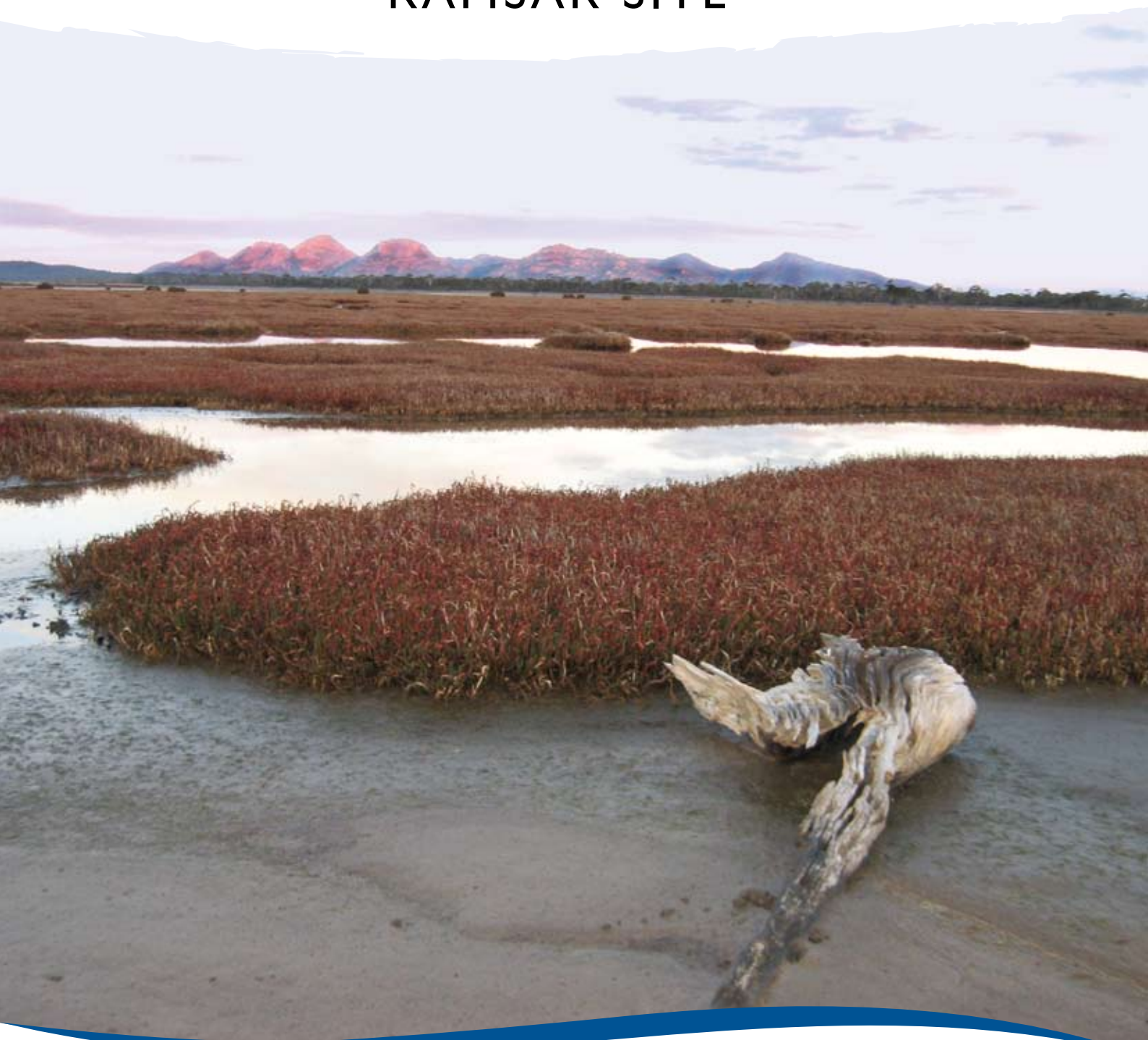


MANAGEMENT PLAN 2003



Moulting Lagoon Game Reserve

RAMSAR SITE



**Moulting Lagoon
Game Reserve
(Ramsar Site)
Management Plan**

2003



Moulting Lagoon Game Reserve (Ramsar Site) Management Plan 2003

This management plan for the Moulting Lagoon Game Reserve has been prepared in accordance with the requirements of Part IV of the *National Parks and Reserves Management Act 2002*.

Unless otherwise specified, this plan adopts the interpretation of terms given in Section 3 of the *National Parks and Reserves Management Act 2002*. The term 'Minister' when used in the plan means the Minister administering the Act. The term 'reserve' refers to the Moulting Lagoon Game Reserve. The term 'PWS' refers to the Parks and Wildlife Service.

In accordance with Section 30(1)(a) of the *National Parks and Reserves Management Act 2002*, the managing authority for the game reserve will give effect to the provisions of this Management Plan.

The appendices do not form part of the statutory plan, but are provided as additional information to assist in management.

ACKNOWLEDGEMENTS

Many people have assisted in the preparation of this plan by providing information and comments on earlier drafts. Their time and effort are gratefully acknowledged. Specifically thanks are extended for the efforts of the Moulting Lagoon Advisory Committee in providing a role in management, as a forum for stakeholders and resolving disputes.

APPROVAL

This management plan was approved by His Excellency, the Governor-in-Council on 15 September 2003 and took effect on 31 December 2003, being seven days after publication of that approval in the *Government Gazette*.

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A note about this publication

There has been a delay in editing and publishing this management plan, during which time State and Federal Government agencies have been restructured and renamed. The plan retains the names and arrangements at the time of plan approval. Use of lead shot in the reserve ended in 2005.

Cover image: Moulting Lagoon by David Geoghegan

Summary

Moulting Lagoon Game Reserve is one of 10 Ramsar sites (wetlands of international importance) listed in Tasmania. Moulting Lagoon is on this list because it supports a large number of waterbirds, particularly black swans and Australian shelducks, at key stages of their lifecycles. It provides year-round habitat for about 8000 black swans and is a critical late-summer staging area for shelducks, chestnut teal, and several shorebird species. The largest Tasmanian flock of greenshank also occurs at the lagoon.

Thirteen plant species found in the Moulting Lagoon area are of particular importance for conservation because of their threatened status. Moulting Lagoon/Great Oyster Bay is a site of geoconservation significance, and the spit at Nine Mile Beach is one of only two mid-bay spits in Tasmania.

Estuaries and coastal wetlands have long been recognised as essential nursery areas for myriad marine species. The area provides a range of recreational and economic opportunities, and has commercial value for the local tourism and aquaculture industries. The lagoon is also highly valued for hunting and fishing. The reserve's continued conservation contributes to the economic and social wellbeing of the local community.

Moulting Lagoon Game Reserve will be managed to protect its outstanding natural and cultural values, and provide for a range of recreational opportunities.

To these ends, the management plan provides for:

- continued duck hunting
- continued closure of " the Sanctuary"
- priority weed removal at Sabinas Island
- interpretive displays with information on the values, Ramsar listing, appropriate recreational activities and any restrictions which apply
- better vehicle access to shacks on the foreshore
- seeking funds for a bird hide/nature walk at Pelican Rocks
- investigation of sediment loading and eutrophication
- participation of stakeholders and community in management of the reserve
- promoting the reserve for ecotourism, interpretation and education
- a survey of wildlife thought to cause a problem to adjacent landowners
- close cooperation with adjacent landowners.



Photo: common greenshank. © Birds Tasmania

Moulting Lagoon supports the largest Tasmanian flock of common greenshank (*Tringa nebularia*).

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PART 1: INTRODUCTION

This plan covers all that land known as Moulting Lagoon Game Reserve. The Ramsar site incorporates all of the Moulting Lagoon Game Reserve, except for a small tract of the reserve 1 km north of the lagoon. Under the *National Parks and Reserves Management Act 2002*, the Director of National Parks and Wildlife is the managing authority responsible for the reserve.

The game reserve covers 4760 hectares and is important for nature conservation due to its landscape, variety of vegetation communities and diversity and quantity of fauna, particularly waterbirds. Moulting Lagoon regularly supports approximately 8000 black swans *Cygnus atrata* and up to 15,000 have been recorded during dry periods. It is the most important feeding and breeding habitat for swans in Tasmania. The lagoon also regularly supports the largest known Tasmanian flocks of the migratory greenshank *Tringa nebularia*.

The reserve contains thirteen plant species listed under the *Threatened Species Protection Act 1995* (see Appendix 4).

The reserve is important for cultural heritage conservation due to its extensive use by Aboriginal tribes prior to European settlement and because of its early European occupation. Duck hunting has occurred in season at Moulting Lagoon since the time of European settlement, and the abundant teal and mountain duck are highly prized, along with the cultural traditions that go with hunting.

This plan outlines the long-term management objectives of the reserve and the necessary management prescriptions to meet those objectives. It consists of four main parts:

Part 1 is an introduction

Part 2 is an account of the physical features, uses and management of the reserve which influence the objectives and prescriptions for future management

Part 3 sets out the significance and management objectives

Part 4 contains the prescriptions for management and together with Part 3 constitutes the Management Plan as described in Part 3 of the *National Parks and Reserves Management Act 2002*.

A review of this plan may be undertaken, and the plan altered and replaced at any time. If not conducted sooner, the plan will be reviewed within 10 years of it being approved.

1.1 THE RAMSAR CONVENTION

The Convention on Wetlands is an inter-governmental treaty that provides the framework for international cooperation for the conservation and wise use of wetlands. It is the first of the modern global treaties on conservation and wise use of natural resources. The convention, which is commonly referred to as the Ramsar Convention, takes its name from the Iranian city of Ramsar where the treaty was adopted in 1971.

The Ramsar List of Wetlands of International Importance has been established under the convention. Sovereignty of the sites remains with the countries within which the sites are located. By January 2000 there were 117 contracting parties to the Convention, with 1011 wetland sites, totalling 71.8 million ha designated for inclusion in the Ramsar List of Wetlands of International Importance.

Management of wetlands and Ramsar sites should be in accordance with the duties and obligations of signatories to the convention. In particular, Article 3.1 states that the contracting parties 'shall formulate and implement their planning so as to promote the conservation of wetlands included in the List, and as far as possible the wise use of wetlands in their territory'.

Australia was the first nation to become a contracting party to the Convention in 1971. It nominated Coburg Peninsula, an Aboriginal Land and Wildlife Sanctuary in the Northern Territory, as its first Ramsar site which, consequently, became the world's first Ramsar site. Australia has 63 Ramsar sites (as at November 2002) covering an area of approximately 7.3 million ha. Ten of these sites are located in Tasmania.

The Moulting Lagoon Game Reserve was the third Australian Ramsar site to be listed under the convention.

1.2 CRITERIA MET FOR RAMSAR LISTING

At the time of listing, Moulting Lagoon Game Reserve met the following criteria for listing as an internationally important wetland.

- Criterion 1(a): It is a particularly good representative example of a natural or near-natural wetland, characteristic of the appropriate biogeographical region
- Criterion 2(a): It supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plants and animals, and an appreciable number of individuals of any one or more of these species
- Criterion 2(c): It is of special value as the habitat of plants or animals at a critical stage of their biological cycle
- Criterion 3(b): It regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity.

Although listing criteria have since been revised (see Appendix 2), these values continue to support the Ramsar listing. Moulting Lagoon is an important breeding area for black swans and an important staging area for all other species of waterfowl in Tasmania, with particularly late-summer concentrations of Australian shelduck *Tadorna tadornoides* and chestnut teal *Anas castanea*. It also supports the largest known Tasmanian flocks of greenshank. Seasonal fluctuations in numbers of birds occur with changes in rainfall.

Thirteen plant species located in the Moulting Lagoon area are of particular significance for conservation because of their rarity. Golden spray *Viminaria juncea* is common on the mainland but is considered endangered in Tasmania and is

found in only one other location. The endemic *Stenanthemum pimeleoides* is considered vulnerable at the state level and endangered at the national level.

The endemic plant species *Lasiopetalum micranthum* has been recorded only in this part of Tasmania (Blackhall 1985). It is not known to occur within the reserve boundaries.

I.3 MIGRATORY BIRDS AGREEMENT

As a signatory to the Japan–Australia and China–Australia Migratory Bird Agreement (JAMBA/CAMBA), and as a member of the East Asian–Australian Shorebird Site Network (EAASSN), Australia has obligations to ensure the protection of migratory bird species and their habitats.

I.4 LEGISLATION

1.4.1 Legislation

Australia's obligations under the Ramsar Convention are primarily met through legislation and administration arrangements governed by the state and territory governments. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* provides a national legislative framework for the protection of Ramsar wetlands and listed migratory species, and came into effect in July 2000. This Act:

- recognises that Ramsar Wetlands of International Importance (and listed threatened and migratory species) are matters of National Environmental Significance
- introduces an environmental assessment and approval regime for actions that are likely to have a significant impact on Ramsar wetlands (and listed threatened and migratory species)
- provides for improved management of Ramsar wetlands.

Game reserves are proclaimed under the *Nature Conservation Act 2002*, managed under the *National Parks and Reserves Management Act 2002* and are subject to the National Parks and Reserved Land Regulations 1999 and Wildlife Regulations 1999. Section 27(2) of the *National Parks and Reserves Management Act 2002* provides that no statutory powers may be exercised in a game reserve unless specifically provided for in a management plan and approved by both Houses of the Tasmanian Parliament.

All items of Aboriginal heritage in the state are protected under the *State Aboriginal Relics Act 1975*. The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* empowers the Commonwealth to protect threatened Aboriginal heritage at the request of Aboriginal people. The state *Threatened Species Protection Act 1995* also applies to the game reserve.

Management of marine animals within the reserve is governed by the *Living Marine Resources Management Act 1995*.

The *National Parks and Reserves Management Act 2002* requires that, in managing development on reserved land, regard must be had to the Resource Management and Planning System objectives. The legislative framework for dealing with development continues to be refined and updated.

The Tasmanian State Coastal Policy 1996 applies to the reserve.

1.4.2 Administration

The Wetlands Unit of Environment Australia is the administrative authority for the Ramsar Convention in Australia. Under the Australian constitution, primary responsibility for land and resource use lies with the state and territory governments. Accordingly, in Australia the Convention on Wetlands is implemented primarily under state and territory legislation. Coordination is achieved through a network of officers representing state, territory and Commonwealth nature conservation agencies constituted under the auspices of the Natural Resource Management Ministerial Council, and known as the Wetlands and Waterbirds Taskforce.

Management of the Moulting Lagoon Game Reserve is the responsibility of the Director. The reserve lies in the North-East District of the Parks and Wildlife Service. The staff of the Service is charged with enforcing the Acts and Regulations and may also be empowered to police other pertinent legislation in consultation with relevant authorities.

1.5 LOCATION, PLAN AREA AND ACCESS

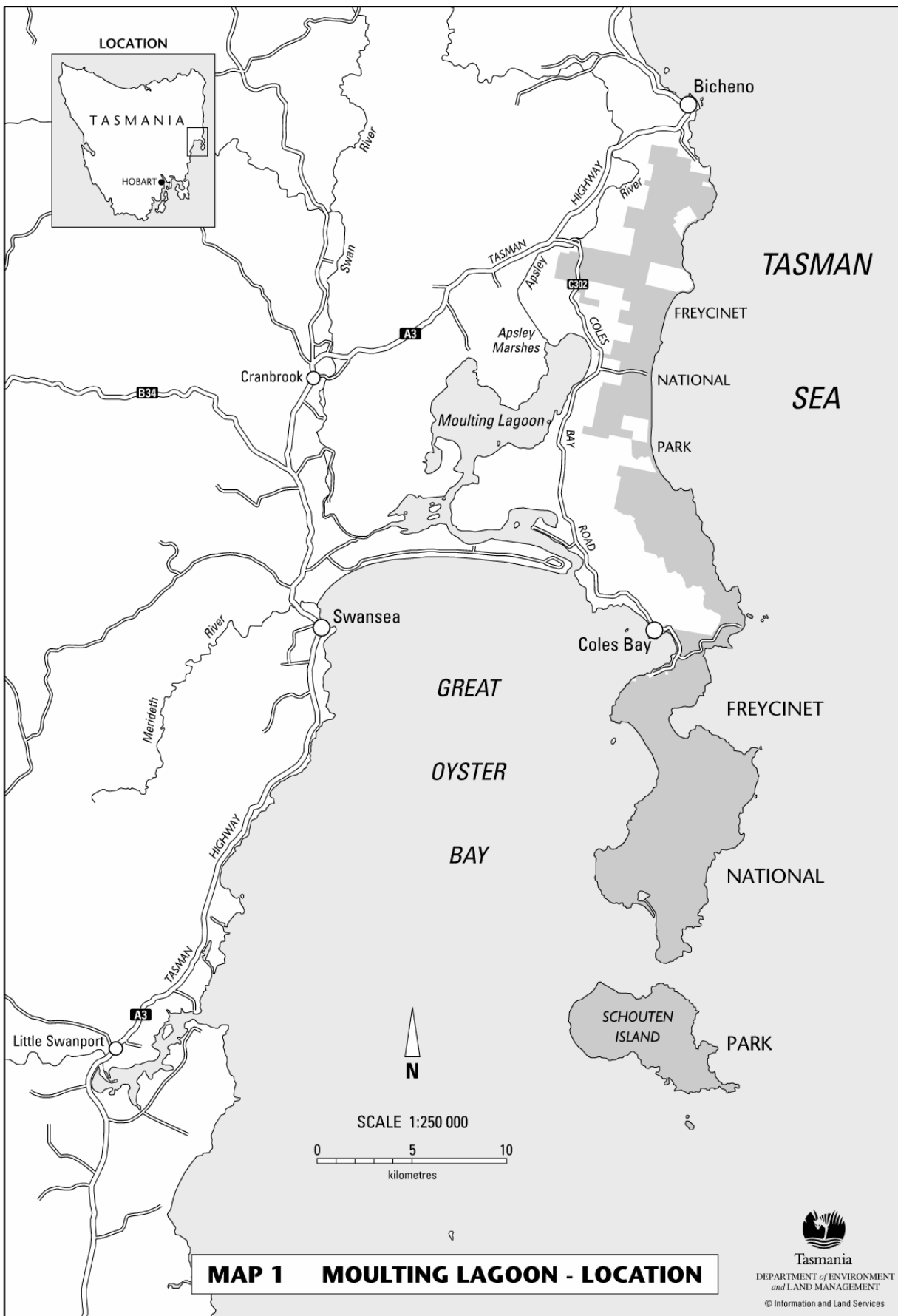
Moulting Lagoon is located in the Glamorgan Spring Bay Municipality on the east coast of Tasmania, adjacent to the Freycinet Peninsula and approximately 10 km north-east of the town of Swansea (Map 1). The midpoint of the reserve lies at approximately 42°02'S, 148°11'E: 598000E, 5346000N.

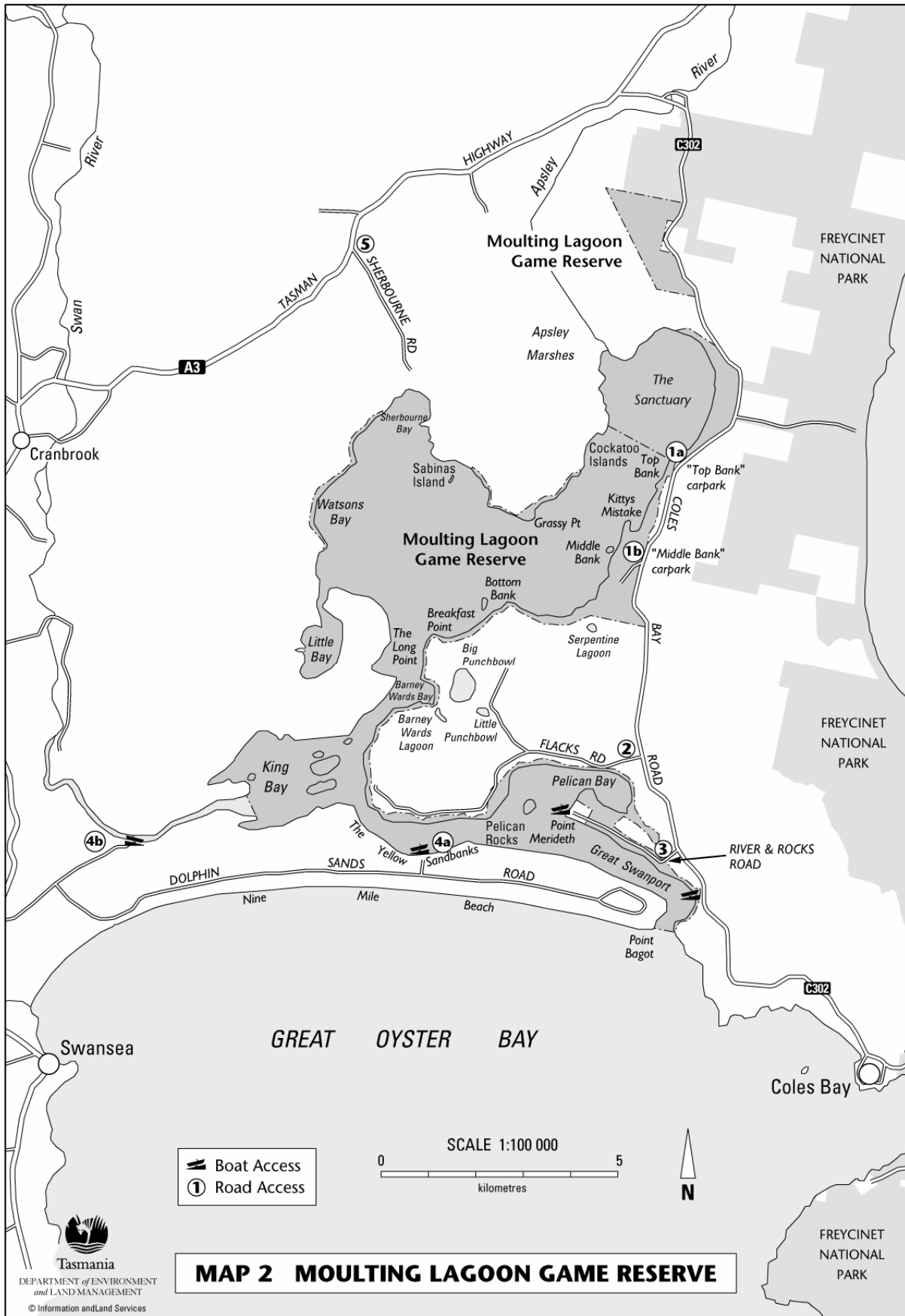
The lagoon is a large estuary formed at the mouths of the Apsley and Swan Rivers. It contains areas of both shallow and deep water and is surrounded by periodically exposed mudflats and saltmarsh. The western shore has been largely cleared and is used for livestock grazing while the eastern shore is relatively undisturbed and covered with native vegetation. The lagoon, some small sections of surrounding land and an additional area of dry land 1 km north comprise Moulting Lagoon Game Reserve (Map 2). The game reserve has an area of approximately 4760 ha while the Ramsar site, which includes all of the reserve except the isolated block of land north of the lagoon, has an area of approximately 4507 hectares (see Section 1.7).

Access to the lagoon is easiest by boat from the three public launching ramps along the southern end (Map 2). With some exceptions, vehicle access is generally across private land and involves obtaining the landowner's permission. At present there are no formed walking tracks in the reserve. Public access points are:

- (1) the two carparks on the east side, accessible from Coles Bay Road
- (2) access to the Pelican Rocks area via Flacks Road
- (3) access to the Point Meredith area via River and Rocks Road
- (4) tracks off Dolphin Sands Road along Nine Mile Spit and the Yellow Sandbank.
- (5) Sherbourne Road.

Sherbourne Road is generally used as access to the Sherbourne Bay coastline. The road, which is a council maintained road through private property, deteriorates into improved pasture approximately 400 m from the lagoon. The landowner's permission should be sought to access the lagoon via Sherbourne Road.





I.6 LAND TENURE

All of the area below high water mark as well as approximately half of the foreshore to a width of between 30 and 150 m is contained in the reserve. The surrounding land and the majority of the remaining foreshore of the lagoon is privately owned and is mostly contained in five large pastoral properties. The reserve is adjoined by the Crown land shack site area at Meredith Point, by the block of land containing the gravel pit between the lagoon and the isolated section of the reserve to the north, and by the river reserve along the northern edge of Dolphin Sands.

I.7 PROCLAMATION HISTORY

1.7.1 Game Reserve

Portions of the estuary had been declared sanctuaries over the years prior to the Ramsar designation. In 1918, all of the lagoon above a line from The Long Point to Breakfast Point was proclaimed a sanctuary for wildfowl under the *Crown Lands Act 1911*. However, in 1928, when the Animals and Birds Protection Board was formed, there was no provision for the carry over of existing reserves, so the area reverted to uncommitted Crown land. In 1959, an area of approximately 600 ha at the far northern section of the lagoon was declared a wildlife sanctuary under the *Animals and Birds Protection Act 1928*. A further 13.7 ha at Pelican Bay was declared a conservation area in 1980 under the *National Parks and Wildlife Act 1970*.

Several attempts to enlarge the conservation areas were unsuccessful, being met with strong opposition from hunters and local residents, primarily because of the restrictions on hunting which such a designation would impose. In 1976, a new category of reserve was created that allows for the taking of game, known as game reserves. The Moulting Lagoon Game Reserve was proclaimed in December 1988 and incorporated both of the previously designated conservation areas.

1.7.2 Ramsar Site

The Moulting Lagoon Game Reserve Ramsar Site was designated as a Wetland of International Importance under the Convention on Wetlands in 1982. The Ramsar Site covers 4507 ha and includes all of the Moulting Lagoon Game Reserve except the small tract of dry land north of the lagoon (Map 2).

PART 2: ACCOUNT OF THE AREA

2.1 GEOLOGY, GEOMORPHOLOGY AND SOILS

The geology of the Moulting Lagoon area is outlined in Map 3. The Great Swanport estuary was created by the development of a mid-bay spit (Nine Mile Beach) as sea levels started rising some 10 000 years ago. The restriction of flow has resulted in the flooding of the surrounding low-lying land (Moulting Lagoon) and the formation of extensive mudflats where silt carried down by the rivers has been deposited. The underlying rocks are predominantly Jurassic dolerite and Permian and Triassic sediments.

Moulting Lagoon and Great Oyster Bay are composed of a down faulted block (graben) which developed following the separation of Antarctica and Australia which started approximately 70 million years ago. Rivers flowing through this valley feature deposited Tertiary sediment derived from erosion of nearby mountains. With rising sea levels much of the coastline of Tasmania, including Moulting Lagoon and Great Oyster Bay, was flooded. Coastal processes including a relatively protected bay and ample sand supply resulted in the development of the spit over the last 6000 years. Sand accumulation in dune areas has been seriously impacted by a large marram grass infestation.

The majority of the low lying land around Moulting Lagoon is of recent alluvial or aeolian origin. The nature and distribution of these materials produce landscape features that react differently to use and management. Jurassic dolerite outcrops extend to the edge of the lagoon in a few places on the western shore with some marine limestone on the eastern shore. There are only occasional isolated patches of the granite so common nearer the coast and down on the Freycinet Peninsula. Coal and tin have been mined in the carbonaceous Triassic sequences north-east of the Apsley Marshes and in the hills near Coles Bay.

2.2 CLIMATE

The lagoon lies midway along Tasmania's east coast. Tasmania in general has a temperate maritime climate, and temperatures in the south-east are generally among the warmest in the state. Because of the prevailing westerly wind flow, this area falls in a rain shadow much of the year. Rain that does fall is fairly evenly spread over the year with slight peaks in autumn and spring when changeable weather patterns bring easterly winds. The nearest meteorological station is at Swansea, approximately 10 km south-west of the centre of the lagoon. Swansea rainfall data from 1884 to 1989 exhibit a mean annual rainfall of 611 mm, with an average of 119 rain days per year. Freycinet National Park, about 25 km to the south along the Coles Bay Road, has recorded somewhat higher rainfall (730 mm per annum since 1985), primarily because of local geography and two unusually high rainfall years.

Bureau of Meteorology records from Swansea for the period 1957 to 1990 show that the temperature in January, the warmest month, ranges from a mean daily maximum of 22.2°C to a mean daily minimum of 11.3°C. In July, the coldest month, temperatures range from a mean daily maximum of 13.0°C to a mean daily minimum of 3.4°C (Blackhall 1985; Tasmania Parks and Wildlife Service 1995).

2.3 HYDROLOGY

Catchment areas of the Swan and Apsley rivers total just over 900 sq km, being 682 sq km and 228 sq km respectively (Rivers and Water Supply Commission 1983). Both rivers are subject to intense flooding and flow rates vary considerably throughout the year (Tables 1 & 2). The maximum flow rate recorded for the Swan River between 1985 and 1995 was 808.2 cumecs on 18 May 1986 (average flow in 1986 of 7.084 cumecs) while in 1994 the maximum flow was only 24.47 cumecs (average flow in 1994 of 0.432 cumecs).

The tidal range of the lagoon varies from 0.8 m at the mouth to 0.3 m in its upper reaches but is also dependent on wind strength and direction and barometric pressure at the time. Salinity varies considerably with climatic conditions and flow of the rivers, being generally higher in dry seasons and lower during wet periods. During hot and dry weather, evaporation can create salinity levels more than twice that of seawater in some areas (Blackhall 1984, Last 1983).

2.4 FLORA

The plant communities around Moulting Lagoon reflect the wide diversity of terrain and consequent soil drainage. The immediate edge of the lagoon supports an almost continuous belt of *Sarcocornia quinqueflora* often mixed with *Sclerostegia arbuscula* in areas where stock have been excluded. Behind the *Sarcocornia* where the bank begins to rise, there is again an almost continuous fringe of *Juncus kraussii* and *Poa* sp. tussocks. These two bands range in width from 1-2 m each to 30 m or more depending on elevation. Behind this zone the vegetation cover is highly variable depending on the terrain. Lower, wetter areas support either *Melaleuca ericifolia*, *Acacia dealbata* or some small stands of *Callitris rhomboidea*. On the western side, the relief is gradual and consequently much of the original vegetation cover has been removed to create improved pasture for livestock grazing. The few rocky outcrops retain a cover of *A. dealbata*, *Allocasuarina verticillata*, *Banksia marginata* and eucalypt species. On the eastern side the bank rises steeply from the shore in most places and *Kunzea ambigua*, *A. dealbata* and eucalypt species grow to within a few metres of the water. Mature stands of eucalypts are found on most of Nine Mile Spit and in one small area near Watsons Bay.

The mouth of the Apsley marshes contains extensive stands of *M. ericifolia* and also large stands of *Phragmites australis*. Three threatened species located during Blackhall's (1985) vegetation survey are of particular significance for conservation because of their rarity. *Viminaria juncea* is common on the mainland, but was previously known from only one location in Tasmania. This species is considered endangered in Tasmania (Schedule 5, *Threatened Species Protection Act 1995*). *Stenanthemum pimeleoides* and *Lasiopetalum micranthum* are endemic to Tasmania and found only in this part of the state. *S. pimeleoides* is considered vulnerable at the state level and Endangered at the national level (Flora Advisory Committee 1994; Schedule 5, *Threatened Species Protection Act 1995*). *L. micranthum* has not been recorded in the Moulting Lagoon Game Reserve but occurs on adjacent land.

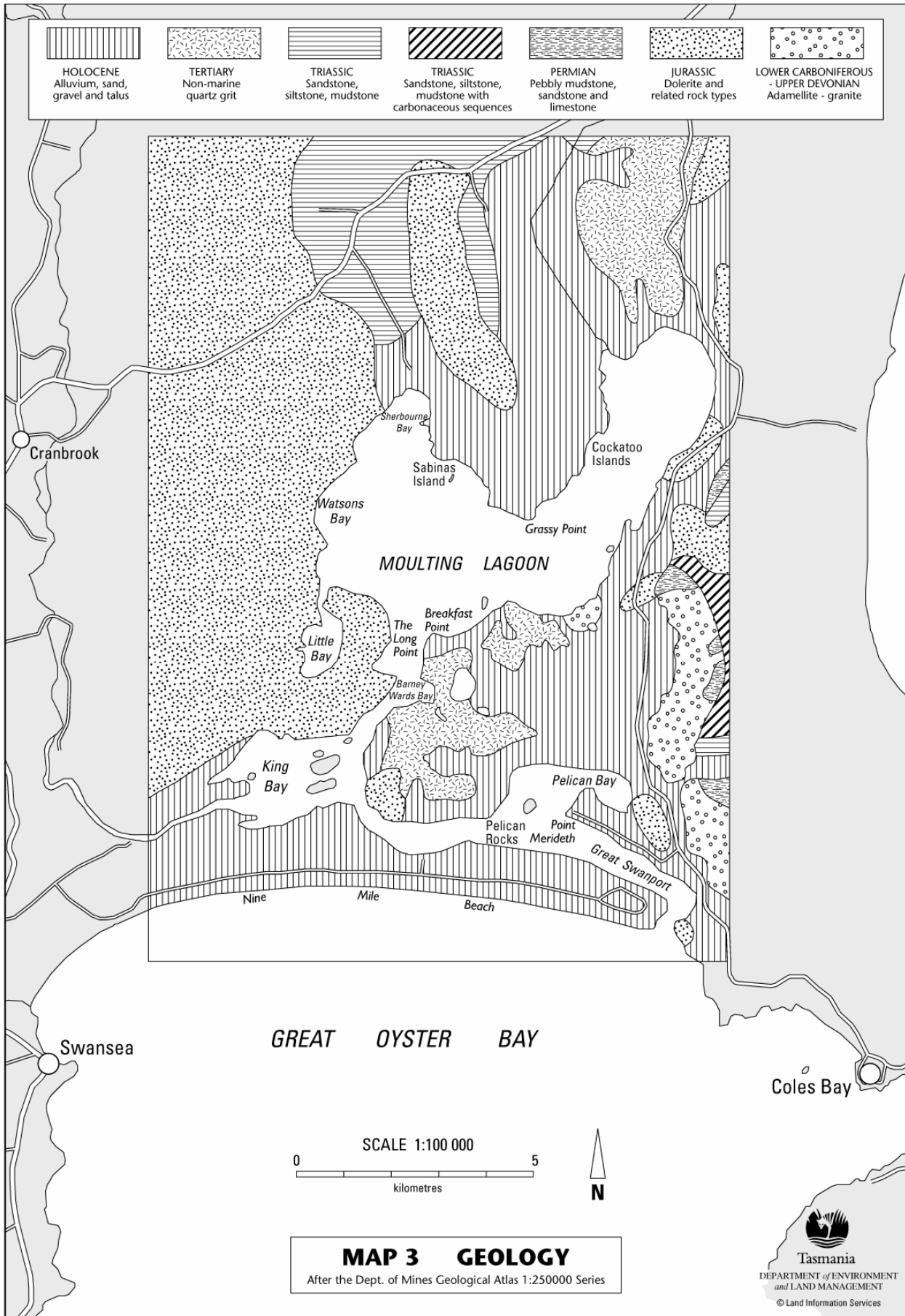


Table 1: Swan River Flow Data*

	1985	1986	1987	1988	1989	1990
Max Flow Cmcs	385.3	808.2X	85.69	406.6	190.6	ND
Time of Max	Dec 16	May 18	Jan 5	May 18	Jul 23	
Max Level (m)	4.252	5.223	1.937	4.309	3.356	ND
Time of Max	Dec 16	May 18	Jan 5	May 18	Jul 23	
Min Flow Cmcs	0.043	0.113X	0.031	0.000	0.091	ND
Time of Min	Feb 28	Apr 14	Apr 21	Apr 6	Feb 13	
Min Level (m)	0.231	0.281	0.221	0.157	0.266	ND
Time of Min	Feb 28	Apr 14	Apr 21	Apr 6	Feb 13	
Avg Flow Cmcs	7.135	7.182X	1.239	5.866	3.810	ND
	1991	1992	1993	1994	1995	
Max Flow Cmcs	ND	ND	512.6X	24.47	695.2X	
Time of Max			Dec 28	Jan 1	Dec 19	
Max Level (m)	ND	ND	4.572	0.900	4.986	
Time of Max			Dec 28	Jan 1	Dec 19	
Min Flow Cmcs	ND	ND	0.051X	0.000	0.000X	
Time of Min			Dec 22	Dec 31	Jan 3	
Min Level (m)	ND	ND	0.236	0.161	0.154	
Time of Min			Dec 22	Dec 31	Jan 4	
Avg Flow Cmcs	ND	ND	3.250X	0.436	3.542X	

* Site: 2200, Swan River at the Grange
Parameter: 100 River Level (metres)
Period 1985 to 1996 (note: monthly values are for period up until 24:00:00 on last day of month)
E = fair estimated data, X = fair extrapolated data, Y = poor estimated data

Table 2: Apsley River Flow Data*

	1985	1986	1987	1988	1989	1990	1991
Max Flow Cmcs	192.8E	350.9E	114.6	176.5	120.0	30.23	78.07Y
Time of Max	Dec 5	May 18	Jan 5	Jul 8	Apr 2	Aug 11	Dec 15
Max Level (m)	3.243E	4.084E	2.489	3.116	2.549	1.254	2.033Y
Time of Max	Dec 5	May 18	Jan 5	Jul 8	Apr 2	Aug 11	Dec 15
Min Flow Cmcs	0.00E	0.031E	0.002	0.00	0.007	0.003	0.003Y
Time of Min	Feb 28	Apr 16	May 5	Mar 2	Feb 14	Jan 31	Mar 9
Min Level (m)	0.005E	0.050E	0.006	0.095	0.018	0.008	0.009Y
Time of Min	Feb 28	Apr 16	May 5	Apr 20	Feb 14	Jan 31	Mar 9
Avg Flow Cmcs	2.828E	2.671E	0.540	2.322	1.664	0.538	1.064Y

* Site: 2200, Apsley River upstream of Coles Bay Road bridge
Parameter 100 River Level (metres)
Period: 1985 to 1992 (note: monthly values are for period up until 24:00:00 on last day of month)
E = fair estimated data, X = fair extrapolated data, Y = poor estimated data

Aquatic vegetation in the estuary is largely composed of seagrasses. According to Rees (1993), seagrass covers approximately 2,492 ha, or 40–70% of the lagoon substrate. Generally, these grasses can be divided into two main groups. *Zostera muelleri* dominates the lower more saline reaches. In the upper reaches of the lagoon and in King Bay, where fresh water enters from the two rivers and salinity is lower, several species of *Ruppia* replace the *Zostera* and form nearly continuous beds along the bottom (Blackhall 1985). Rees (1993) suggests *Heterozostera tasmanica* should be present as well at the entrances and on walls of the deeper channels, but Blackhall (1985) failed to record it. As well as the rooted vegetation, large quantities of algae are produced in seasonal blooms. Many other aquatic plants are found in the freshwater dams and lagoons around the main lagoon. These species (e.g. *Triglochin procerum*, *Myriophyllum* sp. and *Eleocharis sphacelata*) plus the *Ruppia*, *Zostera* and algae form a large part of the diet of waterfowl in the area (Blackhall 1984, unpublished data).

Known plant species within the Moulting Lagoon Game Reserve Ramsar Site are listed in Appendix 4.

2.5 FAUNA

The area has long been regarded as an important area for waterbirds. Blackhall (1985) recorded 60 species of birds in the immediate area of the lagoon. A checklist of known bird species in and around the lagoon is found in Appendix 5.

Black swans are the most obvious and numerous birds on the lagoon. Historically, as much as 80% of swan breeding in Tasmania occurred there (Hemsley 1973). Unfortunately, swans are also the subject of much management controversy, primarily due to their current numbers. Post breeding populations vary somewhat according to breeding conditions, but over the last 30 years they have often approached 15,000 birds (Hemsley 1973; Blackhall 1985, unpublished data).

Some local residents consider that the current numbers of swans are unnaturally high causing degradation to the values of the lagoon. It is claimed that the feeding and nesting of such large numbers of birds are destroying the aquatic vegetation, causing excessive sedimentation and nutrient loading to the lagoon and out-competing other waterbirds on the lagoon. It is also claimed that the occurrence of dead swans around the lagoon at times, particularly during drought, indicates that the numbers are unnaturally high. These residents believe that in order to lower the overall swan population, the species should be placed back onto the list of game birds and that the legal taking of swan eggs should be reintroduced.

It is possible that the swan population has undergone a considerable increase since the late 1960s compared to earlier historic levels when swans were under considerable pressure from hunting and egg collecting. However, it is considered that the current population levels are natural and any periods of high mortality are part of the natural population cycle.

Other common waterbirds include eight species of duck (most numerous being Australian shelduck and chestnut teal), white-faced herons, silver and pacific gulls, masked lapwings and great and little pied cormorants.

As well as the resident population of waterbirds, thirteen species of migrating waders use the area. All but one of these, the double-banded plover *Charadrius bicinctus*, breed in the Arctic region during the northern hemisphere summer and migrate south for the southern hemisphere summer. The double-banded plover overwinters (Feb–

Aug.) in south-east Australia and then migrates to New Zealand to breed. The species is common around Moulting Lagoon during this period. Most of the other migratory species use the area only briefly as a stopover during the summer but small numbers of eastern curlews have been recorded during winter (Blackhall 1985). These migratory waders are listed on JAMBA and CAMBA.

No mammals are known to be dependent on the lagoon although wallaby, Tasmanian devils and brush possums are regularly seen in the immediate vicinity. Very few reptiles or amphibians are seen, presumably as a result of the lack of fresh water however, places such as Charlie Dilgers Hole are known to have concentrations of frogs. Snakes are present but uncommon with Blackhall (1985) seeing only one in 14 months of field work in 1984–85.

Little information is available on the aquatic vertebrates of Moulting Lagoon. Estuaries and coastal wetlands in general have long been recognised as critical nursery areas for myriad marine species including many commercial species. A study by Last (1983) recorded 59 species of fish occurring in or near the estuary. During this study it was estimated that up to 2000 black bream were being caught annually in the lower reaches of the estuary and in the Swan River at that time. Unfortunately, there is no reliable source of data on current angler catches, though fishing for bream continues.

No invertebrate surveys are known to have been conducted in Moulting Lagoon (E. Turner pers. comm.). Four commercial aquaculture operations grow native and Pacific oysters in or near Pelican Bay and Point Meredith.

Any action that has, will have, or is likely to have a significant impact on listed threatened species and ecological communities and/or listed migratory species should be referred to the Commonwealth Minister for the Environment and Heritage to determine whether the action is subject to the *Environment Protection and Biodiversity Conservation Act 1999*.

2.6 CULTURAL RESOURCES

2.6.1 Aboriginal

The following brief overview presents an archaeological perspective of Aboriginal cultural resources in or near Moulting Lagoon. In the management and protection of Aboriginal cultural resources this limited perspective is recognised as inadequate. Appropriate management and protection of Aboriginal cultural resources requires the full recognition of values held by the Tasmanian Aboriginal community concerning the Moulting Lagoon area, and the successful transfer of administration of management and protection of Aboriginal cultural resources to the Aboriginal community. Effective and appropriate management guidance of Aboriginal cultural resources in the study area will be a product of ongoing consultation with Aboriginal community organisations.

At the time of European settlement Moulting Lagoon was part of the territory occupied by the Oyster Bay Tribe. The territory encompassed much of the Tasmanian east coast and extended north from the Derwent estuary to the Fingal Valley and west to the Midlands. The tribe comprised at least 15 bands with a total population of 600–800 people (Brown 1991).

Wildlife around Moulting Lagoon, particularly black swan eggs, were an important food source to Aborigines of the Oyster Bay tribal group. Of this tribe, perhaps as many as 10 bands of up to 70 or 80 people each used the lagoon during the swan breeding

season, while one band, the Linetemairrener, apparently lived primarily at Moulting Lagoon (Brown 1991, Ryan 1981, Hemsley 1973).

To date few archaeological surveys have been conducted in the Moulting Lagoon area. Eight sites have been registered on the Tasmanian Aboriginal Site Index and vary from isolated artefact scatters to middens and quarry sites. Of these, only one occurs within the reserve boundary while the other seven occur on private land. It is unlikely that any base camps existed within the present game reserve because in coastal areas they were usually situated in open forest inland from the shore where they offered maximum shelter while still in close proximity to resources (Brown 1991). Hence, in the Moulting Lagoon area it is most probable that artefacts from base camps exist on private land adjacent to the lagoon.

It is highly likely that many more sites exist in the area as it is known that the Freycinet Peninsula/Friendly Beaches area was used extensively by bands of the Oyster Bay Tribe. The vast shell deposits which lie in the dune swales behind Nine Mile Beach south of Moulting Lagoon have been identified as being natural but less conspicuous deposits in the same beach/lagoon area have been identified as Aboriginal sites (Hermes 1996).

2.6.2 Historic

Freycinet Peninsula and Great Oyster Bay are recorded early in the European history of Tasmania. In 1642, Abel Tasman explored the south and south-eastern coastline of Tasmania naming such features as Schouten Island and Vanderlins Eylandt (now Freycinet Peninsula). In 1802 a French scientific expedition under the command of Captain Nicolas Baudin named other features such as Cape Faure, Cape Baudin, Cape Forestier and Thouin Bay (Parks and Wildlife Service 1995).

The Moulting Lagoon/Swansea area was first settled by Europeans in 1821 when Lieutenant George Meredith took up land north of Swansea. At the same time Adam and John Amos also took up land further north on the Swan River near Cranbrook. By the late 1820s most of the arable land in the Swansea/Moulting Lagoon region had been taken up by European settlers (Davenport & Amos 1988).

Supplies were transported to the area by ship and were usually unloaded at Waterloo Point (now Swansea). Boats were also used on Moulting Lagoon to transport supplies which were unloaded at the junction of the Swan and Wye Rivers or were shipped further up the lagoon towards the Apsley Marshes (Davenport & Amos 1988).

Many industries were established early after European settlement. In 1824, a bay whaling station was established by George Meredith at Coles Bay. The location later became known as The Fishery. Black wattle bark, used in the tanning of leather, was collected throughout the east coast, particularly in the Swansea region during the mid 1800s up until the mid 1900s. Barkstand Point is located on the eastern side of Moulting Lagoon and it is presumed that bark was stacked at this location before being transported to Swansea. Most of the bark was exported to Victoria, New South Wales, Queensland and New Zealand (Davenport & Amos 1988).

In the mid 1800s drains were constructed by convicts in the Apsley Marshes and connected to natural distributaries of the lagoon. It has been claimed that the 'natural' distributaries which exist in the reserve were also constructed by convicts. However, the distributaries are deeper, wider and have a completely different shape than the drains which run in straight lines for considerable distances. It was most likely that the

drains were connected to the distributaries to avoid having to dig a further 300–500m to the lagoon (Pemberton 1995).

Only one historic site has been recorded on the Service's Tasmanian Historic Places Inventory within the reserve (site number 8513: 022). The site is located on Sabinas Island and consists of a rectangular arrangement of stones measuring approximately 5 m x 5 m plus three sides of another rectangular stone structure. It has been suggested that the remains at the site are related to the original settlement in the area by either T Watson or W Lyne (J Fenn-Smith & R Amos pers. comm.).

Since European settlement the lagoon and its environs have been used extensively for a variety of activities including agriculture, transport, industry and recreation. The existence of purpose-built recreational structures, principally associated with duck hunting, in proximity to the reserve attests to the survival of some of these activities to the present. It is likely that further sites related to past use of the lagoon, and which have historic heritage value, may be found within the reserve.

2.7 ENVIRONMENTAL DEGRADATION

2.7.1 Disease

The devil facial tumour disease is known to affect Tasmanian devils all along the east coast, including this area.

The potential exists for outbreaks of disease within the moderately high concentration of black swan, particularly during periods of environmental stress.

Lead poisoning, caused by ingestion of lead shotgun pellets, is of particular concern. While not an infectious disease, it is nonetheless a well-documented killer of waterfowl (Anon 1986), and has been banned for waterfowl shooting in the United States and one Australian state. Smith et al. (1995) have documented both the availability of pellets to waterfowl in Moulting Lagoon, as well as elevated lead levels in both swans and ducks found there. Lead shot poisoning is common among bottom-feeding waterfowl in areas of high shot concentrations. It is insidious, however, in that it is generally 'invisible'. Poisoned birds undergo muscular paralysis, gut impaction, and subsequent starvation. They often hide in their weakened state or are quickly taken by scavengers and consequently never found.

In Tasmania a consultative group has been set up to oversee the phase-out of lead shot on a statewide basis. Additional research took place during the 2000 duck-hunting season to determine lead levels in waterfowl. The research revealed strong grounds for continuing to pursue the phase-out and a timetable was negotiated with duck hunters.

The root-rot fungus *Phytophthora cinnamomi* causes dieback and/or death of a wide range of native plant species, particularly those of the Proteaceae, Epacridaceae and Myrtaceae families. The fungus occurs throughout the east coast and has been recorded along walking tracks on Freycinet Peninsula and Schouten Island (Parks and Wildlife Service 1995). It is likely that the fungus is present in the reserve and adjacent land, particularly along access tracks.

2.7.2 Introduced Species

Feral cats *Felis catus* have been observed throughout the Moulting Lagoon area. Diet studies have revealed that across Australia cats kill over 100 species of birds, 50 species of both reptiles and mammals, and many species of amphibians and

invertebrates (Dredge 1993). There are no data regarding the impact of cats on the fauna of Moulting Lagoon.

Most introduced species concerns relate to terrestrial and aquatic plants. The South African boxthorn *Lycium ferocissimum*, which is established on Sabinas Island, has been outcompeting the native *A. verticilata* overstorey and reducing available nesting habitat for swans on the island. Control of boxthorn on the island is being conducted. Other exotic plant problems could arise from rice grass *Spartina anglica* (already found at Little Swanport), bulrush *Typha latifolia*, blackberry *Rubus fruticosus*, and gorse *Ulex europaeus*.

Based on current distribution of the introduced invertebrate aquatic species in Tasmanian waters (Sustainable Development Advisory Council 1996), there are several species of potential concern to management of Moulting Lagoon. These are a toxic dinoflagellate *Gymnodinium catanatum*, the North Pacific seastar *Asterias amurensis*, and the European shore crab *Carcinus meanus*.

2.7.3 Erosion, Sedimentation and Eutrophication

Heavy sedimentation and the ecological changes it causes may be the lagoon's most immediate problem. Excessive sediments create turbidity, cause harm to benthic fauna and flora, and accelerate successional change. Anecdotal accounts from local residents suggest the lagoon was deep enough for barge travel (J Fenn-Smith, N Dilger, pers. comm.), a feat no longer possible. About 15–20 years ago, the flats north and east of Sabinas Island and bordering on Coombend were hard-bottomed sand which yielded flounder, shrimps and pretty fish to a drag seine. The hard sand is now covered with 10 cm of boggy sediment, and all the shrimp and virtually all flounder are gone from that area (L Poole, pers. comm.). A deep hole at the old 'barkstand' in King Bay near the mouth of the Swan River, perhaps 7–8 m deep 30 years ago, is now waist deep (N Dilger, pers. comm.). Wood (1988) found sedimentation rates in Lindisfarne Bay, Tasmania, of 2.7 to 3.3 cm per year, and documented two other studies where sedimentation rates have approached or exceeded this level. A sedimentation rate of only 0.5 cm/year in Moulting Lagoon could have resulted in 10 cm of excess sediment over 20 years, possibly enough to have degraded the lagoon as a nursery for shrimp and flounder.

There is potential for considerable controversy over the sources of such sediments. Wood (1988) attributed much of the excessive deposition in Lindisfarne Bay to indiscriminate land-use practices within the catchment of the bay. The condition of the catchments upstream of Moulting Lagoon, as well as immediately within the foreshore and surrounds, suggests a similar case for Moulting Lagoon. Erosion within the catchment would most likely come from agricultural practices and the removal of forest canopy and other vegetative cover during timber harvesting resulting in sedimentation in the lagoon. Also, vehicular traffic along the foreshore destroys the mat formed by *Sarcocornia* and other vegetation, leaving deep ruts in soft soils that remain exposed for long periods. This allows sediment from the exposed tracks to run into the lagoon during high tides and heavy rainfall.

When intensive logging activity occurs in the Swan River catchment sediment has to be removed daily from oyster racks in Moulting Lagoon (A. Cole, pers. comm.). In addition, extensive heavy rainfall and floods generally occur in summer and may result in a high loss of topsoil directly into the lagoon. Heavy rains in early summer coincide with freshly ploughed fields while rains in late summer may be after a period of drought when grass cover has been significantly reduced or totally removed through grazing.

An overabundance of black swan in the lagoon is also believed by some local residents to be responsible for the sedimentation of the lagoon. It is considered by these residents that the swans have destroyed vegetation on their loafing islands and disturbed the bottom with their feeding, thus causing movement of otherwise stable substrate.

In addition to sedimentation, runoff from planted croplands, improved pastures, and other agricultural areas may contribute to eutrophication of the lagoon due to high use of fertilisers, particularly superphosphate, on such areas. This may have been more of a problem in the past than present (N Dilger, pers. comm.), but unusually extreme algal blooms still occur (O Smith, pers. comm.).

Rees (1993) and Wood (1988) describe clearly the negative effects of sedimentation and nutrient loading on seagrass communities and aquatic environments. Such problems have contributed to major declines in seagrass communities in various parts of Tasmania, with concomitant deterioration of the aquatic community which derives from such grasses. While there is no evidence suggesting such a seagrass decline in Moulting Lagoon in the recent past (Rees 1993), neither is there available historical or baseline data to suggest there have not been major changes in the past 150 years. Regardless of the causes, sediment loading and eutrophication are primary concerns for the Moulting Lagoon ecosystem.

Research conducted by the Tasmanian Aquaculture and Fisheries Institute on Estuarine Health – Status and Indicators has led to identification of parameters that indicate the health of an estuary. The study identified parameters that can be monitored on a long-term basis by community volunteer groups to reflect the status and health of an estuary, and that have practical relevance to land managers such as the Parks and Wildlife Service and local councils.

2.8 RECREATION AND TOURISM

2.8.1 Camping

Camping locations are limited within the reserve due to the narrow section of land between the lagoon and the reserve boundary in most areas.

Campers are encouraged to use the Freycinet National Park for camping rather than the reserve. A low key camping area has been constructed in the reserve south of the Kittys Mistake carpark off the Coles Bay Road. Fireplaces have been established at this site but no other facilities, such as toilets, are provided. The carpark at Top Bank and an area on River and Rocks Road are both places sometimes used for camping.

2.8.2 Boating

Boating occurs on Moulting Lagoon, primarily in conjunction with duck hunting, fishing, and aquaculture activities. Most is confined to non-motorised craft and small, low-powered open powerboats. Boats launched at the public ramps in the mouth of Swan River or along Nine Mile Spit must travel up or down the channel to reach the fishing grounds. Most proceed with caution because of shallow water and presence of rocks. They probably have little effect on birds, but may contribute to disturbance of sediments and turbidity. Some water-skiing occurs within the mouth of the estuary near Swanwick.

2.8.3 Fishing

Recreational fishing occurs within the reserve and is arguably the second most important recreational activity on the lagoon, after hunting. The lagoon is included in the Fishing Carnival held at Swansea, but is only one of several recreational fishing spots in the area. Once held annually, but now only irregularly, the carnival has attracted as many as 1500 people in the past. Historically, most fishing has occurred in and upstream of the mouth of the Swan River. There are no data on angler catches, but bream is considered to be the most commonly caught sport fish. General anecdotal evidence from several people suggests the flounder catch has declined throughout the lagoon, shrimping has declined at least at the top end near Apsley Marshes and Sherbourne Bay, and the bream catch is fairly stable. Much hand-netting occurs for prettyfish and shrimp as bait, while most recreational fishing occurs from boats. Flounder have traditionally been speared on the bottom.

2.8.4 Off-road Vehicles

Off-road driving along the foreshore occurs in many parts of Moulting Lagoon and is primarily associated with duck hunting, when hunters repair hides for the forthcoming season and to provide access during the hunting season. Virtually all unfenced parts of the foreshore are accessible for most of the year. The activity causes major damage to the foreshore vegetation, especially to the mat of *Sarcocornia quinqueflora* and *Sclerostegia arguscula*. This has resulted in considerable and repeated damage to the loosely consolidated soils and fragile vegetation near the water's edge. Most use of these foreshore tracks is in the summer months when the soil is driest. However, the silty mud near the edge of the lagoon, especially on the eastern side, softens very quickly even after a small amount of rain and the shallow-rooted vegetation is easily dislodged by spinning tyres.

Off-road driving is not permitted within the Moulting Lagoon Game Reserve except along the south eastern shore where vehicles use the foreshore to reach shacks at Breakfast Point. This track is the only vehicular access to the shacks and is used by hunters and fishers. Although the shacks are not located in the reserve, the foreshore track is within the reserve. The saltmarsh vegetation along the track has been significantly degraded and the track is susceptible to erosion and bogging.

The level of use of the track and associated camping areas around Breakfast Point is currently being investigated. At the same time, the possibility and potential environmental impact of constructing an alternative route through private property or native vegetation behind the foreshore in the reserve is being assessed. Vegetation behind the foreshore is a good remnant example of coastal native vegetation that contains few introduced species. However, it appears that a track could be constructed through this area with minimal damage. Alternatively, the foreshore track could be hardened to minimise impacts on the lagoon, but this option is generally considered to be unacceptable.

2.8.5 Birdwatching

Birdwatching in the reserve is primarily pursued by bird observers' groups; however, anecdotal evidence suggests that many of the 200,000 or so visitors to Freycinet stop to bird watch as they get close to Moulting Lagoon on the Coles Bay Road. As yet, the lagoon has not been highly publicised as a bird observation area. The number of migratory and resident bird species which inhabit the reserve, however, make this a potentially popular activity.

2.8.6 Duck Hunting

Though seasonal, duck hunting is probably the most intensive use of the lagoon, and easily the most controversial. There are few historical records available on duck hunting on the lagoon, but it has probably been practised in some form since European settlement (Blackhall 1984). The settlers readily adapted to the taking of black swan and their eggs, and waterfowl hunting in general was a sport familiar to most. Today it is believed that up to 150 hunters, many of whom are local residents, shoot wild duck on the lagoon throughout the season. Permanent hides have been constructed on the lagoon, some of which have been subject to family use for many years. A licence system for duck hides within the reserve has been developed and unlicensed hides have been removed.

Duck hunting and the traditions that go with it are often the basis for controversies surrounding the lagoon. Fathers and sons have hunted the lagoon for several generations, and anecdotal accounts suggest the swans and other waterfowl have often been a source of food to many local residents, particularly during economic hard times. Thus, restrictions on swan shooting, lower bag limits on ducks, introduction of the Sanctuary (Map 2 – an area of the reserve closed to duck hunting) and the preponderance of other wetland reserves in the local area, are all seen as encroachments on the traditional practices of these residents and can become grounds for considerable resentment. Any management actions which further affect such practices must be carefully considered and implemented in consultation with these residents.

2.9 INFORMATION, INTERPRETATION AND EDUCATION

There are currently only two interpretation signs within Moulting Lagoon Game Reserve, located at Top Bank carpark, on the Coles Bay Road, and Pelican Rocks carpark. The signs are identical and provide information on Ramsar and list some of the natural values of the Ramsar site. Wooden signs have been installed at the boundary of the Sanctuary to signify that shooting is prohibited at all times. The Moulting Lagoon area has not been promoted to its recreational and environmental potential outside the relatively small groups of hunting, fishing and birdwatching public. More signs are needed to inform visitors of the nature reserve status of the area, why this area has been reserved for conservation and why it is recognised as a wetland of international importance.

The reserve provides excellent opportunities for environmental education. There are two district high schools and two primary schools within approximately one hour's drive of the lagoon. Much useful information could be gained from field trips to the lagoon or from classroom projects based on life cycles or ecological relationships evident in the area.

Local tourist establishments make limited use of the area as a site for bird and nature observation. Tours are conducted of the oyster farms and these often incorporate birdwatching. Freycinet National Park is a very popular tourist destination for local and overseas visitors but few tourists are aware of the reserve and therefore do not take advantage of the natural values available. This could be overcome by greater promotion of the area via increased tourist operator use, signs and information brochures.

2.10 RESOURCE USE

2.10.1 Marine Farming

Aquaculture is a major growth industry in Tasmania, and is expected to continue growing significantly over the next 10 years (Australian Bureau of Agricultural and Resource Economics 1995). Aquaculture activities in Moulting Lagoon reflect this. Four oyster farmers run operations in six distinct areas of the lagoon, all generally in the channel region running from Pelican Bay to opposite The Yellow Sandbanks (Map 2). These operations are issued long-term permits by the Department of Primary Industries, Water and Environment under the *Marine Farming Planning Act 1995*. Farmers grow both Pacific and native oysters; one has been in operation for 15 years. These permits were issued prior to the lagoon being declared a game reserve and such operations continue as a pre-existing right. While existing operations may be modified according to lease conditions, no new permits may be granted unless provided for by an approved management plan.

Oyster farmers are believed to cause few environmental problems in the Moulting Lagoon area and their presence may be beneficial to wildlife. The racks provide alternative perch sites for birds; and the routine monitoring for biotoxins by the Tasmanian Department of Health and Community Services, conducted because of the oyster farms, constitutes the only monitoring of water quality currently taking place in the lagoon. Tours which some oyster farmers provide heighten visitor awareness of the area as well. Finally, sedimentation on the culture racks serves as an indicator of siltation throughout the lagoon. Alternatively, the additional perches they provide may promote higher populations of cormorants and other fish-eating birds, thus increasing predation on fish populations. There is, however, no scientific evidence available to support these latter claims.

2.11 ADJACENT LAND USE

2.11.1 Grazing and Farming

The majority of the land surrounding Moulting Lagoon has been cleared or significantly altered for agricultural grazing; primarily sheep with a few beef cattle. Improved pastures have been developed on the flat land abutting the lagoon and artificial fertilisers are occasionally spread to increase grass productivity. Some cropping occurs, but mostly in conjunction with grazing programs, e.g. turnips or hay are planted for livestock feed over winter. There is also some cropping of grains such as barley and oats. Soil and nutrient runoff from these farming activities flows into Moulting Lagoon.

Over the last 10 years, farmers seem to be grazing less livestock on similar areas, and there has also been a gradual increase in the use of irrigation for crops. Occasionally pastures are rejuvenated through ploughing and reseeded.

Many farmers within the Moulting Lagoon catchments are diversifying into specialty crops such as walnuts, olives, peas, poppies and grapes. Such changes entail increased irrigation and the increased use of pesticides and fertilisers. Runoff from these activities may ultimately end up in the lagoon.

2.11.2 Mining

Two mining leases exist in the vicinity of Moulting Lagoon (as at June 1999). A sand quarry (under licence ML 59M/88) exists on Crown land immediately north of, and adjacent to, the 'Sanctuary' along Coles Bay Road. The second licence (ML 1551P/M) is to quarry gravel east of the Coles Bay Road near Charlie Dilgers Hole.

2.11.3 Residential Development

At least two adjacent landowners have submitted requests to the local council to permit subdivision and residential development of part of their properties. Dolphin Sands and the Nine Mile Spit have been subdivided into more than 350 residential blocks with a minimum size of approximately 2 ha. While the majority of the 2 ha sized blocks are adjacent to Great Oyster Bay, some adjoin the reserve. Houses in the area require septic tanks for sewerage treatment which, given the large number of houses in the area when fully developed, may result in nutrient leaching into the lagoon and Great Oyster Bay from ground water. Recent advances in integrated waste water treatment systems based on absorption with no discharge, together with cheap alternatives to septic tanks, could improve the quality of ground water and nutrient leaching.

2.11.4 Aquaculture on Adjacent Land

A canal originally designed to grow whitebait was constructed near the north shore of King Bay in the late 1980s. Both ends of the canal are screened and connected to Moulting Lagoon to enable through-flow of water by tidal action. At present the canals are not being used although further development may be considered if the opportunity arises.

PART 3: MANAGEMENT OBJECTIVES

3.1 STATEMENT OF SIGNIFICANCE

The Moulting Lagoon Game Reserve is one of 10 Ramsar sites listed in Tasmania because it supports an appreciable number of waterfowl, particularly black swans and Australian shelducks at critical stages of their life cycles. It provides year-round habitat for the black swan and can host numbers up to 15,000 (Blackhall unpublished) and it is a critical late-summer staging area for shelducks, chestnut teal, and several shorebird species. The largest Tasmanian flocks of greenshank occur at the lagoon. Section 1.2 outlines the criteria that the reserve satisfies for listing as an internationally important wetland, with further details in Appendix 2 (Criteria applied to identify Moulting Lagoon as a Ramsar Site) and Appendix 3 (Moulting Lagoon Game Reserve – Ramsar Listing).

Thirteen plant species located in the Moulting Lagoon area are of particular significance for conservation because of their threatened status. *Viminaria juncea* and *Pterostylis cyanocephala* are endangered and *Stenanthemum pimeleoides* is vulnerable.

Moulting Lagoon/Great Oyster Bay is a site of geoconservation significance for structural reasons (Bradbury 1993). The spit at Nine Mile Beach is one of only two mid-bay spits in Tasmania.

The reserve is also a highly valued recreation area because it provides a spectrum of recreational and economic opportunities. It has commercial value to the local tourism industry and aquaculture operators; and it is valued for the recreational opportunities it provides for hunting and fishing. The reserves continuing conservation is contributing to the economic, social and aesthetic wellbeing of the local community.

Further, estuaries and coastal wetlands in general have long been recognised as critical nursery areas for myriad marine species. Their high productivity derives from their warm temperatures and high photosynthetic rates coupled with an abundance of vegetative biomass in the form of seagrasses and edge vegetation, plankton, and attached algae (Rees 1993, Sustainable Development Advisory Council 1996). Moulting Lagoon, with its inflow of fresh water, mixed salinities, aquatic vegetation and abundant bird life, presents a complex system worthy of preservation.

3.2 MANAGEMENT OBJECTIVES

Under the Ramsar Convention, the primary objective for the Ramsar site is to ensure the **wise use** and conservation of wetlands because of their abundant richness in flora and fauna and their economically important functions and values.

3.2.1 Purposes and Objectives for Game Reserves

Game reserves are a class of reserved land under the *Nature Conservation Act 2002* containing natural values that are unique, important or have representative value particularly with respect to game species.

Purposes

The purposes of reservation of game reserves, as set out in the *Nature Conservation Act 2002*, are; the conservation of the natural values of the area of

land that are unique, important or have representative value; the conservation of the natural biological diversity or geological diversity of that area of land, or both; and ecologically sustainable hunting of game species in that area of land. Moulting Lagoon is reserved for these purposes.

Management Objectives

The management objectives of game reserves are set out in the *National Parks and Reserves Management Act 2002*. All of these objectives apply to Moulting Lagoon Game Reserve.

Because of the complex interrelationship of factors to be considered in managing the game reserve, the reasons these objectives apply and the manner in which the objectives will be achieved are dealt with in a number of sections of the management plan. The sections of the management plan that primarily deal with each management objective in the Act are shown in brackets.

The management objectives that apply to Moulting Lagoon are:

- to conserve natural biological diversity (Sections 4.1, 4.2, 4.6, 4.7)
- to conserve geological diversity (Sections 4.2, 4.3, 4.4)
- to preserve the quality of water and protect catchments (Sections 4.7, 4.11, 4.13)
- to conserve sites or areas of cultural significance (Sections 4.6, 4.8)
- to provide for the taking, on an ecologically sustainable basis, of designated game species for commercial or private purposes, or both (Sections 4.9, 4.10)
- to encourage appropriate tourism, recreational use and enjoyment, particularly sustainable recreational hunting (Sections 4.1, 4.9, 4.10)
- to encourage education based on the purposes of reservation and the natural or cultural values of the game reserve, or both (Sections 4.10, 4.11)
- to encourage research, particularly that which furthers the purposes of reservation (Section 4.11, 4.13)
- to protect the game reserve against, and rehabilitate the game reserve following, adverse impacts such as those of fire, introduced species, diseases and soil erosion on the game reserve's natural and cultural values and on assets within and adjacent to the game reserve (Sections 4.1, 4.4, 4.6.3)
- to encourage cooperative management programs with Aboriginal people in areas of significance to them in a manner consistent with the purposes of reservation and the other management objectives (Sections 4.2, 4.8).

3.2.2 Specific Objectives

Based on the features of the reserve outlined in Part 2 and the Statement of Significance (Section 3.1), more specific objectives, consistent with the objectives for game reserves are to:

- protect and conserve threatened species and their habitat;
- protect and conserve the migratory wader habitat;
- minimise human impact on the environment;
- promote appreciation of the natural values of the reserve;
- encourage protection programs outside the reserve;
- seek to cooperate with hunters and other users in implementing minimum impact practices, particularly in relation to foreshore damage and rubbish;
- seek to ensure that water quality and quantity is adequate to maintain natural systems;
- cooperate with neighbours and all users in managing the reserve;

- provide economic opportunities in keeping with the other objectives;
- maintain the ecological character of the Ramsar site.

PART 4: MANAGEMENT PRESCRIPTIONS

An underlying problem in developing management prescriptions is the lack of baseline information from which to measure changes. With the exception of anecdotal records by landowners, waterfowl data collected by Tasmania Parks and Wildlife Service (Blackhall unpublished data) since 1984, and long-term meteorological records, there is little long-term data currently available or compiled on the natural history of the lagoon since arrival of the Europeans. This only reflects the condition for Tasmania as a whole, which has virtually no baseline data for any of its coastal, estuarine or marine environments. This highlights further the need to implement a baseline study for Moultin Lagoon, in conjunction with long-term monitoring.

4.1 ACCESS

4.1.1 Vehicular Access

The use of vehicles along unformed tracks within the reserve has led to localised destruction of vegetation and erosion. Degradation has primarily occurred along the foreshore of the lagoon. Barriers have been established at most of these access points to the lagoon foreshore. As outlined in Section 2.8.4, further work is required to protect the foreshore near Breakfast Point.

- Investigate and construct an alternative track to Breakfast Point and close the track located on the foreshore. If no alternative access can be provided then consider other options, such as hardening the current track to prevent erosion and protect the foreshore.
- Permit vehicles on the foreshore track to Breakfast Point only until an alternative route is available.
- Prohibit the use of vehicles on the remaining lagoon foreshore within the reserve except under permit.
- Permit limited foreshore access within the reserve for the owners/employees of the aquaculture farms to service the farms.
- Liaise with the Glamorgan Spring Bay Council in the maintenance of the River and Rocks Road to Meredith Point.
- Maintain Top Bank carpark (off the Coles Bay Road) and other public access tracks to the lagoon.

4.1.2 Walking Tracks

At present there are no designated walking tracks within the reserve. Walking tracks provide an opportunity to appreciate the scenic values of the coastal and lagoon environments as well as the flora and fauna.

- Investigate the development of short walks in the reserve.
- Develop a walking track, if needed, at the interpretive area and observation hide at Pelican Rocks (see Section 4.10) to prevent erosion and damage to the saltmarsh vegetation.
- Ensure bird hides are designed and constructed to facilitate visitor access and bird observation, while minimising disturbance to birdlife, and that appropriate design manuals are used as a guide (see references).
- Ensure planning of tracks, walkways and hides takes into consideration disturbance to wildlife (particularly the migratory waders) and that these avoid running close to the shore. The standard of construction and maintenance of any tracks is to be in accordance with the provisions of the Walking Track Management Manual (Blamey 1987).

4.2 PROTECTION OF THE FORESHORE AND VALUES ON ADJACENT LAND

Many natural and cultural values of high conservation value found in the Moulting Lagoon area are located outside the boundaries of the game reserve and therefore may not be given the same degree of protection as those values found within.

The Moulting Lagoon foreshore has been considerably damaged in many areas. Where the foreshore is unfenced, access by vehicles and trampling by livestock has broken and destroyed the protective vegetative mat and caused bogging of the soil. Clearing of the shrub and tree canopy from the upper levels, as well as grazing by livestock on the foreshore and above, has changed the plant composition, contributed to sedimentation of the lagoon, and likely modified the microhabitats of the area. Areas back from the foreshore, but also contributing to the immediate ecology of the lagoon, have also been degraded. The fresh-water and brackish ponds along the south-eastern shore, historically important places for waterfowl during certain times, have been largely modified. Some lagoons, such as Little Punchbowl, have been drained for grazing and the topsoil excavated for loam.

- Inform landowners that the area has great Aboriginal heritage significance and encourage them to be sensitive to this significance in their day-to-day activities.
- Investigate the natural/cultural values of adjacent Crown land to determine whether the reserve can be enhanced by further extensions. The lease for the gravel pit on this land was surrendered in 2000 and the area could now be incorporated in the reserve.
- Investigate adjacent private land, with the permission of the landowners/managers, to determine if it contains natural/cultural values that would further enhance those found in the reserve.
- Liaise with landowners in order to protect these values via mechanisms such as purchase of the land, land swap, donation of the land by the owner, private wildlife reserve or covenants.
- Liaise with and encourage landowners to protect the lagoon foreshore by a variety of methods such as fencing to prevent stock access, tree planting and the development of no-plough zones. These projects may be achieved through government environmental programs such as Landcare and/or Coastcare.
- Support and provide assistance and advice, if required, in the preparation of grant applications that will help to protect the lagoon and/or the environment in general.
- Seek cooperation of the adjacent landowner to rehabilitate whitebait and drainage channels around Little Bay, and reinstate natural drainage.
- Areas of potentially high natural/cultural values include:
 - land between the game reserve and the Friendly Beaches section of the Freycinet National Park providing a wildlife corridor between the reserves
 - Crown land block containing the gravel pit at the northern end of Moulting Lagoon providing a wildlife corridor between the two parts of the game reserve
 - smaller wetland areas on private property such as Big and Little Punchbowl and Barney Wards Lagoon
 - the Long Point peninsula
 - the stand of native vegetation behind Breakfast Point.

4.3 GEOCONSERVATION

Management of geodiversity in the reserve aims to maintain the natural rates and magnitudes of change and to protect sites of geoconservation significance.

- Protect the geodiversity of Moulting Lagoon.
- Conduct surveys to identify requirements for geoconservation prior to the commencement of any developments.
- Ensure that all developments are conducted in consultation with relevant specialists.

4.4 REHABILITATION

- Restore and rehabilitate habitats and areas that have been degraded.
- Monitor erosion of soils, roads or tracks within the reserve and undertake action in consultation with specialists to rehabilitate and restore damaged areas particularly at Kittys Mistake, around Breakfast Point and south towards Barney Wards Bay.

4.5 PROTECTION OF LANDSCAPE VALUES

- Ensure that all structures and facilities are constructed so as not to intrude on the values of the reserve and in keeping with the objectives of this management plan.
- Conduct cultural landscape surveys before the commencement of any developments.

4.6 PROTECTION OF FLORA AND FAUNA

There is potential for conflict between maintenance of the recreational and economic uses of the lagoon and preservation of its value as habitat for important species of fauna, primarily waterfowl. Blackhall (1985) suggested that swan nesting around Apsley Marshes and Sabinas, Cockatoo and Top Bank Islands had declined up to 80% from that reported over the previous 20 years due to vegetative change on the islands and that general disturbance in the Sanctuary – Apsley Marshes area contributed to the decline. Alternatively, there are claims from some local residents that swans are greatly overpopulated relative to historic numbers and that they are out competing other species particularly because of their longer reach and differing technique when feeding. The available evidence does not support these claims.

During the hunting season ducks are extremely sensitive to disturbance. Therefore, the effectiveness of the Sanctuary (see Map 2) as a refuge for waterfowl during this period may be compromised due to the permitting of recreational activities in the area. Activities such as fishing, birdwatching, walking etc. within the Sanctuary during this period may result in the birds being flushed away from cover and/or out of the Sanctuary.

A process of consultation and negotiation is underway to phase out the use of lead shot for duck hunting and to find suitable alternative shot.

Finally, sedimentation may be negatively affecting benthic flora and fauna, damaging the integrity of the lagoon and eliminating a food source for some waterfowl; sedimentation and turbidity may also affect submerged and emergent vegetation, including seagrasses. The latter could be critical, since the condition of seagrass communities may be the best direct indicator of the overall health of the estuarine community (Rees 1993).

4.6.1 Flora

- Give maximum protection to the threatened plant species and plant communities of high conservation value within the reserve. Collection of all species will be in accordance with relevant statutory requirements.
- Monitor the threatened plant species and undertake research and management actions to ensure their survival.
- Limit public access to areas of threatened species if monitoring and/or research shows this to be necessary.
- Survey the submerged and emergent vegetation throughout the lagoon to examine the natural food sources available to waterfowl and other waterbirds.
- Design and implement a seagrass monitoring program.
- Encourage the involvement of community and volunteer groups in weed management programs in the reserve.
- Prepare education and interpretive material for visitors including information on the importance of the reserve for the protection of threatened species and communities, together with descriptions of the characteristics of the vegetation.

4.6.2 Fauna

- Stabilise, revegetate and manage nesting islands within the lagoon.
- Continue to close the Sanctuary and adjacent game reserve land, between the Sanctuary and the Coles Bay Road, to the public during the duck hunting season. This will prevent human disturbance, particularly rousing, of the waterfowl within.
- Conduct a survey of the aquatic macro and micro invertebrates of the lagoon to establish baseline information and to examine the natural food sources available to waterfowl and other waterbirds.
- Identify key indicator species of the lagoon and monitor to determine the health of and changes within the lagoon.
- Continue to monitor waterfowl numbers and other bird species dependent upon the Ramsar wetland complex.
- Attempt to assess the historic composition of waterfowl populations particularly in relation to swan numbers.
- Continue community education and surveillance of the reserve to minimise poaching, illegal shooting and other violations.
- Enforce the use of non-toxic shot for duck hunting.
- Conduct regular research to determine lead levels in waterfowl and the lagoon environment.
- To reduce disturbance to waterfowl, jet-skiing, water-skiing and wind-surfing will only be permitted in the lagoon east of Point Meredith, between Point Meredith and Swanwick, subject to the provisions of the National Parks and Reserves Regulations 1971.
- Prepare educational and interpretive material including information on the importance of the reserve for the protection of threatened fauna species, waterbirds and migratory waders, as well as minimal impact boating around waterbirds.
- Survey wildlife thought to be causing problems to adjacent landowners and, as necessary, assist owners to minimise impacts.

4.6.3 Introduced Species

A number of introduced species have become established in the reserve.

- Eradicate introduced plants and animals from the reserve wherever feasible and warranted by the damage being caused by them. Control and containment of the introduced species will be the objective if eradication is not possible.
- Continue to eradicate/control South African boxthorn on Sabinas Island.
- Monitor and prevent the spread of introduced species in nearby areas, such as rice grass found at Little Swanport, and control/eradicate any infestations according to established procedures.

4.7 WATER QUALITY

Maintenance of water quality is a primary consideration, as water is the basis for the ecological structure of the lagoon. The Department of Community and Health Services already monitors water for contaminants which might threaten oyster production, including coliform counts, temperature and salinity, mineral content and bacteria. However, other concerns, such as dissolved solids, turbidity, eutrophication from agricultural fertilisers and high concentrations of waterfowl, as well as bacterial contamination from surrounding residential development are not being addressed. In addition, it is of the utmost importance to quantify sedimentation and identify its sources, in order to allay controversy and direct management. Parameters for measuring the health and status of estuaries including Moulting Lagoon may allow long term monitoring to be established and continued (Murphy, in prep.).

- Survey and monitor water bodies within the reserve to establish standard physicochemical baseline data. Components of the survey will include oxygen levels, light penetration, dissolved solids and micro- and macronutrients.
- Conduct research to examine the rates, foci and sources of sedimentation in the lagoon and its tributaries, including the possible effects of large swan populations.
- Consult with landowners, Landcare representatives, Forestry Tasmania and other relevant parties to control/reduce erosion and sedimentation within the catchment.
- Liaise with organisations such as Rivers and Water Supply Commission, CSIRO, Waterwatch, Moulting Lagoon Catchment Management Group, student school network, University of Tasmania, Tasmanian Aquaculture and Fisheries Institute and other government departments and/or community groups to develop and implement programs aimed at monitoring the health and status of the wetland and estuary.
- Liaise with adjacent land users/owners to develop buffer zones along watercourses to reduce runoff of sediment, pesticides and fertilisers.
- Encourage the use of integrated waste-water treatment systems based on absorption with no discharge, and alternatives to septic tanks, amongst adjacent landowners, in order to protect the quality of ground water and to minimise nutrient leaching into the lagoon.

4.7.1 Water Quality Policy

The State Policy on Water Quality Management requires that Protected Environmental Values (PEVs) and water quality objectives are set for all waterbodies around the state. The following Protected Environmental Values are proposed for the Moulting Lagoon Game Reserve, having regard for the values for which the site is listed under the Convention on Wetlands (Ramsar 1971) and for

the management objectives for game reserves outlined in Schedule 4 of the *National Parks and Reserves Management Act 2002*.

- A Protection of Aquatic Ecosystem.
- (i) modified ecosystem from which edible fish are harvested and having regard to the values for which the site is listed under the Convention on Wetlands of International Importance (Ramsar)
 - (ii) modified ecosystem from which shellfish are harvested in certain areas as permitted under the management plan or regulations.
- B. Recreational Water Quality and Aesthetics
- (i) primary contact between Point Meredith and the mouth of Great Swanport (for activities which are permitted under the management plan or regulations)
 - (ii) secondary contact (for activities which are permitted under the management plan or regulations)
 - (iii) aesthetics.

That is, as a minimum, the water quality of surface waters in Moulting Lagoon shall be managed to provide water of a physical and chemical nature which will support a healthy but modified aquatic ecosystem recognising the use of the surrounding area for grazing, and from which edible fin-fish and shellfish are harvested and which will allow people to safely engage in recreational activities such as swimming, kayaking and paddling in aesthetically pleasing waters.

4.7.2 Environmental Flows

The DPIWE is undertaking a program of identifying environmental flows for water-bodies around the state, including for the Swan River and the wetlands of Moulting Lagoon.

- Ensure that the ecological requirements of Moulting Lagoon are accounted for in establishing environmental flows for the Swan River, and are appropriately considered in the assessment and development of any further irrigation infrastructure and water catchment strategies that may have an impact on these requirements.

4.7.3 Catchment Management

The Moulting Lagoon Catchment Management Group has representatives from Forestry Tasmania, PWS, farming, local business, council and aquaculture and is funded by the Natural Heritage Trust to develop a strategy for the Moulting Lagoon catchment. This covers the Swan, Apsley and Wye rivers and their tributaries. The group has identified key issues and made preliminary recommendations, including fencing riparian areas. A draft strategy has been developed and released for public comment.

- Ensure that the ecological requirements of Moulting Lagoon are appropriately considered in the assessment and development of water catchment strategies that may have an impact on these requirements.
- Assist, where possible, implementation of the recommendations of the Swan–Apsley Catchment Management Plan that improve water quality and estuarine health.

4.8 CULTURAL HERITAGE

Little work has been done to identify and assess the archaeological resources of the reserve. Although only a small number of Aboriginal or historic heritage sites have been recorded in the reserve it is likely that many more sites exist because of the extensive use made of the lagoon in the past. It is reported that up to 10 Aboriginal bands of the Oyster Bay tribe used the lagoon on an annual basis to harvest swans and their eggs. Similarly, European settlers arrived in the area in the early 1820s and used Moulting Lagoon and the Swan River for access, recreation and industry.

- Undertake management of Aboriginal heritage in the reserve in consultation with representatives of the Tasmanian Aboriginal Land Council and according to the guidelines agreed to between the PWS and the Council.
- Conduct a preliminary survey for Aboriginal and historic heritage resources in the reserve. Strategies to identify and conserve such sites will be developed and implemented.
- Record sites on the Tasmania Aboriginal Site Index or the Tasmanian Historic Places Inventory.
- Liaise with users to better understand living cultural heritage.
- Consult with specialist staff and conduct surveys prior to the approval of any developments in order to identify any cultural resources that may be affected and avoid or mitigate any damage.
- Conduct surveys for Aboriginal sites only with the approval of the Tasmanian Aboriginal Land Council.
- Incorporate the Aboriginal use of the lagoon into interpretive and educational resource materials developed in consultation with the Tasmanian Aboriginal Land Council.

4.9 RECREATION AND TOURISM

In keeping with the game reserve status of the area, duck hunting will be permitted during the designated duck hunting season. Campers are encouraged to use the Freycinet National Park for camping rather than the game reserve. If camping is to occur in the reserve it should be limited to the parking/camping area at Kittys Mistake or an area on River and Rocks Road. Fireplaces have been established at this site but no other camping facilities have been provided.

Boat speeds in the Moulting Lagoon Game Reserve should match the requirements of user safety as well as protection of fauna and the wetlands environment, particularly the waterfowl and shorelines. It is an offence under the Marine and Safety (Motor Boats and Licences) By-Laws 1998 Section 28(3) (b) to travel at a speed faster than 5 knots within 60 m of:

- (i) any shoreline, river bank, diving platform or marine facility
- (ii) any boat under way, at anchor, moored, or engaged in fishing or in rowing
- (iii) any buoy laid by or with the approval of the Marine Safety Authority
- (iv) any person on waterskis, an aquaplane, or similar object being towed by another boat.

Under Section 28 (c) it is an offence to travel at a speed faster than 5 knots within 120 m of:

- (i) any person bathing
- (ii) any vessel or buoy displaying the signal letter 'A' of the International Code of Signals which signifies 'I have a diver down; keep well clear at slow speed'.

Under the Tasmanian Recreational Sea Fishing (Scalefish) Rules 1998 Section 86 (b) the following conditions apply to fishing in Moulting Lagoon: a person must not

use a net, other than a bait net or a landing net, in Moulting Lagoon, King Bay, Pelican Bay and all the waters north of the line of latitude through Point Bagot. No licence is needed for rod and line fishing in marine waters.

- Continue to license duck hunting hides within the reserve under the *National Parks and Reserves Management Act 2002*.
- Continue to remove all unclaimed and unlicensed hides in the reserve.
- Monitor the impact of camping at Kittys Mistake parking/camping area. Further management decisions will be made based on the results of this monitoring, and this may include prohibiting camping.
- Encourage the use of minimal impact recreational practices.
- Jet-skiing, water-skiing and wind-surfing will only be permitted on the lagoon below Point Meredith, between Point Meredith and Swanwick subject to the National Parks and Reserves Regulations 1971.
- Encourage boat users to observe boat safety, protection of fauna (especially waterfowl) and shorelines in determining boat speeds, and to comply with appropriate boating regulations.
- Encourage tourism ventures that focus on the natural and cultural values of the reserve provided they do not compromise other uses.

4.10 INTERPRETATION AND EDUCATION

4.10.1 Interpretation

The recreational and environmental values of Moulting Lagoon Game Reserve are not widely appreciated outside the relatively small groups of hunters, fishers and birdwatchers. There are only two interpretation display signs in the reserve.

- Erect interpretive signs at locations strategic to the reserve such as at Meredith Point. These signs will provide information on:
 - the Ramsar Convention
 - the reasons for the reserve being included on the Ramsar list
 - the natural and cultural values of the reserve, in particular the threatened species and bird life
 - appropriate recreational activities within the reserve
 - any relevant restrictions.
- Produce brochures/notesheets for the reserve explaining its Ramsar listing, values and management requirements, and promoting the reserve as a resource for ecotourism, interpretation, environmental education and recreation. Distribute the information as part of the duck hunting permit process, and to other reserve users.
- Provide information in the form of display boards, brochures and/or any other means at prominent places in the area such as Freycinet National Park, the Coles Bay Road turnoff and the lookout overlooking Moulting Lagoon on the Tasman Highway.
- Construct/improve signs at existing observation points, particularly at the carpark on the Coles Bay Road (Top Bank).
- Provide a screened observation point at Top Bank by either screening or planting locally sourced vegetation, to minimise disturbance to the waterfowl and create wildlife viewing opportunities.
- Develop a carpark, nature observation track, bird observation hide and interpretive area at Pelican Rocks (or at another location if this is deemed unsuitable or a more suitable location is proposed) to provide visitors with an opportunity to view wildlife at close quarters.

4.10.2 Education

The reserve has the potential to be a particularly important educational resource for natural science on the east coast and could be used by school groups, environmental groups and others.

- Liaise with organisations such as Landcare groups, hunting groups, schools etc. to encourage the participation of local residents and members in monitoring and education programs.
- Encourage suitable educational programs in the reserve.
- Prepare guidelines advising reasonable group size, adequate supervision and encouraging the use of qualified personnel to minimise the impacts of education programs conducted in the reserve.
- Prepare guidelines on minimal impact boating around waterbirds and mudbanks, and distribute amongst visitors, ecotourism operators and recreational users of the reserve.
- Prepare educational resource kits or other aids for school groups.

4.11 COMMUNITY LIAISON

Activities on land adjacent to the lagoon and within the Swan and Apsley River catchments have the potential to have considerable impact on the reserve values. Management of activities in and adjacent to the reserve is essential in order to conserve these values.

One way of involving the community in management of the reserve is to establish a community co-management group to meet several times a year with the managing authority to discuss management priorities and programs, problems or conflicts and to encourage volunteer participation in projects. Membership could include but not be restricted to representatives from each of the following:

- Parks and Wildlife Service
 - Nature Conservation Branch
 - Glamorgan Spring Bay Council
 - Glamorgan Spring Bay Landcare Group
 - Tasmanian Aboriginal community
 - Tasmanian Aquaculture and Fisheries Institute
 - local business interests
 - local recreation groups
 - local conservation groups
 - local historical groups
 - local community
- Establish a community co-management group to meet within three months of gazettal of this plan.
 - Encourage and support the development of friends and volunteer programs in the reserve including Landcare, Coastcare, Wildcare, Waterwatch etc.
 - Develop good working relations with adjacent landowners and managers, hunters, local community groups and the Aboriginal community in matters of mutual interest.
 - Liaise with appropriate community interest groups, for instance in assessing historic and living cultural resources and conducting weed management programs in the area.
 - Liaise with aquaculture operators to ensure expansion or changes in their operations do not negatively affect the lagoon.
 - Liaise with the tourism industry, recreational and educational groups regarding commercial and non-commercial uses of the reserve.

- Consult and cooperate with other authorities in relation to fire protection and search and rescue.
- Consult with the Glamorgan Spring Bay Council in order to have input into the planning scheme for development within the Moulting Lagoon catchment or areas adjacent to the lagoon (e.g. residential development along Nine Mile Beach).
- Liaise with the Moulting Lagoon Catchment Management group, landowners and managers within the catchment of Moulting Lagoon to ensure that activities within the catchment do not negatively affect the lagoon values.
- Seek the support of a community group to establish and maintain an estuarine health monitoring program on a long-term basis.

4.12 RESOURCE USE

Use of the lagoon for aquaculture, particularly oyster farming, provides a medium for maintaining a base level of water quality monitoring, and provides an economic incentive to maintain water quality. Oyster racks provide additional perches for birds, and tours to oyster operations maintain some level of awareness among the public of the lagoon's values. Existing oyster farms continue to operate within the game reserve as a pre-existing right, being operational before the lagoon was declared a reserve.

- In cooperation with the operators, monitor the effects of expansion/modification of the oyster farms and implement strategies to alleviate any adverse effects.
- No new leases will be permitted in the reserve but existing operations may be modified in accordance with their lease conditions, provided the total area leased does not exceed that existing prior to proclamation of the reserve.

4.13 RESEARCH AND MONITORING

In order to understand the ecological processes involved in the maintenance of the flora and fauna species and communities in the reserve it is essential that research and ongoing monitoring is conducted. The data are essential for informed decision-making by management and, until studies have been completed, definitive prescriptions cannot be made for relevant plant and animal species. The focus of the research should be to monitor the health and status of the wetland and estuary, and to apply the results directly to management of the land and to land management practices that affect the reserve. Funding for such research and monitoring should be of a high priority.

4.13.1 Priorities for Research and Monitoring Programs

- Surveying and monitoring of wetland areas within the reserve to establish physicochemical baseline data. A long-term water quality program will be established.
- A long-term program monitoring the health and status of the wetland and its estuary, using parameters that can be measured by community groups, that are relevant to land managers and adjacent land owners.
- A periodic count of bird species dependent upon the Ramsar wetland complex.
- Monitoring and research into the distribution, abundance and control of introduced animals, plants and disease will be directed towards determining appropriate management and control measures.
- Investigation of whether a practical and feasible monitoring program of fish catches within the reserve could be developed through discussion between

the management authority, the Nature Conservation Branch, the Tasmanian Aquaculture and Fisheries Institute, and recreational fishers.

- A study and report presenting all available data on the natural history of Moulting Lagoon, including: the historic development and clearing of the foreshore and within the lagoon catchment; historic use as a hunting and fishing area; historic swan populations relative to other waterfowl; boating use; commercial fishing; and water diversion and use within the Swan and Apsley Rivers.
- Research to determine the rates, foci and sources of sedimentation.
- Research to obtain information necessary for management of threatened species.
- Identify gaps in the baseline data on the flora and fauna of the reserve and undertake surveys as necessary. In particular an invertebrate and aquatic plant survey of the lagoon and the monitoring of seagrass beds should be conducted.
- Identify gaps in the baseline data on the cultural heritage of the reserve and undertake surveys as necessary.

4.13.2 Approval for Research Programs

- Authorities are required from the Director for the collection of specimens for research purposes within the reserve.
- The Tasmanian Aboriginal Land Council must be consulted, and an authority obtained under the *Aboriginal Relics Act 1975*, for archaeological projects involving Aboriginal heritage.
- All research is to be undertaken in a manner consistent with the management objectives given in Part 3, and must not have any long-term adverse effects on the natural, cultural or aesthetic values of the reserve.

4.13.3 Current Research Programs

Current research projects in the reserve that will continue include:

- the monitoring of waterfowl and their numbers by PWS and the Nature Conservation Branch.
- water quality monitoring of the aquaculture farms by the Department of Human and Health Services.

REFERENCES

- Anon. 1986, Use of lead shot for hunting migratory birds in the United States, Environmental Impact Statement, final supplement, U.S. Fish and Wildlife Service.
- Australian Bureau of Agricultural and Resource Economics (ABARE) 1995, *Australian Fisheries Statistics, 1995*.
- Blackhall, SA 1984, *Moulting Lagoon Proposed Game Reserve, Stage I – Planning for the reservation and management of a wetland of international importance*, project report, National Parks and Wildlife Service, Tasmania.
- Blackhall, SA 1985, *Moulting Lagoon Proposed Game Reserve, Stage II – Planning for the reservation and management of a wetland of international importance*, Draft Planning Document for Discussion, National Parks and Wildlife Service, Tasmania.
- Blamey, N 1987, *Walking Track Management Manual*, Department of Parks, Wildlife and Heritage and Australian National Parks and Wildlife Service, ACT.
- Bradbury, J 1993, A preliminary geoheritage inventory of the eastern Tasmanian terrain, unpublished report, Parks and Wildlife Service, Tasmania.
- Brown, S 1991, *Aboriginal archaeological sites in eastern Tasmania, a cultural resource management statement*. Occasional Paper No. 31, Tasmania Department of Parks, Wildlife and Heritage, Hobart.
- Christidis L and Boles, WE 1994, *The taxonomy and species of birds of Australia and its territories*, Royal Australasian Ornithologists Union Monograph 2. RAOU, Melbourne.
- Davenport, W and Amos, R 1988, *Glamorgan, Tasmania: The oldest rural municipality in Australia*, Glamorgan Municipal Council, Tasmania.
- Davis, TJ (ed.) 1994, *The Ramsar Convention manual: a guide to the Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, Ramsar Convention Bureau. Gland, Switzerland.
- Dredge, PD 1993, *Impact of feral cats on Tasmanian native fauna: research plan and progress report*, unpublished report to ANCA, Parks and Wildlife Service, Tasmania.
- Flora Advisory Committee 1994, Native higher plant taxa which are rare or threatened in Tasmania, Edition 1, *Species at risk, Tasmania – Flora*, Parks and Wildlife Service, Tasmania.
- Department of Primary Industries, Water and Environment 2003, *Game Tracks*, Issue 8, Tasmania.
- Hemsley, JH 1973, *Black swan in Tasmania*, National Parks and Wildlife Service, Tasmania.
- Hermes, M 1996, Memo to Robbie Gaffney re: Moulting Lagoon draft plan of management, Parks and Wildlife Service, Tasmania file note, File 505701.
- Last, PR 1983, Aspects of the ecology and zoogeography of fishes from soft-bottom habitats of the Tasmanian shore zone, PhD thesis, Department of Zoology, University of Tasmania, Hobart.
- Parks and Wildlife Service 1995, *Freycinet National Park Management Plan*, Parks and Wildlife Service, Tasmania.
- Pemberton, M 1995, Moulting Lagoon drains and natural inlets. Parks and Wildlife Service file note, File 502902 (vol 2).
- Ramsar Convention Bureau 1998, Contracting Parties to the Ramsar Convention on Wetlands, internet site posted 10 January 1998, http://www.iucn.org/themes/ramsar/key_cp_e.htm
- Rees, CG 1993, Tasmania seagrass communities. Master's thesis, Centre for Environmental Studies, University of Tasmania, Hobart.

- Reservation and Conservation Status Data Base 1994, *The reservation and conservation status of Tasmania's native higher plant taxa*. Parks and Wildlife Service, Tasmania.
- Rivers and Waters Supply Commission 1983, *Stream Flow Information*, Rivers and Waters Supply Commission, Hobart, Tasmania.
- Ryan, L 1981, *The Aboriginal Tasmanians*, University of Queensland Press.
- Schokman, C 1987, Pelican Rocks, *BOAT Newsletter*, vol. 17, no. 6.
- Schokman, FCM 1991, Some observations on the birds of Moulting Lagoon, *Tasmanian Bird Report of the Bird Observers Association of Tasmania*, no. 20, pp. 4-17.
- Smith, OL Goede, A and Blackhall, S 1995, Lead contamination of waterfowl in Tasmania by ingestion of shotgun pellets from duck hunting, *Wildlife Research*, Vol X, No X, pp. 609-623.
- Sustainable Development Advisory Council 1996, *State of the environment, volume 1 – condition and trends*, compiled by the State of the Environment Unit, Land Information System, Department of Environment and Land Management, Tasmania.
- Wood, JM 1988, An environmental examination of sedimentation in Lindisfarne Bay. (Master's thesis). Centre for Environmental Studies, Department of Geography and Environmental Studies, University of Tasmania, Hobart.

Appendix I

Implementation Schedule

Reference	Prescription	Priority
4.1.1	Close vehicle tracks according to plan	H
4.2	Investigate and protect natural/cultural values of adjacent crown land	H
4.2	Encourage landowners to protect and prevent erosion of lagoon foreshore	H
4.2	Inform landowners that the area has great Aboriginal heritage significance and encourage them to be sensitive to this significance in their day-to-day activities	H
4.3	Conduct geoheritage surveys prior to the commencement of any developments	H
4.5	Ensure that all structures and facilities are constructed so as not to intrude on the values of the reserve and in keeping with the objectives of this management plan	H
4.5	Conduct cultural landscape surveys prior to the commencement of any developments	H
4.6.2	Continue to monitor waterfowl numbers	H
4.6.2	Support the process of phasing out lead shot	H
4.7	Liaise with adjacent landowners to develop buffers along watercourses	H
4.7	Encourage the use of integrated waste water treatment systems	H
4.8	Survey of potential historic and Aboriginal archaeological sites	H
4.9	Continue to implement licence system for shooting hides	H
4.10.1	Erect interpretive display boards informing visitors of the natural and cultural values of the reserve, Ramsar, appropriate recreational activities and any restrictions which apply	H
4.11	Liaise with, and encourage the participation of, stakeholders and community groups in the management of the reserve	H
4.13.1	Research into management and ecological requirements of threatened species	H
4.4	Monitor areas of erosion and rehabilitate where necessary	M
4.4	Restore and rehabilitate habitats and areas that have been degraded	M
4.6.1	Monitor, research and manage threatened plant species	M
4.6.1	Identify key indicator plant species of the reserves wetlands	M
4.6.1	Survey submerged and emergent vegetation of the lagoon	M
4.6.1	Monitor seagrass	M
4.6.2	Manage nesting islands within the lagoon	M
4.6.2	Close the sanctuary and adjacent part of game reserve to the public, during the duck hunting season, to prevent disturbance to waterfowl	M
4.6.2	Survey aquatic macro and micro invertebrates of the lagoon	M
4.6.2	Identify key indicator fauna species of the reserve's wetlands	M
4.6.3	Wherever possible introduced species will be eradicated or controlled	M
4.6.3	Monitor the spread of introduced species (e.g. rice grass) found in nearby areas	M
4.7	Survey and monitor physicochemical properties of wetlands	M
4.7	Survey to determine the rates, foci and sources of sedimentation	M
4.9	Permit jet-skiing, water-skiing and wind-surfing in the reserve only between Meredith Point and Swanwick	M
4.9	Promote the reserve for ecotourism, interpretation and education	M
4.1.2	Investigate the construction of walking tracks within the reserve, particularly at the Pelican Rocks interpretive area	L
4.2	Seek cooperation of neighbours to reinstate natural drainage on adjacent land	L
4.6.2	Assess historic composition of waterfowl populations	L
4.6.2	Survey wildlife thought to be causing problems to adjacent landowners	L
4.9	Encourage minimal impact bushwalking techniques	L
4.9	Remove unclaimed/unlicensed hides	L
4.10.1	Produce a notesheet about the game reserve and its values	L
4.10.2	Produce educational resource kits about the game reserve and its values	L
4.12	Monitor the effects of changes to oyster farms and, as necessary, implement strategies to minimise any adverse effects.	L

Appendix 2

Criteria Applied to Identify Moulting Lagoon as a Ramsar Site

Note: Below are the criteria that were applied at the time of Moulting Lagoon's designation as a Ramsar site. A new set of criteria was adopted at the 7th Conference of Contracting Parties to the Convention on Wetlands in Costa Rica, May 1999. The new criteria can be found on the Ramsar Convention Bureau website at: http://ramsar.org/key_criteria.htm

(Annex to Recommendation C.4.2)

A wetland is identified as being of international importance if it meets at least one of the criteria set out below.

1. Criteria for representative or unique wetlands

A wetland should be considered internationally important if:

- a) it is a particularly good representative example of a natural or near-natural wetland, characteristic of the appropriate biogeographical region; or
- b) it is a particularly good representative example of a natural or near-natural wetland, common to more than one biogeographical region; or
- c) it is a particularly good representative example of a wetland, which plays a substantial hydrological, biological or ecological role in the natural functioning of a major river basin or coastal system, especially where it is located in a trans-border position; or
- d) it is an example of a specific type of wetland, rare or unusual in the appropriate biogeographical region.

2. General criteria based on plants or animals

A wetland should be considered internationally important if:

- a) it supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal, or an appreciable number of individuals of any one or more of these species; or
- b) it is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna; or
- c) it is of special value as the habitat of plants or animals at a critical stage of their biological cycle; or
- d) it is of special value for one or more endemic plant or animal species or communities.

3. Specific Criteria Based on Waterfowl

A wetland should be considered internationally important if:

- a) it regularly supports 20,000 waterfowl; or
- b) it regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity; or
- c) where data on populations are available it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl

Guidelines for application of the criteria

To assist Contracting Parties in assessing the suitability of wetlands for inclusion on the List of Wetlands of International Importance, the Conference of the Contracting Parties has formulated the following guidelines for application of the Criteria:

- a) **A wetland could be considered of international importance under Criterion I if, because of its outstanding role in natural, biological, ecological or hydrological systems, it is of substantial value in supporting human communities dependant on the wetland. In this context, such support would include:**

- provision of food, fibre or fuel; or
- maintenance of cultural values; or
- support of food chains, water quality, food control or climatic stability.

The support, in all its aspects, should remain within the framework of sustainable use and habitat conservation, and should not change the ecological character of the wetland.

or

- b) A wetland could be considered of international importance under Criterion 1, 2 or 3 if it conforms to additional guidelines developed at regional (eg Scandinavian or West African) or national level. Elaboration of such regional or national guidelines may be especially appropriate:**

- where particular groups of animals (other than waterfowl) or plants are considered more suitable as a basis for evaluation; or
- where waterfowl and other animals do not occur in large concentrations (particularly in northern latitudes); or
- where collection of data is difficult (particularly in very large countries).

or

- c) The 'particular groups of waterfowl, indicative of wetland values, productivity or diversity' in Criterion 3 (b) include any of the following:**

- loons or divers: Gaviidae
- grebes: Podicipedidae
- cormorants: Phalacrocoracidae
- pelicans: Pelicanidae
- herons, bitterns, storks, ibises and spoonbills: Ciconiiformes
- swans, geese and ducks (wildfowl): Anatidae
- wetland related raptors: Accipitriformes and Falconiformes
- cranes: Gruidae
- shorebirds or waders: Charadrii
- terns: Sternidae.

or

- d) The specific criteria based on waterfowl numbers will apply to wetlands of varying size in different Contracting Parties. While it is impossible to give precise guidance on the size of an area in which these numbers may occur, wetlands identified as being of international importance under Criterion 3 should form an ecological unit, and may thus be made up of a big area or a group of smaller wetlands. Consideration may also be given to turnover of waterfowl at migration periods, so that a cumulative total is reached, if such data are available.**

Appendix 3

Moulting Lagoon Game Reserve – Ramsar Listing

Categories approved by Recommendation 4.7 of the Conference of Contracting Parties.

1. **Form compiled by:**
Stewart Blackhall, Anne McEntee and Elizabeth Rollins, Department of Primary Industries, Water and Environment, 134 Macquarie Street, Hobart 7003
2. **Sheet last modified:**
2003
3. **Country:**
Australia
4. **Name of Ramsar site:**
Moulting Lagoon
5. **Map of site included?**
a) hard copy:
b) digital (electronic) format:
6. **Geographical coordinates:**
42 degrees 02' 00", 148 degrees 10' 00"
7. **General Location:**
The lagoon is situated on the central east coast of Tasmania, between the townships of Swansea and Bicheno. The estuary lies at the head of Great Oyster Bay where the Freycinet Peninsula extends offshore.
8. **Elevation:**
Less than 20 m ASL.
9. **Area:**
4507 ha.
10. **Overview:**
A large estuary at the mouths of the Swan and Apsley Rivers, on the east coast of Tasmania, adjacent to, and continuous with, the Apsley Marshes (another Ramsar site). The lagoon with several sections of coastal reserve surrounding it, and an additional area of dry land 1 km north comprise Moulting Lagoon Game Reserve. The lagoon provides important nesting, roosting and breeding habitat for the numerous resident waterfowl.
11. **Ramsar Criteria:**
1, 2, 3, 4, 8
12. **Justification of criteria under point 11:**
Moulting Lagoon is one of the largest and most significant wetland areas in Tasmania. The lagoon supports a number of species and communities which are rare or vulnerable in Tasmania. It is a significant site for the Common Greenshank (*Tringa nebularia*) which is listed under both the China - Australia Migratory Bird Agreement (CAMBA) and the Japan - Australia Migratory Bird Agreement (JAMBA). The lagoon regularly supports the largest known Tasmanian flock of the migratory Greenshank. It also provides an important resting and breeding ground for many species of migratory birds and fish, and an important drought refuge. Having a substantial catchment, it plays a vital hydrological role in the region. Moulting

lagoon and the surrounding area is of cultural significance to both Aboriginal and European people.

13a. Biogeographic region:

Freycinet

13b. Biogeographic regionalisation scheme:

Environment Australia 2000. Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1. - Summary Report. Department of Environment and Heritage, Canberra.

14. Physical Features:

This lagoon formed with the partial closure of the mouths of the Swan and Apsley Rivers, due to the creation of a Holocene alluvial bar approximately 10 000 years ago. The restriction of flow has resulted in the flooding of the surrounding low lying land and the formation of extensive mudflats where silt carried down by the rivers has been deposited. The underlying bedrock is predominantly Jurassic dolerite.

15. Catchment Area:

16. Hydrological Values:

Catchment areas of the two rivers total just over 900 square kilometres, 228 square kilometres for the Apsley River and 682 square kilometres for the Swan. The remaining foreshore vegetation filters run-off from surrounding farms. The maximum depth of water is 8 m at the mouth of the Swan River, but a typical depth in the lagoon is only 1-1.5 m. The pH is 7. The average annual rainfall of the area is 500 - 625 mm, the average annual rainfall recorded at Swansea being 614 mm.

17. Wetland Type:

F, G, H, M, R

18. Ecological Features:

The lagoon contains areas of both shallow and deep water and is surrounded by periodically exposed mudflats and saltmarsh. The western shore has largely been cleared and is used for livestock grazing while the eastern shore is relatively undisturbed and covered with native vegetation. The plant communities around Moulting Lagoon reflect the wide diversity of terrain and consequent soil drainage patterns. Aquatic vegetation in the estuary is largely composed of seagrasses. The immediate edge of the lagoon supports an almost continuous belt of *Sarcocornia quinqueflora*. Behind that is a fringe of *Juncus kraussii* and beyond in wet areas is *Melaleuca ericifolia*, *Acacia dealbata*, or small stands of *Callitris rhomboidea* with scattered *Allocasuarina* spp., *Banksia marginata* and *Acacia dealbata* on the few rocky outcrops. The vegetation in the shallower areas (*Sarcocornia quinqueflora*, *Juncus kraussii*) provides important nesting, roosting and feeding habitat for the numerous resident waterfowl. Seasonal fluctuations in numbers of birds correspond with rainfall patterns. The estuary is also a nursery area for many fish species with at least fifty-nine species have been recorded in or near the estuary. Moulting Lagoon regularly supports approximately 8000 Black Swan (*Cygnus atratus*) and more than 14 000 have been recorded in dry periods.

19. Noteworthy Flora:

Amphibromus neesii (swamp wallaby grass - Rare; Sr; Threatened Species Protection Act (TSPA) 1995), *Lasiopetalum micranthum* (Tasmanian velvet bush - Vulnerable; Sv; TSPA 1995), *Ruppia megacarpa* (Rare; Sr; TSPA 1995), *Lepilaena patentifolia* (Rare; Sr; TSPA 1995), *Lawrencina spicata*, *Viminaria juncea* (native broom - Endangered; Se; TSPA 1995) and *Asperula scoparia* var. *scoparia* (prickly woodruff - Rare; Sr; TSPA 1995) are all considered to be threatened in Tasmania.

20. Noteworthy Fauna:

Moulting Lagoon is an important breeding area for Black Swan (*Cygnus atratus*) and an important staging area for all the other species of waterfowl in Tasmania, with particularly large summer concentrations of Australian Shelduck (*Tadorna tadoroides*) and Chestnut Teal (*Anas castanea*). It also supports the largest known Tasmanian flocks of Greenshank (*Tringa nebularia*). Full species lists are available in the Moulting Lagoon Game Reserve Management Plan 2000.

21. Social and Cultural Values:

Moulting Lagoon is a highly valued recreation area. The area has been used for fishing and the hunting of waterfowl since European settlement, and for the harvest of waterfowl and their eggs by Aboriginal groups living around the lagoon for an unknown length of time prior to this. The reserve also has commercial value to the local tourism industry and aquaculture operators.

22. Land tenure/ownership:

On site: All of the area below mean high water (M.H.W) mark is Crown land as well as approximately one half of the foreshore to a width of between 30 and 150 metres. Approximately 4760 hectares consisting of all of the estuary plus the adjacent Crown foreshore was declared a Game Reserve in December 1988. This status allows for the hunting of waterfowl during the State's open season, however, the 511 hectares that was previously a Conservation Area is still closed to hunting. Surrounding area: All of the remaining foreshore and the surrounding land is privately owned and is mostly contained in five large pastoral properties.

23. Current land use:

On site: Recreational shooting (about 150 hunters use the area in a season), recreational fishing and boating, aquaculture (Pacific oysters at Pelican Bay and Point Meredith), off-road driving. Surrounding area: Grazing, residential development, mining, aquaculture and recreation.

24. Factors adversely affecting ecological character (past, present, potential):

Past/present: Recreational shooting has resulted in probable contamination of bottom sediments of the lagoon by lead shot pellets. Foreshore access to off-road vehicles is contributing to vegetation loss around the lagoon. Grazing and trampling by stock around the edges of the lagoon has caused damage to vegetation, soil structure and alteration of plant community composition. Clearing of native vegetation has resulted in increased run-off, eutrophication and invasion by weeds. In the wider catchment, land clearance for agriculture, forestry operations and the development of residential areas, are contributing to siltation and eutrophication. Several introduced species are present in the area, these include both terrestrial and aquatic plants, feral cats, toxic dinoflagellates, and the European shore crab (*Carcinus meanus*).

Potential: There is threat of further degradation by agricultural runoff, development encroachment and over-use as a shooting and fishing resource. The numbers of sailboards and shallow draft jet boats being used in shallow protected waterways has increased significantly in other parts of the state and this type of activity would cause disturbance to roosting and feeding birds in this area. Plans to build a water catchment reservoir on the upper Swan river would influence water regimes in the reserve. The plans have been postponed for economic reasons, but are likely to be reconsidered in the future. The root-rot fungus, *Phytophthora cinnamomi*, is present in the nearby Freycinet National Park and is a potentially significant threat to the flora surrounding the lagoon. Feral cats (*Felis catus*) are a potential threat to the lagoon's waterbirds, however, there is no data regarding their impact on the bird fauna at the site.

25. Conservation measures taken:

Moulting Lagoon is listed under the Convention on Wetlands and also on the Register of the National Estate. It is a designated Game Reserve. A management plan written for the area is to be implemented. Netting is prohibited within the lagoon and approximately 10 km of foreshore has been fenced to exclude livestock. Four signs have been erected to explain the

Convention on Wetlands of International Importance and further interpretive displays are planned for the general public. Weed control work has been carried out by Conservation Volunteers Australia under the Revive Program.

26. Conservation measures proposed:

The Australian Bush Heritage Fund intends to acquire a large block of private property on the western shore to add to the conservation values of the area.

27. Current scientific research and facilities:

Waterbirds are counted by the Nature Conservation Branch of DPIWE and the Parks and Wildlife Service twice each year in mid winter and mid summer. A brief study was undertaken to determine the occurrence and distribution of lead shot pellets and their effect on birds. Accommodation for field studies is available in the near by Freycinet National Park.

28. Current conservation education:

The area is frequently visited by amateur bird observers. Interpretive displays are planned for the general public. Four signs describing The Convention of Wetlands of International Importance have been erected at prominent points.

29. Current recreation and tourism:

Approximately 150 duck shooters and several hundred sport anglers use the Moultng Lagoon area. The nearby Freycinet Peninsula is one of Tasmania's prime tourist locations, being utilised for bushwalking, family holidays, water recreation and fishing. Visitor figures for Freycinet National Park were 170 000 in 1998-99. The number of entries to the park has increased by an average of 7% per year since the beginning of the 1990's, this is the highest rate of all of Tasmania's National Parks. The incorporation of Moultng Lagoon in an ecotourism program based at Freycinet Lodge has been discussed.

30. Jurisdiction &

31. Management authority:

Director, Parks & Wildlife Service, Tasmania.

32. Bibliographical references:

Blackhall, S.A. (1986). Moultng Lagoon Proposed Game Reserve Stage II, Planning for the Reservation and Management of a Wetland of International Importance - Revised Draft Plan. National Parks and Wildlife Service, Tasmania.

Brown, S. (1991). Aboriginal Archaeological Sites in Eastern Tasmania - A Cultural Resource Management Statement. Department of Parks, Wildlife and Heritage Occasional Paper No. 31, Hobart.

Flora Advisory Committee (1994). Native plant taxa which are rare or threatened in Tasmania. Parks and Wildlife Service, Tasmania.

Hemsley, J.H. (1973). Black swan in Tasmania. National Parks and Wildlife Service, Tasmania.

Kirkpatrick, J.B., Mendel, L. and Gilfedder, L. (1990). Forest values in the National Estate, Tasmania. A Report to the Australian Heritage Commission, Tasmania.

Smith, O.L. (1995). Lead contamination of waterfowl in Tasmania by ingestion of shotgun pellets from duck shooting. Wildl. Res. 22, 611-23.

Sharpe, M. (1995). Tasmanian wetlands listed under the Ramsar Convention. Unpublished report; Department of Environment and Land Management, Hobart.

Tasmanian Parks and Wildlife Service. (1999). Draft Moulting Lagoon Game Reserve Management Plan. Parks and Wildlife Service, Department of Primary Industries, Water and the Environment, Hobart.

Ramsar Convention. (1990). Classification System for Wetland Types, Montreux. Website:
<http://www.biodiversity.environment.gov.au/envirom/wetlands/ramsar/clasfcn.htm>

Appendix 4

Native Plant Species Recorded in and around Moulting Lagoon Game Reserve

i	=	introduced to Tasmania
e	=	endemic to Tasmania
T	=	within Australia, occurs only in Tasmania
r	=	listed in the schedules of the <i>Threatened Species Protection Act 1995</i> (TSPA) as rare
v	=	listed in the schedules of TSPA as vulnerable
en	=	listed in the schedules of TSPA as endangered
EN	=	listed in the schedules of EPBCA as endangered

source: GTSpot Database, DPIWE July 2000

Scientific Name	Common Name	Risk Code
ANGIOSPERMAE: DICOTYLEDONAE		
<i>Acacia dealbata</i>	silver wattle	
<i>Acacia genitifolia</i>	spreading, early wattle	
<i>Acacia mearnsii</i>	black wattle	
<i>Acacia melanoxylon</i>	blackwood	
<i>Acacia sophorae</i>	coast wattle,	
<i>Acacia suaveolens</i>	sweet wattle	
<i>Acacia terminalis</i>	sunshine wattle	
<i>Acacia verticillata</i>	prickly Moses	
<i>Acaena echinata</i>	sheep's burr	
<i>Acaena novae-zelandiae</i>	buzzy, biddy-widdy	
<i>Acetosella vulgaris</i>	sheep's sorrel	
<i>Acrotriche serrulata</i>	ant's delight	
<i>Allocasuarina monilifera</i>	necklace she-oak	e
<i>Allocasuarina littoralis</i>	black she-oak, bullock	
<i>Allocasuarina verticillata</i>	she-oak, drooping she-oak	
<i>Amperea xiphoclada</i>	broom spurge	
<i>Anagallis arvensis</i>	scarlet pimpernel	i
<i>Angianthus preissianus</i>	salt cup flower	
<i>Aotus ericoides</i>	golden pea, common aotus	
<i>Apium prostratum</i>	sea parsley	
<i>Astroloma humifusum</i>	native cranberry	
<i>Astroloma pinifolium</i>	soft cranberry heath	
<i>Atriplex prostrata</i>	saltbush	
<i>Banksia marginata</i>	silver banksia, honeysuckle	
<i>Bedfordia salicina</i>	Tasmanian blanket leaf	e
<i>Boronia parviflora</i>	swamp boronia	
<i>Bossiaea cinerea</i>	showy bossiaea	
<i>Bossiaea prostrata</i>	creeping bossiaea	
<i>Brachyloma ciliatum</i>	ciliate brachyloma	
<i>Brachyscome aculeata</i>	hill or coarse daisy	
<i>Brachyscome cardiocarpa</i>	swamp daisy	
<i>Bursaria spinosa</i>	prickly box, blackthorn	
<i>Callistemon viridiflorus</i>	prickly bottlebrush	
<i>Carpobrotus rossii</i>	native pigface	
<i>Cassinia aculeata</i>	dolly bush	
<i>Cassytha pubescens</i>	hairy dodder-laurel	
<i>Centaurium erythraea</i>	common centaury	i

<i>Centella cordifolia</i>	centella	
<i>Centipeda minima</i>	spreading sneezeweed	
<i>Chenopodium</i>	pale goosefoot	
<i>Chrysocephalum apiculatum</i>	common everlasting, yellow buttons	
<i>Cirsium vulgare</i>	spear thistle, black thistle	i
<i>Clematis gentianoides</i>	gentian clematis	e
<i>Comesperma volubile</i>	blue love creeper	
<i>Correa reflexa</i>	native fuschia	
<i>Cotula coronopifolia</i>	water buttons	
<i>Crassula decumbens</i>	creeping crassula	
<i>Crassula helmsii</i>	swamp stonecrop	
<i>Crassula sieberiana</i>	Australian stonecrop	
<i>Dampiera stricta</i>	blue dampiera	
<i>Daviesia ulicifolia</i>	native gorse, bitter gorse	
<i>Dichondra repens</i>	kidney-weed	
<i>Dillwynia cinerascens</i>	grey parrot pea	
<i>Dillwynia glaberrima</i>	smooth parrot pea	
<i>Disphyma crassifolium</i>	round-leaved pigface	
<i>Dodonaea viscosa</i>	native or broad-leaved hop-bush	
<i>Drosera peltata</i>	pale sundew	
<i>Drosera pygmaea</i>	dwarf sundew	
<i>Elatine gratioloides</i>	waterwort	
<i>Epacris impressa</i>	common heath	
<i>Epacris lanuginosa</i>	swamp heath, woolly-style	
<i>Epacris obtusifolia</i>	blunt-leaved heath	
<i>Epilobium billardierianum</i>	common willowherb	
<i>Eryngium vesiculosum</i>	prickfoot	
<i>Eucalyptus amygdalina</i>	black peppermint	e
<i>Eucalyptus barberi</i>	Barbers gum	r, e
<i>Eucalyptus globulus</i>	Tasmanian blue gum	
<i>Eucalyptus ovata</i>	swamp, black or marrawah gum	
<i>Eucalyptus viminalis</i>	mannan or white gum	
<i>Exocarpos cupressiformis</i>	native cherry	
<i>Geranium potentilloides</i>	mountain geranium	
<i>Gnaphalium</i>	cudweed	
<i>Gompholobium</i>	bladder-pea, pale wedge-pea, karella	
<i>Gonocarpus micranthus ssp. micranthus</i>	common or creeping raspwort	
<i>Goodenia lanata</i>	native primrose	
<i>Goodenia ovata</i>	parrot's food, hop goodenia	
<i>Gratiola nana</i>	matted brookline	
<i>Grevillea australis</i>	southern grevillea	e
<i>Hakea teretifolia</i>	dagger hakea	
<i>Helichrysum (or Xerochysum) bicolor</i>	curling everlasting	r
<i>Hemichroa</i>	trailing hemichroa	
<i>Hibbertia prostrata</i>	prostrate guinea-flower	
<i>Hibbertia riparia</i>	erect guinea-flower	
<i>Hovea linearis</i>	common hovea	
<i>Hydrocotyle muscosa</i>	mossy pennywort	
<i>Hypericum gramineum</i>	small St Johns wort	
<i>Hypericum japonicum</i>	matted St Johns wort	
<i>Hypochoeris glabra</i>	smooth catsear	
<i>Kennedia prostrata</i>	running postman	
<i>Kunzea ambigua</i>	white kunzea, tick-bush	
<i>Lasiopetalum micranthum</i>	Tasmanian velvet bush	e

<i>Lawrenzia spicata</i>	salt lawrenzia	
<i>Leontodon taraxacoides</i>	hairy hawkbit	l
<i>Leptinella longipes</i>	long cotula	
<i>Leptomeria drupacea</i>	currant bush	
<i>Leptorhynchos squamatus</i>	scaly buttons	
<i>Leptospermum lanigerum</i>	woolly tea-tree	
<i>Leptospermum scoparium</i>	manuka	
<i>Leucopogon ericoides</i>	pink beard-heath	
<i>Lilaeopsis polyantha</i>	Australian lilaeopsis	
<i>Lilaeopsis polyantha</i>	Australian liaeopsis	
<i>Limosella australis</i>	mudwort	
<i>Linum marginale</i>	wild or native flax	
<i>Lobelia alata</i>	angled lobelia	
<i>Lomatia tinctoria</i>	guitar plant	e
<i>Mazus pumilio</i>	swamp mazus	
<i>Melaleuca ericifolia</i>	swamp paperbark	
<i>Melaleuca gibbosa</i>	small-leaved melaleuca	
<i>Melaleuca pustulata</i>	Cranbrook paperbark	e, r
<i>Mimulus repens</i>	creeping monkey flower	
<i>Monotoca elliptica</i>	tree broom-heath	
<i>Myriophyllum</i>	brackish water-milfoil	
<i>Odixia angusta</i>	thin odixia	e
<i>Olearia ciliata</i>	fringed daisy bush	
<i>Olearia ericoides</i>	heathy daisy bush	e
<i>Oxalis perennans</i>	native oxalis	
<i>Pelargonium sp.</i>	pelargonium, geranium	i
<i>Pimelea humilis</i>	common or dwarf rice-flower	
<i>Pimelea flava</i>	yellow rice flower	r
<i>Plantago coronopus</i>	plantain, buck's horn	i
<i>Platylobium obtusangulum</i>	common flat-pea	
<i>Platylobium triangulare</i>	ivy flat-pea	
<i>Pomaderris apetala</i>	dogwood, native hazel	
<i>Pomaderris elliptica</i>	yellow dogwood	
<i>Pomaderris pilifera</i>	hairy yellow dogwood	
<i>Poranthera microphylla</i>	small poranthera	
<i>Pratia irrigua</i>	salt pratia	
<i>Pultenaea dentata</i>	button pea	
<i>Pultenaea pedunculata</i>	matted bush-pea	
<i>Ranunculus</i>	water buttercup	
<i>Rhytidosporum procumbens</i>	marys flower	
<i>Ricinocarpos pinifolius</i>	wedding bush	
<i>Sagina sp.</i>		
<i>Samolus repens</i>	creeping brookweed	
<i>Sarcocornia blackiana</i>	marsh samphire	
<i>Sarcocornia quinqueflora</i>	beaded glasswort or samphire	
<i>Scaevola aemula</i>	fairly fan-flower	
<i>Scaevola hookeri</i>	creeping fan-flower	
<i>Scleranthus biflorus</i>	knawel, twin-flower knawel	
<i>Sclerostegia</i>	shrubby glasswort	
<i>Sclerostegia arbuscula</i>	shrubby glasswort	
<i>Sebaea albidiflora</i>	white sebaea	
<i>Selliera radicans</i>	swamp-weed	
<i>Senecio hispidulus</i>	hill fireweed	
<i>Senecio quadridentatus</i>	cotton fireweed	

<i>Spergularia media</i>	coastal sand-spurry	
<i>Spergularia media</i>	coastal sand-spurry	
<i>Stenanthemum pimeleoides</i>	spreading stenanthemum	e, v, EN
<i>Styloidium graminifolium</i>	common trigger plant	
<i>Styphelia adscendens</i>	golden heath	
<i>Suaeda australis</i>	seablite	
<i>Trifolium sp.</i>	subterranean clover, clover	i
<i>Ulex europaeus</i>	common gorse, furze	i
<i>Utricularia dichotoma</i>	bladderwort, fairies' aprons	
<i>Vellereophyton</i>	white cudweed, cudweed	i
<i>Villarsia reniformis</i>	yellow or running marsh-flower	
<i>Viminaria juncea</i>	golden spray or native broom	en
<i>Viola hederacea</i>	ivy-leaf violet	
<i>Wahlenbergia sp.</i>		
<i>Wilsonia backhousei</i>	narrow-leaf wilsonia	
<i>Wilsonia humilus</i>	round-leaf wilsonia	
<i>Xanthosia pilosa</i>	woolly xanthosia	

ANGIOSPERMAE: MONOCOTYLEDONAE

<i>Agrostis aemula</i>	blown grass	r
<i>Agrostis avenacea</i>	blown grass	
<i>Agrostis billardierei</i>	coast blown grass	e
<i>Agrostis capillaris</i>	bent grass	i
<i>Aira caryophylla</i>	silver hair grass	i
<i>Amphibromus neesii</i>	swamp wallaby-grass	r
<i>Amphibromus recurvatus</i>	dark swamp wallaby-grass	
<i>Austrodanthonia caespitosa</i>	common wallaby-grass	
<i>Austrodanthonia laevis</i>	wallaby-grass	
<i>Austrodanthonia racemosa</i>	wallaby-grass	
<i>Austrodanthonia setacea</i>	bristly or mulga wallaby-grass	
<i>Austrodanthonia tenuior</i>	fine wallaby-grass	
<i>Austrostipa mollis</i>	soft spear-grass	
<i>Austrostipa nodosa</i>	spear grass	
<i>Austrostipa pubinodis</i>	tall spear-grass	
<i>Austrostipa rudis australis</i>	Austral spear-grass	
<i>Austrostipa stipoides</i>	coastal spear-grass	
<i>Austrostipa stiposa</i>	corkscrew grass	
<i>Baumea acuta</i>	pale twig-rush	
<i>Baumea arthrophylla</i>	articulate twig-rush	
<i>Baumea juncea</i>	bare twig-rush	
<i>Bolboschoenus caldwellii</i>	sea club-rush	r
<i>Burchardia umbellata</i>	milkmaids, star-of-Bethlehem	
<i>Caladenia alata</i>	winged caladenia	
<i>Caladenia fuscata</i>	dusky caladenia	
<i>Caladenia gracilis</i>	musky caladenia	
<i>Carex appressa</i>	tall sedge	
<i>Carex breviculmis</i>	sedge	
<i>Caustis pentandra</i>	thick twist-rush	
<i>Centrolepis fascicularis</i>	tufted centrolepis	
<i>Centrolepis polygyna</i>	wiry centrolepis	
<i>Chorizandra australis</i>	heron thistle-rush	
<i>Dactylis glomerata</i>	cocksfoot, orchard-grass	i
<i>Deyeuxia monticola</i>	bent grass	
<i>Deyeuxia quadriseta</i>	reed bent grass	

<i>Dianella revoluta</i>	spreading or black-anther flax-lily	
<i>Dianella tasmanica</i>	blue berry, tasman flax-lily	
<i>Dichelachne crinita</i>	long-hair plume grass	
<i>Dichelachne rara</i>	scarce plume-grass	
<i>Diplarrena moraea</i>	white flag iris, butterfly iris	
<i>Distichlis distichophylla</i>	Australian salt-grass	
<i>Ehrharta distichophylla</i>	hairy rice-grass	
<i>Ehrharta stipoides</i>	weeping grass	
<i>Eleocharis pusilla</i>	small spike-rush	
<i>Eleocharis sphacelata</i>	tall spike-rush	
<i>Elymus scaber</i>	rough wheat-grass	
<i>Eriochilus cucullatus</i>	pink autumn orchid	
<i>Eurychorda complanata</i>	flat cord-rush	
<i>Festuca arundinacea</i>	fescue, tall fescue	i
<i>Gahnia filum</i>	chaffy saw-edge, thready saw-edge	
<i>Gahnia radula</i>	thatch saw-edge	
<i>Gahnia trifida</i>	coast saw-sedge	
<i>Genoplesium tasmanicum</i>	Tasmanian midge orchid	
<i>Hemarthria uncinata</i>	matt grass	
<i>Holcus lanatus</i>	velvet grass, Yorkshire fog	i
<i>Holcus mollis</i>	velvet grass	i
<i>Hypolaena fastigiata</i>	tassel rope-rush	
<i>Hypoxis hygrometrica</i>	golden weather-glass	
<i>Imperata cylindrica</i>	blady grass	
<i>Isolepis cernua</i>	nodding, low or grassy club-rush	
<i>Isolepis fluitans</i>	floating club-rush	
<i>Isolepis inundata</i>	swamp club-rush	
<i>Isolepis nodosa</i>	knobby or knotty club-rush	
<i>Isolepis producta</i>	club-rush	
<i>Juncus articulatus</i>	rush, jointed rush	i
<i>Juncus australis</i>	Austral rush	
<i>Juncus bufonius</i>	toad rush	
<i>Juncus kraussii</i>	sea rush	
<i>Juncus pallidus</i>	pale rush	
<i>Juncus planifolius</i>	broad-leaf rush	
<i>Juncus procerus</i>	great rush	
<i>Juncus revolutus</i>	creeping rush	
<i>Lepidosperma concavum</i>	sand or hill sword-sedge	
<i>Lepidosperma gunnii</i>	little or narrow sword-sedge	
<i>Lepidosperma inops</i>	fan sedge	e
<i>Lepidosperma longitudinale</i>	pithy or common sword-sedge	
<i>Lepilaena cylindrocarpa</i>	long-fruited water-mat	
<i>Lepilaena patentifolia</i>	spreading water-mat	r
<i>Leptocarpus brownii</i>	coarse twine-rush	
<i>Leptocarpus tenax</i>	slender twine-rush	
<i>Lepyrodia muelleri</i>	common or erect scale-rush	
<i>Lomandra longifolia</i>	sagg, long or spiny-headed mat-rush	
<i>Lomandra nana</i>	pale mat-rush	
<i>Microtis unifolia</i>	common onion orchid	
<i>Notodanthonia gracilis</i>	graceful wallabygrass	T
<i>Patersonia fragilis</i>	blue iris, short purple-flag	
<i>Poa clelandii</i>	Cleland's poa grass	
<i>Poa labillardierei</i>	tussock grass	
<i>Poa poiformis</i>	blue tussock grass	

<i>Poa sieberiana</i>	tussock or snow grass	
<i>Polypogon</i>	annual beardgrass	i
<i>Potamogeton australiensis</i>	thin pondweed	
<i>Potamogeton ochreatus</i>	blunt pondweed	
<i>Pterostylis</i> aff. <i>cycnocephala</i>	swan greenhood	en
<i>Puccinellia stricta</i>	saltmarsh grass	
<i>Ruppia megacarpa</i>	ruppia	r
<i>Ruppia polycarpa</i>	ruppia	
<i>Schoenus fluitans</i>	floating bog-rush	
<i>Schoenus maschalinus</i>	leafy or dwarf bog-rush	
<i>Schoenus nitens</i>	shiny bog-rush	
<i>Schoenus tesquorum</i>	bog-rush	
<i>Spiranthes australis</i>	pink spiral orchid	
<i>Sporobolus virginicus</i>	salt couch	r
<i>Tetraria capillaris</i>	hair-sedge, bristle twig-rush	
<i>Thelymitra carnea</i>	tiny sun orchid	
<i>Themeda triandra</i>	kangaroo grass	
<i>Triglochin procerum</i>	water-ribbons	
<i>Triglochin striatum</i>	streaked arrow-grass	
<i>Wurmbea uniflora</i>	early Nancy, harbinger-of-spring	
<i>Xanthorrhoea australis</i>	Austral grass-tree, black-boy	
<i>Zostera muelleri</i>	dwarf grass-wrack	
<i>Zoysia macrantha</i>	prickly couch	
GYMNOSPERMA		
<i>Callitris rhomboidea</i>	Oyster Bay pine	
<i>Callitris</i> sp. aff. <i>oblonga</i>	south esk pine	
<i>Pinus radiata</i>	radiata pine	i
PTERIDOPHYTA		
<i>Pteridium esculentum</i>	bracken, Austral bracken	
<i>Selaginella uliginosa</i>	swamp selaginella	

Appendix 5

Birds Recorded in Mouling Lagoon Game Reserve

- I = introduced to Tasmania
 r, v, e = listed in the schedules of the *Threatened Species Protection Act 1995* as rare, vulnerable or endangered respectively
 m = migratory species
 J = listed on the Japan–Australia Migratory Bird Agreement (JAMBA)
 C = listed on the China–Australia Migratory Bird Agreement (CAMBA)

Bird species names follow the taxonomy of Christidis and Boles (1994)

List adapted from Blackhall 1985, Schokman 1987, Schokman 1991, Christidis and Boles 1994

Common Name	Code	Scientific Name
Birds – Resident		
ORDER ANSERIFORMES		
black swan		<i>Cygnus atratus</i>
Australian shelduck		<i>Tadorna tadornoides</i>
black duck		<i>Anas superciliosa</i>
grey teal		<i>Anas gracilis</i>
chestnut teal		<i>Anas castanea</i>
Australasian shoveler		<i>Anas rhynchotis</i>
hardhead		<i>Aythya australis</i>
blue-billed duck		<i>Oxyura australis</i>
musk duck		<i>Biziura lobata</i>
ORDER PODICIPEDIFORMES		
Australasian grebe		<i>Tachypaptus novaehollandiae</i>
hoary-headed grebe		<i>Poliiocephalus poliocephalus</i>
great crested grebe	r	<i>Podiceps cristatus</i>
ORDER PELICANIFORMES		
Australian pelican		<i>Pellecanus conspicillatus</i>
black-faced cormorant		<i>Leucocarbo fuscescens</i>
great cormorant		<i>Phalacrocorax carbo</i>
little pied cormorant		<i>Phalacrocorax melanoleucos</i>
little black cormorant		<i>Phalacrocorax sulcirostris</i>
ORDER CICONIIFORMES		
white-faced heron		<i>Egretta novaehollandiae</i>
great egret	J,C	<i>Ardea alba</i>
little egret		<i>Egretta garzetta</i>
cattle egret	J,C	<i>Ardea ibis</i>
Australasian bittern		<i>Botaurus poiciloptilus</i>
ORDER FALCONIFORMES		
white-bellied sea-eagle		<i>Haliaeetus leucogaster</i>
wedge-tailed eagle	v	<i>Aquila audax</i>
swamp harrier		<i>Circus approximans</i>
peregrine falcon		<i>Falco peregrinus</i>
brown falcon		<i>Falco berigora</i>

ORDER GRUIFORMES

purple swamphen		<i>Porphyrio porphyrio</i>
Eurasian coot		<i>Fulica atra</i>
Tasmanian native hen		<i>Gallinula mortierii</i>

ORDER CHARADRIIFORMES

piec oystercatcher		<i>Haematopus ostralegus</i>
sooty oystercatcher		<i>Haematopus fuliginosus</i>
masked lapwing		<i>Vanellus miles</i>
lesser sand plover	J,C	<i>Charadrius mongolus</i>
Pacific golden plover	m	<i>Pluvialis fulva</i>
hooded plover		<i>Charadrius cucullatus</i>
double-banded dotterel	m	<i>Charadrius bicinctus</i>
red-capped dotterel		<i>Charadrius ruficapillus</i>
black-fronted dotterel		<i>Elsayornis melanops</i>
ruddy turnstone	m,J,C	<i>Arenaria interpres</i>
eastern curlew	m,J,C	<i>Numenius madagascariensis</i>
whimbrel	m,J,C	<i>Numenius phaeopus</i>
common greenshank	m,J,C	<i>Tringa nebularia</i>
marsh sandpiper	m,J,C	<i>Tringa stagnatilis</i>
Latham's snipe	m,J,C	<i>Gallinago hardwickii</i>
bar-tailed godwit	m,J,C	<i>Limosa lapponica</i>
red knot	m,J,C	<i>Calidris canutus</i>
grey-tailed tattler	m	<i>Heteroscelus brevipes</i>
sharp-tailed sandpiper	m,J,C	<i>Calidris acuminata</i>
red-necked stint	m,J,C	<i>Calidris ruficollis</i>
long-toed stint		<i>Calidris subminuta</i>
curlew sandpiper	J,C	<i>Calidris ferruginea</i>
silver gull		<i>Larus novaehollandiae</i>
Pacific gull		<i>Larus pacificus</i>
Caspian tern	J,C	<i>Hydroprogne caspia</i>
crested tern		<i>Sterna bergii</i>

ORDER PSITTACIFORMES

green rosella		<i>Platycercus caledonicus</i>
eastern rosella		<i>Platycercus eximius</i>
yellow-tailed black cockatoo		<i>Calyptorhynchus funereus</i>
musk lorikeet		<i>Glossopsitta concinna</i>
swift parrot	v	<i>Lathamus discolor</i>

ORDER CUCULIFORMES

pallid cuckoo		<i>Cuculis pallidus</i>
fan-tailed cuckoo		<i>Cacomantis flabelliformis</i>

ORDER STRIGIFORMES

southern boobook		<i>Ninox novaeseelandiae</i>
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ORDER CORACIIFORMES

laughing kookaburra		<i>Dacelo novaeguineae</i>
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ORDER PASSERIFORMES

superb fairy wren		<i>Malurus cyaneus</i>
spotted pardalote		<i>Pardalotus punctatus</i>

striated pardalote		<i>Pardalotus striatus</i>
yellow-rumped thornbill		<i>Acanthiza chrysorrha</i>
Tasmanian thornbill		<i>Acanthiza magnus</i>
brown thornbill		<i>Acanthiza ewingii</i>
yellow wattlebird		<i>Anthochaera paradoxa</i>
noisy miner		<i>Manorina melanocephala</i>
crescent honeyeater		<i>Phylidonyris pyrrhoptera</i>
New Holland honeyeater		<i>Phylidonyris novaehollandiae</i>
white-fronted chat		<i>Ephthianura albifrons</i>
eastern spinebill		<i>Acanthorhynchus tenuirostris</i>
scarlet robin		<i>Petroica multicolor</i>
dusky robin		<i>Melanodryas vittata</i>
spotted quail-thrush		<i>Cinlosoma punctatum</i>
grey shrike-thrush		<i>Colluricincla harmonica</i>
grey fantail		<i>Rhipidura fuliginosa</i>
black-faced cuckoo-shrike		<i>Coracina novaehollandiae</i>
dusky woodswallow		<i>Artamus cyanopterus</i>
grey butcher bird		<i>Cracticus torquatus</i>
Australian magpie		<i>Gymnorhina tibicen</i>
grey currawong		<i>Streptera versicolor</i>
forest raven		<i>Corvus tasmanicus</i>
skylark	i	<i>Alauda arvensis</i>
Australian pipit		<i>Anthus novaeseelandiae</i>
welcome swallow		<i>Hirundo neoxena</i>
tree martin		<i>Petrochelidon nigricans</i>
European greenfinch		<i>Chloris chloris</i>
silvereye		<i>Zosterops lateralis</i>
common blackbird	i	<i>Turdus merula</i>
common starling	i	<i>Sturnus vulgarus</i>



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