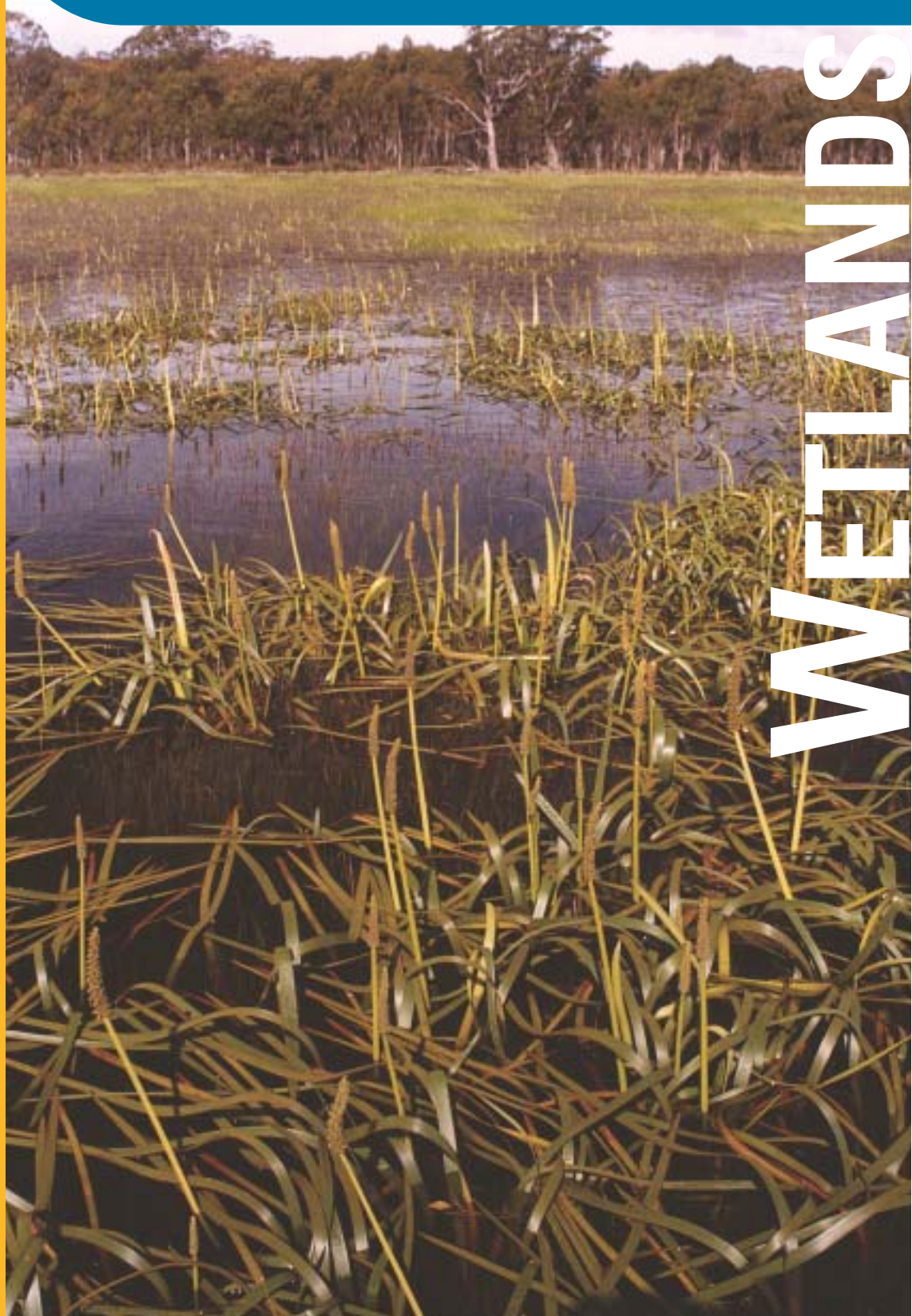
Inland Fisheries SERVICE

Hazelwoods Lagoon

Aquatic Vegetation Survey



Rehabilitation of Lakes Sorell and Crescent Report Series

Number 6/3

February 2003

AUSTRALIA

Natural Heritage Trust

Helping Communities Helping Australia

A Commonwealth Government Initiative

Hazelwoods Lagoon
Aquatic Vegetation Survey

Integrated and multi-disciplinary approach to the rehabilitation of Lakes Sorell and Crescent

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February 2003

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This report is part of a series of documents, which provide management recommendations for the environmental requirements of lakes Sorell and Crescent as part of the Lakes Sorell and Crescent Rehabilitation Project.

The aim of the rehabilitation project is to obtain an understanding of the systems, identify the needs of the users of the lakes and subsequently provide recommendations for the future management and protection of these important ecosystems.

Financial support contributed by the Natural Heritage Trust and the Tasmanian State Government via the Inland Fisheries Service is gratefully acknowledged.

Citation: Heffer, D. K. (2003). Hazelwoods Lagoon. Aquatic Vegetation Survey. Inland Fisheries Service, Hobart.

Executive Summary

A decline in the trout fishery, water quality and ecological values of lakes Sorell and Crescent has occurred over the past few years. In light of these problems, the Inland Fisheries Service (IFS) secured State and Commonwealth (Natural Heritage Trust) funding to implement on-ground works and formulate management options to address the recent environmental decline. The key problem associated with the lakes is low water levels due primarily to drought conditions and competition for water by various users. A multi-disciplinary approach was adopted to address the situation – the Lakes Sorell and Crescent Rehabilitation Project. This project was comprised of ten sub-projects which targeted key areas of physical and biological processes, important to the functioning and management of lakes Sorell and Crescent. The ten sub-projects were:

- Lake Crescent Outflow Screen Duplication
- Mountain Creek Rehabilitation
- Water Management Plan
- Catchment Management Plan
- Water Quality
- Wetlands
- Aquatic Fauna
- Recreational Fisheries
- Carp Management
- Ecological Modelling

The recent dry period experienced in the lakes Sorell and Crescent area has resulted in the wetlands associated with the lakes remaining relatively dry for the past 5-6 years. Concern was raised regarding the impact these dry years have had on the wetland vegetation. Hazelwoods Lagoon is located close to the wetlands associated with Lake Crescent and also has important conservation values. Given this lagoon's close proximity to the lakes Sorell and Crescent wetlands, knowledge of the species composition within Hazelwoods Lagoon is useful to gain an overall understanding of the wetlands in this region. All of the wetlands in the area are important in the conservation of the Sorell-Crescent ecosystems, due to their use as habitat, refuge and a food source for many plants and animals. The significance of the wetlands has justified the inclusion of the wetlands study within the overall project – the Lakes Sorell and Crescent Rehabilitation Project.

Three reports make up the findings and management recommendations for the sub-project - Wetlands:

1. Wetlands of Lakes Sorell and Crescent: Conservation and Management
2. Interlaken Lakeside Reserve. Ramsar Wetland Management Plan
3. Hazelwoods Lagoon. Aquatic Vegetation Survey

This document outlines results from an aquatic vegetation survey and recommendations for conservation of Hazelwoods Lagoon, a wetland located near the Sorell-Crescent wetlands.

The vegetation survey was undertaken to gather information about the types and extent of naturally occurring aquatic vegetation that currently exist within Hazelwoods Lagoon. The aim of this survey was to identify the aquatic vegetation present within the lagoon and provide recommendations for the future restoration and protection of the wetland. A comparison between the study undertaken by Kirkpatrick and Harwood (1981) has also been made.

Hazelwoods Lagoon is a shallow, freshwater lagoon located in the south-east corner of Tasmania's Central Plateau, near Lake Crescent. Although not directly connected to the lakes Sorell-Crescent system, this wetland supports similar flora species and diversity to the wetlands associated with lakes Sorell and Crescent.

Concern for the health of the lagoon prompted the Southern Tasmanian Licenced Anglers Association (STLAA) to undertake some on-ground works to rehabilitate the lagoon. As part of this project, the IFS was invited to conduct a vegetation survey.

This plan provides details of an aquatic vegetation survey conducted by the IFS on behalf of the STLAA Wetland Project Group. The IFS supports the ongoing work by this project group to rehabilitate and protect Hazelwoods Lagoon.

Hazelwoods Lagoon supports diverse populations of aquatic macrophytes with the dominant species occurring within herb and sedge dominated zones. The herb zone generally consisted of *Isolepis fluitans* (floating club-rush) associated with *Pratia surrepens* (pratia), *Triglochin procerum* (water ribbons) and *Villarsia reniformis* (running marsh-flower). The sedge zone was also dominated by *I. fluitans*, as well as *Baumea arthrophylla* (soft twig-rush).

The main threats identified for Hazelwoods Lagoon include an altered water regime and livestock grazing. To manage these given threats whilst retaining the high diversity of aquatic vegetation, the key management recommendations for Hazelwoods Lagoon are:

- Install a water level gauge in the wetland (surveyed into m AHD) and monitor water levels for at least 12 months to identify seasonal water regime cycles;
- Ensure that the wetland does not hold water on a permanent basis and is allowed to dry out completely. It is likely that the cycles of wetting and drying would correspond to rainfall patterns (eg. during drought or low rainfall years, the lagoon would dry completely);
- Remove or limit grazing within the wetland;
- Monitor the vegetation an annual basis to assess any changes in species presence and composition. This is particularly necessary if any changes are implemented in the future (ie. change in water regime and/or removal of grazing). This monitoring could also include waterbird surveys.

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Acknowledgments

The STLAA initiated the survey as part of their work to conserve and protect Hazelwoods lagoon.

Terry Byard (STLAA) provided background for the project and assisted in the field to undertake the vegetation survey.

Jamie Kirkpatrick (University of Tasmania (UTas)) supplied his vegetation survey data from his study of Tasmanian wetlands during 1979-81.

Abbreviations

AHD	Australian Height Datum
GIS	Geographic Information System
GPS	Global Positioning System
IFS	Inland Fisheries Service
PWS	Parks and Wildlife Service, Department of Tourism, Parks, Heritage and the Arts
STLAA	Southern Tasmanian Licenced Anglers Association
UTas	University of Tasmania

1. Introduction

1.1. Background

Hazelwoods Lagoon is a shallow, freshwater wetland, in the south-east corner of the Central Plateau, near Lake Crescent in Tasmania (Map 1).

The lagoon fills from runoff within its own catchment, which is mainly situated within private property known as 'Interlaken Estate'. In the past, during wet years, there was also a periodic inflow from the Clyde River, which meanders through adjacent grasslands. This input into the lagoon has since ceased as a result of channelisation of the Clyde River. The lagoon has also been adversely affected by a large channel, which was installed to drain the wetland. Based on aerial photographs, draining of the wetland and modification of the river seemed to occur sometime between 1974 and 1984. These two factors have led to a change in the water regime for Hazelwoods Lagoon, potentially causing long-term harm to aquatic vegetation. The recent drought experienced across south-east Tasmania over the past 5-6 years has also exacerbated the situation.

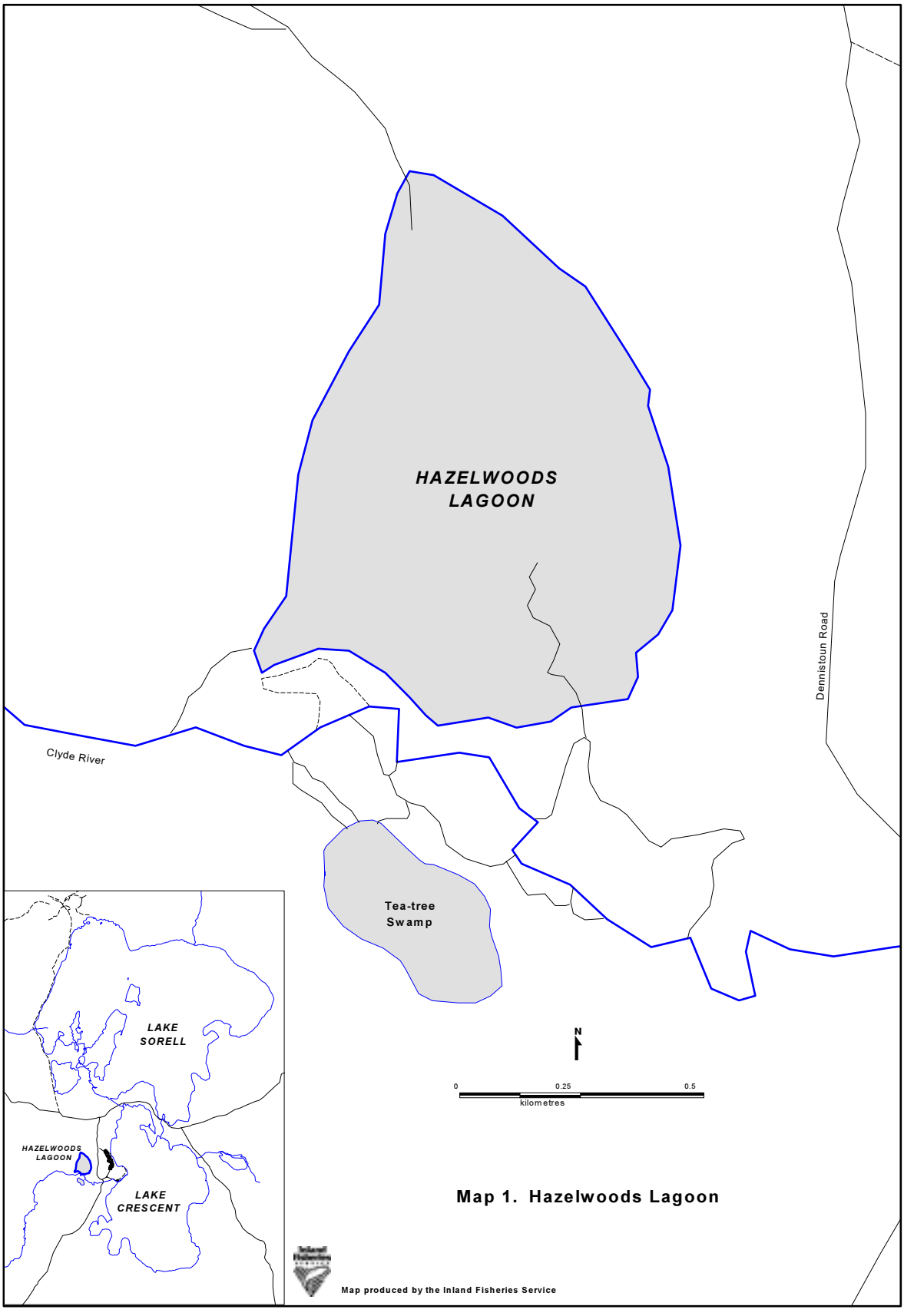
In June 2000, the STLAA announced details of a project to rehabilitate Hazelwoods Lagoon and re-introduce a number of species displaced from the area. In March 2001, the STLAA Wetland Project Group commenced on-ground works aimed to increase the frequency and extend the duration of inundation of the lagoon. This has allowed for a more natural wetting/drying water regime.

In addition to the alteration in the water regime, the occurrence of stock grazing is another threat to the lagoon. Grazing on wetlands by livestock can impact directly on aquatic vegetation and can also cause soil erosion, pugging of wetland soils and increased nutrient input (Robertson 1997; 1998). The lagoon is surrounded by private land, which is primarily used to graze sheep. Due to the absence of a boundary fence, the lagoon is also grazed.

Hazelwoods Lagoon is an important area which provides habitat and protection for animals, especially macroinvertbrates, waterbirds and frogs. Historically, populations of the threatened species', golden galaxias (*Galaxias auratus)* and the green and gold frog (*Litoria raniformis)* have been observed in this wetland although they have not been sited recently. In the past, it is thought that golden galaxias moved from Lake Crescent, down into Hazelwoods Lagoon via the Clyde River to feed and seek refuge.

The future objectives of the working group are to assess and monitor the water levels within the lagoon and investigate the option of re-introducing the threatened species into Hazelwoods Lagoon. Negotiations with the adjacent landholder are currently taking place in order to come to an agreement in regard to the frequency of stock grazing on the lagoon (Byard[1], pers. comm.).

1. Terry Byard, President, Southern Tasmanian Licenced Anglers Association, Tas.



Map 1. Hazelwoods Lagoon

1.2. Relevant research

Current knowledge of the distribution and composition of the macrophytes within Hazelwoods Lagoon is very limited which prompted this investigation. In 1981, Kirkpatrick and Harwood surveyed the lagoon as a part of their study of Tasmanian wetlands during 1978-80. The results of this survey are present in Appendix 1.

1.3. Objectives

This plan provids details of an aquatic vegetation survey conducted by the IFS on behalf of the STLAA Wetland Project Group. IFS supports the ongoing work by this project group to rehabilitate and protect Hazelwoods Lagoon.

This vegetation survey was undertaken to gather information about the types and extent of naturally occurring aquatic vegetation presently existing within Hazelwoods Lagoon. The aim of this survey was to identify the aquatic vegetation present within the lagoon and provide recommendations for the future restoration and protection of the wetland. A comparison between the study undertaken by Kirkpatrick and Harwood (1981) has also been made.

2. Methodology

2.1. Site Description

Hazelwoods Lagoon is a shallow, freshwater wetland, located in the south-east corner of the Central Plateau, near Lake Crescent in Tasmania (co-ordinates 42°10'00"S 147°07'45"E) (Map 1), approximately 30 km north of the township of Bothwell. The lagoon is situated at approximately 800 m AHD and is about 47 ha in area.

The land tenure of the lagoon is currently Crown Land and is managed by the Tasmanian Parks and Wildlife Service (PWS). Hazelwoods Lagoon is surrounded by private land. As a result, public access to the lagoon is limited. The adjacent land use is primarily sheep grazing.

The lagoon fills from catchment run-off from the north end of the wetland and drains into the Clyde River via a network of man-made drains in the south. It is likely that the depth of Hazelwoods Lagoon is less than half a metre (no historic values recorded) with the average depth at the time of study being 30 cm. The water level of the lagoon would normally fluctuate seasonally, responding to rainfall and would experience dry periods when rainfall is low. The average annual rainfall for the area is 699 mm with the highest rainfall experience during the winter and spring (Deakin unpublished). The closest weather station is at Interlaken, approximately 5 km away.

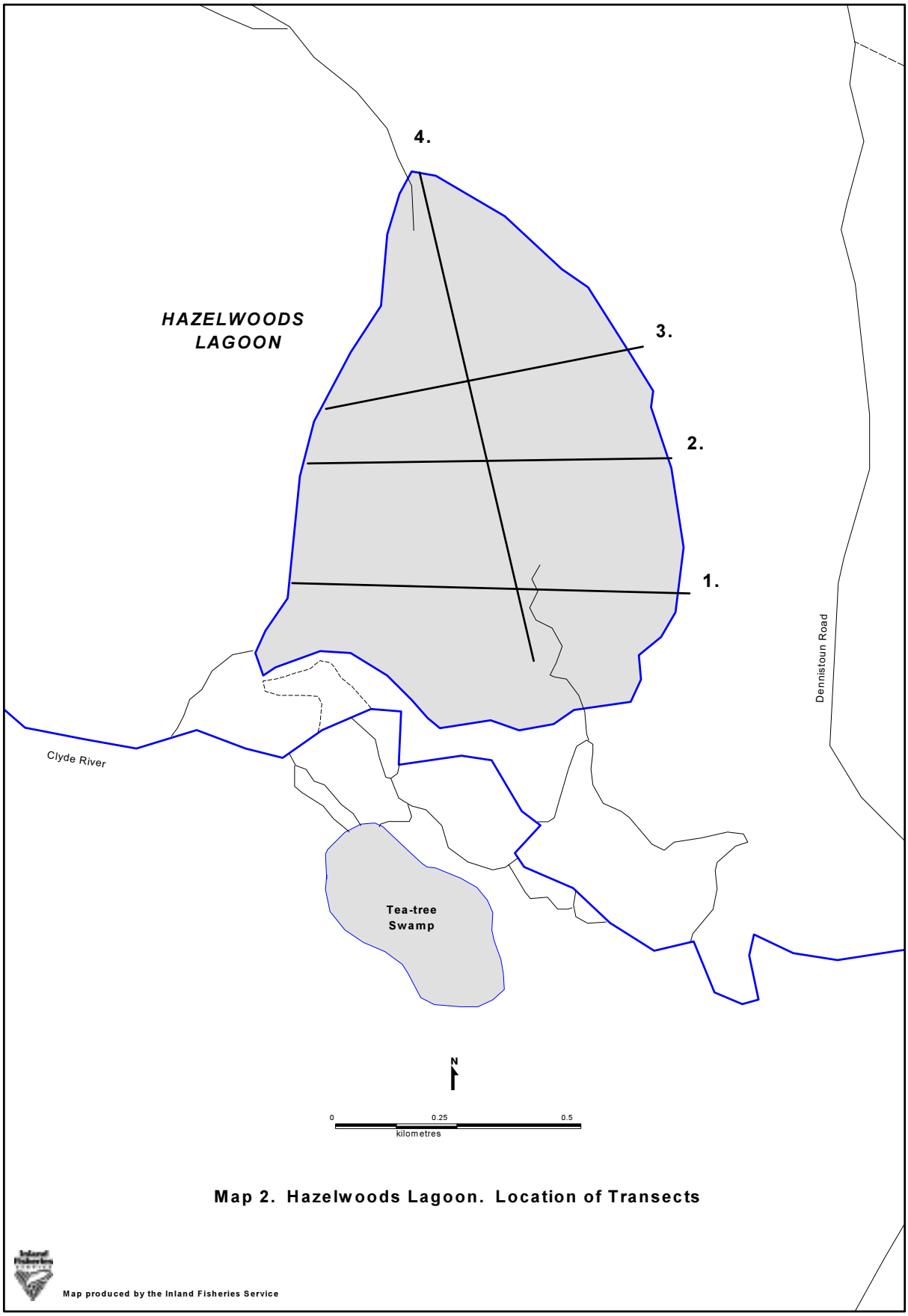
The geology of the area consists of Jurassic dolerite, Tertiary basalt and Triassic sandstone with alluvial deposits common on flats and swampy ground (TDOM 1986).

2.2. Experimental Design

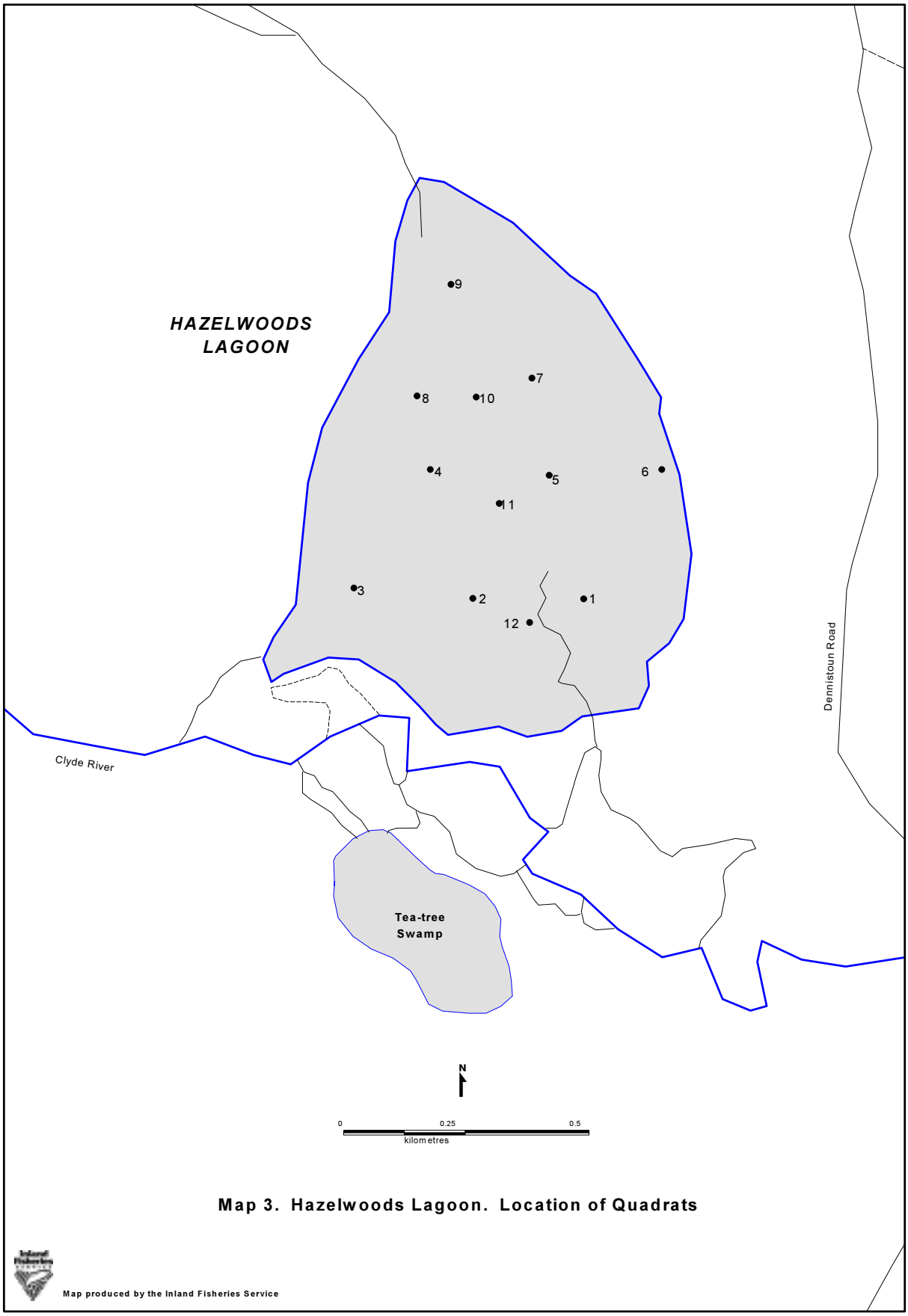
A field survey of the aquatic vegetation of Hazelwoods Lagoon was conducted during November 2001 to assess the types of species present and determine the community structure with the lagoon.

Four transects were established across the wetland (Map 2). 3 transects ran from east-west with 1 transect being located in a north-south orientation. Vegetation was assessed within 1 m x 1 m quadrats, at intervals of 200 m along each transect. Map 3 shows the exact locations of each quadrat. The co-ordinates for each of the quadrats are displayed in Appendix 2. Quadrat locations were recorded using a Global Positioning System (GPS) and mapped using MapInfo Professional Version 6 (Geographical Information System (GIS)). Within each quadrat, the identity and % cover of each macrophyte species was measured. The average height of each plant and the water level was also recorded.

A Braun-blanquet cover scale (Table 1) (Moore & Chapman 1986) was used to record the area within each of the quadrats occupied by a particular species. Vegetation was identified at the time of the survey and where species could not be identified in the field, samples were collected and pressed for later identification. The Student's Flora of Tasmania, Parts 1, 2, 3 and 4B (Curtis & Morris 1993; Curtis 1963; Curtis 1993; Curtis & Morris 1994) were used for identification. Species that were not observed within the quadrats but were present in the lagoon during the survey were also noted. Specimens were collected in accordance with a permit (No. TFL 00040) issued under the Tasmanian *Threatened Species Protection Act 1995*.



Map 2. Hazelwoods Lagoon. Location of Transects



Map 3. Hazelwoods Lagoon. Location of Quadrats

Table 1. Braun-blanquet cover scale (Moore & Chapman 1986).

Class	Braun-blanquet	
+	< 1%	Foliage sparsely or very sparsely present, cover less than 5%
1	1-5%	Plentiful, foliage cover 1-5 %
2	6-25%	5-25% foliage cover
3	26-50%	26-50% foliage cover
4	51-75%	51-75% foliage cover
5	76-100%	76-100% foliage cover

In addition to surveying the vegetation within the quadrats, the point at which a change of vegetation community occurred along each transect, was also recorded. This information was used to develop a map of the distribution of the dominant plant community types (refer to Section 3) within the lagoon.

Whilst undertaking the vegetation assessment, the presence of waterbirds and frogs within the lagoon was also noted. A list of the fauna observed during the vegetation assessment is presented in Appendix 3. The fauna within the lagoon was not directly surveyed hence a comprehensive list of the fauna has not been developed.

3. Results and Discussion

There were 32 different species of macrophytes and 1 charophyte species recorded within Hazelwoods Lagoon at the time of survey (Appendix 4 & 5). Of all these, 28 (87.5%) were native, 2 (6.25%) were introduced to Tasmania and 2 (6.25%) were unknown (not identified to species level). The low number of introduced species is positive considering the length of time the lagoon had been dry and that it has been grazed. It was noted, however, that there were many pasture grasses present along the high water ridgeline of the lagoon. The two introduced species recorded in this survey were also observed near the edge of the wetland.

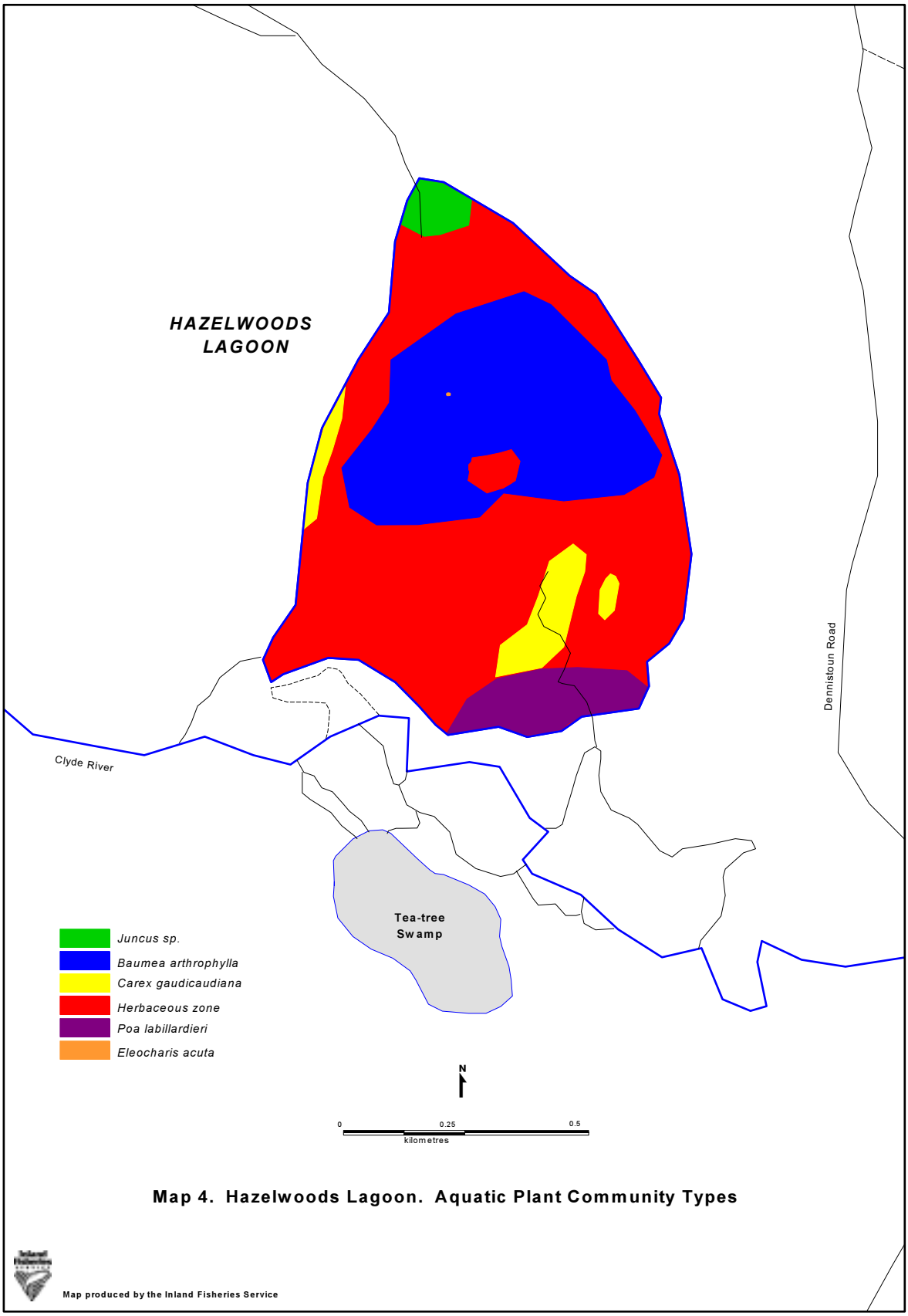
The high diversity of native species present within Hazelwoods Lagoon suggests that the seed bank and/or vegetative structure such as rhizomes, have remained relatively intact since the last inundation event. The fact that no bare ground was evident throughout the lagoon supports this and also indicates that the vegetation has recovered well upon rewetting of the wetland. Aquatic vegetation is usually quick to respond to hydrologic changes (inundation, frequency, duration, timing and water depth) (DNRE 1996).

Nine of the species were in flower at the time of the survey. This indicates that the duration of inundation within the lagoon was long enough to enable certain species to undergo their life cycles, potentially adding to the seed bank. Renewal of the seed bank relies on both seed bank and vegetation composition, which depends on recruitment from the seed bank, survival, dispersal and predation. Reproduction for some species also relies heavily upon vegetative structures, such as rhizomes and tubers (Leck *et. al.* 1989). Charophyte species such as *Chara* sp. and *Nitella* sp. produce spores as a means of reproduction.

There were 6 plant community types identified during the survey – *Juncus* sp. (a rush), *Baumea arthrophylla* (soft twig-rush*), Carex gaudichaudiana* (a sedge), a herbaceous zone, *Poa labillardieri* (a tussock grass) and a small patch of *Eleocharis acuta* (common spike-rush). Map 4 illustrates the areas that were occupied by the various plant community types. The *Juncus* sp., *C. gaudichaudiana* and *P. labillardieri* were generally found around the edge, in the drier areas of the lagoon.

The two most dominant plant community types present within Hazelwoods Lagoon were the sedge and herbaceous plant communities. *Isolepis fluitans* (floating club-rush) was the only species found to be common in both plant community zones. Table 2 summarises the species composition and abundance found within the quadrats. All of the vegetation survey data is presented in Appendix 5. Within the sedge zone, *Baumea arthrophylla* (soft twig-rush*)* was also dominant. *Chorizandra australis* (bristlerush) and *E. acuta* were also present but in much smaller quantities. These two species were not recorded in any of the quadrats.

The herbaceous zone was dominated by *I. fluitans* associated with *Pratia surrepens* (pratia), *Triglochin procerum* (water ribbons) and *Villarsia reniformis* (running marsh-flower).



Map 4. Hazelwoods Lagoon. Aquatic Plant Community Types

Table 2. Summary of the vegetation survey results.

Species	Braun-blanquet Cover	Av. Plant Height (mm)
Sedge		
Baumea arthrophylla	4	567
Isolepis fluitans	4	204
Potamogeton tricarinatus	2	220
Triglochin procerum	2	575
Villarsia reniformis	2	304
Amphibromus recurvatus	+	324
Pratia surrepens	+	20
Herb		
Isolepis fluitans	5	290
Pratia surrepens	3	40
Triglochin procerum	2	558
Villarsia reniformis	2	317
Agrostis avenacea	1	367
Nitella sp.	1	200
Myriophyllum simulans	1	223
Baumea arthrophylla	+	280
Carex gaudichaudiana	+	400
Potamogeton tricarinatus	+	270

Several types of aquatic vegetation were found at Hazelwoods Lagoon. The habitats found in Hazelwoods Lagoon and the types of species found within them are presented in Table 3. It was generally submerged as well as submerged and floating growth types, which were present within the herbaceous zone. Submerged species are those plants, which generally grow under the water and submerged and floating species have leaves that grow up through the water column and float on the surface (Brock 1997). These types include *V. reniformis*, *Myriophyllum simulans* (common milfoil), *I. fluitans*, *Potamogeton tricarinatus* (floating pondweed) and *Ranunculus amphitrichus* (small river buttercup). *T. procerum* (water ribbons), an emergent, was also common in the herb zone and can sometimes have leaves that are floating. All these species respond well to changes in water level and usually disappear when the wetland dries out.

The types of species found in the sedge zone were generally emergents and include *B. arthrophylla, C. australis* and *E. acuta* and *Amphibromus recurvatus* (dark swamp wallaby-grass). Emergent plants grow up as the water level increases and have their leaves and stems above the water surface. These species usually remain in the wetland even if it dries out but may die back. Some submergents and submerged and floating types were also found within the sedge zone. These included *I. fluitans, P. tricarinatus* and *V. reniformis*.

Table 3. Plant habitats types present in Hazelwoods Lagoon (* - introduced).

Habitat	**Growth Type**	***Scientific Name***	**Common name**
Terrestrial	Semi-aquatic/ terrestrial	*Acaena novae-zeldiae* *Agrostis avenacea* *Anthoxanthum odoratum** *Poa labillardieri*	buzzy common blown-grass sweet vernal grass
Edge/ Margins	Emergent low growing	*Hydrocotyle hirta* *Hydrocotyle muscosa* *Hypericum japonicum* *Lazula* sp. *Leptinella reptans* *Neopaxia australasica* *Pseudo-gnaphalium luteo-album* *Ranunculus sp.* *Rorippa dictyosperma* *Taraxacum officinale**	hairy pennywort mossy pennywort matted st. john's wort white purslane cudweed common dandelion
	Emergent	*Carex appressa* *Juncus* sp.	tall sedge
In shallow water	Submerged low growing	*Pratia surrepens*	pratia
	Submerged and Floating	*Potamogeton tricarinatus* *Ranunculus amphitrichus* *Villarsia reniformis*	floating pond-weed small river buttercup running marsh-flower
	Submergent	*Nitella* sp. *Isolepis fluitans*	stonewort floating club-rush
	Submergent and emergent	*Myriophyllum simulans*	common milfoil

Habitat	Growth Type	*Scientific Name*	Common name
In shallow water	Emergent	*Amphibromus recurvatus*	dark swamp wallaby-grass
		Baumea arthrophylla	soft twig-rush
		Brachyscome cardiocarpa	
		Carex gaudichaudiana	
		Chorizandra australis	bristlerush
		Eleocharis acuta	common spike-rush
		Juncus holoschoenus	
		Schoenus tesquorum	soft bog-rush
		Triglochin procerum	water ribbons

A comparison of the species present during the current survey and those observed in the study undertaken by Kirkpatrick and Harwood (1981) is presented in Table 4.

Table 4. Comparison of the species recorded during the current survey with those found in the Kirkpatrick and Harwood (1981) study (* - introduced species).

Scientific Name	Current Survey	Kirkpatrick and Harwood (1981)
Acaena novae-zeldiae	✓	
Agrostis avenacea	✓	✓
*Agrostis stolonifera**		✓
Amphibromus recurvatus	✓	✓
*Anthoxanthum odoratum**	✓	
Baumea arthrophylla	✓	✓
Brachyscome cardiocarpa	✓	✓
Cardamine gunnii		✓
Carex gaudichaudiana	✓	✓
Carex appressa	✓	
Nitella sp.	✓	
Chorizandra australis	✓	
Eleocharis acuta	✓	✓
Eleocharis sphacealata		✓
Hydrocotyle hirta	✓	✓
Hydrocotyle muscosa	✓	
Hydrocotyle sibthorpiodes		✓
Hypericum japonicum	✓	
Isolepis fluitans	✓	✓

Scientific Name	**Current Survey**	**Kirkpatrick and Harwood (1981)**
Juncus holoschoenus	✓	
Juncus sp.	✓	
Lazula sp.	✓	
Leptinella reptans	✓	
Myriophyllum simulans	✓	✓
Neopaxia australasica	✓	
Poa labillardieri	✓	
Potamogeton tricarinatus	✓	
Pratia surrepens	✓	✓
Pseudo-gnaphalium luteo-album	✓	
Ranunculus amphitrichus	✓	✓
Ranunculus sp.	✓	✓
Rorippa dictyosperma	✓	
Schoenus tesquorum	✓	
*Taraxacum officinale**	✓	
Triglochin procerum	✓	✓
Villarsia reniformis	✓	✓

Similar species were recorded within both studies, although 32 species were observed during the current survey compared with 18 recorded during the 1981 study. It is likely that many of the extra species found during the present survey were observed around the margins of the wetland, which may not have strictly been assessed in the 1981 study. Also it was not known what the extent of the water levels were at the time of the earlier study, which may have contributed to the absence of some species.

Only 4 species, *Agrostis stolonifera* (creeping bent), *Cardamine gunnii, Eleocharis sphacealata* (tall spike-rush) and *Hydrocotyle sibthorpiodes*, were observed during Kirkpatrick and Harwood's (1981) study that were not recorded in the present survey. All species were present in low abundances (see Appendix 1) and it could be possible that they were overlooked in the current survey, particular as *C. gunni* and *H. sibthorpiodes* usually prefer moist areas and are probably present on the edges (Curtis 1963; Curtis and Morris 1993).

Whilst undertaking the vegetation survey of Hazelwoods Lagoon, the fauna that was present in the wetland was also recorded which is shown in Table 5. A full list of the fauna observed, including scientific names is listed in Appendix 3.

Table 5. Number of fauna species observed during the current survey.

Fauna species	**Number**
Banjo Frog	(Not counted)
Common Froglet	(Not counted)
Black Swan	4 (incl. 2 on nests)
Masked Lapwing	2
White-faced Heron	2
Swamp Harrier	1

Unfortunately, there weren't any historic records of the fauna present within the lagoon so there was no data to compare to. It is positive, however, to note that the black swan (*Cygnus atratus*) was using the lagoon for breeding this season, considering the length of time that the wetland had been dry.

4. Management Recommendations

To retain the high diversity of aquatic vegetation within Hazelwoods Lagoon, it is recommended that:

- A water level gauge be installed in the wetland (surveyed into m AHD) and water levels monitored for at least 12 months to identify seasonal cycles;
- There is assurance that the wetland does not hold water on a permanent basis and is allowed to dry out completely. It is likely that the cycles of wetting and drying would correspond to rainfall patterns (eg. during drought or low rainfall years, the lagoon would be allowed to dry completely). A more comprehensive assessment of the water levels would need to be undertaken to accurately develop an appropriate water regime for the lagoon;
- Grazing be removed from the wetland. If this is not feasible due to high fencing and survey costs, then grazing should be restricted to March – August; the period of the year when the vegetation isn't going through it's reproductive phase;
- Monitoring of the vegetation should be undertaken on an annual basis to assess any changes in species presence and composition. This is particularly necessary if any changes are implemented in the future (ie. change in water regime and/or removal of grazing). This monitoring could also include the waterbirds.

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Appendices

Appendix 1. Results of survey conducted by Kirkpatrick and Harwood

Zones ranged from the outer edge (Zone 1) to the most central (Zone 3). (% cover abundance (Braun-blanquet scale): + - <1%, 1 – 1-5%, 2 – 6-25%, 3 – 26-50%,4 – 51-75%, 5 – 76-100%; ** - unknown species code). Data provided by Jamie Kirkpatrick (UTas).

Zone 1		**Zone 2**		**Zone 3**	
Carex gaudichaudiana	5	*Eleocharis acuta*	3	*Baumea arthrophylla*	2
Agrostis avenacea	1	*Isolepis fluitans*	2	*Isolepis fluitans*	2
Agrostis stolonifera	1	*Myriophyllum simulans*	2	*Triglochin procerum*	2
Eleocharis acuta	1	*Pratia surrepens*	2	*Villarsia reniformis*	2
Hydrocotyle sibthorpiodes	1	YYA YYA**	2	YYA YYA**	2
Leptinella reptans	1	*Agrostis avenacea*	1	*Eleocharis sphacealata*	1
Ranunculus sp.	1	*Agrostis stolonifera*	1	*Myriophyllum simulans*	1
		Amphibromus recurvatus.	1		
		Ranunculus amphitrichus	1		
		Triglochin procerum	1		
		Villarsia reniformis	1		
		Brachyscome spp.	+		
		Cardamine gunnii	+		

The area, great diameter, least diameter, maximum permanent depth, maximum depth, the persistence of water (more than 2 months exposure of substrate, 2 months to 2 weeks exposure of substrate, only 2 weeks or less exposure of substrate), conductivity, the presence of free salt, pH, surface geology. Soil characteristics, the presence of inflow or outflow channels, the presence of drainage activities, filling or damming, evidence of grazing, shooting, fishing, boating or off-road activity, land tenure, surrounding vegetation and land use, location and geomorphological type were recorded. Depth and persistence data relied on ecological observation and information from local inhabitants, so varies in quality.

Zone	**Wetland No.**	**Geomorphphological Type**	**Area (ha)**	**Great Diameter**	**Least Diameter**
1	1	3	1	500	2
2	1	3	1	500	2
3	0	1	2	500	2

Water Persistence	**Max Depth (m)**	**Max Permanent Depth (m)**	**Conductivity**	**Free Salt**	**pHx10**	**Geology**
*MISSING	*MISSING	8	9	5	9	2
*MISSING	*MISSING	8	9	5	9	2
*MISSING	*MISSING	8	9	5	9	2

Top Texture	**Soil**	**Colour**	**Soil Aeration**	**Soil Deep Texture**	**Inflow Channel**	**Outflow Channel**
1		2	2	2	1	1
1		2	2	2	1	1
1		1	2	2	1	1

Drained	Dammed	Filled	Grazed	Shooting	Fishing	Boating	Offroad Access	Noxious input
1	1	2	3	2	*MISSING	*MISSING	*MISSING	*MISSING
1	1	2	3	2	*MISSING	*MISSING	*MISSING	*MISSING
2	2	2	3	2	*MISSING	*MISSING	*MISSING	*MISSING

Map No.	Map Sheet No.	Easting	Northing
20	*MISSING	*MISSING	110
20	*MISSING	*MISSING	*MISSING
20	*MISSING	*MISSING	*MISSING

Appendix 2. Location co-ordinates for each survey quadrat

Quadrat No.	Easting	Northing
1	0510837	5331731
2	0510644	5331732
3	0510438	5331750
4	0510570	5331956
5	0510776	5331946
6	0510973	5331956
7	0510747	5332115
8	0510547	5332084
9	0510605	5332278
10	0510650	5332082
11	0510689	5331897
12	0510743	5331690

Appendix 3. Fauna Species observed during the Wetland Survey

Common Name	***Scientific Name***
BIRDS	
	ORDER ANSERIFORMES
black swan	*Cygnus atratus*
chestnut teal	*Anas castanea*
	ORDER CICONIIFORMES
white-faced heron	*Egretta novaehollandiae*
	ORDER CHARADRIIFORMES
masked lapwing	*Vanellus miles*
	ORDER FALCONIFORMES
swamp harrier	*Circus approximans*
AMPHIBIANS	
common froglet	*Crinia signifera*
eastern bango frog	*Limnodynastes dumerilii*

Appendix 4. Plant species observed at Hazelwoods Lagoon

* introduced to Tasmania

f in flower at the time of survey

	FAMILY	*Scientific name*	Common name
	Macro algae		
	CHARACEAE	*Nitella* sp.	
	Dicotyledonae		
	APIACEAE	*Hydrocotyle hirta*	hairy pennywort
	APIACEAE	*Hydrocotyle muscosa*	mossy pennywort
f	ASTERACEAE	*Brachyscome cardiocarpa*	
f	ASTERACEAE	*Leptinella reptans*	
	ASTERACEAE	*Pseudo-gnaphalium luteo-album*	
	ASTERACEAE	*Taraxacum officinale**	common dandelion
f	BRASSICACEAE	*Rorippa dictyosperma*	
	CAMPANULACEAE	*Pratia surrepens*	
	CLUSIACEAE	*Hypericum japonicum*	matted st. john's wort
	HALORAGACEAE	*Myriophyllum simulans*	common milfoil
	MENYANTHACEAE	*Villarsia reniformis*	running marsh-flower
	PORTULACEAE	*Neopaxia australasica*	white purslane
f	RANUNCULACEAE	*Ranunculus amphitrichus*	small river buttercup
f	RANUNCULACEAE	*Ranunculus sp.*	
f	ROSACEAE	*Acaena novae-zeldiae*	Buzzy

	FAMILY	*Scientific name*	Common name
	Monocotyledonae		
	CYPERACEAE	*Baumea arthrophylla*	soft twig-rush
	CYPERACEAE	*Carex gaudichaudiana*	
	CYPERACEAE	*Carex appressa*	tall sedge
f	CYPERACEAE	*Chorizandra australis*	
f	CYPERACEAE	*Eleocharis acuta*	common spike-rush
	CYPERACEAE	*Isolepis fluitans*	floating club-rush
	CYPERACEAE	*Schoenus tesquorum*	
	JUNCACEAE	*Juncus holoschoenus*	
	JUNCACEAE	*Juncus sp.*	
	JUNCACEAE	*Lazula sp.*	
f	JUNCAGINACEAE	*Triglochin procerum*	water ribbons
	POACEAE	*Agrostis avenacea*	common blown-grass
	POACEAE	*Amphibromus recurvatus*	dark swamp wallaby grass
	POACEAE	*Anthoxanthum odoratum**	sweet vernal grass
	POACEAE	*Poa labillardieri*	
	POTAMOGETONACEAE	*Potamogeton tricarinatus*	floating pond-weed

Appendix 5. Results of the current survey

(% cover abundance (BBcover): + - <1%, 1 – 1-5%, 2 – 6-25%, 3 – 26-50%,4 – 51-75%, 5 – 76-100%)

SPECIES	BBcover	Av. Plant Height (mm)	SPECIES	BBcover	Av. Plant Height (mm)
Quadrat 1			**Quadrat 2**		
Water Level = 270 mm			Water Level = 230 mm		
Triglochin procerum	3	500	*Triglochin procerum*	3	550
Isolepis fluitans	5	300	*Villarsia reniformis*	1	350
Villarsia reniformis	2	270	*Pratia surrepens*	5	50
Myriophyllum simulans	1	260	*Myriophyllum simulans*	2	240
Agrostis avenacea	2	400	*Agrostis avenacea*	1	250
Pratia surrepens	2	50	*Isolepis fluitans*	5	200
Potamogeton tricarinatus	+	250	*Baumea arthrophylla*	+	280
Carex gaudichaudiana	+	400			
Quadrat 3			**Quadrat 4**		
Water Level = 310 mm			Water Level = 300 mm		
Triglochin procerum	4	600	*Baumea arthrophylla*	5	550
Villarsia reniformis	3	330	*Villarsia reniformis*	1	300
Isolepis fluitans	5	340	*Triglochin procerum*	1	500
Potamogeton tricarinatus	+	300	*Amphibromus recurvatus*	+	320
Agrostis avenacea	1	400			
Myriophyllum simulans	+	320			
Quadrat 5			**Quadrat 6**		
Water Level = 300 mm			Water Level = 300 mm		
Baumea arthrophylla	4	600	*Triglochin procerum*	1	600
Triglochin procerum	1	550	*Villarsia reniformis*	3	350
Villarsia reniformis	3	300	*Isolepis fluitans*	5	320
Potamogeton tricarinatus	2	300	*Agrostis avenacea*	+	400
Isolepis fluitans	3	200	*Potamogeton tricarinatus*	+	280
Amphibromus recurvatus	+	400			

SPECIES	BBcover	Av. Plant Height (mm)	SPECIES	BBcover	Av. Plant Height (mm)
Quadrat 7			**Quadrat 8**		
Water Level = 300 mm			Water Level = 300 mm		
Triglochin procerum	2	600	*Baumea arthrophylla*	5	550
Baumea arthrophylla	4	600	*Triglochin procerum*	1	500
Villarsia reniformis	3	300	*Isolepis fluitans*	4	180
Isolepis fluitans	5	180	*Pratia surrepens*	+	20
Amphibromus recurvatus	1	140	*Amphibromus recurvatus*	+	350
Agrostis avenacea	+	250			
Quadrat 9			**Quadrat 10**		
Water Level = 300 mm			Water Level = 330 mm		
Potamogeton tricarinatus	1	250	*Baumea arthrophylla*	3	600
Villarsia reniformis	2	320	*Triglochin procerum*	2	700
Triglochin procerum	1	700	*Villarsia reniformis*	1	320
Agrostis avenacea	3	400	*Isolepis fluitans*	5	180
Isolepis fluitans	5	300			
Myriophyllum simulans	1	25			
Quadrat 11			**Quadrat 12**		
Water Level = 290 mm			Water Level = 270 mm		
Baumea arthrophylla	3	500	*Villarsia reniformis*	3	280
Triglochin procerum	2	600	*Schoenus fluitans*	5	280
Villarsia reniformis	3	300	*Triglochin procerum*	2	400
Isolepis fluitans	5	280	*Pratia surrepens*	3	20
Amphibromus recurvatus	1	300	*Myriophyllum simulans*	1	270
			Agrostis avenacea	1	350
			Nitella sp.	1	200