

## APPENDIX 2—BIOLOGICAL MONITORING RESULTS

The Macro invertebrate monitoring results for the Spring 2003 and Autumn 2004 sessions are as follows:

### Spring 2003\*

<b>Reference Sites</b>				
<b>Site</b>	<b>Taxa Band</b>	<b>Numerically Dominant Taxa (% Contribution)</b>	<b>Field Observations</b>	<b>Possible Impacts</b>
10 Paddy's River	A	Chironomidae (44%) Oligochaeta (31%) Other (6%)	Site and catchment extensively burnt, surrounding hill slopes cleared of burnt trees. Slightly elevated, conductivity (greater than other reference sites). Silt deposits, 35-65% of the reach and edge habitat covered with periphyton. Increased biological richness since autumn.	Runoff from burnt, cleared catchment. Potential for sedimentation with any significant rainfall.  Low rainfall has probably minimized possible catchment impacts
15 Tidbinbilla River	A	Oligochaeta (43%) Plecoptera (16%) Chironomidae (14%)	Greatest % of Ephemeroptera of all sites. Regrowth of ground cover since fire disturbance. Stream choked with sand, silt and fine organic debris within the reach. Reduced periphyton cover since autumn.	Runoff from burnt catchment, increased sedimentation but probably reduced by post-fire regrowth.  Low rainfall has probably minimized possible catchment impacts
40 Angle Crossing Murrumbidgee River	C	Oligochaeta (48%) Chironomidae (40%) Ephemeroptera (4%)	Riparian renewal post-fire. River water level low. Increased macrophyte growth and undercut banks exposed by low water level. Water pooling above road crossing. Lots of plume, 35-65% periphyton in reach. The most turbid of all sites in the study. All other water quality variables have improved since autumn.	Runoff from burnt catchment, nutrient enrichment from grazing in catchment.  Low rainfall.
<b>Test Sites</b>				
20 Gudgenby River	A	Oligochaeta (60%) Chironomidae (15%) Coleoptera and Plecoptera (6%)	Site and catchment extensively burnt. Turbidity slight, some plume, deposit of fine sediments on sand banks. Conductivity and alkalinity similar to reference sites. Periphyton increased in edge and reach since autumn sampling. Increased mud/muck in reach and edge. However continuing to increase in diversity.	Moderate flow, runoff from burnt catchment, nutrient enrichment and sediment disturbance from grazing in catchment. Low rainfall.
53 Halls Crossing Murrumbidgee River	C	Oligochaeta (92%) Chironomidae (5%) Other (2%)	Vegetation renewal in burnt catchment. Conductivity halved since autumn sampling, still far greater than reference streams. Dense periphyton cover across the reach. Lots of plume. Evidence of high energy flows responsible for elevated turbidity.	Runoff from burnt catchment upstream, STP nutrient inputs, nutrient and sediment disturbance from grazing in catchment  Location downstream of Sewage Treatment Plant. Low rainfall.

\* ACT Water Quality Monitoring Program, Macroinvertebrate Component, Cooperative Research Centre for Freshwater Ecology, October 2003.

Site	Taxa Band	Numerically Dominant Taxa (% Contribution)	Field Observations	Possible Impacts
58 Tuggeranong Creek	B	Oligochaeta (69%) Chironomidae (15%) Ephemeroptera (6%)	Renewal of burnt vegetation in the catchment. Conductivity halved since autumn sampling, still double that of reference streams, lots of sediment plume, silt deposit, high turbidity. 65-90% of the reach covered with periphyton. Flow has increased since autumn.	Runoff from burnt catchment, urban runoff, altered flow regime. Sedimentation.  Low rainfall.
Location downstream of Lake Tuggeranong				
64 Ginninderra Creek	B	Oligochaeta (66%) Chironomidae (26%)	Dissolved oxygen and turbidity have returned to within guideline levels since autumn. Conductivity decreased from autumn, lots of sediment plume, silt deposits, periphyton in 65-90% of edge and reach, filamentous algae covering 10-35% reach. Increased flow since autumn sampling. Rubbish present.	Increased flow level, newly inundated edge habitat dominated by decomposing willow root mats.  Low rainfall
Location adjacent to residential area.				
189 Yarralumla Creek	C	Oligochaeta (84%) Other taxa (12%)	Reduced turbidity from autumn levels. Conductivity has continued to climb even higher than autumn. Lots of plume, however, turbidity has decreased. Anaerobic sediment odours. >90% of reach covered by periphyton. Alkalinity has remained high. A decrease in cover of filamentous algae in reach. Large amount of rubbish present. Evidence of recent high-energy flows.	Willow removal decreased shading. Nutrient enrichment from adjacent playing field, stream channel concreted upstream of site.  Low rainfall.
Location adjacent to playing fields and below stormwater drain outflow pipes.				
195 Ginninderra Creek	C	Oligochaeta (93%) Chironomidae (4%)	Creek flowing again improving DO since autumn sampling. Turbidity has also decreased since autumn sampling. Anaerobic sediment odours, silt deposits and large amounts of plume. Periphyton covering 65-90% of reach and habitat substratum.	Sedimentation, nutrient enrichment, runoff from urban catchment. Some construction works up stream of site.
Location adjacent to residential area.				
Low rainfall.				
196 Ginninderra Creek	C	Oligochaeta (71%) Chironomidae (25%) Other Taxa (3%)	Dissolved oxygen has improved. Sediment plume, slight turbidity, anaerobic sediment odours, water and sediment oils absent on this occasion. Macrophyte cover decreased, Increase in periphyton covering >90% reach.	Some dilution of urban runoff, dam upstream, altered flow regime, poor habitat, sedimentation.  Low rainfall.
Stormwater drains located within the reach, site located adjacent to residential area and near main road. Downstream of Lake Ginninderra.				
235 Queanbeyan River	D	Oligochaeta (76%) Chironomidae (18%) Other Taxa (5%)	Dissolved oxygen has improved. Lots of sediment plume, anaerobic odour. Low flow, right bank willow choked, 35-65% periphyton in reach and 65-90% in edge habitat.	Low rainfall (reduced flow), little dilution of urban runoff and runoff from adjacent playing fields (possible nutrient enrichment), poor habitat, sedimentation.
Located adjacent to industrial area, playing fields and residential areas.				

Site	Taxa Band	Numerically Dominant Taxa (% Contribution)	Field Observations	Possible Impacts
242 Molonglo River	C	Chironomidae (56%) Oligochaeta (19%) Diptera (Other) (12%)	Dissolved oxygen levels have improved since autumn sampling, highest conductivity reading of all sites, anaerobic sediment odours, lots of sediment plume, silt deposits, willows dominating the riparian zone, edge dominated by willow root mats encroaching on stream channel. 65-90% periphyton covering reach, macrophytes increased 65-90%.	Rural runoff, willows, poor habitat, sedimentation. Possible industrial runoff and detrimental impacts from Captains Flat mine upstream.  Low rainfall.
246 Jerrabomberra Creek	B	Oligochaeta (76%) Chironomidae (13%) Other taxa (10%)	High conductivity and alkalinity. Lots of sediment plume, anaerobic sediment odour, sand and silt deposits. 65-90% of reach and edge habitat covered by periphyton and >90% covered by macrophytes, no obvious channel can be seen.	Low rainfall (low flow), very poor habitat, macrophytes dominating channel, sedimentation, rural runoff, nutrient enrichment.

### Autumn 2004 \*

#### Reference Sites

Site	Taxa Band	Numerically Dominant Taxa (% Contribution)	Field Observations	Possible Impacts
10 Paddy's River	B	Oligochaeta(72%)	Some riparian regrowth since extensive burning of catchment. Elevated turbidity greater than other reference sites however, reduced from last autumn sampling. Lowest dissolved oxygen of all reference sites ( $6.81\text{mgL}^{-1}$ ), greatest turbidity of all sites (32 NTU). Silt and sand deposits, lots of plume, periphyton reduced.	Runoff from burnt catchment, Runoff from active clearing on right bank and weed spraying along river. Drought (low flow).
15 Tidbinbilla River	A	Trichoptera (48%) Chironomidae (17%) Oligochaeta (15%)	Riparian regrowth since extensive burning of catchment largely weeds. Conductivity and alkalinity less than previous autumn sampling. Scouring below culvert. Lots of plume, 65-90% of the reach and 35-65% of edge habitat covered with periphyton.	Runoff from burnt catchment, drought (low flow), sedimentation.
40 Murrumbidgee River. Angle Crossing	B	Chironomidae (61%)	Some regrowth apparent after burning of catchment. River water level low. Increased macrophyte growth and undercut banks exposed by low water level. Water pooling above road crossing. Lots of plume, 35-65% periphyton. Turbidity 10.8 NTU	Runoff from burnt catchment, drought (low flow), extensive grazing in catchment has reduced ground cover.

#### Test Sites

20 Gudgenby River	A	Oligochaeta (43%) Chironomidae (15%) Ephemeroptera (16%) Trichoptera (14%)	Extensively burnt site and catchment showing regrowth. Elevated turbidity. Conductivity and alkalinity >4 x previous sampling occasion. Heavy silt deposits in river and lots of plume. Periphyton 10-35% of edge and reach.	Runoff from burnt catchment, drought (low flow), nutrient enrichment and sediment disturbance from grazing in catchment
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\* ACT Water Quality Monitoring Program, Macroinvertebrate Component, Cooperative Research Centre for Freshwater Ecology, March 2004.

Site	Taxa Band	Numerically Dominant Taxa (% Contribution)	Field Observations	Possible Impacts
53 Murrumbidgee River. Halls Crossing	A	Oligochaeta (30%) Chironomidae (22%) Ephemeroptera (27%)	Regrowth apparent in burnt catchment. Conductivity and alkalinity less than previous sampling. Elevated conductivity >2x reference site levels. Periphyton 65-90% covering reach substrate, increased filamentous algae in reach. Lots of plume. Macrophyte beds above current low water level. Downstream of Sewage Treatment Plant	Runoff from burnt catchment upstream, drought, STP nutrient inputs, nutrient and sediment disturbance from grazing in catchment
58 Tuggeranong Creek	B	Oligochaeta (26%), Chironomidae (44%) Trichoptera (11%)	Regrowth apparent in burnt catchment. Elevated conductivity >2x reference site levels, alkalinity greater than reference, lots of plume, silt deposit, 65-90% of the reach covered with periphyton. Very low flow. Location downstream of Lake Tuggeranong	Runoff from burnt catchment. Drought (low flow), urban runoff, altered flow regime. Stock observed in reserve corridor. Sedimentation
64 Ginninderra Creek	B	Oligochaeta (35%), Chironomidae (28%)	Dissolved oxygen low (3.64mg L <sup>-1</sup> ) and turbidity exceeding guidelines. Conductivity increased from 2 previous sampling occasions, lots of sediment plume, silt deposits, periphyton in 65-90% of edge and reach, filamentous algae covering 10-35% reach. Rubbish present and extremely low flow. Location adjacent to residential area.	Drought (low flow), little dilution of urban runoff, poor edge habitat dominated by decomposing willow root mats.
189 Yarralumla Creek	C	Oligochaeta (50%) Chironomidae (36%)	Reduced turbidity from last autumn samplings excessive levels. Conductivity 3x and alkalinity 2x previous Autumn sampling levels. Dissolved oxygen less than two previous sampling occasions (5.16 mgL <sup>-1</sup> ). Lots of plume and slight anaerobic sediment odours. >90% of reach covered by periphyton, 65-90% reach covered by filamentous algae. Large amount of rubbish present. Location adjacent to playing fields and below stormwater drain outflow pipes.	Drought (low flow), little dilution of urban runoff, nutrient enrichment from adjacent playing field; stream channel concreted upstream of site.
195 Ginninderra Creek	C	Oligochaeta (33%) Chironomidae (57%)	Creek not flowing: Sampled upstream in pool, as regular site was completely dry. Low dissolved oxygen (4.19mgL <sup>-1</sup> ), turbidity > than 2 previous sampling occasions. Anaerobic sediment odours, silt deposits and large amounts of plume. 65-90% periphyton covering reach substratum, >90% in edge. No flow, decreased water level exposing mud bank. Location adjacent to residential area.	Drought (low flow), little dilution of urban runoff, sedimentation, nutrient enrichment.
196 Ginninderra Creek	C	Oligochaeta (73%) Chironomidae (18%)	Very low dissolved oxygen (2.74mg L <sup>-1</sup> ), lots of sediment plume, slight turbidity, anaerobic sediment odours, water oil sheen present and moderate sediment oils, low flow. >90% macrophytes and 65-90% periphyton in reach, 30% of substratum in reach and edge habitat comprised of detritus. Increased macrophyte growth Stormwater drains located within the reach, site located adjacent to residential area and near main road. Downstream of Lake Ginninderra.	Drought (very low flow), little dilution of urban runoff, dam upstream, altered flow regime, poor habitat, sedimentation

Site	Taxa Band	Numerically Dominant Taxa (% Contribution)	Field Observations	Possible Impacts
235 Queanbeyan River	C	Oligochaeta (58%), Chironomidae (26%)	Dissolved oxygen low ( $4.4.1\text{mg L}^{-1}$ ), highest temperature of all sites ( $22.84^{\circ}\text{C}$ ). Lots of sediment plume, anaerobic odour. Low flow, right bank willow choked, 35-65% periphyton in reach and edge habitat. Located adjacent to industrial area, playing fields, and residential areas and below the cemetery.	Drought (flow observed), little dilution of urban runoff and runoff from adjacent playing fields (possible nutrient enrichment), poor habitat, sedimentation.
242 Molonglo River	C	Oligochaeta (58%) Chironomidae (23%)	Lowest dissolved oxygen levels ( $2.24\text{mg L}^{-1}$ ) of all sites, conductivity above reference site levels, anaerobic sediment odours, lots of sediment plume, silt deposits, water oil sheen, willows dominating the riparian zone, edge dominated by willow root mats encroaching on stream channel. 35-65% periphyton covering reach and edge habitat. Located in primarily rural catchment with some apparent industry upstream.	Drought (low flow), rural runoff, willows, poor habitat, sedimentation. Possible industrial runoff.
246 Jerrabomberra Creek	B	Oligochaeta (32%) Chironomidae (14%) Trichoptera (12%)	Highest conductivity (7x reference) and alkalinity (5x reference) of all sites. Very low flow, lots of sediment plume, anaerobic sediment odour, sand and silt deposits. 35-65% of reach and edge habitat covered by periphyton and >90% covered by macrophytes, no obvious channel can be seen.	Drought (very low flow), poor habitat, sedimentation, rural runoff, nutrient enrichment

Where:

- X – Outside the model
- A - Equivalent to reference sites
- B – Below reference
- C – Well below reference
- D – Impoverished