Woronora River Macquarie Perch Survey

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SUMMARY

The Woronora River system was sampled at 20 sites during February 2001 to determine whether Macquarie perch exist within the catchment. Macquarie perch are fully protected in New South Wales and are listed as a vulnerable species under Schedule 5 of the Fisheries Management Act (1994). The confirmed existence of Macquarie perch within the catchment would have implications for the management of the Woronora River catchment by Sydney Catchment Authority and for the release of environmental flows downstream of the Woronora Dam.

This survey found no Macquarie perch upstream or downstream of Woronora Dam. When these results are combined with other fish surveys conducted in the Woronora catchment since 1994 and historical information there remains no evidence that Macquarie perch ever existed in the Woronora River system. However, Macquarie perch were recorded in the nearby Georges River in 1894.

There is some uncertainty associated with the conclusions because of the extent of sampling during previous and current surveys and appropriate management responses may be required by the Sydney Catchment Authority, in the future, should a viable population of Macquarie Perch be discovered.

1. INTRODUCTION

Macquarie perch (*Macquaria australasica*) are listed as a vulnerable species in New South Wales under Schedule 5 of the Fisheries Management Act (1994) and are fully protected. Their range and abundance have declined markedly in river drainages west of the Great Dividing Range (Harris and Rowland 1996; Paxton *et al.* 1989). The most likely causes for their decline include past overfishing and more recent habitat degradation, river regulation and interactions with alien species (Harris and Rowland 1996).

In coastal rivers east of the Great Dividing Range, the species has been recorded in the Hawkesbury-Nepean system (Gehrke and Harris 1996), the Georges River (Australian Museum Records) and the Shoalhaven catchment (Gehrke *et al*. 2001). The current distribution of Macquarie perch in the Hawkesbury-Nepean River system includes the upper Nepean River system, the Colo River, tributaries of the Warragamba River (
Figure **1**) (Australian Museum records, Harris and Rowland 1996, Gehrke *et al*. 1999, J. Harris pers. comm, W. Erskine pers. comm). There is some uncertainty as to whether eastern populations constitute a separate species from the populations in Victoria and the populations in the Murray-Darling Basin but current evidence suggests that they are different (Dufty 1986, Harris and Rowland 1996). However, the population in the Shoalhaven catchment may have originated from fish translocated from the Murray-Darling River system earlier in the century (Harris and Rowland 1996). Until the taxonomic status of the separate populations is resolved, both eastern and western populations are protected by New South Wales legislation.

Macquarie perch occur widely in river and lake habitats, usually in deep holes (Allen 1989, Harris and Rowland 1996) and are most abundant in large lakes fed by streams having rock or gravel substrata (Merrick and Schmida 1984).

The Sydney Catchment Authority (SCA) is planning to initiate an environmental flow regime consisting of controlled releases of water to the Woronora River from the Woronora Dam. In preparation for the environmental flows, the SCA has developed a performance-monitoring program to ensure effective monitoring and evaluation of the flows. Yearly sampling of the fish fauna below the dam will be done as a part of on-going monitoring of the environmental flows released from Woronora Dam. The presence of Macquarie perch within the Woronora River system would have management implications for environmental flows delivered from the Woronora Dam.

SCA contracted NSW Fisheries Office of Conservation to do a survey of fish in the Woronora River to find any evidence of Macquarie perch within the Woronora River system. This report outlines the findings of the survey, describes the habitats sampled and identifies the fish captured.

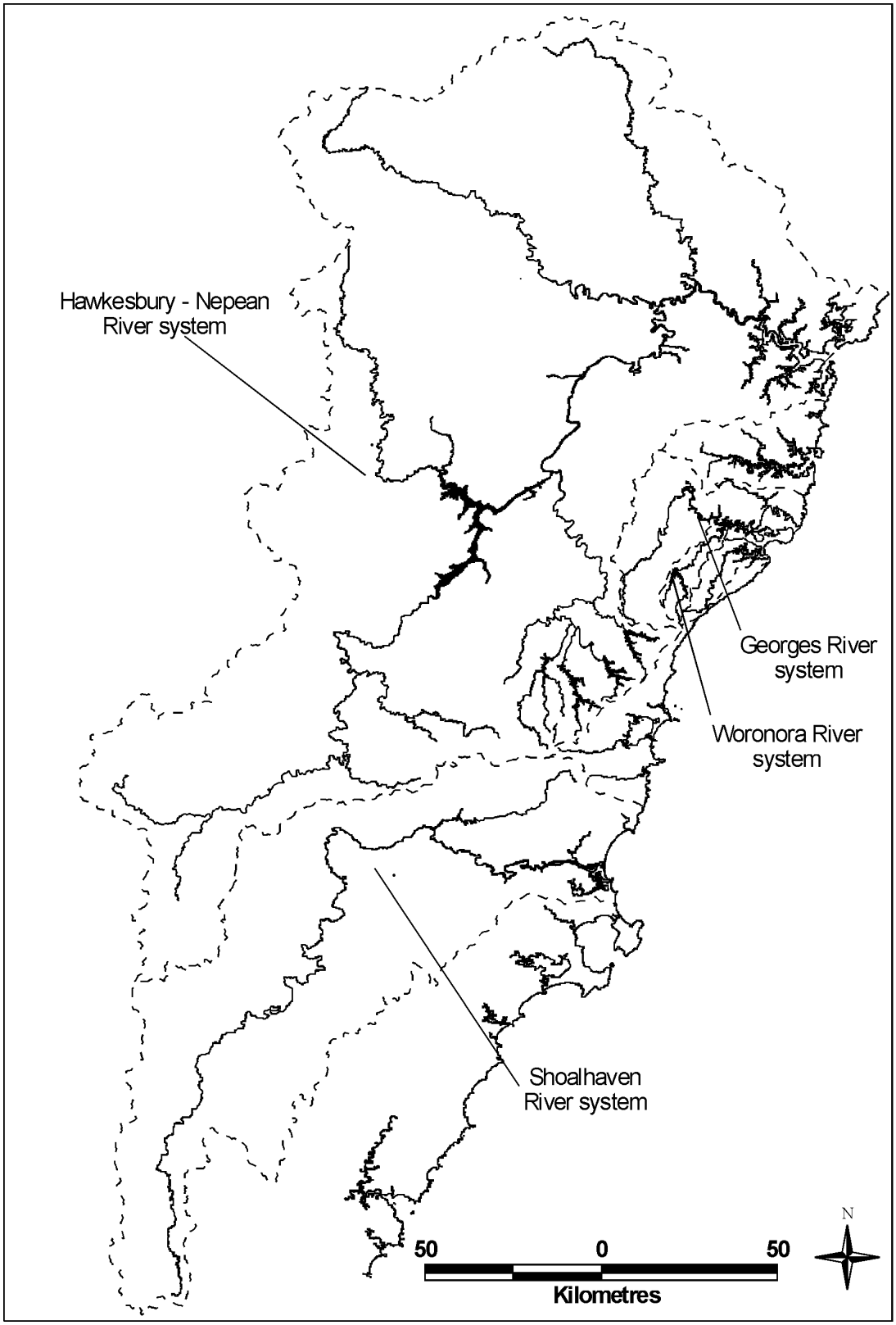

Figure 1. Map showing catchments surrounding Woronora River - including Shoalhaven, Hawkesbury-Nepean and Georges.

2. METHODS

Sites were chosen to cover all the possible Macquarie perch habitats within the catchment. Three sites along each of the three major inflowing streams to the dam; one site within the dam near each of these three inflows plus two other sites within the dam; and six sites downstream of the dam to Heathcote Road (**Figure 2**).

Repeated sampling of the Woronora River during the NSW Rivers Survey from 1994 to 1999 at a site further downstream towards the estuary, the Needles, had failed to locate any Macquarie perch (Harris and Gehrke 1997, NSW Fisheries unpublished data), so this section of the stream was excluded from this survey.

Methods were chosen to maximise the chances of capturing Macquarie perch at each sites (Table 1). These methods were:

- *Backpack electrofishing:* 15 x two-minute shots were performed at each site above the dam and at three of the six sites below the dam (where space allowed). Backpack electrofishing was not conducted at the deep pools below the dam. The edges of the pools below the dam are very steep and therefore electrofishing could only be conducted from the water's edge. This method would only sample the surface perimeter of the pools and was therefore unlikely to catch Macquarie perch.

- *Boat electrofishing:* 15 x two minute shots were conducted at each of the sites within the dam with the exception of site 14, where only one shot was completed due to equipment failure.

- *Gill nets and fyke nets:* Three multi-panel gill nets (3 x 5 m panels with randomly ordered mesh sizes of 38mm, 67mm and 100mm, and a drop of 2m) plus two fyke nets (1 m diameter entrance, 5 m central wing, one each of 30 mm and 8 mm mesh) were set overnight in pools at sites 17-19 where there was no access to launch an electrofishing boat.

During all electrofishing operations, captured fish were measured and returned to the water unharmed. Habitat characteristics were also recorded for each site. Sampling was conducted during February 2001, as required by the SCA and because late spring and summer is the best time to sample Macquarie perch (Harris and Gehrke 1997).

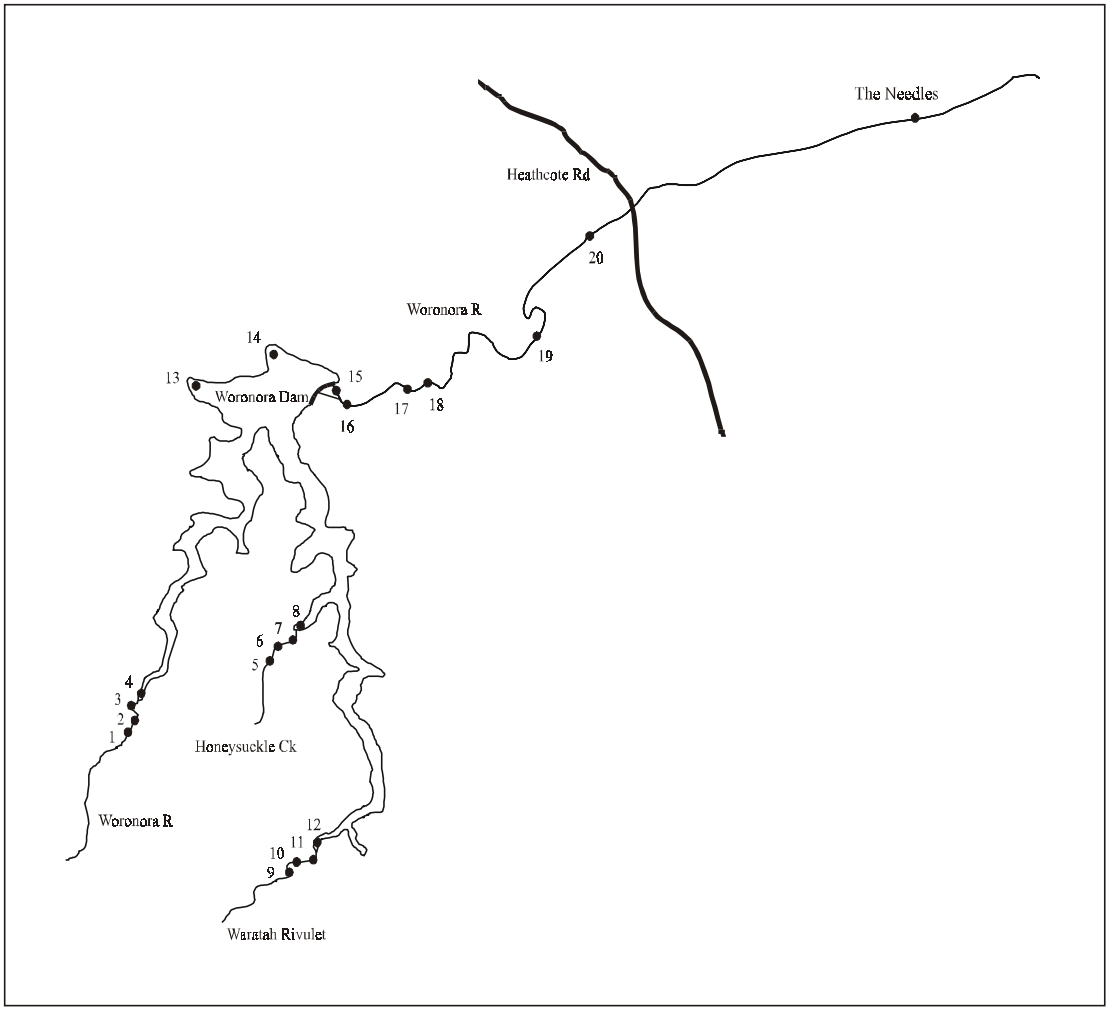

Figure 2. Location of sampling sites.

Table 1. Sampling sites and methods.

River reach	Site no.	Site	Sampling methods
Upstream of the Woronora Dam at the junctions of the storage and its inflowing streams	1 - 3	3 sites in Woronora River	Backpack e/fish
	4	Woronora River inflow to dam	Boat electrofish
	5 - 7	3 sites in Honeysuckle Creek	Backpack e/fish
	8	Honeysuckle Creek inflow to dam	Boat electrofish
	9 - 11	3 sites in Waratah Rivulet	Backpack e/fish
	12	Waratah Rivulet inflow to dam	Boat electrofish
	13 - 14	Woronora Dam bays	Boat electrofish
Woronora River immediately below the dam downstream to the Needles	15	Below dam wall	Backpack e/fish
	16	Downstream of spillway	Backpack e/fish
	17	Adina Pool	Gill nets & fyke nets
	18	Friar Bird Pool	Gill nets & fyke nets
	19	Lake Eckersley	Gill nets & fyke nets
	20	Upstream of Heathcote Rd	Backpack e/fish

3. RESULTS

3.1. Fish populations

No Macquarie perch were found at any of the 20 sites surveyed.

A total of 398 fish from seven species was recorded from the Woronora River, the Woronora storage and its tributaries (Table 2). Only two species (Australian smelt and long-finned eel) were found at the sites above the dam wall (sites 1-14), while all seven species were present below the dam.

No fish were recorded from the pool immediately below the dam (site 15), whilst the next pool downstream (site 16) was found to contain Australian smelt, long-finned eels, Cox's gudgeons and striped gudgeons. Cox's gudgeons were recorded in Adina Pool (site 17) and Australian bass were recorded in Friar Bird Pool (site 18).

Gambusia were the only alien fish species recorded in the Woronora River and were found at the two most downstream sites, Lake Eckersley (site 19) and upstream of Heathcote Road (site 20).

No fish were captured or observed at four sites above the dam (sites 1, 5, 8 & 9) and at one site below the dam (site 15).

3.2. Habitat

The riparian vegetation of all sites was mainly comprised of native trees and shrub species that appeared to be undisturbed (Appendix A). Floating macrophytes were rare or absent, submerged macrophytes were neither frequent nor abundant, and filamentous algae were only abundant downstream of the dam and in Adina Pool.

The substratum of the tributary sites was mainly comprised of bedrock (Appendix A). Boulders were frequent to abundant at sites 4 - 12. Cobbles, gravel and sand were generally rare or absent at all 12 sites. The main types of fish cover were rock and timber and the main habitat type was pool, with occasional runs.

The main types of fish cover at the dam and pool sites were rock and timber (Appendix A). The substrata of the dam and pool sites were similar to the tributary sites, being mainly comprised of boulders with infrequent cobbles and gravels. In contrast, the dam sites did not have any bedrock substrata and sand was more abundant in both dam and pool sites.

The substratum of the spillway site was different to all other sites by having an abundance of cobbles and frequent gravel. This substratum was mainly formed during the blasting to build the spillway.

Table 2. Number of fish caught and observed at each site.

Site no.	Site	Australian smelt (*Retropinna semoni)*	Long-finned eel (*Anguilla reinhardtii*)	Cox's gudgeon (*Gobiomorphus coxii*)	Striped gudgeon (*Gobiomorphus australis*)	Gambusia (*Gambusia holbrooki*)	Australian bass (*Macquaria novemaculeata*)	Flathead gudgeon (*Philypnodon grandiceps*)
1	Upper Woronora River							
2	Mid Woronora River	9	1					
3	Lower Woronora River	2	2					
4	Woronora River inflow to dam	4						
5	Upper Honeysuckle Creek							
6	Mid Honeysuckle Creek		2					
7	Lower Honeysuckle Creek		1					
8	Honeysuckle Creek inflow to dam							
9	Upper Waratah Rivulet							
10	Mid Waratah Rivulet		1					
11	Lower Waratah Rivulet	5						
12	Waratah Rivulet inflow to dam	46	15					
13	Woronora Dam bay 1	9	6					
14	Woronora Dam bay 2	2*						
15	Below dam wall							
16	D/S spillway	166	10	11	3			
17	Adina Pool			7				
18	Friar Bird Pool						1	
19	Lake Eckersley	12		3		2	6	
20	U/S Heathcote Rd	3	5	4		53	3	6
Total		**256**	**43**	**25**	**3**	**55**	**10**	**6**

*Only one electrofishing shot was completed because of equipment failure.

4. DISCUSSION

4.3. Macquarie perch

There have been no confirmed recent captures of Macquarie perch within either the Georges River or Woronora River catchments (Bishop 1997, Dames and Moore 1997, Gehrke and Harris 2000, this survey). In contrast, Bishop (1997) cites an anecdotal report from the one member of the Campbelltown City Sportsfishing Club, from a survey of 150 members, indicating that he had captured Macquarie perch in both the Georges and Woronora River systems as recently as 1995. However, members of Bass Sydney fishing club, who regularly fish the Woronora and Georges Rivers, have never reported captures of Macquarie perch from these rivers (Percy Short, Project Officer - Bass Sydney, pers. comm.).

It is unclear whether Macquarie perch naturally occurred in the Woronora catchment. Records from the Australian Museum list Macquarie perch from the adjacent Georges River catchment in 1894, but contain no entries for the species from the Woronora system. The records of the species from the Georges River system may be either misidentification or translocated fish that have since disappeared. Translocation of fish between river systems was once common in the Sydney region (NSW Fisheries 1916), and unauthorised translocation of fish between river systems is still known to occur.

The apparent absence of Macquarie perch from the Woronora and Georges rivers and their presence in the surrounding Shoalhaven River and Hawkesbury-Nepean River is unusual. The Woronora, Georges, Shoalhaven and upper Nepean rivers all have similar geology, consisting of narrow incised gorges cutting into Hawkesbury sandstone, soil types, vegetation and catchment areas. The geomorphology of the rivers is also similar, consisting of long, relatively shallow pools with predominantly bedrock substrata connected by short steep riffles. However, the substrata of the Woronora and Georges rivers appears to have less gravels and cobbles than the upper Nepean and Shoalhaven rivers (I. Growns, pers. obs., NSW Fisheries, unpublished data). Riffle areas with cobbles and gravels are the main spawning location of Macquarie perch (Harris and Rowland 1996) and the rarity of the cobbles and gravels substrata and riffle habitats in the Woronora system may have resulted in their absence.

The Woronora River system is small compared to the Hawkesbury-Nepean or Shoalhaven systems. The small size of the Woronora system, in comparison to other systems that maintain Macquarie perch populations, may limit the ability of the species to recolonise areas following natural, historical, localised environmental disturbance.

The lack of current evidence of the presence of Macquarie perch in the Woronora River system, despite an extensive survey of suitable habitats in the river and examination of historical records, suggests that the chances of a population of Macquarie perch existing within the Woronora River system are extremely remote. Any remnant or translocated populations would be very small, and may have questionable long-term viability. This study concludes that Macquarie perch most likely do not currently exist in the Woronora River system, and there are no confirmed records that the species ever existed in the system.

4.4. Other species

Woronora Dam and its inflowing streams are extremely depauperate in fish life, with few individuals of only two species (Australian smelt and long-finned eel) recorded in this survey. Bishop (1997) recorded three species in the Woronora River above the dam, Cox's gudgeon plus the same species as in the present study. Australian smelt maintain successful populations in impoundments and upstream tributaries throughout the species range, and are not eliminated by dams (NSW Fisheries, unpublished data). Long-finned eels and Cox's gudgeons are able to climb some dams that act as barriers to other species (Gehrke *et al*. 2001). The small number of species occurring above large impoundments is characteristic of dams in the nearby Hawkesbury-Nepean River system (Gehrke *et al.* 1999).

Species only recorded downstream of the dam during this survey were Cox's gudgeon, striped gudgeon, flathead gudgeon, Australian bass, and gambusia. Species requiring access to estuarine waters for part of their life-cycles, such as Australian bass, were not found at sites above the dam wall because the species' upstream migrations are blocked.

Flathead gudgeon do not require an estuarine phase to complete their life-cycle, and maintain populations upstream of other dams. The absence of this species from current sampling suggests that they did not occur upstream of the dam when it was built and they do not appear to have been subsequently released into the storage.

Gambusia are an introduced alien species that give birth to live young in freshwater, and maintain large populations in many storages. Failure to record gambusia upstream of Woronora Dam suggests that this species, which is usually highly abundant wherever it is found (Allen 1989), may not have been introduced into the Woronora catchment above the dam. The relative inaccessibility of the catchment may assist in keeping gambusia from establishing an upstream population.

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APPENDIX A

HABITAT CHARACTERISTICS AT EACH SITE

	Tributary sites					
Project Site No.	**1**	**2**	**3**	**4**	**5**	**6**
Substrate						
Bedrock	F	F	F	-	F	F
Boulder	R	R	R	A	O	O
Cobble	R	R	R	-	O	O
Gravel	R	R	R	R	-	-
Sand	O	O	R	R	R	R
Mud/Silt	-	R	O	A	R	R
Clay	-	-	-	-	-	-
Unknown	-	-	-	-	-	-
Plants						
Native trees	A	A	F	A	F	F
Exotic trees	-	-	-	-	R	R
Shrubs	F	O	O	A	O	O
Terrestrial grass	-	-	-	-	R	R
Rushes, sedges	R	R	R	R	O	R
Littoral grasses	-	R	-	-	-	R
Floating macrophytes	-	-	-	-	-	-
Submerged m'phytes	O	O	R	O	R	R
Filamentous algae	R	R	R	-	R	R
Cover						
Rock	F	F	F	F	F	F
Timber	O	O	O	O	O	O
Undercuts	R	R	R	-	R	O
Plant litter	R	R	R	-	R	R
Level change	steady	steady	steady	steady	steady	steady
Turbidity	clear	clear	clear	clear	clear	clear
Streams						
Flow	mod	mod	mod	-	low	low
Velocity	mod	mod	mod	-	mod	mod
Still Water						
Level	-	-	-	mod	-	-
Habitat						
Pool	F	F	O	A	O	F
Run	O	O	O	-	O	O
Riffle	R	R	R	-	O	O
Rapid	-	-	-	-	-	-
Av. Width (m)	5	4	5	-	2	2.5
Av. Depth (m)	1	0.8	1	1.5	0.6	0.5

A - abundant (>90%), F - frequent (50-90%), O - occasional (10-50%), R - rare (<10%), - absent

	Tributary sites					
Site No.	**7**	**8**	**9**	**10**	**11**	**12**
Substrate						
Bedrock	F	A	A	A	A	R
Boulder	F	A	A	O	O	A
Cobble	O	R	R	R	-	-
Gravel	-	R	R	R	R	-
Sand	R	O	F	R	R	R
Mud/Silt	R	-	-	-	-	F
Clay	-	-	-	-	-	-
Unknown	-	-	-	-	-	-
Plants						
Native trees	F	A	A	A	A	A
Exotic trees	R	-	-	-	-	-
Shrubs	F	A	A	A	A	A
Terrestrial grass	R	R	-	-	-	R
Rushes, sedges	O	R	-	-	R	O
Littoral grasses	-	R	-	-	-	R
Floating macrophytes	-	-	-	-	-	-
Submerged m'phytes	R	O	O	O	-	O
Filamentous algae	R	-		-	-	-
Cover						
Rock	F	F	F	O	F	F
Timber	O	F	O	R	R	O
Undercuts	R	O	O	O	R	-
Plant litter	R	-	-	-	-	-
Level change	steady	steady	steady	steady	steady	steady
Turbidity	clear	clear	clear	clear	clear	clear
Streams						
Flow	low	-	mod	mod	mod	-
Velocity	mod	-	slow	slow	slow	-
Still Water						
Level	-	mod	-	-	-	mod
Habitat						
Pool	O	A	A	A	A	A
Run	O	-	-	-	-	-
Riffle	O	-	-	-	R	-
Rapid	-	-	-	-	-	-
Av. Width (m)	2	-	20	20	20	-
Av. Depth (m)	0.5	1	0.5	0.5	0.3	1.5

A - abundant (>90%), F - frequent (50-90%), O - occasional (10-50%), R - rare (<10%), - absent

	Dam sites		Downstream dam	Spillway	Pool sites	
Site No.	**13**	**14**	**15**	**16**	**17**	**18**
Substrate						
Bedrock	-	-	-	F	A	R
Boulder	A	F	R	F	R	F
Cobble	R	-	R	A	R	R
Gravel	R	-	R	F	R	-
Sand	O	F	O	O	F	R
Mud/Silt	-	F	A	-	F	A
Clay	-	-	-	-	-	-
Unknown	-	-	-	-	-	-
Plants						
Native trees	A	A	O	A	A	A
Exotic trees	-	-	-	R	-	-
Shrubs	A	F	R	F	A	A
Terrestrial grass	-	-	-	-	R	R
Rushes, sedges	O	-	F	R	F	F
Littoral grasses	R	-	O	-	R	R
Floating macrophytes	-	-	-	-	-	R
Submerged m'phytes	R	O	R	-	O	O
Filamentous algae	-	-	A	-	A	-
Cover						
Rock	A	F	R	F	F	F
Timber	A	O	R	-	O	F
Undercuts	-	-	-	R	O	O
Plant litter	-	-	O	-	-	-
Level change	steady	steady	steady	steady	steady	steady
Turbidity	clear	clear	clear	low	low	mod
Streams						
Flow	-	-	low	mod	mod	mod
Velocity	-	-	slow	mod	slow	slow
Still Water						
Level	mod	mod	-	-	-	-
Habitat						
Pool	A	A	A	A	A	A
Run	-	-	-	R	-	-
Riffle	-	-	-	F	-	-
Rapid	-	-	-	-	-	-
Av. Width (m)	-	-	8	2	20	30
Av. Depth (m)	1.8	1.5	0.3	0.1	1	1

A - abundant (>90%), F - frequent (50-90%), O - occasional (10-50%), R - rare (<10%), - absent

	Pool	Heathcote Rd
Site No.	**19**	**20**
Substrate		
Bedrock	O	R
Boulder	R	A
Cobble	R	O
Gravel	R	R
Sand	A	R
Mud/Silt	F	-
Clay	O	-
Unknown	-	-
Plants		
Native trees	A	O
Exotic trees	-	-
Shrubs	A	O
Terrestrial grass	-	-
Rushes, sedges	F	-
Littoral grasses	R	-
Floating macrophytes	-	-
Submerged m'phytes	O	-
Filamentous algae	-	O
Cover		
Rock	F	A
Timber	O	-
Undercuts	R	-
Plant litter	R	-
Level change	steady	steady
Turbidity	low	clear
Streams		
Flow	low	low
Velocity	slow	slow
Still Water		
Level	-	-
Habitat		
Pool	A	F
Run	-	F
Riffle	-	R
Rapid	-	R
Av. Width (m)	30	4
Av. Depth (m)	2	0.3

A - abundant (>90%), F - frequent (50-90%), O - occasional (10-50%), R - rare (<10%), - absent

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