Big Brook Dam — Pemberton

Water Authority of Western Australia

Report and Recommendations of the Environmental Protection Authority

Department of Conservation and Environment,
Perth, Western Australia
Bulletin No 226 October 1985

BIG BROOK DAM - PEMBERTON

WATER AUTHORITY OF WESTERN AUSTRALIA

REPORT AND RECOMMENDATIONS
OF THE
ENVIRONMENTAL PROTECTION AUTHORITY

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1. INTRODUCTION

Potable water supplies to the Pemberton townsite are provided from the Pemberton Weir, located on Lefroy Brook. The demand is divided between the town and the Pemberton trout hatchery. While the Pemberton Weir has the capacity to provide all water requirements for both, summer river flows are such that supply restrictions are sometimes necessary. These are imposed on the trout hatchery, which then has to curtail its operations.

To provide an assured water supply to the trout hatchery, the Water Authority of WA, in conjunction with the Department of Fisheries, the operator of the hatchery, investigated a range of supply options. The outcome has been the proposal to construct a dam on Big Brook, a tributary of Lefroy Brook.

The Hon Minister for Water Resources referred the proposal to the EPA, which indicated that the project should be subject to public review, by means of a Public Environmental Report (PER). A period of 6 weeks was recommended for public release. The submission period closed on 2 September 1985.

2. DESCRIPTION OF PROPOSAL

2.1 Pemberton Water Supply

The existing Pemberton Weir has a usable storage of 66 000 cubic metres, although this can be increased up to 89 000 cubic metres by raising the spillway with sandbags. This storage is only required during the summer period, when Brook flows are low. During the remainder of the year, the Weir is overtopped.

The town of Pemberton and the trout hatchery are both served by the Weir, through different off-takes. For most of the year, the flow of the Lefroy Brook is such that their combined demands are met without any difficulty, by using 'run of the river' flows. Flows during summer decline significantly and result in the Weir's storage capacity being required. In normal summers, this has been sufficient for the requirements of both the town and the hatchery. During some summers, however, the storage has between such that the hatchery has had water restrictions applied. These have resulted in breeding stock being placed at risk, and has contributed in the past to the total loss of breeding stock.

The trout hatchery is the major consumer of water from the Weir. Its daily consumption is approximately 2 150 cubic metres, compared with a summer average of approximately 680 cubic metres per day for the Town Water Supply (PWD, 1984).

2.2 Alternatives Considered

Four alternative to the current proposal were considered:

- improved recirculation of hatchery water
- water releases from farm dams into Lefroy Brook
- expanding storage at Pemberton Weir
- constructing a new storage

The issues relating to each of these have been outlined in the PER. Briefly they are:

Improved recirculation - while this possible, the risk of mechanised breakdown and reduction in water quality limit this option's suitability.

Water releases - demands for irrigation water from Lefroy Brook are expected to increase up to threefold within the next ten years, further reducing flows into Pemberton Weir (PWD, 1984). Although controls could be applied to, or release arrangement made with land owners, this would not guarantee water supplies. (Dames and Moore, 1985).

Expanding Pemberton Weir - the topography of this site makes this an uneconomic option.

New Storage - two sites were investigated, at the gauging weir on Lefroy Brook above Pemberton Weir and on Big Brook. The former was discounted because it would affect private land. It would also provide a significantly smaller storage capacity, compared with Big Brook (PWD, 1984). Big Brook would not be affected by irrigation demands and would be located in State Forest.

2.3 The Project

An earth and concrete embankment is proposed to be constructed across Big Brook, a tributary of Lefroy Brook. The proposal is located approximately 4 kilometres north of Pemberton (Figure 1). The storage capacity of the dam would be approximately 680 000 cubic metres, and would inundate about 11 hectares of State Forest. The reservoir's area would be cleared of most vegetation.

As proposed, the dam would be approximately 100 metres long and be up to 7 metres high, requiring about 5 000 cubic metres of earth fill, and 400 cubic metres of concrete for the spillway section.

Earth materials would be obtained from within the reservoir area, while concrete and stone, for the

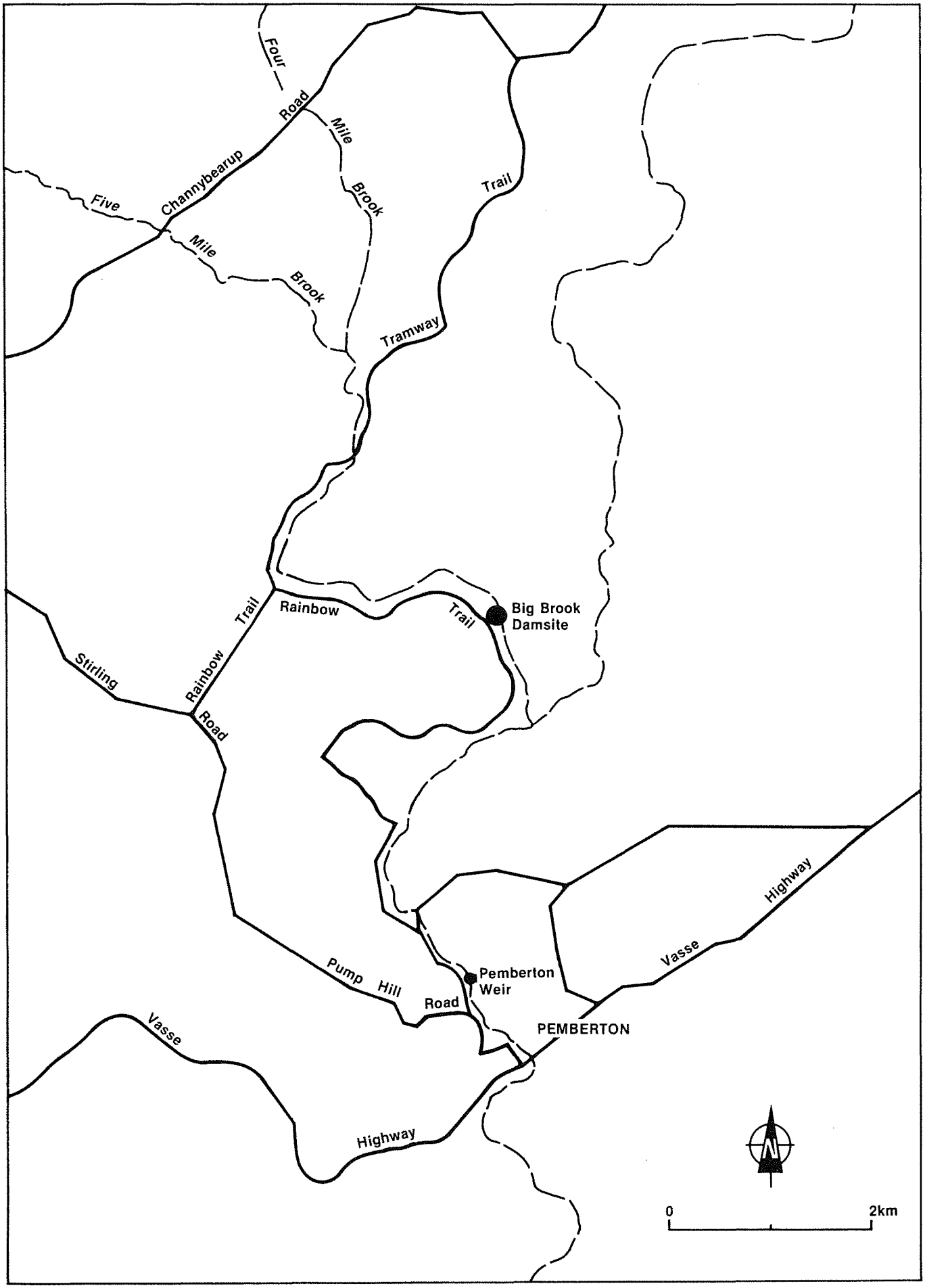

Figure 1 Site of proposed Big Brook Dam

up-stream face of the embankment, would be imported to the site from existing supplies.

Incorporated in the spillway section would be a stilling basin and fish trap.

3. REVIEW OF PUBLIC SUBMISSIONS

A total of five submissions were received on the Public Environmental Report; 2 from Government departments and 3 from other organisations. They were:

- Shire of Manjimup
- The Western Australian Trout and Freshwater Angling Association Inc
- Pemberton - Northcliffe Tourist Bureau Inc
- Department of Fisheries
- Department of Conservation and Land Management

Four of the submissions supported the Big Brook dam proposal while one indicated that the PER did not provide sufficient information to make an objective appraisal of the environmental implications of the project. In particular, water quality data and information on aquatic fauna was not presented in the PER, and as a consequence the identification of the impact of the dam on fish and invertebrates was not possible.

The proposed dam was seen as a new tourist attraction as well as a facility serving an important existing tourist attraction, the Pemberton trout hatchery. Two submissions also referred to the possibility of allowing appropriate recreation activities adjacent to and on the reservoir, such as trout and marron fishing and canoeing and rowing boats.

4. ENVIRONMENTAL IMPACTS

4.1 Construction

Construction of the dam would have four potential impacts:

- obtaining of construction materials
- clearing of vegetation
- other construction aspects
- tourist use of Rainbow Trail

As mentioned in Section 2.3, the Water Authority proposes to obtain materials for the earth embankment from within the reservoir area, and other construction

materials would be obtained from existing sites or using established facilities.

Approximately 11 hectares of State Forest would be located within the full supply level, 108 metres AHD. Almost all of the vegetation would be cleared. The PER indicates that this vegetation, which is predominantly "mixed and variable swampland and stream/valley vegetation, often with small stands of white cedar (Agonis juniperina)" (Dames & Moore, p.11). Few karri (Eucalyptus diversicolor) would be affected by clearing.

Figure 4 in the PER indicates that the vegetation association that would be affected continues upstream. (Dames & Moore, 1985). This habitat is not limited to this valley, and is found along many of the water courses flowing through the karri forest. The loss of 11 ha is not seen as being significant, but is clearly an environmental cost of the proposal.

It could be expected that some of the terrestrial fauna that currently uses this habitat would not move from the site and would be inundated. In those cases where the fauna does attempt to reestablish elsewhere, survival will depend on the extent of additional competition for niches in the ecosystem. Unless food and territorial space, among other things, are plentiful some mortality will result.

Some construction related activities and facilities will be located outside the reservoir area. These should be restricted in area and any disturbance of soil or vegetation should be minimised. The PER indicates that temporary structures, construction refuse and hardstand material would be removed at the end of construction of the dam (Dames & Moore, 1985).

Where clearing is required, it should be anticipated that rehabilitation would be required and topsoil should be retained for that purpose.

In order to reduce potential conflicts with tourists during the construction programme, it is likely that a portion of the Rainbow Trail would be closed to tourist traffic, and an alternative route provided. In addition, construction vehicles will gain access to the site by using the forest track on the north side of Big Brook. Selection of the temporary diversion of the Rainbow Trail should be undertaken in co-operation and with the agreement of the Department of Conservation and Land Management.

4.2 Reservoir Environment

Clearing of the existing riverine vegetation and the creation of a new, deep-water area will cause significant environmental change. In addition, the dam

embankment would represent a barrier to many migratory species of fish.

A new vegetation association would establish around the periphery of the reservoir. The riverine vegetation presently along the Brook would be unlikely to re-establish on the reservoir foreshore, due to the different water regime.

Within the reservoir, water would be deeper and much calmer. This would provide a new habitat which would

"probably result in an overall decrease in the diversity and abundance of animals, however it would favour colonisation by open water species of birds such as ducks and cormorants"(Dames and Moore, p. 18).

It could be expected that marron and large species of fish, such as trout, would continue to be found at the site.

The dam will prevent most species of fish and invertebrates from migrating down or up stream. One of the submissions pointed out that the PER did not provide information upon which the implications of this could be determined. As a result of this submission, the Water Authority has provided the EPA with a Supplement dealing with the impact of migratory aquatic fauna of the Big Brook dam. A copy of this Supplement is appended as an Appendix to this Report. The Table attached to the Supplement indicates that Big Brook has a diverse aquatic fauna.

The Water Authority has proposed the construction of a fish trap as part of the spillway structure, and has indicted in the PER that fish caught in the trap would be released into the dam by staff from the Pemberton trout hatchery, In addition, lamprey (Geotria australis) migration is not expected to be inhibited as they would be able to move around the embankment (Dames & Moore, 1985).

The effect of this structure on the migration of aquatic fauna should be monitored.

RECOMMENDATION

The EPA recommends that the Water Authority of WA, in conjunction with the Department of Fisheries and Department of Conservation and Land Management, establish a monitoring programme to determine the effect of the proposed dam on migratory species of aquatic fauna and the effectiveness of remedial measures proposed in the PER. The results of the monitoring programme should be provided on a regular basis to appropriate Government departments.

4.3 Downstream Environment

It is anticipated by the Water Authority that the proposed dam would only have a minor effect on downstream fauna and flora "due to the relatively small size of the dam and the fact that it will be overtopping for much of the year, thus not restricting flow" (Dames & Moore, p 18). However, it is expected that

"animals which have narrow habitat requirements are more likely to be removed from an altered ecosystem, whereas species with wide ranges of habitat and high levels of tolerance are likely to become more abundant" (Dames & Moore, p 18).

The dam would not be expected to significantly alter winter flows in Big Brook but summer flows may be significantly higher due to releases from the dam to maintain the water level in Pemberton Weir. As a consequence, fauna which requires a habitat with reduced water flows and the water quality that would result from such flows would be expected to be disadvantaged by the new water regime. Studies have shown that the diversity and abundance of invertebrate fauna declines following construction of a dam (State River and Water Supply Commission, 1978).

Lefroy Brook flows all of the year, although summer (January - March) flows are low. As a result, the effect of the new flow regime in Big Brook may be restricted to the portion of Big Brook below the proposed dam, a distance of about 3/4 kilometres.

Several other issues concerning the downstream ecosystem are the changes that have already resulted from the construction in 1947/48 of the Pemberton Weir and the more recent changes that might have resulted form the increased use of water form Lefroy Brook for irrigation. The construction of the Weir effectively blocked most migratory species of fish and invertebrates and, as would the proposed Big Brook dam, significantly altered the habitat at the dam site. The effect of reduced flows resulting from irrigation demands is more difficult to identify, due to the incremental reduction in flows and the releases of water that have occurred. This is an issue that is common to many water courses flowing through agricultural land in the South West and requires investigation to identify and quantify the impacts as well as suggesting remedial actions that could be adopted.

RECOMMENDATION

The EPA recommends that consideration be given by the Water Authority to the construction of a fish trap immediately below the existing Pemberton Weir.

Such a structure would enhance the effectiveness of the trap proposed on Big Brook and reduce the barrier effect of the Weir.

4.4 Recreation

Several submissions raised the possibility of recreation adjacent to and on the proposed reservoir. Activities such as fishing for marron and trout and the use of canoes and rowing boats were suggested, where appropriate.

The proposed dam offers the opportunity for appropriate recreational acitvities because it would not be used directly for potable water supplies. These would continue to be drawn from the Pemberton Weir. Rather, this reservoir would impound water until it is required for the Town Water Supply or the trout hatchery, when it would be gradually released. This dam would be over 3 kilometres above the Weir, and the water released from the dam would be subject to natural aeration and filtration over this distance. In addition, water drawn from the Pemberton Weir is subject to full treatment (Dames & Moore, 1985).

Recreation on reservoirs and catchments in Western Australia is currently under consideration by the Western Australian Water Resources Council. The Council has published a report on public access to reservoirs and catchments, and has prepared a set of guidelines which establish a framework to assist in the preparation of detailed management plans (WAWRC, 1985).

Allowing recreational access to the proposed Big Brook reservoir is currently being considered by the Water Authority. Some recreation may be permitted, but would be undertaken in accordance with a management plan.

The EPA supports the view, as expressed in Water Resources Council report, that

"carefully prepared individual management plans provide the key to the successful introduction of recreational activities on water supply reservoirs and their catchments" (WAWRC, p. 5).

The proposed dam will affect two existing recreational routes, the Bibbulmun Track and the Rainbow Trail. Each will require the relocation of a portion of its route. In the case of the Bibbulmun Track, a new bridge across Big Brook would be constructed. Some of the Rainbow Trail would be inundated by the reservoir and affected sections would be replaced.

RECOMMENDATION

The EPA recommends that a management plan be prepared by the Water Authority of WA, with the assistance of and local groups, which would ensure that recreation activities on and adjacent to the proposed dam are facilitated in appropriate ways and at appropriate places.

5. CONCLUSION

The EPA considers that the proposed construction of a dam on Big Brook should not represent a major impact on the local or regional environment and would provide tangible social and economic benefits to the Pemberton area, as well as ensuring adequate water supplies to the Pemberton trout hatchery and the town.

RECOMMENDATION

The EPA recommends that, subject to the implementation of the recommendations in this Assessment Report and the commitments of the Water Authority of WA, the construction of the proposed dam on Big Brook is acceptable on environmental grounds.

REFERENCES

Dames & Moore (1985). Public Environmental Report - Pemberton Trout Hatchery Water Supply, Big Brook Dam.

Public Works Department (1984). Pemberton/Manjimup Water Supply Options. Report No WRB 98.

State Rivers and Water Supply Commission (1978). Dartmouth Dam Project. Report On Environmental Studies. Melbourne.

Western Australia Water Resources Council (1985). Recreation On Reservoirs And Catchments In Western Australia.

APPENDIX

SUPPLEMENT TO

PUBLIC ENVIRONMENTAL REPORT
PEMBERTON TROUT HATCHERY
BIG BROOK WATER SUPPLY

Re: Impact on Migratory Aquatic Fauna of a Dam on Big Brook

In reviewing the potential impacts on migratory aquatic fauna of a dam on Big Brook, the following sources were consulted:

Department of Fisheries (Dr N. M. Morrissy)
Fisheries Research Group, Murdoch University (Mr R. Hilliard)
Pemberton Trout Hatchery Staff

The following publications were also reviewed:

Allen, G.R. (1982). A Field Guide to Inland Fishes in Western Australia. Western Australian Museum, Perth.

Christensen, P. (1982). The distribution of Lepidogalaxias salamandroides and other small fresh-water fishes in the lower south-west of Western Australia. J. Royal Soc. W.A. 65:131-141.

Dames & Moore (1985). Draft Environmental Overview: Proposed Alternative Water Supplies Manjimup W.A. For Public Works Department of Western Australia, January 1985. Unpublished report.

Morrissy, N., Fellows, C. and Caputi, N. (1984). The Amateur Fishery for Marron (Cherax tenuimanus) in Western Australia - Summary Logbook Data 1971-1983. Department of Fisheries and Wildlife: Perth37pp.

A list of aquatic fauna collected during catchment surveys of the Manjimup/Pemberton area, carried out by Dames & Moore staff (Dames & Moore, 1985) is attached. The survey identified 2 species of fish which were recorded in Big Brook. These were the western pygmy perch (Edelia vittata) and the rainbow trout (Salmo gairdneri). Other fish species not found in the survey but known in the region include the common minnow (Galaxias occidentalis), the striped minnow (Galaxiella munda) (Christensen, 1982), the nightfish (Bostockia porosa) and the lamprey (Geotria australis).

The construction of a dam on Big Brook will restrict the upstream migration of any mobile species. After discussions with Department of Fisheries and Murdoch University Fisheries Research personnel, these impacts were identified and appropriate mitigations proposed.

Potential impacts include:-

- o Interruption of upstream movement and migration of fish.
- o Interruption of intermittent upstream migration of lamprey.

Mitigations of these impacts will be as follows:-

- o The incorporation of a fish trap into the design of the dam, be operated by trout hatchery staff, will provide a means of aiding migratory species. The fish captured in the trap will be released upstream of the dam.

- o The dam will not prevent intermittent upstream migration of the lamprey as the maintenance of suitable surrounding vegetation will allow lampreys to manoeuvre around the dam on the banks. This mode of lamprey mobility has been observed at Pemberton Weir which has similar surrounding vegetation to that which will occur at the Big Brook dam (Hilliard, pers. comm.).

TABLE 7

AQUATIC FAUNA COLLECTED DURING CATCHMENT SURVEY

PHYLUM
Class
Order
Family
Genus species
Common Name

Abundance Scale
UC - Uncommon
C - Common
VC - Very Common

Habitat types
a - Narrow Channels
b - Riffles
c - Pools
d - Flats
e - Shallow Zone[1]
f - Deep Zone[1]
[1] applicable only to dams

	Lefroy Brook	Four Mile Brook	Scabby Gully Dam	Big Brook Five Mile Brook
VERTEBRATA				
Class: Osteichthyes				
Order: Teleostei				
Fam: Galaxiidae				
Galaxias occidentalis				
Western Minnow	UC - a			
Fam: Kuhliidae				
Edelia vittata				
Western Pygmy Perch	VC - a,c,d	UC - d	UC-e	UC-a,d
Fam: Salmonidae				
Salmonidae				
Salmo gairdneri	UC - a			C-a
Rainblow Trout				
S. trutta				
Brown Trout				C-a,c,d
Class: Amphibia				
Order: Anura				
Fam: Leptodactylidae				
Heleioporus sp.				UC - d
Crinia georgoama				UC - a
Geocrinia leai				C - a,c,d
ANNELIDA				
Class: Oligochaeta				
Fam: Enchytraeidae				UC - c
Class: Hirundinea				
leach sp. 1	UC - b			
leach sp. 2			UC-c	
MOLLUSCA				
Class: Gastropoda				
Order:				
Fam: Lymnaeidae				
Pseudosuccinea lessoni			UC-c	
Fam: Planorbidae				UC - d
Fam: Ancylidae				UC - a

PLATYHELMINTHES					
Class:	Turbellaria				UC - d
Class:	Temnocephalidea				
Fam:	Temnocephalidae				
	Temnocephala sp.		UC - c		UC - a
ARACHNIDA					
Order:	Araneida				
Fam:	Pisauridae				
	Dolomedes sp.				UC - d
Order:	Acarina -				
	Hydracarina				C - d,e
ARTHROPODA					
Class:	Crustacea				
Order:	Cladocera				
Fam:	Daphniidae				VC - e
S/Class:	Ostracoda				VC - d
S/Class:	Copepoda				
	Calanoida				VC - e
Order:	Amphipoda				
Fam:	Gammaridae				
	Perthia branchialis	VC - a,c,d	VC - d	C - e	VC - a,c,d
Order:	Decapoda				
Fam:	Parastacidae				
	Cherax tenuimanus				
	Marron	VC - a,c,d	UC - d	C- e	
	C. crassimanus	C - a,c,d	UC - d		C - a,d
	C. destructor				
	Yabbie				UC - d
Class:	Insecta				
Order:	Collembola				UC - a,c,d
Order:	Odonata				
Fam:	Aeshnidae				
	Acanthaeshna anacantha	UC - b			UC - a,b
	Aeshna brevistyla				C - d
Fam:	Corduliidae				
	Lathrocordulia metallica	UC - b			
	Percodulia alfinis				UC - e
Fam:	Gomphidae				
	Austrogomphus lateralis	UC - b			
Fam:	Coenagriidae				
	Xanthagrion erthroneurum			UC - e	UC - d,e
Fam:	Megapodagriidae				
	Argiolestes minimus				UC - a,b
Fam:	Libellulidae				
	?Nannophya sp.			UC - e	
Fam:	Synthemidae				
	Synthemis cyanitincta		C - d		C - a,b
Order:	Hemiptera				
Fam:	Veliidae	UC - b,c	C - c		UC - d
Fam:	Corixidae				
	Diaprepocris sp.			UC - e	
	Sigara sp.		C - c		
	Micronecta sp.				C - d,e
Fam:	Notonectidae				
	Notonecta handlirschi			UC - e	
	Paranisops sp.				UC - d
Order:	Megaloptera				

Fam:	Corydalidae				
	Archichauliodes cervulus	UC - b			UC - a,b
Order:	Coleoptera				
Fam:	Staphylinidae			UC - b	
Fam:	Dytiscidae		C - c	VC - e	C - d,e
Fam:	Hydrophilidae				UC - d
Fam:	Gyrinidae			VC - e	
Order:	Diptera				
Fam:	Chironomidae	C - c,d	C - c		C - c,d,e
Fam:	Culicidae				
	Aedes alboannulatus				UC - d
Fam:	Simuliidae				
	Austrosimulium furiosum	UC - d	UC - d		VC - d
	Cnephia (three species)				VC - a,b
Fam:	Empididae		C - d		VC - a,d
Fam:	Dolichopodidae		C - c		
Order:	Plecoptera				
Fam:	Gripopterygidae				
	Leptoperla australica		C - d		VC - a,d
	Newmanoperia exigua				VC - a,b
Order:	Ephemeroptera				
Fam:	Leptophlebiidae (Five species)		UC - d		C - a,b,d
Fam:	Caenidae				UC - a
Order:	Trichoptera				
Fam:	Leptoceridae				VC - a,c,d
	Hydrobiosidae				UC - a
	Economidae				VC - b