



CHRISTCHURCH CITY COUNCIL  
DRAINAGE AND WASTE MANAGEMENT UNIT  
LABORATORY

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A BIOLOGICAL RE-EVALUATION  
OF THE HEATHCOTE RIVER CATCHMENT  
1989-91

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A REPORT PREPARED FOR THE  
CHRISTCHURCH CITY COUNCIL

BY

J A ROBB (Dr)  
*Environmental Scientist*

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FEBRUARY 1994

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## CONTENTS

	<b>PAGE(S)</b>
1 INTRODUCTION	1
2 SAMPLING AND METHODS	2- 4
3 RESULTS AND DISCUSSION	
3.1 Freshwater Invertebrates	5- 9
3.2 Estuarine Invertebrates	11
3.3 Macrophytes	11-14
4 SUMMARY AND CONCLUSIONS	14-16
5 ACKNOWLEDGMENTS	17
6 REFERENCES	18-20

<b>APPENDICES</b>	<b>PAGE(S)</b>
1 Distribution of aquatic plants and benthic invertebrates 1989-91	21-33
2 MCI site-scores and numbers of freshwater taxa at individual sites 1989-91	35-36
3 Sampling sites and maps	37-44
4 Taxonomic listing of plant and animal species present 1989-91	45-50
5 Occurrence of freshwater invertebrate taxa, 1978-79 & 1989-91	51-52
6 MCI scores allocated to freshwater invertebrate taxa	53-54

#### **TABLES**

1 Percentage occurrence of key benthic invertebrate taxa, 1978-79 & 1989-91	6
2 Summary statistics for freshwater invertebrates, 1978-79 & 1989-91	8
3 Percentage occurrence of key riverine plants, 1978-79, 1984-85 & 1989-91	10

Table 3: Percentage occurrence of key riverine plants, 1978-79, 1984-85 &amp; 1989-91

	Heathcote River			Cashmere Stream			Drains (collective)			Total catchment		
	1978-79 (n=120)	1984-85 (n=120)	1989-91 (n=106)	1978-79 (n=27)	1984-85 (n=27)	1989-91 (n=16)	1978-79 (n=48)	1984-85 (n=48)	1989-91 (n=24)	1978-79 (n=195)	1984-85 (n=195)	1989-91 (n=146)
Filamentous green algae	64.2	53.3	61.3	66.7	59.3	56.3	25.0	27.1	62.5	54.9	47.7	61.6
<i>Nitella hookeri</i>	34.2	25.0	24.5	85.1	74.1	75.0	20.8	22.9	20.8	38.0	31.5	29.5
Water mosses	0.8	29.2	24.5	22.2	18.5	87.5	6.3	18.8	29.2	5.4	24.9	32.2
<i>Potamogeton cheesemanii</i>	5.0	8.3	17.0	nil	nil	nil	nil	2.1	12.5	3.1	5.6	14.2
<i>Potamogeton crispus</i>	13.3	20.8	21.7	nil	3.7	nil	nil	10.4	29.2	8.2	15.9	20.4
<i>Potamogeton ochreatus</i>	nil	18.3	8.5	nil	nil	nil	nil	nil	nil	nil	11.3	6.5
<i>Elodea canadensis</i>	nil	1.7	nil	7.4	nil	nil	14.6	nil	nil	4.6	1.0	nil
<i>Myriophyllum</i> sp.	11.7	15.0	12.3	7.4	7.4	6.3	nil	nil	4.2	8.2	10.3	10.0
<i>Callitriche stagnalis</i>	9.2	62.5	26.4	nil	44.4	25.0	14.6	58.3	12.5	9.3	59.0	24.3
<i>Glyceria</i> sp.	40.0	34.2	26.4	25.9	70.4	43.8	10.4	18.8	58.3	30.8	35.4	34.0
<i>Agrostis stolonifera</i>	10.0	31.7	37.7	3.7	40.7	37.5	14.6	6.3	50.0	10.1	26.8	39.1
<i>Ruppia</i> sp.	10.0	nil	0.9	nil	nil	nil	nil	nil	nil	6.2	nil	0.7
<i>Rorippa microphylla</i>	10.0	24.2	16.0	14.8	59.2	37.5	4.2	25.0	25.0	9.2	29.3	19.3
<i>Ranunculus repens</i>	1.7	65.0	43.4	nil	70.4	43.8	nil	18.8	37.5	1.0	54.4	42.4
<i>Mimulus guttatus</i>	7.5	44.2	47.2	nil	22.2	56.3	nil	2.1	29.2	4.6	30.8	45.3

### 3.2 Estuarine Invertebrates

Twenty one estuarine species were recognised during the course of this study (Appendices 1 & 4). Two of these (the polychaete *Scolecopides benhami* and the mud crab *Helice crassa*) extended well upstream into the upper limits of seawater intrusion - *Scolecopides* to Armstrong avenue (site 146) and *H. crassa* (usually not seen but identified by the presence of crab-holes in the river banking<sup>7</sup>) to site 147 which is adjacent to the Scout Den in Centaurus Road. The small estuarine gastropod snail *Potamopyrgus estuarinus* and the polychaete *Nicon estuarinus* extended up to Opawa Road (site 154) which at the time of sampling lay just above the permanently estuarine section of river (Robb & Voyce, 1993). Other prominent species above the Tunnel Road bridge were the molluscs *Macra ovata* (to site 177) and *Amphibola crenata* (to Radley Street) and the isopod *Exosphaeroma planulum* (to site 162). It should be noted though that in 1990-91 the ecology of the estuarine section of river was in a state of flux as several brackish water species were still actively colonising the area above Radley Street. By 1992-93 eleven estuarine species were well established between Radley Street and the railway over-bridge (Robb & Voyce, 1993).

Because most brackish water species are not allocated individual MCI scores, MCI statistics obtained from the section of river below Radley Street (site 161) do not necessarily reflect the true ecological qualities of the resident invertebrate community and should therefore be interpreted with caution.

### 3.3 Macrophytes

A taxonomic listing of all plants recorded during this survey is included in Appendix 4 and the frequencies of occurrence of the more prominent riverine species are summarised in Table 3.

Almost 50 plant taxa were recorded from the Heathcote catchment during the course of this study (Appendix 4b). Many of them are marginal species though and only a dozen or so are normally confined to the main river channel.

In 1989-91 filamentous green algae were by far the most prominent macrophyte and appear to have been more widespread than they were in 1984-85 (Table 3). They were present at almost two-thirds of all sites sampled and were fairly evenly distributed throughout the catchment with 56% occurrence in the Cashmere Stream, 63% in the Drains and 61% in the Heathcote. A similar situation was noted in the Avon catchment (Robb, 1992) and a recently completed ecological overview of the two catchments suggests that this predominance of filamentous green algae is probably due to a combination of high nutrient inputs, reduced stream-flows and higher rates of siltation (Royds Garden Environmental Services, 1993).

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<sup>7</sup> and indicated as - - - in Appendix 1.

Six other riverine taxa - *Agrostis* with 39% occurrence, *Glyceria* (34%), water mosses (32%), *Nitella hookeri* (30%), *Callitriche stagnalis* (24%) and *Potamogeton crispus* (20%) - were also well represented throughout the catchment. *P. crispus* was particularly abundant within the lower reaches of the Heathcote between sites 138 (between Sandwich Road and Fisher Avenue) and 156 (opposite Marshall Street) where it has staged a dramatic come-back since its virtual disappearance from the area when the Woolston Cut was commissioned in April 1986 (Robb & Voyce, 1993). Two native species of *Potamogeton* (*P. ochreatus* and *P. cheesemanii*) were also well established. One of the more distinctive features of the Heathcote River between its confluence with the Cashmere Stream and Wilsons Road (site 140) was the high incidence of *P. cheesemanii* within many of the stony, swift-flowing reaches. *P. ochreatus* was only found associated with *P. crispus* between Wilsons Road and site 155 (the railway over-bridge).

*Myriophyllum* was restricted to 13 of the sites sampled, most of them concentrated within the section of river between Wilsons Road (site 140) and Opawa Road (site 154). Even after making allowances for the fact that several sites in the headwaters of the Cashmere Stream (where *Myriophyllum* is still abundant) were not sampled, it can be concluded that the distribution of this native species has changed considerably since 1984-85. At that time *Myriophyllum* was prominent in the upper reaches of the Heathcote River between sites 76 (Nash Road) and 102 (adjacent to Christchurch United Football Club grounds) but absent from all other sites except one (145) further downstream. When this section of river was re-sampled in 1989-91, river flows were markedly reduced and sites 68-80 and 85 had dried up altogether.

No Canadian pondweed (*Elodea canadensis*) was recorded. This species was not present in 1978-79 either (CDB, 1980) and in 1984-85 was restricted to two sites (148 & 153 - CDB, 1986).

*Ruppia* was only recorded at one site (172). In 1978-79 this species was well established at 12 sites (most of them within the loop), but despite a thorough search was not recorded at all in 1984-85. By 1993 though, it had firmly re-established itself within the loop and also within the section of river between Opawa Road and Mackenzie Avenue (Robb & Voyce, 1993).

Several of the more marginal species, particularly *Mimulus guttatus* (with 45% occurrence), *Ranunculus repens* (42%) and *Rorippa microphylla* (19%), were also well established in many sections of this catchment.

In 1991, the Department of Conservation was requested by the CRC<sup>8</sup> and CCC to make a formal assessment of all macrophyte data collected by the CDB and CCC during the course of their biological surveys of the Avon and Heathcote River catchments since 1978-79. This included the raw data presented in this report. In due course, a report (Baird, 1992) was received which includes the following observations on data collected from the Heathcote catchment:

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<sup>8</sup> Canterbury Regional Council

(a) "The natural values of the Heathcote appear to be more degraded than those of the Avon, particularly downstream of the Cashmere Stream confluence."

(b) "The native aquatic plant complement is much the same as in the Avon. Potamogeton species records, however, are more common, occurring at intervals between Princess Margaret Hospital and Aynsley Terrace. The native species are apparently declining as a result of competition from the exotic P. crispus which is present in the middle reaches of the Heathcote."

The data collected during the course of the 1990-91 & 1992-93 surveys do not support this conclusion. *P. cheesemanii* was confined to the section of river above site 140 and rarely overlapped with *P. crispus* (refer Appendix 1). *P. crispus* and *P. ochreatus* do co-exist between sites 140 & 155 but it is well documented that (commencing 1988) these species recolonised this area simultaneously after disappearing altogether when the Woolston Cut was commissioned in 1986 (refer Robb & Voyce, 1993). Furthermore, additional evidence is now coming to light to suggest that these two species may have distinct spatial distributions within our local rivers (CCC, unpublished data).

(c) "Myriophyllum --- is now far more restricted than in the past. Nitella hookeri and filamentous green algae are widespread. The former, however, is in decline<sup>9</sup> though it is the dominant species in places".

(d) "--- downstream from Sutherlands Road Azolla rubra<sup>10</sup> and duckweed (Lemna minor) occur regularly."

(e) "Native sedges and rushes<sup>11</sup> are relatively more restricted in distribution and fewer species are present than for the Avon. There is, however, a notable population of the sedge Carex geminata and raupo<sup>12</sup> (Typha orientalis) --- near the headwaters (of the Heathcote). --- The headwaters have a rural character and the structure of the river is more natural. In this portion there is a reasonable presence of the native rush Juncus gregiflorus and --- raupo ---."

(f) "The lower reaches are drain-like; having steeper margins and relatively narrow banks. The banks are dominated by introduced grasses and --- willows. --- The lower portion of the river has few relic native plants ---."

Attention is also drawn in Baird's report to the rank growth and high incidence of monkey musk (*Mimulus guttatus*), watercress (*Rorippa microphylla*), buttercup (*Ranunculus* sp.) and tall fescue<sup>13</sup> (*Festuca arundinacea*) along the river margins between Tennyson Street and Aynsley Terrace. Since 1987 the marginal vegetation

---

<sup>9</sup> Debatable given the size of the differences noted between the 1984-85 & 1989-91 surveys (Table 3).

<sup>10</sup> *Azolla filiculoides*

<sup>11</sup> many of which were not considered in this survey as they were not in close proximity to the stream/river.

<sup>12</sup> Occurrence not recorded. Refer Section 2.

<sup>13</sup> Occurrence not recorded. Refer section 2.



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*Bulletin of the Entomological Society, No 9.* 95p.

**Appendix 1: Distribution of aquatic plants and benthic invertebrates, 1989-91**

**Note:** Sites labelled \* sampled 1989  
Remainder sampled 1990-91







	HAYTONS DRAIN			CURLETTS ROAD DRAIN					
	52	53	54	58	60	61	63	66	67
Filamentous green algae		o	o				o		o
Water moss (unidentified)				+	*	*	o	o	
Marchantia berteriana								o	
Blechnum sp.	o								
Agrostis stolonifera	o								o
Glyceria fluitans	*		o	*	o				o
Mimulus guttatus	o							o	
Ranunculus repens	*	o	o					*	o
Oligochaeta (unidentified spp.)				o					
Tubifex tubifex	*	*	*	o	o	o	*	*	*
Lumbriculus variegatus	o	o	*	*	o	o	*	o	o
Potamopyrgus antipodarum	o		o				o	o	*
Physa sp.									*
Gyraulus corinna									o
Sphaerium novaezelandiae							o	o	o
Simocephalus sp.							o	o	o
Herpetocypris pascheri							o	o	o
Eucyclops serrulatus									o
Sigara arguta	*	*	o					o	o
Chironomidae: Orthoclaadiinae		o						o	o
Chironomidae: Tanypodinae									o
Chironomus zealandicus	*	o	*			o	*	*	*











	HEATHCOTE RIVER (Cont'd)										JACKSONS CREEK					HEATHCOTE RIVER (Cont'd)									
	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164
Filamentous green algae	+												*						*	*					*
<i>Vaucheria</i> sp.																									
<i>Nitella hookeri</i>		0	0	*	0																			0	*
Water moss (unidentified)	0	0	0	0																				0	*
<i>Leptodictyum riparium</i>	*	0	*	*																					
<i>Marchantia berteroana</i>				0	0																				
<i>Blechnum</i> sp.					0	0	*					0													
<i>Callitriche stagnalis</i>	+	*	*	*	*			0																	
<i>Potamogeton ochreateus</i>	+	0	+					*	0																
<i>Potamogeton crispus</i>	+	0	*	0	0			+							+	*									
<i>Myriophyllum</i> sp.	*	*	0	0	0	0	*	0	0		0		0		+	+	0								
<i>Rorippa microphylla</i>	*	*	0	0	0	0	0																		
<i>Mimulus guttatus</i>	+	*	+	+	*	*	+	*																	
<i>Ranunculus repens</i>	*	*	*	*	*	0	*	0																	
<i>Agrostis stolonifera</i>	+	*	+	*	+	*	*	0					0												
<i>Glyceria maxima</i>	+	*	*	*	0	*	*	*				0													
<i>Juncus gregiflorus</i>	*	*	0	*	0	0	*	*																	
<i>Bolboschoenus caldwellii</i>	0	*	0	0	0	0	*	*																	
<i>Lemna minor</i>									*																
<i>Myosotis caespitosa</i>	0	0		0	*	*	+	*																	
<i>Mentha</i> sp.	0		0	0	0	0	0	0																	
<i>Rumex crispus</i>	0		0	0	0	0	*	0			*		0		0									+	*
<i>Cotula coronopifolia</i>								0			0		0		*	0	*	*	0	0	*	*	+	+	*

	HEATHCOTE RIVER (Cont'd)										JACKSONS CREEK					HEATHCOTE RIVER (Cont'd)									
	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164
<i>Cura pinguis</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Neppia montana</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tubifex tubifex</i>	*	*	*	+	*	*	+	+	+	+	+	+	*	*	*	*	*	*	*	*	+	*	*	*	*
<i>Lumbriculus variegatus</i>	+	*	*	*	*	*	*	*	*	*	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Eisenella tetraeda</i>																									
<i>Nicon aestuariensis</i>																									
<i>Scolecopides benhami</i>																									
<i>Potamopyrgus antipodarum</i>	*	*	*	0	+	*	+	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Potamopyrgus estuarinus</i>	*	*	0	0	0	*	*	*	*	*	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Physa</i> sp.																									
<i>Physastra variabilis</i>																									
<i>Gyraulus corinna</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cominella glandiformis</i>																									
<i>Amphibola crenata</i>																									
<i>Sphaerium novaezealandiae</i>	0	*	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Psidium</i> sp.	*																								
<i>Simocephalus</i> sp.																									
<i>Herpetocypris pascheri</i>	*	*											0	*											
<i>Exophaeroma planulum</i>																									
<i>Gammaropsis</i> sp.																									
<i>Paracalliope fluviatilis</i>																									
<i>Paratya curvirostris</i>													0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Helice crassa</i>																									
<i>Eylais</i> sp.																									
<i>Austrolestes colenensis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Xanthocnemis zealandica</i>	*	*	*	*	*	*	*	*	*	*	*	*													
<i>Anisops assimilis</i>																									
<i>Sigara arguta</i>	0	*	*	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Antiporus strigosulus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Zelandotipula</i> sp.																									
<i>Ceratopogonidae</i> (unidentified sp.)																									
<i>Limnophora</i> sp.	0																								
<i>Chironomidae: Tanypodinae</i>	*	*	*	0	0	0	+	+	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Chironomus zealandicus</i>	*	*	0	0	0	0	+	+	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Culex</i> sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
Filamentous green algae										0					
Vaucheria sp.	*	+	*	0	*	+	*	*	+	+	+	+	*	+	*
Ruppia polycarpa			*	*	*			0							
Cotula coronopifolia	*	0	*	*	*	+	*	*	0		*	*	*		
Spartina anglica		*		*	*	*	*	*	*	*	*	*	*	*	*
Plagianthus divaricatus		*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tubifex tubifex			0	0	0	0	0	+	*	0	*	*		*	
Lumbriculus variegatus							0								
Nicon aestuariensis		0	0	*		0	0	0	0	0	0	0		*	0
Scolecopides benhami	0	*	0	*	*	0	*	0	0	0	0	0		*	0
Potamopyrgus antipodarum	+	0	*	*	*	*	+	+	*	*	*	+	*	+	0
Potamopyrgus estuarinus	+	0	*	*	+	*	*	*	+	+	+	+	+	+	+
Cominella glandiformis	0														
Amphibola crenata	0			0			0	0	0				0	0	
Macla ovata													0	0	0
Exosphaeroma planulum							0	0				0		0	0
Eucyclops serrulatus			0								0				
Helice crassa															
Sigara arguta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antiporus wakefieldi													0	0	

HEATHCOTE RIVER (Cont'd)

	180	181	182	183	184	185	186	187	188	189	190
<i>Ulva lactuca</i>	*	*		*	+	*	*	*	*	*	*
<i>Gracilaria secundata</i>	o	o			+	*	*	*	*	*	*
<i>Juncus maritimus</i>		*	*	+	+	+	+	+	+	+	*
<i>Leptocarpus similis</i>						*					
<i>Hordeum marinum</i>								*			
<i>Suaeda novae-zelandiae</i>		*						*			*
<i>Mesembryanthemum australe</i>		*						*		*	+
<i>Sarcocornia quinqueflora</i>	*	*	*	*	*	*		*			*
<i>Plantago coronopus</i>	*	o				*		*			
<i>Atriplex prostrata</i>	*	*		*		*		*			o
<i>Apium prostratum</i>	o										
<i>Spartina anglica</i>	*	*	*					*	*	*	
<i>Anthopleura aureoradiata</i>					o						*
<i>Tubifex tubifex</i>		o			o	*					
<i>Nicon aestuariensis</i>	o	o	*	*		o	o	o	o	o	o
<i>Scolecopides benhami</i>	o	o	*		o	o					
<i>Potamopyrgus antipodarum</i>	*	*	*	*	*	*		*			
<i>Potamopyrgus estuarinus</i>	*	+	*	*	*	*		*	o		
<i>Notoacmea helmsi</i>				o			o			*	*
<i>Diloma subrostrata</i>							o			o	*
<i>Diloma nigerrima</i>			o						o		o
<i>Cominella glandiformis</i>										o	o
<i>Amphibola crenata</i>	*	*	*	*	o		*	*	*	*	+
<i>Chione stutchburyi</i>				*		o	*	o	o	o	+
<i>Mactra ovata</i>		o	*			o					
<i>Xenostrobus pulex</i>											o
<i>Elminius modestus</i>											*
<i>Exosphaeroma planulum</i>		o									
<i>Melita awa</i>					*						*
<i>Paracorophium excavatum</i>											o
<i>Transorchestia tenuis</i>			o							o	*
<i>Helice crassa</i>	*	*	o	*	*	*	*	*	*	*	*
<i>Hemigrapsus crenulatus</i>											o
<i>Halicarcinus whitei</i>					*		o		o		o
<i>Paratya curvirostris</i>				o							



**Appendix 2: MCI site-scores and numbers of freshwater taxa at individual sites 1989-91**

**(a) Milnes Drain**

Site number	No taxa	MCI site-score
1	27	66
2	21	67

**(b) Dunbars Drain**

3	18	67
4	21	71

**(c) Hendersons Road Drain**

6	20	72
8	21	69
10	21	70
12	19	63
14	25	72

**(d) Ballantines Drain**

22	14	62
23	17	64
24	18	64

**(e) Haytons Drain**

52	5	52
53	5	44
54	5	52

**(f) Curletts Road Drain**

58	3	20
60	2	20
61	3	26
63	7	48
66	9	53
67	13	58

**(g) Cashmere Stream**

Site number	No taxa	MCI site-score
34	26	71
37	10	66
38	26	79
39	26	75
40	9	73
41	21	65
42	23	67
43	11	80
44	11	61
45	21	72
46	15	68
47	21	73
48	22	70
49	24	66
50	10	60
51	17	65

**(h) Jacksons Creek**

149	4	60
150	4	40
151	11	63



(i) Heathcote River

Site number	No taxa	MCI site-score
81	21	64
82	25	72
83	31	71
84	23	72
86	20	67
87	24	75
88	20	73
89	15	65
90	12	65
91	18	68
92	14	60
93	19	70
94	18	73
95	15	76
96	7	54
97	11	58
98	11	67
99	13	69
100	12	63
101	12	66
102	10	58
103	16	63
104	11	56
105	13	63
106	9	57
107	13	69
108	7	48
109	10	54
110	13	61
111	12	61
112	14	58
113	13	61
114	13	61
115	16	68
116	15	61
117	11	54
118	17	65
119	16	68
120	20	72
121	17	68
122	15	69
123	13	58
124	17	69
125	17	74
126	14	64
127	11	65
128	16	78

Site number	No taxa	MCI site-score
129	17	67
130	11	63
131	16	72
132	15	68
133	12	65
134	13	67
135	15	69
136	14	74
137	17	76
138	12	70
139	15	62
140	16	65
141	18	71
142	11	69
143	7	65
144	5	52
145	7	68
146	10	52
147	7	54
148	8	65
152	6	60
153	5	48
154	4	60
155	6	56
156	5	52
157	3	46
158	2	50
159	3	40
160	2	50
161	3	33
162	2	20
163	3	53
164	3	40
165	1	80
166	0	0
167	1	20
168	0	0
169	1	20
170	2	50
171	1	20
172	2	50
173	2	50
174	1	20
175	2	50
176	2	50
177	3	93
178	1	20
179	1	80

### **Appendix 3: Sampling sites**

#### **Milnes Drain:**

- 1 10m below Sparks Road
- 2 10m upstream of confluence with Cashmere Stream

#### **Dunbars Drain:**

- 3 5m below Sparks Road
- 4 5m upstream of confluence with Cashmere Stream

#### **Hendersons Road Drain:**

- 6 3m below bridge to old dairy farm
- 8 2m upstream of Sparks Road
- 10 Opposite 100 Hendersons Road
- 12 100m upstream of confluence with Cashmere Stream (at small bridge)
- 14 30m above confluence with Cashmere Stream

#### **Ballantines Drain:**

- 22 End of section at 156 Sparks Road
- 23 20m below junction of side drains
- 24 5m above Cashmere Road

#### **Cashmere Stream:**

- 34 Just below confluence with Milnes Drain
- 37 Just upstream of Hendersons Road Drain
- 38 Just downstream of Hendersons Road Drain
- 39 Just below bridge, corner Hendersons and Cashmere Roads
- 40 Halfway between Hendersons Road & Penruddock Rise
- 41 10m downstream of Ballantines Drain
- 42 Bridge on Penruddock Rise
- 43 10m downstream of log bridge, old Cashmere Downs Nursery subdivision
- 44 50m upstream of first house east on Cashmere Road past site 43
- 45 40m above start of large macrocarpa hedge
- 46 Opposite 41 Waiiau Street
- 47 Opposite 19 Waiiau Street
- 48 Opposite 9 Waiiau Street
- 49 20m downstream of Worsleys Road bridge
- 50 100m above Cashmere Road opposite Hurunui Street
- 51 5m above Cashmere Road bridge

**Haytons Drain:**

- 52 Downstream end of bend in drain
- 53 30m below Wigram Road
- 54 100m upstream of confluence with Heathcote

**Curletts Road Drain:**

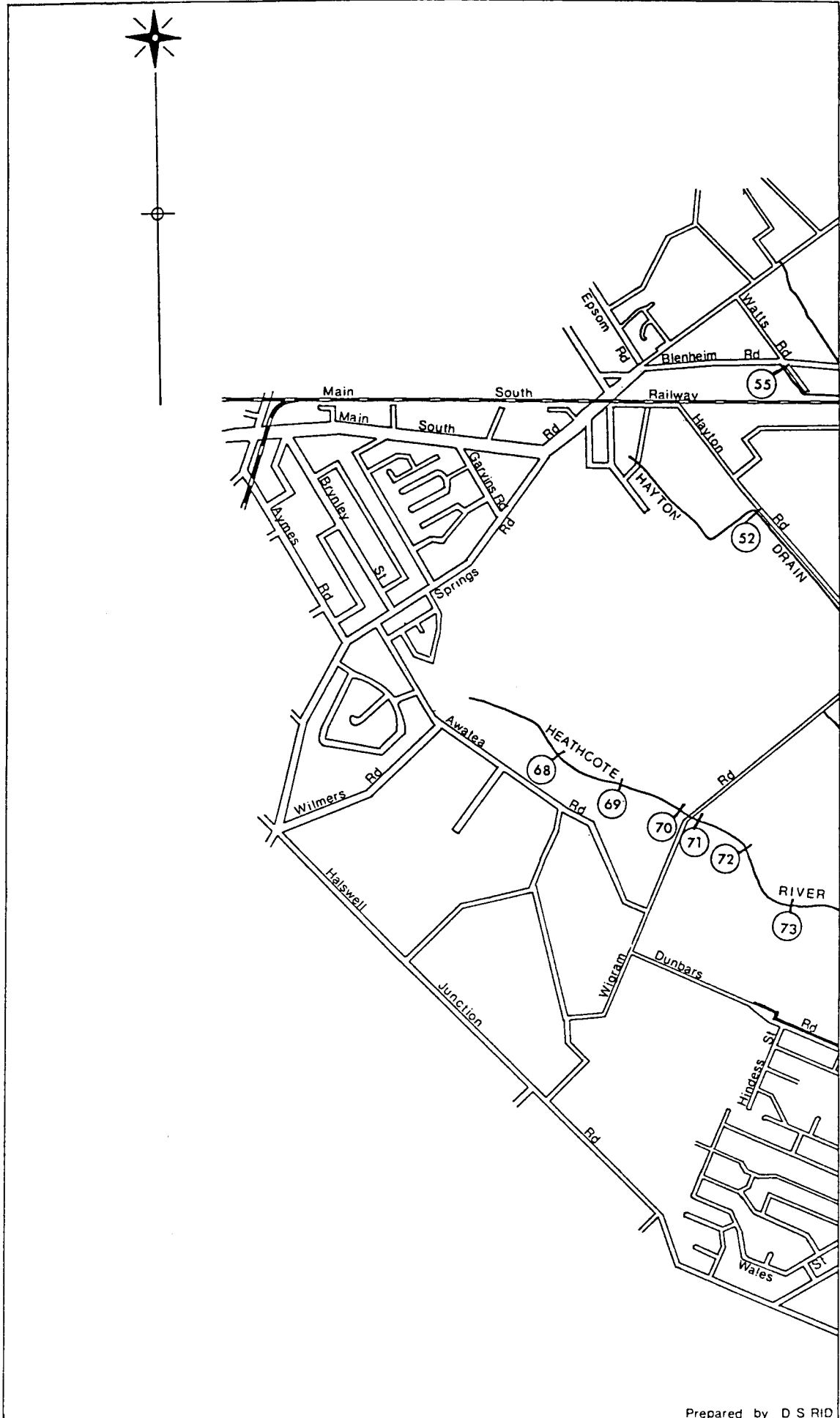
- 58 25m above right angle bend at Wigram Road
- 60 1m above Wigram Road
- 61 3m above culvert at right angle bend at end of row of poplars
- 63 15m above culvert under motorway on small side-drain from subdivision on eastern side of Annex Road
- 66 At end of swift-flowing shingly patch in drain 200m upstream of bridge at Hospital Board's bulk store
- 67 10m above confluence with Heathcote

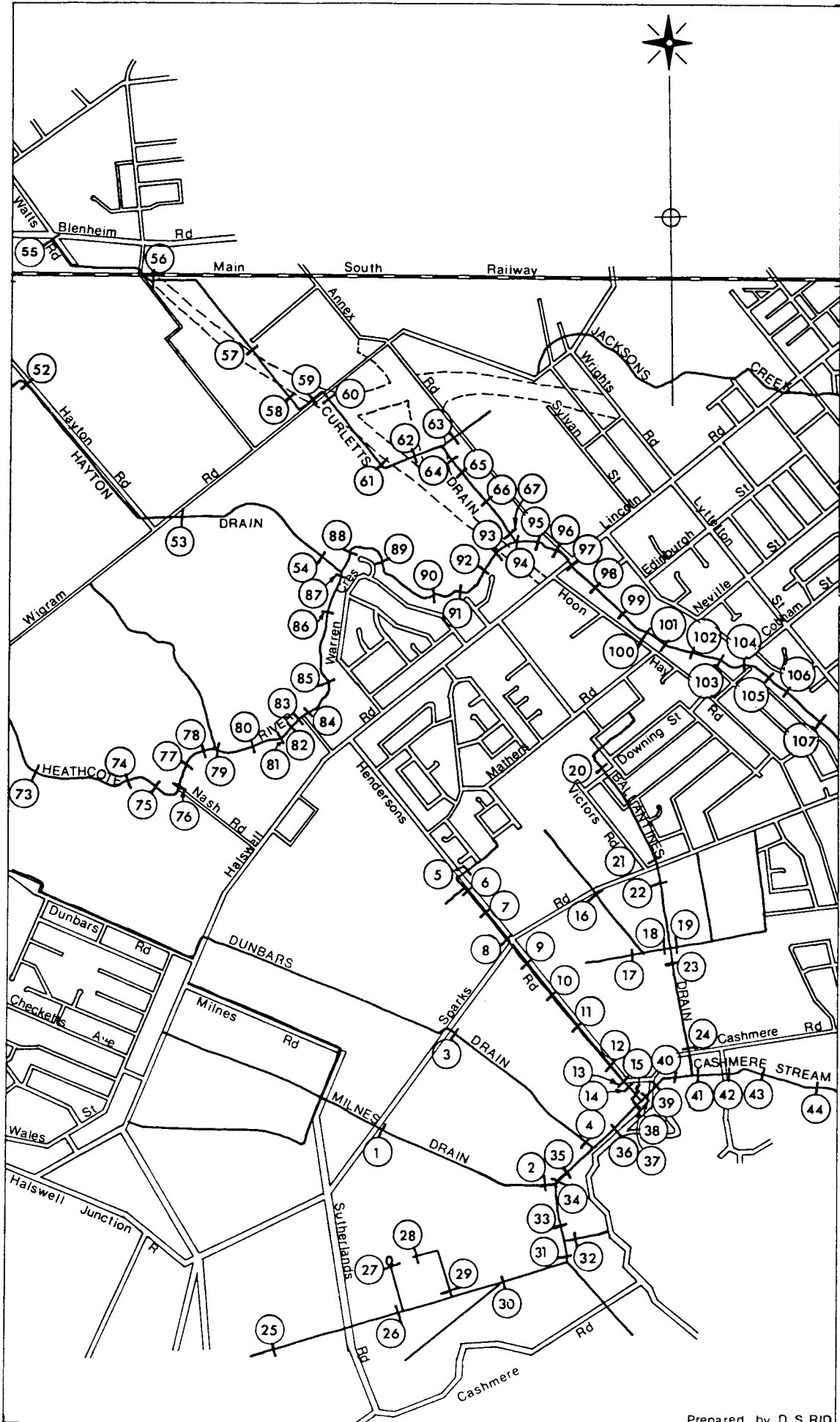
**Heathcote River:**

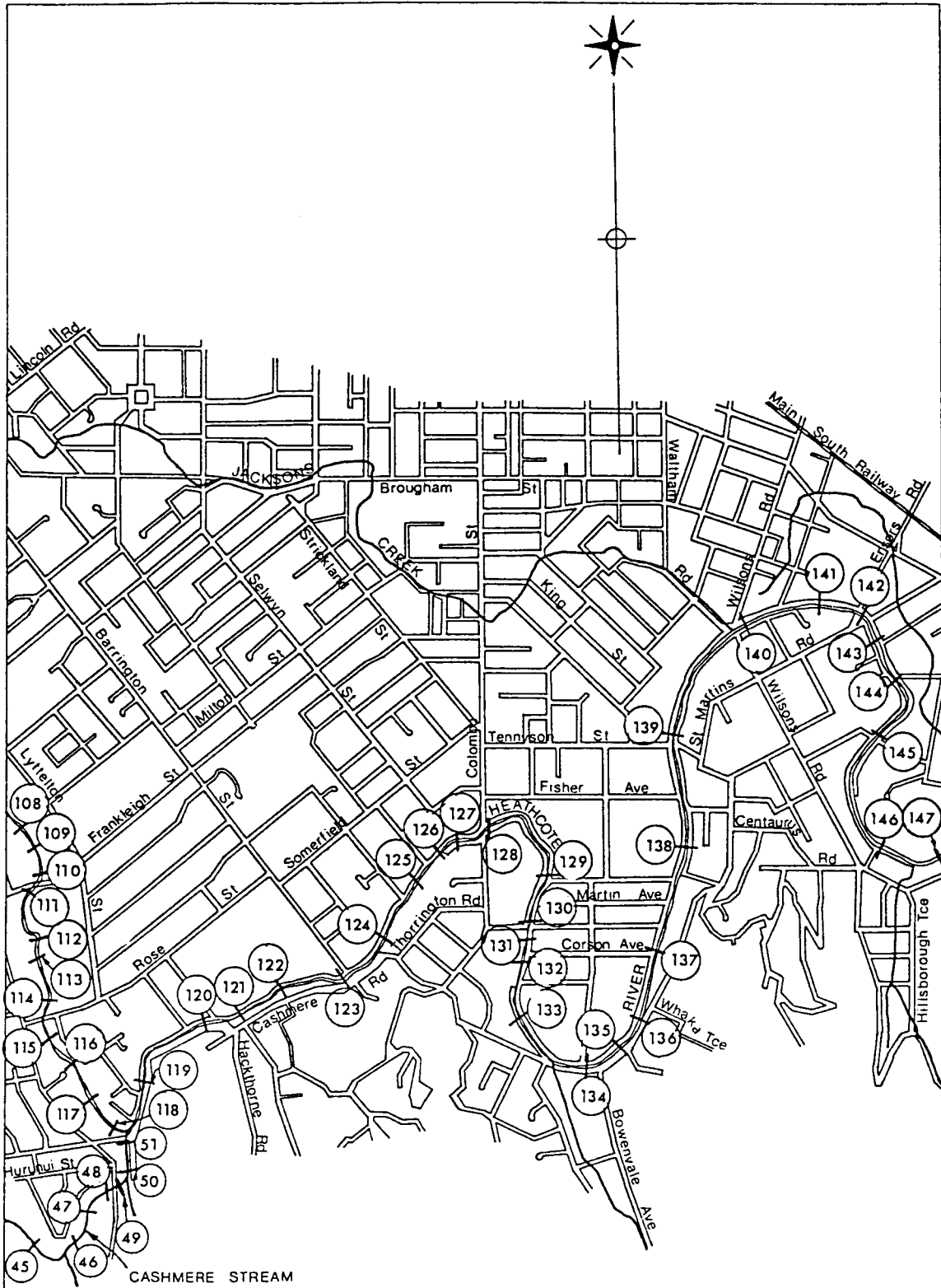
- 81 120m upstream of bridge at Templetons Road
- 82 30m above bridge at Templetons Road
- 83 6m above bridge at Templetons Road
- 84 2m below bridge at Templetons Road
- 86 300m downstream of old radio mast
- 87 3m upstream of confluence with Hayton Road Drain
- 88 100m downstream of confluence with Hayton Road Drain
- 89 Opposite Bidwell Place just upstream of pronounced bend in river
- 90 200m upstream of site 91, under large willow tree
- 91 Just upstream of 23 Kinnaird Place
- 92 Opposite 21 Renwick Place
- 93 Immediately above motorway bridge
- 94 100m downstream of motorway bridge
- 95 100m downstream of site 94 just below stormwater outfall, north bank
- 96 100m above Lincoln Road where river meets Annex Road
- 97 5m below Lincoln Road
- 98 Opposite 17 Hoon Hay Road
- 99 15m above footbridge to bowling club
- 100 5m below same footbridge
- 101 10m below a point opposite Mathers Road
- 102 Opposite Christchurch United Association Football Club
- 103 100m above site 104
- 104 Just above footbridge at Smartlea Street
- 105 100m downstream of same footbridge
- 106 Upstream end of West Spreydon School
- 107 Downstream end of West Spreydon School
- 108 200m downstream of site 107, one house upstream of private radio mast
- 109 Opposite house between 1 & 3 Waimokihi Place on north bank
- 110 5m upstream of Sparks Road

- 111 30m downstream of Sparks Road
- 112 130m downstream of Sparks Road, adjacent to board fence
- 113 Centennial Park, at end of fence at northern end of Pioneer Sports Stadium
- 114 30m upstream of Rose Street
- 115 Opposite 277 Hoon Hay Road
- 116 Opposite 19 Tekoa Place
- 117 Opposite 21 Greta Place
- 118 134 Cashmere Road
- 119 20m downstream of Ferniehurst Street at CCC gauge
- 120 30m upstream of Fairview Street
- 121 3m upstream of footbridge opposite supermarket
- 122 5m downstream of footbridge opposite Council depot
- 123 2m upstream of Barrington Street bridge
- 124 Opposite 243 Ashgrove Terrace
- 125 Opposite 295 Ashgrove Terrace
- 126 Opposite 319 Ashgrove Terrace
- 127 400m upstream of Colombo Street bridge
- 128 Colombo Street bridge
- 129 Sandwich Road
- 130 Malcolm Avenue bridge
- 131 50m downstream of site 130
- 132 5m below upstream side of Corson Avenue
- 133 Opposite 199 Waimea Terrace
- 134 20m upstream of Bowenvale Avenue bridge
- 135 Opposite 55 Eastern Terrace
- 136 Opposite 69 Eastern Terrace
- 137 Opposite Corson Avenue, Eastern Terrace
- 138 Halfway between Sandwich Road & Fisher Avenue
- 139 10m downstream of Tennyson Street bridge
- 140 30m downstream of Wilsons Road
- 141 Opposite 54 Fifield Terrace
- 142 Opposite 115b Fifield Terrace
- 143 Opposite end of Cholmondeley Avenue
- 144 10m upstream of Ford Road footbridge
- 145 10m upstream of Beckford Road bridge
- 146 30m downstream of Armstrong Avenue footbridge
- 147 Just upstream of Scout Den, Centaurus Road
- 148 Just upstream of footbridge, Aynsley Terrace
- 152 30m upstream of Garlands Road footbridge
- 153 Halfway between sites 152 & 154
- 154 Opawa Road bridge
- 155 Railway over-bridge
- 156 Marshall Street
- 157 Mackenzie Avenue footbridge
- 158 Wildberry Street
- 159 Opposite Woolston Park
- 160 25m upstream of confluence with Bells Creek
- 161 10m upstream of Radley Street bridge

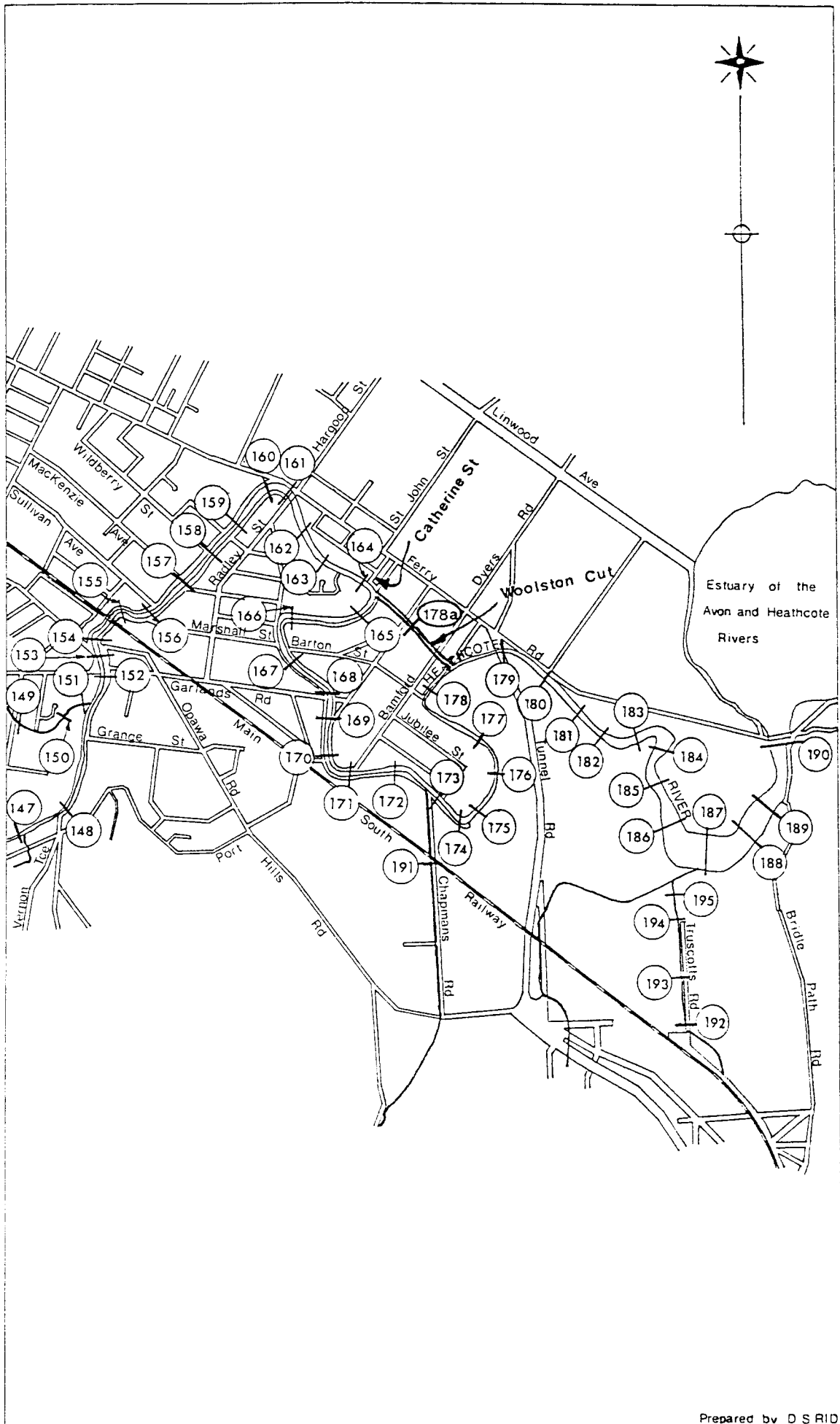
- 162 120m downstream of Radley Street bridge
- 163 Opposite de Spa woolscourers
- 164 Catherine Street footbridge
- 165 Opposite Dunlop factory in loop
- 166 Lower end of Radley Park just before river narrows at Cumnor Terrace
- 167 Opposite Skellerup Industries
- 168 Garlands Road bridge
- 169 Opposite Henry York Ltd
- 170 Opposite Hurricane Wire Products
- 171 Opposite end of Bamford Street
- 172 Opposite Fumigation Station
- 173 Opposite end of Staunton Street
- 174 Opposite entrance to farm (old Kennaway Estate)
- 175 140m downstream of site 174 opposite back of Independent Fisheries
- 176 Sharp bend at upstream end of straight running past G L Bowron & Co
- 177 Opposite G L Bowron & Co halfway along straight
- 178 100m downstream of end of Barton Street
- 179 Tunnel Road bridge
- 180 Opposite Charlesworth Street
- 181 200m downstream of fire-station
- 182 20m downstream of pylon
- 183 240m downstream of site 182
- 184 Sharp bend in river adjacent to row of pine trees
- 185 160m downstream of site 184
- 186 200m downstream of site 185, opposite slag heap
- 187 Wide section of river halfway between sites 186 & 188
- 188 Opposite Ferrymead railway station
- 189 180m downstream of site 188
- 190 Just upstream of Ferrymead bridge, western side of river











**Appendix 4: Taxonomic listing of species present 1989-91**

**(a) Benthic invertebrates**

Phylum Coelenterata

*Hydra* sp.  
*Anthopleura aureoradiata*\*

Phylum: Platyhelminthes

Class: Turbellaria

*Phaenocora* sp.

Class: Tricladida

*Cura pinguis*  
*Neppia montana*

Phylum: Annelida

Class: Oligochaeta

*Lumbriculus variegatus*  
*Eiseniella tetraeda*  
*Tubifex tubifex*  
Unidentified Oligochaeta

Class: Polychaeta

*Nicon aestuariensis*\*  
*Scolecoides benhami*\*

Class: Hirudinea

*Glossiphonia multistriata*

Phylum: Mollusca

Class: Gastropoda

*Potamopyrgus antipodarum*  
*Potamopyrgus estuarinus*\*  
*Physa* sp.  
*Physastra variabilis*  
*Gyraulus corinna*  
*Notoacmea helmsi*\*  
*Cominella glandiformis*\*  
*Amphibola crenata*\*  
*Diloma nigerrima*\*  
*Diloma subrostrata*\*

Class: Lamellibranchia

*Sphaerium novaezelandiae*

*Pisidium* sp.

*Chione stutchburyi*\*

*Maetra ovata*\*

*Xenostrobus pulex*\*

Phylum: Arthropoda

Class: Crustacea

Sub class: Branchiopoda

*Simocephalus* sp.

Sub class: Ostracoda

*Herpetocypris pascheri*

Subclass Cirripedia

*Elminius modestus*\*

Sub class: Copepoda

*Eucyclops serrulatus*

Sub class: Malacostraca

Order: Isopoda

*Exosphaeroma planulum*\*

Order: Amphipoda

*Melita awa*\*

*Paracorophium excavatum*\*

*Gammaropsis* sp\*

*Paracalliope fluviatilis*

*Transorchestia tenuis (Orchestia tenuis)*\*

Order: Decapoda

*Helice crassa*\*

*Hemigrapsus crenulatus*\*

*Halicarcinus whitei*\*

*Paratya curvirostris*

Class: Arachnida

*Eylais waikawae*  
*Piona uncata*  
Acarina (unidentified)

Class: Insecta  
Order Lepidoptera

*Hygraula nitens* (*Nymphula nitens*)

Order Plecoptera

*Zelandobius confusus*

Order Ephemeroptera

*Coloburiscus humeralis*

Order: Hemiptera

*Anisops assimilis*  
*Sigara arguta*  
*Microvelia macgregori*

Order: Trichoptera

*Oxyethira albiceps*  
*Triplectides obsoleta*  
*Oecetis unicolor*  
*Paroxyethira hendersoni*  
*Polyplectropus puerilis*  
*Hudsonema amabilis*  
*Hydrobiosis parumbripennis*

Order: Odonata

*Austrolestes colenisonis*  
*Xanthocnemis zealandica*

Order: Coleoptera

*Liodessus plicatus*  
*Antiporus strigosulus*  
*Rhantus pulverosus*  
*Hydora* sp. (Elmidae)

Order: Diptera

*Zelandotipula* sp.

*Limonia* sp.

*Paralimnophila skusei*

*Culex* sp.

*Paradixa* sp

*Austrosimulium* sp.

Chironomidae: Tanypodinae

Chironomidae: Orthoclaadiinae

*Chironomus zealandicus*

Ceratopogonidae (unidentified)

*Limnophora* sp.

Empididae (unidentified)

\* estuarine taxa

**(b) Plants**

Phylum: Chlorophyta (Green Algae)

*Vaucheria* sp.  
*Ulva lactuca*  
Filamentous green algae  
*Nitella hookeri*

Phylum: Rhodophyta (Red Algae)

*Gracilaria secundata*

Phylum: Bryophyta (Mosses, Liverworts)

*Marchantia berteroana*  
*Riccia fluitans*  
*Leptodictyum (Amblystegium) riparium*  
Water mosses (unidentified)

Phylum: Tracheophyta (Vascular Plants)

Class: Filicopsida (Ferns)

*Blechnum* sp.  
*Azolla filiculoides*

Class: Spermatopsida (Flowering Plants)

Monocotyledones

<i>Potamogeton crispus</i> **	curly pondweed
<i>Potamogeton ochreatus</i>	blunt pondweed
<i>Potamogeton cheesemanii</i>	red pondweed, manihi
<i>Glyceria maxima</i> **	reed sweet grass
<i>Glyceria fluitans</i> **	floating sweet grass
<i>Agrostis stolonifera</i> **	creeping bent
<i>Hordeum marinum</i>	salt barley grass
<i>Lemna minor</i>	duckweed, karearea
<i>Ruppia polycarpa</i>	horse's mane weed
<i>Bolboschoenus (Scirpus) caldwellii</i>	
<i>Juncus gregiflorus</i>	
<i>Juncus maritimus</i> var. <i>australiensis</i>	sea rush
<i>Leptocarpus similis</i>	jointed wire rush
<i>Spartina anglica</i>	

Dicotyledones

<i>Ranunculus repens</i> **	creeping buttercup
<i>Ranunculus sceleratus</i> **	celery buttercup
<i>Callitriche stagnalis</i> **	starwort
<i>Mentha</i> sp.	mint
<i>Mimulus guttatus</i> **	monkey musk
<i>Rorippa (Nasturtium) microphylla</i> **	water cress
<i>Myriophyllum</i> sp.	water milfoil
<i>Cotula coronopifolia</i>	bachelor's button
<i>Sarcocornia quinqueflora (Salicornia australis)</i>	glasswort
<i>Suaeda novae-zelandiae</i>	sea blite
<i>Apium prostratum</i>	native celery
<i>Atriplex prostrata (hastata)</i> **	orache
<i>Myosotis laxa</i> subsp. <i>caespitosa (caespitosa)</i> **	water forget-me-not
<i>Epilobium</i> spp.	willow herbs
<i>Plantago coronopus</i> **	buck's horn plantain
<i>Polygonum persicaria</i>	
<i>Mesembryanthemum australe</i>	ice-plant
<i>Rumex crispus</i> **	curled dock
<i>Plagianthus divaricatus</i>	saltmarsh ribbonwood

\*\* introduced species

**Appendix 5: Occurrence of freshwater invertebrate taxa, 1978-79 & 1989-91**

**(a) Recorded during both surveys**

*Phaenocora* sp.  
*Cura pinguis*  
Oligochaeta (various)  
*Potamopyrgus antipodarum*  
*Physa* sp.  
*Gyraulus corinna*  
*Sphaerium novaezelandiae*  
*Pisidium* sp.  
*Simocephalus* sp.  
*Herpetocypris pascheri*  
*Eucyclops serrulatus*  
*Paracalliope fluviatilis*  
*Paratya curvirostris*  
*Paranephrops zealandicus*  
*Eylais waikawae*  
*Piona uncata*  
*Xanthocnemis zealandica*  
*Sigara arguta*  
*Oxyethira albiceps*  
*Triplectides obsoleta*  
*Oecetis unicolor*  
*Polyplectropus puerilis*  
*Hudsonema amabilis*  
*Hydrobiosis parumbripennis*  
*Liodessus plicatus*  
*Antiporus strigosulus*  
*Rhantus pulverosus*  
Tipulidae (various)  
*Paralimnophila skusei*  
*Culex* sp.  
*Austrosimulium* sp.  
Chironomidae: Tanypodinae  
Chironomidae: Orthoclaadiinae  
*Chironomus zealandicus*  
Ceratopogonidae (unidentified)  
*Limnophora* sp



**(b) Recorded 1989-91 but not 1978-79**

*Hydra* sp.  
*Neppia montana*  
*Glossiphonia multistriata*  
*Physastra variabilis*  
*Zelandobius confusus*  
*Coloburiscus humeralis*  
*Austrolestes colensonis*  
*Microvelia macgregori*  
*Paroxyethira hendersoni*  
*Hydora* sp.  
*Zelandotipula* sp.\*  
*Limonia* sp\*.  
*Paradixa* sp.  
Empididae (unidentified)

\* probably recorded in 1978-79 as Tipulidae

**(c) Recorded 1978-79 but not 1989-91**

Nematoda (unidentified)  
*Hyridella menziesi*  
*Phreatogammarus fragilis*  
*Paranephrops zealandicus*  
*Hygraula nitens*  
*Deleatidium* sp.  
*Olinga feredayi*  
*Pycnocentroides aureola*  
*Aoteapsyche colonica*  
*Ephydrella novaezealandiae*

**Appendix 6: MCI scores allocated to freshwater invertebrate taxa**

<i>Hydra</i> sp.*	5
<i>Phaenocora</i> sp.	3
<i>Cura pinguis</i>	3
<i>Neppia montana</i>	3
Nematoda (unidentified)*	3
<i>Lumbriculus variegatus</i>	1
<i>Eiseniella tetraeda</i>	1
<i>Tubifex tubifex</i>	1
Oligochaeta (unidentified spp.)	1
<i>Glossiphonia multistriata</i>	3
<i>Potamopyrgus antipodarum</i>	4
<i>Physa</i> sp.	3
<i>Physastra variabilis</i>	5
<i>Gyraulus corinna</i>	3
<i>Sphaerium novaezelandiae</i>	3
<i>Pisidium</i> sp.	3
<i>Hyridella menziesi</i> *	3
<i>Simocephalus</i> sp.*	3
<i>Herpetocypris pascheri</i>	3
<i>Eucyclops serrulatus</i> *	3
<i>Paracalliope fluviatilis</i>	5
<i>Phreatogammarus fragilis</i>	5
<i>Paratya curvirostris</i>	5
<i>Paranephrops zealandicus</i>	5
<i>Eylais</i> sp.	5
<i>Piona uncata</i>	5
Acarina (unidentified spp.)	5
<i>Hygraula nitens</i>	4
<i>Zelandobius confusus</i>	5
<i>Deleatidium</i> sp.	8
<i>Coloburiscus humeralis</i>	9
<i>Anisops assimilis</i> *	5
<i>Sigara arguta</i>	5
<i>Microvelia macgregori</i>	5
<i>Oxyethira albiceps</i>	2
<i>Triplectides obsoleta</i>	5
<i>Oecetis unicolor</i> *	5
<i>Olinga feredayi</i>	9
<i>Pycnocentroides aureola</i>	5
<i>Paroxyethira hendersoni</i>	2
<i>Polyplectropus puerilis</i>	8
<i>Hudsonema amabilis</i>	6
<i>Hydrobiosis parumbripennis</i>	5
<i>Aoteapsyche colonica</i>	4

<i>Austrolestes colenisonis</i>	6
<i>Xanthocnemis zealandica</i>	6
<i>Liodessus plicatus</i>	5
<i>Antiporus strigosulus</i>	5
<i>Rhantus pulverosus</i>	5
<i>Hydora</i> sp.	6
Tipulidae (unidentified spp.) *	6
<i>Zelandotipula</i> sp.	6
<i>Limonia</i> sp	6
<i>Paralimnophila skusei</i>	6
<i>Culex</i> sp.	3
<i>Paradixa</i> sp	4
<i>Austrosimulium</i> sp.	3
Chironomidae: Tanypodinae	5
Chironomidae: Orthocladiinae	2
<i>Chironomus zealandicus</i> *	2
<i>Ephydrella novaezealandiae</i>	4
Ceratopogonidae (unidentified spp.)	3
<i>Limnophora</i> sp.	3
Empididae (unidentified)	3

\* Score allocated by CCC staff.

