

Introduction	4	
Methods	6	
Results	7	
3.1 Balonne River at St George		7
3.1.1 Water quality		7
3.1.2 Macrophytes		7
3.1.3 Fish		7
3.1.4 Macroinvertebrates		8
3.2 Balonne River at Mooramanna		9
3.2.1 Water quality		9
3.2.2 Macrophytes		9
3.2.3 Fish		9
3.2.4 Macroinvertebrates		10
3.3 Balonne River at Whyenbah		11
3.3.1 Water quality		11
3.3.2 Macrophytes		11
3.3.3 Fish		12
3.3.4 Macroinvertebrates		12
3.4 Culgoa River at Whyenbah		13
3.4.1 Water quality		13
3.4.2 Macrophytes		13
3.4.3 Fish		13
3.4.4 Macroinvertebrates		14
3.5 Culgoa River at Cubbie		15
3.5.1 Water quality		15
3.5.2 Macrophytes		15
3.5.3 Fish		15
3.5.4 Macroinvertebrates		16
3.6 Culgoa River at Woolerbilla		16
3.6.1 Water quality		17
3.6.2 Macrophytes		17
3.6.3 Fish		18
3.6.4 Macroinvertebrates		18
3.7 Culgoa River at Balandool		19
3.7.1 Water quality		19
3.7.2 Macrophytes		19
3.7.3 Fish		20
3.7.4 Macroinvertebrates		20
3.8 Balonne Minor River at Meigunyah		21
3.8.1 Water quality		21
3.8.2 Macrophytes		21
3.8.3 Fish		21
3.8.4 Macroinvertebrates		22
3.9 Balonne Minor at Trafalgar		23
3.9.1 Water quality		23
3.9.2 Macrophytes		23
3.9.3 Fish		23
3.9.4 Macroinvertebrates		23
3.10 Donegri Ck (Narran River) at Dirranbandi		24
3.10.1 Water quality		24

3.10.2	Macrophytes	25
3.10.3	Fish	25
3.10.4	Macroinvertebrates	25
3.11	Narran River at Clyde	26
3.11.1	Water quality	26
3.11.2	Macrophytes	26
3.11.3	Fish	27
3.11.4	Macroinvertebrates	27
3.12	Narran River at Booligar	28
3.12.1	Water quality	28
3.12.2	Macrophytes	28
3.12.3	Fish	28
3.12.4	Macroinvertebrates	29
3.13	Balandool River at Cubbie	30
3.14	Balandool River at Euraba	30
3.15	Bokhara River at Kirrima	30
3.15.1	Water quality	30
3.15.2	Macrophytes	30
3.15.3	Fish	30
3.15.4	Macroinvertebrates	31
3.16	Bokhara River at Koala	32
3.16.1	Water quality	32
3.16.2	Macrophytes	32
3.16.3	Fish	32
3.16.4	Macroinvertebrates	33
3.17	Warrego River at Shannonvale	33
3.17.1	Water quality	34
3.17.2	Macrophytes	34
3.17.3	Fish	34
3.17.4	Macroinvertebrates	34
3.18	Warrego River at Tinnenburra	35
3.18.1	Water quality	36
3.18.2	Macrophytes	36
3.18.3	Fish	36
3.18.4	Macroinvertebrates	36
3.19	Moonie River at Nindigully	37
3.19.1	Water quality	37
3.19.2	Macrophytes	38
3.19.3	Fish	38
3.19.4	Macroinvertebrates	38
3.20	Moonie River at Fenton	39
3.20.1	Water quality	39
3.20.2	Macrophytes	39
3.20.3	Fish	40
3.20.4	Macroinvertebrates	40
3.21	Belah Creek	41
3.21.1	Water Quality	41
3.21.2	Fish	41
3.21.3	Macrophytes	42
3.21.4	Macroinvertebrates	42

3.22 Clyde Lagoon	43
3.22.1 Water Quality	43
3.22.2 Fish	43
3.22.3 Macrophytes	44
3.22.4 Macroinvertebrates	44
3.23 Chinaman Creek	45
3.23.1 Water Quality	45
3.23.2 Fish	45
3.23.3 Macrophytes	46
3.23.4 Macroinvertebrates	46
3.24 Big Holes	47
3.24.1 Water Quality	47
3.24.2 Fish	48
3.24.3 Macrophytes	48
3.24.4 Macroinvertebrates	48
Discussion	49
4.1 Water quality	49
4.2 Macrophytes	52
4.3 Fish	52
4.4 Macroinvertebrates	54
4.5 General	55
References	56

Introduction

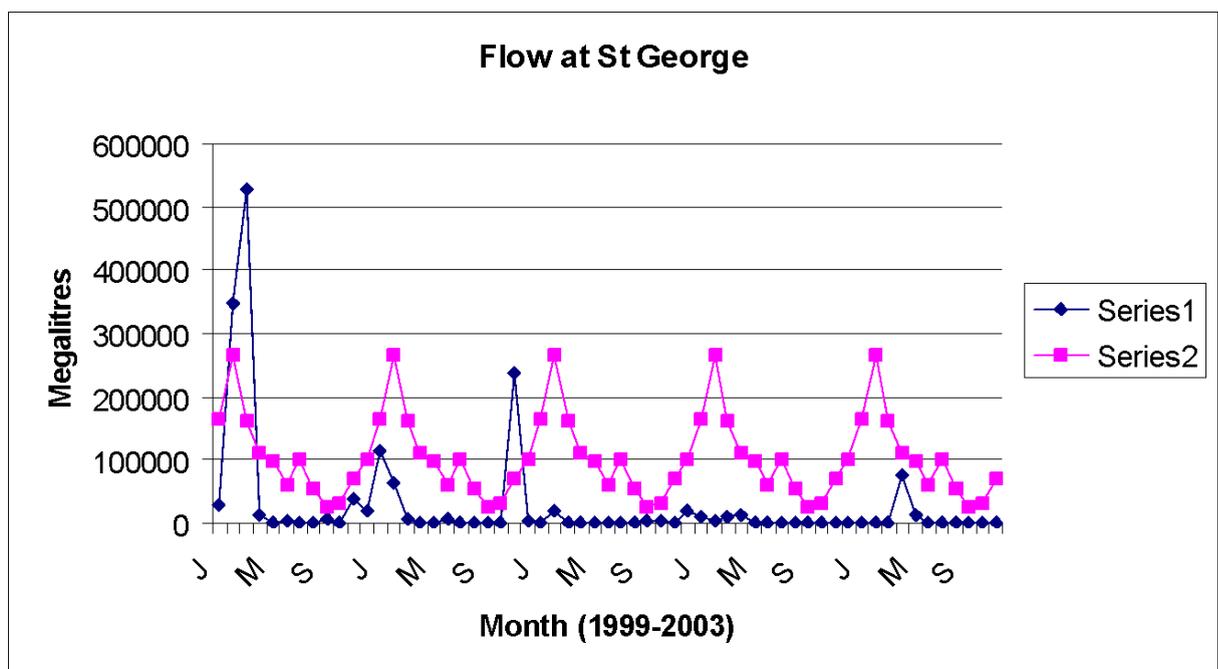
This report represents the fifth in a series recording the results of monitoring events sponsored by stakeholder organizations in the Lower Balonne.

At the time of sampling in November 2003, the area was drought affected with little local rain over the previous 12 months. Flows since January 1999 are shown below (**Figure 1.1**). Flows in only one month since March 1999 have exceeded the average for that month (November 2000). The previous sampling event in May 2002 was undertaken after a series of very low level compensation flows between early December 2001 and mid April 2002.

In 2003 a small flood occurred from April 20 to April 24 and flows downstream were extended by compensation level releases in order to ensure the rivers of the distributary system flowed through to their end points. Water harvesters also gave up part of their extraction opportunity in order that river flow could be enhanced. The peak of 17,419ML/d represents a small flood and it was of very short duration. This did not initiate floodplain flow or significant flow in any major flood runners, such as Chinaman Ck.

Flow in the Culgoa was stopped after 14 days at the first bifurcation weir and diverted down the Balonne Minor and smaller distributary rivers via the use of stop logs or siphons at later bifurcations. These releases resulted in flow in the Narran till 13 June. Total inflow to Beardmore Dam during the event was 166,639ML and releases were 83,564ML. As the flows occurred quite late in the season and EM had sampled in May the previous year, it was decided not to sample till October / November. In the meantime the system dried out substantially.

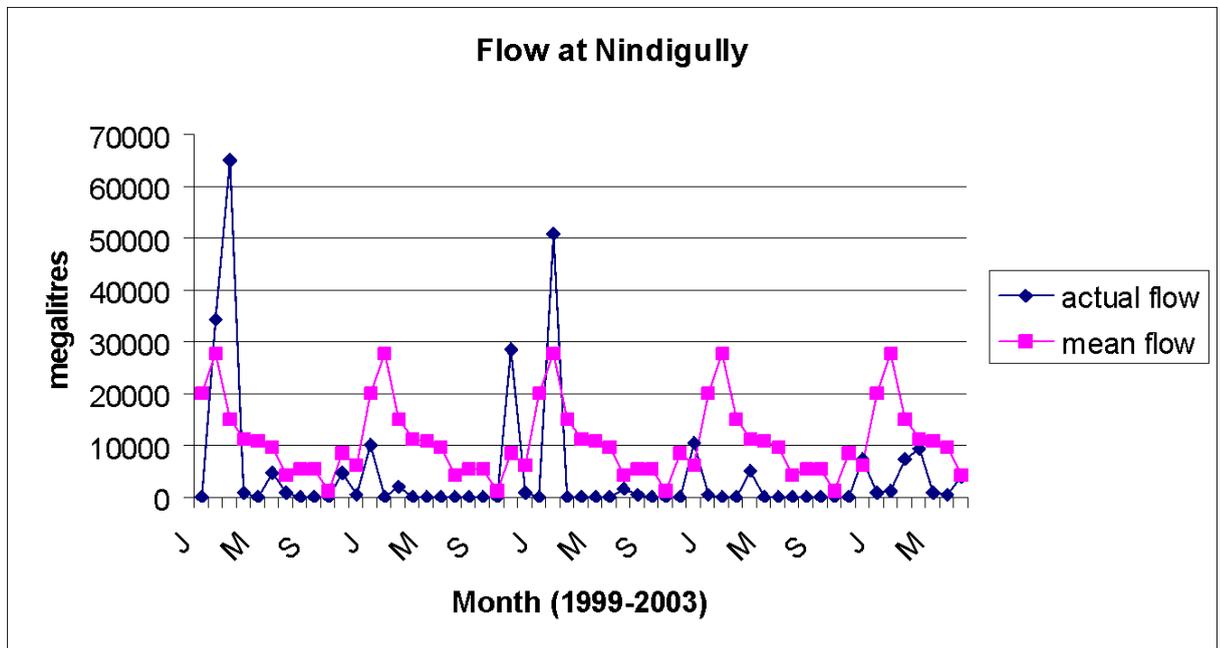
■ **Figure 1.1 Balonne River - flow at St George since January 1999.**



Note: Data sourced from DNRM

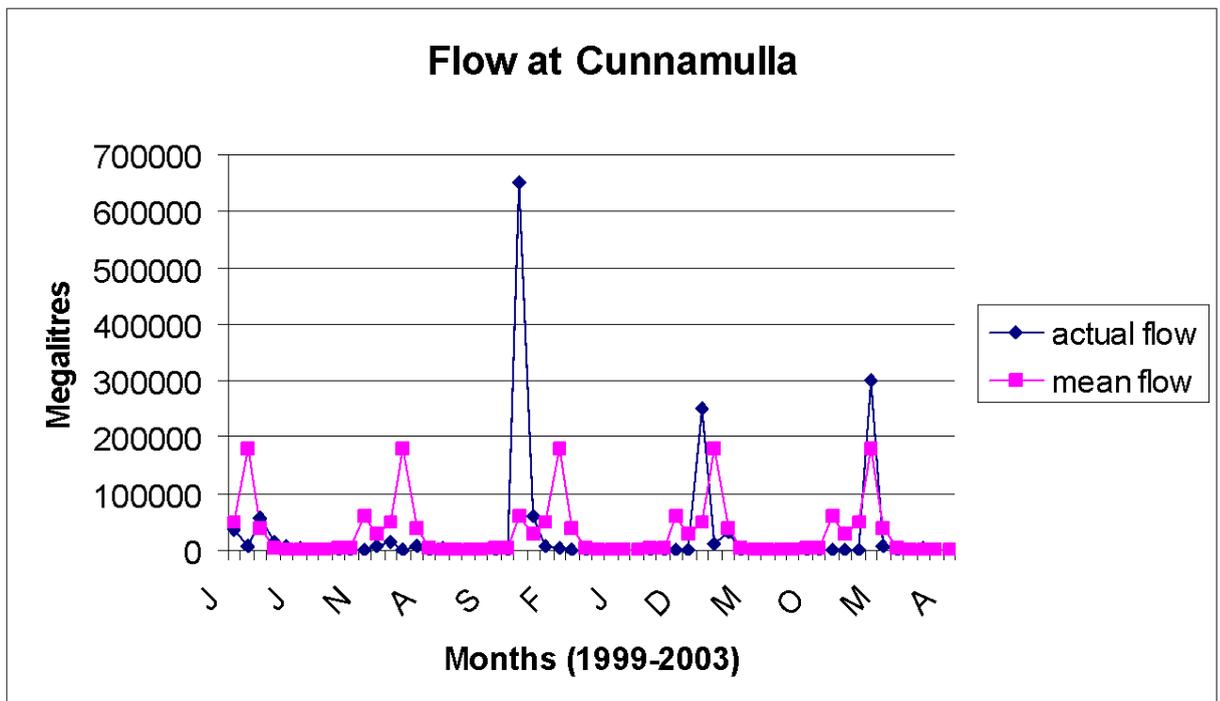
Flows in the Warrego River and Moonie River are shown in Figures 1.2. and 1.3.

■ **Figure 1.2 Moonie River flow at Nindigully since January 1999**



Note: Data sourced from DNRM

■ **Figure 1.3 Warrego River flow at Cunnamulla Weir since January 1999**



Note: Data sourced from DNRM

Each system has been differently affected by the drought, and the Balonne has undoubtedly been worst affected. Table 1.1 shows the proportion of mean annual flow achieved in each river since 1998. Data for the 2003 year is complete in the Balonne but only includes flows to July (inclusive) in the Moonie and August in the Warrego and in these cases the percentage is calculated against the mean for those months only.

■ **Table 1.1 Percentage of mean annual flow achieved in regional rivers**

Year	Balonne	Moonie	Warrego
1998	144	207	27
1999	80	87	34
2000	35	32	192
2001	3.5	49.5	2.8
2002	3.1	10	76
2003	8.5	23.9	81

As can be seen, the Warrego was in drought before the other two catchments and it broke in November/December 2000. This was followed by an exceptionally dry year but quite good years thereafter. The Warrego has in fact seen good, though short, summer wet seasons and very dry dry-seasons. The Moonie has not suffered to the extent of the Balonne, showing occasional flows which have been significant enough to flush the system.

The primary aim of sampling at this time was to note the ongoing effect of the drought and to ensure a sample was collected prior to the summer wet season, which many were forecasting would see an end to the drought.

Methods

Eighteen riverine and four floodplain sites were sampled between 3 November and 19 November 2003. Sampling methods mirrored earlier events (Benson and Paton 2002) with respect to:

- Fish sampled by multiple gill and fyke nets, bait traps, seine and dip nets
- Water quality sampled by a multi-parameter data logging water quality meter (a Yeokal 610)
- Replicated surber samples in the edge habitat
- Specialised habitats sampled for macroinvertebrates by qualitative dip netting.

No investigation of riparian zones was undertaken as these have been described previously. No analytical chemistry was undertaken as this data is only collected occasionally, the most recent occasion being November 2001.

Macroinvertebrates were identified and counted by Ecowise Pty Ltd. Staff overseeing the work included Dr Garry Bennison and Mr Bernie Cockayne, the latter formerly of DNRM and a person with significant experience of the local fauna. Ecowise used a Marchant box subsampling technique and for samples with high numbers of micro-crustacea, a further technique which employed a Sedgwick rafter sorting tray was used.

Results

Results are initially presented by site. A regional appraisal is presented in the Discussion.

3.1 Balonne River at St George

This site is adjacent the gauging station below Jack Taylor weir. The banks have a fairly gradual slope and a good cover of grass and trees. The substrate is mainly deep silt with outcroppings of large areas of conglomerate rock. The river is approximately 60m wide and contained a significant number of large snags, particularly near the gauge. Water level was similar to previous sampling events. Flow was zero.

3.1.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 24.3 – 25.2°C

Dissolved oxygen: 69 – 77 % sat; 5.7 – 6.8mg/l

pH: 7.4 – 7.6

Conductivity: 158 – 163 µS/cm

Turbidity: 274 – 289 NTU.

3.1.2 Macrophytes

Ludwigia peploides was noted in a small area near the rocks.

3.1.3 Fish

All nets were set and used at this site. **Table 3-1.1** shows the catch by netting technique. The result of six native species and two introduced for a total catch of 139 individuals is a vast improvement on the result from May 2002 when only two individuals were captured (a Yellowbelly and a Carp). The seine net had not previously been used at this site but even if we disregard the catch from that net, the site total in comparison with previous events is four native species and two introduced in a total catch of 34 individuals. The reason for the poor catch in May 2002 is unknown. Hyrtl's tandan and Rainbow fish had not previously been captured at this site while Spangled Perch and Mosquito fish have been caught on only one occasion (both June 2000).

■ **Table 3-1.1 Results of fishing at St George in November 2003, by fishing method**

Species	Common name	Gill nets	Seine nets	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1		4			5
<i>Nematolosa erebit</i>	Bony Bream	6	33	9			48
<i>Neosilurus hyrtlil</i>	Hyrtl's tandan			2			2
<i>Retropinna semoni</i>	Smelt		44				44
<i>Melanotaenia fluviatilis</i>	Rainbow fish		4				4
<i>Hypseleotris klunzineri</i>	Western carp gudgeon		24	1	1		26
<i>Carrasius auratus</i>	Goldfish			1			1
<i>Cyprinus Carpio</i>	Carp	5		4			9

Total Numbers		12	105	21	1		139
---------------	--	----	-----	----	---	--	-----

3.1.4 Macroinvertebrates

Two habitats were sampled at St George. Surber samples were collected from rock (1), gravel (1) and silt / leaf litter (3) substrates. A dip net sample was collected from *Ludwigia*. A total of twenty-seven discrete (non-overlapping) taxa were identified, 20 each from the surbers and the dip net (**Table 3-1.2**). Bait traps also collected seven *Macrobrachium*. The fauna was dominated by chironomids, micro-crustacea (particularly cladocera) and corixids.

■ **Table 3-1.2 Numbers of aquatic macroinvertebrates recorded from St George**

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Acarina	1.2+/-1.8	
Ancylidae	0.2+/-0.4	20
Gastropoda	0.8+/-1.8	240
Planorbidae		60
Nematoda	3.6+/-5.0	
Oligochaeta	5.6+/-3.8	700
Cladocera	72.8+/-25.2	19600
Copepoda	74.4+/-31.2	980
Ostracoda	28.0+/-36.7	280
Atyidae		29
Palaeomonidae		1
Dytiscidae	0.2+/-0.4	
Hydrophilidae		40
Staphylinide		60
Ceratopogonidae	6.4+/-1.5	
Culicidae		80
s-f Chironominae	178.6+/-69.3	1120
s-f Orthoclaadiinae	9.7+/-10.0	3140
s-f Tanypodinae	31.2+/-29.2	140
Baetidae	5.8+/-4.6	220
Caenidae	22.2+/-7.9	
Corixidae	32.6+/-24.8	100
Mesoveliidae		280
Notonectidae	0.8+/-0.8	
Coenagrionidae	0.2+/-0.4	80
Zygoptera		360
Gomphidae	1.2+/-0.8	
Odonata	0.2+/-0.4	
Hydroptilidae		20
Leptoceridae	6.6+/-5.9	20
Taxa per sample	14.4+/-1.3	20
Individuals per sample	477.2+/-146.1	27570
Total taxa		27

3.2 Balonne River at Mooramanna

This site was on a straight stretch of river just upstream from the Brookdale pump station. The channel was approximately 50m wide and of trapezoidal shape with parallel flood-runners. The banks were generally well grassed but on the outside of the meander bend downstream from the pumps they were bare and eroding. Cattle also accessed this area. The substrate varied from silt to coarse sand and a number of sand bars were exposed. Bank undercuts were limited but some tree roots were exposed. *Juncus* sp was present in low density near the low water line but there were no macrophytes. Filamentous green alga was common, particularly on sticks in shallow water. The area was obviously frequented by recreational fishers and campers.

The site was generally very shallow, though small areas reached about 1.5 to 1.8m. The water level and site characteristics were very similar to May 2002.

3.2.1 Water quality

The datalogger malfunctioned at this site so only spot readings are available. Spot surface readings at 0825 hrs showed:

Temperature; 18.5°C,
Dissolved oxygen; 7.9mg/l or 84% saturation,
Conductivity; 179µS/cm, and
Turbidity; 233 NTU.

3.2.2 Macrophytes

No macrophytes were recorded though *Juncus* sp. was present on the edge and green alga was common, particularly on sticks in shallow water.

3.2.3 Fish

Table 3-2.1 shows the fish catch by netting technique.

■ Table 32.1 Results of fishing at Mooramanna in Nov 2003, by fishing method

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2					2
<i>Nematolosa erebi</i>	Bony Bream	1	13				14
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		6				6
<i>Hypseleotris</i> sp IV	Sp 4		1				1
<i>Retropinna semoni</i>	Smelt		4				4
<i>Melanotaenia fluviatilis</i>	Rainbow fish		12	5			17
<i>Gambusia holbrooki</i>	Mosquito fish		11				11
<i>Cyprinus Carpio</i>	Carp	1					1
Total Numbers		4	47	5	0	0	56

Six native fish species and two introduced were captured, predominantly in the seine net. The number of fish captured on this occasion is much less than that captured in May 2002 but similar to previous catches, e.g. (native sp / total catch): June 2000 (3/14), April 2001 (4/65), November 2001 (not sampled), May 2002 (4/484). The

numbers in May 2002 were largely based on Carp gudgeon (242) and Bony Bream (111) caught in the seine net. Rainbow fish, H. sp 4 and Carp were not captured in May 2002 but Goldfish were.

3.2.4 Macroinvertebrates

Surber samples were collected from sand/gravel and silt substrates on different sides of the river. One dip net was collected from amongst the fibrous roots of Melaleucas and one from amongst green algae in shallow water over sand. Twenty-two discrete taxa were recorded at the site with micro crustaceans, chironomids, corixids and oligochaetes the most common (**Table 3-2.2**). Bait traps collected 22 *Macrobrachium*. One Yabby (*Cherax destructor*) was sitting atop a trap when collected. The seine haul captured numerous *Macrobrachium* and Atyids. The site has been sampled eight times previously and has recorded between 12 and 22 taxa in edge and macrophyte habitats. SKM (June 2000) noted that only between about 30 – 50% of the taxa captured at this site in one sampling event were captured in the next.

■ **Table 32.2 Numbers of aquatic macroinvertebrates recorded from Mooramanna**

Taxa	Edge surber (mean +/- sd)	Filamentous alga dip	Dip roots
Acarina	1.6+/-3.6		
Ancylidae			4
Gastropoda		40	
Planorbidae		27	
Nematoda	0.4+/-0.5		
Oligochaeta	288.4+/-281.7	73	40
Cladocera	532.0+/-406.0	2320	144
Copepoda	270.4+/-357.5	1040	1328
Ostracoda	203.2+/-135.9	220	32
Atyidae			4
Dytiscidae	1.6+/-3.6		
Ceratopogonidae	91.6+/-110.2	40	8
s-f Chironominae	164.4+/-168.3	400	208
s-f Orthoclaadiinae	12.4+/-12.0	333	8
s-f Tanypodinae	106.0+/-81.2	273	68
Baetidae	4.6+/-4.5	67	16
Caenidae	80.2+/-68.1	67	96
Corixidae	87.8+/-50.0	593	
Ochteridae			4
Epiproctophora	3.2+/-3.7		
Gomphidae	14.6+/-31	7	
Odonata	3.0+/-4.1		
Hemicorduliidae		20	
Libellulidae	1.0+/-2.2		
Hydroptilidae		13	
Leptoceridae	4.3+/-2.1	13	4
Taxa per sample	15.2+/-1.3	17	14
Individuals per sample	1878+/-1063	5546	1964
Total taxa			22

3.3 Balonne River at Whyenbah

This site is within the pool formed by the bifurcation weirs and is just upstream of the bridge, within a popular camping and fishing area. The right bank has a relatively gentle slope while the left is very steep for about 4 metres above the water line. The substrate is black soil or fine sand. The flat camping area is reasonably cleared with only a thin line of young melaleuca at the water's edge. The left bank is better treed. Cattle access both banks.

The pool was approximately 60m across and the sampling gear was spaced over about 150m. The water level was a little lower than in May 2002 such that patchy snags and exposed eucalypt roots were evident. No Melaleuca roots trailed in the water but vegetation overhang was significant on the left bank. No algal scum was present.

3.3.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 20.0 – 22.0°C

Dissolved oxygen: 60 – 72 % sat; 5.4 – 6.3mg/l

pH: 7.5 – 7.6

Conductivity: 140 – 145 µS/cm

Turbidity: 217 – 220 NTU.

Datalogging in June 2000 recorded 9.5-11°C, pH about 7.2, DO 90-100% sat, conductivity 277µS/cm and turbidity 110-160NTU. Spot readings in November 2003 showed very little difference between the surface and 0.5m depth.

3.3.2 Macrophytes

Juncus occurred above the water line in patches. Small tufts of submerged alga were noted in shallow water.

3.3.3 Fish

All fishing nets were deployed at this site and the results are presented in **Table 3-3.1**.

■ **Table 33.1 Results of fishing the Balonne River at Whyenbah in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net (0)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		1	2			3
<i>Nematolosa erebi</i>	Bony Bream	1	9	9			19
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		44		1		45
<i>Hypseleotris sp.4</i>	Carp gudgeon		1	1			2
<i>Melanotaenia fluviatilis</i>	Rainbow fish			6			6
<i>Retropinna semoni</i>	Smelt		196				196
<i>Gambusia holbrooki</i>	Mosquito fish		62				62
<i>Cyprinus Carpio</i>	Carp	2					2
Total Numbers		3	313	18	1		335

The catch of 6 native species and two introduced is in line with previous catches of (native/introduced species); 5/2, 6/1, 7/3 and 6/1 for a total of 9 native species and 3 introduced. Data from only a single fyke net and seine haul are available from May 2002 but these recorded a total of six native species and 179 individuals, dominated by small Smelt, Western Carp gudgeon and Bony Bream.

One long-neck turtle (*Chelodina longicollis*) was captured in a gill net and another in a fyke net.

3.3.4 Macroinvertebrates

Surber samples were collected from a fine sandy/silt substrate and some samples included leaf litter. No dip net samples were collected, as no habitat was available. Twenty-two discrete taxa were identified with micro-crustacea, chironomids, corixids and caenids being most common (**Table 3-3.2**). Twenty-seven prawns and two yabbies were captured in bait traps.

■ **Table 33.2 Numbers of aquatic macroinvertebrates recorded from the Balonne River at Whyenbah**

Taxa	Edge surber (mean +/- sd)
Acarina	0.4+/-0.9
Corbiculidae	1.6+/-3.6
Ancylidae	3.2+/-5.2
Nematoda	3.0+/-3.2
Oligochaeta	36.0+/-65.0
Cladocera	237.2+/-333.4
Copepoda	102.4+/-90.8
Ostracoda	415.2+/-558.6
Dytiscidae	1.0+/-1.7
Ceratopogonidae	34.0+/-43.9
s-f Chironominae	181.4+/-84.5
s-f Orthoclaadiinae	5.3+/-5.0
s-f Tanypodinae	8.6+/-6.6
Tabanidae	2.4+/-5.4
Baetidae	1.2+/-1.8
Caenidae	67.6+/-77.3
Corixidae	93.4+/-104.1
Notonectidae	1.8+/-2.5
Epiproctophora	0.2+/-0.4
Gomphidae	4.8+/-4.4
Libellulidae	0.8+/-1.8
Hydroptilidae	0.4+/-0.9
Taxa per sample	13.8+/-2.2
Individuals per sample	1200.8+/-972.8
Total taxa	22

3.4 Culgoa River at Whyenbah

This site is about 1.5 km downstream from the gauging station and weir and just upstream of an old bridge. Water level at the sampling site was the lowest seen since sampling commenced. Only remnant shallow pools remained, with the largest being 100m upstream of the bridge. There was very little evidence of an algal ring, most snags and roots were above the water line and pigs had been active on the edge. There was no foam on the water or odour emitted from it.

3.4.1 Water quality

Spot water quality readings were collected from a small pool near a large tree at the entrance point to the site (the same point as in May 2002). Depth at the sampling point was about 20cm. Readings from just below the surface at 1145 hrs were:

Temperature; 21.7 °C,
Dissolved oxygen (% sat); 61,
pH; 7.6,
Conductivity; 270 µS/cm, and
Turbidity; 310 NTU.

Conductivity was double that of the May 2002 sampling event but turbidity and dissolved oxygen levels were lower.

3.4.2 Macrophytes

Red *Azolla* covered approximately 30% of the water surface of the largest pool, about 100m upstream from the bridge and on a bend in the river.

3.4.3 Fish

Due to the lack of water, no gill or fyke nets were set at this site. Five native fish and one introduced were recorded. All species recorded in May 2002 were captured except for Carp. The Smelt count is an estimate based on two 1/32 sub-samples and the Bony Bream count is based on 2 x 1/8 and 1 x 1/4 sub-sample (**Table 3-4.1**).

■ **Table 34.1 Results of fishing the Culgoa River at Whyenbah in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (1)	Fyke nets (0)	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		1				1
<i>Nematolosa erebi</i>	Bony Bream		259		1		260
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		6		1		7
<i>Retropinna semoni</i>	Smelt		1408				1408
<i>Melanotaenia fluviatilis</i>	Rainbow fish		25				25
<i>Gambusia holbrooki</i>	Mosquito fish		10				10
Total Numbers			1709		2		1711

3.4.4 Macroinvertebrates

Surber samples were collected from fine compact silt (2 samples), gravel (2) and leaf litter. One dip net sample was collected from *Azolla*. Twenty-five discrete taxa were recorded at the site with copepods, ceratopogonids and corixids most common (**Table**

3-4.2). Abundances and mean number of taxa per surber were relatively low. The fauna collected in the dip net was quite different to that collected in the surber samples. Bait traps captured 11 prawns and one yabby was found on top of a trap. Prawns and shrimp were abundant in the seine haul.

■ **Table 34.2 Numbers of aquatic macroinvertebrates recorded from Culgoa River at Whyenbah**

Taxa	Edge surber (mean +/- sd)	Azolla dip
Acarina	0.6+/-0.9	
Ancylidae	2.0+/-3.9	
Planorbidae	1.0+/-2.2	
Nematoda	1.4+/-2.1	
Oligochaeta	4.4+/-4.0	
Cladocera	5.0+/-4.3	3038
Copepoda	95.8+/-65.3	63
Ostracoda	16.8+/-9.2	
Hydraenidae		38
Ceratopogonidae	55.6+/-68.1	26
Culicidae		188
s-f Chironominae	17.0+/-17.0	188
s-f Orthoclaadiinae		2005
s-f Tanypodinae	12.4+/-13.1	113
Baetidae	14.7+/-19.5	175
Caenidae	14.2+/-7.7	
Corixidae	47.0+/-25.2	25
Notonectidae		13
Veliidae		63
Coenagrionidae		38
Epiproctophora	0.2+/-0.4	
Gomphidae	0.2+/-0.4	
Zygoptera		88
Leptoceridae	6.3+/-4.3	
Lepidoptera		145
Taxa per sample	12.2+/-2.6	15
Individuals per sample	286.4+/-134.4	6206
Total taxa		25

3.5 Culgoa River at Cubbie

This site has been regularly sampled by either SKM or NRM since June 2000. It is described in earlier reports. The western bank has only a very thin riparian zone and the outer side of the meander is eroding. The banks are steep with little or no vegetation. Snags are plentiful in the water but no other specialised habitats exist. An obvious fringe of filamentous green algae existed and a significant amount of leaf litter was present on the edge. A debris dam formed the lower end of the site (normally the middle of the site) and the sampled pool was separated by between 50 and 100m from the next pools. Water depth was the lowest seen and no gill nets were set.

3.5.1 Water quality

No depth stratified spot samples were collected due to the shallow water. Overnight logging of water quality parameters was undertaken and little variation was evident.

The recorded ranges for each parameter were:

Temperature: 19.6 – 20.9°C

Dissolved oxygen: 54 – 68 % sat; 4.8 – 6.2mg/l

pH: 7.7 – 7.9

Conductivity: 221 – 226 μ S/cm

Turbidity: 310 – 328 NTU.

3.5.2 Macrophytes

No macrophytes or fringing aquatic plants were observed.

3.5.3 Fish

Three native species and mosquito fish were caught at the site. Seining produced relatively large numbers of Smelt. Previous sampling at this site has resulted in (native sp / total catch): June 2000 (6/49), April 2001 (4/67), November 2001 (2/58) and May 2002 (4/20) plus the capture of three introduced species.

■ **Table 35.1 Results of fishing the Culgoa River at Cubbie in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			3			3
<i>Leiopotherapon unicolor</i>	Spangled perch			1			1
<i>Retropinna semoni</i>	Smelt		154				154
<i>Gambusia holbrooki</i>	Mosquito fish		7				7
Total Numbers			161	4	0		165

3.5.4 Macroinvertebrates

Surber samples were collected from compact silt on the edge and included bath-tub ring when present. No dip net samples were collected. Twenty-seven discrete taxa were identified from the edge habitat. The most common elements were micro-crustacea, chironomids and corixids. Bait traps collected 21 *Macrobrachium* and 7 *Cherax* with some *Macrobrachium* also captured in the seine and fyke nets.

■ **Table 35.2. Numbers of aquatic macroinvertebrates recorded from Culgoa River at Cubbie**

Taxa	Edge surber (mean +/- sd)
Ancylidae	6.0+/-3.5
Planorbidae	0.6+/-1.3
Nematoda	0.2+/-0.4
Oligochaeta	16.2+/-24.0
Cladocera	65.4+/-49.2
Copepoda	245.2+/-214.3
Ostracoda	46.6+/-59.5

Atyidae	0.2+/-0.4
Dytiscidae	1.2+/-2.2
Elmidae	0.2+/-0.4
Hydraenidae	1.0+/-1.4
Hydrophilidae	0.4+/-0.9
Staphylinidae	0.2+/-0.4
Ceratopogonidae	11.2+/-10.2
s-f Chironominae	14.8+/-7.7
s-f Orthoclaadiinae	0.8+/-1.3
s-f Tanypodinae	47.4+/-38.3
Tabanidae	0.2+/-0.4
Baetidae	9.4+/-11.3
Caenidae	11.2+/-5.2
Corixidae	49.2+/-25.7
Gerridae	0.2+/-0.4
Veliidae	0.4+/-0.5
Epiproctophora	0.2+/-0.4
Gomphidae	2.8+/-4.6
Odonata	1.0+/-2.2
Ecnomidae	0.2+/-0.4
Leptoceridae	4.0+/-3.7
Taxa per sample	15.8+/-4.0
Individuals per sample	536.4+/-314.9
Total taxa	27

3.6 Culgoa River at Woolerbilla

The usual sampling site between the gauging station and the house was completely dry. The lack of water allowed a visual assessment of a safety issue raised during previous events, that is, a bottle dump and other waste material such as drums and wire was noted as slumping into the river but the extent of the problem was unknown until now. Broken and whole bottles plus other material extend over a considerable area of river bed and bank from behind the house for some distance downstream. A site approximately 1km downstream was found to still hold considerable water and as there was no evidence of waste material, this site was sampled and will be used in future sampling events.

The new site was on a bend in the river and consisted of a central channel of 3-6m in width and a bench which ranged up to 15m in width on the eastern side. The top of the bank was about 4m higher than the bench. The western side was steep to the top of the bank. The bench was bare of vegetation except at the downstream end where it tapered and a number of melaleucas were present. A debris dam had formed in this narrow area. The upstream end of the reach was wider and without a bench but the riparian zone which elsewhere existed on the top of the bank, came to the waters edge. Red gum and melaleuca were common and the more distant vegetation was primarily coolibah and wattle. Snags were common in the water and tree roots were also common but not submerged due to the low water levels.

No bath tub ring of algae was present but very small amounts of *Azolla* were observed.

3.6.1 Water quality

Spot water quality samples were collected from an area with maximum depth of 0.4m (Table 3.6.1).

■ Table 3.6.1 Spot water quality readings – Culgoa R at Woolerbilla

Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1645	Surface	27.7	95	238	146	8.1
	0.4	20.8	42	235	206	7.7

Stratification with depth was clear. In comparison to the overnight results from May 2002, the November 2003 data shows higher conductivity and dissolved oxygen concentrations but lower turbidity. Higher pH than previous samples was also recorded.

Overnight logging of water quality parameters was undertaken about 1.5km upstream of this site at a site which was shallower, more open and at which there was more evidence of cattle accessing the area. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 20.6 – 28.2°C

Dissolved oxygen: 66 – 94 % sat; 5.4 – 7.4mg/l

pH: 7.9 – 8.2

Conductivity: 268 – 275 µS/cm

Turbidity: 209 – 238 NTU.

3.6.2 Macrophytes

No macrophytes or fringing rushes were noted and only limited *Azolla* was observed.

3.6.3 Fish

No gill nets were set both because of the generally shallow water and the difficulty of getting a boat into the site. Three species of native fish plus two introduced were captured. In all sampling events to date at the previous Woolerbilla site a total of four native species plus three introduced have been captured. Historical sampling at the previous site shows (native sp / total catch): June 2000 (3/26), April 2001 (3/33), November 2001 (3/24) and May 2002 (2/13). The proportion of the catch represented by introduced species, dominated by Carp, has traditionally been high and the current sampling site also shows a high relative abundance of introduced species (Table 3-6.2).

■ Table 36.2 Results of fishing the Culgoa River at Woolerbilla in November 2003, by fishing method

Species	Common name	Gill nets (0)	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			2			2
<i>Nematolosa erebi</i>	Bony Bream		3				3

<i>Retropinna semoni</i>	Smelt		8				8
<i>Gambusia holbrooki</i>	Mosquito fish		112				112
<i>Carrasius auratus</i>	Goldfish		44	1			45
Total Numbers		N/A	167	3	0	0	170

Ten long-neck turtles were captured in the fyke nets. Three tadpoles were captured in the seine net or bait traps. Snags decreased the effectiveness of one seine haul.

3.6.4 Macroinvertebrates

No specialised habitats were available for sampling but an increase in water depth would inundate several areas of fibrous tree roots. No ring of filamentous green algae was present so surber samples were collected only from compact clay/silt.

Twenty-eight discrete taxa were identified with micro-crustacea, chironomids, baetids and corixids most common (**Table 3-6.3**). One prawn and four yabbies were captured in bait traps.

■ **Table 36.3 Numbers of aquatic macroinvertebrates recorded from the Culgoa River at Woolerbilla**

Taxa	Edge surber (mean +/- sd)
Acarina	1.6+/-2.2
Ancylidae	20.2+/-14.6
Gastropoda	2.8+/-4.4
Planorbidae	2.0+/-4.5
Oligochaeta	23.8+/-30.3
Cladocera	694.4+/-340.2
Copepoda	51.0+/-22.6
Ostracoda	180.2+/-66.7
Palaemonidae	0.4+/-0.9
Dytiscidae	1.6+/-2.2
Hydrophilidae	1.0+/-2.0
Scirtidae	1.6+/-2.2
Ceratopogonidae	32.8+/-12.4
Culicidae	49.0+/-47.1
s-f Chironominae	165.4+/-91.2
s-f Orthoclaadiinae	26.8+/-8.4
s-f Tanypodinae	128.8+/-43.5
Tabanidae	0.8+/-1.8
Baetidae	63.2+/-24.8
Caenidae	0.8+/-1.8
Corixidae	53.0+/-31.8
Notonectidae	2.6+/-3.7
Veliidae	4.4+/-4.6
Coenagrionidae	0.8+/-1.8
Epiproctophora	2.4+/-3.6
Hemicorduliidae	3.8+/-4.1
Libellulidae	0.8+/-1.8
Hydroptilidae	10.2+/-15.5
Leptoceridae	16.0+/-12.1

Taxa per sample	18.2+/-2.4
Individuals per sample	1542+/-302
Total taxa	28

3.7 Culgoa River at Balandool

The water level was again lower than at any previous sampling time though two pools were still evident. Tree roots were all above the water line and the bed and banks were largely exposed and bare.

3.7.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. More variation was evident than at other sites, possibly because the site is more open and the location was shallow. The recorded ranges for each parameter were:

Temperature: 21.3 – 27.8°C

Dissolved oxygen: 61 – 92 % sat; 5.3 – 7.3mg/l

pH: 8.4 – 8.6

Conductivity: 345 – 362 µS/cm

Turbidity: 109 – 189 NTU.

The results from May 2002 show temperature; 8.8°C, dissolved oxygen; 7.8mg/L or 66% saturation, pH (malfunctioned), conductivity 165µS/cm and turbidity >500NTU. In April 2001 the results showed DO of 6.4mg/L or 70% saturation, conductivity of 107µS/cm, turbidity of 338NTU and pH of 6.9. Conductivity and pH on this occasion were noticeably higher, while turbidity was lower.

3.7.2 Macrophytes

No macrophytes or algal fringe was present.

3.7.3 Fish

Gill and fyke nets could not be used because of the low water level and small pool size. Three native species and one introduced were recorded from the seine net, all in low numbers. Previous samples had captured four and six native species respectively.

■ **Table 37.1 Results of fishing the Culgoa River at Balandool in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (1)	Fyke nets (0)	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		1				1
<i>Nematolosa erebi</i>	Bony Bream		1				1
<i>Retropinna semoni</i>	Smelt		32				32
<i>Carrasius auratus</i>	Goldfish		8				8
Total Numbers		N/A	42	N/A			42

3.7.4 Macroinvertebrates

Surber samples were collected from compact mud substrate. There were no macrophytes or filamentous algae at this site and no dip net samples were collected. Twenty-two discrete taxa were recorded with taxonomic density and overall abundance relatively low. The fauna was dominated by micro-crustacea, chironomids, corixids and ceratopogonids. One prawn and 7 yabbies were captured in bait traps.

■ **Table 37.2 Numbers of aquatic macroinvertebrates recorded from the Culgoa River at Balandool.**

Taxa	Edge surber (mean +/- sd)
Ancylidae	0.2+/-0.4
Hydridae	0.2+/-0.4
Nematoda	0.6+/-0.5
Oligochaeta	0.8+/-0.8
Cladocera	9.0+/-9.0
Copepoda	36.6+/-30.6
Ostracoda	7.8+/-6.8
Dytiscidae	0.6+/-0.9
Ceratopogonidae	9.2+/-3.7
s-f Chironominae	103.6+/-113.3
s-f Orthoclaadiinae	0.2+/-0.4
s-f Tanypodinae	22.8+/-9.4
Tabanidae	0.8+/-1.1
Baetidae	0.6+/-0.9
Corixidae	16.8+/-7.7
Mesoveliidae	0.2+/-0.4
Notonectidae	1.8+/-1.1
Saldidae	0.4+/-0.9
Veliidae	1.8+/-2.5
Libellulidae	0.2+/-0.4
Hydroptilidae	0.2+/-0.4
Leptoceridae	2.2+/-1.8
Taxa per sample	13.0+/-2.0
Individuals per sample	216.6+/-153.3
Total taxa	22

3.8 Balonne Minor River at Meigunyah

The mouth of Middle Creek marks the downstream end of this significant pool. At this point the Balonne Minor constricts and flows through a well treed section with more sand and gravel than the pool upstream. The constricted section was a riffle/glide when sampled in May 2002 but was now dry. The site includes plenty of snags in the pool but no trailing roots, macrophytes or algae.

3.8.1 Water quality

Spot water quality readings were taken near the tarzan swing and the logger was also placed here. **Table 3-8.1** shows the spot readings. Maximum depth at this location was 1.1m.

■ **Table 3-8.1 Spot water quality readings – Balonne Minor at Meigunyah**

Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1645	Surface	30.7	90	145	336	7.6
	0.5	18.4	77	142	353	7.5
	1.0	17.2	65	149	361	7.5

Overnight logging of water quality parameters was also undertaken at this site. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 17.0 – 18.1°C

Dissolved oxygen: 46 – 55 % sat; 4.4 – 5.5mg/l

pH: 7.3 – 7.5

Conductivity: 150 – 155 µS/cm

Turbidity: 330 – 340 NTU.

3.8.2 Macrophytes

No macrophytes or algae were present.

3.8.3 Fish

All nets were used this site. Five native species and one introduced were captured. Historical sampling at the site shows (native sp / total catch): June 2000 (5/333, including 114 *Gambusia*), April 2001 (3/133 - NRM), November 2001 (dry - NRM) and May 2002 (5/256, including 228 Western Carp Gudgeon). NRM sampled in a slightly different location on Meigunyah so the 2001 results are not strictly comparable.

■ **Table 38.2 Results of fishing the Balonne Minor River at Meigunyah in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1		1			2
<i>Nematolosa erebi</i>	Bony Bream	12	9				21
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		15				15
<i>Retropinna semoni</i>	Smelt		18				18
<i>Melanotaenia fluviatilis</i>	Rainbow fish		4				4
<i>Gambusia holbrooki</i>	Mosquito fish		2				2
Total Numbers		13	48	1	0		62

3.8.4 Macroinvertebrates

Surber samples were collected from compact silt (4) and gravel (1) at the downstream end of the pool. No dip net samples were collected due to lack of habitat. Twenty-one discrete taxa were recorded from the edge samples (**Table 3-8.3**). The most common

elements were micro-crustacea, chironomids and corixids. Bait traps collected 12 prawns and 4 yabbies.

■ **Table 38.3 Numbers of aquatic macroinvertebrates recorded from Meigunyah**

Taxa	Edge surber (mean +/- sd)
Acarina	0.2+/-0.4
Corbiculidae	0.2+/-0.4
Ancylidae	1.6+/-1.3
Gastropoda	0.2+/-0.4
Nematoda	0.4+/-0.9
Oligochaeta	3.8+/-4.8
Cladocera	184.4+/-177.3
Copepoda	138.8+/-49.0
Ostracoda	119.6+/-75.0
Dytiscidae	5.6+/-8.0
Hydrophilidae	0.2+/-0.4
Ceratopogonidae	14.8+/-11.3
s-f Chironominae	36.6+/-31.1
s-f Tanypodinae	17.2+/-10.8
Baetidae	2.8+/-3.0
Caenidae	16.8+/-8.3
Corixidae	53.8+/-26.7
Notonectidae	0.4+/-0.5
Epiproctophora	1.0+/-1.7
Gomphidae	3.2+/-3.1
Odonata	0.2+/-0.4
Hydroptilidae	0.2+/-0.4
Leptoceridae	5.8+/-5.9
Taxa per sample	14.6+/-2.6
Individuals per sample	608+/-254
Total taxa	21

3.9 Balonne Minor at Trafalgar

This site is within the weir pool which includes Cubbie's licenced offtake on this river. The site contains a good number of snags and partly submerged red gums and melaleucas but no macrophytes were observed and the extent of fibrous roots within the water is very limited. The substrate is black clay.

3.9.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 22.5 – 24.2°C

Dissolved oxygen: 32 – 52 % sat; 2.7 – 4.4mg/l

pH: 7.2 – 7.5

Conductivity: 182 – 190 µS/cm

Turbidity: 358 – 370 NTU.

3.9.2 Macrophytes

No macrophytes were observed, nor was a filamentous algal fringe.

3.9.3 Fish

All nets were used at this site but only 7 bait traps could be set due to a shortage of bait. Six native species and three introduced were captured at this site, most in low numbers. This is equal to the total fish species complement recorded from the site over four previous sampling events. The largest Yellowbelly caught was noted as ripe.

■ **Table 39.2 Results of fishing the Balonne Minor at Trafalgar in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	3		1			4
<i>Nematolosa erebi</i>	Bony Bream	2		1			3
<i>Bidyanus bidyanus</i>	Silver perch	1					1
<i>Leiopotherapon unicolor</i>	Spangled perch			1			1
<i>Melanotaenia fluviatilis</i>	Rainbow fish			1			1
<i>Retropinna selmoni</i>	Smelt		43	1			44
<i>Gambusia holbrooki</i>	Mosquito fish		16				16
<i>Carrasius auratus</i>	Goldfish			2			2
<i>Cyprinus Carpio</i>	Common Carp	4		1			5
Total Numbers		10	59	8			77

3.9.4 Macroinvertebrates

Five surbers were collected from black clay silt areas. Twenty-six taxa were recorded from the surbers with common taxa including micro-crustacea, ceratopogonids, chironomids and corixids (**Table 3-9.3**). Six prawns and three yabbies were captured in bait traps and several were captured in the seine and fyke nets.

■ **Table 39.3 Numbers of aquatic macroinvertebrates recorded from the Balonne Minor at Trafalgar.**

Taxa	Edge surber (mean +/- sd)
Acarina	0.6+/-0.5
Bivalvia	0.2+/-0.4
Ancylidae	2.0+/-2.1
Nematoda	2.2+/-1.3
Oligochaeta	8.2+/-10.8
Cladocera	158.4+/-97.7
Copepoda	303.2+/-89.9
Ostracoda	6.8+/-5.9
Atyidae	0.2+/-0.4
Palaemonidae	0.4+/-0.5
Hydraenidae	1.4+/-1.3
Ceratopogonidae	53.2+/-27.0
Culicidae	1.6+/-1.3

s-f Chironominae	13.6+/-9.5
s-f Orthoclaadiinae	0.6+/-0.5
s-f Tanypodinae	35.2+/-11.6
Tabanidae	0.2+/-0.4
Baetidae	10.8+/-7.0
Caenidae	3.8+/-4.0
Corixidae	40.6+/-26.2
Notonectidae	0.2+/-0.4
Veliidae	0.4+/-0.9
Epiproctophora	0.2+/-0.4
Gomphidae	1.6+/-1.1
Hydroptilidae	0.2+/-0.4
Leptoceridae	8.0+/-5.5
Trichoptera	0.2+/-0.4
Taxa per sample	17.4+/-2.8
Individuals per sample	654+/-188
Total taxa	26

3.10 Donegri Ck (Narran River) at Dirranbandi

The water level at the site was very low and several sections of river had dried completely. The pool sampled was about 60m long and up to 10m wide. Depth was generally less than 0.5m. Few snags were in the water, no tree roots and no macrophytes or algae were observed. *Juncus* was noted about 1.5m above the water line. Sticks marking fishing spots were common.

3.10.1 Water quality

Spot water quality readings were recorded near the centre of the pool (**Table 3-10.1**). No datalogging was undertaken.

■ **Table 3-10.1 Spot water quality readings – Donegri Creek**

Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1215	Surface	25	91	179	420	7.9
	0.5	21.3	88	177	432	7.9

3.10.2 Macrophytes

Patchy sedges occurred above the water line.

3.10.3 Fish

Gill and fyke nets could not be set at the site due to the depth and size of the pool. The fish catch was very poor, other than large numbers of Smelt, some of which were quite large (seven fish between 50 and 63mm). From all previous sampling events, six native species and two introduced have been captured at this site. The site is heavily fished by locals targeting Yellowbelly and given the general lack of water, this pool has probably been fished out.

■ **Table 310.2 Results of fishing at Donegri Creek in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (2)	Fyke nets (0)	Bait traps	Dip net	Total Numbers caught
<i>Retropinna semoni</i>	Smelt		188				188
<i>Nematolosa erebi</i>	Bony Bream		3				3
<i>Gambusia holbrooki</i>	Mosquito fish		2				2
Total Numbers		N/A	193	N/A			193

3.10.4 Macroinvertebrates

Surbers were collected from edge mud substrate, at times including significant leaf litter. No dip net samples were collected due to the lack of habitat. Twenty-three discrete taxa were recorded with the most abundant being micro-crustacea, chironomids, corixids and caenids (**Table 3-10.3**). Bait traps captured 11 prawns and one yabby.

■ **Table 310.3 Numbers of aquatic macroinvertebrates recorded from Donegri Creek (Narran River)**

Taxa	Edge surber (mean +/- sd)
Ancylidae	10.2+/-10.4
Hydridae	1.0+/-1.4
Nematoda	0.2+/-0.4
Oligochaeta	1.8+/-0.8
Cladocera	51.2+/-43.6
Copepoda	214.4+/-58.0
Ostracoda	134.4+/-80.1
Palaemonidae	0.4+/-0.9
Heteroceridae	0.2+/-0.4
Hydraenidae	0.8+/-1.3
Ceratopogonidae	4.2+/-1.3
Culicidae	0.4+/-0.9
s-f Chironominae	21.0+/-15.9
s-f Orthocladiinae	0.8+/-1.8
s-f Tanypodinae	13.8+/-10.6
Baetidae	2.2+/-1.9
Caenidae	10.6+/-9.2
Corixidae	22.6+/-16.7
Notonectidae	0.2+/-0.4
Gomphidae	2.8+/-3.0
Odonata	0.6+/-0.9
Libellulidae	0.2+/-0.4
Hydroptilidae	0.5+/-0.6
Leptoceridae	4.6+/-3.1
Taxa per sample	15.2+/-2.4
Individuals per sample	498+/-180
Total taxa	23

3.11 Narran River at Clyde

The previously used site was dry so a pool approximately 700m upstream was sampled. The pool was about 75m long and 10m wide. Depth was generally less than 0.5m though a small patch to 1m was found. The substrate was black clay over fine sand. The eroding outer edge of the meander had very little riparian vegetation and this then merged with cleared grazing land. The inner edge was more thickly wooded for a considerable distance and the species comprised red gum, wattle and Coolabah. There were quite a few snags and roots above the water line; no fibrous tree roots in the water, no macrophytes and a very limited filamentous algal ring.

3.11.1 Water quality

Logged data was recorded from a depth of approximately 0.2m. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 20.7 – 22.9°C

Dissolved oxygen: 66 – 82 % sat; 5.9 – 7.1mg/l

pH: 8.0 – 8.1

Conductivity: 238 – 249 µS/cm

Turbidity: 367 – 417 NTU.

Spot measurements are shown in **Table 3.11.1**. The bottom was reached at 0.6m.

■ **Table 3.11.1 Spot water quality readings – Narran River at Clyde**

Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1330	Surface	23.7	90	227	405	8.0
	0.5	21.5	81	231	432	8.0

3.11.2 Macrophytes

No macrophytes were recorded. The bath-tub ring was only weakly developed.

3.11.3 Fish

No gill or fyke nets were set at the site because of the shallow water. Even though only one seine haul was undertaken, the catch was actually better than any previous effort at the former site. Five native species and one introduced were captured, with Smelt strongly dominating (**Table 3-11.2**). The Smelt were sub-sampled to ¼; with one sub-sample measured and one just counted. The total count is the sum of the two sub-sample counts plus 2 x the mean of the two.

■ **Table 311.2 Results of fishing the Narran River at Clyde in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (1)	Fyke nets (0)	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		2				2
<i>Nematolosa erebi</i>	Bony Bream		3				3
<i>Retropinna semoni</i>	Smelt		157				157
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		2				2

<i>H.sp4</i>	Carp gudgeon		1				1
<i>Gambusia holbrooki</i>	Mosquito fish		4				4
Total Numbers		N/A	169	N/A	0		169

3.11.4 Macroinvertebrates

No specialised habitats were available to sample at this site. The surbers were all collected from fine silt over sand. Twenty-six discrete taxa were recorded with micro-crustacea, ceratopogonids, corixids and chironomids most common (**Table 3-11.3**). Bait traps captured 5 prawns and four yabbies.

■ **Table 311.3 Numbers of aquatic macroinvertebrates recorded from the Narran River at Clyde**

Taxa	Edge surber (mean +/- sd)
Acarina	0.2+/-0.4
Ancylidae	15.4+/-19.1
Hydridae	8.6+/-16.5
Nematoda	0.4+/-0.5
Oligochaeta	6.0+/-6.3
Cladocera	145.2+/-65.0
Copepoda	230.2+/-95.9
Ostracoda	60.6+/-53.9
Atyidae	0.2+/-0.4
Palaemonidae	0.2+/-0.4
Dytiscidae	0.2+/-0.4
Ceratopogonidae	50.8+/-69.7
s-f Chironominae	25.2+/-14.8
s-f Orthoclaadiinae	0.6+/-0.9
s-f Tanypodinae	20.2+/-13.0
Tabanidae	0.8+/-1.8
Tipulidae	0.2+/-0.4
Baetidae	27.6+/-29.9
Caenidae	2.4+/-2.1
Corixidae	50.2+/-37.0
Notonectidae	1.0+/-0.7
Epiproctophora	2.0+/-2.5
Gomphidae	0.4+/-0.9
Libellulidae	0.2+/-0.4
Ecnomidae	0.4+/-0.9
Leptoceridae	16.0+/-10.7
Taxa per sample	16.4+/-3.0
Individuals per sample	665+/-221
Total taxa	26

3.12 Narran River at Booligar

The river was significantly lower than in May 2002 such that only two remnant pools were available to sample. The main pool was 25-30m long, 4-5m wide and up to .8m

deep. The upstream pool was slightly smaller and shallower and was overhung by the canopy. Cattle were accessing the site for water. There were minor snags in both pools and no tree roots in the water. No macrophytes or filamentous algal fringe were noted.

3.12.1 Water quality

Spot water quality readings showed strong stratification just below the surface. The recordings in **Table 3-12.1** are from the downstream pool. The datalogger was not placed here for fear of damage by cattle.

■ **Table 3-12.1 Spot water quality readings – Narran River at Booligar**

Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1530	Surface	33.7	101	151	432	8.3
	0.3	20.5	29	162	432	7.5
	0.7	20.7	28	153	432	7.7

3.12.2 Macrophytes

No macrophytes or filamentous algae were observed.

3.12.3 Fish

No gill or fyke nets were set because of the small size of the pools and the risk of cattle entangling the nets. Similar only 8 sites for bait traps could be found which were unlikely to conflict with cattle movement. The species complement of three natives and one introduced is in line with previous samples though abundances were very low (**Table 3-12.2**).

■ **Table 312.2 Results of fishing the Narran River at Booligar in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (2)	Fyke nets (0)	Bait traps (8)	Dip net	Total Numbers caught
<i>Nematolosa erebi</i>	Bony Bream		2				2
<i>Retropinna semoni</i>	Smelt		1				1
<i>Leiopotherapon unicolor</i>	Spangled perch		2				2
<i>Gambusia holbrooki</i>	Mosquito fish		1				1
Total Numbers		N/A	6	N/A			6

3.12.4 Macroinvertebrates

All surbers were collected from the upper end of the downstream pool and all had a substrate of silt/mud. No dip nets were collected due to lack of habitat. Nineteen discrete taxa were recorded. The fauna was strongly dominated by micro-crustacea and chironomids (**Table3-12.3**). Bait traps collected 3 prawns and 4 yabbies. Thirty-one prawns were captured in a seine haul.

■ **Table 312.3 Numbers of aquatic macroinvertebrates recorded from Narran River at Booligar**

Taxa	Edge surber (mean +/- sd)
Acarina	0.4+/-0.9
Ancylidae	5.2+/-7.6
Nematoda	1.6+/-1.1
Oligochaeta	5.6+/-5.4
Cladocera	965.6+/-377.2
Copepoda	172.8+/-123.2
Ostracoda	8.8+/-4.4
Parastacidae	0.4+/-0.9
Hydraenidae	0.6+/-0.9
Ceratopogonidae	5.4+/-3.9
Culicidae	3.0+/-1.6
s-f Chironominae	53.4+/-89.1
s-f Tanypodinae	18.6+/-2.9
Baetidae	6.4+/-3.0
Caenidae	2.0+/-2.1
Corixidae	8.2+/-9.7
Notonectidae	0.4+/-0.5
Ecnomidae	0.4+/-0.5
Leptoceridae	4.6+/-5.5
Taxa per sample	14.2+/-2.2
Individuals per sample	1263+/-347
Total taxa	19

3.13 Balandool River at Cubbie

SKM sampled this site in April 2001 but it was dry in November 2001. In May 2002 the river was just flowing and it certainly flowed well in April/May 2003. The site was dry in November 2003 and was not sampled.

3.14 Balandool River at Euraba

In April 2001 this site was a series of shallow isolated pools and in November 2001 it was dry. It was sampled in May 2002 but was again dry in November 2003.

3.15 Bokhara River at Kirrima

This site was sampled by NRM in April 2001 but was dry in November 2001. It was last sampled in May 2002. Sampling is usually conducted downstream of the weir but the only water present on this occasion was a pool upstream and abutting the weir wall. The pool was about 30m long and a maximum of 12-16m wide. The banks were bare and exposed black soil under a sparse canopy of eucalypts and melaleucas. There were only a few small snags in the water, limited *Azolla* and a limited algal bath-tub ring.

3.15.1 Water quality

Spot water quality measurements only were taken at this site. As the maximum depth was 0.3m, readings were taken only at the surface (**Table 3-15.1**).

■ **Table 3-15.1 Spot water quality readings – Bokhara River at Kirrima**

Sample time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1345	Surface	31.4	66	226	233	7.4

3.15.2 Macrophytes

No macrophytes were observed and algae were represented by only sparse *Azolla* and limited filamentous algal growth.

3.15.3 Fish

The size of the pool only allowed one gill net and one fyke net to be set. One seine haul was collected and all 10 bait traps were set and collected. Five native species (three of which were gudgeons and these are often pooled for comparative purposes) and two introduced were captured, with significant numbers of Mosquito fish, Smelt and Goldfish captured in the seine net (**Table 3-15.2**). A long-neck turtle was also captured in the seine net. In May 2002, seven native fish species plus two introduced were captured within a total catch of 36 individuals. Fish captured in May 2002 but not November 2003 were Yellowbelly (8 individuals), Bony Bream (12), Spangled perch (1) and Hyrtl's Tandan (1).

■ **Table 3-15.2 Results of fishing the Bokhara River at Kirrima in November 2003, by fishing method**

Species	Common name	Gill nets (1)	Seine net (1)	Fyke nets (1)	Bait traps	Dip net	Total Numbers caught
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		1		1		2
<i>Hypseleotris sp 4</i>	Gudgeon		5				5
<i>Hypseleotris sp 5</i>	Gudgeon		9	1	5		15
<i>Retropinna semoni</i>	Smelt		153				153
<i>Melanotaenia fluviatilis</i>	Rainbow fish			1			1
<i>Carrasius auratus</i>	Goldfish		43	7			50
<i>Gambusia holbrooki</i>	Mosquito fish		416	2	4		422
Total Numbers		0	627	11	10		648

3.15.4 Macroinvertebrates

Surber samples were collected from silt substrate along the edge, though this area would normally be well within the pool area. No habitat was available for dip net sampling. A total of 24 discrete taxa were captured with the most common being chironomids, cladocera, oligochaetes and ceratopogonids (**Table 3-15.3**). Bait traps captured 1 prawn, 2 shrimps and 1 yabby. Some prawns and shrimps were also caught in fyke and seine nets.

■ **Table 3-15.3 Numbers of aquatic macroinvertebrates recorded from the Bokhara River at Kirrima**

Taxa	Edge surber (mean +/- sd)
Ancylidae	2.8+/-3.3

Planorbidae	0.8+/-1.8
Hydridae	9.8+/-9.3
Amphisopidae	0.8+/-1.8
Nematoda	4.8+/-7.2
Tetrastemmatidae	0.4+/-0.9
Oligochaeta	54.6+/-55.1
Cladocera	76.4+/-30.9
Copepoda	9.6+/-4.8
Ostracoda	6.0+/-5.2
Palaemonidae	0.2+/-0.4
Dytiscidae	0.2+/-0.4
Ceratopogonidae	39.4+/-38.6
s-f Chironominae	164.0+/-77.0
s-f Orthoclaadiinae	1.6+/-3.6
s-f Tanypodinae	49.4+/-22.0
Tabanidae	1.6+/-2.2
Baetidae	1.6+/-3.6
Caenidae	2.2+/-3.3
Corixidae	33.8+/-24.3
Mesovelliidae	1.6+/-3.6
Notonectidae	0.2+/-0.4
Odonata	4.8+/-8.6
Hemicorduliidae	0.6+/-1.3
Leptoceridae	1.4+/-1.9
Taxa per sample	13.8+/-2.7
Individuals per sample	469+/-182
Total taxa	24

3.16 Bokhara River at Koala

The site is basically a long and apparently permanent pool which is often over 2m deep in places. On this occasion it was much shallower. The water had retreated to be some distance from the riparian zone, which is generally sparse, particularly on the eastern side. A bath-tub ring was evident in places but was often smothered by *Azolla*, which occurred in patches. Few snags were noted in the water.

3.16.1 Water quality

■ Table 3-16.1 Spot water quality readings – Bokhara River at Koala

Sample time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1735	Surface	27.3	80 (6.3)	236	169	7.8
	0.3	25.5	79 (6.4)	234	233	7.8

3.16.2 Macrophytes

Azolla occurred in small patches totalling less than 1% of the surface area. A slight fringe of filamentous green alga was present.

3.16.3 Fish

All nets could be successfully deployed at this site. Two seine hauls were conducted but the net tore on the second so the results are only shown for the first. Three native species plus Mosquito fish were captured (**Table 3-16.2**). In May 2002, single specimens of Spangled perch, Carp and Goldfish were recorded while Bony Bream and Yellowbelly dominated in a total catch of 34 individuals. The Yellowbelly captured in the gill net on this occasion was 425mm long.

■ **Table 3-16.2 Results of fishing the Bokhara River at Koala in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1	2	9			12
<i>Nematolosa erebi</i>	Bony Bream	1					1
<i>Retropinna semoni</i>	Smelt		4				4
<i>Gambusia holbrooki</i>	Mosquito fish		1	2			3
Total Numbers		2	7	11			20

3.16.4 Macroinvertebrates

Surber samples were collected from soft mud. A dip net sample was collected from a small area of *Azolla*. Twenty-four discrete taxa were recorded, 19 from the dip net and 22 from the surbers. The more common taxa were micro-crustacea, chironomids, baetids, caenogrionids and corixids (**Table 3-16.2**). Bait traps captured 37 yabbies and one leech. Yabbies, prawns and tadpoles were captured in the seine and fyke nets.

■ **Table 3-16.2 Numbers of aquatic macroinvertebrates recorded from Bokhara River at Koala**

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Acarina	0.8+/-1.8	5
Ancylidae	14.0+/-8.7	
Physidae	1.2+/-1.8	
Gastropoda	4.0+/-4.0	
Oligochaeta	13.2+/-13.2	85
Cladocera	272.8+/-166.4	2340
Copepoda	186.4+/-175.3	1440
Ostracoda	159.2+/-76.4	640
Atyidae		5
Hydraenidae	8.8+/-7.7	5
Ceratopogonidae	16.8+/-9.1	5
Culicidae	4.8+/-8.7	10
Muscidae	11.6+/-10.6	
s-f Chironominae	31.6+/-39.4	115
s-f Orthoclaadiinae	87.6+/-55.3	140
s-f Tanypodinae	41.6+/-18.5	160
Baetidae	27.6+/-15.8	310
Corixidae	47.2+/-16.3	10
Mesoveliidae	5.6+/-6.1	15

Notonectidae	2.0+/-3.5	15
Coenagrionidae	18.8+/-12.8	150
Epiproctophora	0.8+/-1.8	
Odonata	0.4+/-0.9	
Hemicorduliidae		5
Hydroptilidae	0.4+/-0.9	
Leptoceridae	8.4+/-6.4	10
Taxa per sample	17.6+/-1.1	19
Individuals per sample	966+/-250	5465
Total taxa		24

3.17 Warrego River at Shannonvale

The site consists of a long pool with a sandy substrate. The water level was lower than in May 2002 and a number of snags were now exposed. The pool was 10-15m wide and up to a metre or more deep. The overhanging eucalypts sometimes trailed branches in the water.

3.17.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. Little variation was evident. The recorded ranges for each parameter were:

Temperature: 20.6 – 20.9°C

Dissolved oxygen: 1 – 10 % sat; 0.1 – 0.9mg/l

pH: 7.5 – 7.5

Conductivity: 240 – 246 µS/cm

Turbidity: 32 – 65 NTU.

These results appear very odd and should possibly be disregarded.

3.17.2 Macrophytes

No macrophytes or bath tub ring were recorded.

3.17.3 Fish

All nets were deployed at this site. Eight species of native fish, including three *Hypseleotris*, plus Carp were captured (**Table 3-17.1**). The same species count was recorded in May 2002 but Spangled Perch and Eeltail catfish were each recorded as single specimens on that occasion while *Hypseleotris* sp. and Rainbow fish were not. On each of two sampling occasions prior to that, only three native species plus two introduced had been captured.

■ **Table 3-17.1 Results of fishing the Warrego River at Shannonvale in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	3		7	3		13
<i>Nematolosa erebi</i>	Bony Bream	13	28	1	1		43
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		46		4		50
<i>Hypseleotris sp4</i>	Gudgeon		4		1		5

<i>Hypseleotris sp</i>	Gudgeon		116				116
<i>Retropinna semoni</i>	Smelt		5				5
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan	1		10			11
<i>Melanotaenia fluviatilis</i>	Rainbowfish		22	5			27
<i>Cyprinus Carpio</i>	Common Carp	4					4
Total Numbers		21	221	23	9		274

3.17.4 Macroinvertebrates

Twenty-eight taxa were recorded from two habitats at Shannonvale (**Table 3-17.2**); 25 from the dip net and 17 from the surbers. In addition, 30 *Macrobrachium* and 7 *Cherax* were captured in bait traps. The mean number of taxa and individuals in surbers was relatively low. Common faunal elements were chironomids, micro-crustacea, baetids and ceratopogonids.

■ **Table 3-17.2 Numbers of aquatic macroinvertebrates recorded from Shannonvale**

Taxa	Edge surber (mean +/- sd)	Leaf and root dip
Acarina	0.4+/-0.9	60
Corbiculidae	0.4+/-0.9	
Ancylidae	0.4+/-0.9	10
Nematoda		10
Oligochaeta	7.6+/-8.9	340
Cladocera	7.6+/-4.8	2050
Copepoda	29.6+/-17.5	530
Ostracoda	0.4+/-0.9	40
Atyidae		90
Hydraenidae	0.4+/-0.9	30
Hydrophilidae		30
Ceratopogonidae	34.8+/-18.2	220
Culicidae		20
s-f Chironominae	239.6+/-69.2	490
s-f Orthoclaadiinae	55.6+/-39.1	590
s-f Tanypodinae	42.8+/-22.6	600
Tabanidae		10
Baetidae		950
Caenidae	36.4+/-20.0	10
Corixidae	12.0+/-7.6	10
Gerridae		50
Hydrometridae		30
Mesoveliidae		110
Veliidae		30
Epiproctophora	1.2+/-1.8	
Gomphidae	1.2+/-1.8	
Odonata	0.4+/-0.9	
Ecnomidae		10
Leptoceridae	5.2+/-6.1	10
Taxa per sample	11.4+/-1.7	25
Individuals per sample	476+/-100	6330
Total taxa		28

3.18 Warrego River at Tinnenburra

On previous sampling occasions this site has varied from two very small pools to a single pool at least 400m long and 20m wide. On this occasion the pool was about 50m long and 6-8m wide. The substrate was a clay silt overlaying sand. A few isolated snags occurred in places but generally the riparian related habitat was exposed away from the water.

3.18.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. More variation was evident than at other sites. The recorded ranges for each parameter were:

Temperature: 22.7 – 27.3°C

Dissolved oxygen: 37 – 76 % sat; 3.1 – 6.1mg/l

pH: 7.7 – 8.0

Conductivity: 238 – 249 μ S/cm

Turbidity: 49 – 76 NTU.

In November 2001 surface waters were supersaturated with dissolved oxygen (113%), conductivity was 166 μ S/cm, turbidity 660NTU and pH 7.4.

3.18.2 Macrophytes

No macrophytes were observed and only a slight algal ring was present.

3.18.3 Fish

The site was too small and shallow for gill nets and only one fyke net could be set. Eight native fish species plus Carp were captured and several were in very good numbers (**Table 3-18.1**). This is a substantial improvement on previous sampling occasions such as May 2002 when five natives plus Carp were identified in a total catch of 60. In November 2001 only seine netting was possible as the site consisted of just two very small pools. Only three species were recorded on that occasion; Yellowbelly, Bony Bream and Goldfish.

Many of the fish captured on this occasion were small, for example the Yellowbelly ranged from 37mm to 66mm in total length.

■ **Table 3-18.1 Results of fishing the Warrego River at Tinnenburra in November 2003, by fishing method**

Species	Common name	Gill nets (0)	Seine net (1)	Fyke nets (1)	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		4	79			83
<i>Nematolosa erebi</i>	Bony Bream		97	41			138
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		10		1		11
<i>Retropinna semoni</i>	Smelt		7				7
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan		1	54			55
<i>Bidyanus bidyanus</i>	Silver Perch		8	5			13
<i>Leiopotherapon unicolor</i>	Spangled perch		1				1
<i>Melanotaenia fluviatilis</i>	Rainbow fish		74				74
<i>Cyprinus carpio</i>	Common Carp		1	2	4		7
Total Numbers			203	181	5		389

3.18.4 Macroinvertebrates

No specialised habitats were present at Tinnenburra so sampling was restricted to the edge habitat. Surbers were collected from silty sand with leaf litter and twigs. Sixteen discrete taxa were recorded with chironomids, micro-crustacea, caenids and ceratopogonids most common (**Table 3-18.2**). Ninety-one *Macrobrachium* and six *Cherax* were captured in bait traps.

■ **Table 3-18.2 Numbers of aquatic macroinvertebrates recorded from Tinnenburra**

Taxa	Edge surber (mean +/- SD)
Acarina	6.2+/-6.9
Oligochaeta	33.8+/-30.9
Cladocera	35.3+/-35.6
Copepoda	62.4+/-53.7
Ostracoda	7.8+/-10.0
Palaemonidae	1.0+/-2.2
Ceratopogonidae	46.6+/-46.6
s-f Chironominae	710.2+/-418.3
s-f Orthoclaadiinae	5.8+/-4.3
s-f Tanypodinae	19.0+/-13.9
Tabanidae	0.8+/-1.8
Caenidae	91.6+/-92.2
Corixidae	7.4+/-13.9
Odonata	0.8+/-1.8
Ecnomidae	1.0+/-2.2
Leptoceridae	7.8+/-7.7
Taxa per sample	10.6+/-2.2
Individuals per sample	1030+/-409
Total taxa	16

3.19 Moonie River at Nindigully

In May 2002 this site had constricted at the downstream end to a short clay-based riffle. In November 2003 the water level was slightly lower again and the riffle was not present. A major gum tree had recently fallen over the lower end of the pool. No *Ludwigia* was present and the fringe of filamentous algae was very poorly developed. The pool was still about 100m long, up to 40m wide and 1.5m deep.

3.19.1 Water quality

Spot water quality meter data was collected from this site. A strong thermocline was evident at about 1m (**Table 3-19.1**).

■ **Table 3-19.1 Spot water quality readings - Moonie River at Nindigully in November 2003**

Sampling Time	Depth (m)	Temp. (°C)	DO (mg/L)	DO (% sat.)	Conductivity (µS/cm)	Turbidity	pH
1310	Surface	34.9	5.2	75	128	432	7.1
	1.0	22.4	1.2	12	132	432	7.0

3.19.2 Macrophytes

No macrophytes were observed. Occasional *Juncus* and Sword sedge were noted above the waterline.

3.19.3 Fish

All nets were set at this site. One gill net was cleared twice because a number of fish were noted as gilled soon after capture. On the second clearing, one of the Bony Bream may have been a re-capture. Single specimens of long neck turtle were recorded from gill and fyke nets. Three native fish species and two introduced were recorded (**Table 3-19.2**). As has been observed previously, the fish were generally larger than those captured in the Lower Balonne and the seine was relatively unsuccessful. In June 2000 four native species plus one introduced were identified from a total of 19 fish. In November 2001 the catch was 24 fish and comprised of three native species. In May 2002 four native species (49 individuals) plus carp (three individuals) were captured. Other than good numbers of relatively large Bony Bream and Yellowbelly, the site regularly produces a poor fish fauna. Western carp gudgeon is yet to be captured here though it is often abundant at other sites.

■ **Table 3-19.2 Results of fishing the Moonie River at Nindigully in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	5	1	5			11
<i>Nematolosa erebi</i>	Bony Bream	22					22
<i>Tandanus tandanusi</i>	Eeltail catfish	1					1
<i>Gambusia holbrooki</i>	Mosquito fish		10				10
<i>Cyprinus carpio</i>	Common Carp	2		4			6
Total Numbers		30	11	9	0		50

3.19.4 Macroinvertebrates

Surber samples were collected from compact mud substrate. Bait traps returned a zero catch but some *Macrobrachium* were captured in the seine hauls and fyke nets.

Twenty-three discrete taxa were identified (**Table 3-19.3**). This compares with 16 taxa collected in June 2000, 14 in November 2001 and 21 (from three habitats) in May 2002. The common taxa included microcrustacea, corixids, chironomids and baetids.

■ **Table 3-19.3 Numbers of aquatic macroinvertebrates recorded from Nindigully**

Taxa	Edge surber (mean+/-sd)
Ancylidae	8.2+/-15.6
Gastropoda	0.2+/-0.4
Planorbidae	0.2+/-0.4
Nematoda	0.2+/-0.4
Oligochaeta	9.6+/-4.3
Cladocera	145.4+/-174.7
Copepoda	122.2+/-49.0
Ostracoda	226.2+/-231.6
Atyidae	0.2+/-0.4
Hydrophilidae	0.2+/-0.4
Ceratopogonidae	10.4+/-4.4
Culicidae	0.2+/-0.4

s-f Chironominae	22.8+/-8.2
s-f Orthoclaadiinae	1.0+/-1.7
s-f Tanypodinae	24.2+/-8.2
Baetidae	16.2+/-10.1
Caenidae	7.2+/-8.2
Corixidae	199.0+/-263.0
Notonectidae	3.4+/-3.0
Saldidae	0.2+/-0.4
Gomphidae	1.4+/-1.7
Ecnomidae	0.8+/-1.8
Hydroptilidae	0.2+/-0.4
Leptoceridae	4.8+/-4.8
Taxa per sample	15.2+/-1.6
Individuals per sample	804+/-255
Total taxa	23

3.20 Moonie River at Fenton

The site was physically very similar to previous sampling events though the water level was approximately 30cm lower. Sparse *Ludwigia* and a lightly developed algal ring were present.

3.20.1 Water quality

Overnight logging of water quality parameters was undertaken at this site. Some variation was evident. The recorded ranges for each parameter were:

Temperature: 25.7 – 32.3°C

Dissolved oxygen: 51 – 74 % sat; 3.9 – 5.5mg/l

pH: 7.1 – 7.4

Conductivity: 111 – 121 µS/cm

Turbidity: 419 – 432 NTU.

Logged data in November 2001 was recorded with the probe at about 0.3m depth, apparently in the upper, productive layer, because temperature and dissolved oxygen showed a very strong diurnal pattern. Dissolved oxygen dropped from around 80% saturation in the late afternoon to below 30% in the early morning. pH remained stable at just below 7. Overnight recordings in May 2002 showed little pattern but temperature dropped from 8.9 to 6°C while conductivity was stable at 90-94µS/cm. Dissolved oxygen was very low, between 30 and 23% saturation.

3.20.2 Macrophytes

Ludwigia was present in one patch but covered <1% of the pool surface. A single line of *Juncus* and *Schoenoplectus* lined 80% of the waterhole. A mild fringe of filamentous algae was present.

3.20.3 Fish

Two native species plus Carp were captured (**Table 3-20.1**). The Murray Cod measured 18, 25 and 25mm total length. The fish were otherwise large and the seine produced very little. The site total from three sampling events is four native species and three introduced.

■ **Table 3-20.1 Results of fishing the Moonie River at Fenton in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1	3	6			10
<i>McCullochella peelii</i>	Murray Cod		3				3
<i>Cyprinus carpio</i>	Common Carp	2					2
Total Numbers		3	6	6	0		15

3.20.4 Macroinvertebrates

Two habitats were sampled at Fenton with 26 discrete taxa identified from both the edge habitat and the macrophyte habitat (**Table 3-20.2**) for a site total of 33 taxa. The most common taxa were microcrustacea, chironomids, leptocerids and caenid/baetid mayflies. The taxa count compares with 23 collected in May 2002 and 21 taxa collected from three habitats in November 2001. The fauna was of relatively low abundance. Twenty *Macrobrachium* were captured in bait traps and low numbers were recorded from seine hauls and fyke nets.

■ **Table 3-20.2 Macroinvertebrates captured at Fenton**

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Acarina	0.4+/-0.9	44
Ancyliidae	8.8+/-7.6	22
Physidae	2.8+/-3.3	
Gastropoda	2.8+/-3.3	178
Planorbidae	1.2+/-1.8	233
Nematoda	2.6+/-2.6	
Oligochaeta	14.2+/-8.7	300
Cladocera	80.6+/-68.3	222
Copepoda	158.6+/-107.9	344
Ostracoda	65.4+/-28.9	433
Atyidae	0.4+/-0.9	11
Dytiscidae		11
Hydraenidae	0.4+/-0.9	22
Hydrophilidae		44
Ceratopogonidae	17.2+/-15.8	33
Muscidae		44
s-f Chironominae	40.6+/-32.5	100
s-f Orthoclaadiinae	1.0+/-1.0	278
s-f Tanypodinae	13.4+/-6.5	478
Tabanidae		11
Baetidae	21.0+/-10.2	189
Caenidae	24.0+/-15.5	22
Corixidae	44.0+/-16.4	11
Mesoveliidae	1.0+/-1.4	78
Naucoridae		11
Notonectidae	2.6+/-2.4	

Coenagrionidae		110
Epiproctophora	1.6+/-2.2	
Odonata	3.6+/-3.6	
Hemicorduliidae	0.4+/-0.9	
Libellulidae	0.8+/-1.8	
Zygoptera	0.4+/-0.9	144
Ecnomidae	0.2+/-0.4	
Hydroptilidae	0.4+/-0.9	
Leptoceridae	24.8+/-24.4	33
Lepidoptera		67
Taxa per sample	18.4+/-2.3	26
Individuals per sample	535+/-177	3473
Total taxa		33

3.21 Belah Creek

This site has only been sampled once previously (November 2001) and it is described in that report. On this occasion it appears the water level was approximately the same, there was a significant number of snags in the water and riparian zone was in good condition though some weeds were present and grazing, apparently by kangaroos, had been significant. The lagoon had dried completely in 2002 and re-filled from the small flow event of April 2003.

3.21.1 Water Quality

Overnight logging of water quality parameters was undertaken at this site. Limited variation was evident. The recorded ranges for each parameter were:

Temperature: 23.7 – 29.0°C

Dissolved oxygen: 63 – 84 % sat; 5.3 – 6.7mg/l

pH: 8.0 – 8.1

Conductivity: 362 – 371 µS/cm

Turbidity: 111 – 124 NTU.

3.21.2 Fish

All nets were deployed at this site. Four native species and one introduced were recorded. The Yellowbelly were quite small, between 81 and 110mm. On the only previous sampling occasion the catch comprised Bony Bream (19), Spangled perch (4), Carp (1) and Goldfish (11). The species complement at any time probably reflects the duration of inundation and connection to the river as well as the condition in the river prior to recommencement of flow.

■ Table 3-21.1 Results of fishing Belah Ck lagoon in November 2003, by fishing method

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			6			6
<i>Nematolosa erebi</i>	Bony Bream			12			12
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		3				3

<i>Melanotaenia fluviatilis</i>	Rainbow fish			1			1
<i>Gambusia holbrooki</i>	Mosquito fish		4				4
Total Numbers		0	7	19	0	0	26

3.21.3 Macrophytes

No macrophytes were recorded. No bath-tub ring was present.

3.21.4 Macroinvertebrates

Five surber samples were collected from sandy silt substrate (**Table 3-21.2**). No dip net samples were collected due to the lack of habitat. Twenty discrete taxa were identified and the most common elements were micro-crustacea, chironomids, ceratopogonids and oligochaetes. Bait traps captured 8 *Holthuisana* (freshwater crab) and 17 tadpoles. Tadpoles and a crab were also captured in the seine haul. No shrimps, prawns or yabbies were recorded from the site. This is the only site to record crabs.

■ **Table 3-21.2 Macroinvertebrates captured at Belah Creek**

Taxa	Edge surber (mean +/- sd)
Ancylidae	1.2+/-1.8
Gastropoda	1.6+/-1.7
Planorbidae	0.4+/-0.9
Nematoda	2.4+/-5.4
Oligochaeta	50.2+/-51.5
Cladocera	529+/-390
Copepoda	688+/-378
Ostracoda	1041+/-651
Dytiscidae	1.6+/-2.6
Ceratopogonidae	52.2+/-43.3
s-f Chironominae	13.6+/-11.9
s-f Tanypodinae	90.6+/-57.3
Tabanidae	0.4+/-0.9
Baetidae	15.2+/-14.9
Caenidae	0.8+/-1.1
Corixidae	19.4+/-22.8
Notonectidae	3.0+/-3.7
Ochteridae	0.2+/-0.4
Epiproctophora	0.4+/-0.9
Gomphidae	0.2+/-0.4
Odonata	0.4+/-0.9
Leptoceridae	17.2+/-8.8
Taxa per sample	13.8+/-1.3
Individuals per sample	2529+/-512
Total taxa	20

3.22 Clyde Lagoon

This site was sampled in November 2001 but was dry prior to the flow of April 2003. During the dry period the lagoon had been dredged and cleaned. The spoil had been placed on both banks, but primarily the western. The northern end of the pool upstream of the fence line had not been dredged so remained broad and very shallow. Upstream of this point the watercourse was of natural shape, being narrower and with more riparian vegetation but it contained little water. A recently fallen major tree formed a significant snag in this upstream pool. The lagoon proper had only patches of riparian lignum and grass, the rest having been covered with spoil. The area near the windmill had not been disturbed on the edge. No snags remained in the lagoon and only limited *Ludwigia* was present.

3.22.1 Water Quality

Spot water quality readings were taken at this site (**Table 3-22.1**). The water was well oxygenated, not stratified, with relatively low turbidity but high conductivity and pH. In November 2001, the site showed turbidity of around 90NTU, conductivity about 260 μ S/cm and pH just below 8.

■ **Table 3-22.1 Spot water quality readings –Clyde Lagoon, Narran River in November 2003**

Sampling Time	Depth (m)	Temp. (°C)	DO (mg/L)	DO (% sat.)	Conductivity (μ S/cm)	Turbidity	pH
0830	Surface	21.7	8.7	99	350	114	8.7
	0.5	21.6	8.7	99	350	115	8.7
	1.0	20.5	8.6	94	353	113	8.6
	1.2	20.2	8.1	88	351	130	8.5

3.22.2 Fish

No fyke nets could be set at this site because of the steep edge profile. Four bait traps were placed in the upstream snag area with the remainder in the main lagoon. Results are shown in **Table 3-22.2**. Three native and three introduced fish were captured. In November 2001, Yellowbelly, Spangled perch and Eeltail catfish were captured but Smelt and Gudgeon were not.

■ **Table 3-22.2 Results of fishing Clyde lagoon, Narran River in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets (0)	Bait traps	Dip net	Total Numbers caught
<i>Nematolosa erebi</i>	Bony Bream	3	1				4
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		1		2		3
<i>Retropinna semoni</i>	Smelt		97				97
<i>Cyprinus carpio</i>	Carp	2					2
<i>Carrasius auratus</i>	Goldfish		1				1
<i>Gambusia holbrooki</i>	Mosquito fish		10				10
Total Numbers		5	110	N/A	2		117

3.22.3 Macrophytes

Single stems of *Ludwigia* were scattered along the edge. In November 2001 this plant produced a mat about 20m long and extending up to 3m into the water. No algal ring was evident.

3.22.4 Macroinvertebrates

Five surber samples were collected from fine sand/silt substrate in the area where the edge had not been disturbed. No algae and very little leaf litter were encountered.

Twenty-four discrete taxa were identified (**Table 3-22.3**). The fauna was dominated by micro-crustacea (particularly ostracods), ceratopogonids, chironomids and corixids. No macroinvertebrates were captured in the bait traps.

■ **Table 3-22.3 Macroinvertebrates captured at Clyde Lagoon**

Taxa	Edge surber (mean +/- sd)
Acarina	0.2+/-0.4
Hirudinea	1.4+/-3.1
Nematoda	1.0+/-1.0
Oligochaeta	10.6+/-6.7
Dugesidae	1.2+/-2.7
Cladocera	9.6+/-15.1
Copepoda	84.8+/-27.9
Ostracoda	1113+/-703
Coleoptera	0.2+/-0.4
Dytiscidae	1.4+/-2.2
Hydraenidae	1.8+/-4.0
Hydrophilidae	0.4+/-0.9
Ceratopogonidae	295+/-166
s-f Chironominae	43.4+/-33.8
s-f Orthoclaadiinae	2.4+/-5.4
s-f Tanypodinae	3.0+/-3.9
Tabanidae	0.8+/-0.4
Tipulidae	0.4+/-0.5
Baetidae	0.8+/-1.3
Caenidae	0.2+/-0.4
Corixidae	32.4+/-45.8
Notonectidae	1.0+/-0.7
Epiproctophora	0.2+/-0.4
Odonata	0.4+/-0.9
Hemicorduliidae	0.4+/-0.9
Leptoceridae	3.4+/-4.7
Taxa per sample	13.2+/-4.4
Individuals per sample	1609+/-631
Total taxa	24

3.23 Chinaman Creek

The small flows of April 2003 entered the upstream end of the Chinaman Creek floodplain but only reached the first cross floodplain channel on Cubbie. Only the most upstream of the three floodplain sampling sites on this system received any water. Prior to the flow, the site had been reduced to one very small pool. At the time of sampling the full length of creek in this section was wet. The upstream end of the site was a largely exposed sand/mud bar on which *Melaleucas* had germinated following the April flow. Some small snags were noted, minor patches of *Ludwigia* and a well developed algal ring.

The site had been sampled in April and November 2001.

3.23.1 Water Quality

Both spot and logged water quality data were collected from this site (**Table 3-23.1**).

■ **Table 3-23.1 Spot water quality readings – Chinaman Creek in November 2003**

Sampling Time	Depth (m)	Temp. (°C)	DO (mg/L)	DO (% sat.)	Conductivity (µS/cm)	Turbidity	pH
0930	Surface	23.1	6.6	78	234	260	8.1
	0.7	18.4	4.7	51	233	264	7.9

Overnight logging of water quality parameters showed little variation, possibly because of the overcast and rainy conditions. The recorded ranges for each parameter were:

Temperature: 18.6 – 19.0°C

Dissolved oxygen: 55 – 74 % sat; 5.2 – 7.1mg/l

pH: 7.8 – 8.1

Conductivity: 231 – 236 µS/cm

Turbidity: 252 – 267 NTU.

3.23.2 Fish

All nets were deployed at this site. Six native species and two introduced were captured. The dominance by Yellowbelly is unusual and the specimens from the fyke and seine nets were quite small (39-69mm), suggesting breeding in the April flow. Hyrtl's tandan and Rainbow fish had not previously been recorded at the site and one specimen of Mosquito fish was captured in April 2001. In November 2001, Western Carp Gudgeon contributed 145 individuals to a total catch of 176. The catch in April 2001 was just 32 individuals and was dominated by Bony Bream (22). A long-neck turtle was captured and released from a gill net.

■ **Table 3-23.2 Results of fishing Chinaman Creek in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Maquaria ambigua</i>	Yellowbelly	1	4	18			23
<i>Nematolosa erebi</i>	Bony Bream	2					2
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		3				3
<i>Retropinna semoni</i>	Smelt		11				11

<i>Melanotaenia fluviatilis</i>	Rainbow fish		1	1			2
<i>Neosilurus hyrtlili</i>	Hyrtl's tandan			1			1
<i>Cyprinus carpio</i>	Carp	3	1	1			5
<i>Carrasius auratus</i>	Goldfish	1		1			2
Total Numbers		7	20	22	0		49

3.23.3 Macrophytes

Ludwigia occurred in patches, probably covering no more than one percent of the water surface. It was far more prevalent in November 2001. The bath-tub ring of filamentous green algae was well developed.

3.23.4 Macroinvertebrates

Four surber samples were collected from fine mud and one from leaf litter. A dip net sample was taken amongst *Ludwigia*. Twenty-three taxa were collected by each sampling technique for a site total of 31 taxa. Micro-crustacea and orthoclad chironomids were very abundant in the dip net sample. The most common taxa were micro-crustacea, oligochaetes, chironomids and ceratopogonids. The fauna is indicative of a permanent site, or a near permanent site which is physically close to a permanent site. Bait traps captured 16 *Macrobrachium*.

■ Table 3-23.3 Macroinvertebrates captured at Chinaman Creek

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Acarina	2.0+/-3.5	
Ancylidae	19.8+/-17.6	17
Physidae	0.8+/-1.8	
Gastropoda	3.4+/-3.4	
Planorbidae		17
Nematoda	8.0+/-9.7	
Oligochaeta	220.8+/-85.4	100
Collembola		17
Cladocera	230+/-236	1283
Copepoda	700+/-697	7758
Ostracoda	148+/-108	3842
Atyidae		17
Palaemonidae	2.4+/-5.4	67
Hydraenidae		25
Hydrophilidae		33
Limnichidae		8
Ceratopogonidae	96.8+/-68.1	17
Culicidae		67
s-f Chironominae	33.4+/-28.2	100
s-f Orthoclaediinae	0.8+/-1.8	1083
s-f Tanypodinae	62.0+/-40.0	225
Tabanidae	3.4+/-3.4	
Tipulidae	3.4+/-3.4	
Baetidae	19.0+/-23.1	283
Caenidae	0.8+/-1.8	
Corixidae	56.6+/-43.2	300

Notonectidae	4.4+/-6.7	283
Veliidae		42
Coenagrionidae	0.4+/-0.9	
Epiproctophora	0.8+/-1.8	
Zygoptera	0.8+/-1.8	883
Hydroptilidae	0.8+/-1.8	
Leptoceridae	6.8+/-14.1	25
Taxa per sample	15.0+/-1.0	23
Individuals per sample	1625+/-931	16492
Total taxa		31

3.24 Big Holes

This site represents flood runners on the western side of the Culgoa River on Cubbie Station. It fills at relatively low flow levels and holds water for significant periods of time. The area was historically used for sheep and cattle grazing though no cattle have been in the area in recent times as the system has been dry. The site consisted of 2 pools, one being 8-10m wide and 40m long, the other being up to 30m wide and about 200m long. The riparian zone was sparse and consisted primarily of Coolabah and Sally wattle with a sparse understorey of grass and weeds. Many of the trees had limited leaf growth, perhaps a consequence of the drought. Bank slope was variable but mainly quite gentle and they were well covered in recent forb and grass growth.

3.24.1 Water Quality

Spot and logged water quality data was collected at this site. Spot readings are shown below (**Table 3-24.1**). Dissolved oxygen near the bottom was very limited.

■ **Table 3-24.1 Spot water quality readings – Big Holes in November 2003**

Sampling Time	Depth (m)	Temp. (°C)	DO (mg/L)	DO (% sat.)	Conductivity (µS/cm)	Turbidity	pH
0845	Surface	21.9	5.5	67	222	94	8.0
	0.7	17.3	0.4	1	214	60	7.5

Overnight logging of water quality parameters was undertaken at this site and little variation was evident. The recorded ranges, at 30cm depth, for each parameter were:

Temperature: 21.1 – 23.5°C

Dissolved oxygen: 49 – 67 % sat; 4.2 – 6.7mg/l

pH: 7.6 - 8.0

Conductivity: 213 – 221 µS/cm

Turbidity: 89 – 97 NTU.

3.24.2 Fish

All nets were deployed at this site. Four native species and two introduced were captured (**Table 3-24.2**). Yellowbelly captured in seine and fyke nets ranged between 48 and 108mm in length. Nine long neck turtles were captured in one fyke net along with one tadpole.

■ **Table 3-24.2 Results of fishing Big Holes in November 2003, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Maquaria ambigua</i>	Yellowbelly	2	5	6			13
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		6				6
<i>Retropinna semoni</i>	Smelt		13				13
<i>Melanotaenia fluviatilis</i>	Rainbow fish		1	1			2
<i>Cyprinus carpio</i>	Carp	1					1
<i>Gambusia holbrooki</i>	Mosquito fish		17	11			28
Total Numbers		3	42	18	0		63

3.24.3 Macrophytes

No macrophytes were observed.

3.24.4 Macroinvertebrates

Surbers were collected from fine silt. No dip net samples were collected due to lack of habitat. Twenty-four discrete taxa were identified with the most common elements being micro-crustacea (particularly cladocerans), chironomids, corixids and baetids. The bait traps returned a zero catch but 3 prawns were captured in the seine net.

■ **Table 3-24.3 Macroinvertebrates captured at Big Holes**

Taxa	Edge surber (mean +/- sd)
Sphaeriidae	0.2+/-0.4
Ancylidae	5.4+/-3.5
Gastropoda	1.0+/-2.2
Planorbidae	13.6+/-11.0
Nematoda	0.8+/-1.8
Oligochaeta	6.2+/-7.9
Cladocera	2285+/-885
Copepoda	211+/-99
Ostracoda	294+/-253
Dytiscidae	2.4+/-2.2
Gyrinidae	1.0+/-2.2
Ceratopogonidae	54.0+/-23.8
s-f Chironominae	109.0+/-83.7
s-f Orthoclaadiinae	0.8+/-1.8
s-f Tanypodinae	127.6+/-41.2
Tabanidae	1.2+/-2.2
Tipulidae	0.2+/-0.4
Baetidae	60.6+/-32.6
Caenidae	2.4+/-2.1
Corixidae	67.0+/-28.9
Mesoveliidae	0.8+/-1.8
Notonectidae	2.2+/-2.0
Epiproctophora	0.4+/-0.9
Odonata	1.2+/-1.8

Hemicorduliidae	0.4+/-0.9
Leptoceridae	24.6+/-14.0
Taxa per sample	16.0+/-1.7
Individuals per sample	3273+/-609
Total taxa	24

Discussion

4.1 Water quality

As the water quality logger was placed at a single point at each site where logging was undertaken, the peculiarities of that point should be taken into account when interpreting the data. For example if the only place to fix the logger was near the edge of the waterbody, this may produce different results to if it had been suspended in the centre, particularly if the edge was shaded and the centre was very open to sunlight. Similarly while it is standard procedure to place the logger about 0.2-0.3m below the surface, at some sites this meant it was near the bottom while at others it was well above the bottom.

The range of the various parameters recorded overnight was often very small and close inspection of the record showed that the difference between consecutive recordings (10 min apart) was often nearly as great.

It was postulated in November 2001 that the lack of flow and consequent drying out of the waterholes had led to development of eutrophic conditions in some cases and at least to stratification and higher pH, turbidity and conductivity in many others. The flows achieved over summer 2001/2002 were only at compensation level, that is, very low flows, and no flooding occurred. Sampling in May 2002 occurred when flow had generally ceased or was very low in most rivers. While these flows relieved the water quality stress noted in November 2001 to some extent, it was suggested that it was likely to be only a temporary reprieve if no further flows eventuate, as the waterholes would again commence the drying cycle. No further flows eventuated till the small flood of April 2003 and it is assumed it had a similar effect on water quality, that is, relieving the stress of the drought. No sampling took place immediately after the flows as it had in 2002 but the results from November 2003 are similar to those of November 2001, suggesting the drying cycle commenced again and hence we found the various waterbodies at different stages of drying.

Table 4-1.1 summarises the results from all sites sampled in November 2003. Shading highlights individual river systems. Ranges are given where time series or vertical stratification data are available. The Warrego tends to show similar pH and conductivity to the Lower Balonne but much lower turbidity. This is not consistent over time however because in May 2002 the site showed much lower conductivity while the turbidity was similar to Lower Balonne sites. In November 2001 Tinnenburra had a conductivity of 166 μ S/cm and turbidity of 660 NTU. The Moonie sites show higher pH and turbidity but lower conductivity and this is a more consistent result through time.

The floodplain sites, particularly Belah Creek and Clyde Lagoon, also show low turbidity, high pH and high conductivity. The only riverine site with similar results was the Culgoa at Balandool. All of the lagoons sampled fill from low level floods and in April they did so then quickly became isolated again. None have been subject to significant access by stock since filling so this may explain the low turbidity while isolation and the extended drought may explain the conductivity. However the conductivity and turbidity at Belah are much lower than in November 2001, at Chinaman they are somewhat lower and at Clyde they are somewhat higher.

The trend noted in May 2002 for conductivities to increase in a downstream direction is evident again and may reflect the lower level of flushing achieved in this region relative to above the first bifurcation. The effect of the management action of stopping flow in the Culgoa in preference to maintaining flow in the Balonne Minor and Narran can also perhaps be detected in lower turbidities and higher conductivities at the downstream end of the Culgoa, that is, it has been stable and drying out for longer.

The universally high turbidities of May 2002 were not seen, possibly because of the time lag since flow ceased.

■ Table 4-1.1 Summary Water Quality Data for November 2003.

	Temperature (°C)	Dissolved O ₂ (% sat)	Conductivity (µS/cm)	pH	Turbidity (NTU)
Balonne at St George	24.3 – 25.2	69 - 77	158 - 163	7.4 – 7.6	274 - 289
Balonne at Mooramanna*	18.5	84	179	-	233
Balonne at Whyenbah	20 - 22	60 - 72	140 - 145	7.5 – 7.6	217 - 220
Culgoa at Whyenbah	21.7	61	270	7.6	310
Culgoa at Cubbie	19.6 – 20.9	54 - 68	221 - 226	7.7 – 7.9	310 - 328
Culgoa at Woolerbilla*	20.8 – 27.7	42 - 95	235 - 238	7.7 – 8.1	146 - 206
Culgoa at Balandool	21.3 – 27.8	61 - 92	345 - 362	8.4 – 8.6	109 – 189
Balonne Minor at Meigunyah	17.0 – 18.1	46 - 55	150 - 155	7.3 – 7.5	330 – 340
Balonne Minor at Trafalgar	22.5 – 24.2	32 - 52	182 - 190	7.2 – 7.5	358 - 370
Narran at Donegri*	21.3 – 25.0	88 - 91	177 - 179	7.9	420 - 432
Narran at Clyde	20.7 – 22.9	66 - 82	238 - 249	8.0 – 8.1	367 - 417
Narran at Booligar*	20.5 – 33.7	28 - 101	151 - 162	7.5 – 8.3	432
Balandool on Cubbie	DRY				
Balandool at Euraba	DRY				
Bokhara at Kirrima*	31.4	66	226	7.4	233
Bokhara at Koala*	25.5 – 27.3	79 - 80	234 - 236	7.8	169 - 233
Warrego at Shannonvale	20.6 – 20.9	0.9 - 10	240 - 246	7.5	32 – 65
Warrego at Tinnenburra	22.9 – 27.3	37 - 76	288 - 298	7.7 – 8.0	49 – 76
Moonie at Nindigully*	22.4 – 34.9	12 - 75	128 - 132	7.0 – 7.1	432
Moonie at Fenton	25.7 – 32.3	51 - 74	111 - 121	7.1 – 7.4	419 - 432
Belah Creek	23.7 – 29.0	63 - 84	362 - 371	8.0 – 8.1	111 - 124
Clyde Lagoon*	20.2 – 21.7	88 - 99	350 - 353	8.5 – 8.7	113 - 130
Chinaman Creek	18.6 – 19.0	55 - 74	231 - 236	7.8 – 8.1	252 - 267
Big Holes	21.1 – 23.5	49 - 67	213 - 221	7.6 – 8.0	89 - 97

Note: Ranges are from logged data unless marked *, indicating the range is from stratification data.

4.2 Macrophytes

Macrophytes were very limited in their distribution and *Ludwigia* remains the most commonly encountered species. *Azolla* is occasionally seen and may reach significant coverage (e.g. Culgoa at Whyenbah). The fringe of filamentous green algae was a common site but development was often not pronounced.

4.3 Fish

In a total catch of 4776 individuals, ten native species of fish (13 if *Hypseleotris* spp are split) were identified from sites in the Lower Balonne and eleven from reference sites. This is more than double the number of fish captured in May 2002 even though only 10% more sites were sampled. The main difference was the number of Smelt, with more captured on this occasion than of all species combined in May 2002. The number of taxa is in accord with historical sampling.

With the exception of *Tandanus tandanus* and *MucCullochella peeli* (Murray Cod), all native species captured at reference sites were also captured at test sites and *Tandanus* was only represented by one specimen and Cod by 3 very young juveniles. Silver perch were common at Tinnenburra but only one specimen was captured in the Lower Balonne. The introduced Goldfish was not captured at reference sites. Goldfish has however been recorded previously at all reference sites.

Table 4-3.1 summaries the fish catch across all sites. Shading in the table marks each river and sites are placed from upstream to downstream within each river. The number of native species recorded at test sites varied between two and six and at reference sites between two and eight. The number of individuals captured varied from 6 to 1711 at test sites and from 15 to 389 at reference sites. It should be remembered that the use of the seine and the proportion of total habitat sampled, that is, the size of the available pools, varied among sites and this can significantly affect the total catch.

The species complement and total catch at Moonie River reference sites was very poor compared to the Warrego River reference sites, or to most Lower Balonne sites. The poorest results overall were recorded at several lower distributary channel sites (Donegri Ck, Booligar, Balandool, Woolerbilla, Koala) and at the Moonie reference sites (Fenton and Nindigully) while the better results were recorded at Tinnenburra, Shannonvale, Balonne river sites and sites immediately below the first bifurcation. This may support a suggestion put forward in an earlier report that the more permanent sites in the regulated single channel, sandy-bottom section upstream of Whyenbah, which also contains no physical barriers, are likely to provide better fish habitat than the less permanent sites in the smaller clay-bottom distributary channels. Cattle and pigs also more easily impact the distributary channels because they are smaller and often have less steep sides than the upper channel.

The number of taxa captured at a site can vary significantly between sampling events. For example Booligar recorded 5 native species in May 2002; Kirrima, which recorded 4 native species on this occasion, recorded 7 in May 2002 and Cubbie, which recorded 3 native species on this occasion, recorded 6 in June 2000. Similarly Shannonvale recorded 7 native species on this occasion and 8 in May 2002 (three of these being represented by single specimens), but only recorded 3 native species in

June 2000 and November 2001. This may reflect the different flow histories of the river systems. The Warrego was in a period of significant drought in June 2000 (it broke in November / December 2000) and 2001 saw only 2.8% of mean annual flow achieved. Good but short wet seasons occurred in 2002 and 2003. The Balonne and Moonie on the other hand gradually slipped into drought from 2000, conditions becoming worse in the Balonne as time went on, with little reprieve.

The most commonly encountered species at test sites were Smelt (all but one site) and Bony Bream, Yellowbelly and Mosquito fish (all but three sites). The most abundant species at test sites were Smelt (62.5% of the total catch), Mosquito fish (17.4%) and Bony Bream (9.7%). Introduced species contributed 21.4% of the catch at test sites and 4% at reference sites. Carp represented just 1.3% of the total catch from all sites. The least common species were Eeltail catfish (1 individual), Spangled perch (5 individuals), *Hypseleotris* sp5. (5 individuals) and Silver Perch (14 individuals). While species such as Yellowbelly were relatively evenly distributed across sites, others such as Smelt, Mosquito fish and at times Bony Bream, were very patchily distributed. The results are obviously affected by the low water levels over most of the area. In some cases the high catch was a direct result of concentration of the fauna into small remaining areas of habitat, thus making them easy to catch.

■ Table 4-3.1 Summary of fish catch by site; November 2003

Site	<i>M c C u l l o c h e l l a p e e l i i</i>	<i>M a q u a r i a a m b i g u a</i>	<i>L e i p o t h e r a p o n u n i c o l o r</i>	<i>B i d y a n u s b i d y a n u s</i>	<i>N e m a t a l o s a e r e b i</i>	<i>H y p s e l e o t r i s k l u n z i n g e r i</i>	<i>H y p s e l e o t r i s p. 4 a n d 5</i>	<i>M e l a n o t a e n i a f l u v i a t i l i s</i>	<i>R e t r o p i n a s e m o n i</i>	<i>T a n d a n u s t a n d a n u s</i>	<i>N e o s i l u r u s h y r t l i i</i>	<i>C y p r i n u s C a r p i o</i>	<i>C a r r a s i u s a u r a t u s</i>	<i>G a m b u s i a h o l b r o o k *</i>	Total catch	Natives	Introduced
St George		5			48	26		4	44		2	9	1		139	6	2
Mooramanna		2			14	6	1	17	4			1		11	56	6	2
Whyenbah		3			19	45	2	6	196			2		62	335	6	2
Culgoa at Whyenbah		1			260	7		25	1408					10	1711	5	1
Culgoa at Cubbie		3	1						154					7	165	3	1
Culgoa at Woolerbilla		2			3				8				45	112	170	3	2
Culgoa at Balandool		1			1				32				8		42	3	1
Meigunyah		2			21	15		4	18					2	62	5	1
Trafalgar		4	1	1	3			1	44			5	2	16	77	6	3
Bokhara at Kirrima						2	20*	1	153				50	422	648	4	2
Bokhara at Koala		12			1				4					3	20	3	1
Donegri Ck					3				188					2	193	2	1

Narran at Clyde		2			3	2	1		157				4	169	5	1	
Narran at Booligar			2		2				1				1	6	3	1	
Clyde Lagoon					4	3			97			2	1	10	117	3	3
Belah Ck		9			12	3		1					4	26	4	1	
Chinaman Ck		23			2	3		2	11		1	5	2	49	6	2	
Big Holes		13				6		2	13			1		28	63	4	2
Shannonvale		13			43	50	121*	27	5		11	4		274	7	1	
Tinnenburra		83	1	13	138	11		74	7		55	7		389	8	1	
Nindigully		11			22					1		6		10	50	3	2
Fenton	3	10										2		15	2	1	
SUM	3	212	5	14	597	179	145	158	2544	1	69	63	109	704	4776	13	3

4.4 Macroinvertebrates

The 110 surber samples produced 58 taxa (52 non-overlapping) and 115,716 individuals while the 8 dip net samples added a further 5 taxa and 73,046 individuals. In the surbers, nine taxa were represented by just 1 individual while a further five were represented by less than 10 individuals. Micro-crustacea provided 65.9% of the fauna and chironomids a further 15.2%. The most common taxa (with total count from surbers in brackets) were: cladocera (33925), ostracod (21444), copepod (20937), chironominae (11916), corixid (5370), ceratopogonid (5162), tanypodinae (4679) and oligochaetes (4107). In the dip nets, micro-crustacea (68.4%) and chironomids (16.%) again dominated.

The abundance of the fauna per unit area was generally an order of magnitude greater than when last sampled in May 2002. This may reflect concentration as a result of the drought and the smaller volume of habitat available. The number of taxa per surber was also noticeably higher though the total number of taxa identified from the survey was only 7 greater than in May 2002. This may in part represent concentration but also reflects a change in the subconsultant undertaking the sorting such that the latest data includes more “overlapping taxa”, that is, when animals cannot be identified they are placed in the next highest taxonomic group (Zygoptera and Odonata are examples) but also the subfamilies of Chironomidae have not previously been split and these were found in most samples. The low counts in May may also have been a result of fluctuating water levels associated with a series of compensation flow releases. In any case, the pool of taxa available in the region is about 60 at the current level of discrimination and the number at any one site tends to be between 20 and 30 at any one time. This is in accord with previous site analysis which showed about 35% of the faunal complement from a sampling event was likely to be found on the next sampling occasion.

Table 4-4.1 summarises the macroinvertebrate data for all sites. A trend observed in the May 2002 data wherein both the number of taxa and the number of individuals per surber sample increased downstream within each test river, is evident again though it is not perfect. The trend is evident in the Balonne Minor and Bokhara, the Culgoa except for at Balandool (which was a very poor site this time), in the Narran except for the number of taxa at Booligar and in the Balonne except for Whyenbah. The total number of taxa at a site does not show this trend, probably because the number of habitats at a site affects it.

It was suggested previously that the trend may be related to total floodplain diversity, that is, as the floodplain becomes larger towards the south, perhaps riverine diversity

reflects floodplain diversity, particularly as the floodplain habitats dry up and the only available habitat is in the river. Mean abundance at each of the (4) floodplain sites was greater than that at all (18) riverine sites except one (Mooramanna), so this might add support to the hypothesis and certainly indicates the productivity of these environments. Taxonomic richness was no greater at floodplain sites.

Clyde lagoon recorded the poorest of the floodplain results and this may reflect the fact that not only had it been dry prior to the small April flow but it had also been dredged.

■ **Table 4-4.1 Summary of macroinvertebrate data**

	Taxa (Surbers)	Taxa (dip nets)	Taxa Total	Individuals (surber)
Balonne at St George	14.4+/-1.3	22	20(27)	477+/-146
Balonne at Mooramanna	15.2+/-1.3	20	18(22)	1877+/-1063
Balonne at Whyenbah	13.8+/-2.2		22	1201+/-973
Culgoa at Whyenbah	12.2+/-2.6	15	17(25)	286+/-134
Culgoa at Cubbie	15.8+/-4.0		27	536+/-315
Culgoa at Woolerbilla	18.2+/-2.4		28	1542+/-310
Culgoa at Balandool	13.0+/-2.0		22	217+/-153
Balonne Minor at Meigunyah	14.6+/-2.6		21	608+/-254
Balonne Minor at Trafalgar	17.4+/-2.8		26	654+/-188
Narran at Donegri	15.2+/-2.4		23	498+/-180
Narran at Clyde	16.4+/-3.0		26	665+/-221
Narran at Booligar	14.2+/-2.2		19	1263+/-347
Balandool on Cubbie		DRY		
Balandool on Euraba		DRY		
Bokhara at Kirrima	13.8+/-2.7		24	469+/-182
Bokhara at Koala	17.6+/-1.1	19	22(24)	966+/-250
Warrego at Shannonvale	11.4+/-1.7	25	17(28)	476+/-100
Warrego at Tinnenburra	10.6+/-2.2		16	1030+/-409
Moonie at Nindigully	15.2+/-1.6		23	804+/-255
Moonie at Fenton	18.4+/-2.3	27	26(33)	535+/-177
Belah Creek	13.8+/-1.3		20	2529+/-512
Clyde Lagoon	13.2+/-4.4		24	1609+/-631
Chinaman Ck	15.0+/-1.0	23	23(31)	1625+/-930
Big Holes	16.0+/-1.7		24	3273+/-609

Note: Taxa total column shows the surber total then site total in brackets.

As with the fish results, the macroinvertebrate results show a range of recolonisation strengths. Some sites came back strongly after being dry, such as the floodplain sites, while others did not show a good fauna, such as the Balandool River at Cubbie. This may reflect permanence of nearby habitats and the possible avenues for recolonisation. Recolonisation by microcrustacea can occur rapidly from in situ sources.

4.5 General

This sampling event was undertaken during extreme drought conditions in the Lower Balonne, luckily broken to an extent for the aquatic fauna by a small flow event in April. If it had not been for that flow, many more sites would have dried out and very few refuges would have remained. As it turned out, the survey encountered a very similar faunal complement to previous sampling events but at much higher densities (abundance per unit area sampled). In other words, all components of the fish and macroinvertebrate fauna appear to be surviving the drought and will be available to recolonise when the drought breaks. That the abundance result largely reflects concentration is probably best evidenced by the turtle catch. These animals breed far more slowly than macroinvertebrates or fish so the specimens captured in this survey can only have moved to these remaining water bodies from elsewhere, rather than bred recently in the waterbodies as some species of fish and macroinvertebrates will have done.

Recolonisation can be rapid, as evidenced by the results from floodplain sites and from sampling in May 2002. This again emphasises the importance to the aquatic fauna of the low flow events which maintain the riverine water holes and nearby flood runners. The larger flood events are obviously of more importance to fauna such as birds and for floodplain plants but they are of lesser importance to the obligate aquatic fauna. Smartrivers or QMDC should consider the benefits of including infrequent but regular monitoring of floodplain vegetation at sites effected to varying degrees by water extraction.

Another clear result of the survey is the significant impact of grazing and feral animals on small waterbodies as they dry out. There is an undoubted need, as was noted in an earlier report, for maintenance of areas of high quality habitat, that is, protected from such impacts. The importance of these areas for grazing animals is recognised so in any cases where it is possible, graziers should be assisted to investigate and provide alternative water supplies.

References

EM (Ecology Management) Pty Ltd. *Lower Balonne Ecological Condition Report – Survey of May 2002*. Prepared for Smartrivers.

Sinclair Knight Merz (2000, 2001) *Lower Balonne Environmental Condition Assessments*. Prepared for Smartrivers.