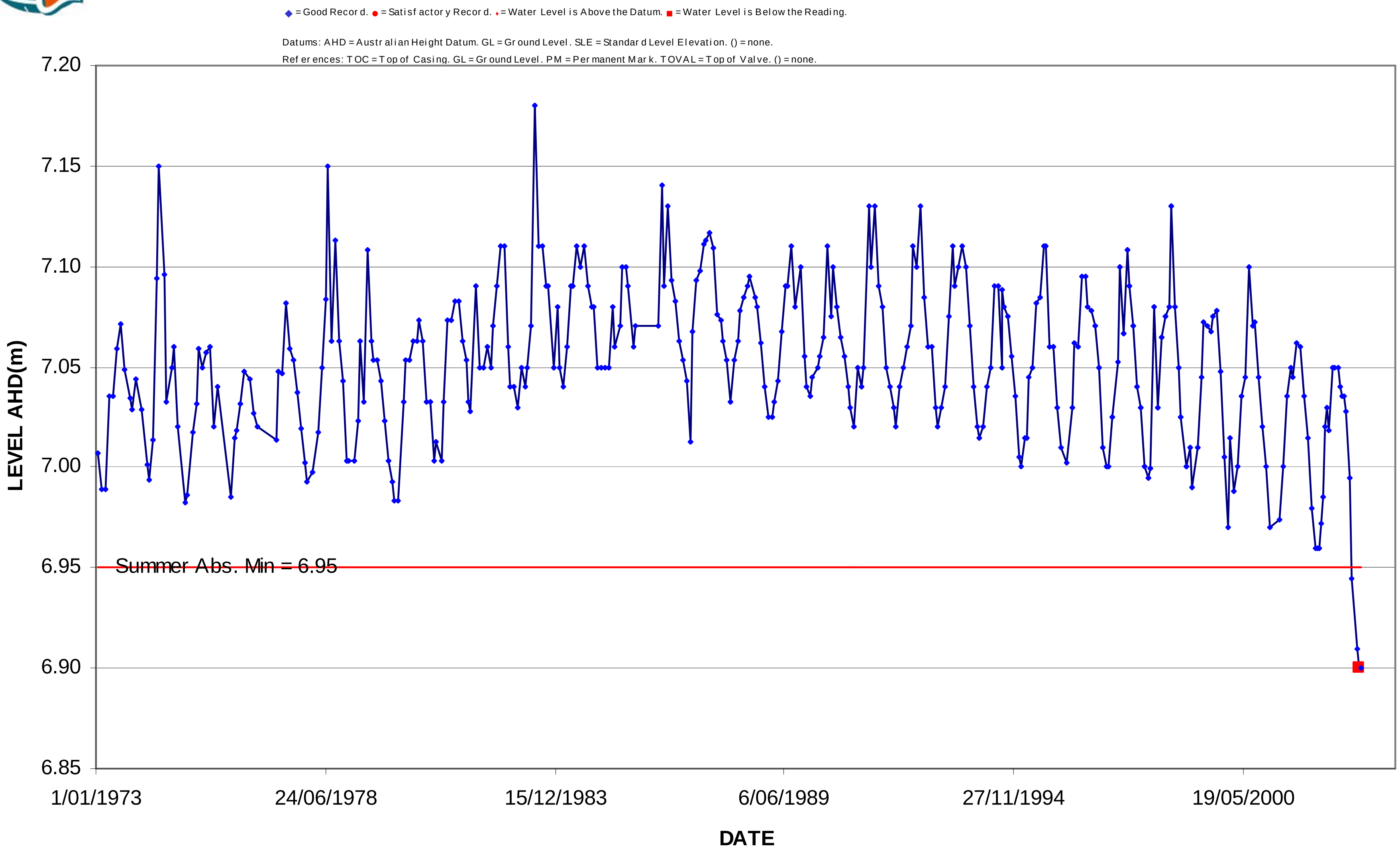
61613216 GNANGARA MOUND GNM17A (SEMINIUK D8S)

Easting = 402824.00 Northing = 6486433.00 Zone = 50 TOC = 48.003mAHD WIN SITE ID = 12282948



6162564 LAKES AND WETLANDS LOCH MCNESS 8754

Easting = 374799.00 Northing = 6508739.00 Zone = 50 PM = 13.871mAHD WIN SITE ID = 14585

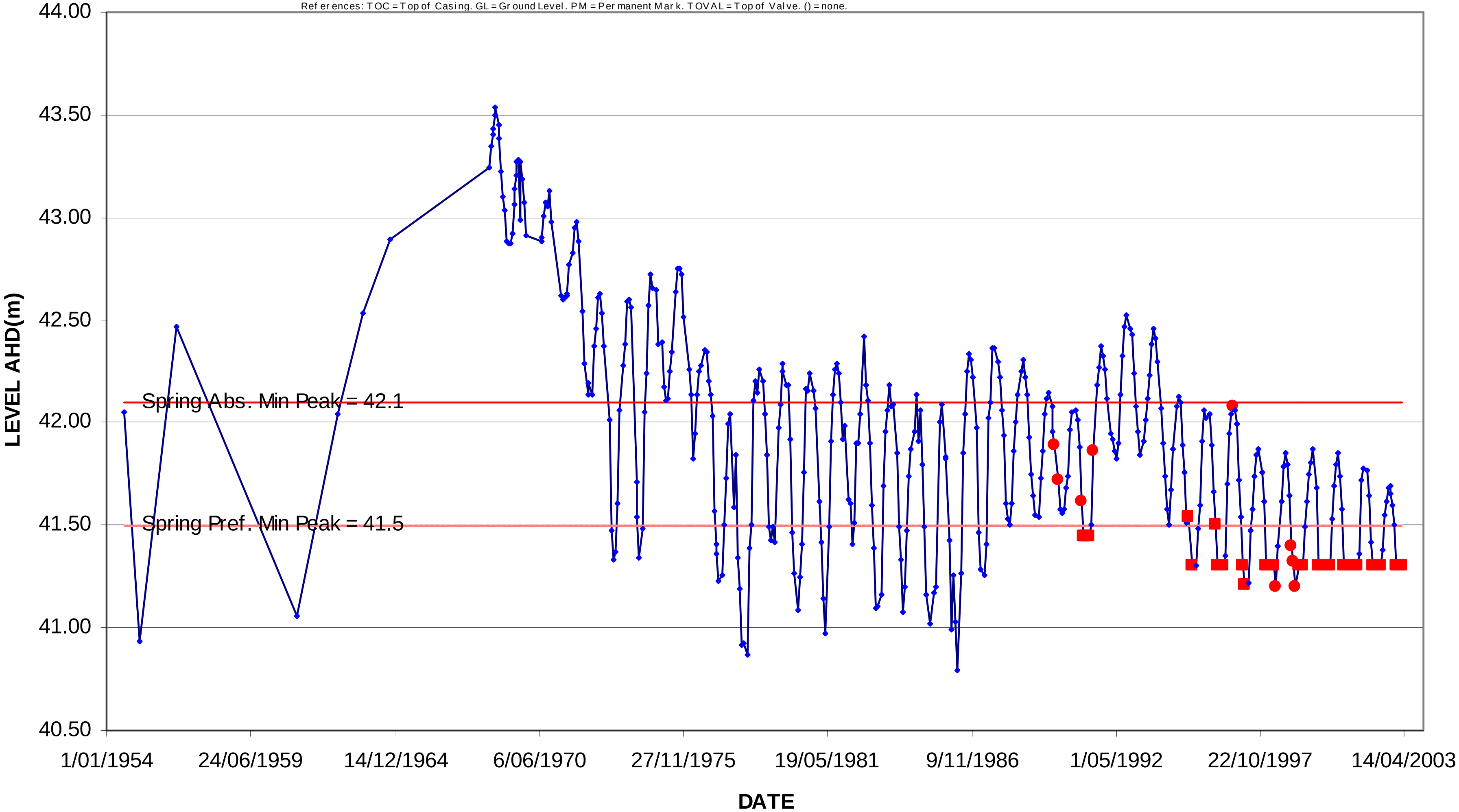


6162577 LAKES AND WETLANDS LAKE MARIGINIUP 1943

Easting = 387304.00 Northing = 6489134.00 Zone = 50 PM = 51.169mAHD WIN SITE ID = 14598

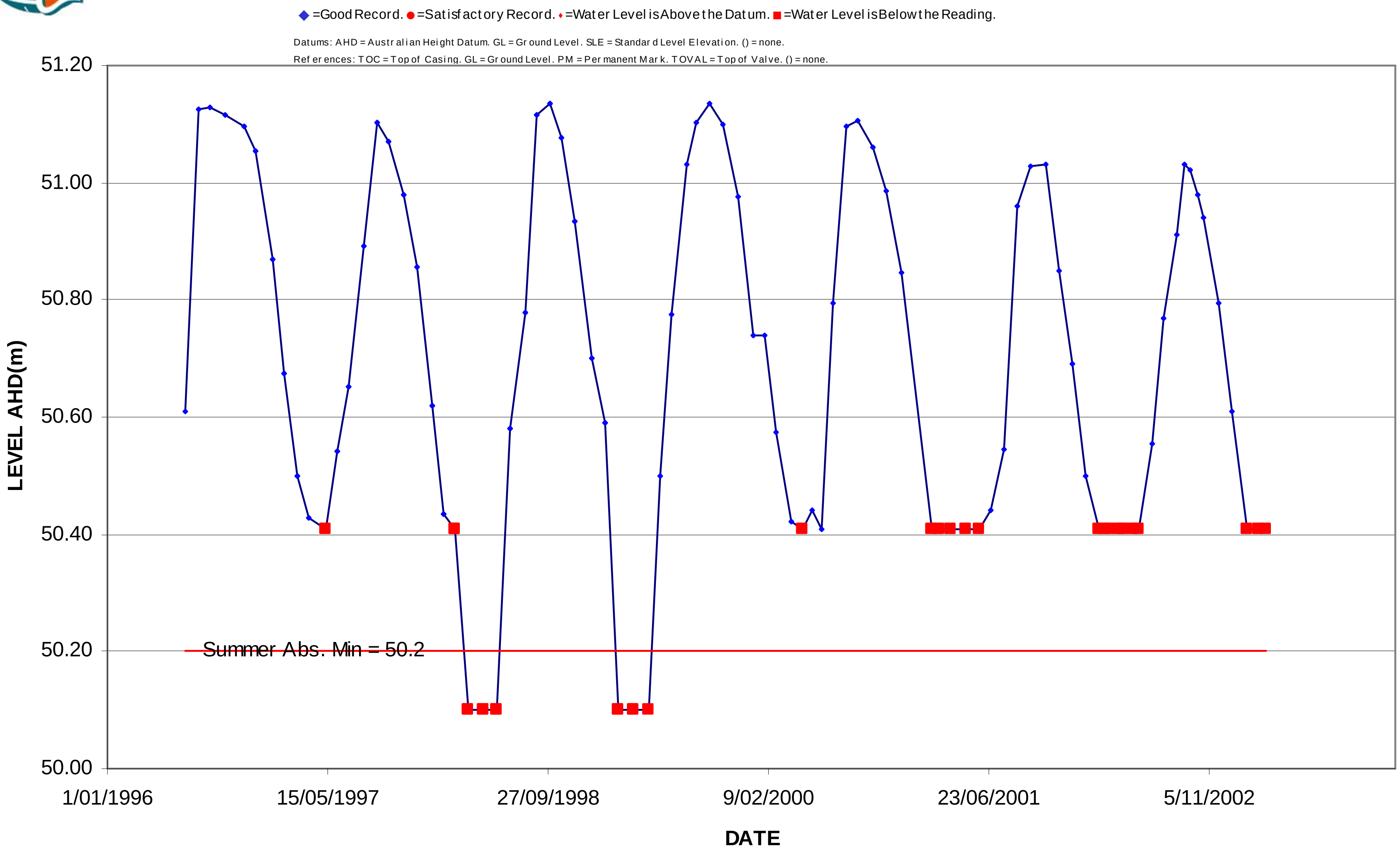
◆ = Good Record. ● = Satisfactory Record. • = Water Level is Above the Datum. ■ = Water Level is Below the Reading.

Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation. () = none.
References: TOC = Top of Casing. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.



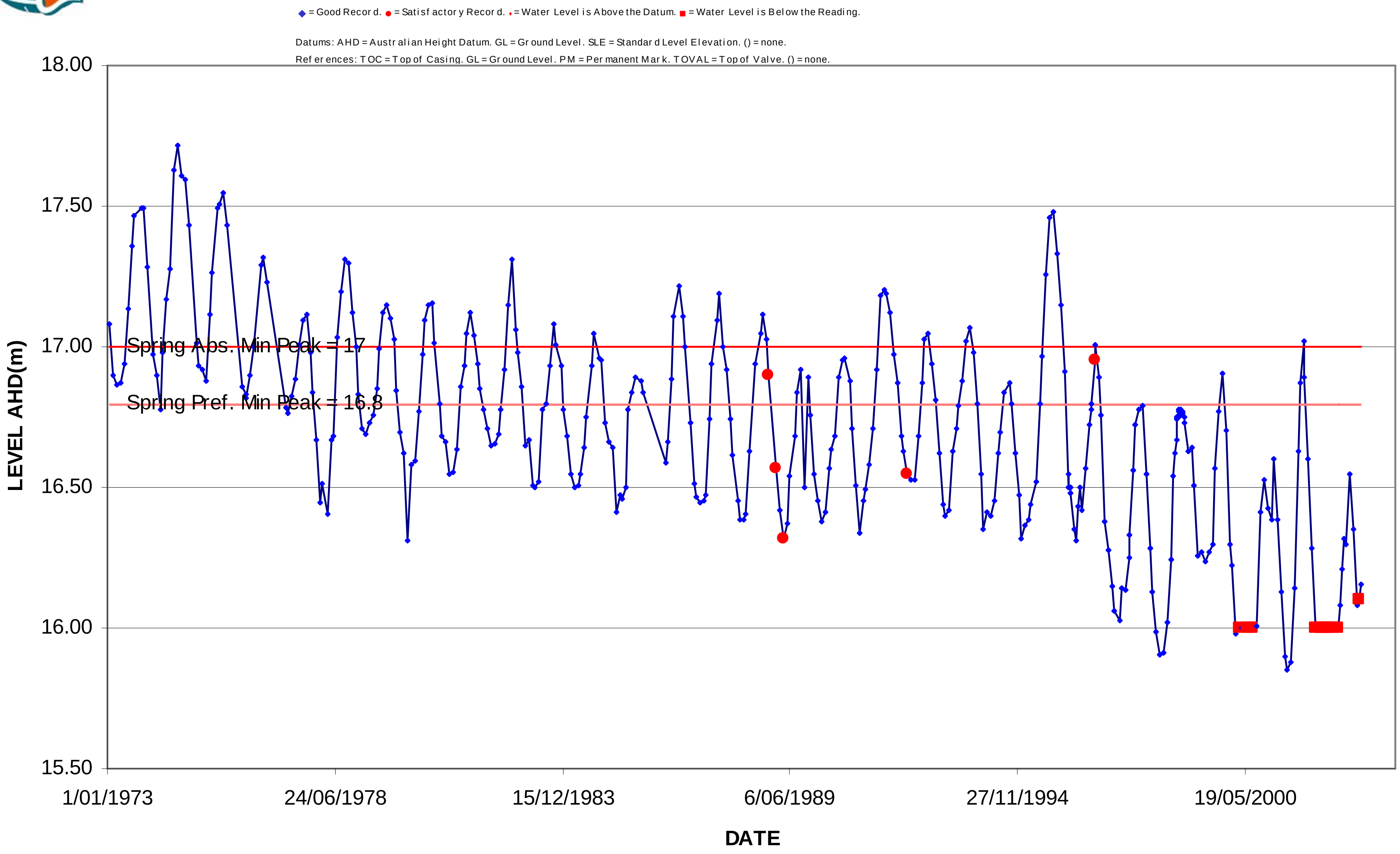
6162628 LAKES AND WETLANDS GNM14SG

Easting = 401754.00 Northing = 6491898.00 Zone = 50 PM = 51.488mAHD WIN SITE ID = 12865389



6162567 LAKES AND WETLANDS LAKE NOWERGUP 8756

Easting = 379746.00 Northing = 6499839.00 Zone = 50 PM = 20.145mAHD WIN SITE ID = 14588



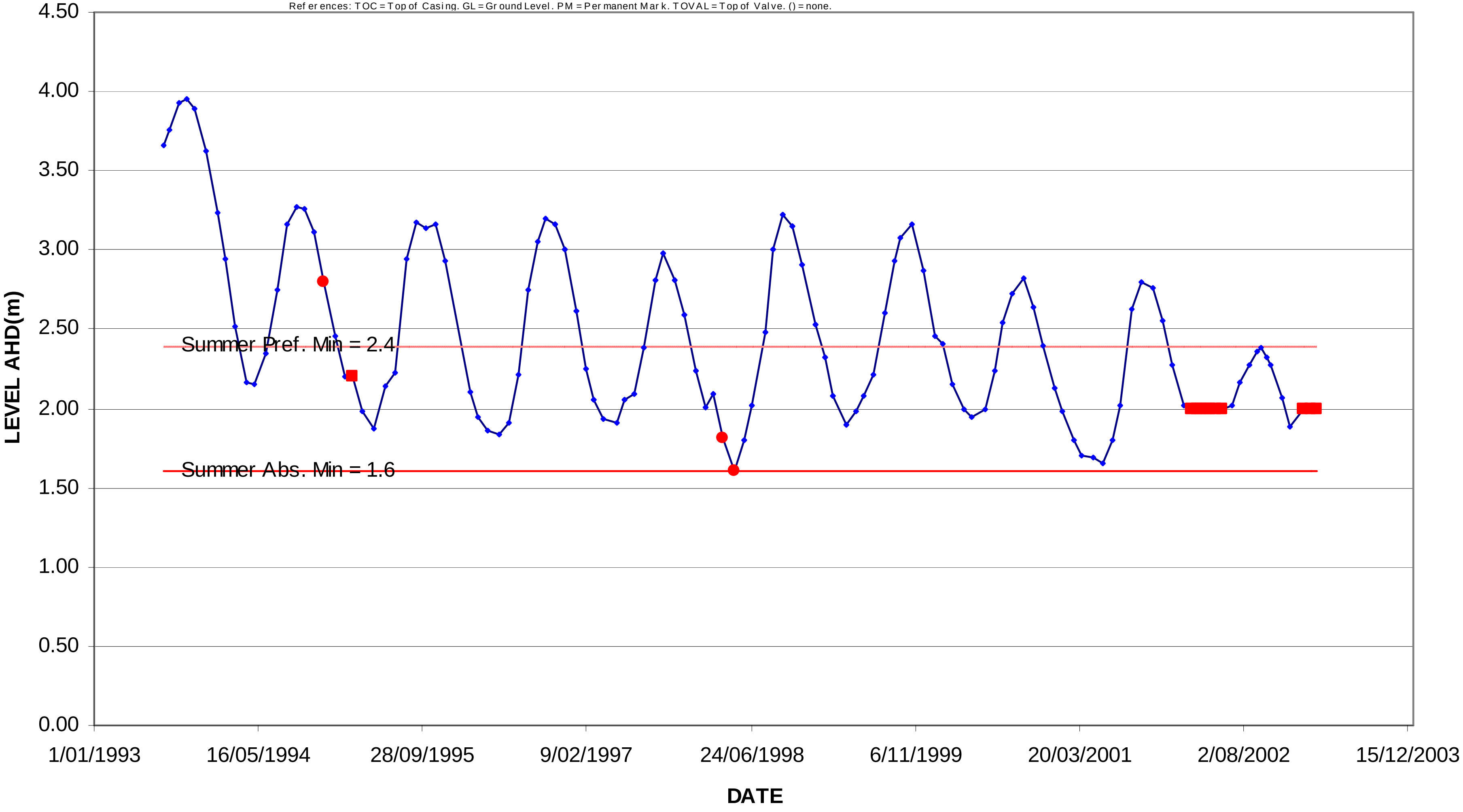
6162624 LAKES AND WETLANDS PIPIDINNY SWAMP

Easting = 375023.00 Northing = 6505329.00 Zone = 50 PM = 5.236mAHD WIN SITE ID = 10278971

◆ = Good Record. ● = Satisfactory Record. + = Water Level is Above the Datum. ■ = Water Level is Below the Reading.

Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation. () = none.

References: TOC = Top of Casing. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.



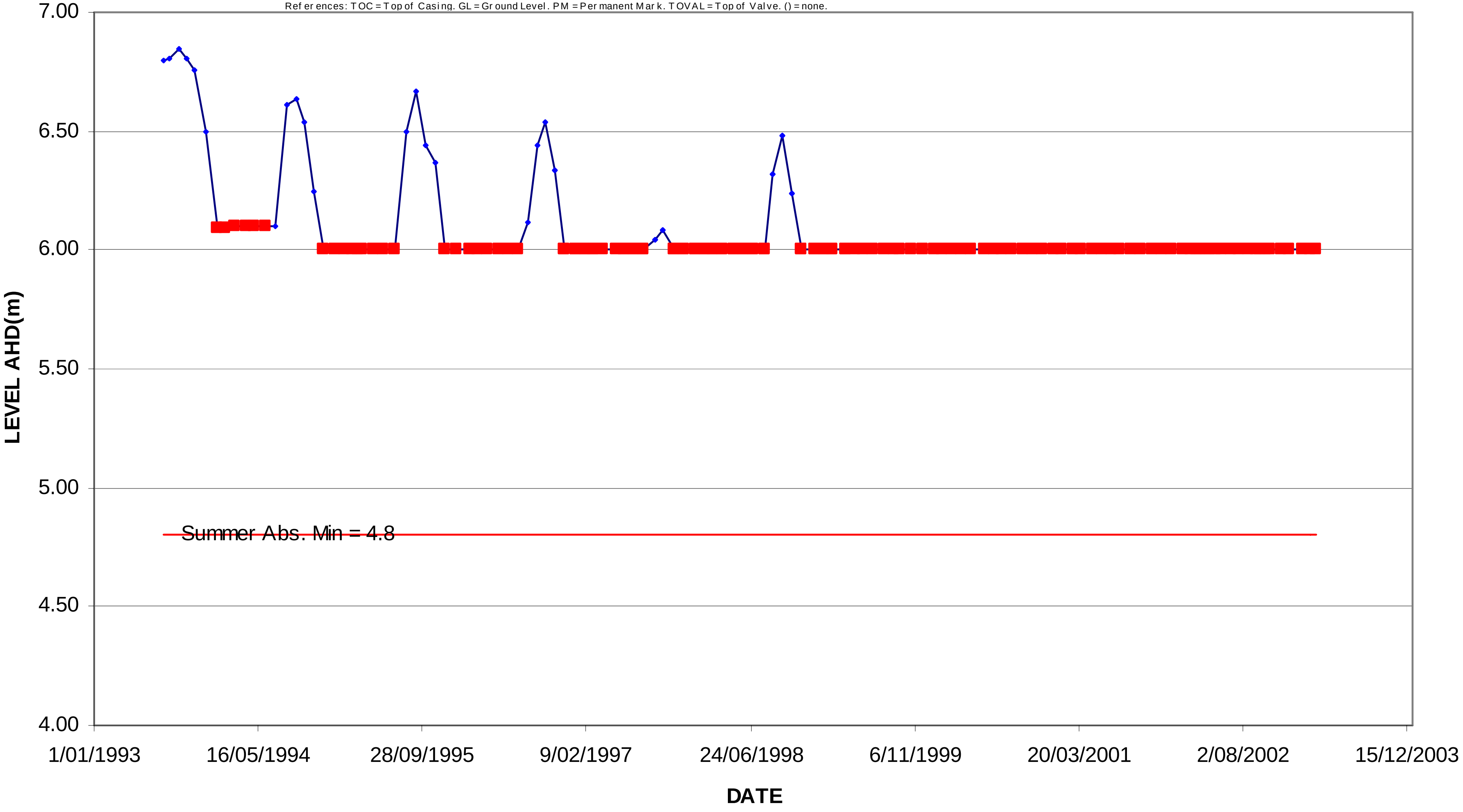
6162623 LAKES AND WETLANDS WILGARUP LAKE

Easting = 375725.00 Northing = 6505904.00 Zone = 50 PM = 7.192mAHD WIN SITE ID = 10246057

◆ = Good Record. ● = Satisfactory Record. ▴ = Water Level is Above the Datum. ■ = Water Level is Below the Reading.

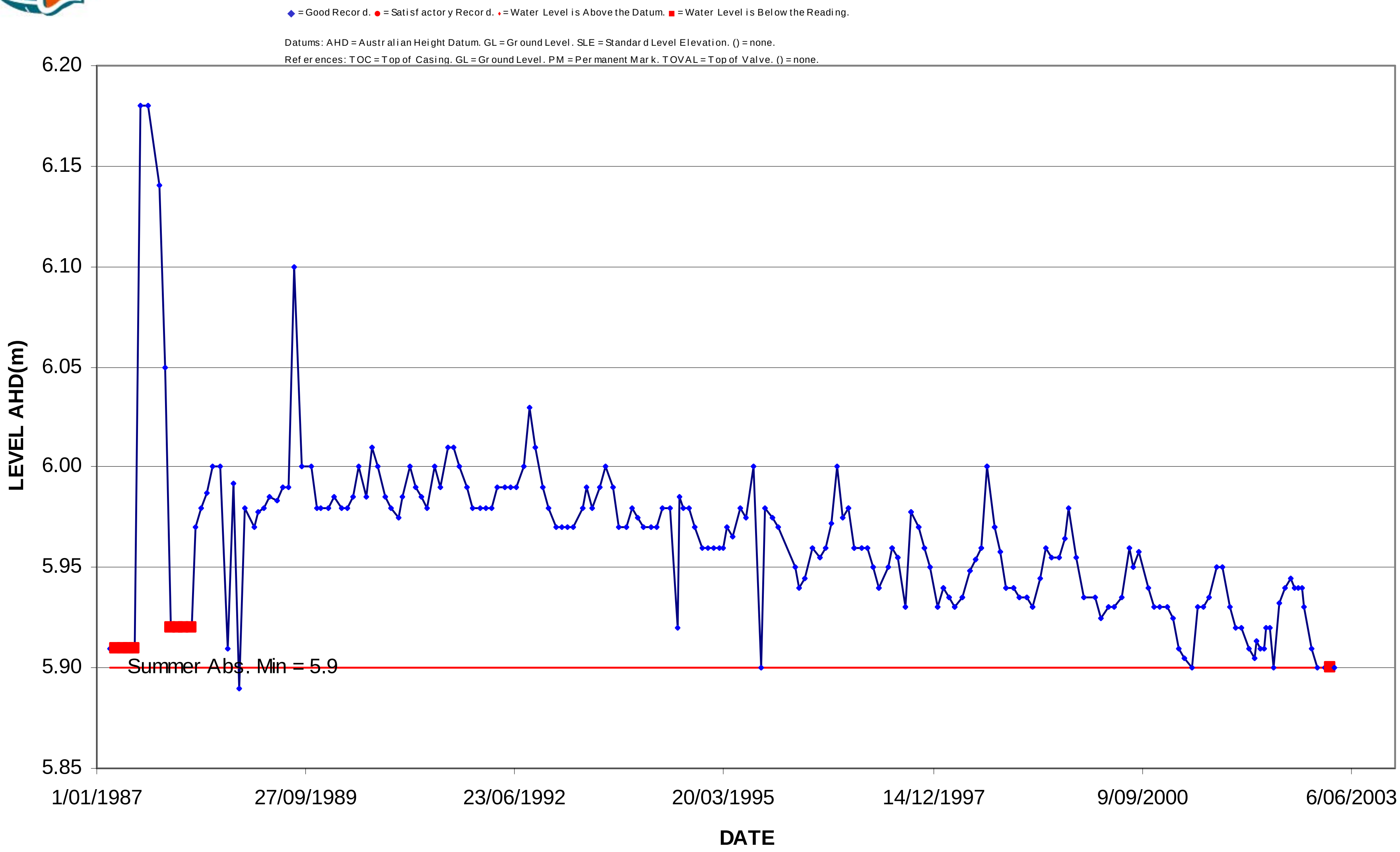
Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation. () = none.

References: TOC = Top of Casing. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.



6162565 LAKES AND WETLANDS LAKE YONDERUP 8780

Easting = 375305.00 Northing = 6508126.00 Zone = 50 PM = 13.871mAHD WIN SITE ID = 14586



APPENDIX II: Macroinvertebrate Community Structure Results

6 Macroinvertebrate Community Structure Results

Macroinvertebrate community structure data (identifications to family level where possible) are presented for each wetland in **Tables A2.1 - A2.15**. Abundance categories score the relative abundance of animals live-picked (i.e. 1=rare, 2=scarce, 3=common, 4=abundant), being those outlined by Chessman (1995). In each table the number of sampling rounds (out of 15) in which a family has been collected is indicated, as is the overall number of families collected (cumulative) over all the rounds. These allow the most common families from each wetland to be identified (taxa recorded in 80% or more of sampling rounds are considered characteristic of the wetlands aquatic macroinvertebrate community (Davis, Rosich, Bradley, Growms, Schmidt and Cheal, 1993), as well as the identification of new and rare families. The number of families recorded from a single habitat and percentage of total families found at a single habitat is also listed, allowing for analysis of the diversity in community structure between habitats at individual wetlands.

6.1 Coogee Springs

No sampling of the aquatic macroinvertebrate community could be undertaken at Coogee Spring as the wetland was dry in both Round 14 and 15. Round 14 was the first spring sampling round in which Coogee Spring has been dry.

6.2 Lake Gnangara

Three sites were sampled at lake Gnangara in Round 14. No surface water was apparent at the wetland at the time of Round 15 sampling. In total eighteen families of aquatic macroinvertebrate were collected at Lake Gnangara in Round 14. To date thirty-seven families of aquatic macroinvertebrate have been recorded at Lake Gnangara from fourteen sampling occasions. An unknown taxa of Lepidoptera was recorded for the first time at this wetland in Round 14. Of the eighteen taxa identified in Round 14, seven (39%) were recorded from a single habitat. Taxa considered characteristic in the aquatic invertebrate community of lake Gnangara are Dytiscidae and Hydrophilidae (Coleoptera), Chironominae and Ceratopogonidae (Diptera) and Corixidae and Notonectidae (Hemiptera). Of the thirty-seven taxa recorded from Lake Gnangara eleven (29.7%) have been recorded from only a single sampling round.

6.3 Lake Goollelal

Three sites were sampled at Lake Goollelal in both Rounds 14 and 15. Twenty-six taxa of aquatic macroinvertebrate were collected in each round respectively. Following Rounds 14 and 15 forty-eight taxa of aquatic macroinvertebrate have now recorded at Lake Goollelal from fifteen sample occasions. Mesoveliidae (Hemiptera) and Gyrinidae (Coleoptera) were both recorded for the first time at this wetland in Round 14, and subsequently in Round 15 also. Of the twenty-six families identified in Round 14 twelve (46%) were recorded from a single habitat. Of the twenty-six taxa recorded in Round 15, fifteen (58%) were recorded from a single habitat. The aquatic macroinvertebrate community of lake Goollelal is characterised by Physidae and Planorbidae (Mollusca), Ceinidae and Amphisopidae (Amphipoda), Palaemonidae (Decapoda), Leptoceridae (Trichoptera), Chironominae and Tanypodinae (Diptera) and Cyclopoida (Copepoda). Palaemonidae (Decapoda) is the only taxa recorded in every sampling round. Eight of the forty-eight taxa (16.7%) identified at Lake Goollelal have been recorded from only one sampling round.

6.4 Lake Jandabup

Five habitats were sampled in both Rounds 14 and 15. Thirty-four families of aquatic macroinvertebrate were identified in each round respectively. A total of sixty-one families of aquatic macroinvertebrate have been collected at this wetland from fourteen sample rounds. Aquatic invertebrate family richness in summer sampling rounds has increased significantly since artificial water level maintenance was commenced, subsequent to the wetland drying excessively in 1998 (Round 5). The family Moinidae (Cladocera) was recorded in Round 15, the occasion at this wetland. In Round 14 eight of the thirty-four taxa (18%) were recorded from a single habitat only. Of the thirty-four taxa identified in Round 15 eight (24%) were recorded at only one habitat. The aquatic macroinvertebrate community of Lake Jandabup is characterised by Aeshnidae, Lestidae and Libellulidae (Odonata), Leptoceridae (Trichoptera), Corixidae and Notonectidae (Hemiptera), Chironominae and Tanypodinae (Diptera), Dytiscidae and Hydrophilidae (Coleoptera), Cyprididae (Ostracoda) and Chydoridae and Daphniidae (Cladocera). Of the sixty-one families recorded at Lake Jandabup fourteen (23%) were recorded from a single sampling round only.

Ceinidae (Amphipoda), which was in high abundance prior to Lake Jandabup drying in 1998 (Round 5), and recorded at a single habitat in Round 13, was collected from two habitats in Round 14 and at all five habitats sampled in Round 15. Ceinidae abundance has also increased between Round 13 and Round 15. Planorbidae (Gastropoda) that also disappeared from the wetland following the Round 5 drying event has been recorded in all round subsequent to Round 12. Macrothricidae (Cladocera) which were first recorded (in relatively high abundance) following the Round 5 drying event have declined significantly in abundance and frequency of collection, with the taxa recorded from only a single habitat in Rounds 14 and 15.

6.5 Lake Joondalup (North)

Twenty-nine families of aquatic macroinvertebrates were identified from the three habitats sampled in Round 14. In Round 15 only two habitats were inundated at the time of sampling, from these eighteen taxa of aquatic macroinvertebrate were collected. In total fifty-four taxa have been collected at Lake Joondalup (North) from fourteen sampling rounds. Gomphodellidae (Ostracoda) was recorded for the first time at this wetland in Round 14. Of the twenty-nine taxa identified in Round 14 seven (24%) were collected at a single site only. In Round 15 nine of the eighteen taxa (50%) were collected at a single habitat only. The aquatic macroinvertebrate community of Lake Joondalup (North) is characterised by Physidae (Gastropoda), Ceinidae (Amphipoda), Palaemonidae (Decapoda), Corixidae (Hemiptera), Chironominae and Tanypodinae (Diptera), Dytiscidae (Coleoptera), Cyclopoida (Cladocera) and Cyprididae (Ostracoda). Of the fifty-four taxa collected to date from this wetland nine families (17%) have been recorded from only a single sampling round.

6.6 Lake Joondalup (South)

Three habitats were sample at Lake Joondalup (South) in Round 14. Only one habitat was sampled in Round 15 (open water) due to low water level. Twenty-seven families of aquatic macroinvertebrates were identified in Round 14 and fourteen families from Round 15. In total forty-nine families of aquatic macroinvertebrate have bee recorded at this wetland from ten sampling rounds. Ceinidae (Amphipoda) and Mesoveliidae (Hemiptera) were both recorded for the first time at this wetland in Round 14. Moinidae (Cladocera) was recorded for the first time in Round 15. Eight of the thirty-seven taxa (30%) recorded in Round 14 were collected from a single habitat. The aquatic macroinvertebrate community of Lake Joondalup (South) is characterised by Oligochaeta, Physidae (Gastropoda), Poinidae (Acarina), Amphisopidae (Amphipoda), Leptoceridae (Trichoptera), Corixidae and Notonectidae (Hemiptera), Chironominae and Tanypodinae (Diptera), Hydrophilidae (Coleoptera), Cyclopoida (Copepoda) and Cyprididae (Ostracoda). Of the forty-nine taxa so far collected at Lake Joondalup (South) sixteen taxa (33%) have been recorded from only a single sampling round.

6.7 Lexia 86

No surface water was apparent at Lexia 86 at the time of sampling in either Round 14 or 15. Round 14 macroinvertebrate samples were collected from three *Cherax* burrow which contained groundwater. The same burrows were dry at the time of sampling in Round 15. Seven aquatic macroinvertebrate taxa were collected in Round 14. In total thirty-five taxa have been collected from Lexia 86, as part of the GMEMP and by Knott and Jasinska (2000). Nematoda and Ceinidae (Amphipoda) were collected at this wetland in Round 14 for the first time. Four of the seven taxa (54%) collected in Round 14 were from a single habitat. The small data set for this wetland makes it difficult to characterise the aquatic invertebrate community composition of Lexia 86, only Tanypodinae (Diptera) and Cyclopoida (Copepoda) have been recorded from three GMEMP sampling rounds. Of the taxa identified by Knott and Jasinska (2000) Oligochaeta, Chaoborinae (Diptera), Daphniidae and Macrothricidae (Cladocera) have yet to collected in GMEMP sampling.

6.8 Lexia 186

Sampling in Round 14 was again restricted to a small excavated sump on the Northern margin of the wetland. The wetland was completely dry in round 15. Seven taxa of aquatic macroinvertebrate were collected from Lexia 186 in Round 14. The total number of aquatic invertebrate taxa identified from this wetland (including data from Knott and Jasinska, 2000) is twenty-four taxa. No new taxa were identified at this wetland in Round 14. On one family (Parastacidae) has been recorded at the wetland on three occasions. Chydoridae (Cladocera), Chaoborinae (Diptera), Corixidae (Hemiptera), Megapodagrionidae (Odonata) and Oligochaeta, all of which were collected by Knott and Jasinska (2000) have yet to be collected in GMEMP sampling.

6.9 Lake Mariginiup

Three sites were sampled at Lake Mariginiup in Round14. Some surface water was apparent in isolated pools at lake Mariginiup in Round 15, but these could not be sampled due to field workers being unable to stand on the soft organic sediments of the lakebed. Thirty-one taxa of aquatic macroinvertebrates were collected in Round 14. In total fifty-eight taxa have now been recorded at this wetland from twelve sampling rounds. Megapodagrionidae (Odonata) and Nepidae (Hemiptera) were identified for the first time at Lake Mariginiup in Round 14. Of the thirty-one taxa collected in Round 14 eleven (31%) were found at a single habitat. The aquatic macroinvertebrate community of Lake Mariginiup is characterised by Amphisopidae (Isopoda), Corixidae and Notonectidae (Hemiptera), Chironominae and Tanypodinae (Diptera), Hydrophilidae (Coleoptera) and Cyprididae (Ostracoda). Of the fifty-eight taxa collected to date from this wetland fifteen families (26%) have been recorded from only a single sampling round

6.10 Loch McNess (North)

Two sites were sampled at Loch McNess (North) in Round 14. This Northern section of the wetland was again dry during summer/autumn (Round 15). In total fifty-nine taxa of aquatic macroinvertebrates have been identified at Loch McNess (North) from only ten sampling occasions (the fourth highest cumulative family richness of all wetlands sampled). Lymnaeidae (Mollusca) and Stratiomyidae (Diptera) were recorded for the first time at Loch McNess (North) in Round 14. Of the thirty-one taxa collected in Round 14 twelve (39%) were identified at a single habitat only. Oligochaeta, Leptoceridae (Trichoptera) Chironominae and Tanypodinae (Diptera), Dytiscidae and Hydrophilidae (Coleoptera) and Cyprididae (Ostracoda) are characteristic of the aquatic macroinvertebrate community of Loch McNess (North). Of the fifty-nine taxa collected at this wetland to date seventeen (29%) are recorded from a single sampling round only.

6.11 Loch McNess (South)

Five habitats were sampled at Loch McNess (South) in Rounds 14 and 15 respectively. Thirty-eight taxa were recorded in Round 14, the highest family richness of any wetland sampled in this round. Twenty-eight taxa were collected in Round 15. In total sixty-nine taxa have now been collected from Loch McNess (South). Loch McNess (South) had the greatest increase in cumulative family richness compared to the 2002, and now has the highest cumulative family richness of all wetlands samples as part of the GMEMP. This wetland has been sampled in all fifteen rounds. Moinidae (Daphnia), Curculionidae (Coleoptera), Veliidae and Nepidae (Hemiptera), Sisyridae (Neuroptera) and Collembola were collected for the first time at this wetland in Round 14. No new taxa were identified in Round 15 samples. In both Round 14 and 50% (nineteen and fourteen taxa respectively) were identified at a single habitat only. The aquatic macroinvertebrate community of Loch McNess (South) is characterised by Hirundinea (Annelida), Ceinidae (Amphipoda), Palaemonidae (Decapoda), Baetidae (Ephemeroptera), Leptoceridae (Trichoptera), Chironominae and Tanypodinae (Diptera), Dytiscidae (Coleoptera) and Cyclopoida (Copepoda). Fifteen of the sixty-nine taxa (22%) identified from this wetland have been collected in a single sampling round only.

6.12 Melaleuca Park

Melaleuca Park was first sampled as part of the GMEMP in Round 10 (spring 2000). Knott and Jasinska (2000) collected five samples from the wetland between 1995 and 1998, the results of which are given shown in **Table A.2.12**. Four habitats were sampled at Melaleuca Park in Round 14; the seasonal creek line was again dry during the spring sampling period. One habitat only was sampled in Round 15, with shallow surface water restricted to the middle of the wetland basin that is covered by dense *Baumea articulata*. Twenty-three taxa were collected at this wetland in Round 14. Ten taxa were collected in round 15. No new taxa were identified at this wetland in either Round 14 or 15. Four of the twenty-three taxa (17%) collected in Round 14 were recorded at a single habitat only. Unionicolidae (Acarina), Parastacidae (Decapoda), Ecnomidae and Leptoceridae (Trichoptera) and Dytiscidae (Coleoptera) have been recorded from all five GMEMP sampling round conducted at this wetland. The aquatic macroinvertebrate community is also characterised by Limnesiidae (Acarina), Notonectidae (Hemiptera), Orthocladiinae (Diptera), Hydrophilidae (Coleoptera) and Calanoida and Cyclopoida (Copepoda). Of the forty-five taxa collected at this wetland to date only six (13%) are recorded from a single sampling round. Of the taxa identified by Knott and Jasinska (2000), Nematoda, Oribatidae and Poinidae (Acarina), Gomphidae (Odonata), Gerridae and Hebridae (Hemiptera), Dryopidae (Coleoptera) and Harpacticoida (Copepoda) have yet to be collected in GMEMP sampling. A single *Galaxiella nigrostriata* was collected in Round 14 samples, confirming the continued presence of the species at

Melaleuca Park. This species was not recorded in Round 15 samples. No discussion can be undertaken as to abundance of this species or it's continued presence at this wetland based on GMEMP monitoring. A specific sampling regime is required to confirm the population ecology of *Galaxiella nigrostriata*.

6.13 Lake Nowergup

Four habitats were sampled at lake Nowergup in Round 14. Low water levels resulted in only two habitats being sampled in Round 15 (restricted to open-water and submerged *Typha* stand). Thirty-one taxa of aquatic macroinvertebrates were collected in Round 14. Seventeen taxa were identified from Round 15 samples. Fifty-two taxa of aquatic macroinvertebrate have been collected at Lake Nowergup from fifteen sampling rounds. Harpacticoida (Copepoda) and Oribatidae (Acarina) were identified for the first time at this wetland in Round 14 and 15 respectively. Of the thirty-one taxa collected in Round 14 seventeen (55%) were collected from a single habitat. Platyhelminthes (Turbellaria), Oligochaeta, Physidae (Gastropoda), Ceinidae (Amphipoda), Corixidae (Hemiptera), Chironominae and Tanypodinae (Diptera), Calanoida and Cyclopoida (Copepoda), Cyprididae (Ostracoda) and Chydoridae (Cladocera) are considered characteristic of the aquatic macroinvertebrate community of this wetland. Of the fifty-two taxa collected at Lake Nowergup ten (19%) are recorded from a single sampling round.

6.14 Pipidinny Swamp

Three habitats were sampled at Pipidinny Swamp in both Round 14 and 15. Declining water levels have resulted in many of the GMEMP sites being dry in both rounds. Thirty-one taxa of aquatic macroinvertebrates were identified from Round 14 samples. Twenty-eight taxa were collected in Round 15. Sixty-six taxa of aquatic macroinvertebrate have been collected at Pipidinny Swamp from fifteen sampling rounds. Hydroptilidae (Trichoptera) and Veliidae (Hemiptera) were recorded for the first time at this wetland in Round 14 and 15 respectively. Of the thirty-one taxa identified in Round 14 samples thirteen (42%) were from collected at a single habitat only. Sixteen of the twenty-eight taxa (57%) collected in Round 15 were found at a single habitat. The macroinvertebrate community of Pipidinny Swamp is characterised by Oligochaeta, Physidae (Coleoptera), Ceinidae (Amphipoda), Palaemonidae (Decapoda), Coenagrionidae (Odonata), Leptoceridae (Trichoptera), Corixidae and Notonectidae (Hemiptera), Chironominae and Tanypodinae (Diptera), Dytiscidae and Hydrophilidae (Coleoptera), Calanoida and Cyclopoida (Copepoda) and Cyprididae (Ostracoda). Of these taxa Physidae, Leptoceridae, Corixidae, Chironominae and Dytiscidae have been collected in all fifteen sampling rounds. Of the sixty-six taxa of aquatic macroinvertebrate identified at Pipidinny Swamp twenty (30%) have been collected from a single sampling round only.

6.15 Lake Wilgarup

Lake Wilgarup was dry in both Round 14 and 15. This wetland has not contained surface at the time of GMEMP sampling since Round 8 (spring 1999).

6.16 Lake Yonderup

Five habitats were sampled at Lake Yonderup in both Round 14 and 15. Thiry-five taxa of aquatic macroinvertebrates were collected in Round 14. In Round 15 twenty-eight taxa of aquatic macroinvertebrates were identified. Samples have been collected from Lake Yonderup in all fifteen GMEMP rounds with a total of sixty taxa now having been identified at this wetland. Hydra, Arrenuridae (Acarina), Ephydridae (Diptera) and Macrothricidae (Cladocera) were recorded for the first time at this wetland in Round 14. No new taxa of aquatic macroinvertebrate were identified in Round 15. Twelve of the thirty-five taxa (34%) identified in Round 14 samples were collected from a single habitat. Of the twenty-eight taxa of aquatic macroinvertebrates collected in Round 15 eleven (39%) were from a single habitat only. The aquatic macroinvertebrate community of Lake Yonderup is characterised by Oligochaeta, Palaemonidae (Decapoda), Coenagrionidae (Odonata), Leptoceridae (Trichoptera), Chironominae, Tanypodinae and Ceratopogonidae (Diptera), Dytiscidae and Hydrophilidae (Coleoptera), Cyclopoida (Copepoda) and Cyprididae (Ostracoda). Of the sixty taxa identified from Lake Yonderup thirteen (20%) are recorded from a single sampling round.

Figure A2.1 Coogee Spring aquatic macroinvertebrate community data (Round 2 – 12)

Coogee Spring		Round 4				Round 6				Round 7				Round 8				Round 9				Round 10				Round 11				Round 12					
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	dry	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)				0				0				0				0				0				0				0				0	0	0
NEMATODA	Unidentified				0				0				0				0				0				0				0				0	0	0
NEMERTINI	Unidentified				0				0				0				0				0				0				0				0	0	0
PORIFERA	Unidentified				0				0				0				0				0				0				0				0	0	0
TURBELLARIA	Unidentified				0				0				0			3	1				0				0				0				0	1	1
ANNELIDA	Ohirudinea				0				0				0				0				0				0	2		4	1				0	2	1
	Ooligochaete				0	1		1	1				0		1		1	2		1	1	1			1			1	1	1	1		1	7	1
MOLLUSCA	Ancylidae				0				0				0				0				0				0				0				0	0	0
	Lymnaeidae				0			1	1				0				0				0				0				0				0	1	1
	Physidae			3	1				0				0	3	2	2	1	1		1	1		2	3	1		1	2	1	1		1	1	7	1
	Planorbidae				0			1	1				0				0				0				0				0				0	1	1
	Sphaeriidae				0				0				0				0				0				0				0				0	0	0
ACARINA	Araneae				0				0				0				0				0				0				0				0	0	0
	Arrenuridae	1		1	1				0				0				0	1		1	1				0	4	2	2	1				0	3	1
	Astigmata				0				0				0				0				0				0				0				0	0	0
	Eylaidae		1		1				0				0				0				0				0				0				0	1	1
	Halacoroidea				0				0				0				0				0				0				0				0	0	0
	Hydrachnidae				0				0				0				0	1			1				0	4		1	1				0	2	1
	Hydrodromidae	3			1				0				0				0				0				0				0				0	1	1
	Limnocharidae				0				0				0				0				0				0				0				0	0	0
	Limnesiidae			3	1	3	4	4	1				0	3	3	2	1				0	2	3	3	1				0	2	2	3	1	5	1
	Oribatida				0				0				0				0				0				0				0				0	0	0
	Oxidae				0			1	1				0				0				0				0				0				0	1	1
	Pionidae		3		1	4			1				0	2	3	3	1	2		1	1	3			1	2		1	1	1	2	1	1	7	1
	Unidentified		4		1				0				0				0				0		4	4	1				0				0	3	1
	Unioncolidae				0				0				0				0				0				0				0				0	0	0
AMPHIPODA	Ceinidae				0				0				0				0				0				0				0				0	0	0
	Perthidae				0				0				0				0				0				0				0				0	0	0
ISOPODA	Amphisopidae				0	1		2	1				0				0				0				0				0				0	2	1
	Janiridae		4		1				0				0				0				0				0				0				0	2	1
DECAPODA	Palaemonidae				0				0				0				0				0				0				0				0	0	0
	Parastacidae				0				0				0				0				0				0				0				0	0	0
EPHEMEROPTERA	Caenidae				0				0				0				0				0				0	1			1				0	1	1
	Baetidae				0				0				0				0				0				0				0				0	0	0
COLLEMBOLA	Unidentified				0				0				0				0				0				0				0		1		1	1	1
MECOPTERA	Unidentified	1			1				0				0				0				0				0				0				0	1	1
ODONATA	Aeshnidae	1	1	1	1			2	1				0	2	2		1				0			1	1	1	1	1	1				0	6	1
	Coenagrionidae				0			3	1				0	2			1			1	1				0	4	1	4	1				0	4	1
	Cordulidae		1		1				0				0	1		2	1	1		1	1				0	2		1	1				0	4	1
	Gomphidae				0				0				0				0				0				0				0				0	0	0
	Lestidae	1	2		1				0				0		2	2	1				0				0				0				0	3	1
	Libellulidae				0			4	1				0				0				0				0		4	4	1				0	3	1
	Megapodagrionidae				0				0				0				0				0				0				0				0	0	0
	Synthemidae				0				0				0				0				0				0				0				0	0	0
TRICHOPTERA	Ecnomidae				0				0				0				0				0				0				0				0	0	0
	Hydroptilidae				0				0				0				0				0				0				0				0	0	0
	Leptoceridae		1		1	2	1	3	1				0	1	1	1	1	2		2	1				0	4	2	4	1				0	5	1
HEMIPTERA	Corixidae		2		1		3	2	1				0	2	2	2	1	3		3	1	1	1	1	1	2	4	4	1				0	7	1
	Gerridae				0				0				0				0				0				0				0				0	0	0
	Hydrometridae				0				0				0				0				0				0				0				0	0	0
	Mesoveliidae				0				0				0	1			1				0				0	4		1	1				0	2	1
	Nepidae				0				0				0				0				0				0			1	1				0	1	1
	Notonectidae		3	1	1	4	4	4	1				0	2	2	2	1	3		3	1		2		1	4	4	4	1				0	7	1
	Saldidae				0				0				0				0				0				0				0				0	0	0
	Veliidae				0				0				0				0				0				0				0				0	0	0
DIPTERA	Ceratopogonidae				0				0				0				0				0				0	1			1				0	1	1
	Chironominae	1		4	1	4	4	4	1				0	1	2	1	1	3		2	1	4	4	4	1	4	4	4	1	1	2	2	1	8	1
	Culicidae	1		1	1	1		1	1				0	1			1				0				0				0			1	1	5	1
	Empididae				0				0				0				0				0				0				0				0	0	0
	Ephydridae				0				0				0				0				0				0				0				0	1	1
	Orthocladiinae	3	4	4	1				0				0				0				0				0	2	2	2	1	1			1	4	1
	Simulidae				0				0				0				0				0				0				0				0	0	0
	Stratiomyidae	1			1			1	1				0				0				0				0				0				0	3	1
	Tabanidae				0				0				0				0				0				0				0				0	0	0
	Tanypodinae	1	4		1	1		1	1				0		1	1	1	2		2	1			2	1	4	4	4	1	1		1	1	8	1
	Tipulidae				0				0				0				0				0				0				0				0	0	0
LEPIDOPTERA	Pyralidae				0				0				0	1			1				0				0				0				0	1	1
COLEOPTERA	Carabidae				0				0				0				0				0				0				0				0	0	0
	Chyrsomelidae				0				0				0				0				0				0				0				0	0	0
	Curculionidae				0				0				0				0				0				0				0				0	1	1
	Dytiscidae	4	3	3	1	4	1	4	1				0	1		1	1	3		3	1		1	1	1	2	4	2	1			1	1	8	1
	Haliplidae				0				0				0				0				0				0				0				0	0	0
	Helminthidae				0				0				0				0				0				0				0				0	0	0
	Hydraenidae				0				0				0				0			1	1				0				0				0	1	1
	Hydrophilidae	4	1	4	1	2	1	4	1				0			1	1				0				0				0	1	1	1	1	5	1
	Limnichidae				0				0				0				0				0				0				0				0	0	0
	Noteridae				0				0				0				0				0				0				0				0	0	0
	Ptilodactilidae				0				0				0				0				0				0				0				0	0	0
	Scirtidae				0				0				0				0				0				0				0				0	0	0
	Staphylinidae				0				0				0				0				0				0				0				0	0	0
	Ucoleoptera				0				0				0				0				0				0				0				0	0	0
COPEPODA: Cal.	Unidentified				0				0				0				0				0				0			1	1				0	2	1
Harp.	Unidentified				0				0				0				0				0				0				0				0	0	0
Cyc.	Unidentified	4	4	4	1	2		3	1				0	3	3	4	1	3		4	1		2	4	1				0	1	2	2	1	7	1
OSTRACODA	Cyprididae	4	4	4	1	4	4	4	1				0	3	3	4	1	4		4	1	3	4	4	1	4	4	2	1	2	3	3	1	8	1
	Gomphodellidae				0				0				0				0				0				0				0				0	0	0
	Ilyocyprididae				0				0								0																	0	
	Notodromadidae				0				0				0				0				0				0				0				0	0	0
	Uostracoda				0				0				0				0				0				0				0				0	0	0
CLADOCERA	Chydoridae	4	4	4	1	4	3	4	1				0	4	3	2	1				0	1	1	4	1				0				0	5	1
	Daphniidae	4	4	4	1	4	3	4	1				0			1	1				0			3	1				0		1	1	1	6	1
	Ilyocryptidae				0				0				0				0				0				0				0				0	0	0
	Macrothricidae				0				0				0				0				0			2	1				0				0	1	1
TOTAL NO. OF FAMILIES (all rounds)																																			47
HABITAT TOTAL		16	18	14		15	10	22		0	0	0		17	14	17		14	0	15		7	10	13		18	13	21		10	9	11			
WETLAND TOTAL					26				23				0				23				16				16				23				14		
RESTRICTED TO THE HABITAT		3	6	2		1	0	6						4	1	3		1	0	2		2	1	4		2	0	3		1	1	2			
TOTAL FROM ONLY ONE HABITAT			11				7								8				3				7				5				4				
%FAMILIES FROM SINGLE HABITAT			42				30				0				35				19				44				22				29				

Figure A2.2 Lake Gnangara aquatic macroinvertebrate community data (Round 7 – 14)

Gnangara		Round 7				Round 8				Round 9			Round 10				Round 11				Round 12				Round 13				Round 14					
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	5	P/A	4	5	6	P/A	4	6	P/A	2	5	6	P/A	1	2	3	P/A	4	5	6	P/A	1	dry	3	P/A	1	4	6	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)				0				0			0				0				0				0				0				0	0	0
NEMATODA	Unidentified				0				0			0				0				0				0				0				0	0	0
NEMERTINI	Unidentified				0				0			0				0				0				0				0				0	0	0
PORIFERA	Unidentified				0				0			0				0				0				0				0				0	0	0
TURBELLARIA	Unidentified				0				0			0				0				0				0				0				0	0	0
ANNELIDA	Uhirudinea				0				0			0				0				0				0				0				0	1	1
	Uoligochaete				0				0			0				0				0				0				0				0	2	1
MOLLUSCA	Ancylidae				0				0			0				0				0				0				0				0	0	0
	Lymnaeidae				0				0			0				0				0				0				0				0	0	0
	Physidae				0				0			0				0				0				0				0				0	0	0
	Planorbidae				0				0			0				0				0				0				0				0	0	0
	Sphaeriidae				0				0			0				0				0				0				0				0	0	0
ACARINA	Araneae				0				0			0				0				0				0				0				0	0	0
	Arrenuridae				0				0			0				0				0				0				0				0	0	0
	Astigmata				0				0			0				0				0				0	1			1				0	1	1
	Eylaidae				0				0			0				0				0				0				0				0	0	0
	Halacoroidea				0				0			0				0				0				0				0				0	0	0
	Hydrachnidae				0				0			0				0				0				0				0				0	0	0
	Hydrodromidae				0				0			0				0				0				0				0				0	0	0
	Limnocharidae				0				0			0				0				0				0				0				0	0	0
	Limnesiidae				0				0			0				0				0		1		1				0				0	1	1
	Oribatida				0				0			0	1	1		1				0				0				0	1		1	1	2	1
	Oxidae				0				0			0				0				0				0				0				0	0	0
	Pionidae				0				0			0				0				0				0				0				0	0	0
	Unidentified				0				0			0				0				0				0				0				0	0	0
	Unioncolidae				0				0			0				0				0	1			1				0				0	1	1
AMPHIPODA	Ceinidae				0				0			0				0				0				0				0				0	0	0
	Perthidae				0				0			0				0				0				0				0				0	0	0
ISOPODA	Amphisopidae				0				0			0				0				0				0				0				0	0	0
	Janiridae				0				0			0				0				0				0				0				0	0	0
DECAPODA	Palaemonidae				0				0			0				0				0		1		1				0				0	1	1
	Parastacidae				0				0			0				0				0		1		1				0		1		1	4	1
EPHEMEROPTERA	Caenidae				0				0			0				0				0				0				0				0	0	0
	Baetidae				0				0			0				0				0				0				0				0	0	0
COLLEMBOLA	Unidentified				0				0			0				0				0				0				0				0	0	0
MECOPTERA	Unidentified				0				0			0				0				0				0				0				0	0	0
ODONATA	Aeshnidae				0	1	2		1			0				0				0				0				0	1	1		1	4	1
	Coenagrionidae				0				0			0				0				0				0				0				0	2	1
	Cordulidae				0	1	2	1	1	1		1				0				0				0				0				0	5	1
	Gomphidae				0				0			0				0				0				0				0				0	0	0
	Lestidae				0	1	2		1			0				0				0				0				0			1	1	4	1
	Libellulidae				0				0			0		1		1				0				0				0				0	3	1
	Megapodagrionidae				0				0			0				0				0				0				0				0	0	0
	Synthemidae				0				0			0				0				0				0				0				0	0	0
TRICHOPTERA	Ecnomidae				0				0			0				0				0				0				0				0	0	0
	Hydroptilidae				0				0			0				0				0				0				0				0	1	1
	Leptoceridae				0			1	1			0				0				0				0	1			1				0	3	1
HEMIPTERA	Corixidae	3	2	2	1	1	2	1	1	2		1	1	3		1	4	4	2	1		2		1	2		2	1	1	1	2	1	13	1
	Gerridae				0				0			0				0				0				0				0				0	0	0
	Hydrometridae				0				0			0				0				0				0				0				0	0	0
	Mesoveliidae				0				0			0				0	1			1				0				0		1		1	3	1
	Nepidae				0				0			0				0				0				0				0				0	0	0
	Notonectidae			1	1			1	1	2		1				0	4			1	1			1	1		1	1	1	1		1	12	1
	Saldidae				0	1			1			0				0				0				0				0				0	1	1
	Veliidae				0				0			0				0				0				0				0				0	0	0
DIPTERA	Ceratopogonidae	3	3	4	1		2	3	1	1	1	1			3	1	1		1	1	1	1	1	1	1		1	1	3	3	1	1	14	1
	Chironominae			1	1	2	3	3	1			0	4	4	4	1	2	4	4	1	2	1	1	1	2		1	1	2	3	2	1	11	1
	Culicidae				0			3	1			0				0				0				0				0				0	1	1
	Empididae				0				0			0				0				0				0				0				0	0	0
	Ephydridae				0				0			0				0				0				0				0				0	0	0
	Orthocladiinae	2	2		1				0			0		2		1				0				0	1			1				0	5	1
	Simulidae				0				0			0				0				0				0				0				0	0	0
	Stratiomyidae				0				0			0				0				0				0				0				0	0	0
	Tabanidae				0				0			0				0				0				0				0				0	0	0
	Tanypodinae		1		1				0	1		1				0				0		1		1				0	2	1		1	9	1
	Tipulidae				0				0			0				0				0				0				0				0	0	0
LEPIDOPTERA	Pyralidae				0				0			0				0				0				0				0		1		1	1	1
COLEOPTERA	Carabidae				0				0			0				0				0				0				0				0	1	1
	Chyrsomelidae				0				0			0				0				0				0				0				0	0	0
	Curculionidae				0			1	1			0				0				0				0				0		1		1	2	1
	Dytiscidae	2	4	3	1	1	2	2	1	2	1	1	3	4	4	1	4	4	4	1	2	2	2	1	2		1	1	2	2	2	1	14	1
	Haliplidae				0				0			0				0				0				0				0				0	1	1
	Helminthidae				0				0			0				0				0				0				0				0	0	0
	Hydraenidae				0				0			0				0				0				0				0				0	0	0
	Hydrophilidae		3	1	1	1	1	1	1			0		3	4	1	1		1	1	1	2	2	1	1		1	1	2	2	2	1	12	1
	Limnichidae				0	1		1	1			0			1	1				0				0				0		2	1	1	4	1
	Noteridae				0				0			0				0				0				0				0				0	0	0
	Ptilodactilidae				0				0			0			1	1				0				0				0				0	2	1
	Scirtidae				0				0			0				0				0	1	1		1				0		1		1	3	1
	Staphylinidae				0				0			0				0				0				0				0				0	0	0
	Ucoleoptera				0				0			0				0				0				0				0				0	0	0
COPEPODA: Cal.	Unidentified				0				0			0				0				0				0				0				0	0	0
Harp.	Unidentified				0				0			0				0				0				0				0				0	0	0
Cyc.	Unidentified	1			1				0			0		1		1				0	1			1	1			1				0	6	1
OSTRACODA	Cyprididae				0				0			0				0				0		1		1				0		1		1	2	1
	Gomphodellidae				0				0			0				0				0				0				0				0	0	0
	Ilyocyprididae				0				0			0				0				0				0				0				0	0	0
	Notodromadidae				0				0			0				0				0				0				0				0	0	0
	Uostracoda				0				0			0				0				0				0				0				0	0	0
CLADOCERA	Chydoridae				0				0			0				0				0				0				0				0	0	0
	Daphniidae				0				0			0				0				0	2			1				0				0	3	1
	Ilyocryptidae				0				0			0				0				0				0				0				0	0	0
	Macrothricidae	1		3	1	3	3	4	1			0	2	1	4	1				0		2	2	1				0	2	2	3	1	5	1
TOTAL NO. OF FAMILIES (all rounds)																																		37
HABITAT TOTAL		6	6	7		10	9	12		6	2		5	9	7		7	3	5		9	12	5		10	0	6		10	16	9			
WETLAND TOTAL					**10**				**15**			**6**				**12**				**7**				**16**				**10**				**18**		
RESTRICTED TO THE HABITAT		1	1	2		1	0	4		4	0		0	3	3		2	0	0		4	5	0		4	0	0		0	6	1			
TOTAL FROM ONLY ONE HABITAT			4				5			4				6				2				9				4				7				
%FAMILIES FROM SINGLE HABITAT			40				33			67				50				29				56				40				39				

Figure A2.3 Lake Goollelal aquatic macroinvertebrate community data (Round 8 – 15)

Goollelal		Round 8				Round 9				Round 10				Round 11				Round 12				Round 13				Round 14				Round 15					
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)	1			1				0				0				0			1	1				0				0				0	2	1
NEMATODA	Unidentified	1			1				0				0				0				0				0				0	1			1	2	1
NEMERTINI	Unidentified	1			1				0				0				0				0				0				0				0	1	1
PORIFERA	Unidentified				0				0				0				0				0				0				0				0	0	0
TURBELLARIA	Unidentified				0				0				0				0				0		1	1	1				0				0	2	1
ANNELIDA	Uhirudinea				0		1		1	1	1	1	1				0	1			1	1			1		1	1	1	1			1	10	1
	Uoligochaete				0		1	1	1				0	2			1		1	1	1		1	1	1	1			1				0	10	1
MOLLUSCA	Ancylidae				0				0		1		1				0				0				0	1			1				0	2	1
	Lymnaeidae				0				0				0				0				0				0				0				0	1	1
	Physidae	1	1		1		1	1	1	1		1	1			2	1	1	1	1	1	1			1	2			1			1	1	14	1
	Planorbidae				0				0	3		2	1			1	1				0	1			1				0		1		1	11	1
	Sphaeriidae				0				0				0				0				0				0				0				0	0	0
ACARINA	Araneae				0				0				0				0				0				0				0				0	0	0
	Arrenuridae				0				0				0				0				0				0				0				0	0	0
	Astigmata				0				0				0				0				0				0				0				0	0	0
	Eylaidae				0				0				0				0				0				0				0				0	0	0
	Halacoroidea				0				0				0				0				0				0				0				0	0	0
	Hydrachnidae				0				0				0				0				0				0				0				0	0	0
	Hydrodromidae				0				0				0				0				0				0				0				0	0	0
	Limnocharidae				0				0				0				0				0				0				0				0	0	0
	Limnesiidae				0				0				0				0				0				0				0				0	0	0
	Oribatida	1			1			1	1				0				0				0				0				0	1			1	3	1
	Oxidae	1			1				0				0				0				0				0				0				0	1	1
	Pionidae		1		1				0				0				0				0				0				0				0	2	1
	Unidentified				0				0				0				0				0				0				0				0	2	1
	Unioncolidae				0				0				0				0		1		1				0				0				0	1	1
AMPHIPODA	Ceinidae	1	2	2	1		2	2	1				0			1	1	1	2	2	1	1	1	1	1	2	2	2	1	1	1		1	12	1
	Perthidae				0				0				0				0				0				0				0				0	0	0
ISOPODA	Amphisopidae	1		1	1			1	1	4	2		1				0	2	1		1			1	1	2	1	2	1			1	1	12	1
	Janiridae				0				0				0				0				0				0				0				0	0	0
DECAPODA	Palaemonidae	2	1	2	1	2	1	1	1	3	4	4	1		1	4	1	2	2	2	1	2	2	2	1	2	2	2	1	3	3	2	1	15	1
	Parastacidae				0				0				0				0				0				0				0				0	0	0
EPHEMEROPTERA	Caenidae				0				0	1			1				0	1			1				0	1			1	1			1	6	1
	Baetidae				0				0				0				0				0				0				0				0	0	0
COLLEMBOLA	Unidentified				0				0				0				0		1		1				0			1	1	1	1		1	3	1
MECOPTERA	Unidentified				0				0				0				0				0				0				0				0	0	0
ODONATA	Aeshnidae			1	1				0			1	1		1		1				0		1		1			1	1		1		1	7	1
	Coenagriidae				0		1		1			1	1	2	4	2	1	1	1		1	1	1		1		1		1	2			1	11	1
	Cordulidae	1		1	1				0				0		1		1				0				0				0				0	3	1
	Gomphidae				0				0				0				0				0				0				0				0	0	0
	Lestidae	1	1	2	1				0				0				0				0				0				0				0	1	1
	Libellulidae				0				0	1			1				0				0				0				0				0	2	1
	Megapodagrionidae				0				0				0				0				0				0				0				0	0	0
	Synthemidae				0				0				0				0				0				0				0				0	0	0
TRICHOPTERA	Ecnomidae				0				0				0				0				0			1	1				0				0	1	1
	Hydroptilidae			1	1	1	2	2	1			1	1				0				0				0	1		2	1				0	6	1
	Leptoceridae	1	2	2	1		2	2	1	4	1	1	1	2	1	4	1	1	1	1	1	2	1	1	1			1	1	2	2	1	1	14	1
HEMIPTERA	Corixidae	1	1	2	1		1	2	1	4			1	2	4	2	1	1	1	2	1				0				0	1		1	1	11	1
	Gerridae				0				0				0				0				0				0				0				0	0	0
	Hydrometridae				0				0				0				0				0				0				0				0	0	0
	Mesoveliidae				0				0				0				0				0				0		1		1		1		1	2	1
	Nepidae				0				0				0				0				0				0				0				0	0	0
	Notonectidae		1		1	1	1		1				0		1		1				0	1			1				0	1	1	1	1	5	1
	Saldidae				0				0				0				0				0				0				0				0	0	0
	Veliidae				0				0				0				0				0				0				0				0	0	0
DIPTERA	Ceratopogonidae				0				0				0				0				0				0				0				0	0	0
	Chironominae	1	1	2	1	1	2	1	1	2	2	3	1	4	1	2	1	2	1	1	1	2	2	2	1	2		2	1	2	2		1	15	1
	Culicidae				0				0				0				0				0				0				0				0	0	0
	Empididae				0				0				0				0				0				0				0				0	0	0
	Ephydridae				0				0				0				0				0				0				0				0	0	0
	Orthocladiinae			1	1	1	1		1		2	2	1				0				0				0		2	2	1		2	1	1	6	1
	Simulidae				0				0				0				0				0				0				0				0	0	0
	Stratiomyidae				0				0			1	1	2			1				0			1	1				0	1	2	1	1	6	1
	Tabanidae				0				0				0				0				0				0				0				0	0	0
	Tanypodinae	2			1	1	2		1				0	1	1	4	1	1		1	1	1			1				0	1			1	12	1
	Tipulidae				0				0				0				0				0				0				0				0	0	0
LEPIDOPTERA	Pyralidae				0				0				0		1		1				0				0	1	1		1				0	2	1
COLEOPTERA	Carabidae				0				0				0				0				0				0				0				0	0	0
	Chyrsomelidae				0				0				0				0				0				0				0				0	0	0
	Curculionidae				0				0				0				0				0				0				0				0	0	0
	Dytiscidae		1	1	1		1		1	2			1				0	1			1		1	1	1	1	1		1				0	11	1
	Gyrinidae																									1			1	1	1		1	2	1
	Haliplidae				0				0				0				0				0				0				0				0	0	0
	Helminthidae				0				0				0				0				0				0				0				0	0	0
	Hydraenidae				0				0				0				0				0				0				0				0	0	0
	Hydrophilidae				0				0	2			1	1			1				0				0			1	1			1	1	7	1
	Limnichidae				0				0				0				0				0				0				0				0	0	0
	Noteridae				0				0			1	1				0				0				0				0				0	1	1
	Ptilodactilidae				0				0				0				0				0				0				0				0	0	0
	Scirtidae	1			1				0				0				0				0		1		1		1	1	1				0	4	1
	Staphylinidae				0				0				0				0				0				0				0				0	0	0
	Ucoleoptera				0				0				0				0				0				0				0				0	0	0
COPEPODA: Cal.	Unidentified	1	2	2	1	3		4	1	4	4	3	1				0	4	4	4	1			1	1	2	4	4	1				0	10	1
Harp.	Unidentified				0				0	1			1				0				0				0				0	1			1	2	1
Cyc.	Unidentified	1	3	2	1	2	3	3	1	4	4	3	1		1		1	2	1	2	1			2	1	2	1	2	1	2			1	12	1
OSTRACODA	Cyprididae	3	1		1			2	1				0	1			1	2	1	2	1	1	1		1	2	3	2	1	1	1		1	10	1
	Gomphodellidae				0				0				0				0				0				0				0				0	0	0
	Ilyocyprididae																																0	0	0
	Notodromadidae	1			1				0				0				0				0				0				0				0	1	1
	Uostracoda				0				0				0				0				0				0				0				0	0	0
CLADOCERA	Chydoridae	3	2	3	1	1	2	3	1	4			1				0	4	2	2	1				0	2	2		1				0	7	1
	Daphniidae				0				0				0				0		1		1				0		3		1	1			1	4	1
	Ilyocryptidae				0				0				0				0				0				0				0				0	0	0
	Macrothricidae				0				0				0				0				0				0				0				0	0	0
TOTAL NO. OF FAMILIES (all rounds)																																			**48**
HABITAT TOTAL		21	14	15		9	16	14		16	9	14		9	11	9		16	16	13		11	11	12		16	15	15		19	13	9			
WETLAND TOTAL					**27**				**20**				**23**				**18**				**21**				**21**				**26**				**26**		
RESTRICTED TO THE HABITAT		7	2	3		0	3	3		7	1	5		4	5	3		3	3	1		4	2	5		5	3	4		9	3	3			
TOTAL FROM ONLY ONE HABITAT			12				6				13				12				7				11				12				15				
%FAMILIES FROM SINGLE HABITAT			44				30				57				67				33				52				46				58				

Figure A2.4 Lake Jandabup aquatic macroinvertebrate community data (Round 8 – 15)

Jandabup		Round 8						Round 9						Round 10						Round 11						Round 12						Round 13						Round 14						Round 15							
HIGHER TAXA	FAMILY/ SUBFAMILY	4	5	7	8	9	P/A	6	5	8	9	10	P/A	4	5	7	8	9	P/A	4	5	6	9	10	P/A	4	5	7	8	9	P/A	3	5	6	9	10	P/A	4	5	7	8	9	P/A	1	3	5	6	10	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)						0						0		2			1	1				1		1						0		2	1	1		1						0						0	3	1
NEMATODA	Unidentified				1		1						0						0						0						0						0						0						0	1	1
NEMERTINI	Unidentified						0						0						0						0						0						0						0						0	0	0
PORIFERA	Unidentified						0						0						0						0						0						0						0						0	0	0
TURBELLARIA	Unidentified				1		1						0						0						0						0						0						0						0	1	1
ANNELIDA	Uhirudinea						0						0	1					1						0						0						0						0	1			1		1	6	1
	Uoligochaete					1	1		1	1		1	1						0		2			4	1	1					1	2	1	1			1			1			1	2	1	2	1		1	10	1
MOLLUSCA	Ancylidae						0						0						0						0						0						0						0						0	0	0
	Lymnaeidae						0						0						0						0						0		1	1			1						0						0	2	1
	Physidae						0						0						0						0						0						0						0						0	0	0
	Planorbidae						0						0						0						0		2		2	1	1		1	1	2		1		2		1		1			1	1		1	7	1
	Sphaeriidae						0						0						0						0						0						0						0						0	2	1
ACARINA	Araneae						0						0			1			1						0						0						0						0						0	1	1
	Arrenuridae						0						0						0						0				1		1				1		1		1		1		1				1		1	5	1
	Astigmata						0						0						0						0						0						0						0						0	0	0
	Eylaidae						0						0						0						0						0						0						0						0	0	0
	Halacoroidea						0						0						0						0						0						0						0						0	0	0
	Hydrachnidae					1	1						0						0						0						0		1				1						0			1	1		1	3	1
	Hydrodromidae						0						0						0						0						0	1	1	1	1		1						0						0	1	1
	Limnocharidae						0						0						0						0						0						0						0						0	0	0
	Limnesiidae						0						0						0						0						0						0						0						0	2	1
	Oribatida	1			1		1					1	1	1	4		1	4	1						0				1		1		1	1	1	1	1						0				1		1	6	1
	Oxidae						0						0						0						0						0						0						0						0	0	0
	Pionidae						0						0						0						0		1			1	1						0						0			1			1	3	1
	Unidentified						0						0			1			1						0						0						0						0						0	5	1
	Unioncolidae						0						0						0						0						0						0						0						0	0	0
AMPHIPODA	Ceinidae						0						0						0						0						0					1	1		2		3		1	2	4	2	1	1	1	7	1
	Perthidae						0						0						0						0						0						0						0						0	0	0
ISOPODA	Amphisopidae	1				1	1						0	4					1						0	1	1		1		1	1	1	1	2	1	1	1	2		2	2	1	2	1	1	2		1	10	1
	Janiridae						0						0						0						0						0						0						0						0	0	0
DECAPODA	Palaemonidae						0						0						0						0						0						0						0						0	0	0
	Parastacidae			1	1		1						0				1		1						0						0						0						0					1	1	6	1
EPHEMEROPTERA	Caenidae						0						0						0					1	1						0	1		1	1	2	1			1	3		1	1	2	1	1	1	1	6	1
	Baetidae						0					1	1						0	4	4		4	4	1	1	2	2	2	3	1	2		1	1	1	1		2	1	2		1				2	1	1	6	1
COLLEMBOLA	Unidentified						0						0						0						0						0						0						0						0	1	1
MECOPTERA	Unidentified						0						0						0						0						0						0						0						0	0	0
ODONATA	Aeshnidae	1			1	2	1						0	3	1	3	1	2	1		2	1		2	1	1	1	1		1	1		1	1	1		1	2	1			2	1			1	1	1	1	11	1
	Coenagrionidae						0	1				1	1		4	4	4	2	1	2	4	4	1	4	1		2	2	2	2	1	1	1				1		1		2		1	1			1	1	1	10	1
	Corduliidae						0					1	1	1		3	2	4	1	1	1	1		2	1						0		1	1		1	1		1	1		1	1	1				1	1	10	1
	Gomphidae						0						0						0						0						0						0						0						0	0	0
	Lestidae	2	2		2	2	1				1		1	3	1			4	1		1			4	1	2	1	1	1	1	1		1	1	1		1	2	1	2	1	2	1	1		2	1	1	1	12	1
	Libellulidae						0	1	1	2			1	3	3	4	1	3	1	2	2	2	4	4	1		1	1	1	2	1	2	1	1	1		1		2		2	1	1	1	1	1	1		1	13	1
	Megapodagrionidae						0						0						0						0						0						0						0						0	0	0
	Synthemidae						0						0						0						0						0						0						0						0	0	0
TRICHOPTERA	Ecnomidae	1	1	1			1						0						0						0	1			1	1	1	1			1		1			1	1		1	2	1		1		1	8	1
	Hydroptilidae						0						0						0						0				1		1						0						0						0	2	1
	Leptoceridae			1	2	1	1				1	1	1	1	1		4	4	1	4	2	1	1	2	1	1	1		2	2	1	2		1	2		1	1	2		2	1	1	2	2	2	2	2	1	12	1
HEMIPTERA	Corixidae						0	3	3	2		3	1					1	1	4	1	2	2	4	1		2				1	2	2	2	1	1	1		2		1		1	1	1	2	3	4	1	13	1
	Gerridae						0						0						0						0						0						0						0						0	0	0
	Hydrometridae						0						0						0						0						0						0						0						0	0	0
	Mesoveliidae		1		1		1						0		1	1			1	1	4		1	2	1			1			1			1	1		1	1				1	1			1	1	1	1	7	1
	Nepidae						0						0						0					1	1						0						0	1				1	1						0	2	1
	Notonectidae	1	1				1	2	2	1		2	1	3	3	3	4	4	1	2	4	2	4	4	1	1	2	2	2	2	1	1	1	2		1	1	1	1		1	1	1		1	2	3	3	1	11	1
	Saldidae						0						0						0						0						0						0						0						0	1	1
	Veliidae						0						0						0						0						0						0				1		1				2		1	4	1
DIPTERA	Ceratopogonidae	2	1		1	2	1	2	2	2	3	2	1				1		1						0						0	1			1		1						0		1				1	8	1
	Chironominae						0	2	2	2		3	1		1	1		1	1		2	4	2	4	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2		1	12	1
	Culicidae		1	1			1			1		1	1						0		2				1						0						0	1					1						0	5	1
	Empididae						0						0						0						0						0						0						0						0	0	0
	Ephydridae						0						0						0						0						0						0						0						0	0	0
	Orthocladiinae	1	1	1	1		1						0	1					1						0	1		1	1		1						0	1					1						0	9	1
	Simulidae						0						0						0						0						0						0						0						0	0	0
	Stratiomyidae						0						0						0						0						0		1				1						0						0	1	1
	Tabanidae						0			1			1						0						0						0						0						0						0	1	1
	Tanypodinae		1			1	1						0	3		1	1	3	1			2		2	1	1		2	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1	1		1	13	1
	Tipulidae						0					1	1						0						0						0						0						0						0	1	1
LEPIDOPTERA	Pyralidae						0						0						0						0						0						0						0						0	1	1
COLEOPTERA	Carabidae						0						0						0						0						0						0						0						0	0	0
	Chyrsomelidae						0						0						0				1		1						0						0						0						0	3	1
	Curculionidae						0						0	1			1		1						0						0						0	1					1						0	4	1
	Dytiscidae	1	3		1	2	1		1			1	1	1	1	1	1	3	1		1			1	1	2	1		1	1	1	1			1		1	2	1	1	1	1	1	1	1	1	1	1	1	14	1
	Haliplidae						0						0						0						0						0						0						0						0	1	1
	Helminthidae						0						0						0						0						0						0						0						0	0	0
	Hydraenidae	1					1						0						0						0						0						0						0						0	1	1
	Hydrophilidae	2	3	1	2	2	1	1		1	1	1	1	4				1	1		1				1	1					1		1				1	1	1		2	1	1		1	1	1	1	1	13	1
	Limnichidae				1	1	1						0					3	1						0						0						0	1				2	1						0	6	1
	Noteridae						0						0						0						0						0						0						0						0	0	0
	Ptilodactilidae						0						0						0						0						0						0						0						0	0	0
	Scirtidae	1		1	1		1						0						0						0	1		1		1	1						0	1					1						0	4	1
	Staphylinidae						0						0						0						0						0						0						0						0	0	0
	Ucoleoptera						0						0						0						0						0						0						0						0	0	0
COPEPODA: Cal.	Unidentified	2		1		1	1						0	1	2		4	4	1			1			1	2	3	3	4	2	1	3			1		1	2	2	3	3	1	1	2	4				1	9	1
Harp.	Unidentified						0						0						0			1			1						0						0						0						0	1	1
Cyc.	Unidentified	1				1	1						0					1	1					1	1	2	2	2		1	1		1				1	2	2	1	2		1			1	2	1	1	10	1
OSTRACODA	Cyprididae				3	3	1						0		4		4	4	1	4	4	4	1	4	1		3	2	2	3	1	4	2	3	2	3	1	2	4	2	3	2	1	4	4	4	2	2	1	13	1
	Gomphodellidae						0						0						0						0						0						0						0						0	0	0
	Ilyocyprididae																																																0	0	0
	Notodromadidae						0						0						0						0						0						0						0						0	0	0
	Uostracoda						0						0						0						0						0						0						0						0	0	0
CLADOCERA	Chydoridae	1			1	1	1						0		4		4	4	1		4	4	2	1	1		2	3	2	3	1		2		1		1	2		1	3		1					1	1	11	1
	Daphniidae	2	4				1	3					1					1	1	1	4	4			1	1	3	1	2	2	1				2		1	2	3	2	3	2	1						0	11	1
	Ilyocryptidae						0						0						0						0						0						0						0						0	0	0
	Moinidae																																													1	1		1	1	1
	Macrothricidae				1	3	1	3	3	3	4	3	1	1		1			1			2	4	1	1	2					1						0	2					1			1			1	9	1
TOTAL NO. OF FAMILIES (all rounds)																																																			61
HABITAT TOTAL		16	11	8	16	16		9	7	10	5	15		16	14	12	15	20		10	18	15	13	20		18	18	16	20	19		17	22	20	22	11		22	21	14	23	17		17	15	21	28	17			
WETLAND TOTAL							28						19						30						27						29						33						34						34		
RESTRICTED TO THE HABITAT		1	0	0	2	2		1	0	1	1	4		3	1	2	2	4		0	3	2	2	3		3	1	1	3	0		0	4	0	2	1		5	0	1	0	0		0	1	1	4	2			
TOTAL FROM ONLY ONE HABITAT				5						7						12						10						8						7						6						8					
% FAMILIES FROM SINGLE HABITAT				18						37						40						37						28						21						18						24					

Figure A2.5 Lake Joondalup (North) aquatic macroinvertebrate community data (Round 8 – 15)

Joondalup (north)		Round 8				Round 9				Round 10				Round 11				Round 12				Round 13				Round 14				Round 15				
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	5/6	P/A	1	2	5/6	P/A	1	2	5/6	P/A	3	5/6	8	P/A	1	2	5\6	P/A	1	3	5\6	P/A	1	3	5\6	P/A	5/6	8	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)				0				0				0				0				0				0				0			0	0	0
NEMATODA	Unidentified				0				0				0				0				0				0				0			0	0	0
NEMERTINI	Unidentified				0				0				0				0				0				0				0			0	0	0
PORIFERA	Unidentified				0				0			1	1				0				0				0				0			0	1	1
TURBELLARIA	Unidentified				0				0				0				0			2	1				0		1	2	1			0	2	1
ANNELIDA	Uhirudinea		1		1				0		3	4	1		4	1	1		1	1	1	1		2	1	1	1	2	1	1	1	1	11	1
	Uoligochaete				0		2		1				0				0	1			1				0			1	1			0	6	1
MOLLUSCA	Ancylidae				0				0				0				0				0				0				0			0	0	0
	Lymnaeidae				0				0				0				0				0				0				0			0	4	1
	Physidae	2	4	2	1	1	2	3	1	4	4	4	1		4	4	1	2	2	2	1	3	2	1	1	3	2	2	1	2	2	1	14	1
	Planorbidae				0				0				0			2	1				0				0				0			0	1	1
	Sphaeriidae				0				0				0				0				0				0				0			0	0	0
ACARINA	Araneae				0				0			1	1				0				0				0				0			0	1	1
	Arrenuridae				0				0			1	1				0				0	1	1	1	1				0			0	5	1
	Astigmata				0				0				0				0				0				0				0			0	0	0
	Eylaidae				0				0				0				0				0				0				0			0	0	0
	Halacoroidea				0				0				0				0				0				0				0			0	0	0
	Hydrachnidae		1	2	1				0				0				0				0	2	1	1	1				0			0	2	1
	Hydrodromidae				0				0				0				0				0				0				0			0	0	0
	Limnocharidae				0				0				0				0				0				0		2		1			0	2	1
	Limnesiidae	1		2	1				0			2	1				0	1	2	2	1				0	1	2	3	1			0	5	1
	Oribatida				0				0	2	3	4	1				0	1	2	2	1			1	1	1	1	1	1			0	4	1
	Oxidae				0				0				0				0				0				0				0			0	0	0
	Pionidae	3	3	2	1			2	1	2	3	2	1				0	1	2	2	1	1			1	2	2		1			0	9	1
	Unidentified				0				0	2	2	4	1				0				0				0				0			0	4	1
	Unioncolidae				0				0				0				0				0				0				0			0	0	0
AMPHIPODA	Ceinidae	2	2	2	1	1	2	2	1	4	4	4	1	1		2	1	3	2	2	1	2	1	3	1	3	3	2	1	2		1	13	1
	Perthidae				0				0				0				0				0				0				0			0	0	0
ISOPODA	Amphisopidae	1		1	1			1	1			3	1				0		1	1	1	1		1	1			2	1	1		1	10	1
	Janiridae				0				0				0				0				0				0				0			0	0	0
DECAPODA	Palaemonidae				0			2	1			2	1		2		1				0	2		1	1	1	1		1	1	2	1	12	1
	Parastacidae				0				0				0				0				0				0				0			0	1	1
EPHEMEROPTERA	Caenidae				0			1	1				0				0				0	1			1				0			0	2	1
	Baetidae				0				0				0				0				0			1	1				0			0	1	1
COLLEMBOLA	Unidentified				0				0		1		1				0				0				0				0			0	1	1
MECOPTERA	Unidentified				0				0				0				0				0				0				0			0	0	0
ODONATA	Aeshnidae		1		1				0	1		1	1				0				0	1			1	1		1	1			0	8	1
	Coenagrionidae				0				0				0		2	1	1				0			1	1				0	1	2	1	3	1
	Cordulidae			1	1			1	1			1	1			1	1				0				0				0		1	1	7	1
	Gomphidae				0				0				0				0				0				0				0			0	0	0
	Lestidae		2		1				0		1	1	1		1		1				0	1		1	1	2	1	1	1			0	9	1
	Libellulidae				0	1		1	1				0			1	1				0				0				0			0	4	1
	Megapodagrionidae				0				0				0				0				0				0				0			0	0	0
	Synthemidae				0				0				0				0				0				0				0			0	0	0
TRICHOPTERA	Ecnomidae				0				0				0				0				0				0				0			0	1	1
	Hydroptilidae				0				0				0				0				0				0				0			0	1	1
	Leptoceridae				0			1	1			4	1		2	2	1			1	1	2		2	1	2	1	2	1	2	2	1	11	1
HEMIPTERA	Corixidae	2	3	3	1	3	3	1	1	4	4	4	1	4	4	4	1	3	3	2	1	3	4	3	1	2	3	2	1	4	4	1	14	1
	Gerridae				0				0				0				0				0				0				0			0	0	0
	Hydrometridae				0				0				0				0				0				0				0			0	0	0
	Mesoveliidae				0				0				0				0				0			1	1				0		1	1	3	1
	Nepidae				0				0				0		1		1				0			1	1				0		1	1	3	1
	Notonectidae	2	2	3	1				0	3	3	1	1				0	1	1	1	1	1	2	3	1	2	3	2	1	2	2	1	11	1
	Saldidae				0				0				0				0				0				0				0			0	0	0
	Veliidae				0				0				0				0				0				0		1	1	1			0	2	1
DIPTERA	Ceratopogonidae				0	1			1	1			1				0				0				0				0			0	3	1
	Chironominae	1	2	3	1		2	2	1	4	4	3	1	1		1	1	1	2	1	1	1	1	2	1	2	2	2	1	3		1	14	1
	Culicidae				0				0	1			1				0		2	1	1				0				0			0	3	1
	Empididae				0				0				0				0				0				0				0			0	0	0
	Ephydridae				0				0				0				0				0				0				0			0	0	0
	Orthocladiinae				0				0				0				0				0				0				0			0	0	0
	Simulidae				0				0				0				0				0				0				0			0	0	0
	Stratiomyidae	1			1				0		1		1			1	1		1		1	1		1	1			1	1	1		1	9	1
	Tabanidae				0				0				0				0		1	1	1	1		1	1				0			0	2	1
	Tanypodinae	2	2	3	1				0	3	4	2	1	2		2	1	1	2		1		1		1	2	2	2	1	2		1	13	1
	Tipulidae				0				0				0				0				0				0			1	1			0	2	1
LEPIDOPTERA	Pyralidae				0				0				0				0				0				0				0			0	0	0
COLEOPTERA	Carabidae				0				0				0				0				0				0				0			0	0	0
	Chyrsomelidae				0				0				0				0			1	1				0				0			0	2	1
	Curculionidae				0				0				0				0				0				0				0			0	0	0
	Dytiscidae	1	1	1	1	1	1	2	1		3	3	1		1	2	1	1	1	1	1	2		2	1	1		1	1	2	2	1	14	1
	Haliplidae		1		1				0	1	4		1			1	1		2		1				0				0			0	4	1
	Helminthidae				0				0				0				0				0				0				0			0	0	0
	Hydraenidae				0				0				0				0				0				0				0			0	0	0
	Hydrophilidae	1	1	1	1	1			1	1	4	3	1		2	4	1			1	1	1		1	1	2		1	1			0	11	1
	Limnichidae				0				0				0				0				0				0				0			0	0	0
	Noteridae				0				0				0				0				0				0				0			0	0	0
	Ptilodactilidae				0				0				0				0				0				0				0			0	0	0
	Scirtidae				0				0				0				0			1	1				0				0			0	3	1
	Staphylinidae				0				0				0				0				0				0				0			0	0	0
	Ucoleoptera				0				0				0				0				0				0				0			0	0	0
COPEPODA: Cal.	Unidentified				0				0				0				0	1	1		1				0	2	4	4	1			0	6	1
Harp.	Unidentified				0				0				0				0				0				0				0			0	0	0
Cyc.	Unidentified			2	1		3		1			1	1		1	1	1	2	3	2	1	3	3	3	1	1			1	1	1	1	12	1
OSTRACODA	Cyprididae	4	4	4	1	2	3	1	1	4	4	4	1			4	1	4	4	3	1	3	3	3	1	3	3	1	1	1		1	13	1
	Gomphodellidae				0				0				0				0				0				0			1	1			0	1	1
	Ilyocyprididae																												0			0	0	0
	Notodromadidae				0				0				0				0			2	1				0		1	3	1			0	2	1
	Uostracoda				0				0				0				0				0				0				0			0	0	0
CLADOCERA	Chydoridae				0				0				0				0				0				0				0			0	3	1
	Daphniidae				0		1		1	3			1				0			1	1				0		2	1	1			0	7	1
	Ilyocryptidae				0				0				0				0				0				0				0			0	0	0
	Macrothricidae				0				0				0				0				0				0				0			0	0	0
TOTAL NO. OF FAMILIES (all rounds)																																		54
HABITAT TOTAL		13	15	15		8	9	13		16	17	24		4	11	17		14	19	22		21	10	23		19	20	25		15	12			
WETLAND TOTAL					20				18				30				20				27				27				29			18		
RESTRICTED TO THE HABITAT		1	4	2		2	3	6		3	2	9		0	3	6		1	2	7		3	1	5		1	1	5		6	3			
TOTAL FROM ONLY ONE HABITAT			7				11				14				9				10				9				7			9				
%FAMILIES FROM SINGLE HABITAT			35				61				47				45				37				33				24			50				

Figure A2.6 Lake Joondalup (South) aquatic macroinvertebrate community data (Round 8 – 15)

Joondalup (south)		Round 8				Round 9				Round 10				Round 11				Round 12				Round 13				Round 14				Round 15			
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	3	P/A	1	2	3	P/A	1	3	4	P/A	4	5	6	P/A	1	3	4	P/A	3	4	6	P/A	1	2	3	P/A	6	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)				0				0				0				0				0				0				0		0	0	0
NEMATODA	Unidentified				0				0				0				0				0				0				0		0	0	0
NEMERTINI	Unidentified				0				0				0				0				0				0				0		0	0	0
PORIFERA	Unidentified				0				0		1		1				0				0				0				0		0	1	1
TURBELLARIA	Unidentified	2			1				0				0				0	1			1				0				0		0	2	1
ANNELIDA	Uhirudinea	1		1	1	1	1		1	3	2		1				0	1			1	2	1	1	1				0		0	6	1
	Uoligochaete	2	1		1	2			1			1	1	1	1	2	1	1	1	1	1				0	1			1	2	1	8	1
MOLLUSCA	Ancylidae	1			1				0				0				0				0				0				0		0	2	1
	Lymnaeidae	1			1				0				0				0				0				0				0		0	1	1
	Physidae	2	1	1	1	3	2	2	1	1	4	4	1	4	4	2	1	2	1	2	1	2	2	2	1	1	1	2	1	2	1	10	1
	Planorbidae				0				0				0	1			1				0				0				0		0	1	1
	Sphaeriidae				0				0				0				0				0				0				0		0	0	0
ACARINA	Araneae				0				0				0				0				0				0				0		0	0	0
	Arrenuridae				0		1		1				0				0				0				0	1		1	1		0	4	1
	Astigmata				0				0		1		1				0				0				0				0		0	1	1
	Eylaidae				0				0				0				0				0				0				0		0	0	0
	Halacoroidea				0				0				0				0				0				0				0		0	0	0
	Hydrachnidae				0				0				0				0	2			1	1			1				0		0	3	1
	Hydrodromidae				0				0				0				0				0				0				0		0	0	0
	Limnocharidae				0				0				0				0				0				0				0		0	0	0
	Limnesiidae	2	2	2	1	2	3	3	1	4	2		1				0	2	2	2	1		1		1	2	3	2	1		0	7	1
	Oribatida				0				0				0				0				0				0				0		0	0	0
	Oxidae				0				0				0				0				0				0				0		0	0	0
	Pionidae	3	2	3	1		2		1				0				0	2	2	1	1		1		1	3	4	2	1	4	1	8	1
	Unidentified				0				0	4		2	1				0				0				0				0		0	2	1
	Unioncolidae				0				0				0				0				0	1			1			1	1		0	2	1
AMPHIPODA	Ceinidae				0				0				0				0				0				0	1		1	1		0	1	1
	Perthidae				0				0				0				0				0				0				0		0	0	0
ISOPODA	Amphisopidae	3	2	3	1	1	2	1	1	4	4	4	1				0	2	2	2	1	1			1	2	3	2	1		0	8	1
	Janiridae				0				0				0				0				0				0				0		0	0	0
DECAPODA	Palaemonidae				0				0				0	2		1	1				0	1		1	1				0		0	4	1
	Parastacidae				0				0				0				0				0				0				0		0	0	0
EPHEMEROPTERA	Caenidae				0				0				0	4			1				0				0				0		0	1	1
	Baetidae				0				0				0				0	1			1	2	1	1	1			1	1		0	3	1
COLLEMBOLA	Unidentified				0				0				0				0				0	1			1				0		0	1	1
MECOPTERA	Unidentified				0				0				0				0				0				0				0		0	0	0
ODONATA	Aeshnidae	1			1				0	1			1				0	1	1		1	1		1	1	1		1	1		0	5	1
	Coenagrionidae				0	2	1		1				0	2	1		1				0	2	1	2	1			1	1	1	1	5	1
	Cordulidae				0				0	1			1				0				0				0				0		0	1	1
	Gomphidae				0				0				0				0				0				0				0		0	0	0
	Lestidae				0				0	3	4	3	1				0	1	1	1	1	1		1	1			1	1		0	5	1
	Libellulidae				0				0				0				0				0	1	1	2	1				0		0	1	1
	Megapodagrionidae				0				0				0				0				0				0				0		0	0	0
	Synthemidae				0				0				0				0				0				0				0		0	0	0
TRICHOPTERA	Ecnomidae				0				0				0				0				0	1			1				0		0	1	1
	Hydroptilidae				0				0				0				0			1	1				0				0		0	1	1
	Leptoceridae	1		1	1	3	2	2	1	3	3		1	4	1	1	1	1			1	2	1	2	1		1	1	1	1	1	9	1
HEMIPTERA	Corixidae	1		2	1	1	3	3	1	4	4	4	1	4	4	4	1	2	2	2	1	3	3	3	1	2	2	1	1	3	1	10	1
	Gerridae				0				0				0				0				0				0				0		0	0	0
	Hydrometridae				0				0				0				0				0				0				0		0	0	0
	Mesoveliidae				0				0				0				0				0				0			1	1		0	1	1
	Nepidae				0				0				0				0				0				0				0		0	0	0
	Notonectidae		1	2	1	2	3	3	1				0	2	4		1	2	1		1	3	1	3	1	1		1	1	1	1	8	1
	Saldidae	1			1				0				0				0				0				0				0		0	1	1
	Veliidae				0				0				0				0				0				0				0		0	0	0
DIPTERA	Ceratopogonidae				0				0		1		1			4	1				0				0				0	1	1	3	1
	Chironominae	2	2	2	1	1	1	1	1	2		1	1	2	1	4	1	3	3	2	1	2	2	2	1	2	2	1	1	3	1	10	1
	Culicidae				0				0				0				0				0				0				0		0	0	0
	Empididae				0				0				0				0				0				0				0		0	0	0
	Ephydridae				0				0				0				0				0				0				0		0	0	0
	Orthocladiinae				0				0	3			1				0		1		1				0			1	1		0	3	1
	Simulidae				0				0				0				0				0				0				0		0	0	0
	Stratiomyidae				0	1			1				0				0				0	1		1	1				0		0	2	1
	Tabanidae				0				0				0				0				0				0				0		0	0	0
	Tanypodinae	1	1		1				0		1	1	1	4	4	4	1	1	2	2	1	1	1	1	1	2	2	2	1	2	1	9	1
	Tipulidae				0				0				0				0				0				0				0		0	0	0
LEPIDOPTERA	Pyralidae				0				0				0				0				0	1	1		1	1			1		0	2	1
COLEOPTERA	Carabidae				0				0				0				0				0				0				0		0	0	0
	Chyrsomelidae				0				0		1		1				0				0				0				0		0	1	1
	Curculionidae				0				0				0				0				0				0				0		0	0	0
	Dytiscidae				0				0	3	1	1	1		1		1	2	1	1	1	1	1	1	1	1		1	1		0	6	1
	Haliplidae		1		1				0				0				0				0				0				0		0	1	1
	Helminthidae				0				0				0				0				0				0				0		0	0	0
	Hydraenidae				0				0				0				0				0				0				0		0	0	0
	Hydrophilidae		1	1	1	1	1		1	2	2		1		4		1	1	1		1	1	1	1	1	1	1	1	1	1	1	9	1
	Limnichidae				0				0				0				0				0				0				0		0	0	0
	Noteridae				0				0				0				0				0				0				0		0	0	0
	Ptilodactilidae				0				0				0				0				0				0				0		0	0	0
	Scirtidae				0				0				0				0				0				0				0		0	0	0
	Staphylinidae				0				0				0				0				0				0				0		0	0	0
	Ucoleoptera				0				0				0				0				0				0				0		0	0	0
COPEPODA: Cal.	Unidentified	2	2	2	1		1		1	2	4	4	1				0	2	4	2	1	2			1	3	3	3	1		0	7	1
Harp.	Unidentified				0				0				0				0				0				0				0		0	0	0
Cyc.	Unidentified		1	1	1		1		1	2	4	4	1	2		1	1	3	2	2	1	2			1	2	2	2	1	4	1	10	1
OSTRACODA	Cyprididae	4	2	4	1	3	3	4	1	4	4	4	1	2	4	4	1	4	3	4	1	4	4	4	1	3	3	3	1	2	1	10	1
	Gomphodellidae				0				0				0				0				0				0				0		0	0	0
	Ilyocyprididae																															0	
	Notodromadidae				0				0				0				0				0				0				0		0	0	0
	Uostracoda				0				0				0				0				0				0				0		0	0	0
CLADOCERA	Chydoridae	4	1	3	1				0				0				0	4	3	3	1			1	1	3	3	4	1		0	5	1
	Daphniidae	2	1	2	1				0				0				0	1	3	2	1				0	2	2	2	1		0	4	1
	Ilyocryptidae				0				0				0				0				0				0				0		0	0	0
	Moinidae																				0				0				0	2	1	1	1
	Macrothricidae				0				0				0				0				0				0				0		0	0	0
TOTAL NO. OF FAMILIES (all rounds)																																	49
HABITAT TOTAL		19	15	15		13	15	8		17	17	12		13	11	10		23	19	16		25	16	18		20	14	25		14			
WETLAND TOTAL					23				17				23				16				25				28				27		14		
RESTRICTED TO THE HABITAT		5	1	0		2	4	0		3	4	1		4	2	1		5	1	1		7	2	5		2	0	6		14			
TOTAL FROM ONLY ONE HABITAT			6				6				8				7				7				14				8			14			
%FAMILIES FROM SINGLE HABITAT			26				35				35				44				28				50				30			100			

Figure A2.7 Lexia 86 wetland aquatic macroinvertebrate community data (Round 10 – 14)

Lexia 86		1997*	Round 10				Round 11				Round 12				Round 13				Round 14				Round 15					
HIGHER TAXA	FAMILY/ SUBFAMILY	5 combined habitats				P/A	dry	dry	dry	P/A	1	2	3	P/A	dry	dry	dry	P/A	1	2	3	P/A	dry	dry	dry	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)					0				0				0				0				0				0	0	0
NEMATODA	Unidentified					0				0				0				0	2	2		1				0	1	1
NEMERTINI	Unidentified					0				0				0				0				0				0	0	0
PORIFERA	Unidentified					0				0				0				0				0				0	0	0
TURBELLARIA	Unidentified					0				0				0				0				0				0	0	0
ANNELIDA	Uhirudinea					0				0				0				0				0				0	0	0
	Uoligochaete	x				0				0				0				0				0				0	0	1
MOLLUSCA	Ancylidae					0				0				0				0				0				0	0	0
	Lymnaeidae					0				0				0				0				0				0	0	0
	Physidae					0				0				0				0				0				0	0	0
	Planorbidae					0				0				0				0				0				0	0	0
	Sphaeriidae					0				0				0				0				0				0	0	0
ACARINA	Araneae					0				0				0				0				0				0	0	0
	Arrenuridae					0				0				0				0				0				0	0	0
	Astigmata					0				0				0				0				0				0	0	0
	Eylaidae					0				0				0				0				0				0	0	0
	Halacoroidea					0				0				0				0				0				0	0	0
	Hydrachnidae					0				0				0				0				0				0	0	0
	Hydrodromidae					0				0				0				0				0				0	0	0
	Limnocharidae					0				0				0				0				0				0	0	0
	Limnesiidae					0				0			1	1				0				0				0	1	1
	Oribatida	x				0				0				0				0		1		1				0	1	1
	Oxidae					0				0				0				0				0				0	0	0
	Pionidae					0				0	1			1				0				0				0	1	1
	Unidentified					0				0				0				0				0				0	0	0
	Unioncolidae	x				0				0	1			1				0				0				0	1	1
AMPHIPODA	Ceinidae					0				0				0				0			1	1				0	1	1
	Perthidae	x	1			1				0	1			1				0				0				0	2	1
ISOPODA	Amphisopidae					0				0				0				0				0				0	0	0
	Janiridae					0				0				0				0				0				0	0	0
DECAPODA	Palaemonidae					0				0				0				0				0				0	0	0
	Parastacidae	x	3			1				0	2	1	1	1				0				0				0	2	1
EPHEMEROPTERA	Caenidae					0				0				0				0				0				0	0	0
	Baetidae					0				0				0				0				0				0	0	0
COLLEMBOLA	Unidentified			1		1				0	1	1	1	1				0				0				0	2	1
MECOPTERA	Unidentified					0				0				0				0				0				0	0	0
ODONATA	Aeshnidae	x		1	1	1				0				0				0				0				0	1	1
	Coenagrionidae					0				0				0				0				0				0	0	0
	Cordulidae				1	1				0				0				0				0				0	1	1
	Gomphidae					0				0				0				0				0				0	0	0
	Lestidae	x	3	4	4	1				0	1			1				0				0				0	2	1
	Libellulidae					0				0				0				0				0				0	0	0
	Megapodagrionidae					0				0				0				0				0				0	0	0
	Synthemidae					0				0				0				0				0				0	0	0
TRICHOPTERA	Ecnomidae					0				0		1		1				0				0				0	1	1
	Hydroptilidae					0				0				0				0				0				0	0	0
	Leptoceridae	x	2	4	2	1				0				0				0				0				0	1	1
HEMIPTERA	Corixidae	x	4	1	3	1				0			1	1				0				0				0	2	1
	Gerridae					0				0				0				0				0				0	0	0
	Hebridae					0				0				0				0				0				0	0	0
	Hydrometridae					0				0				0				0				0				0	0	0
	Mesoveliidae			1		1				0				0				0				0				0	1	1
	Nepidae	x	1			1				0				0				0				0				0	1	1
	Notonectidae	x	4	1		1				0				0				0				0				0	1	1
	Saldidae					0				0				0				0				0				0	0	0
	Veliidae	x		2	1	1				0				0				0				0				0	1	1
DIPTERA	Ceratopogonidae					0				0				0				0				0				0	0	0
	Chaoborinae	x												0				0				0				0	0	1
	Chironominae	x				0				0	1			1				0		1		1				0	2	1
	Culicidae					0				0	1	1	1	1				0				0				0	1	1
	Empididae					0				0				0				0				0				0	0	0
	Ephydridae					0				0				0				0				0				0	0	0
	Orthocladiinae					0				0				0				0				0				0	0	0
	Simulidae					0				0				0				0				0				0	0	0
	Stratiomyidae					0				0				0				0				0				0	0	0
	Tabanidae					0				0			1	1				0				0				0	1	1
	Tanypodinae				1	1				0	2	3	2	1				0	1	1		1				0	3	1
	Tipulidae					0				0				0				0				0				0	0	0
LEPIDOPTERA	Pyralidae					0				0				0				0				0				0	0	0
COLEOPTERA	Carabidae					0				0				0				0				0				0	0	0
	Chyrsomelidae					0				0				0				0				0				0	0	0
	Curculionidae					0				0			1	1				0				0				0	1	1
	Dryopidae					0				0				0				0				0				0	0	0
	Dytiscidae	x	1	4	3	1				0	2	2	2	1				0				0				0	2	1
	Haliplidae					0				0				0				0				0				0	0	0
	Helminthidae					0				0				0				0				0				0	0	0
	Hydraenidae					0				0				0				0				0				0	0	0
	Hydrophilidae	x		3	3	1				0	1	1	2	1				0				0				0	2	1
	Limnichidae					0				0				0				0				0				0	0	0
	Noteridae					0				0				0				0				0				0	0	0
	Ptilodactilidae					0				0				0				0				0				0	0	0
	Scirtidae			2		1				0				0				0				0				0	1	1
	Staphylinidae					0				0				0				0				0				0	0	0
	Ucoleoptera					0				0				0				0				0				0	0	0
COPEPODA: Cal.	Unidentified		4			1				0				0				0				0				0	1	1
Harp.	Unidentified					0				0				0				0				0				0	0	0
Cyc.	Unidentified	x			1	1				0	2	1		1				0	2	1	2	1				0	3	1
CONCHOSTRACA	Unidentified					0				0				0				0				0				0	0	0
OSTRACODA	Cyprididae		4	1	3	1				0	3	1	1	1				0				0				0	2	1
	Gomphodellidae					0				0				0				0				0				0	0	0
	Ilyocyprididae					0				0				0				0				0				0	0	0
	Notodromadidae					0				0				0				0				0				0	0	0
	Uostracoda					0				0				0				0				0				0	0	0
CLADOCERA	Chydoridae	x				0				0				0				0	1			1				0	1	1
	Daphniidae	x				0				0				0				0				0				0	0	1
	Ilyocryptidae					0				0				0				0				0				0	0	0
	Macrothricidae	x				0				0				0				0				0				0	0	1
TOTAL NO. OF FAMILIES (all rounds)																												**35**
HABITAT TOTAL			10	12	11		0	0	0		13	9	11		0	0	0		4	5	2		0	0	0			
WETLAND TOTAL		**20**				**19**				**0**				**18**				**0**				**7**				**0**		
RESTRICTED TO THE HABITAT			3	3	3		0	0	0		5	1	4		0	0	0		1	2	1		0	0	0			
TOTAL FROM ONLY ONE HABITAT				9				0				10				0				4				0				
%FAMILIES FROM SINGLE HABITAT				47				0				56				0				57				0				

* This data was collected over 2 sample events in October and November 1997, in a separate study by Knott and Jasinska (2000). X indicates presence of the taxa in the wetland. Results from this study are incorporated into the Total Presence/Absence column and the cumulative family score for the wetland.

Figure A2.8 Lexia 186 wetland aquatic macroinvertebrate community data (Round 10 – 14)

Lexia 186		1996-1998*	Round 10				Round 11				Round 12				Round 13		Round 14		Round 15			
HIGHER TAXA	FAMILY/ SUBFAMILY	5 combined habitats	1	dry	dry	P/ A	dry	dry	dry	P/ A	1	dry	dry	P/ A	dry	P/A	1	P/A	dry	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)					0				0				0		0		0		0	0	0
NEMATODA	Unidentified					0				0				0		0		0		0	0	0
NEMERTINI	Unidentified					0				0				0		0		0		0	0	0
PORIFERA	Unidentified					0				0				0		0		0		0	0	0
TURBELLARIA	Unidentified					0				0				0		0		0		0	0	0
ANNELIDA	Uhirudinea					0				0				0		0		0		0	0	0
	Uoligochaete	x				0				0				0		0		0		0	0	1
MOLLUSCA	Ancylidae					0				0				0		0		0		0	0	0
	Lymnaeidae					0				0				0		0		0		0	0	0
	Physidae					0				0				0		0		0		0	0	0
	Planorbidae					0				0				0		0		0		0	0	0
	Sphaeriidae					0				0				0		0		0		0	0	0
ACARINA	Araneae					0				0				0		0		0		0	0	0
	Arrenuridae					0				0				0		0		0		0	0	0
	Astigmata					0				0				0		0		0		0	0	0
	Eylaidae					0				0				0		0		0		0	0	0
	Halacoroidea					0				0				0		0		0		0	0	0
	Hydrachnidae					0				0				0		0		0		0	0	0
	Hydrodromidae					0				0				0		0		0		0	0	0
	Limnocharidae					0				0				0		0		0		0	0	0
	Limnesiidae					0				0				0		0		0		0	0	0
	Oribatida					0				0				0		0		0		0	0	0
	Oxidae					0				0				0		0		0		0	0	0
	Pionidae					0				0				0		0		0		0	0	0
	Unidentified		2			1				0				0		0		0		0	1	1
	Unioncolidae					0				0	1			1		0		0		0	1	1
AMPHIPODA	Ceinidae					0				0				0		0		0		0	0	0
	Perthidae					0				0				0		0		0		0	0	0
ISOPODA	Amphisopidae					0				0				0		0		0		0	0	0
	Janiridae					0				0				0		0		0		0	0	0
DECAPODA	Palaemonidae					0				0				0		0		0		0	0	0
	Parastacidae	x	1			1				0	2			1		0	2	1		0	3	1
EPHEMEROPTERA	Caenidae					0				0				0		0		0		0	0	0
	Baetidae					0				0				0		0		0		0	0	0
COLLEMBOLA	Unidentified					0				0				0		0		0		0	0	0
MECOPTERA	Unidentified					0				0				0		0		0		0	0	0
ODONATA	Aeshnidae					0				0				0		0		0		0	0	0
	Coenagrionidae					0				0				0		0		0		0	0	0
	Cordulidae					0				0				0		0		0		0	0	0
	Gomphidae					0				0				0		0		0		0	0	0
	Lestidae	x	3			1				0				0		0		0		0	1	1
	Libellulidae					0				0				0		0		0		0	0	0
	Megapodagrionidae	x				0				0				0		0		0		0	0	1
	Synthemidae					0				0				0		0		0		0	0	0
TRICHOPTERA	Ecnomidae					0				0				0		0		0		0	0	0
	Hydroptilidae					0				0				0		0		0		0	0	0
	Leptoceridae					0				0				0		0		0		0	0	0
HEMIPTERA	Corixidae	x				0				0				0		0		0		0	0	1
	Gerridae					0				0				0		0		0		0	0	0
	Hebridae					0				0				0		0		0		0	0	0
	Hydrometridae					0				0				0		0		0		0	0	0
	Mesoveliidae					0				0				0		0		0		0	0	0
	Nepidae					0				0				0		0		0		0	0	0
	Notonectidae	x	1			1				0				0		0		0		0	1	1
	Saldidae					0				0				0		0		0		0	0	0
	Veliidae	x	2			1				0				0		0	1	1		0	2	1
DIPTERA	Ceratopogonidae					0				0				0		0		0		0	0	0
	Chaoborinae	x				0				0				0		0		0		0	0	1
	Chironominae	x	2			1				0	1			1		0		0		0	2	1
	Culicidae	x				0				0				0		0	1	1		0	1	1
	Empididae					0				0				0		0		0		0	0	0
	Ephydridae					0				0				0		0		0		0	0	0
	Orthocladiinae		3			1				0				0		0		0		0	1	1
	Simulidae					0				0				0		0		0		0	0	0
	Stratiomyidae					0				0				0		0		0		0	0	0
	Tabanidae					0				0				0		0		0		0	0	0
	Tanypodinae					0				0	2			1		0	1	1		0	2	1
	Tipulidae					0				0				0		0		0		0	0	0
LEPIDOPTERA	Pyralidae					0				0				0		0		0		0	0	0
COLEOPTERA	Carabidae					0				0				0		0		0		0	0	0
	Chyrsomelidae					0				0				0		0		0		0	0	0
	Curculionidae					0				0				0		0		0		0	0	0
	Dryopidae					0				0				0		0		0		0	0	0
	Dytiscidae	x	4			1				0				0		0	1	1		0	2	1
	Haliplidae					0				0				0		0		0		0	0	0
	Helminthidae					0				0				0		0		0		0	0	0
	Hydraenidae					0				0				0		0		0		0	0	0
	Hydrophilidae	x	2			1				0				0		0		0		0	1	1
	Limnichidae					0				0				0		0		0		0	0	0
	Noteridae					0				0				0		0		0		0	0	0
	Ptilodactilidae					0				0				0		0		0		0	0	0
	Scirtidae		3			1				0				0		0		0		0	1	1
	Staphylinidae					0				0				0		0		0		0	0	0
	Ucoleoptera					0				0				0		0		0		0	0	0
COPEPODA: Cal.	Unidentified		2			1				0				0		0	4	1		0	2	1
Harp.	Unidentified					0				0				0		0		0		0	0	0
Cyc.	Unidentified	x	2			1				0	1			1		0		0		0	2	1
CONCHOSTRACA	Unidentified	x				0				0				0		0	1	1		0	1	1
OSTRACODA	Cyprididae	x	4			1				0				0		0		0		0	1	1
	Gomphodellidae					0				0				0		0		0		0	0	0
	Ilyocyprididae																				0	
	Notodromadidae					0				0				0		0		0		0	0	0
	Uostracoda					0				0				0		0		0		0	0	0
CLADOCERA	Chydoridae	x				0				0				0		0		0		0	0	1
	Daphniidae	x	2			1				0				0		0		0		0	1	1
	Ilyocryptidae					0				0				0		0		0		0	0	0
	Macrothricidae	x	3			1				0				0		0		0		0	1	1
TOTAL NO. OF FAMILIES (all rounds)																						24
HABITAT TOTAL			15	0	0		0	0	0		5	0	0		0		7		0			
WETLAND TOTAL		18				15				0				5		0		7		0		
RESTRICTED TO THE HABITAT			15	0	0		0	0	0		5	0	0		0		7		0			
TOTAL FROM ONLY ONE HABITAT				15				0				5			0		7		0			
%FAMILIES FROM SINGLE HABITAT				100				0				100			0		100		0			

* This data was collected over 5 sample events between 1995 and 1998, in a separate study by Knott and Jasinska (2000). X indicates presence of the taxa in the wetland. Results from this study are incorporated into the Total Presence/Absence column and the cumulative family score for the wetland.

Figure A2.9 Lake Mariginiup aquatic macroinvertebrate community data (Round 7 – 14)

Mariginiup		Round 8				Round 9				Round 10				Round 11		Round 12				Round13		Round 14				Round 15					
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	3	P/A	I	2	dry	P/A	1	2	3	P/A	5	P/A	1	2	3	P/A	5	P/A	1	2	3	P/A	d	r	y	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)			1	1				0				0		0				0		0				0				0	1	1
NEMATODA	Unidentified				0				0				0		0				0		0				0				0	0	0
NEMERTINI	Unidentified				0				0				0		0				0		0				0				0	0	0
PORIFERA	Unidentified				0				0				0		0				0		0				0				0	0	0
TURBELLARIA	Unidentified			1	1				0				0		0				0		0				0				0	1	1
ANNELIDA	Uhirudinea				0				0				0		0	1	1		1		0	1			1				0	2	1
	Uoligochaete				0				0				0		0		1	1	1	1	1				0				0	7	1
MOLLUSCA	Ancylidae				0				0				0		0				0		0				0				0	0	0
	Lymnaeidae				0				0				0		0				0		0				0				0	0	0
	Physidae				0				0	1		1	1		0			1	1	1	1				0				0	5	1
	Planorbidae				0				0				0		0				0		0				0				0	2	1
	Sphaeriidae				0				0				0		0				0		0				0				0	0	0
ACARINA	Araneae				0				0		1		1		0				0		0				0				0	1	1
	Arrenuridae				0				0				0		0		1		1		0				0				0	1	1
	Astigmata				0				0				0		0				0		0				0				0	0	0
	Eylaidae	1			1				0				0		0	1		1	1		0				0				0	2	1
	Halacoroidea				0				0	1			1		0				0		0				0				0	1	1
	Hydrachnidae				0				0				0		0	1	1		1		0				0				0	1	1
	Hydrodromidae				0				0				0		0				0		0				0				0	0	0
	Limnocharidae				0				0				0		0				0		0				0				0	0	0
	Limnesiidae	1			1				0	1			1		0	1	1	1	1		0			1	1				0	5	1
	Oribatida				0				0	1		3	1		0	1	1	1	1		0		1		1				0	3	1
	Oxidae				0				0			2	1		0				0		0				0				0	1	1
	Pionidae		1	1	1				0				0		0		1	1	1		0		1		1				0	5	1
	Unidentified				0				0	2			1		0				0		0			1	1				0	6	1
	Unioncolidae				0				0				0		0				0		0				0				0	0	0
AMPHIPODA	Ceinidae				0				0				0		0				0		0			2	1				0	6	1
	Perthidae				0				0				0		0				0		0				0				0	0	0
ISOPODA	Amphisopidae		1	1	1				0	4	2	4	1	1	1	2	2	1	1	1	1	2	3	3	1				0	10	1
	Janiridae				0				0				0		0				0		0				0				0	0	0
DECAPODA	Palaemonidae				0				0				0		0				0		0				0				0	0	0
	Parastacidae				0				0			1	1		0				0		0				0				0	3	1
EPHEMEROPTERA	Caenidae				0				0				0	1	1				0	1	1				0				0	3	1
	Baetidae				0				0				0		0				0	1	1				0				0	1	1
COLLEMBOLA	Unidentified				0				0		2		1		0			1	1		0				0				0	2	1
MECOPTERA	Unidentified				0				0				0		0				0		0				0				0	0	0
ODONATA	Aeshnidae	1		1	1	1			1	2	1	4	1		0	1	1	1	1		0	1	1		1				0	8	1
	Coenagrionidae	2			1				0				0	4	1				0	1	1				0				0	7	1
	Cordulidae				0	1	1		1	3	1	1	1		0				0		0		1		1				0	7	1
	Gomphidae				0				0				0		0				0		0				0				0	0	0
	Lestidae	2		1	1				0	4	4	4	1		0	2	2	2	1		0	2	2	2	1				0	8	1
	Libellulidae				0				0	1	1		1	4	1	1		1	1	2	1	1	1		1				0	7	1
	Megapodagrionidae				0				0				0		0				0		0	1			1				0	1	1
	Synthemidae				0				0				0		0				0		0				0				0	0	0
TRICHOPTERA	Ecnomidae				0				0				0		0				0		0				0				0	0	0
	Hydroptilidae			1	1				0				0		0				0		0				0				0	3	1
	Leptoceridae	1	1		1				0	4	1	4	1		0	1	1		1		0	3	2	2	1				0	9	1
HEMIPTERA	Corixidae	1		1	1	3	2		1	1	3	1	1	4	1	1		1	1	2	1	1	1		1				0	11	1
	Gerridae				0				0				0		0				0		0				0				0	0	0
	Hydrometridae				0				0				0		0				0		0				0				0	0	0
	Mesoveliidae				0				0				0		0				0		0	1	2	2	1				0	2	1
	Nepidae				0				0				0		0				0		0		1		1				0	1	1
	Notonectidae	3	1	2	1	1			1	3		4	1		0	2	2	2	1	1	1	2	2	2	1				0	11	1
	Saldidae				0				0				0		0				0		0				0				0	0	0
	Veliidae				0				0			1	1		0				0		0				0				0	1	1
DIPTERA	Ceratopogonidae	1			1				0				0		0			1	1		0	1	1	1	1				0	5	1
	Chironominae	3	3	2	1	2	2		1	2	2	1	1	2	1	2	1	2	1	2	1	2	1	2	1				0	10	1
	Culicidae	1			1				0			1	1		0				0		0			1	1				0	5	1
	Empididae				0				0				0		0				0		0				0				0	0	0
	Ephydridae				0				0				0		0				0		0				0				0	0	0
	Orthocladiinae				0				0	1		1	1		0	1		1	1		0	1	1		1				0	5	1
	Simulidae				0				0				0		0				0		0				0				0	0	0
	Stratiomyidae				0				0				0		0				0		0				0				0	2	1
	Tabanidae				0				0				0		0				0		0				0				0	0	0
	Tanypodinae	1	1	1	1	2	1		1	1	1		1	4	1	1	1	1	1	1	1	1	1	1	1				0	12	1
	Tipulidae				0				0				0		0				0		0				0				0	0	0
LEPIDOPTERA	Pyralidae	1			1				0				0		0				0		0				0				0	3	1
COLEOPTERA	Carabidae				0				0				0		0				0		0				0				0	0	0
	Chyrsomelidae				0				0				0		0				0		0				0				0	0	0
	Curculionidae				0				0				0		0	1			1		0				0				0	1	1
	Dytiscidae	1		1	1				0	2	1	3	1	2	1	2	1	1	1		0	2	1	1	1				0	9	1
	Haliplidae				0				0				0		0				0		0				0				0	3	1
	Helminthidae				0				0	1	1		1		0				0		0				0				0	1	1
	Hydraenidae				0				0				0		0				0		0				0				0	0	0
	Hydrophilidae	1	1		1	1	1		1	3	2	1	1	1	1	2	2	1	1	1	1	1	1		1				0	11	1
	Limnichidae				0				0				0		0				0		0				0				0	0	0
	Noteridae				0				0				0		0				0		0				0				0	0	0
	Ptilodactilidae				0				0				0		0				0		0				0				0	0	0
	Scirtidae				0				0	3	1		1		0				0		0	1	1	2	1				0	2	1
	Staphylinidae				0				0				0		0				0		0				0				0	0	0
	Ucoleoptera				0				0				0		0				0		0				0				0	0	0
COPEPODA: Cal.	Unidentified	3	1	2	1				0	3	4	1	1		0	2	2	3	1		0		2		1				0	6	1
Harp.	Unidentified				0				0			1	1		0				0		0				0				0	2	1
Cyc.	Unidentified	1	1	1	1	2			1	3	1		1		0	1	1	2	1	1	1	1	1	2	1				0	7	1
OSTRACODA	Cyprididae	3	1	2	1	2	2		1	3	3	4	1	4	1	3	3	3	1	2	1	4	2	3	1				0	12	1
	Gomphodellidae				0				0				0		0				0		0				0				0	0	0
	Ilyocyprididae				0				0				0		0				0		0				0				0	0	0
	Notodromadidae	2			1				0			4	1		0	2	2	2	1		0	1	1	1	1				0	4	1
	Uostracoda				0				0				0		0				0		0				0				0	1	1
CLADOCERA	Chydoridae	3	2	3	1				0	4	4	4	1		0	2	1	3	1	1	1	3	4	2	1				0	9	1
	Daphniidae			2	1				0	3	3	4	1		0	2	2	2	1		0	3	3	1	1				0	8	1
	Ilyocryptidae		2	2	1				0				0		0				0		0				0				0	1	1
	Macrothricidae		1	2	1	3	2		1				0		0				0	2	1				0				0	3	1
TOTAL NO. OF FAMILIES (all rounds)																															58
HABITAT TOTAL		20	12	18		10	7	0		25	20	23		10		24	22	25		16		22	25	19		0	0	0			
WETLAND TOTAL					25				9				33		10				30		15				31				0		
RESTRICTED TO THE HABITAT		7	0	3		3	0	0		3	2	6		0		3	2	6		2		2	5	4							
TOTAL FROM ONLY ONE HABITAT			10				3				11						11			2			11				0				
%FAMILIES FROM SINGLE HABITAT			0				0				33						0			13			35				0				

Figure A2.10 Loch McNess (North) aquatic macroinvertebrate community data (Round 3 – 14)

McNess (north)		Round 3			Round 4			Round 5			Round 6				Round 7			Round 8				Round 12			Round 14				
HIGHER TAXA	FAMILY/ SUBFAMILY	4	6	P/A	7	8	P/A	4	6	P/A	7	8	9	P/A	4	5	P/A	7	8	9	P/A	7	8	P/A	7	8	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)			0			0			0				0			0				0			0			0	0	0
NEMATODA	Unidentified			0			0			0				0			0				0			0			0	0	0
NEMERTINI	Unidentified			0			0			0				0			0				0			0			0	0	0
PORIFERA	Unidentified			0			0			0				0			0				0			0			0	0	0
TURBELLARIA	Unidentified			0			0			0				0		1	1	2	1	2	1		1	1			0	3	1
ANNELIDA	Uhirudinea			0	1		1			0	1	1	4	1			0			1	1		1	1			0	4	1
	Uoligochaete	1		1	1		1		1	1	1	1	4	1	1		1	1			1	2		1	2		1	10	1
MOLLUSCA	Ancylidae			0			0			0			1	1			0				0			0	1		1	2	1
	Lymnaeidae			0			0			0				0			0				0			0	1	1	1	1	1
	Physidae			0			0			0	2		3	1			0	2	1	2	1		2	1	1		1	5	1
	Planorbidae			0			0			0				0			0				0			0			0	0	0
	Sphaeriidae			0			0	2		1				0			0				0			0			0	1	1
ACARINA	Araneae			0			0			0				0			0				0			0			0	0	0
	Arrenuridae			0			0			0		1	3	1			0			3	1			0			0	2	1
	Astigmata			0			0			0				0			0				0			0			0	0	0
	Eylaidae			0			0			0	1	2		1			0		3		1			0		2	1	3	1
	Halacoroidea			0			0			0				0			0				0			0			0	0	0
	Hydrachnidae			0			0			0				0			0				0			0			0	0	0
	Hydrodromidae			0			0			0				0			0				0			0			0	0	0
	Limnocharidae			0			0			0				0			0				0			0			0	0	0
	Limnesiidae			0			0			0	2	2	3	1			0	3	1	4	1	2	1	1	1	1	1	4	1
	Oribatida			0			0			0				0			0				0		1	1	1	1	1	2	1
	Oxidae			0			0			0				0			0	1			1			0	1		1	2	1
	Pionidae			0			0			0	4	4	1	1			0				0	2	2	1	3	4	1	3	1
	Unidentified			0	4	4	1			0	2		1	1			0				0		2	1			0	5	1
	Unioncolidae			0	1		1			0				0			0				0			0			0	1	1
AMPHIPODA	Ceinidae		1	1			0			0				0		1	1				0			0	2		1	4	1
	Perthidae			0			0			0				0			0				0			0			0	0	0
ISOPODA	Amphisopidae			0	2	2	1			0	4	4	4	1			0	2	1	3	1	1	1	1	2	1	1	6	1
	Janiridae			0			0			0				0			0				0			0			0	0	0
DECAPODA	Palaemonidae	4	3	1			0	4	4	1				0	4	4	1			1	1			0			0	5	1
	Parastacidae		1	1		1	1			0				0	1		1				0			0			0	3	1
EPHEMEROPTERA	Caenidae		1	1			0			0				0			0				0			0			0	1	1
	Baetidae	1		1			0		1	1				0		3	1		1		1	1		1			0	6	1
COLLEMBOLA	Unidentified			0		1	1			0				0			0				0			0			0	1	1
MECOPTERA	Unidentified			0			0			0				0			0				0			0			0	0	0
ODONATA	Aeshnidae		1	1	2	3	1		1	1				0	1		1	2		1	1			0	1	1	1	7	1
	Coenagrionidae		1	1			0			0				0			0				0			0			0	1	1
	Cordulidae			0	1		1		1	1				0			0				0	1		1		1	1	5	1
	Gomphidae			0			0			0				0		1	1				0			0			0	1	1
	Lestidae			0		1	1			0		2	1	1			0	1	2		1		1	1	2	2	1	6	1
	Libellulidae			0	1	3	1			0				0			0			2	1			0			0	3	1
	Megapodagrionidae			0			0			0				0			0				0			0			0	0	0
	Synthemidae			0			0			0				0			0				0			0			0	0	0
TRICHOPTERA	Ecnomidae			0			0			0				0			0				0			0			0	0	0
	Hydroptilidae	1	2	1			0			0		3		1	1		1		1		1		1	1		1	1	7	1
	Leptoceridae	1	2	1	1	4	1		2	1	3	1	4	1		1	1	2	1	3	1	1		1		1	1	10	1
HEMIPTERA	Corixidae		1	1		4	1			0	4	3	4	1			0	2	3	3	1	1	1	1		1	1	7	1
	Gerridae			0			0			0				0			0				0			0			0	0	0
	Hydrometridae			0			0			0				0			0				0			0			0	0	0
	Mesoveliidae			0			0			0	1			1			0				0			0			0	1	1
	Nepidae			0			0			0				0			0				0			0			0	0	0
	Notonectidae			0		1	1			0	3	1	3	1			0	2	3	3	1	1		1	1		1	6	1
	Saldidae			0			0			0				0			0		1		1			0			0	1	1
	Veliidae			0			0			0				0			0				0			0			0	0	0
DIPTERA	Ceratopogonidae			0	2	2	1			0	1	4	3	1			0	2	2	1	1	2	2	1	1	1	1	6	1
	Chironominae	4	3	1		1	1	4	4	1	4	4	3	1	1	1	1	3	2	2	1	2	2	1	3	2	1	10	1
	Culicidae			0	2	1	1			0				0			0	1	1	2	1	1	2	1	1	1	1	5	1
	Empididae			0			0			0				0			0				0			0			0	0	0
	Ephydridae			0			0			0				0			0				0			0			0	1	1
	Orthocladiinae			0		4	1			0			2	1			0	1		2	1	1	1	1	1	1	1	6	1
	Simulidae			0			0			0				0			0				0			0			0	0	0
	Stratiomyidae			0			0			0				0			0				0			0	1	1	1	1	1
	Tabanidae			0			0		1	1				0			0				0			0			0	1	1
	Tanypodinae	1		1	4	4	1	2		1	2		3	1	2	1	1	2		2	1	2	1	1		2	1	9	1
	Tipulidae			0			0			0				0			0				0			0			0	0	0
LEPIDOPTERA	Pyralidae			0			0		1	1				0			0		1		1			0	1		1	3	1
COLEOPTERA	Carabidae			0			0			0				0			0				0			0			0	0	0
	Chyrsomelidae			0		2	1			0				0			0				0			0			0	1	1
	Curculionidae			0			0			0				0			0				0			0			0	0	0
	Dytiscidae		3	1	1	4	1		1	1	1	4	1	1			0	2	2	2	1	1	2	1	1	2	1	9	1
	Haliplidae			0		1	1			0				0			0	1			1			0			0	3	1
	Helminthidae			0			0			0				0			0				0			0			0	0	0
	Hydraenidae			0			0			0				0		1	1				0			0			0	2	1
	Hydrophilidae		1	1	2	1	1			0	2	3	4	1			0		1	1	1	1	2	1	1	2	1	8	1
	Limnichidae			0			0			0				0			0				0			0			0	0	0
	Noteridae			0			0			0				0			0				0			0			0	0	0
	Ptilodactilidae			0			0			0	1			1			0				0			0			0	1	1
	Scirtidae		1	1			0			0				0			0				0			0			0	2	1
	Staphylinidae			0			0			0				0			0				0			0			0	0	0
	Ucoleoptera			0			0			0				0			0				0			0			0	0	0
COPEPODA: Cal.	Unidentified			0			0			0				0			0				0		1	1			0	2	1
Harp.	Unidentified			0			0			0				0			0				0			0			0	1	1
Cyc.	Unidentified			0	4	4	1			0	4	4	3	1			0	2	2	3	1	3	3	1	3	3	1	7	1
OSTRACODA	Cyprididae	1		1	4	4	1	2		1	4	4	4	1	3	1	1	3	3	3	1	3	4	1	4	4	1	10	1
	Gomphodellidae			0			0			0				0			0	1			1			0			0	1	1
	Ilyocyprididae			0			0			0				0			0				0			0			0	0	0
	Notodromadidae			0			0			0				0			0	1		2	1	1		1			0	2	1
	Uostracoda			0			0			0				0			0				0			0			0	0	0
CLADOCERA	Chydoridae			0	4	4	1			0	1	4		1			0	2		2	1		3	1	2	4	1	6	1
	Daphniidae			0	4	4	1			0	4	4	3	1			0	2	2	2	1	3	3	1	4	4	1	6	1
	Ilyocryptidae			0			0			0				0			0				0			0			0	0	0
	Macrothricidae			0			0			0				0			0				0		1	1			0	1	1
TOTAL NO. OF FAMILIES (all rounds)																													59
HABITAT TOTAL		8	13		18	23		5	10		22	20	22		8	9		23	20	23		20	23		25	24			
WETLAND TOTAL				17			27			13				27			14				34			30			31		
RESTRICTED TO THE HABITAT		1	3		2	9		1	5		1	1	0		2	4		2	4	1		1	5		6	6			
TOTAL FROM ONLY ONE HABITAT		3			11			6				2			6				7			6			12				
%FAMILIES FROM SINGLE HABITAT		18			41			46				7			43				21			20			39				

Figure A2.11 Loch McNess (South) aquatic macroinvertebrate community data (Round 8 – 15)

McNess (south)

HIGHER TAXA	FAMILY/ SUBFAMILY	Round 8				Round 9				Round 10						Round 11						Round 12				Round 13						Round 14					Round 15						No. Rounds present	Total P/A
		1	2	3	P/A	1	2	3	P/A	1	2	3	4	6	P/A	1	2	3	4	6	P/A	1	2	3	P/A	1	2	3	4	6	P/A	1	2	3	6	P/A	1	2	3	4	6	P/A		
CNIDARIA	(Hydra)				0				0						0						0				0						0					0						0	0	0
NEMATODA	Unidentified				0				0						0						0				0						0					0						0	0	0
NEMERTINI	Unidentified				0				0						0						0				0						0					0						0	0	0
PORIFERA	Unidentified				0				0						0						0				0						0					0						0	0	0
TURBELLARIA	Unidentified				0				0						0						0				0						0					0					1	1	2	1
ANNELIDA	Uhirudinea				0				0				1		1	1					1				0					1	1				1	1						0	6	1
	Uoligochaete		1		1			1	1	1	2	3	1	1	1		2		1	2	1		1	1	1						0	1		1	1	1			1			1	14	1
MOLLUSCA	Ancylidae		1		1				0						0						0			1	1						0					0					1	1	4	1
	Lymnaeidae				0				0						0						0				0						0					0						0	2	1
	Physidae				0				0						0					1	1			1	1						0	1			1	1						0	4	1
	Planorbidae				0				0						0						0				0						0					0						0	0	0
	Sphaeriidae				0				0	2					1	2					1				0						0					0						0	4	1
ACARINA	Araneae				0				0					1	1						0				0						0					0						0	1	1
	Arrenuridae		1		1				0						0						0				0						0					0						0	1	1
	Astigmata				0				0						0						0				0						0					0						0	0	0
	Eylaidae				0				0						0						0				0						0					0						0	0	0
	Halacoroidea				0				0						0						0				0						0					0						0	0	0
	Hydrachnidae				0				0						0						0				0						0					0						0	0	0
	Hydrodromidae				0				0						0						0				0						0					0						0	0	0
	Limnocharidae				0				0						0						0				0						0					0						0	0	0
	Limnesiidae			1	1				0	1					1						0	1			1	1					1			1		1						0	6	1
	Oribatida				0				0						0						0	1			1						0	1				1				1		1	3	1
	Oxidae	1			1				0	1					1						0	1	1		1	1					1					0	1					1	7	1
	Pionidae				0				0						0						0	1			1						0	1				1						0	3	1
	Unidentified				0				0						0						0				0						0					0						0	4	1
	Unioncolidae		1	1	1		1	1	1		4	3	1	3	1						0		1		1				1		1				1	1	1	2	1	1		1	9	1
AMPHIPODA	Ceinidae	2	3		1	1			1		4	2	2	1	1		2	2	1	1	1	2	2		1	1			1	1	1	3	1	1	1	1	1		1	1	1	1	15	1
	Perthidae				0				0						0						0				0						0					0						0	0	0
ISOPODA	Amphisopidae	1	2		1				0						0						0	1			1						0	1				1	1					1	7	1
	Janiridae	2			1	1			1						0						0				0						0					0						0	2	1
DECAPODA	Palaemonidae		2	2	1			2	1	1	3	3	4	2	1	4	2	4	4	4	1	1	2	2	1	2	3	2	2	2	1	1	2	2	2	1	2	2	2	2	2	1	15	1
	Parastacidae	1			1				0					1	1	1					1				0						0	1				1	1					1	10	1
EPHEMEROPTERA	Caenidae	2	2	1	1				0					3	1						0	1	1	1	1						0	1	1	1	1	1						0	8	1
	Baetidae				0	1		1	1						0		1		1		1	1			1					1	1	1			1	1	2	1	1	1	1	1	12	1
COLLEMBOLA	Unidentified				0				0						0						0				0						0	1				1						0	1	1
MECOPTERA	Unidentified				0				0						0						0				0						0					0						0	0	0
NEUROPTERA	Sisyridae				0				0						0						0				0						0				1	1						0	1	1
ODONATA	Aeshnidae				0				0					1	1					2	1				0					1	1					0			1		1	1	9	1
	Coenagrionidae				0				0			1		1	1						0				0						0				1	1			1		1	1	5	1
	Corduliidae	1			1				0						0						0				0			1		1	1	1				1					1	1	8	1
	Gomphidae				0				0						0		1			1	1				0						0					0						0	2	1
	Lestidae				0				0						0						0	1			1						0					0						0	1	1
	Libellulidae		1	1	1		1		1						0	1					1				0						0					0						0	3	1
	Megapodagrionidae				0				0						0						0				0						0					0						0	0	0
	Synthemidae				0				0						0						0				0						0					0						0	1	1
TRICHOPTERA	Ecnomidae				0				0						0						0				0						0			1		1						0	2	1
	Hydroptilidae	1	2	1	1				0	1	1	1		1	1						0	1	2	2	1	1					1	1	1	1	1	1		1				1	11	1
	Leptoceridae		2	1	1			1	1	1	2			3	1	1	1		1	2	1	1		1	1	1		1		1	1	1		1	1	1	1	1	2	1	2	1	15	1
HEMIPTERA	Corixidae		1		1				0						0						0		1		1						0					0	1					1	4	1
	Gerridae				0				0						0						0				0						0					0	1					1	2	1
	Hydrometridae				0				0						0						0				0						0					0						0	1	1
	Mesoveliidae				0				0						0						0				0						0	2	1			1			1			1	4	1
	Nepidae				0				0						0						0				0						0				1	1						0	1	1
	Notonectidae				0				0						0	1					1				0						0					0	2		1			1	4	1
	Saldidae				0				0						0						0				0						0					0						0	0	0
	Veliidae				0				0						0						0				0						0		1			1						0	1	1
DIPTERA	Ceratopogonidae	1	2		1				0						0			1			1	1			1						0					0						0	6	1
	Chironominae	2	2	2	1		3	2	1	2			1	4	1	2	1			2	1	1	2	2	1	1	1	1	1	2	1	1	2	2	2	1	1	2	2	1	2	1	14	1
	Culicidae				0				0	1					1				1	1	1	1			1						0	1				1						0	4	1
	Empididae				0				0						0						0				0						0					0						0	3	1
	Ephydridae				0				0						0						0				0						0					0						0	0	0
	Orthocladiinae	2			1				0	1	2	1	2	1	1		1	2	1		1	1	1	2	1		1			1	1	2			2	1	1		1		1	1	9	1
	Simulidae				0	1			1						0						0	1			1						0	2				1						0	5	1
	Stratiomyidae				0				0						0				1		1				0						0					0	1		1			1	3	1
	Tabanidae				0				0						0	1					1	1		1	1						0					0						0	3	1
	Tanypodinae	2	1	1	1	1	1	1	1	4					1	1	2	1		1	1	1	1	1	1	1					1			2	1	1		1	1	1	2	1	15	1
	Tipulidae				0				0						0						0				0						0					0						0	1	1
LEPIDOPTERA	Pyralidae				0				0						0						0				0						0			1		1						0	2	1
COLEOPTERA	Carabidae				0				0						0						0				0						0					0						0	0	0
	Chyrsomelidae				0				0						0						0				0						0					0						0	0	0
	Curculionidae				0				0						0						0				0						0	1			1	1						0	1	1
	Dytiscidae	1	1		1			1	1			1	1	1	1			1	1	1	1	1	1	1	1					1	1		1			1	1		1	1		1	14	1
	Haliplidae				0				0						0						0				0						0					0						0	0	0
	Helminthidae				0				0						0						0				0						0					0						0	0	0
	Hydraenidae				0				0						0						0				0						0					0	1					1	2	1
	Hydrophilidae		1		1				0		1		3		1	2		1		1	1				0						0					0						0	5	1
	Limnichidae				0				0						0						0				0						0					0						0	0	0
	Noteridae				0				0						0						0				0						0					0						0	0	0
	Ptilodactilidae				0				0						0						0				0						0					0						0	0	0
	Scirtidae				0				0						0						0				0						0					0						0	2	1
	Staphylinidae				0				0						0						0				0						0					0						0	0	0
	Ucoleoptera				0				0						0	1					1				0						0					0						0	1	1
COPEPODA: Cal.	Unidentified				0				0					4	1						0		1	1	1						0			3	4	1						0	4	1
Harp.	Unidentified				0				0						0						0				0						0			1	1	1						0	2	1
Cyc.	Unidentified	3	1	1	1	3		2	1		3	3	3		1	1					1	3	1	1	1	2		1			1	2	1			1	3					1	15	1
OSTRACODA	Cyprididae	3	4		1	2			1		1			1	1		1				1	1			1	1			1		1		3		1	1		1	1		1	1	8	1
	Gomphodellidae				0				0						0						0			1	1						0					0						0	1	1
	Ilyocyprididae																																			0						0	0	
	Notodromadidae				0				0						0						0				0						0					0						0	0	0
	Uostracoda				0				0						0						0				0						0					0						0	7	1
CLADOCERA	Chydoridae	1	3	1	1				0			3	4	4	1						0	1	3	2	1	1				1	1	2	2	2	3	1						0	7	1
	Daphniidae		3		1				0					1	1						0			2	1						0		2	1		1						0	6	1
	Ilyocryptidae				0	1			1						0						0				0						0					0						0	1	1
	Moinidae																															1				1						0	1	1
	Macrothricidae				0			1	1		3		4	2	1						0		2	1	1						0					0						0	4	1
TOTAL NO. OF FAMILIES (all rounds)																																												69
HABITAT TOTAL		16	21	11		8	4	10		11	11	10	12	19		13	10	7	9	12		23	16	18		11	3	5	5	11		23	12	15	21		17	8	16	9	12			
WETLAND TOTAL					**27**				**16**						**27**						**25**				**32**						**18**					**38**						**28**		
RESTRICTED TO THE HABITAT		0	1	0		5	1	5		5	0	0	1	6		8	1	1	1	2		0	1	0		2	0	0	1	4		9	2	3	5		7	1	2	1	3			
TOTAL FROM ONLY ONE HABITAT			1					11				12						13					1					7					19						14					
% FAMILIES FROM SINGLE HABITAT			4					69				44						52					3					39					50						50					

Figure A2.12 Melaleuca Park wetland aquatic macroinvertebrate community data (Round 10 – 15)

Melaleuca Park		1995-1998*	Round 10						Round 12						Round 13				Round 14					Round 15			
HIGHER TAXA	FAMILY/ SUBFAMILY	6 combined habitats	1	2	3	4	5	P/A	1	2	3	4	dry	P/A	3	4	dry	P/A	1	2	3	4	P/A	4	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)							0						0				0					0		0	0	0
NEMATODA	Unidentified	x						0						0				0					0		0	0	1
NEMERTINI	Unidentified							0						0				0					0		0	0	0
PORIFERA	Unidentified							0						0				0					0		0	0	0
TURBELLARIA	Unidentified							0						0		1		1					0		0	1	1
ANNELIDA	Ohirudinea							0						0				0					0		0	0	0
	Ooligochaete	x		1				1						0				0					0		0	1	1
MOLLUSCA	Ancylidae							0						0				0					0		0	0	0
	Lymnaeidae							0						0				0					0		0	0	0
	Physidae							0						0				0					0		0	0	0
	Planorbidae							0						0				0					0		0	0	0
	Sphaeriidae							0						0				0					0		0	0	0
ACARINA	Araneae		1	3		2		1		1		1		1				0					0		0	2	1
	Arrenuridae							0						0				0					0		0	0	0
	Astigmata							0						0				0					0		0	0	0
	Eylaidae							0						0				0					0		0	0	0
	Halacoroidea							0						0				0					0		0	0	0
	Hydrachnidae							0						0				0					0		0	0	0
	Hydrodromidae							0						0				0					0		0	0	0
	Limnocharidae							0						0				0					0		0	0	0
	Limnesiidae		1			1		1	2			2		1	1			1	2	1	1	2	1		0	4	1
	Oribatida	x						0						0				0					0		0	0	1
	Oxidae							0						0				0					0		0	0	0
	Pionidae	x						0						0				0					0		0	0	1
	Unidentified	x						0						0				0					0		0	0	1
	Unioncolidae		1			2		1	1	2	1	1		1	2	2		1	2	1	1	2	1	2	1	5	1
AMPHIPODA	Ceinidae							0						0				0					0		0	0	0
	Perthidae				2			1			1			1	1			1					0		0	3	1
ISOPODA	Amphisopidae							0						0				0					0		0	0	0
	Janiridae							0						0				0					0		0	0	0
DECAPODA	Palaemonidae							0						0				0					0		0	0	0
	Parastacidae	x	3		2	2	4	1	2		1	1		1		1		1	2	1	1	1	1	1	1	5	1
EPHEMEROPTERA	Caenidae							0						0				0					0		0	0	0
	Baetidae							0						0	1			1					0		0	1	1
COLLEMBOLA	Unidentified		4					1	1					1				0	1				1		0	3	1
MECOPTERA	Unidentified							0						0				0					0		0	0	0
ODONATA	Aeshnidae							0			1			1	1			1	1		1		1		0	3	1
	Coenagrionidae							0						0	1	2		1					0		0	1	1
	Cordulidae							0						0				0					0		0	0	0
	Gomphidae	x						0						0				0					0		0	0	1
	Lestidae	x	1	2	1	3		1						0	1	1		1		1		1	1		0	3	1
	Libellulidae							0						0				0					0		0	0	0
	Megapodagrionidae	x	1	1				1		1				1				0					0		0	2	1
	Synthemidae							0						0				0					0		0	0	0
TRICHOPTERA	Ecnomidae		1		2			1			1			1	1			1		1	1	1	1	1	1	5	1
	Hydroptilidae							0						0				0					0		0	0	0
	Leptoceridae	x	4	2		4	1	1	2	2	1	2		1	1	1		1	2	2	1	2	1	1	1	5	1
HEMIPTERA	Corixidae	x	1					1				1		1	1	1		1					0		0	3	1
	Gerridae	x						0						0				0					0		0	0	1
	Hebridae	x						0						0				0					0		0	0	1
	Hydrometridae							0						0				0					0		0	0	0
	Mesoveliidae						1	1						0				0	1		1	1	1	1	1	3	1
	Nepidae							0		1				1				0					0		0	1	1
	Notonectidae					1		1						0		1		1		1		1	1	1	1	4	1
	Saldidae							0						0				0					0		0	0	0
	Veliidae	x	3				2	1						0				0					0		0	1	1
DIPTERA	Ceratopogonidae							0						0				0					0		0	0	0
	Chaoborinae	x						0	1	1	1	1		1	1			1					0		0	2	1
	Chironominae	x				1	1	1						0	1	1		1					0	2	1	3	1
	Culicidae							0	2	1	1	2		1				0	2	2	1	1	1		0	2	1
	Empididae							0						0				0					0		0	0	0
	Ephydridae							0						0				0					0		0	0	0
	Orthocladiinae		1	3		1	1	1						0		2		1		1	1	1	1	1	1	4	1
	Simulidae							0						0				0					0		0	0	0
	Stratiomyidae							0						0				0					0		0	0	0
	Tabanidae							0						0				0					0		0	0	0
	Tanypodinae	x	1			1	2	1			1			1				0	3	2			1		0	3	1
	Tipulidae							0						0				0					0		0	0	0
LEPIDOPTERA	Pyralidae							0	1					1				0			1	1	1		0	2	1
COLEOPTERA	Carabidae							0						0				0					0		0	0	0
	Chyrsomelidae							0						0				0					0		0	0	0
	Curculionidae							0	1	1	1	1		1				0			1		1		0	2	1
	Dryopidae	x						0						0				0					0		0	0	1
	Dytiscidae	x	4	4	4	4	4	1	2	2	2	2		1	2	2		1	3	2	1	2	1	1	1	5	1
	Haliplidae							0						0				0					0		0	0	0
	Helminthidae							0						0				0					0		0	0	0
	Hydraenidae							0						0				0					0		0	0	0
	Hydrophilidae	x					1	1		1		1		1	1	1		1					0	1	1	4	1
	Limnichidae							0						0				0					0		0	0	0
	Noteridae							0						0				0					0		0	0	0
	Ptilodactilidae							0						0				0					0		0	0	0
	Scirtidae		1			1	1	1			2	1		1				0	1				1		0	3	1
	Staphylinidae							0						0				0					0		0	0	0
	Ocoleoptera							0						0				0					0		0	0	0
COPEPODA: Cal.	Unidentified	x		4		3		1	3	3	2	2		1	2	2		1	3	3	3	3	1		0	4	1
Harp.	Unidentified	x						0						0				0					0		0	0	1
Cyc.	Unidentified	x	2					1	1	1		1		1	1	1		1	3	1	1		1		0	4	1
CONCHOSTRACA	Unidentified							0						0				0					0		0	0	0
OSTRACODA	Cyprididae	x					3	1						0				0		3	2		1		0	2	1
	Gomphodellidae							0						0				0					0		0	0	0
	Ilyocyprididae																									0	0
	Notodromadidae							0						0				0					0		0	0	0
	Oostracoda							0						0				0					0		0	0	0
CLADOCERA	Chydoridae	x	3					1	1	1	1			1				0		3	2	2	1		0	3	1
	Daphniidae	x						0	3	2	1	2		1	2	2		1		1	2	2	1		0	3	1
	Ilyocryptidae							0						0				0					0		0	0	0
	Macrothricidae	x		1				1						0				0			1		1		0	2	1
TOTAL NO. OF FAMILIES (all rounds)																											45
HABITAT TOTAL			17	9	5	13	11		14	14	15	15	0		17	15	0		13	16	18	15		10			
WETLAND TOTAL		27						26						24				21					23		10		
RESTRICTED TO THE HABITAT			4	2	1	1	3		2	2	4	1	0		7	4			2	0	2	0		10			
TOTAL FROM ONLY ONE HABITAT					11						9					11				4				10			
%FAMILIES FROM SINGLE HABITAT					42						38					52				17				100			

* This data was collected over 5 sample events between 1995 and 1998, in a separate study by Knott and Jasinska (2000). X indicates presence of the taxa in the wetland. Results from this study are incorporated into the Total Presence/Absence column and the cumulative family score for the wetland.

Figure A2.13 Lake Nowergup aquatic macroinvertebrate community data (Round 8 – 15)

Nowergup		Round 8				Round 9				Round 10				Round 11				Round 12						Round 13				Round 14					Round 15					
HIGHER TAXA	FAMILY/ SUBFAMILY	3	4	6	P/A	4	6	dry	P/A	3	4	6	P/A	3	4	6	P/A	2	3	4	5	6	P/A	dry	5	6	P/A	2	4	5	6	P/A	4	dry	6	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)				0				0				0				0						0				0					0				0	0	0
NEMATODA	Unidentified				0				0				0				0						0				0					0				0	0	0
NEMERTINI	Unidentified				0				0				0				0						0				0					0				0	0	0
PORIFERA	Unidentified				0				0				0				0						0				0					0				0	0	0
TURBELLARIA	Unidentified	1	3	1	1	1			1				0	4	4		1	1	1	1	1		1		3	2	1		1			1	4		2	1	12	1
ANNELIDA	Uhirudinea				0				0	4	1		1				0	2					1				0					0	1			1	5	1
	Uoligochaete	1	2		1				0	1			1			2	1	1	1	1			1				0	2			1	1	2			1	13	1
MOLLUSCA	Ancylidae				0				0				0				0						0				0					0				0	0	0
	Lymnaeidae				0				0				0				0						0				0					0				0	1	1
	Physidae	1			1	1			1	4	1		1	4	2		1	2	1	1	1		1				0	1	1	1		1	2			1	12	1
	Planorbidae			1	1				0				0				0						0			1	1		1			1				0	6	1
	Sphaeriidae			1	1		1		1			3	1				0						0				0				1	1				0	9	1
ACARINA	Araneae				0				0				0				0						0				0					0				0	0	0
	Arrenuridae	1			1				0				0				0		1				1				0	1				1				0	5	1
	Astigmata				0				0				0				0					1	1				0					0				0	1	1
	Eylaidae				0				0				0				0						0				0					0				0	0	0
	Halacoroidea				0				0				0				0						0				0					0				0	0	0
	Hydrachnidae				0				0				0				0						0				0					0				0	2	1
	Hydrodromidae				0				0				0				0						0				0					0				0	0	0
	Limnocharidae				0				0				0				0						0				0					0				0	1	1
	Limnesiidae				0				0				0				0	1			1		1				0	1	2			1				0	3	1
	Oribatida				0				0				0				0						0				0					0	1			1	1	1
	Oxidae				0				0				0				0			1			1				0					0				0	1	1
	Pionidae	3	3		1				0				0				0	2	2	2	1	1	1				0	1	3	2	1	1	3		1	1	8	1
	Unidentified				0				0		2		1	2		1	1						0				0					0				0	8	1
	Unioncolidae				0				0				0		4		1						0				0					0				0	1	1
AMPHIPODA	Ceinidae	3	3	3	1	2	2		1	4	4	4	1	4	4	4	1		3	4	3	2	1		2	1	1		4	3	2	1				0	14	1
	Perthidae				0				0				0				0						0				0					0				0	0	0
ISOPODA	Amphisopidae			1	1				0	4	1	1	1	1		1	1	1					1			2	1	1				1				0	11	1
	Janiridae				0				0				0				0						0				0					0				0	0	0
DECAPODA	Palaemonidae	1			1	1			1	3	1		1	2	4		1				1		1				0					0				0	10	1
	Parastacidae				0				0				0				0						0				0					0				0	1	1
EPHEMEROPTERA	Caenidae				0				0				0				0						0				0					0				0	0	0
	Baetidae				0				0				0		1		1						0				0					0				0	1	1
COLLEMBOLA	Unidentified				0				0	1			1				0						0				0					0				0	1	1
MECOPTERA	Unidentified				0				0				0				0						0				0					0				0	0	0
ODONATA	Aeshnidae	1			1				0	3			1	1			1				2		1				0		1			1				0	8	1
	Coenagrionidae				0	1			1				0				0						0				0					0				0	4	1
	Cordulidae				0				0				0				0						0				0					0				0	3	1
	Gomphidae				0				0				0				0						0				0					0				0	0	0
	Lestidae	1	1		1	1			1	4			1				0		1	1	1		1				0			1		1				0	9	1
	Libellulidae				0				0	1			1	4			1						0				0					0				0	5	1
	Megapodagrionidae				0				0				0				0						0				0					0				0	0	0
	Synthemidae				0				0				0				0						0				0					0				0	0	0
TRICHOPTERA	Ecnomidae				0				0				0				0						0				0					0				0	0	0
	Hydroptilidae		1		1				0				0				0			2			1				0		1			1				0	6	1
	Leptoceridae	3			1				0	4			1				0			1	1		1				0		1			1				0	8	1
HEMIPTERA	Corixidae	3	3	1	1	3	1		1	4	4	3	1	2	1	1	1		2	3	2	1	1				0		1	1	1	1	2		2	1	14	1
	Gerridae				0				0				0				0						0				0					0				0	0	0
	Hydrometridae				0				0				0				0						0				0					0				0	0	0
	Mesoveliidae				0				0				0				0						0				0	2				1	1			1	3	1
	Nepidae				0				0				0				0						0				0					0				0	0	0
	Notonectidae	2	2		1	2	2		1	3	2	1	1			2	1		2	2	1	1	1				0		1	1		1				0	10	1
	Saldidae				0				0				0				0						0				0					0				0	0	0
	Veliidae				0				0				0				0						0				0					0				0	0	0
DIPTERA	Ceratopogonidae				0				0	1			1				0	1	1	1	1		1				0					0				0	6	1
	Chironominae	2	2	2	1	1	1		1	4	4		1			4	1	2	3	2	2		1		1	1	1		2	1	2	1	2		2	1	15	1
	Culicidae	1			1				0				0				0	1		1			1				0					0				0	4	1
	Empididae				0				0				0				0						0				0					0				0	0	0
	Ephydridae				0				0				0				0						0				0					0				0	0	0
	Orthocladiinae	1			1				0	1			1	1		2	1		1	1			1				0		2			1				0	8	1
	Simulidae				0				0				0				0						0				0					0				0	0	0
	Stratiomyidae				0	1			1				0		1		1						0				0		1			1	1			1	6	1
	Tabanidae				0				0				0				0						0				0					0			1	1	2	1
	Tanypodinae		2	2	1	2			1	1		3	1		1	1	1	1	1	1	1		1		1	1	1				1	1				0	14	1
	Tipulidae				0				0				0				0						0				0					0				0	0	0
LEPIDOPTERA	Pyralidae				0				0				0				0						0				0					0				0	0	0
COLEOPTERA	Carabidae				0				0				0				0						0				0					0				0	0	0
	Chyrsomelidae				0				0				0				0						0				0					0				0	0	0
	Curculionidae				0				0				0				0						0				0	1				1				0	2	1
	Dytiscidae				0				0	4	1		1	4			1		2	1			1				0	1	1	1		1	1			1	10	1
	Haliplidae				0				0				0				0						0				0					0				0	0	0
	Helminthidae				0				0				0				0						0				0					0				0	0	0
	Hydraenidae				0				0				0				0						0		1		1					0				0	2	1
	Hydrophilidae	1			1				0	4	1		1				0			1			1				0	2		1		1				0	8	1
	Limnichidae				0				0				0				0						0				0					0				0	0	0
	Noteridae				0				0				0				0						0				0					0				0	0	0
	Ptilodactilidae				0				0				0				0						0				0					0				0	0	0
	Scirtidae				0				0				0				0	1	1	1	1		1				0	1				1				0	3	1
	Staphylinidae				0				0				0				0						0				0					0				0	0	0
	Ucoleoptera				0				0				0				0						0				0					0				0	0	0
COPEPODA: Cal.	Unidentified	2	2	2	1	1	4		1	2	4	4	1			2	1	3	4	3	1	4	1		3	2	1		3	2	2	1	2		4	1	15	1
Har	Unidentified				0				0				0				0						0				0				1	1				0	1	1
Cyc	Unidentified	1	2	1	1				0	2			1		1		1	2	2	2	3	3	1				0				2	1	3		2	1	12	1
OSTRACODA	Cyprididae				0				0	4	3	4	1	4	4	4	1	4	4	3	2	2	1		3	4	1	2	3	4	3	1	4		2	1	13	1
	Gomphodellidae				0				0				0				0						0				0					0				0	0	0
	Ilyocyprididae																															0				0	0	0
	Notodromadidae	3	3	3	1	1			1				0				0						0				0					0				0	7	1
	Uostracoda				0				0				0				0						0				0					0				0	0	0
CLADOCERA	Chydoridae	1	2		1				0	4	4		1			2	1	3	1	4	1	1	1				0		3	3	2	1	4		1	1	12	1
	Daphniidae		1	3	1				0		2		1			1	1	2	2	1			1		3	3	1		1	3	4	1			3	1	10	1
	Ilyocryptidae				0				0				0				0						0				0					0				0	0	0
	Macrothricidae				0				0				0				0						0				0					0				0	0	0
TOTAL NO. OF FAMILIES (all rounds)																																						**52**
HABITAT TOTAL		20	15	12		13	6			23	15	8		12	11	13		17	20	24	19	9		0	8	9		12	19	13	13		15	0	10			
WETLAND TOTAL					**26**				**14**				**26**				**23**						**31**				**10**					**31**				**17**		
RESTRICTED TO THE HABITAT		8	1	3		7	1			9	2	1		3	4	6		2	1	3	2	1		0	1	2		5	7	1	4		7		2			
TOTAL FROM ONLY ONE HABITAT			12				8				12				13					9					3				17					9				
%FAMILIES FROM SINGLE HABITAT			46				57				46				57					29					30				55					53				

Figure A2.14 Pipidinny Swamp aquatic macroinvertebrate community data (Round 8 – 15)

Pipidinny Swamp		Round 8				Round 9				Round 10						Round 11				Round 12						Round 13				Round 14				Round 15					
HIGHER TAXA	FAMILY/ SUBFAMILY	2	4	6	P/A	1	2	4	P/A	2	3	4	7	8	P/A	2	7	8	P/A	2	4	6	7	8	P/A	2	7	8	P/A	4	5	8	P/A	2	3	8	P/A	No. Rounds present	Total P/A
CNIDARIA	(Hydra)				0				0						0				0						0				0				0				0	0	0
NEMATODA	Unidentified				0				0						0				0						0				0				0				0	0	0
NEMERTINI	Unidentified				0				0						0				0						0				0				0				0	0	0
PORIFERA	Unidentified				0				0						0				0						0				0				0				0	0	0
TURBELLARIA	Unidentified				0				0						0				0						0				0				0				0	0	0
ANNELIDA	Uhirudinea				0				0						0				0						0				0				0				0	1	1
	Uoligochaete			1	1	3	1		1	1		1			1				0	1					1	1			1				0	1	1		1	12	1
MOLLUSCA	Ancylidae				0				0	1					1				0						0				0				0				0	2	1
	Lymnaeidae				0				0		1				1				0						0				0				0				0	1	1
	Physidae	1		3	1	2			1	3	3	3		1	1	2			1	2		2		1	1	3			1	2			1	2	1		1	15	1
	Planorbidae				0				0	1	1				1	1			1						0	1			1				0	1			1	10	1
	Sphaeriidae				0				0		1				1	1			1						0			1	1				0	1			1	7	1
ACARINA	Araneae				0				0						0				0						0				0				0				0	0	0
	Arrenuridae				0				0						0				0			1			1				0		1		1				0	3	1
	Astigmata				0				0						0				0						0				0				0				0	0	0
	Eylaidae				0				0						0				0		1			1	1				0				0				0	1	1
	Halacoroidea				0				0						0				0						0				0				0				0	0	0
	Hydrachnidae	1		1	1				0						0				0		1		1	1	1	1			1				0	1			1	4	1
	Hydrodromidae				0				0						0				0						0				0				0				0	1	1
	Limnocharidae				0				0						0				0						0				0				0				0	0	0
	Limnesiidae				0				0				1		1				0			2	1	1	1				0			1	1				0	5	1
	Oribatida				0				0						0				0			1			1				0		1		1				0	2	1
	Oxidae				0				0						0				0						0				0				0				0	0	0
	Pionidae			2	1				0						0				0			2			1				0		1		1				0	4	1
	Unidentified				0				0			4	1		1				0						0				0				0	1			1	6	1
	Unioncolidae				0				0						0				0						0				0				0				0	1	1
AMPHIPODA	Ceinidae	2	2	1	1		1		1	1		4	1	1	1	2		1	1	2	1		1	1	1	1	2	1	1	2	1	3	1	2		1	1	12	1
	Perthidae				0				0						0				0						0				0				0				0	0	0
ISOPODA	Amphisopidae			2	1				0				4	1	1				0		1	2	2	1	1				0		2		1				0	9	1
	Janiridae				0				0						0				0						0				0				0				0	0	0
DECAPODA	Palaemonidae	1			1		2		1	4			1	4	1	4			1	2					1	2			1	2			1				0	12	1
	Parastacidae				0				0		2	1			1				0	1			1		1	1			1		1		1				0	7	1
EPHEMEROPTERA	Caenidae	1			1				0						0				0						0				0				0				0	4	1
	Baetidae	1			1				0						0				0						0				0		1		1	1			1	5	1
COLLEMBOLA	Unidentified				0				0						0				0						0				0				0				0	0	0
MECOPTERA	Unidentified				0				0						0				0						0				0				0				0	0	0
ODONATA	Aeshnidae			1	1				0				1		1				0		1		1	1	1				0		1		1				0	7	1
	Coenagrionidae	2	2		1	1			1		4		1		1			1	1	1	1				1	1	2	1	1	1			1	2			1	14	1
	Cordulidae				0	1	1	1	1		2	1	2		1				0	1	1			1	1	1		2	1				0			1	1	5	1
	Gomphidae	1		1	1				0						0				0						0				0				0				0	5	1
	Lestidae	1		1	1				0		2	4	4		1				0	1	2		2	2	1	1	1		1	1	2	2	1	2			1	10	1
	Libellulidae				0				0		1		1	2	1			2	1						0	1	1	1	1				0	1		1	1	10	1
	Megapodagrionidae				0				0						0				0						0				0				0				0	1	1
	Synthemidae				0				0						0				0						0				0				0				0	1	1
TRICHOPTERA	Ecnomidae				0				0						0				0						0				0				0				0	0	0
	Hydroptilidae				0				0						0				0						0				0		1		1				0	1	1
	Leptoceridae	2	3	2	1	2	2		1		2	1	3		1			1	1	1	1			1	1	2		1	1		2	1	1	1		1	1	15	1
HEMIPTERA	Corixidae	1		3	1		2	1	1		4	4	1		1	1		4	1	1	2	1	1	2	1	2	2	1	1	1	2	2	1	2		2	1	15	1
	Gerridae				0				0			3			1				0						0				0				0				0	1	1
	Hydrometridae				0				0						0				0						0				0				0				0	0	0
	Mesoveliidae				0				0						0				0						0				0				0	1			1	2	1
	Nepidae				0				0						0				0						0	1			1				0				0	1	1
	Notonectidae	2		3	1	1	1		1	4					1	4			1	3		1		2	1	2	2		1	2	2	1	1	3			1	12	1
	Pleidae				0				0						0	1			1						0				0				0				0	1	1
	Veliidae				0				0						0				0						0				0				0	1			1	1	1
DIPTERA	Ceratopogonidae				0				0						0		1		1		1				1				0		1	2	1	1	1	1	1	7	1
	Chironominae	1	1	3	1	3	3		1	2	2	1	4	1	1	4		4	1	2	1	3	2	2	1	1	2		1	2	2	2	1	1	2	3	1	15	1
	Culicidae	1	1		1				0			1	1		1		2		1		2	2	2		1				0		2	1	1	1			1	10	1
	Empididae				0				0				1		1				0						0				0				0				0	1	1
	Ephydridae				0				0			1			1				0						0				0				0				0	1	1
	Orthocladiinae	1	1		1				0						0			4	1	1	1			1	1			1	1		2	1	1				0	8	1
	Simulidae				0				0						0				0						0				0				0				0	0	0
	Stratiomyidae				0	1			1						0				0		1		2		1				0				0	1			1	3	1
	Tabanidae				0		1		1						0				0						0				0				0				0	3	1
	Tanypodinae				0		1		1	1	4	2	1		1		1	2	1	1	2		1	1	1	2	1	2	1	2	2	2	1	2	2	3	1	14	1
	Tipulidae				0				0						0				0						0				0				0				0	0	0
LEPIDOPTERA	Pyralidae				0				0						0				0						0				0				0				0	0	0
COLEOPTERA	Carabidae				0				0						0				0						0				0				0				0	1	1
	Chyrsomelidae				0				0						0				0						0				0				0				0	0	0
	Curculionidae				0				0						0				0						0				0				0				0	0	0
	Dytiscidae	2		2	1		1	1	1	2		4	3	3	1	4	2	4	1	1	2	2	2	2	1	2	2	2	1	1	2	2	1	1	2	1	1	15	1
	Haliplidae				0				0			2		1	1				0						0				0				0				0	3	1
	Helminthidae				0				0						0				0						0				0				0				0	0	0
	Hydraenidae				0				0						0	1			1						0				0			1	1		2	1	1	4	1
	Hydrophilidae	1		2	1	1	1		1			1	2	3	1		1	1	1	1	1	2	2	2	1	1		1	1	1	2	1	1	1			1	14	1
	Limnichidae				0				0						0				0						0				0				0				0	0	0
	Noteridae				0				0						0				0						0				0				0				0	0	0
	Ptilodactilidae				0				0						0				0						0				0				0				0	0	0
	Scirtidae				0				0			1			1				0						0				0				0				0	2	1
	Staphylinidae				0				0						0				0						0				0				0				0	2	1
	Ucoleoptera				0				0						0				0						0				0				0				0	1	1
COPEPODA: Cal.	Unidentified	4	4		1		3		1	4	4	3	3	3	1	4			1	2	4		3	4	1	2			1	4	4	4	1	2			1	12	1
Harp.	Unidentified				0				0						0				0						0				0				0				0	1	1
Cyc.	Unidentified	2		3	1			1	1	1	1	1	3		1				0	2	3	2	3	3	1	2	2		1	2	2	2	1	2			1	12	1
OSTRACODA	Cyprididae	2	2	2	1	3			1		4	4	4	1	1		1	1	1		3		4	4	1		3	2	1	2	4	2	1		2	4	1	14	1
	Gomphodellidae				0				0			3			1				0						0				0				0				0	1	1
	Ilyocyprididae				0				0						0				0		3		2		1				0				0				0	1	1
	Notodromadidae	1			1				0			4		2	1				0	1					1		3	1	1		2	2	1				0	5	1
	Uostracoda				0				0	4					1				0						0				0				0				0	1	1
CLADOCERA	Chydoridae				0				0						0				0		4		1		1				0	2	3		1				0	5	1
	Daphniidae	2	1	4	1				0						0				0		4	4	4	2	1				0	3	2	3	1				0	6	1
	Ilyocryptidae				0				0						0				0						0				0				0				0	0	0
	Macrothricidae				0				0						0				0						0				0				0				0	0	0
TOTAL NO. OF FAMILIES (all rounds)																																							66
HABITAT TOTAL		22	9	18		10	13	4		13	16	23	21	12		12	6	11		19	0	24	20	21		21	12	13		16	26	19		25	8	11			
WETLAND TOTAL					26				18						36				21						34				25				31				28		
RESTRICTED TO THE HABITAT		4	0	4		4	5	1		3	0	4	3	0		8	2	4		2	1	3	0	0		8	0	2		3	8	2		15	0	1			
TOTAL FROM ONLY ONE HABITAT			8				10					10					14					6					10				13				16				
%FAMILIES FROM SINGLE HABITAT			31				56					0					67					18					40				42				57				

Figure A2.15 Lake Wilgarup aquatic macroinvertebrate community data (Round 2 – 13)

Wilgarup		Round 2				Round 4				Round 6				Round 7*				Round 8				Round 9*		Round 10*		Round 11*			
HIGHER TAXA	FAMILY/ SUBFAMILY	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	1	2	3	P/A	dry	P/A	dry	P/A	dry	P/A	No. Rounds present	Total P/A
CNIDARIA	Unidentified				0				0				0				0				0		0		0		0	0	0
NEMATODA	Unidentified				0				0				0	1			1				0		0		0		0	1	1
NEMERTINI	Unidentified				0				0				0				0				0		0		0		0	0	0
TURBELLARIA	Unidentified				0				0				0	1			1				0		0		0		0	1	1
ANNELIDA	Uhirudinea				0				0				0				0				0		0		0		0	0	0
	Uoligochaete				0				0	3		2	1				0				0		0		0		0	1	1
MOLLUSCA	Ancylidae				0				0				0				0				0		0		0		0	0	0
	Lymnaeidae				0				0				0				0				0		0		0		0	0	0
	Physidae				0				0				0		1	1	1				0		0		0		0	1	1
	Planorbidae		1		1				0	1			1				0				0		0		0		0	2	1
	Sphaeriidae				0				0				0				0				0		0		0		0	0	0
ACARINA	Arrenuridae				0	4	4	4	1	3	4	4	1	1	4	2	1	1	1	2	1		0		0		0	4	1
	Eylaidae				0				0				0				0				0		0		0		0	0	0
	Hydrachnidae				0				0				0				0				0		0		0		0	0	0
	Hydrodromidae				0				0				0				0				0		0		0		0	0	0
	Limnocharidae				0				0				0				0				0		0		0		0	0	0
	Limnesiidae				0				0				0				0				0		0		0		0	0	0
	Oribatida				0				0				0				0				0		0		0		0	0	0
	Oxidae				0				0				0				0				0		0		0		0	0	0
	Pionidae				0				0				0	1	1	1	1			1	1		0		0		0	2	1
	Unidentified	3	2		1				0				0				0				0		0		0		0	1	1
	Unioncolidae				0	1			1				0				0				0		0		0		0	1	1
AMPHIPODA	Ceinidae				0	1	1		1				0				0		1		1		0		0		0	2	1
ISOPODA	Amphisopidae	4	4	1	1				0	3	4	4	1	4	4	4	1	1		1	1		0		0		0	4	1
	Jainridae				0				0				0				0				0		0		0		0	0	0
DECAPODA	Palaemonidae				0	1			1				0		1		1				0		0		0		0	2	1
	Parastacidae	1			1			2	1				0				0				0		0		0		0	2	1
EPHEMEROPTERA	Caenidae				0				0				0				0				0		0		0		0	0	0
	Baetidae				0				0				0				0				0		0		0		0	0	0
COLLEMBOLA	Unidentified				0				0				0				0				0		0		0		0	0	0
MECOPTERA	Unidentified				0				0				0				0				0		0		0		0	0	0
ODONATA	Aeshnidae				0				0				0				0				0		0		0		0	0	0
	Coenagrionidae				0				0				0				0				0		0		0		0	0	0
	Cordulidae				0				0				0				0				0		0		0		0	0	0
	Gomphidae				0				0				0				0				0		0		0		0	0	0
	Lestidae	3	1		1				0				0				0				0		0		0		0	1	1
	Libellulidae				0				0				0				0				0		0		0		0	0	0
	Megapodagrionidae				0				0				0				0				0		0		0		0	0	0
	Synthemidae				0				0				0				0				0		0		0		0	0	0
TRICHOPTERA	Ecnomidae				0				0				0				0				0		0		0		0	0	0
	Hydroptilidae				0				0				0				0				0		0		0		0	0	0
	Leptoceridae		2		1	4	3	1	1	1		1	1	1		1	1				0		0		0		0	4	1
HEMIPTERA	Corixidae				0				0				0				0				0		0		0		0	0	0
	Gerridae				0				0				0				0				0		0		0		0	0	0
	Hydrometridae				0				0				0				0				0		0		0		0	0	0
	Mesoveliidae				0				0				0				0				0		0		0		0	0	0
	Notonectidae				0				0				0				0				0		0		0		0	0	0
	Saldidae				0				0				0				0				0		0		0		0	0	0
	Veliidae				0				0				0				0				0		0		0		0	0	0
DIPTERA	Ceratopogonidae				0				0				0				0				0		0		0		0	0	0
	Chironominae	1	1		1				0				0	1	1		1				0		0		0		0	2	1
	Culicidae			2	1	4	2	1	1	2	4	1	1	2	4	1	1	2	2	2	1		0		0		0	5	1
	Ephydridae				0				0				0				0				0		0		0		0	0	0
	Orthocladiinae		1		1	1			1				0				0				0		0		0		0	2	1
	Simulidae				0				0				0				0				0		0		0		0	0	0
	Stratiomyidae				0				0				0				0				0		0		0		0	0	0
	Tabanidae				0				0				0				0				0		0		0		0	0	0
	Tanypodinae	1	1		1				0	1		1	1				0				0		0		0		0	2	1
	Tipulidae				0				0				0				0				0		0		0		0	0	0
LEPIDOPTERA	Pyralidae				0				0				0				0				0		0		0		0	0	0
COLEOPTERA	Carabidae		1		1				0				0				0				0		0		0		0	1	1
	Chyrsomelidae				0				0				0				0				0		0		0		0	0	0
	Curculionidae				0				0				0				0				0		0		0		0	0	0
	Dytiscidae	1	3		1	1	1	1	1		1	2	1	2	4	3	1	1	2	2	1		0		0		0	5	1
	Haliplidae				0				0				0				0				0		0		0		0	0	0
	Hydraenidae				0				0				0				0				0		0		0		0	0	0
	Hydrophilidae				0				0				0		4		1				0		0		0		0	1	1
	Limnichidae				0				0				0				0				0		0		0		0	0	0
	Ptilodactilidae				0				0	1	1	1	1				0				0		0		0		0	1	1
	Scirtidae	2	3	4	1	2	4	2	1	2		4	1	4		2	1	3	3	3	1		0		0		0	5	1
	Staphylinidae			1	1				0				0		1		1				0		0		0		0	2	1
	Ucoleoptera				0	1			1				0				0				0		0		0		0	1	1
COPEPODA: Cal.	Unidentified				0				0				0				0				0		0		0		0	0	0
Harp.	Unidentified				0				0				0				0				0		0		0		0	0	0
Cyc.	Unidentified	2			1	2			1			3	1	1			1			1	1		0		0		0	5	1
OSTRACODA	Cyprididae	4	4	3	1	1			1				0	4	4	4	1			2	1		0		0		0	4	1
	Gomphodellidae				0				0				0				0				0		0		0		0	0	0
	Notodromadidae				0				0				0				0				0		0		0		0	0	0
CLADOCERA	Chydoridae				0				0				0	1			1				0		0		0		0	1	1
	Daphnidae	2			1				0				0			3	1				0		0		0		0	2	1
	Ilyocryptidae				0				0				0				0				0		0		0		0	0	0
	Macrothricidae				0				0				0				0				0		0		0		0	0	0
TOTAL NO. OF FAMILIES (all rounds)																													**30**
HABITAT TOTAL		11	12	5		12	6	6		9	5	10		13	11	10		5	5	8		0 0 0		0 0 0		0 0 0			
WETLAND TOTAL					**17**				**13**				**11**				**18**				**9**		**0**		**0**		**0**		
RESTRICTED TO THE HABITAT		3	4	2		6	0	1		1	0	1		4	2	1		0	1	3		0 0 0		0 0 0		0 0 0			
TOTAL FROM ONLY ONE HABITAT			9				7				2				7				4			0		0		0			
%FAMILIES FROM SINGLE HABITAT			53				54				18				39				44			0		0		0			

Figure A2.16 Lake Yonderup aquatic macroinvertebrate community data (Round 8 – 15)

Yonderup

HIGHER TAXA	FAMILY/ SUBFAMILY	Round 8				Round 9				Round 10						Round 11					
		2	4	5	P/A	2	4	5	P/A	1	2	4	5	6	P/A	1	2	4	5	6	P/A
CNIDARIA	(Hydra)				0				0						0						0
NEMATODA	Unidentified		1		1				0		1				1						0
NEMERTINI	Unidentified				0				0						0						0
PORIFERA	Unidentified				0				0						0						0
TURBELLARIA	Unidentified			4	1				0						0				2		1
ANNELIDA	Uhirudinea				0				0						0						0
	Uoligochaete	2	1		1	1	1	1	1	3	1	1		1	1	2	1				1
MOLLUSCA	Ancylidae				0				0						0						0
	Lymnaeidae				0				0						0						0
	Physidae	1		3	1				0			4	3		1				2	1	1
	Planorbidae				0				0						0						0
	Sphaeriidae				0				0						0						0
ACARINA	Araneae				0				0						0						0
	Arrenuridae				0				0						0						0
	Astigmata				0				0						0						0
	Eylaidae				0				0						0						0
	Halacoroidea				0				0						0						0
	Hydrachnidae				0				0						0						0
	Hydrodromidae				0				0						0						0
	Limnocharidae				0				0						0						0
	Limnesiidae			1	1				0						0						0
	Oribatida				0		1		1						0						0
	Oxidae	1			1				0			1			1						0
	Pionidae				0				0						0						0
	Unidentified				0				0						0						0
	Unioncolidae				0				0						0						0
AMPHIPODA	Ceinidae		1		1				0						0						0
	Perthidae				0				0						0						0
ISOPODA	Amphisopidae				0				0						0						0
	Janiridae				0				0						0						0
DECAPODA	Palaemonidae	1	1	1	1	2	2	2	1	1	3	2	1	2	1	2		2	4	4	1
	Parastacidae			1	1				0						0		1	1			1
EPHEMEROPTERA	Caenidae				0	1	1		1						0						0
	Baetidae	1	1		1	1	2	1	1						0	1		1		2	1
COLLEMBOLA	Unidentified				0				0						0						0
MECOPTERA	Unidentified				0				0						0						0
ODONATA	Aeshnidae		2	1	1				0						0			1		1	1
	Coenagrionidae	1		1	1	1		1	1		2	1			1		2		1	2	1
	Cordulidae				0				0						0						0
	Gomphidae				0				0						0						0
	Lestidae				0				0						0						0
	Libellulidae	1	1	1	1			1	1						0		1			2	1
	Macrodiplactidae																		1		1
	Megapodagrionidae				0				0						0						0
	Synthemidae				0				0						0						0
TRICHOPTERA	Ecnomidae				0				0						0						0
	Hydroptilidae		1		1				0						0						0
	Leptoceridae		2	1	1	1	2		1		1	2		1	1		4	2		4	1
HEMIPTERA	Corixidae	1		1	1		1		1		1		1	2	1						0
	Gerridae				0				0						0						0
	Hydrometridae				0				0						0						0
	Mesoveliidae				0				0						0						0
	Nepidae				0				0						0						0
	Notonectidae				0				0						0						0
	Saldidae				0				0						0						0
	Veliidae				0				0						0						0
DIPTERA	Ceratopogonidae	1	1	1	1			1	1					1	1						0
	Chironominae	3	3	2	1	2	3	3	1	4	4	4	3	4	1	2	2	4	1	4	1
	Culicidae		1		1				0						0			1			1
	Empididae				0				0						0						0
	Ephydridae				0				0						0						0
	Orthocladiinae	1	2		1				0			1		1	1						0
	Simulidae				0				0						0						0
	Stratiomyidae				0				0						0						0
	Tabanidae				0				0						0						0
	Tanypodinae	1	3	1	1	1	2	1	1	3	1	2		1	1	2	1	2		1	1
	Tipulidae				0				0						0						0
LEPIDOPTERA	Pyralidae				0				0						0						0
COLEOPTERA	Carabidae				0				0						0						0
	Chyrsomelidae				0				0						0						0
	Curculionidae				0				0						0						0
	Dytiscidae	1		1	1	1		1	1		1			1	1		4		1	2	1
	Haliplidae				0				0						0						0
	Helminthidae				0				0						0						0
	Hydraenidae				0				0						0		1				1
	Hydrophilidae				0				0		1			2	1		1				1
	Limnichidae				0				0						0						0
	Noteridae				0				0		1				1						0
	Ptilodactilidae				0				0						0						0
	Scirtidae				0				0						0						0
	Staphylinidae				0				0						0						0
	Ucoleoptera				0				0						0						0
COPEPODA: Cal.	Unidentified	1			1				0	4			1	1	1	4					1
Harp.	Unidentified				0				0		1			1	1						0
Cyc.	Unidentified	3	4	3	1	1	1	1	1		1			1	1	1				1	1
OSTRACODA	Cyprididae	3	4	4	1	3	2	4	1				1	2	1		2		4	2	1
	Gomphodellidae	1		1	1				0						0						0
	Ilyocyprididae																				
	Notodromadidae				0				0						0						0
	Uostracoda				0				0						0						0
CLADOCERA	Chydoridae	1	2	2	1				0					1	1						0
	Daphniidae	2	2	1	1				0	1					1						0
	Ilyocryptidae		1		1				0						0						0
	Macrothricidae				0				0						0						0

HIGHER TAXA	FAMILY/ SUBFAMILY	Round 12						Round 13						Round 14						Round 15						No. Rounds present	Total P/A
		1	2	4	5	6	P/A	1	2	4	5	6	P/A	1	2	4	5	6	P/A	1	3	4	5	6	P/A		
CNIDARIA	(Hydra)						0						0			1			1						0	1	1
NEMATODA	Unidentified						0						0						0					1	1	6	1
NEMERTINI	Unidentified						0						0						0						0	0	0
PORIFERA	Unidentified						0						0						0						0	0	0
TURBELLARIA	Unidentified				2		1						0				2		1	2	2		1	1	1	8	1
ANNELIDA	Uhirudinea						0						0						0						0	2	1
	Uoligochaete	2	1	2	1	1	1	1		1	1		1	1	1	2	1	1	1	1			1	1	1	15	1
MOLLUSCA	Ancylidae						0						0						0						0	1	1
	Lymnaeidae						0						0						0						0	2	1
	Physidae		1		1	1	1						0				1	1	1						0	8	1
	Planorbidae						0						0						0						0	1	1
	Sphaeriidae						0						0						0						0	0	0
ACARINA	Araneae						0						0						0						0	0	0
	Arrenuridae						0						0				1		1						0	1	1
	Astigmata						0						0						0						0	0	0
	Eylaidae						0						0						0						0	0	0
	Halacoroidea						0						0						0						0	0	0
	Hydrachnidae						0						0						0						0	0	0
	Hydrodromidae						0						0						0						0	0	0
	Limnocharidae						0						0						0						0	0	0
	Limnesiidae						0					1	1		1		1	1	1						0	4	1
	Oribatida						0						0						0						0	1	1
	Oxidae				1	1	1						0		1		1	1	1						0	5	1
	Pionidae						0						0	1			1		1						0	3	1
	Unidentified						0						0						0		1				1	5	1
	Unioncolidae						0						0		1	1	1	1	1				1	1	1	3	1
AMPHIPODA	Ceinidae			1			1						0		1	1			1						0	5	1
	Perthidae						0						0						0						0	0	0
ISOPODA	Amphisopidae						0						0						0						0	1	1
	Janiridae						0						0						0						0	0	0
DECAPODA	Palaemonidae	1	2	1	2		1	3	1	1	2	2	1	1	1		1	1	1	2	2	1	1		1	15	1
	Parastacidae					1	1						0						0					2	1	4	1
EPHEMEROPTERA	Caenidae						0		1			1	1		1	1		1	1						0	4	1
	Baetidae		1			1	1		1		1	1	1						0	1	2	1	1	1	1	10	1
COLLEMBOLA	Unidentified		1		1		1						0					1	1						0	2	1
MECOPTERA	Unidentified						0						0						0						0	0	0
ODONATA	Aeshnidae		1		1		1						0						0						0	9	1
	Coenagrionidae		1		2	1	1	1	1		1	1	1				1	1	1		1		1	1	1	14	1
	Cordulidae		1				1					1	1					1	1	1	1			1	1	7	1
	Gomphidae						0						0						0						0	0	0
	Lestidae						0						0		1				1						0	2	1
	Libellulidae						0		1		1		1						0		1		1		1	6	1
	Macrodiplactidae						0						0						0						0	1	1
	Megapodagrionidae						0						0						0						0	0	0
	Synthemidae						0						0						0						0	0	0
TRICHOPTERA	Ecnomidae						0						0						0						0	2	1
	Hydroptilidae	1	2	2		2	1					1	1	1	1	2		1	1			1	1	1	1	10	1
	Leptoceridae	1	1	1	1	1	1	3	2	1		2	1		1	1	1	1	1		1	2	1	1	1	15	1
HEMIPTERA	Corixidae		1	2	2	2	1	3				1	1		1	1	1		1						0	12	1
	Gerridae						0						0						0						0	0	0
	Hydrometridae						0						0						0						0	0	0
	Mesoveliidae						0						0		1		1	1	1			1			1	5	1
	Nepidae						0						0						0						0	0	0
	Notonectidae						0						0						0		1				1	2	1
	Saldidae						0						0						0						0	1	1
	Veliidae						0						0						0						0	0	0
DIPTERA	Ceratopogonidae			1	1	1	1		1		1		1			1	1	1	1			1	1		1	12	1
	Chironominae	2	2	2	2	3	1	4	2	2	3	2	1	2	2	3	2	2	1	1	1	2	2	2	1	14	1
	Culicidae				1		1						0						0						0	6	1
	Empididae						0						0						0						0	0	0
	Ephydridae						0						0				1		1						0	1	1
	Orthocladiinae			1	1	1	1						0		2	2	2	2	1		1				1	9	1
	Simulidae						0						0						0						0	0	0
	Stratiomyidae						0						0						0				1		1	4	1
	Tabanidae						0						0						0						0	2	1
	Tanypodinae			1	1	1	1	4	1	1	1	1	1	2	1	2		2	1	1		1	1	1	1	15	1
	Tipulidae			1			1						0						0						0	2	1
LEPIDOPTERA	Pyralidae						0						0						0						0	1	1
COLEOPTERA	Carabidae						0						0						0						0	0	0
	Chyrsomelidae						0						0						0						0	0	0
	Curculionidae						0						0						0						0	0	0
	Dytiscidae			1			1	1	1	1	1	2	1				1		1				1	1	1	15	1
	Haliplidae						0						0						0						0	0	0
	Helminthidae						0						0						0						0	0	0
	Hydraenidae						0						0						0						0	2	1
	Hydrophilidae				1		1					1	1			1	1	1	1			1	1		1	13	1
	Limnichidae						0						0						0						0	0	0
	Noteridae						0						0						0						0	1	1
	Ptilodactilidae						0						0						0						0	0	0
	Scirtidae						0						0						0						0	0	0
	Staphylinidae						0						0						0						0	0	0
	Ucoleoptera						0						0						0						0	0	0
COPEPODA: Cal.	Unidentified	4		1	1	1	1						0	4					1					2	1	7	1
Harp.	Unidentified						0						0					1	1			1			1	3	1
Cyc.	Unidentified		3	3	2	3	1			2	1	2	1		3	1	1	3	1						0	14	1
OSTRACODA	Cyprididae	1	2	3	3	3	1		1	1	4	2	1	1	3	2	2	2	1	2	3	2	2	2	1	15	1
	Gomphodellidae				1		1						0				1		1		1				1	4	1
	Ilyocyprididae																									0	0
	Notodromadidae				1	1	1						0						0	1					1	2	1
	Uostracoda						0						0						0						0	0	0
CLADOCERA	Chydoridae	2	2	2	3	1	1		1			1	1	1	2	2	2	2	1		1	1	1		1	9	1
	Daphniidae	3	2	3	1	1	1						0	1	2			2	1						0	5	1
	Ilyocryptidae						0						0						0						0	1	1
	Macrothricidae						0						0			2			1						0	1	1

	Round 8	Round 9	Round 10	Round 11	Round 12	Round 13	Round 14	Round 15
TOTAL NO. OF FAMILIES (all rounds)								**60**
HABITAT TOTAL	19 18 19	11 11 11	6 13 9 6 15	7 11 8 8 12	9 16 17 23 19	8 12 8 11 16	10 19 17 23 23	9 14 12 17 15
WETLAND TOTAL	**29**	**15**	**21**	**20**	**30**	**19**	**35**	**28**
RESTRICTED TO THE HABITAT	2 4 4	0 2 3	1 2 2 1 2	2 2 1 1 0	0 1 3 4 1	0 0 0 0 3	1 1 2 5 3	1 4 2 1 3
TOTAL FROM ONLY ONE HABITAT	10	5	8	6	9	3	12	11
%FAMILIES FROM SINGLE HABITAT	34	33	38	30	30	16	34	39

APPENDIX III: Water Quality Results

7 Water Quality Results

7.1 Coogee Springs

No sampling of the water physico-chemistry could be undertaken at Coogee Spring as the wetland was dry in both Round 14 and 15.

7.2 Lake Gnangara

Although in Round 14 the water level at time of sampling was low in comparison to many spring rounds, water quality parameters such as pH, conductivity, dissolved oxygen and all nutrient concentrations were within the range recorded in previous spring sampling rounds. Water temperature (17-20.5^{o}C) was though the lowest recorded in a spring sampling round. Chlorophyll *a* concentration in Round 14 was the highest ever recorded at this wetland (31.68μg/L), with the dense algal growth apparent at Lake Gnangara reflected in the highest recorded turbidity in a spring round (11 FTU). Gilvin concentration in Round 14 was the lowest recorded in spring sampling rounds at this wetland (0.5g440). Fe concentration (0.81mg/L) was low, being comparable to that of Round 12.

Lake Gnangara was dry at the time of sampling in Round 15, therefore no discussion of physico-chemistry for this round is undertaken.

7.3 Lake Goollelal

The water level in Round 14 was low but within the range experienced in previous spring sampling rounds. Conductivity was the highest recorded at this wetland in spring rounds (922-938μS/cm). The presence of dense filamentous green algae throughout the wetland is reflected by the highest ever chlorophyll-a concentration (32.25μg/L) recorded from any round, and the relatively high turbidity (8 FTU; the highest recorded in a spring round except for Round 10). All nutrient concentrations except for NO_2^-/NO_3^- were within the range recorded from previous spring rounds, NO_2^-/NO_3^- concentration (17μg/L) was the highest recorded in spring except for Round 4 (21μg/L). Both temperature range (16.4-17.8^{o}C) and gilvin concentration (1.2g440) were the lowest recorded in spring rounds.

Water levels at sites sampled in Round 15 (15-50cm) were the lowest recorded at this wetland. pH (7.30) was the lowest recorded in summer sampling round since Round 1. Dissolved oxygen concentration of (3.72mg/L) recorded in Round 15 was the second lowest recorded in summer rounds at this wetland. Chlorophyll *a* concentration in Round 15 (14.25μg/L) is relatively high compared to previous summer sampling rounds. Gilvin concentration (1.44g440) was the second lowest recorded in summer sampling rounds (Round 13 = 0.2g440). All nutrient concentration except for NO_2^-/NO_3^- was within the range of previous summer sampling rounds. NO_2^-/NO_3^- concentration (120μg/L) is the highest recorded at Lake Goollelal.

7.4 Lake Jandabup

Water level at the time of monitoring was low in comparison to many previous spring rounds. Significantly pH in Round 14 (5.71-7.0) was lower than that of Round 12 (6.48-7.6), reversing the trend of increasing pH in spring rounds apparent since R6, subsequent to the initiation of water level maintenance. Water temperature (15.9-20.0^{o}C), gilvin (1.9g440) and Chlorophyll *a* concentration (2.26μg\L) were lower than previously spring sampling rounds. Turbidity in Round 14 (8 FTU) was lower than recent spring rounds, reversing a trend of increasing turbidity in spring rounds since Round 8. All nutrient concentrations were within the range recorded from previous spring sampling rounds. Fe (1.1mg/L) remained stable in comparison to Round 12. SO_4^{2+} concentration (7.4mg/L) in Round 14 was the lowest ever recorded at Lake Jandabup.

Conductivity in round 15 (647-1005μS/cm) was relatively high compared to previous summer sampling rounds. Chlorophyll *a* concentration in Round 15 (3.39μg/L) was the second lowest recorded in summer sampling rounds (Round 3 = 2.67μg/L). Round 15 gilvin concentration (2.36g440) was also relatively low compared to previous summer rounds. Of the nutrients, NO_2^-/NO_3^- (25μg/L) and TP (35μg/L) were at there highest concentrations in summer rounds. NH_4^+ (100μg/L) was high in comparison to all other summer rounds except Round 7 (199458μg/L) and Round 9 (4300μg/L), which preceded the drying event in 1998. Fe (1.8mg/L) was within the range of previous summer sampling rounds. SO_4^{2+} (61mg/L) was significantly higher than both Round 11 (29mg/L) and Round 13 (12mg/L).

7.4.1 Lake Jandabup – Site 8

pH at Site 8 (6.67-6.95) was within the range of previous spring samples and the range recorded at other sites in Round 14, but was lower than Round 12 (7.01-7.03), reversing the trend of increasing pH in spring rounds apparent since R6. Chlorophyll *a* (6.79µg/L), gilvin (2.0g440) and turbidity (11 FTU) were all higher at Site 8 than in the combined wetland sample, although both gilvin and turbidity were lower than in Round 8. While NO_2^-/NO_3^- concentration at Site 8 (13µg/L) was higher than the combined lake sample, NH_4^+ (12µg/L) was half that of the combined lake sample and TKN was only marginally lower (760µg/L). Both PO_4^{2-} and TP concentrations were comparable to the combined lake sample. Round 14 Fe (1.2mg/L) was higher than Round 8 (0.23mg/L), but comparable to that of the combined lake sample. SO_4^{2+} (10mg/L) was lower than Round 8 (36mg/L), but marginally higher than the combined lake sample.

Round 15 pH (7.03) is the lowest recorded at this site in summer sampling rounds, but is within the pH range recorded throughout the wetland in round 15. Although conductivity in at site 8 in Round 15 (556µS/cm) was higher than that recorded at the same site in Round 13, it was lower than recorded at any other site at lake Jandabup in Round 15 (647-1005µS/cm). Dissolved oxygen (4.7mg/L) was less than that at other lake Jandabup sites in Round 15 (5.67-8.33mg/L). Chlorophyll *a* concentration (1.20µg/L) recorded in Round 15 at Site 8 is the lowest ever recorded at this wetland. NO_2^-/NO_3^- (8µg/L) was the highest concentration recorded at Site 8 but was within the range recorded at other sites in Round 15. NH_4^+ (170µg/L) concentration was significantly higher than previous recorded at Site 8. TKN (1200µg/L) the highest concentration recorded at Site 8 but is well below concentration recorded at other Lake Jandabup site in previous summer sampling rounds. PO_4^{2-} (14µg/L) is the highest ever recorded at Site 8 and was relatively high in comparison to the other site sampled at Lake Jandabup. Fe (2.4mg/L) at Site 8 in Round 15 was below that recorded in Round 13 (4.1mg/L). Although SO_4^{2+} (45mg/L) in Round 15 is the highest ever concentration recorded at Site 8, it is lower than that found at other sites in Round 15 (61mg/L).

7.5 Lake Joondalup (North)

The water level in Round 14 was low but within the range experienced in previous spring sampling rounds. In Round 14, chlorophyll *a* concentration (5.09μg/L) and conductivity (1387-1457μS/cm) were the highest recorded in spring rounds from this wetland. Temperature (23.6-24.5^{o}C) was high but within the range of previous spring sampling rounds. Conversely turbidity (1 FTU) and gilvin (1.0g440) were lower than previously recorded in spring rounds. Dissolved oxygen, pH and all nutrient concentrations were within the range of previous spring rounds.

Round 15 conductivity (4420-4680μS/cm) was high relative to most other summer sampling rounds, except for Round 7 (5548-5937μS/cm). Water temperature (24.0-28.1^{o}C), Dissolved oxygen (10.92-13.24mg/L) and Chlorophyll *a* (94.06μg/L) in Round 15 are the highest recorded concentrations at Lake Joondalup (North). In Round 15 NO_2^-/NO_3^- (13μg/L) concentration was the highest from a summer sampling round. TKN (13000μg/L) and PO_4^{2-} (40μg/L) concentrations in round 15 were the highest recorded at this wetland. TP (310μg/L) is the second highest recorded summer concentration after Round 11 (421μg/L).

7.6 Lake Joondalup (South)

Unlike almost all other wetlands sampled in Round 14, water level at Lake Joondalup (South) was high in comparison to many earlier spring rounds. Chlorophyll *a* concentration (5.66μg/L) was the highest recorded in any spring round. Gilvin concentration (3.0g440) was lower than in previous spring sampling rounds. pH, conductivity, dissolved oxygen, turbidity and temperature were all within the range of previous spring rounds. All nutrient concentrations were within the range of previous spring rounds, except for TKN (870μg/L), which was the lowest concentration of this nutrient ever recorded from Joondalup (South).

The pH (7.67) recorded in Round 15 is considered relatively low in comparison to previous summer sampling rounds. Dissolved oxygen concentration in Round 15 (1.48-1.77mg/L) is the second lowest recorded in summer rounds at this wetland (Round 9 = 1.04-3.95mg/L). Chlorophyll *a* (26.33μg/L) in Round 15 is the second highest recorded at this wetland from any sampling round (Round 7 = 156.37μg/L). In Round 15 the gilvin concentration

(2.82g440) is the lowest recorded concentration ever from Lake Joondalup (South). Concentrations of NH_4^+ (350µg/L), PO_4^{2-} (830µg/L) and TP (1900µg/L) in Round 15 were the second highest for each of these nutrients respectively in summer sampling rounds.

7.7 Lexia 186

In Round 14 surface water was again restricted to a small (3x2m) excavated sump on the Northern margin of the wetland basin. Water depth in the sump is approximately 60cm below the wetland basin height. Surface water has been restricted to the sump (i.e. wetland basin dry) in every year since Lexia 186 was incorporated in to GMEMP schedule in 1999/2000. Other than *Baumea articulata* around the sump and some very sparse *Lepiodosperma*, all other sedges and reeds are dead within the wetland. All physico-chemical parameters were within the range previously recorded in spring rounds, except for gilvin (5.0g440) and turbidity (11 FTU) that were both lower than previously recorded in spring rounds.

No sampling of the water physico-chemistry could be undertaken at Lexia 186, the wetland was dry in Round 15 (including the small excavated sump sampled in Round 14). Round 15 was the third consecutive summer sampling round in which this wetland has been dry.

7.8 Lexia 86

Lexia 86 wetland did not contain surface water on either sampling occasion in Round 14 (26-08-02 and 21-10-02); therefore three *Cherax* burrows were sampled for macro-invertebrates. This is the first spring, since Lexia 86 was incorporated into the GMEMP monitoring schedule, in which the wetland has not filled. The reduced wetland water level can be attributed to the low winter rainfall in 2002 combined with the declining spring peak groundwater levels in the region. Result discussed here are for sub-surface water collected from the *Cherax* burrows, and as such little comparison can be made to physico-chemical results from previous spring sampling rounds.

No sampling of the water physico-chemistry could be undertaken at Lexia 86, the wetland was dry in Round 15. Round 15 was the third consecutive summer sampling round in which this wetland has been dry.

The organic/peat soils of Lexia 86 combined with the current period of excessive drying require that a fire management strategy be developed for this wetland. Although limited data exists, pH levels have declined in successive spring sampling rounds (Round 10 and Round 12) and as such the susceptibility of this wetland to acidification must also be established.

7.9 Lake Mariginiup

Water level was low at the time of sampling in comparison to many previous spring sampling rounds. pH in Round 14 (4.87-5.05) was the lowest recorded at this wetland in either spring or summer sampling rounds. Gilvin concentration (2.4g440) was significantly lower than in previous spring rounds. Both conductivity (1287-1402μS/cm) and chlorophyll *a* concentration (19.89μg/L) were higher than in previous spring rounds. In Round 14, NO_2^-/NO_3^- concentration (8μg/L) was equal to the lowest spring levels in Round 2, NH_4^+ (57μg/L) was the lowest ever recorded concentration at this wetland, and TKN (2200μg/L) was the second lowest concentration except for Round 4 (1877μg/L). Despite the apparent reduction in nitrogen availability with the wetland, PO_4^{2-} concentration (7μg/L) was higher (marginally) and TP was within the range of previous spring rounds. The high chlorophyll *a* concentration in Round 14 appears to indicate that primary production in Lake Mariginiup is phosphorus limited.

Lake Mariginiup was almost completely dry at the time of Round 15 sampling; surface water was restricted to isolated shallow pools in the Northwest section of the lakebed. The below outlines the water physico-chemistry of one such pool. The pH in Round 15 (6.49) is the second lowest recorded at this wetland in summer sampling rounds (Round 7 = 5.92-6.42), and continues the trend of declining pH levels at this wetland. Chlorophyll *a* concentration (17.38μg/L) is the highest recorded in a summer sampling round. Gilvin (3.4g440) is the lowest recorded concentration in summer sampling rounds. Although NO_2^-/NO_3^- (100μg/L) and NH_4^+ (1100μg/L) were high relative to previous summer sampling rounds PO_4^{2-} (52μg/L) was the only nutrient recorded at the highest concentrations ever from Lake Mariginiup. Fe (2.3mg/L) is the lowest concentration recorded in summer rounds and continues the trend of declining Fe concentration. SO_4^{2+} (400mg/L) was the highest concentration ever recorded at this wetland from any sampling round.

7.10 Loch McNess (North)

Water level at the time of monitoring was low in comparison to many previous spring rounds. Conductivity (662-666µS/cm) and chlorophyll *a* concentration (17.35µg/L) in Round 14 were higher than previous spring sampling rounds. Turbidity (20 FTU) and NO_2^-/NO_3^- concentration (5µg/L) were recorded at their highest concentration ever at Loch McNess (North). Gilvin concentration (2.6g440) and water temperature (12.8-13.7^{o}C) were lower than in any previous sampling round. All other physico-chemical parameters were within the range of previous spring rounds.

Loch McNess (North) was dry at the time of Round 15 sampling. Since Loch McNess (North) has been sampled separately the wetland has not contained surface water in a summer sampling round.

7.11 Loch McNess (South)

The water level in Round 14 was low but within the range experienced in previous spring sampling rounds. Conductivity in Round 14 (458-487µS/cm) was the second highest recorded at this wetland after Round 2 (410-606µS/cm). Turbidity in Round 14 (10 FTU) was also the second highest recorded (Round 4–11 FTU). Water temperature (13.0-17.3^{o}C) and gilvin concentration (0.2g440) were both the lower than previously recorded in spring rounds. TP concentration (8µg/L) in Round 14 was lower than previous spring rounds. Although TKN concentration (180µg/L) was the lowest ever recorded at this wetland in Round 14, NO_2^-/NO_3^- (9µg/L) had the highest spring concentration since Round 4 (20-21µg/L).

With the exception of turbidity all other physico-chemical parameters were recorded within the range of previous summer sampling rounds. Turbidity (7FTU) in Round 15 was equal to the maximum recorded in Round 5. NO_2^-/NO_3^- concentration (3µg/L) was low in comparison to recent summer sampling rounds (Round 11 = 124µg/L; Round 13 = 41µg/L) but was within the range recorded in previous summer rounds.

7.12 Melaleuca Park

Water depth at the time of sampling was low in comparison to many previous spring sampling rounds. Although only limited data is available, the pH recorded in Round 14 (3.90-4.56) indicates that spring pH is declining at this wetland. Temperature (9.0-10.1^oC) and dissolved oxygen concentration (3.45-4.12mg\L) in Round 14 were lower than in previous spring rounds. Turbidity (0 FTU), gilvin (12.1g440) and concentrations of the nutrients NH_4^+ (52µg/L) and PO_4^{2-} (11µg/L) were below that previous recorded at the wetland. Both chlorophyll *a* (6.22µg/L) and NO_2^-/NO_3^- (34µg/L) concentrations were higher that in any previous sampling round.

Except for Round 11 (when the wetland was completely dry) the water depth recorded in round 15 (3cm) is the lowest ever. pH in Round 15 (3.78) is the lowest recorded at this wetland from any previous sampling round. Conductivity (778µS/cm), chlorophyll *a* 8.49µg/L) and temperature (32.2^oC) in Round 15 were the highest ever recorded at Melaleuca Park in any previous sampling round. Turbidity is round 15 (71FTU) is the highest from a summer sampling round. Dissolved oxygen concentration (2.61mg/L) in Round 15 is lowest ever recorded at Melaleuca Park. The concentration of all nutrients in Round 15 (NO_2^-/NO_3^- =42µg/L, NH_4^+=170µg/L, TKN=3400µg/L, PO_4^{2-}=42µg/L and TP=55µg/L) were the highest ever recorded at this wetland.

7.13 Lake Nowergup

The water level in Round 14 was low but within the range experienced in previous spring sampling rounds. Chlorophyll *a* concentration (12.45µg/L) was higher than recorded in previous spring rounds, and turbidity (19 FTU) was the highest since Round 4 (21 FTU). Temperature (14.8-16.2^oC), conductivity (462-544µS/cm) and dissolved oxygen (1.13-9.06mg/L) were low in Round 14 compared to previous spring rounds. The continuing trend of low conductivity and dissolved oxygen at some sites is attributed to the inflow of low conductivity (382µs/cm) low oxygen (0.8mg/L) groundwater to the wetland for water level maintenance. NH_4^+ (58 µg/L) concentration in Round 14 was higher than previously recorded in spring sampling rounds. TKN in Round14 (710µg/L) was the second highest concentration except for Round 4 (851-1027µg/L). All other physico-chemical parameters were within the range of previous spring sampling rounds.

The maximum water depth (200cm) in round 15 is equal to that of Round 9. pH range (9.11-9.18) in Round 15 is the highest in summer sampling rounds and the second highest overall

(Round 10 = 9.44-9.76). Conductivity (531-540µS/cm) in Round 15 is the lowest recorded in a summer sampling round. Round 15 dissolved oxygen concentration (10.81mg/L) is marginally higher than the previous highest (Round 7 = 10.80mg/L) summer record. Chlorophyll *a* concentration (12.98µg/L) in Round 15 is higher than in recent summer sampling rounds but well below that recorded in Round 3 (37.53µg/L). Round 15 turbidity (20FTU) is the highest recorded in a summer sampling round at lake Nowergup. Gilvin concentration (0.8g440) is the lowest from a summer sampling round. All nutrient concentrations were within the range of previous summer samples.

7.14 Pipidinny Swamp

As per the contract brief, the discussion for Pipidinny Swamp includes analysis of individual sites. Depths in Round 14 (30-61cm) at all sites were within the range recorded in previous spring sampling rounds. Although the range of pH recorded at sites in Round 14 (7.38-8.93) was within that recorded in previous spring rounds, there was a distinct separation of sites based on pH, with sites 2, 3 and 4 all being strongly alkaline and sites 7 and 8 being near neutral. Conductivity results for Site 3 (18710µS/cm) and Site 7 (14970µS/cm) may indicate saltwater intrusion into these sites associated with reduced groundwater levels. The conductivity of both sites was above that recorded in previous spring rounds. Although dissolved oxygen levels in Round 14 (3.29-11.73mg/L) were within the range recorded in previous spring rounds, both Site 3 (5.09mg/L) and Site 7 (3.29mg/L) had significantly lower dissolve oxygen levels compared to the other sites sampled in Round 14. Chlorophyll *a* concentration varied highly between sites, ranging between 0.0-6.03µg/L. All sites had relatively high turbidity in Round 14 (28-44 FTU) in comparison to most previous spring sampling rounds. As with the majority of wetlands in Round 14, the gilvin concentration of sites at Pipidinny Swamp (0.5-1.7g440) were significantly lower than previous spring rounds. NO_2^-/NO_3^- and NH_4^+ concentrations at sites in Round 14 (2-11µg/L; 5-44µg/L respectively) were below that of Round 12 (86µg/L; 82µg/L respectively) but high in comparison to other spring rounds. The highest concentration of TKN (5000µg/L), PO_4^{2-} (7µg/L) and TP (77µg/L) were recorded at Site 3 in Round 14, with each being higher than previous recorded in spring sampling rounds. TKN concentration in Site 7 (4500µg/L) was also higher than previously recorded in spring rounds.

Round 15 pH results (7.16-8.17), although within the range, are relatively low in comparison to previous summer sampling rounds. Conductivity at Site 8 (16510µS/cm) is the second highest ever recorded at this wetland (Round 7 = 18320-18340µS/cm). Conductivity results for Site 3 (11980µS/cm) and Site 8 may indicate saltwater intrusion into these sites associated with reduced groundwater levels. In Round 15 the dissolved oxygen concentration of Site 3 (0.35mg/L) and Site 8 (0.57-0.33mg/L) were considerably lower than that recorded at Site 2 (3.49-3.42mg/L). Turbidity at all sites sampled in Round 15 (78-220FTU) was high relative to any previous sampling round, with turbidity at Site 8 (220FTU) being the highest ever recorded at Pipidinny Swamp. Gilvin concentration at Site 8 (1.3g440) and Site 2 (0.7g440) are below that previously recorded at this wetland. Nutrient concentrations at both Site 2 and Site 8 were within the range recorded in previous summer sampling rounds. Site 3 in Round 15 had second highest recorded concentration of NH_4^+ (1800µg/L) of any previous sampling round. TKN (10000µg/L) and TP (360µg/L) at Site 3 were the highest ever recorded concentration of theses nutrients at Pipidinny Swamp.

7.15 Lake Wilgarup

Lake Wilgarup was again completely dry in Round 14 and Round 15. No surface has been recorded at Lake Wilgarup since Round 8 (spring 1999).

7.16 Lake Yonderup

Water depth at the time of sampling was within the range of previous spring sampling rounds. Concentrations of gilvin (0.5g440), TP (9µg/L), NH_4^+ (<3µg/L) and TKN (150µg/L) were all lower than previous spring sampling rounds. NO_2^-/NO_3^- concentration (<2ug/L) remained very low in Round 14. pH was low in Round 14 (7.12-7.28) compared to other spring rounds, with pH declining in spring rounds subsequent to Round 10. Conductivity (473-540µS/cm) in Round 14 was the highest in spring rounds, and turbidity (5 FTU) was equal to the highest in Round 6.

With the exception of conductivity all physico-chemical parameters measured at Lake Yonderup in Round 15 were within the range of previous summer sampling rounds. Conductivity (496-517µS/cm) is the highest recorded in a summer sampling round. TKN (250µg/L) concentration is the second highest recorded in a summer sampling round at this wetland (Round 3 = 852µg/L).

Table A3.1 Physico-chemistry of the GMEMP wetlands from summer 1996 (Round 1) to summer 2003 (Round 15).

	Round	COOGEE	GNANGARA	GOOLLELAL	JANDABUP	JANDABUP 8(Spring) & 10(Summer)	JOONDALUP North	JOONDALUP South	LEXIA 86	LEXIA 186	MARIGINIUP	MCNESS North	MCNESS South	MELALEUCA PARK	NOWERGUP	PIPIDINNY	PIPIDINNY S2	PIPIDINNY S3	PIPIDINNY S4	PIPIDINNY S7	PIPIDINNY S8	WILGARUP	YONDERUP
depth	R1		12.5	38.3	13.8		20.0	-	-	-		-	53.0	-	58.3	53.3	-	-	-	-	-		28.3
(cm)	R2	18.3	24.7	100.0	43.4		54.0	-	-	-	55.3	-	53.4	-	55.6	30.3	-	-	-	-	-	11.0	14.3
	R3		32.7	27.7	13.2		24.0	-	-	-	2.0	-	55.0	-	42.5	16.0	-	-	-	-	-		23.7
	R4	19.2	15.0	65.2	36.7		45.7	-	-	-	36.7	-	40.6	-	40.5	62.3	-	-	-	-	-	12.3	37.0
	R5		1-10	21-43				-	-	-			43-85	-	7-55	5-10	-	-	-	-	-		20-90
	R6	15-18	8-35	85-90	28-53		35-44	18-78	-	-	37-46	17-76	57-100	-	32-74	50-65	-	-	-	-	-	14-28	10-75
	R7		15-35	25-48	5-15		10-70	10-20	-	-	5-10		58-100	-	23-62	20-70	-	-	-	-	-	10-30	15-105
	R8	80-110	15-36	50-120	25-52	10-25	50-72	60-72	-	-	30-45	38-80	20-67	-	62-170	55-100	-	-	-	-	-	5-7	30-65
	R9	5	2-5	34-95	5-24	7	5-22	50-62	-	-	2-4		15-85	-	20-200	10-15	-	-	-	-	-		15-105
	R10	75-90	15-80	45-80	30-75		40-90	70-90	5-20	7-30	20-40		20-80	10-65	35-115	70-100	-	-	-	-	-		10-130
	R11	20-35	10-20	20	7-25		5-20	20-40			12		25-60		35-75	15-25	-	-	-	-	-		10-70
	R12	85-90	11-30	55-90	50-80	60	20-95	50-80	3-24	25	30-40	65-85	45-75	25-62	17-187	20-102	-	-	-	-	-		15-105
	R13		5-10	20-50	7-17	20	15-35	15-30			4		25-45	15	17-30		50			40	15		7-72
	R14		5-25	45-75	18-75	50	30-67	60-85	-15	33	25-27	42-70	48-77	20-50	7->200		45	30	53	50	61		10-100
	R15			15-50	8-15	15	15-50	45			10		20-60	3	30-200		50	15			20		12-100
pH range	R1		3.14	7.20-9.30	7.20-7.90		7.90-9.30						6.90-8.40		8.20-8.30	7.40-8.50	-	-	-	-	-		6.90-7.30
	R2	6.99-8.60	3.51-3.55	7.89-8.71	6.32-7.06		7.89-8.71				6.63-7.25		6.90-8.31		6.76-8.11	7.24-8.30	-	-	-	-	-	5.90-7.10	6.26-6.75
	R3		3.00-3.03	9.37-9.58	7.25-8.30		8.97-9.15				8.03		6.83-8.82		8.28-8.78	7.58-8.10	-	-	-	-	-		7.28-7.93
	R4	6.65-7.99	3.60-3.89	7.58-8.52	4.86-6.71		7.72-9.01				7.29-9.18		6.01-8.59		7.15-8.18	7.68-8.26	-	-	-	-	-	6.00-6.95	7.05-7.30
	R5		3.93	8.65-9.18									7.01-8.69		8.43-8.65	7.58-8.33	-	-	-	-	-		7.10-7.31
	R6	7.36-7.38	3.17-3.53	7.67-8.12	3.97-4.42		8.18-9.41	7.83-8.27			5.72-6.65	7.52-7.74	7.37-8.60		7.30-8.36	7.88-9.04	-	-	-	-	-	5.87-7.06	7.35-7.79
	R7		3.24-3.92	9.16-9.68	4.32-4.34		9.84-10.07	8.35-9.18			5.92-6.42		6.59-8.49		7.80-8.23	7.25-8.22	-	-	-	-	-	6.67-7.07	8.19-8.51
	R8	6.74-6.97	3.83-3.94	7.4-8.39	4.29-4.65	6.7	7.91-10.09	7.14-7.56			6.08-6.67	7.35-8.38	6.80-8.70		7.65-9.13	7.53-8.25	-	-	-	-	-	4.68-5.95	6.65-7.40
	R9	7.00-7.23	3.44-3.96	7.49-9.02	3.4-6.23	7.3	9.14-9.41	7.06-7.76			7.17-7.5		6.83-8.18		8.32-9.02	7.57-7.56	-	-	-	-	-		7.08-7.41
	R10	7.53-7.56	4.45-4.52	8.53-9.07	5.42-7.25		8.74-9.47	8.84-10.08	5.48-6.63	5.42-5.67	7.11-7.61		7.77-10.13	5.00-5.13	9.44-9.76	7.87-9.88	-	-	-	-	-		7.65-8.62
	R11	7.33-8.24	3.17-4.01	7.95-9.33	7.59-8.42		8.68-9.38	8.51-8.90			8.54		6.88-8.60		8.18-8.48	7.15-7.71	-	-	-	-	-		7.22-7.92
	R12	7.09-7.17	3.86-4.07	7.49-7.87	6.48-7.6	7.01-7.03	7.32-9.88	6.95-7.64	4.0-5.29	4.24-4.25	5.57-6.28	7.34-7.62	7.37-7.99	3.84-4.91	6.76-9.27	7.15-8.62	-	-	-	-	-		7.33-7.66
	R13		3.28-3.32	8.66-9.24	6.97-8.63	7.34-7.28	8.37-8.69	8.09-8.63			7.67		6.60-8.40	3.84-3.92	8.53-8.67		7.92			7.71-7.64	7.39		6.82-7.37
	R14		3.83-3.99	7.57-8.43	5.71-7.00	6.95-6.67	8.23-9.34	7.69-8.31	3.83-4.01	4.50-4.51	4.87-5.05	7.27-7.61	7.07-8.60	3.90-4.56	7.13-9.20		8.93	8.30	8.22-7.99	7.38	7.80-7.83		7.12-7.28
	R15			7.30-9.08	6.76-7.25	7.03	9.13-9.35	7.67			6.49		6.95-8.77	3.78	9.11-9.18		7.31-7.46	7.19			7.16-8.17		7.11-7.46
conductivity range (µS/cm)	R1		1288	1213-1295	1490-1889		1065-4740						454-510		1121-1128	1500-4870	-	-	-	-	-		401-409
	R2	1658-1971	1140-1164	649-709	303-425		1199-1235				1053-1090		410-606		838-845	1119-3930	-	-	-	-	-	894-1483	424-498
	R3		3590-3650	1103-1115	1204-1654		2620-2870				3680		415-521		1153-1187	1383-1621	-	-	-	-	-		471-478
	R4	2190-2420	968-1414	830-870	321-421		1205-1248				837-931		363-555		850-960	1746-4320	-	-	-	-	-	1474	409-442
	R5		996	1472-1505									415-536		1293-1299	1246-4120	-	-	-	-	-		423-433
	R6	2077-2297	607-1652	807	168-976		1235-1272	530-744			919-1147	521-528	360-402		573-933	1702-4340	-	-	-	-	-	1476-2190	355-377
	R7		513-3217	1471-1529	3301-3355		5548-5937	2216-7183			2386-2533		429-993		908-927	1804-14330	-	-	-	-	-	817-1125	436-459
	R8	421-467	1257-1364	837-880	425-650	430-440	970-1043	480-520			1037-1151	482-542	373-433		681-704	1349-3580	-	-	-	-	-	3620-8500	400-505
	R9	11.29-11.30	1117-5000	960-990	19.9-33.1	8.4	46-50	15.92-20.4			71-79.6		482-586		18.4-18.5	1700-4610	-	-	-	-	-		444-470
	R10	398-421	1233-1291	791-796	397-859		1102-1126	681-708	385-639	799-1100	839-892		415-484	419-481	742-753	1368-6224	-	-	-	-	-		418-445
	R11	448-467	529-5130	1453-1535	419-996		4380-4540	1955-1977			3260		450-603		686-696	29.1-14110	-	-	-	-	-		460-480
	R12	381-389	946-1194	707-735	306-316	307-308	978-1089	592-629	562-954	1215-1243	818-932	604-618	412-441	629-660	345-413	1305-7442	-	-	-	-	-		427-450
	R13		4820-4860	1155-1191	618-914	428-420	3210-3370	1159-1206			4760		378-523	548-579	834-842		1831-1832			18340-18320	14140		453-479
	R14		1304-1832	922-938	358-407	364-362	1387-1457	631-653	778-874	1120-1124	1287-1402	662-666	458-487	485-545	462-544		941-940	18710	3480-3510	14970	7310-7390		473-540
	R15			1080-1499	647-1005	556	4420-4680	1522-1531			2690		448-646	778	531-540		1371	11980			16510		496-517
temperature range (°C)	R1		19.9	18.6-23.5	22.7-27.4		16.0-22.0						14.1-18.3		18.0-19.7	15.4-19.5	-	-	-	-	-		16.5-17.2
	R2	19.5-22.0	21.6-21.9	19.1-20.5	18.2-25.0		18.4-18.7				23.7-24.6		16.0-22.9		20.5-22.4	14.1-28.3	-	-	-	-	-	15.2-16.4	22.9-23.0
	R3		19.0-19.3	24.8-25.5	25.7-38.5		21.2-27.1				25.6		21.3-30.3		24.3-25.1	26.7-29.0	-	-	-	-	-		26.3-30.3
	R4	17.4-21.6	18.8-23.2	20.5-22.8	18.2-21.9		19.3-20.9				15.6-17.9		15.9-20.4		14.5-20.4	18.4-21.9	-	-	-	-	-	13.6-15.5	18.9-22.5
	R5		32.9	22.7-22.9									20.0-24.9		21.2-21.4	19.2-22.0	-	-	-	-	-		17.5-19.7
	R6	15.88-18.53	19.9-24.6	17.20-17.53	19.08-23.98		16.81-18.96	18.60-20.70			17.94-18.84	17.84-20.19	15.66-19.55		20.0-20.6	16.47-19.61	-	-	-	-	-	14.18-15.22	14.65-17.80
	R7		34.63-36.40	25.22-27.75	21.93-23.74		21.29-23.15	16.40-19.09			26.79-29.60		19.9-24.3		22.76-23.93	21.48-24.02	-	-	-	-	-	14.20-15.27	21.02-24.11
	R8	20.3-23.9	17.9-20.5	20.2-22.5	17.3-19.4	16.4	21.0-25.7	18.3-22.4			20.5-25.0	17.0-24.0	17.8-23.8		20.0-23.0	15.8-21.6	-	-	-	-	-	14.8-19.2	20.3-24.8
	R9	21.3-33.3	18.7-23.3	20.0-22.3	23.3-29.2	27.2	24.1-27	22.7-28.9			25.5-27.1		23.6-27.4		26.6-29.4	19.4-20.9	-	-	-	-	-		21.1-23.4
	R10	18.01-20.5	19.9-20.7	20.3-20.4	16.5-19.1		20.8-21.5	20.3-21.7	19.2-31.2	14.6-16.3	15.8-19.5		17.3-21.3	11.6-18.0	17.4-18.6	13.4-20.0	-	-	-	-	-		17.7-19.4
	R11	19.5-20.2	22.4-26.5	23.7-25.5	22.6-30.3		16.6-20.0	26.1-26.5			27.15		18.7-21.0		24.5-25.3	20.2-23.0	-	-	-	-	-		17.6-20.9
	R12	17.39-18.33	23.81-29.43	17.21-19.18	18.08-20.34	18.08-19.0	14.37-20.11	17.17-18.2	12.2-12.8	11.1-13.1	16.76-18.83	14.42-16.41	16.63-20.1	9.73-15.63	16.74-19.63	13.43-19.86	-	-	-	-	-		15.76-19.26
	R13		27.3-28.4	22.2-23.1	21.7-22.0	21.8-21.5	22.7-25.4	25.3-27.0			36.1		19.0-22.2	21.0-22.4	21.7-22.0		24.5			24.9-25.1	25.8		22.5-23.9
	R14		17.0-20.5	16.4-17.8	15.9-20.0	16.3-15.1	23.6-24.5	16.8-18.5	17.5-18.0	13.1-11.7	15.9-18.3	12.8-13.7	13.0-17.3	9.0-10.1	14.8-16.2		17.4-17.3	20.1	15.9	19.9	17.6-17.4		16.4-18.4
	R15			20.1-22.5	23.2-26.6	22.5	24.0-28.1	24.7-24.0			28.1		19.2-25.7	32.2	23.4-24.3		24.8-24.6	26.8			23.3-22.7		22.5-24.2
dissolved oxygen range (mg/l)	R1		7.5-7.8	7.8-10.7	8.3-8.6		6.6-13.8						3.7-9.2		7.2-8.3	1.5-11.1	-	-	-	-	-		6.3-7
	R2	3.13-7.92	9.30-9.80	3.08-8.60	5.41-8.84		6.98-7.13				7.89-10.60		0.10-8.60		0.09-7.13	0.24-15.90	-	-	-	-	-	1.13-4.24	6.54-7.80
	R3		7.7-9.3	7.0-8.2	6.0-8.4		-				8.3		2.9-9.0		8.1	3.7-7.6	-	-	-	-	-		9.4-9.8
	R4	3.41-6.39	8.88-9.62	6.49-10.20	4.75-7.87		6.42-8.38				8.53-11.07		3.81-7.86		3.02-8.18	4.79-11.56	-	-	-	-	-	0.85-1.06	6.17-9.91
	R5		5.62	6.68-8.55									3.39-8.69		5.08-7.11	3.32-8.65	-	-	-	-	-		6.02-6.77
	R6	1.4-5.4	6.7-8.3	2.0-2.7	2.6-7.0		4.0-8.7	6.3-12.0			4.1-5.7	2.7-5.0	2.4-3.9		9.74-11.07	0.3-8.7	-	-	-	-	-	0.3-1.7	7.3-10.3
	R7		6.9-7.9	7.1-11.3	9.1-9.3		9.6-10.8	4.7-11.9			10.5-11.6		0.53-4.59		9.3-10.8	0.3-9.5	-	-	-	-	-	1.8-3.5	5.6-7.2
	R8	2.2-7.7	7.0-9.23	2.54-9.20	6.75-10.0	8.75-8.85	1.40-18.5	2.2-6.6			0.6-10.8	3.5-9.9	3.5-11.25		6.0-12.2	1.5-11.3	-	-	-	-	-	0.95-1.64	0.3-9.7
	R9	0.57-3.73	4.16-4.39	1.84-4.40	3-4.19	3.92	2.18-4.76	1.04-3.95			4.82-8.78		1.61-4.5		3.90-7.65	0.59-1.4	-	-	-	-	-		3.5-4.67
	R10	3.6-6.8	6.5-9.2	6.3-7.5	3.0-8.2		3.8-8.9	1.0-13.6	6.3-8.7	4.7-5.1	6.3-11.6		4.4-12.0	5.6-7.1	6.3-8.1	9.3-15.6	-	-	-	-	-		6.0-11.7
	R11	0.71-3.77	7.8-8.6	3.8-7.5	7.93-10.3		4.65-8.86	12.7-12.8			6		3.56-9.68		5.86-7.56	0.07-5.97	-	-	-	-	-		5.42-8.17
	R12	4.4-5.6	7.1-9.7	4.1-9.4	7.2-9.3	7.3-8.8	0.4-14.8	0.6-9.0	4.8-8.35	6.59-6.78	8.0-10.5	0.1-5.3	5.1-9.7	8.0-9.2	1.2-12.3	0.8->20	-	-	-	-	-		7.4-8.7
	R13		5.2-5.8	5.1-6.0	5.22-8.63	8.21-8.5	4.5-7.3	3.6-4.1			6.4		3.16-9.58	2.9	9.15-9.3		4.5-4.7			2.0-3.4	2.9		4.7-6.2
	R14		7.78-9.05	6.58-8.65	5.38-8.28	7.86-7.78	3.74-8.89	6.51-9.03	0.71-1.13	5.60-5.80	5.14-9.28	2.28-6.41	6.05-10.01	3.45-4.12	1.13-9.06		11.31-11.51	5.09	11.34-11.73	3.29	11.34-11.51		6.10-7.14
	R15			3.72-9.41	5.67-8.33	4.7	10.92-13.24	1.77-1.48			6.09		2.65-9.02	2.61	7.75-10.81		3.49-3.42	0.35			0.57-0.33		5.58-7.76

Table A3.1: continued

	Round	COOGEE	GNANGARA	GOOLLELAL	JANDABUP	JANDABUP 8(Spring) & 10(Summer)	JOONDALUP North	JOONDALUP South	EXIA 86	EXIA 18	MARIGINIUP	MCNESS North	MCNESS South	MELALEUCA PARK	NOWERGUP	PIPIDINNY	PIPIDINNY S2	PIPIDINNY S3	PIPIDINNY S4	PIPIDINNY S7	PIPIDINNY S8	WILGARUP	YONDERUP
chlorophyll-a	R1		10	27	16		38						6		7	19	-	-	-	-	-		6
(µg / l)	R2	*	*	*	*		*				*		*		*	*	-	-	-	-	-	*	*
	R3		2.47	5.92	2.67		*				5.8		1.28		37.53	6.17	-	-	-	-	-		*
	R4	*	*	*	*		0.74				0.77		*		*	*	-	-	-	-	-	*	12.05
	R5		0.21	25.23									1.99		4.12	28.02	-	-	-	-	-		3.91
	R6	2.42	2.90	0.43	2.84		3.7	1.92			1.35	2.42	0.5		2.9	3.62	-	-	-	-	-	0.15	0.21
	R7		1.6	11.07	4.31		13.79	156.37			1.71		0.71		3.83	9.48	-	-	-	-	-	0.28	1.99
	R8	2.18	0.521	0.044	3.127	3.402	3.127	0.190			0.07	0.521	0.332		0.071	5.12	-	-	-	-	-	0.142	0.047
	R9	17.1	0.32	2.67	3.41	24.6	23.31	12.69			5.58		5.7		4.2	12.27	-	-	-	-	-		2.37
	R10																-	-	-	-	-		
	R11																-	-	-	-	-		
	R12	1.13	2.83	1.70	4.53		2.83	0.0	3.39	9.05	0.57	2.51	0.57	1.13	1.13	1.13	-	-	-	-	-		1.13
	R13		4.74	1.41	11.46	5.81	6.58	16.94			15.07		3.40	1.27	5.26		10.25			1.91	2.26		1.20
	R14		31.68	32.25	2.26	6.79	5.09	5.66	15.09	16.97	19.89	17.35	0.51	6.22	12.45		3.54	2.26	0.71	6.03	0.00		1.13
	R15			14.25	3.39	1.20	94.06	26.33			17.38		1.39	8.49	12.98		6.93				7.34		1.38
turbidity (FTU)	R1		1.0	9.0	11.0		21.0						1.0		2.0	6.0	-	-	-	-	-		1.0
	R2	9.3	4.5	4.9	1.6-2.3		7.7				2.4		7.9		13.0	92.9	-	-	-	-	-	4.6	1.7
	R3		2.0	13.0	25.0		9.0				50.0		4.0		13.0	12.0	-	-	-	-	-		5.0
	R4	79.0	8.0	8.0	18.0		10.0				35.0		11.0		21.0	16.0	-	-	-	-	-	26.0	4.0
	R5		16	30									7		8	30	-	-	-	-	-		6
	R6	35-93	7	2-4	3-8		5-12	6-29			3-8	3-11	3-4		11	3-12	-	-	-	-	-	0.1-4.1	2-5
	R7		6-53	25-37	12-15		28-31	89-122			9-13		2		14-15	5-35	-	-	-	-	-	4-6	11-12
	R8	8	6	8	4	21	5	10			13	5	2		11	10	-	-	-	-	-	60	3
	R9	65	3	1	4	6	4	7			10		3		1	10	-	-	-	-	-		2
	R10	19	2	17	14		10	32	106	77	35		3	304	5	15	-	-	-	-	-		2
	R11	102.7	6.5	29.2	35.2		94.2	91.1			87.6		0		4.1	66.3	-	-	-	-	-		2
	R12	4	2	3	23		9	6	24	26	3	11	3	7	4	34	-	-	-	-	-		0
	R13		9	5	48	54	4	34			74		4	30	13		48			4	3		1
	R14		11	8	8	11	1	26	181	11	19	20	10	0	19		41	39	28	34	44		5
	R15			20	16	32	72	33			41		7	71	20		87	220			78		3
gilvin	R1		1.3	4.7	7.3		4.4						1.6		1.5	3.7	-	-	-	-	-		7.5
(g440)	R2	30.0	0.7	3.9	12.2-13.6		4.6				12.9		2.3		0.2	6.0	-	-	-	-	-	9.7	0.9
	R3		1.2	7.8	11.1-16.8		6.9				37.1		1.6		1.6	15.5	-	-	-	-	-		1.4
	R4	33.32	1.8	3.6	7.4-8.2		8.0				9.51		5.1		8.6-9.0	11.1	-	-	-	-	-	12.9	1.4
	R5		2	7									4		2	16	-	-	-	-	-		1
	R6	59	2	7	4		12	22			10	8	5		1	2-21	-	-	-	-	-	10	1
	R7		3	7	2		4	19			7		5		3	11	-	-	-	-	-	11	0.5
	R8	7.4	2.8	10.1	2.5	20.5	10.4	43.8			16.1	15.9	4.6		3.7	17.7	-	-	-	-	-	37.8	5.1
	R9	59	0.2	3	0.2	8.8	4.5	15			21		0.9		1.4	72	-	-	-	-	-		0.2
	R10	5.8	1.4	31.1	4.1		3.7	16.8	34.5	13.1	12.0		0.5	120.7	0.5	3.7	-	-	-	-	-		5.8
	R11	18.4	1.2	3.9	8.5		6.2	11.7			20.7		0.9		0.9	4.6	-	-	-	-	-		0.7
	R12	6.9	0.8	13.6	30.2		23.7	59.4	57.8	112.4	23.7	37.3	5.3	19.4	3.9	33.4	-	-	-	-	-		7.6
	R13		0.7	0.2	16.0	17.2	0.4	10.4			12.6		1.1	95.6	3.2		1.5			7.3	3.6		0.0
	R14		0.5	1.2	1.9	2.0	1.0	3.0	1.7	5.0	2.4	2.6	0.2	12.1	1.3		0.9	0.9	0.8	1.7	0.5		0.5
	R15			1.44	2.36	4.09	1.67	2.82			3.4		1.21	25.7	0.8		0.7	1.5			1.3		0.4
NO_2 / NO_3	R1		5.5	1.4	1.7		2.3						2.2		2	1.2	-	-	-	-	-		0.6
(µg / l)	R2	52	76	2	1.2-1.6		1.2				8		4.9		1.2	0.9	-	-	-	-	-	398	2.3
	R3		22	8	10-11		8						14		12	8	-	-	-	-	-		7
	R4	56	55	21	22 - 23		21				21		20 - 21		22 - 23	21	-	-	-	-	-	559	20
	R5		12	2									2		<2	318	-	-	-	-	-		5
	R6	16	92	3	13		21	63			199	3	2		<2	4	-	-	-	-	-	3662	5
	R7		12	3	6		6	10			48		3		2	4	-	-	-	-	-	6057	2
	R8	<2	91	<2	36	3	3	39			70	<2	2		3	<2	-	-	-	-	-	1019	<2
	R9	18	539	2	7	<2	3	4			27		2		<2	6	-	-	-	-	-		<2
	R10	3	1105	5	3		8	4	15	5	78		4	32	7	3	-	-	-	-	-		<2
	R11	15	17	5	7		5	20			17		124		6	18	-	-	-	-	-		16
	R12	<2	820	7	3		3	9	14	13	88	3	2	12	<2	86	-	-	-	-	-		<2
	R13		69	31	24	2	4	2			134		41	31	2		4			6	6		<2
	R14		780	17	5	13	18	6	17	13	8	5	9	34	5		11	5	3	10	2		<2
	R15			120	25	8	13	11			100		3	42	4		4	7			3		2
NH_4	R1		3854	98	144		315						37		88	414	-	-	-	-	-		48
(µg / l)	R2	71	8817	10	8 - 11		1911				114		15		11	19	-	-	-	-	-	478	25
	R3		12182	31	123-127		64				162		574		37	324	-	-	-	-	-		1620
	R4	14	3220	7	9		51				67		7		9 - 10	13	-	-	-	-	-	138	7
	R5		3949	12									12		12	2416	-	-	-	-	-		<3
	R6	27	5377	8	1090		235	104			3696	5	3		4	48	-	-	-	-	-	227	4
	R7		15523	10	19458		15	17			7619		8		17	41	-	-	-	-	-	159	2
	R8	78	3524	7	534	15	77	139			1573	45	20		5	13	-	-	-	-	-	1787	28
	R9	5330	19500	89	4300	55	97	48			1829		24		30	389	-	-	-	-	-		19
	R10	5	5940	7	12		18	9	47	11	339		9	117	10	17	-	-	-	-	-		4
	R11	414	19000	6	47		17	1060			365		13		16	217	-	-	-	-	-		4
	R12	9	5600	8	20		17	32	480	96	1200	16	7	69	6	82	-	-	-	-	-		14
	R13		23000	13	20	16	35	19			1100		12	110	7		3			54	21		3
	R14		5700	8	24	12	190	14	380	37	57	8	8	52	58		5	22	8	44	9		<3
	R15			37	100	170	32	350			1100		12	170	11		92	1800			200		6

Table A3.1: continued

	Round	COOGEE	GNANGARA	GOOLLELAL	JANDABUP	JANDABUP 8(Spring) & 10(Summer)	JOONDALUP North	JOONDALUP South	EXIA 8	EXIA 18	MARIGINIUP	MCNESS North	MCNESS South	MELALEUCA PARK	NOWERGUP	PIPIDINNY	PIPIDINNY S2	PIPIDINNY S3	PIPIDINNY S4	PIPIDINNY S7	PIPIDINNY S8	WILGARUP	YONDERUP
TKN	R1		10292	1683	2397		3498						300		664	1288	-	-	-	-	-		208
(µg / l)	R2	3772	8164	1789	1075-1105		1683				2291		1789		558	1440	-	-	-	-	-	1713	239
	R3		27640	1374	1952-2085		3046				7590		1017		1142	1886	-	-	-	-	-		852
	R4	3626	7862	771	707-723		1685				1877		418-450		851-1027	1606	-	-	-	-	-	1574	273
	R5		10155	2339									254		1006	4823	-	-	-	-	-		<200
	R6	5549	5803	644	1260		3400	1142			5893	780	272		435	1886	-	-	-	-	-	1777	<200
	R7		30677	2258	20009		11380	17775			12250		261		799	4134	-	-	-	-	-	1324	223
	R8	560	8829	882	1026	631	2629	1519			4326	915	315		526	2007	-	-	-	-	-	3606	360
	R9	17813	23880	1360	5275	662	7313	2114			12772		487		705	2513	-	-	-	-	-		206
	R10	726	6596	1163	406		2089	1122	1874	845	2681		229	2052	679	2030	-	-	-	-	-		<200
	R11	9260	19514	2309	1650		12705	5175			8297		255		647	7463	-	-	-	-	-		139
	R12	220	6000	700	760		2300	1000	1400	2000	2600	1000	230	1700	380	2000	-	-	-	-	-		180
	R13		23000	1100	1400	990	5200	3000			8700		320	2400	870		1200			5400	3000		200
	R14		6600	1100	770	760	2500	870	2800	1300	2200	830	180	2000	710		620	5000	1200	4500	1200		150
	R15			1400	1800	1200	13000	3700			8300		440	3400	730		1300	10000			7100		250
PO_4	R1		2	56	3		3						2		5	5	-	-	-	-	-		3
(µg / l)	R2	84	3	7	3		3				3		56		3	3	-	-	-	-	-	3	3
	R3		3	12	5		5				5		432			5	-	-	-	-	-		5
	R4	640	5	5	12 - 16		9				6		23 - 29		9 - 14	12	-	-	-	-	-	6	5
	R5		<2	3									<2		<2	2	-	-	-	-	-		<2
	R6	306	<2	<2	<2		17	51			3	7	<2		<2	2	-	-	-	-	-	3	<2
	R7		<2	5	2		8	126			<2		3		6	4	-	-	-	-	-	2	2
	R8	7	<2	3	<2	<2	7	94			<2	5	2		<2	2	-	-	-	-	-	<2	<2
	R9	493	5	7	<2	4	6	119			6		3		2	4	-	-	-	-	-		2
	R10	8	3	5	2		5	71	9	3	3		6	12	4	6	-	-	-	-	-		4
	R11	15	3	7	6		10	420			6		6		4	12	-	-	-	-	-		5
	R12	4	3	5	12		20	160	12	15	6	24	2	17	4	5	-	-	-	-	-		4
	R13		5	8	15	3	9	990			8		5	26	<2		8			5	5		5
	R14		2	5	6	5	5	150	7	15	7	16	3	11	5		4	7	4	5	3		3
	R15			8	5	14	40	830			52		4	42	<2		3	9			7		3
TP	R1		7	74	14		20						6		18	20	-	-	-	-	-		8
(µg / l)	R2	225	25	88	17-20		24				30		42		28	58	-	-	-	-	-	32	15
	R3		14	42	23-27		50				134		1225		78	70	-	-	-	-	-		18
	R4	534	19	20	12-19		29				23		41-53		54-59	61	-	-	-	-	-	62	26
	R5		<15	66									<15		43	122	-	-	-	-	-		15
	R6	682	<15	17	<15		111	329			25	78	<15		41	56	-	-	-	-	-	33	<15
	R7		<15	57	28		175	3230			<15		15		39	71	-	-	-	-	-	15	17
	R8	53	6	20	13	9	62	384			23	45	11		23	52	-	-	-	-	-	51	14
	R9	1271	<10	27	11	17	186	330			70		17		28	65	-	-	-	-	-		12
	R10	94	<10	45	14		40	295	54	42	28		13	20	47	47	-	-	-	-	-		13
	R11	318	<10	67	25		421	1792			144		11		28	93	-	-	-	-	-		15
	R12	36	12	21	13		90	440	17	29	19	140	11	19	26	45	-	-	-	-	-		10
	R13		34	27	31	41	110	1500			73		14	35	28		40			58	31		10
	R14		13	37	14	16	53	430	91	33	27	110	8	19	33		33	77	18	57	17		9
	R15			48	35	26	310	1900			73		15	55	30		58	360			310		14
Fe	R5																						
(mg / L)	R6				0.82																		
	R7				5.09																		
	R8		1.30		0.57	0.23																	
	R9				1.3	0.3																	
	R10		1.4		0.84						1.2												
	R11		4.3		2.3						4.7												
	R12		0.8		1.1						0.43												
	R13		6.1		1.6	4.1					2.5												
	R14		0.81		1.1	1.2					0.9												
	R15				1.8	2.4					2.3												
SO_4	R5																						
(mg / L)	R6				163																		
	R7				886																		
	R8		360		134	36																	
	R9				204	21																	
	R10		315		75						125												
	R11		845		29						284												
	R12		95		9.8						60												
	R13		430		12	11					190												
	R14		130		7.4	10					78												
	R15				61	45					400												