FURNEAUX NATURAL RESOURCE MANAGEMENT STRATEGY

2nd EDITION 2007

DRAFT

June 2007

Prepared by SFM Environmental Solutions Pty Ltd

For the Northern Tasmanian NRM Association Inc.

Australian Government

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Acknowledgements

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Authors

This is an updated version of the original Furneaux NRM Strategy 1999 which was prepared by Sam Bayley. This updated version has been prepared by Dayani Gunawardana of SFM Environmental Solutions with the assistance of Amanda Locatelli of SFM Environmental Solutions.

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LIST OF ACRONYMS

ALCT	Aboriginal Land Council of Tasmania
ANZECC	Australian New Zealand Environment and Conservation Council
AQIS	Australian Quarantine and Inspection Service
BOM	Bureau of Meteorology
CBIAA	Cape Barren Island Aboriginal Association
DAFF	Australian Government, Department of Agriculture, Forestry and Fisheries
DPIW	Department of Primary Industries and Water, Tasmanian State Government (Previously DPIWE).
DPIWE	Department of Primary Industries, Water and the Environment, Tasmanian State Government
DTAE	Department of Tourism, Arts and the Environment, Tasmanian State Government
FC	Flinders Council
FIAA	Flinders Island Aboriginal Association
FFMAC	Furneaux Fire Management Area Committee
FPA	Forest Practices Authority
GIS	Geographic Information System
MATs	Management Action Targets - The desired short-term outcomes and outputs of Management Actions over one to five years.
NAP	National Action Plan for Salinity and Water Quality
NHT	Natural Heritage Trust
NIMP CG	National Introduced Marine Pests Coordination Group
NRM	Natural Resource Management
NRM North	Northern Tasmanian NRM Association

PWS	Parks and Wildlife Service
RAMSAR	This term refers to the Convention on Wetlands, signed in Ramsar, Iran, in 1971, which is an intergovernmental treaty for the conservation and wise use of wetlands and their resources.
RCTs	Resource Condition Targets - The desired condition of the natural resources in the medium term (10-20 years).
RPDC	Resource Planning and Development Commission
RWSC	Rivers and Water Supply Commission
SCEAM	Soil Condition Evaluation and Monitoring Project
TAFI	Tasmanian Aquaculture and Fisheries Institute
TASMARC	Tasmanian Shoreline Monitoring and Archiving Project
TASVEG	Tasmanian Vegetation Monitoring and Mapping Program
TFGA	Tasmanian Farmers and Graziers Association
TasPorts	Tasmanian Ports Corporation Pty Ltd
TFS	Tasmanian Fire Service
TSN	Threatened Species Network (TSN) - a partnership between WWF-Australia and the Australian Government
UTAS	University of Tasmania

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Chapter 1. Introduction

1.1. Introduction

The natural resources of the Furneaux Group are unique and special. Described as "Mountains in the Sea" the many islands of the Furneaux are characterised by spectacular granite ridges, coastal plains, dunes and beaches. Its fresh waters support an extensive system of wetlands including two Ramsar sites and fourteen wetlands of national importance. The regions biodiversity has considerable significance as the southern most limit of some Australian mainland species and the northern most limit for some Tasmanian endemic species The region is home to many rare or threatened species and communities, some of which occur no where else. The coastal, estuarine and marine environments have important conservation significance and provide important habitat for many species including seabirds, fish and marine invertebrates. These natural resources have great intrinsic and ecological value and are the foundation of the distinctive economic, social and cultural life of the Furneaux community.

The Furneaux Group is subject to a range of processes that threaten the integrity of its natural resources. The condition of the land, water, biodiversity and coastal, estuarine and marine environments has and continues to be degraded to various degrees by a range of threatening processes such as soil erosion, salinity, weed invasion, water pollution, altered fire regimes, habitat loss and modification, pests and disease. To ensure the region has an ecologically sustainable future, a strategic approach is required to attract investment and facilitate cooperation between stakeholders to mitigate the threats and issues impacting upon the regions natural environment.

1.1.1. Background

The Furneaux Natural Resource Management Strategy (FNRMS) was originally developed in 1999 as a framework and action plan for the

conservation, maintenance and sustainability of the Furneaux's natural resources. The original project was funded through the Natural Heritage Trust (NHT) with assistance and resources provided by the Furneaux community, local government, industry and state and federal government.

Since 1999, NRM within Tasmania has undergone considerable change. Significant changes include the development of the Tasmanian NRM framework and supporting legislation (Tasmanian *NRM Act 2002*) and the establishment of three formally recognised regional NRM bodies in Tasmania, including the Northern Tasmanian NRM Association Inc (NRM North) which was established in 2003. The Furneaux sub-region is one of six sub-regions in the northern NRM region. Given these changes and others at the sub-regional and State level a review and update of the Strategy is timely. In January 2007 SFM Environmental Solutions was engaged by NRM North to undertake a review of the Strategy.

1.2. Scope and objectives of the Strategy

The specific objectives of the FNRMS 2nd edition 2007 are to:

- provide general background information covering the natural resources of the region
- transfer the focus of the Strategy to the natural resource assets of the sub-region and the services they provide
- identify and investigate current and potential threatening processes and issues associated with the condition of each asset
- develop resource condition targets (RCTs), management action targets (MATs) and management actions for each asset which address key threatening processes and provide a blueprint for the conservation, maintenance and sustainability of the regions natural resources

This approach was taken to more closely align the Strategy with the Northern Tasmanian Natural Resource Management Strategy and national NRM frameworks.

In the past NRM activities have been criticized because investment often appeared to be *ad hoc* and it was difficult to measure the results of on-ground

works. Thus frameworks have been developed at a national level to encourage more strategic and targeted investment and action together with improved monitoring and evaluation to enable assessment of progress towards achieving targets.

The 2nd edition of the Furneaux NRM Strategy aims to be consistent with the national NRM frameworks for monitoring and evaluation as outlined in a number of key documents including:

- *National Natural Resource Management Monitoring and Evaluation Framework.* 2003. Endorsed by the Natural Resource Management Ministerial Council, 3 May 2002 Meeting.
- *National Framework for Natural Resource Management Standards and Targets.* 2003. Endorsed by the Natural Resource Management Ministerial Council, 3 May 2002 Meeting.
- *Draft Users' Guide (Preamble) Monitoring and Reporting on Natural Resource Management.*

In line with these frameworks the Strategy includes:

- **Management Actions:** Activities to be undertaken in the next one to five years to improve the condition of the region's natural resources.
- **Management Action Targets (MATs)**: The desired short-term outcomes and outputs of Management Actions over one to five years. These should contribute to the achievement of one or more RCTs.
- **Resource Condition Targets (RCTs)**: The desired condition of the natural resources in the medium term (10-20 years). Ideally these will be SMART (Specific, Measurable, Achievable, Realistic and Time-bound).

Community Aspirational Statements were also developed which aim to reflect the community's vision for the condition of natural resources in the long term (~ 50 years).

The Strategy is a non-statutory document which focuses on management of the natural assets of the Furneaux Group, specifically the assets of: Land; Water; Biodiversity; and Coasts, Estuaries and Marine. It does not consider the management of the atmosphere, Aboriginal heritage or European heritage.

Geographically the plan focuses on the Furneaux Group of islands, located off the north-east tip of Tasmania in Bass Strait.

1.3. Development of the Strategy

Much of the information in this Strategy has been taken directly from the original Furneaux NRM Strategy developed by Sam Bayley in 1999. This has been updated with information from reports and studies conducted since 1999, including previous consultation reports, as well as information gained during consultation undertaken in 2007.

Development of the Strategy was informed and guided by consultation with the Furneaux NRM committee, the Furneaux community and relevant technical experts and stakeholders.

Three workshops were held on Flinders Island to gain input from the Furneaux NRM committee and the Furneaux community. The first workshop was held in January 2007 with the Furneaux NRM committee to identify key issues and threats impacting upon natural resources in the Furneaux. Two further workshops, held in May and June 2007, were open to the whole Furneaux community. The purpose of the May workshop was to develop Community Aspirational Statements and the second to present draft management actions to the community for comment.

A Peer Review Group was established to provide technical advice and support during development of the Strategy, in particular advice was sought on the development of resource condition targets (RCTs), management action targets (MATs) and management actions. Consultation with this group was undertaken in a series of one-on-one meetings, email and phone correspondence. The first series of meetings were held in March 2007 to develop draft RCTs and MATs. These were followed up with meetings in May to further refine RCTs and MATs and to develop draft management actions. In addition to the Peer Review Group, comment was sought from NRM professionals at NRM North and other technical experts and stakeholders as required.

1.4. Structure of the management plan

In line with National NRM frameworks and the Tasmanian NRM Framework adopted by NRM North, an asset based approach was used to develop the Strategy which focuses on four key physical asset groups: Land; Water; Biodiversity; and Coasts, Estuaries and Marine. A fifth asset category is also included which tackles overarching issues associated with People and Management.

Following the introductory chapter the report begins with a general description of the area. This is followed by the 5 asset chapters. Each asset chapter begins with a description of the asset, followed by a discussion of the threats and priority issues impacting upon the condition of the asset, and concluding with a section titled management directions. The management directions section of each chapter presents Community Aspirational Statement, Resource Condition Targets (RCTs), Management Action Targets (MATs) and Management Actions. The Strategy concludes with a discussion of recommendations for effective implementation of the Strategy including MATs and management actions for monitoring and evaluation.

Some of the information presented in a particular chapter is relevant across two or more asset categories. Rather than repeat information, references are provided in text to direct the reader to relevant information in other chapters.

Chapter 2. DESCRIPTION OF THE AREA

2.1. General

The Furneaux Group consists of over 50 islands located between 39°30'S and 40°40'S (Figure 2.1). The largest islands in the group is Flinders Island (1333km^2), followed by Cape Barren Island (445km^2) and Clark Island (82km^2). A map of the Furneaux Group is provided in Figure 2.2.

The Furneaux Group forms the greater part of the Flinders Municipality (with the Kent and Hogan groups forming the lesser part). Its commercial and administrative centre is located at Whitemark. Lady Barron, the second largest township, is associated with the fishing and tourism industries, the main port being located there. Killiecrankie is a small township with one shop. The Cape Barren Island township is the main settlement on Cape Barren Island.

The current population of the Furneaux Group is less than 1000 people (ABS 2001).

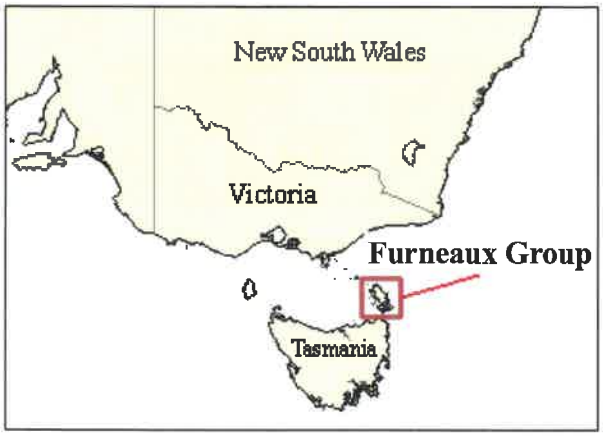

Figure 2.1 Location of the Furneaux Group

Figure 2.2 Furneaux Group with Main Towns and Roads

2.2. *Climate*

The sea tends to moderate temperatures in the Furneaux Group. The only station in the Furneaux Group that has climate data for any significant period is located at the Flinders Island Airport, with data records from 1942 to present (BOM 1999). The average annual daily temperature is 17.6°C with an average annual minimum temperature of 9.7oC. The warmest months are January, February and March when average daily temperatures exceed 21°C

while the coldest are the winter months when the average maximum temperatures are less than 14°C. Average minimum temperatures vary from 14°C in summer to 6°C in winter. Average monthly temperatures for the Flinders Island Airport are shown in Figure 2.3.

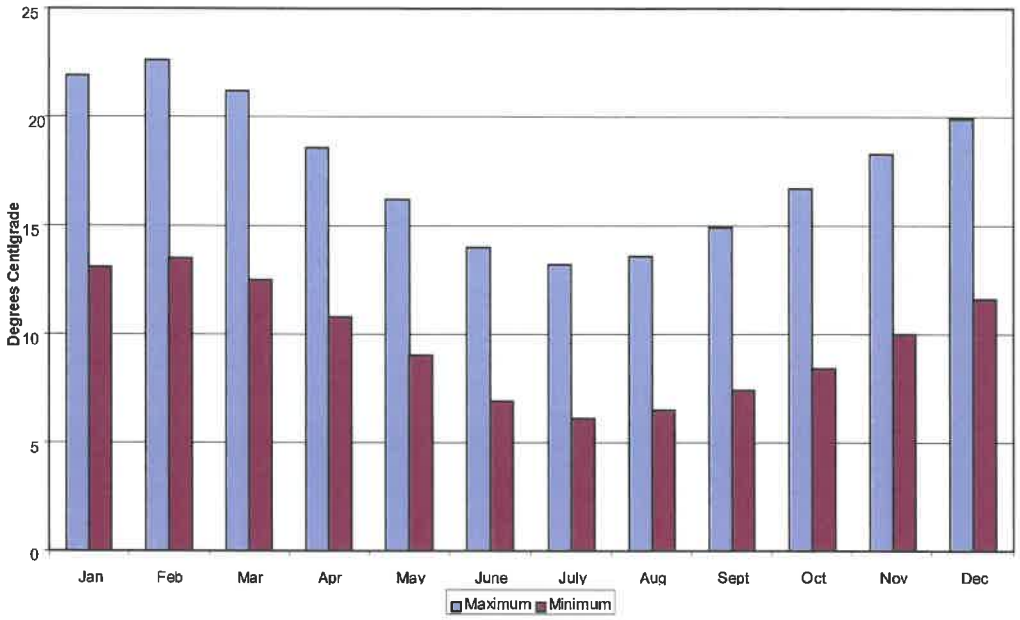

Figure 2.3 Average Monthly Temperatures for the Flinders Island Airport

Source: BOM (1999)

The average number of frost days per year at the airport is 14. However, many areas on Flinders Island and the outer islands experience no frosts at all due to their proximity to the sea. A temperature gradient appears to occur between the south and the north of Flinders Island, with higher temperatures in the north (Underwood 1998).

Rainfall is the principal means of precipitation and varies throughout the region with the wettest months for most locations being May to August. Rainfall figures are shown in Table 2.1 for various locations in the region. On Flinders Island the highest average rainfall is 838 mm/year at Lackrana while Emita and Killiecrankie have the lowest average annual rainfall with 681 mm/year. The township on Cape Barren Island has an annual rainfall of 711 mm/year. The average number of rain days per year at Flinders Island Airport is 163. Snowfalls have been recorded at higher altitudes but are very rare occurrences.

Table 2.1 Mean Monthly and Annual Rainfall at Stations in Furneaux Group

Source: BOM (1999)

Station (Period of records)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Cape Barren Island (1905 – present)	40.1	36.9	54.8	64.6	66.5	79.9	70.3	68.4	59.4	61.3	47.7	52.2	711.3
Flinders Is. Airport (1942 – present)	45.9	40.7	50.8	61.5	84.4	74.3	86.9	75.6	64.9	60.5	55.9	59.5	761.1
Whitemark P.Office (1962 – present)	48.6	36.1	52.5	63.5	81.7	68.4	78.9	73.3	67.0	46.4	54.0	61.8	729.0
Lady Barron (1912 – present)	45.8	40.8	57.3	64.4	75.4	78.8	83.3	75.4	65.2	61.9	53.2	54.6	766.5
Killiecrankie (1968 – present)	41.8	31.8	46.8	55.4	77.8	66.2	75.6	68.7	62.9	48.4	51.1	58.7	681.5
The Hermitage (1910 – 1982)	44.8	44.2	56.8	60.5	75.4	77.9	72.8	71.9	59.4	64.9	56.5	51.2	737.5
Wingaroo (1915 – present)	44.0	39.8	50.2	60.4	75.4	73.8	77.8	74.2	60.8	64.6	54.5	54.2	740.4
Station (Period of records)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
Lughrata (1913 – 1982)	40.1	43.4	56.9	59.9	75.3	76.3	80.2	73.8	60.3	63.7	54.9	51.7	732.7
Emita (1915 – 1984)	42.1	40.0	65.6	60.7	59.1	68.0	68.6	64.1	60.4	59.2	49.9	46.7	681.2
Memana (Babel Farm) (1961 – present)	56.4	38.6	61.1	61.9	83.8	76.2	82.7	76.2	70.3	52.3	58.9	57.6	790.5
Lackrana (Burra Downs) (1968 – 1986)	44.3	41.4	75.6	73.6	88.7	72.5	87.9	92.0	80.0	54.7	62.2	65.6	838.0
Goose Island (1871 – 1931)	35.5	23.6	44.6	47.7	63.1	71.9	59.4	56.9	48.2	53.9	39.6	41.9	583.7

The Furneaux Group lies in the path of the 'Roaring Forties', with a prevailing westerly wind. The average number of days recorded at the Flinders Island Airport with strong winds (22 – 33 knots) and gale winds (>33 knots) is 67 days and 5 days respectively (BOM 1999). Strong westerly winds occur throughout the year but are more likely during late winter and spring. Strong south-westerlies and north-easterlies are less frequent.

2.3. *Industry*

A number of industries in the Furneaux are directly reliant on the regions natural assets including agriculture, fisheries and tourism.

Agriculture is the main employment industry in the region and a major component of the local economy. Almost 30% of the workforce, 120 persons were directly involved in agriculture at the last census (ABS 2001). Many local businesses directly rely upon the agriculture sector to maintain their viability. Major products are wool, lamb, beef and live cattle.

The fishing industry in the region has experienced a decline over the last couple of decades with less boats working out of Flinders Island. At the last census 21 persons were employed directly in the fishing industry (ABS 2001). The major fisheries include rock lobster, abalone, scallops, shark, garfish and other fish species. The main ports/anchorages for the fishing industry are at Lady Barron and Killiecrankie. Currently only one abalone processing factory is operating on Flinders.

The State Government has produced a Marine Farming Development Plan (January 1999) for the Furneaux Islands. The aim of this document is to promote marine farming on a sustainable basis in the region. The plan has identified 18 suitable zones for the purposes of marine farming, increasing the potential area from 92 ha to 738 ha. There are five marine farming leases in the Furneaux Group covering an area of approximately 111 hectares (Marine Environment Section 2004). Currently there are three abalone farms (2 operators) operating in the region.

The Furneaux Group has a small seasonal tourist industry, centered on Flinders Island. Previous estimates suggest that between 7,000 and 8,000 visitors come to Flinders Island each year with an enormous potential for future growth (RPDC 1999). Tourism studies of the region identify the natural assets as the biggest draw card and of the most interest to the majority of visitors (Dept. Tourism, Sport and Recreation 1989, Tourism Techniques and Rob Tonge & Associates 1994). The three most popular activities undertaken by visitors are recreational walking (44% of visitors), bushwalking (30%) and sea fishing (22%) (Tourism Tasmania 2001). Natural attractions of the region include: long unspoiled beaches, rugged cliffs, coastal and marine life and habitats, clean coastal waters, diverse vegetation and habitat, the outer islands, native wildlife (especially birdlife), and generally the natural landscapes and scenery.

Chapter 3. PEOPLE & MANAGEMENT

3.1. People and Management - Description of the asset

The people of the Furneaux Group are a vital asset in managing the regions natural resources. In this Strategy the term people or community refers to all those with a stake or role in the management of the natural resources of the Furneaux Group (i.e. residents, landholders, Local, State and Commonwealth governments, business, industry etc.).

Approximately 871 people live in the Flinders Municipality. A large proportion of the 451 strong labour force work in industries which are dependant on the regions natural assets including agriculture (~30%), fishing (~7%) and tourism (ABS 2001).

Many members of the community have been actively involved in on-ground activities to address threats to the regions natural assets. There is currently one active Landcare group on Flinders Island, Westside Landcare Inc, but in the past, three Landcare groups have been active on Flinders Island. In recent years Westside Landcare has received funding to support various activities including weed removal and maintenance of trails used by the community. Other community organisations that have been actively involved in NRM activities include the Furneaux Historical Research Association, Tree Action Group, Palana Progress Group, Friends of Lady Barren, Friends of Bass Strait Islands, the Aboriginal Lands Council of Tasmania and the Cape Barren Island Aboriginal Association. Individual landholders have also taken part in various programs such as property management planning designed to improve the sustainability of land uses and reduce the impacts agriculture and other land uses have on the natural environment.

The Aboriginal community is actively involved in the management of the regions natural resources. Approximately 17% of the population in the Flinders municipality is Aboriginal. In the last decade or so a series of plans have been developed by the Aboriginal community for the management of natural values on Cape Barren, Chappell, Badger and Clarke Islands. These

plans were updated in 2004-2005 but the ability to fully implement these plans has been limited by a lack of resources.

3.1.1. Cultural Heritage

While the main focus of this project is on natural resources it is important to note that cultural heritage can be viewed as an integral part of the natural environment. The Aboriginal community do not necessarily differentiate between 'natural' and 'cultural' resources and do not categorise these resources into sub-groups. "The whole of Tasmania can be considered a cultural landscape produced by Aboriginals" (SoE 1996). Within this 'cultural landscape' there are some places/areas of particularly high value to the Aboriginal community.

Descendants of European settlers take a similar view where 'traditional activities' have occurred in the natural environment. However, they do not view the whole of Tasmania as a cultural landscape but assign a high value to the natural areas where these traditional activities have taken place.

It should be noted that the significance of cultural heritage can only be identified or decided by the people who are connected for example to those areas or customs of cultural heritage.

Many Aboriginal sites with stone tools and artefacts and shell middens have been found within the Furneaux Group. A total of 41 Aboriginal sites and 8 potential sites have been recorded on Flinders Island, with the greatest concentration in the western and south western coastal zones. Fewer sites have been located in the eastern lowlands associated with lagoons and other water sources (RPDC 1999). Radiocarbon dating suggests these sites to be 7,000 to 8,000 years old. A further 39 sites are recorded on Cape Barren Island (Department of Premier and Cabinet 2004). A stone tool scatter has also been discovered on Prime Seal Island (Harris 1988).

Over 120 shipwrecks have occurred in the Furneaux Group (Edgecombe 1986). The most significant being the Sydney Cove in 1797. Sealing activities followed the Sydney Cove rescue and many historic settlement sites are associated with these activities and the subsistence occupation by islanders (Straitsmen) who remained once the sealing industry collapsed due to over-hunting. Settlements were established on many of the outer islands as these became available for leasing from the 1860s onwards (RPDC 1999). Historic

sites of significance include the Wybalenna settlement, lighthouses, and sites established for mining and birding (muttonbird harvesting) activities.

A detailed summary of the prehistoric and historic settlement of the Furneaux Group is provided in the *Inquiry into Unallocated Crown Land on Flinders Island, Tasmania: Background Report* (RPDC 1999).

3.1.2. Land Tenure

Just over half the land in the Furneaux is freehold title (~53%, Figure 7.1). Most of the remainder is Crown Land. Large areas of Crown Land are declared as reserves under the *Nature Conservation Act 2002*, and are managed by the Parks and Wildlife Service (Figure 3.2). The objectives of reserve management depend on the class of reserve and differ in the relative emphasis placed on human use and conservation. Nonetheless the conservation of natural biological and geological diversity is an objective of all these reserves.

Approximately half of freehold title land in the Furneaux is devoted to agricultural uses. However, large areas of freehold title land also remain in a largely natural state, including most of Cape Barren Island and Clarke Island which were handed back to the Tasmanian Aboriginal community in 2005 under the under the *Aboriginal Lands Amendment Act 2004*. This land is held and managed by the Aboriginal Land Council of Tasmania. In 2000, the Tasmanian Aboriginal Centre declared Chappell (325 ha) and Badger (971 ha) Islands as Indigenous Protected Areas.

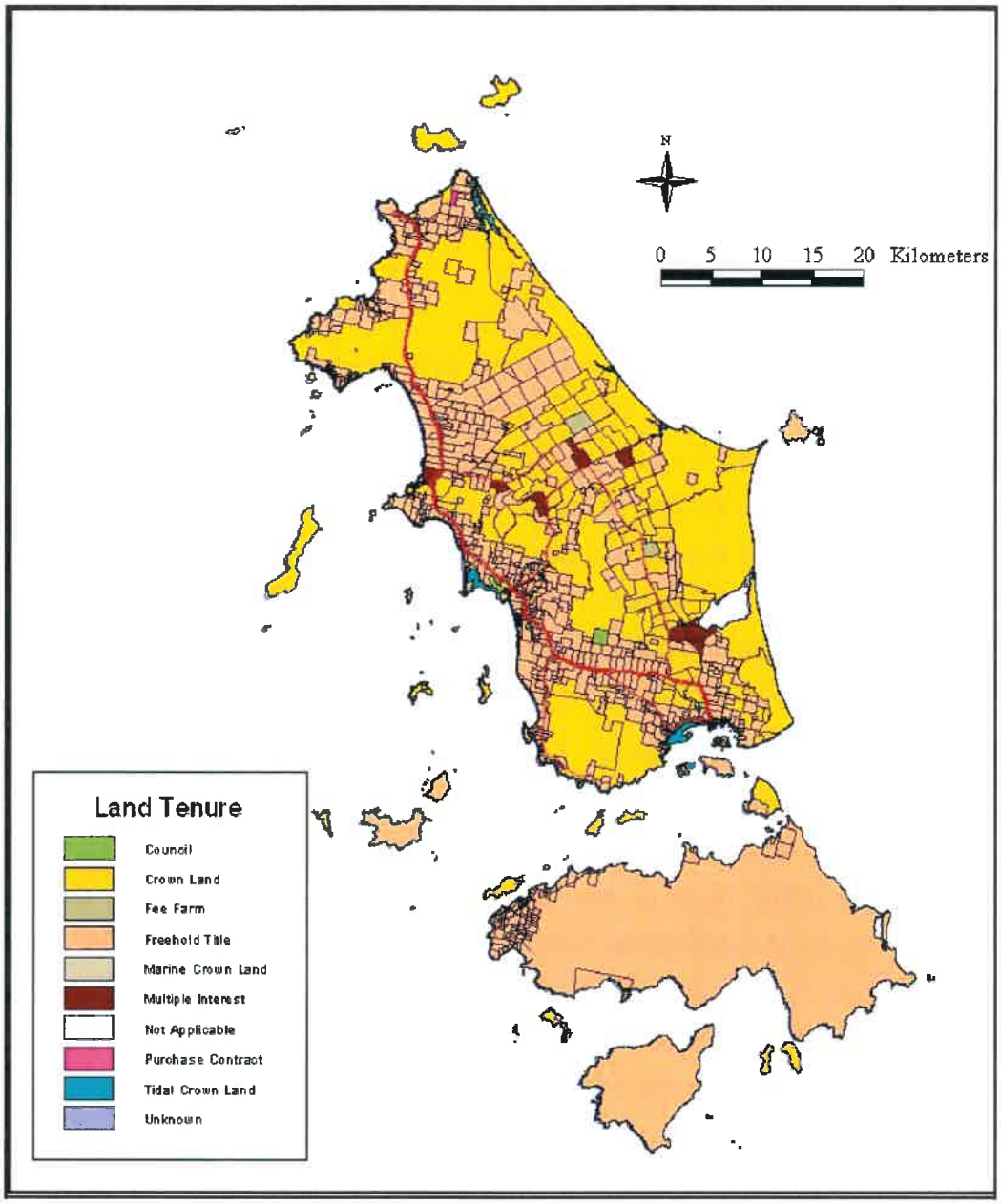

Figure 3.1 Land Tenure in the Furneaux Group.

Source: Information Land Services 2006.

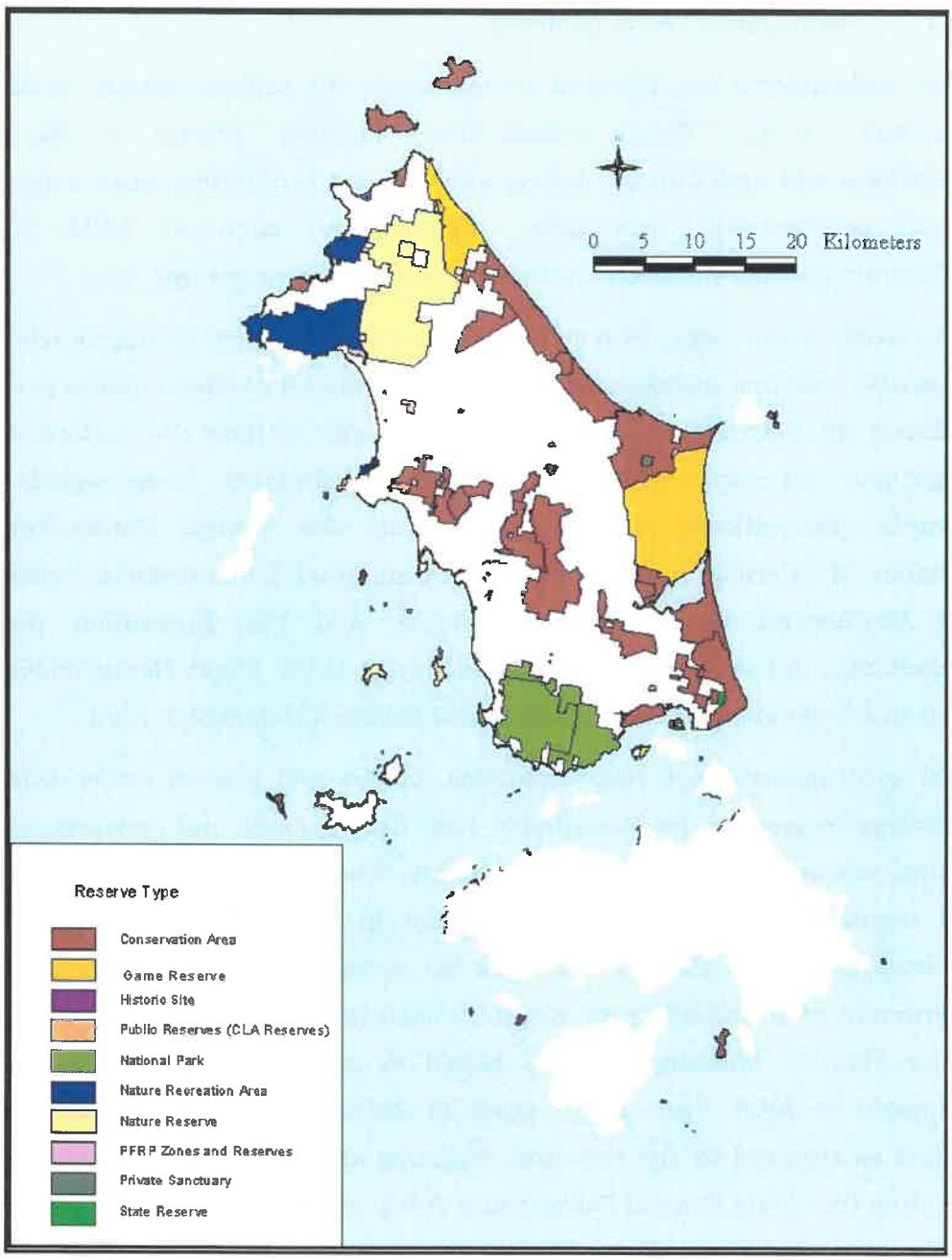

Figure 3.2 Reserved Land in the Furneaux Group.

Source: The LIST

3.1.3. Management Arrangements

Many stakeholders are involved in managing the natural resources of the Furneaux Group. These stakeholders include; private landholders, businesses and agricultural, fishing and tourism industries; local, state and federal governments; and other organisations such as NRM North, community groups, research institutions and reference groups.

There exists a vast array of policies, legislation, plans and strategies relevant to natural resource management in the Furneaux all of which aim to provide guidance on natural resource management and outline the various legal obligations and responsibilities of different stakeholders. These include, for example: international agreements such as the *Ramsar Convention* on Wetlands of International Importance, the national *Environmental Protection and Biodiversity Conservation Act 1999*, and the Tasmanian *Nature Conservation Act 2002*, *Weed Management Act 1999*, *Water Management Act 1999* and *Environmental Management and Pollution Control Act 1994*.

Local governments have responsibilities, duties and powers under existing legislation to ensure the sustainable use, development and conservation of natural resources within their municipality. The primary piece of legislation that regulates land use and development in Tasmania is the *Land Use Planning and Approvals Act 1993*. This Act is enacted through approved local government planning schemes and their associated permit systems. A review of the Flinders Planning Scheme began in late 2005 and is due to be completed in 2008. The second stage of the review will incorporate State Policies as required by the Resource Planning and Development Commission including the: *State Coastal Policy*; State *Policy on the Protection of Agricultural Lands*; *State Policy on Water Quality Management*; and *Bushfire Protection Guidelines*. Stage three of the review will address issues raised by the community including natural resource management issues such as land clearing, waste water issues and the establishment of environmental management zones.

State government agencies invest considerable resources in the management of natural resources on both crown and private land and play a key role in the provision of technical support and guidance to natural resource managers. On Flinders Island the State Government currently employs two

Parks and Wildlife Service staff to manage Crown land declared as reserves under the *Nature Conservation Act 2002.*

Specific funding for natural resource management from the Commonwealth Government is made available through the Natural Heritage Trust (NHT), the National Action Plan for Salinity and Water Quality (NAP) and the National Landcare Program. The Northern Tasmanian Natural Resource Management Association (NRM North) is the regional body which is responsible for the joint delivery of NHT and NAP funds in northern Tasmania, including the Furneaux Group.

In 2004-2005 NRM North allocated approximately 5.5 million dollars to invest in programs and activities to manage natural resources in northern Tasmania. To aid in the implementation of NRM programs and to ensure the Furneaux region receives support NRM North and Flinders Council jointly fund and support a Furneaux NRM Facilitator position which is hosted within Council offices in Whitemark. Flinders Council also has a Natural Resource Management Special Committee which provides advice to Council on NRM issues.

3.2. *People and Management - Priority Issues*

This section outlines the key issues and threats which relate to people and management in the Furneaux Group. These issues and threats have been identified form the existing literature and during consultation with technical experts and Furneaux community.

A range of issues can limit the community's capacity to achieve effective management of its natural resources. These issues include a lack of or ineffective:

- Education and awareness of NRM issues
- Community capacity and participation
- Institutional frameworks, policy and legislation
- Baseline data, monitoring and evaluation
- Resources and funding

Adequately addressing these five issues is vital to ensuring the strategic and effective implementation of NRM Strategies. These issues are common barriers to implementing NRM based actions at a broad scale and not just issues faced by the Furneaux Region.

Improving education and awareness is critical. Effective NRM relies on broad community support which is primarily gained through improving education and raising awareness of the issues at hand. A well informed community has the commitment and drive to implement actions and to make informed decisions. Improving education and awareness is linked to improving skill levels and the capacity of the community to participate and engage in NRM activities. Building the capacity of the community also includes fostering the support and cooperation of management authorities and other key stakeholders involved in managing and using the Region's natural assets. Natural resource management requires long term partnerships to result in lasting resource condition improvements. This hinges on the successful engagement and participation of all sectors of the community.

Establishing credibility and trust with a community, key stakeholders and investors includes communicating the right information as well as being transparent and accountable. To achieve this adequate information (e.g. baseline data, monitoring and evaluation) and effective institutional, legislative and policy frameworks are required to support and implement NRM strategies and principles. Information is also required to inform an adaptive management approach in which management aims to learn from the implementation of policies and strategies to inform subsequent decision making process and improve management. Monitoring and evaluation is further discussed in Chapter 8.

Lack of resources and funding presents a major impediment to the achievement of NRM goals. This includes lack human resources, financial resources and time resources which again are not uncommon in the NRM based industries. These issues can be exacerbated in the Furneaux Region, due in part to its isolation and relatively small population as well as the cost associated with traveling to the Region, which can be overlooked in terms of investing resources and funding for implementation of NRM actions. Within the Furneaux Group there are few State Government resources and personnel involved specifically with natural resource management. Visits by extension

officers and technical experts are vital in maintaining links and the flow of information between the region and the State Government. It is also necessary to actively seek out opportunities for external funding, investment and in-kind support available through State and Commonwealth Government programs and by establishing relationships with business, industry and research groups. One of the primary aims of this Strategy is to act as a further leverage to attract investment and resources to the Furneaux Region to implement NRM based actions.

3.3. *Management Directions*

This section presents Community Aspirational Statements and recommended Management Actions Targets (RCTs), and Management Actions for people and management. These targets ad actions are focused on the key issues associated with people and management. To achieve on-ground improvement in resource condition the actions presented in this chapter must be implemented together with actions presented in Asset Chapters 4, 5, 6 and 7.

Community Aspirational Statements for People and Management

NRM principles are strongly embedded in the culture of the Furneaux community.

There is a permanent well resourced NRM leadership capacity in the Furneaux.

The Furneaux community is involved in all decision making which affects natural resources in the Furneaux Group.

The Furneaux NRM Strategy is integrated into local, state and federal decision making.

Table 3.1 Targets and Actions for People and Management

Issue	#	MAT (Management Action Targets 1-5 years)	#	Management Actions	Key Partners
Ineffective institutional frameworks, policy and legislation	**PM1**	Flinders Council and broader community has effective and viable mechanisms in place to guide local level NRM decision making and coordinate NRM activities by 2012	**PA1**	Continue to fund NRM officer and support NRM Committee	FC, NRM North
			PA2	Work with Council to develop a Council environmental policy and best practice guidelines	FC, NRM North
			PA3	Incorporate NRM principles into Council Strategic Plan and Council policies	FC
			PA4	Establish a planning framework (e.g. GIS layer) which identifies areas with significant natural values (e.g. priority vegetation communities, listed geoconservation sites, priority fauna habitat etc.) where developments can only occur under conditions designed to ensure the impact on the natural values is minimised/reduced	FC, DPIW, FPA
			PA5	Work with Council to ensure the review of the Flinders planning scheme gives adequate consideration to NRM issues raised in this Strategy including issues associated with land clearing, coastal development, waste water and the establishment of environmental management zones	FC
Lack of resources and funding	**PM2**	Key potential sources of funding, resources and support have been investigated and pursued (ongoing)	**PA6**	Seek external funding, investment and in-kind support for actions contained in this Strategy (eg. NRM funding, Australian Government Funding programs)	NRM North, FC
			PA7	Develop and implement strategies to further engage business, industries and government in NRM planning and decision making processes as well as implementing on-ground activities	NRM North, FC
			PA8	Support investigations into establishing a "clean green" brand for the Furneaux region	FC
			PA9	Develop partnerships with research and educational institutions to support delivery of research and education actions identified in this Strategy (ongoing)	NRM North, FC, TAFI, TIAR, UTAS etc
Understanding and awareness of NRM issues	**PM3**	By 2009, the first publicly available report card has been produced which summarizes the latest information on condition, trends and management of natural values in the region	**PA10**	Produce a regular report card (eg. annually or biannually) summarising the latest information on condition, trends and management of natural values in the region and promote this in the community by 2009	NRM North, FC
	PM4	60% of people in the region understand the meaning of Natural Resource Management by 2012	**PA11**	Develop and implement a general community and school communication Strategy to raise awareness of NRM principles and objectives as well as increase understanding of the special and unique nature of natural values in the region (by 2009 and ongoing)	NRM North, FC

Community capacity and participation in NRM	**PM5**	By 2012, 50% of community members have participated in some form(s) of NRM activities within the previous year	**PA12**	Support the establishment and maintenance of "Care" groups within the Municipality including within schools (including administrative, financial and technical support and recognition of achievements) (ongoing)	FC, NRM North
			PA13	Develop community education and awareness raising programs to foster and build the capacity and skills of the community to undertake NRM related activities (ongoing)	NRM North, FC
			PA14	Foster working partnerships and better communication with the Aboriginal community to encourage greater participation and involvement in NRM activities	ALCT, FIA, CBIAA
			PA15	Undertake a survey/s to determine current land management practices and adoption of best practice land management as well as participation in NRM related activities (ongoing)	NRM North, TFGA
			PA16	Provide incentives to increase the adoption and implementation of integrated property planning by landholders for sustainable land management by 2010 (and ongoing)	NRM North, TFGA
			PA17	Support and foster the development of self-sustaining and collaborative NRM networks and services (e.g. 'good neighbour' programs and field days) to promote and learn NRM best practice methods	NRM North, TFGA
	PM6	50% of land managers are utilising science based information systems to improve understanding, awareness and skills to achieve improved NRM outcomes by 2012	**PA18**	Promote an information program on natural resources that both raises awareness of NRM processes and provides land managers (including new residents) with timely and relevant information to support their planning and management activities	NRM North, TFGA
			PA19	Develop voluntary codes of best practice to address NRM issues (e.g. salinity management, erosion control, weed management etc) and through an awareness, education and/or incentive program encourage and support the adoption of these codes by land managers by 2010 (ongoing)	NRM North, FC, TFGA
			PA20	Support and facilitate access to and use of information, databases and training (e.g. use of codes of practice, guidelines, the Natural Values Atlas etc.) to increase the knowledge and skill levels of NRM facilitators, Council staff and those involved in on-ground natural resource management activities (e.g. contractors)	NRM North, FC

Chapter 4. LAND

4.1. Land – Description of the Asset

The Tasmanian State of the Environment report (1996) defines 'land' to include geological, landform and soil features, vegetation, and human uses of the land.

4.1.1. Geology

In broad terms the Furneaux Group can be characterised as a Paleozoic basement consisting of folded quartzites and argillites (the Mathinna Beds) intruded by granitoid plutons. On Flinders Island there is a broad eastern coastal plain and a narrow western coastal plain which are composed of Cainozoic sediments, sands, grits and clays (Dixon 1996; Dimmock 1957). The oldest rocks in the region consist of a small patch of Precambrian granite (600 million years old) near Pats River on Flinders Island (Pinkard and Richley 1982).

The following is a summary of the Furneaux Group's geological history, primarily taken from Underwood's literature review (1998) and Dixon (1996).

Paleozoic Era (245 – 570 million years ago)

Development of the Mathinna Group rocks followed the Precambrian (600 million years ago) granite. These beds consist of a 'thick monotonous sequence of sandy, silty, and muddy sediments' and occur in the central and southern regions of Flinders, northeast Cape Barren Island and Clarke and Badger Islands. Examples on Flinders island include The Sugarloaf and from the southeastern side of Mt Strzelecki to Big Badger Corner.

Deposition of the Mathinna Group rocks in the Paleozoic era ended with a period of folding and uplift throughout eastern Australia, resulting in large intrusions of granitoids. These granitoids (largely granites and granodiorite) constitute approximately 70% of the Paleozoic basement of the Furneaux

Group and have been dated at 370 million years. This granitoid basement extends along the Bassian Rise to northeast Tasmania and to Wilsons Promontory in Victoria.

Mesozoic Era (65 – 245 million years ago)

During this era the granites and Mathinna Group rocks on Flinders and Cape Barren Islands were intruded by dolerite dykes. These dolerite dykes tend to occupy tensional fractures in the granitoid rocks.

Tertiary Period (2 – 65 million years ago)

The Tertiary rocks in the Furneaux Group consist of sandy and calcareous sediments, with basaltic volcanics in some areas that flowed along faults or granite contacts (e.g. north of Ranga). Fossil wood has been found in basalt near Badgers Corner, Petrification Bay. Basalt is also exposed in a small tidal platform near Lascars Point (Cape Barren Island).

Non-marine gravels, clays, sands and lignites (which include tin bearing deposits that were once mined) also occur on Flinders Island. Calcareous marine sediments (sandstones and limestones) occur on western Cape Barren Island and the eastern shore of Preservation Island. These sediments are believed to have been deposited under subtropical to tropical conditions in shallow water (approximately 19 million years ago). These sediments have been recorded up to 70 m above present sea level on Cape Barren Island, however they are usually found 15 m above sea level. Fossil whale bones and sharks teeth have been recovered from the sea floor just off the east coast of Flinders Island, believed to have been from the Pliocene age (approx. 5 million years ago).

Quaternary Period (present - 2 million years ago)

The Quaternary period saw the formation of many dune systems in the region, with the oldest being the Pleistocene aeolianite dunes on the west coast. On the eastern coastal plain Holocene parabolic dunes and lunettes have formed along with an extensive coastal barrier and beach ridge system.

Subfossil sites are common in the Furneaux Group, usually located in wind eroded sand dune formations and blowouts, such as at Palana, and contain both mammalian and avian remains. On several of the outer islands and in

some areas along the west coast of Flinders Island (e.g. Cave Beach) spectacular coastal karst features have developed in aeolian calcarenite.

Mineral Resources

Small quantities of silver have been found on Big Silver and Little Silver (mountains) and a little gold has been found on Watering Beach (RPDC 1999). Tin is found in the alluvial deposits at Tanners Bays and near the Darling Range on Flinders Island and there were extensive alluvial tin workings at Rooks River on Cape Barren Island. Four mines once operated small-scale tin mining operations on Flinders Island. On Flinders Island fossickers collect topaz, quartz, zircon and beryl.

"Comprehensive mineral resource potential assessment of mainland Tasmania was carried out in 1996 as part of the Regional Forest Agreement process. Although no comparable work has been done on the Furneaux Group the known mineral occurrences and similarity of geology with Northeastern Tasmania demonstrates a high mineral resource potential for greisen tin deposits in the fractionated granites on Flinders and Cape Barren islands and vien tin, tungsten and base-metal silver deposits in the Mathinna Group granite aureole. In addition there is potential for slate-belt gold deposits, similar to those in the Mathinna area in the Mathinna Group rocks. There is also demonstrated potential for gemstones" (Pemberton 1999).

The only extractive industries currently operating are for construction purposes (i.e. gravel and sand) and for 'liming' agricultural soils (the alkaline sands inland from Marshall Bay are sometimes used on agricultural soils to help raise pH levels). However a notice of application for two exploration licences covering areas of 244 km^2 and 245 km^2 in the vicinity of Lackrana and Memana was posted in April 2007.

4.1.2. Geomorphology

The most comprehensive soil study of Flinders Island was by Dimmock in 1957. This study divided Flinders Island into six geomorphic units. The six units are; mountains, foothills, the east and south coastal plain, the west coastal plain, calcareous dunes, and basalt flows. A study in 1982 further surveyed land and soil resources in relation to regional rainfall, topography

and vegetation in order to group similar land systems or types, see Figure 4.1 (Pinkard and Richley 1982).

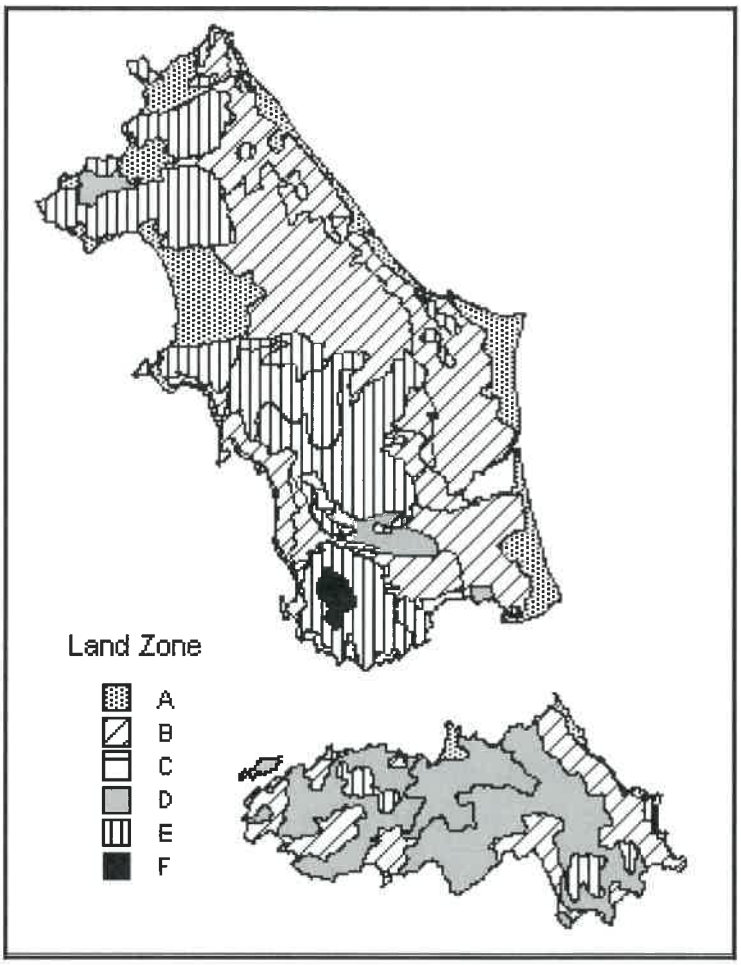

Figure 4.1 Land Systems of Flinders and Cape Barren islands

Notes:

A = Quaternary, coastal beaches, dunes, ridges and flats. Mostly deep, calcareous, pale sand soils. Mostly scrub vegetation with some scrubland, woodland and low forest.

B = Undulating plains. Quaternary sands and clays. Deep mostly uniform sand and duplex soils. Mostly eucalypt woodland and scrub vegetation with some forest.

C = Low hills and undulating plains. Tertiary basalt. Dark brown gradational soils and mottled clays. Paperbark scrub vegetation.

D = Low hills. Geology diverse. Eucalypt woodland with some forest and scrub.

E = Forested hills. Devonian granite and Mathinna beds. Mostly mottled duplex soils. Peppermint eucalypt forest and woodland vegetation.

F = Mountains. Devonian granite. Shallow, stony, brown gradational soils. Most heath and scrub vegetation.

Source: Pinkard and Richley 1982. Digital data supplied by DPIWE.

Mountains and Foothills

The mountains are formed by granitic rock of the Paleozoic basement. On Flinders Island examples include the Strzelecki Peaks, Darling Range, Mount Killiecrankie and the Patriarchs; and Mt. Munro and Mount Kerford on Cape Barren Island.

The Coastal Plains

The plains are divided into the eastern-southern coastal plain and the western coastal plain. The eastern-southern coastal plain occupies almost half Flinders Island, extending from North-East River to southeastern Flinders Island and is mostly less than 10 metres above mean low water spring tide (Underwood 1998). The topography of this coastal plain is characterised by sand dunes, inland and coastal lagoons, and an extensive coastal barrier and beach ridge system that runs parallel to the coast for virtually its entire length. A large area of this coastal plain was cleared to form the Memana and Lackrana farming districts.

The western coastal plain is much narrower and shorter than its eastern counterpart, extending from Settlement Point to southern Flinders Island. It is characterised by sand dunes and siliceous beach ridges (Underwood 1998).

The Calcareous Dune Systems

During the early Quaternary period the prevailing westerly winds formed aeolian calcarenite parabolic dunes behind the west facing beaches. The limestone found in the region was formed through a simple consolidation process of these dune sands that are rich in shell fragments (calcium carbonate) (Dimmock 1957; Underwood 1998). However, the greater part of the limestone appears to represent a denuded calcareous B horizon of former soils developed on calcareous sand. The limestone is generally cream to buff in colour but once weathered forms shallow red-brown soils (e.g. Ranga).

Aeolian calcarenite principally occurs in the Palana, Lughrata and Ranga districts. The largest deposit is located inland of Marshall Bay covering an area approximately 32 km2, extending 7 km inland up to a height of over 160 m (Underwood 1998). Some excellent examples of the aeolian calcarenite

(limestone) can be seen at Cave Beach and the southwestern corner of Fotheringate Bay.

The Basalt Flows

The basalt areas are regarded as small isolated flows rather than the remains of former extensive sheets. There are three main basalt areas on Flinders Island, all are characterised by their flat topography. The largest area is a small plateau at Thule at an altitude of about 130 metres. The other sites are behind Petrification Bay and a small patch southwest of The Dutchman (Dimmock 1957).

4.1.3. Soils

Dimmock (1957) defined 19 soil types or associations (a characteristic pattern of soils occurring together in a distinctive landscape). The distribution of soil associations for Flinders Island is shown in Figure 4.2. The land systems (Figure X) of Flinders Island influence the distribution of the soil associations. These relationships are noted in Table 4.1. Some soil association boundaries are poorly defined (e.g. on the relatively flat east and south coastal plain) while others have well defined boundaries due to sharp breaks in parent material, topography or both. Pinkard and Richley (1982) arrange the soils into three broad categories:

- Soils with uniform texture profiles: these constitute almost one quarter of Flinders, Clarke and Cape Barren islands. Most are deep sands distributed over the coastal plains and dunes, and other areas of low relief.
- Soils with gradational texture profiles: these soils vary from shallow and stony profiles along the crests and steep upper slopes of the Strzelecki Range to a profile that is deep, whole coloured and mottled on the undulating plains and low hills. These soils cover about 20% of the three main islands.
- Soils with duplex texture profiles: these soils are mostly greater than 1.5 metres deep and cover over half of Flinders, Cape Barren and Clarke islands.

- The most common soil association on Flinders Island is the Nala Association covering 254 km², occupying a series of stabilised dunes and intervening lagoons at Wingaroo and the eastern lagoon and coastal system (Dimmock 1957). The principal soil type of the Nala association is gritty sand with some surface organic matter and a cemented pan below 75cm and is very acid.

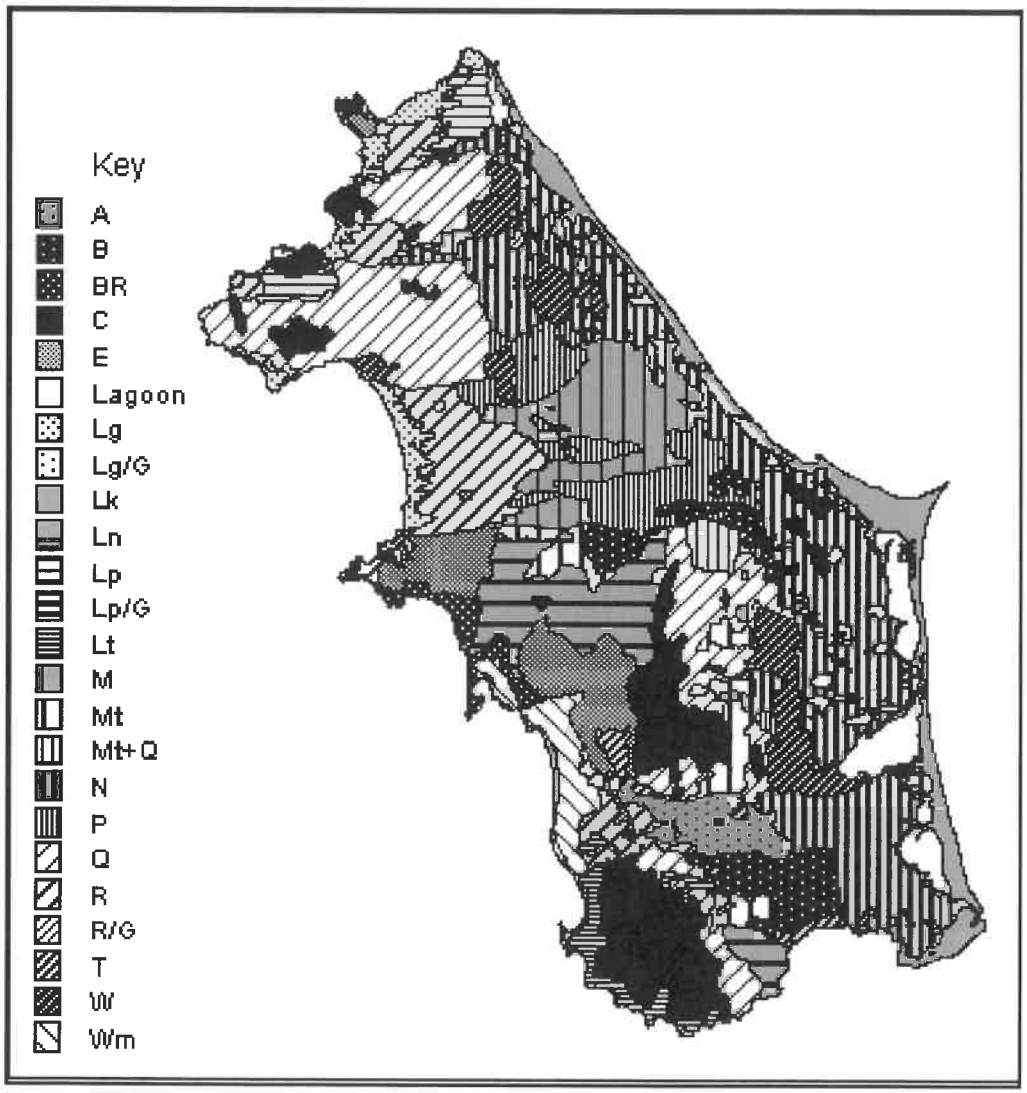

Figure 4.2 Soil map of Flinders Island

Notes: A = Altmoor; B = Bootjack; BR = Blue Rocks; C = Carena; E = Emita; Lg = Lughrata; Lg/G = Lughrata/granite; Lk = Lackrana; Ln = Lenna; Lp = Liapota; Lp/G = Liapota/granite; Lt = Loccota; M = Memana; Mt = Metta; Mt+Q = Metta with Quoin; N = Nala; P = Petibela; Q = Quoin; R = Ranga; R/G = Ranga/granite; T = Thule; W = Wingaroo; Wm = Whitemark.

Source: Dimmock 1957; Digital data supplied by DPIWE.

Table 4.1 Relation Between Geomorphic Units and Soil Association on Flinders Island

Sources: Dimmock 1957; Pinkard and Richely 1982.

Geomorphic Unit	Characteristics	Soil Association
1. Mountains	(a) Granite: Steep slopes with mainly bare outcrops. Elevations up to 760 m. Drainage pattern from these areas influenced by rectangular joint systems.	Carena
	(b) Quartzite: Elevations up to 500 m. Steep slopes with rock outcrops and rock debris. Distribution confined to area around Broughman Sugarloaf.	Lenna
2. Foothills	(a) Quartzite and slates: Much dissected country with moderate to steep slopes. Loose rock debris common on surface with quartzite areas.	Lenna
	(b) Granite: (i) Maturely dissected hills with broad valleys, now showing slight rejuvenation. Probably belongs to a very ancient land surface. (ii)Younger smooth granite hills with tors fairly common.	 Quoin & Metta Emita
3. East and South Coastal Plain	(a) Belt of former beach ridges parallel to present coastline. Includes current coastal lagoons or lagoons in the process of being cut-off from the sea through the migration of offshore sand bars.	Lackrana
	(b) Series of stabilised dunes with district ENE-WSW orientation. Numerous shallow lagoons occupying hollows and depressions between ridges. The average altitude is <7m.	Nala
	(c) Broad flats, formerly floors of old coastal lagoons (i) Older, with deposits of secondary carbonate, sometimes with shells, at shallow depths. Altitude ranging from 7 – 28 m. (ii) Younger, with highly organic surfaces overlying loose sand and shell beds. Altitude is 7 m or less.	 Memana Wingaroo
	(d) Undulating and broken country made up of low sand rises separated in places by narrow strips of alluvium. Altitude between 5 and 35 m.	Petibela
	(e) Complex of broad flats and very subordinate sandy rises. Flats considered to be largely of alluvial origin. Gentle fall towards the coast from 35 m to about 7 m above sea-level.	Bootjack
	(f) East-west sand dunes superimposed on a plain composed of stratified unconsolidated marine sediments and having a gentle southeasterly fall. Elevation between 30 and 70 m above sea-level.	Altmoor
4. West Coastal Plain	(a) Marine bench at an average elevation of about 5 m above present sea-level, considered to be related to last eustatic fall in sea-level. Also includes gentle lower slopes to granite ridge bounding coastal plain on eastern side.	Whitemark
	(b) Gentle sloping to flat areas of granite and quartzite colluvium with superimposed siliceous sand dunes in some places. Loccota association includes a continuation of the marine bench in (a). Blue Rocks association contains a remnant of another higher and older bench, probably at about 10 m above sea-level.	Loccota Blue Rocks
5. Calcareous Dunes	Two series usually occurring together, both aligned parallel to the prevailing westerly winds and stabilised. Adjacent to west facing boundaries. (a) Younger series: Dunes, when well developed, hairpin-shaped with open end facing upwind; adjacent to present coast and composed very largely of shell sand. In several areas the sand has been blown over granite hills	 Lughrata
	(b) Older series: Hairpin shape not evident, but there are district longitudinal ridges superimposed on hills of granite and quartzite up to 170 m in height. These ridges represent modified former calcareous dunes from which the shell material has been dissolved and redeposited in the form of dune limestone.	Ranga
6. Basalt Flows	(a) Small plateau at an altitude of about 130 m. (b) A number of other very small widely scattered outcrops elsewhere on the island, usually at much lower elevations than (a).	Thule

4.1.4. Geoconservation

Geodiversity is the natural diversity of the earth's features and processes (geological, landform and soil). While many landforms and geological features are considered robust many geodiversity features are very susceptible to damage (e.g. sand dunes, cave systems, fossil sites, soils). The vulnerability of such features must be taken into account.

The Furneaux Group contains good representative, and in some cases outstanding examples of various geology, geomorphology and geomorphic processes. Dixon (1996) provides an inventory of sites of geoconservation significance on Tasmanian islands. While only considered a preliminary inventory it provides a significant insight into the geodiversity of Tasmania's islands, including the Furneaux Group, and identifies relevant management issues.

More recently information on sites of geoconservation significance, including the information provided by Dixon (1996) has been compiled by DPIW in the online geoconservation database (now incorporated into the database known as the Natural Values Atlas). It is important to note that there is very little data regarding the distribution and significance of geodiversity features and processes on private land. Much of the geoconservation database contains records from pre-existing inventories which were largely restricted to public land.

The Natural Values Atlas includes more than 67 sites of geoconservation significance in the Furneaux Islands (see appendix A). Each feature has been assigned a significance level depending on their spatially defined significance i.e. local, regional, Tasmanian, Australian or global. The Cameron Inlet Offshore Fossil Locality is considered to be of Australian significance, a further 16 sites have Tasmanian significance, and the remainder either regional or local significance. The location of these sites is shown in Figure 4.3.

Figure 4.3 Location of listed geoconservation sites in the Furneaux Group.

Source: Map produced on the LISTmap (DPIW 2007)

Geological and geomorphological features of the region include (Dixon 1996).

- Devonian granite intrusive features: There are at least six compositional suites of granitoids, each of which may include several rock types (differing in mineralogy and texture).
- Granite geomorphology: The mountains of Flinders and Cape Barren Islands and the coastlines of many of the outer islands display many different characteristic granite landform features.
- Pleistocene and Holocene dunes that have formed on the east, west and north coasts of Flinders Island. The oldest dunes in the west are calcareous while the eastern dunes are composed of siliceous sands.
- Lagoons and lunettes: lagoons occur extensively throughout eastern Flinders and Cape Barren Islands, most being impounded by the dune systems on the eastern coastal plain.

- The extensive coastal barrier-parallel dune complex and the associated coastal lagoons and inlets on Flinders Island followed the establishment of current sea-levels (about 6,500 years ago).
- Coastal karst: Spectacular coastal karst features have developed in aeolian (wind blown) calcarenite in several areas along the west coast of Flinders Island and are the best examples of such features in Tasmania. Features include deep intertidal notches, rugged karren, broad shore platforms, stacks, caves formed by emerging groundwater and marine erosion, and alveolar weathering of cliffs. Inland karst landforms can be found at Ranga and Emita. The most significant cave in the region is Ranga cave, which contains sub-fossil bone deposits.

4.1.5. Land capability

Land Capability is a widely accepted form of land evaluation, used to classify land on a sustainable basis. The classification is primarily based on 3 factors: soil, slope and climate. It does not consider the economic viability of particular uses or the potential for irrigated agriculture or horticulture. Since 1999 land capability maps have been produced for the entire Furneaux group.

A Land Capability map of Flinders Island and accompanying report (Bayley 2002) was produced as the result of a joint initiative between Furneaux NRM and Flinders Council in 2002 (Figure 4.4). Almost eighty percent of the surveyed area was classified as land suitable for grazing (with slight to moderate limitations) but generally unsuitable for cropping (Class 5). Most of the remaining land has either severe or extreme limitations to agricultural use and thus should be left under native vegetation cover (Class 6 and 7). A small area is considered well suited to grazing and some restricted cropping (Class 4) (Table 4.2).

A Modelled Land Capability map has been produced by DPIW for the Lady Barron map sheet area which includes Clark Island, Lady Barron Island and the southern half of Flinders Island (Figure 4.5). Very limited field checking of these maps has been undertaken but they are considered quite reliable at the 1:100 000 scale. Similarly to the Flinders Island map almost eighty percent of the mapped area is classified as Class 5 which is unsuitable for cropping and

has slight to moderate limitations to pastoral use. Most of the remaining land is mapped as Class 6 which is only marginally suitable for grazing and should be retained under its natural vegetation cover (Table 4.3).

Table 4.2 Land Capability classes for Flinders Island.

Source: Bayley 2002

Land Capability Class	% of Area	Class definition
Class 4	4	Land well suited to grazing but which is limited to occasional cropping or to a very restricted range of crops. The length of the cropping phase and/or range of crops are constrained by severe limitations of erosion, wetness, soils or climate. Major conservation treatments and/or careful management is required to minimise degradation.
Class 5	79	Land with a slight to moderate limitation to pastoral use but which is unsuitable for cropping, although some areas on easier slopes may be cultivated for pasture establishment or renewal and occasional fodder crops may be possible. The effects of limitations on the grazing potential may be reduced by applying appropriate soil conservation measures and land management practices.
Class 6	12	Land only marginally suited to grazing activities due to severe limitations. The land has low productivity, high risk of erosion, low natural fertility or other limitations that severely restrict agricultural use. This land should be retained under its natural vegetation cover.
Class 6/7 complex	4	Refer to descriptions of Class 6 and 7.
Class 7	1	Land with very severe to extreme limitations, which make it unsuitable for agricultural use.

Table 4.3 Land Capability classes for the Lady Barron mapsheet.

Source: Lynch 2005

Land Capability Class	% of Area	Class definition
Class 5	79	Land with a slight to moderate limitation to pastoral use but which is unsuitable for cropping, although some areas on easier slopes may be cultivated for pasture establishment or renewal and occasional fodder crops may be possible. The effects of limitations on the grazing potential may be reduced by applying appropriate soil conservation measures and land management practices.
Class 6	20	Land only marginally suited to grazing activities due to severe limitations. The land has low productivity, high risk of erosion, low natural fertility or other limitations that severely restrict agricultural use. This land should be retained under its natural vegetation cover.
Class 7	1	Land with very severe to extreme limitations, which make it unsuitable for agricultural use.

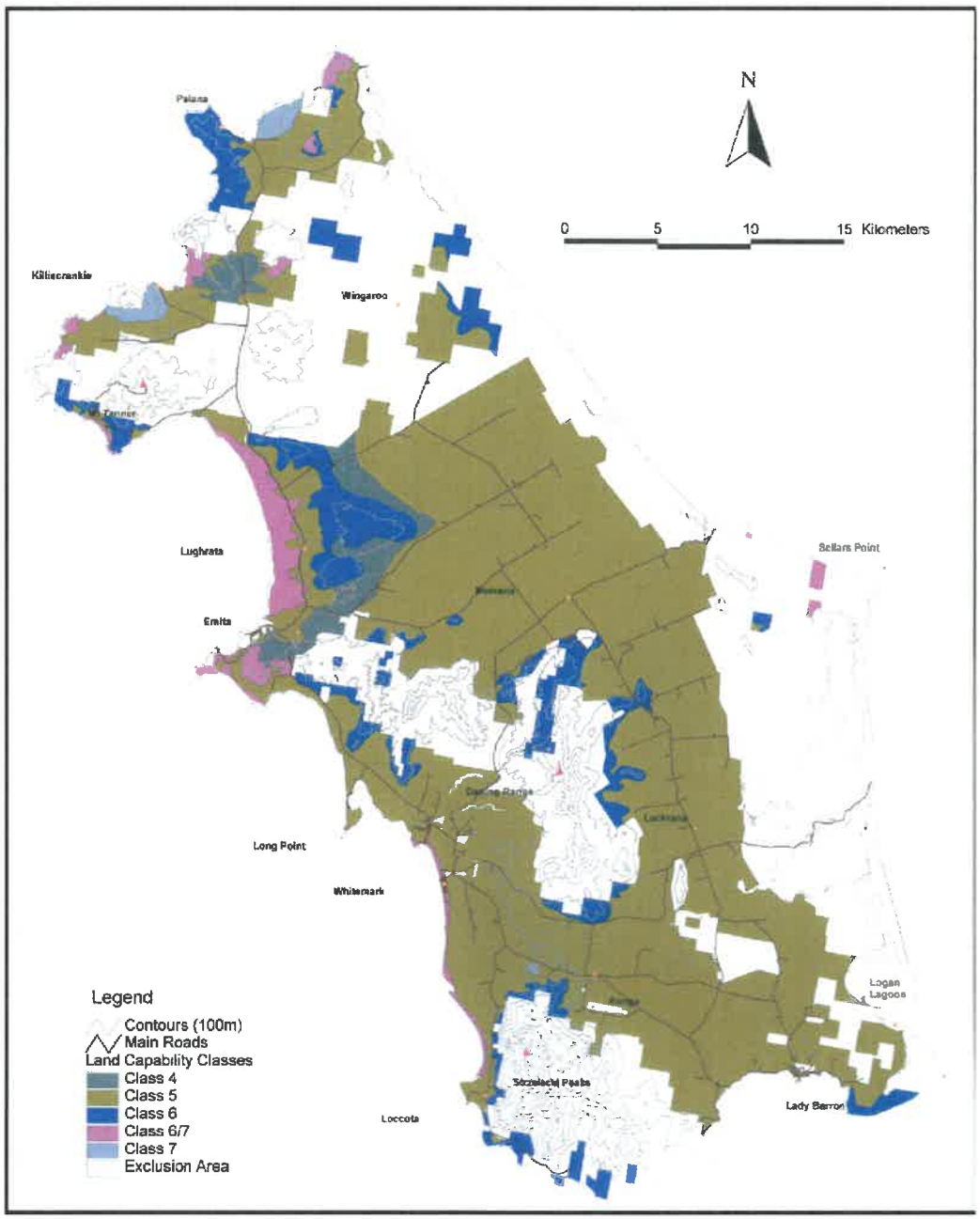

Figure 4.4 Land Capability map for Flinders Island

Source: Bayley 2002. This Land Capability Survey was conducted at a mapping scale of 1:100 000.

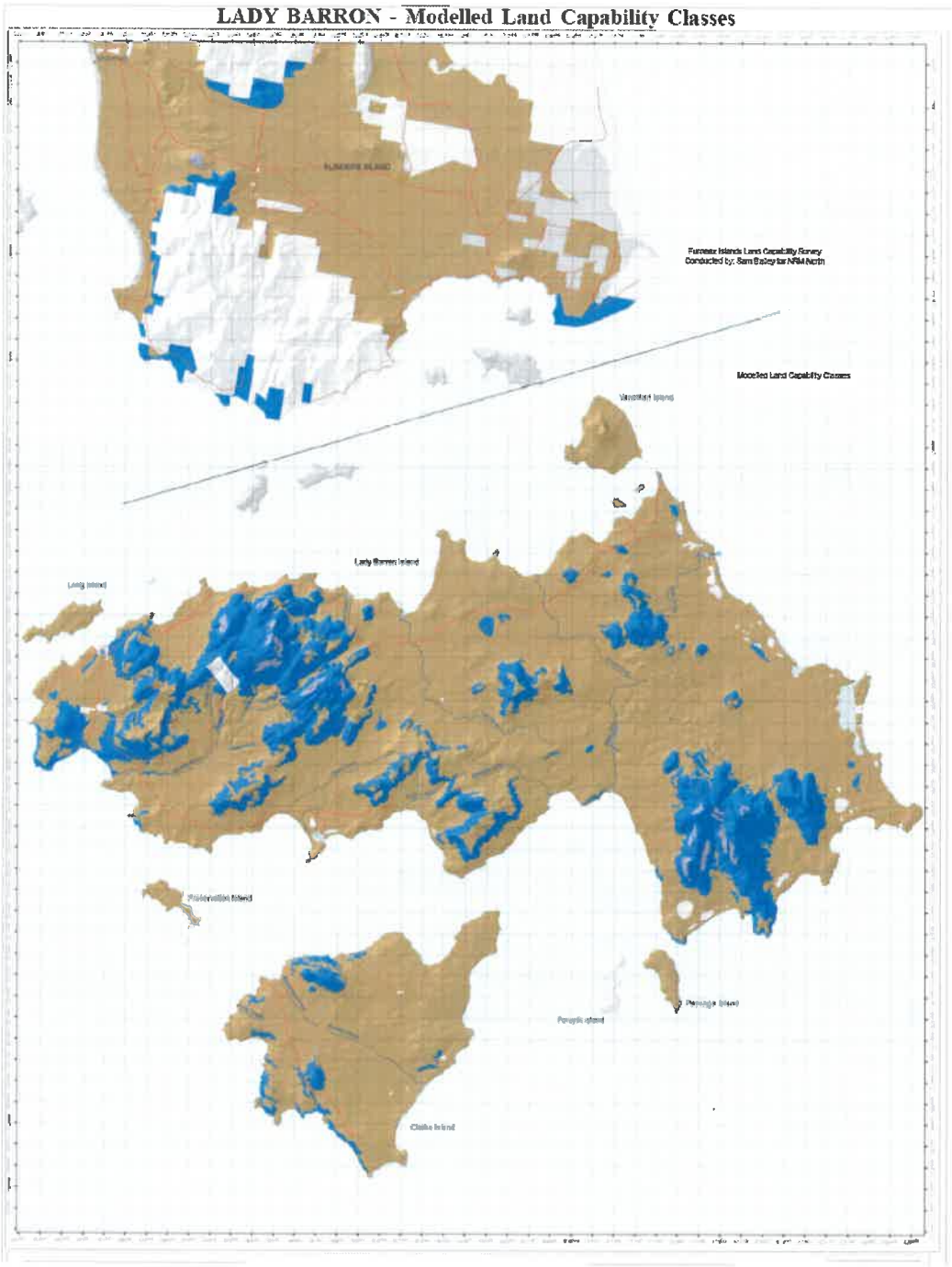

Figure 4.5 Modelled Land Capability map for the Lady Barron mapsheet.

Notes: Brown is Class 5, blue is Class 6, dark grey is Class 7 and light grey is an exclusion area (e.g. State Forests, conservation areas, major water bodies etc.).

Source: Lynch (2005).

4.1.6. Land Use

Seventy-two percent of land use in the Furneaux Group is categorised as 'conservation and natural environments'. This includes areas such as National Parks, Conservation Areas and remnant native vegetation on public and private land. The other large land use is grazing of modified pasture which accounts for a further 27 % of land use (Table 4.4 and Figure 4.6).

Table 4.4 Land use in the Furneaux Group.

Source: Bureau of Rural Sciences 2003.

Land use category	Type of land use	Total area (ha)	% of total municipal area
1. Conservation and natural environments	Nature reserve, wilderness area, national park, stock route, rehabilitation area, surface/groundwater supply.	141 000	72
2. Production from natural environments	Grazing of natural vegetation	1 650	<1
	Native production forestry	1 230	1.5
3. Dryland agriculture and forestry	Grazing of modified pasture	52 400	27
	Plantation forestry	303	<1
4. Irrigated agriculture	Irrigated modified pasture, cropping, perennial and seasonal horticulture.	0	0
5. Intensive use	Intensive farming, industrial, urban, mining, water treatment	486	<1
6. Water	Lake, stream. river, wetlands.	36	<1

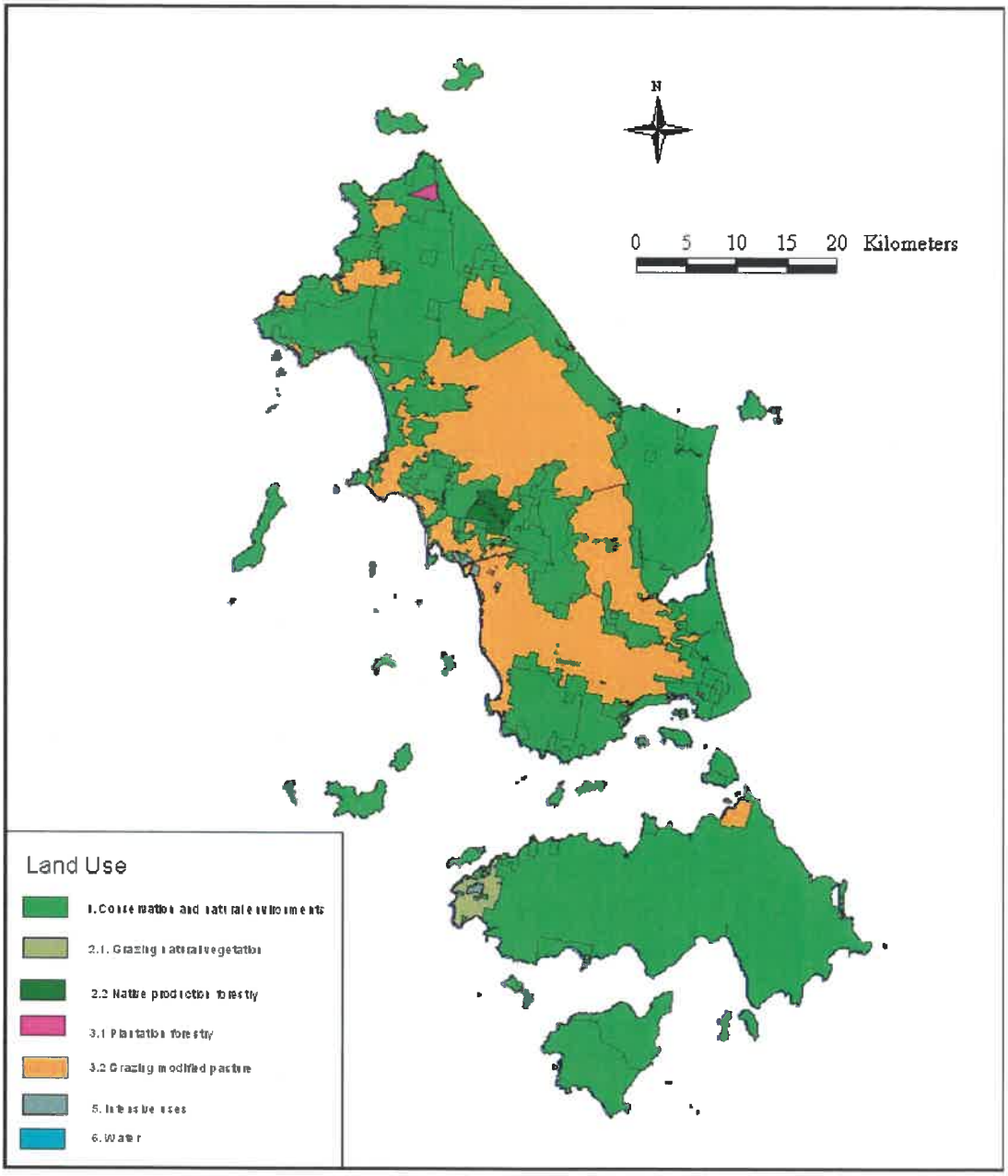

Figure 4.6 Land use in the Furneaux Group.

Source: Bureau of Rural Sciences 2003.

4.2. *Managing Land- Threats and Priority Issues*

This section outlines the key issues and threats which impact upon the condition of land in the Furneaux Group. These issues and threats have been identified form the existing literature and during consultation with technical experts and Furneaux community.

Most of the threats and issues discussed in detail in this chapter fall under the heading of soil degradation which includes issues associated with declining soil condition, salinity and acid sulfate soils. Waste management is also discussed. It is important to note that threats and priority issues discussed in other chapters may also impact upon the asset of land.

4.2.1. Soil degradation

Soil degradation is a broad issue that covers soils on agricultural land and to a lesser extent on Crown Land. Soil degradation on economically productive lands can cause a loss of the productive capacity, a loss of soil resources (i.e. topsoil), decreased fertility and structural decline. Soil degradation in areas with native vegetation can cause a loss of natural resources (e.g. vegetation, habitat, soils) and open pathways or opportunities for weed infestation. The more pressing issues in the Furneaux Group relate to degradation problems on agricultural land.

As agriculture is a major industry and employer in the Furneaux Group the protection of the region's soil resources through sustainable management regimes is essential to ensure that this industry remains productive into the future. The natural resources of some farms in the region are suffering due to poor management techniques but there are also some excellent land managers in the region who are leading the way with sustainable farming practices. Degrading soil characteristics and performance will adversely impact upon the local economy and the standard and quality of living for the region in the future.

The major types of soil degradation in the Furneaux Group are salinity and wind and water erosion. A considerable potential for the development of acid sulphate soils has also been recognised. Table 4.5 lists these and other types

of soil degradation occurring in the Furneaux Group and the areas of occurrence.

The National Action Plan for Salinity and Water Quality (NAP) has identified 21 regions in Australia most affected by salinity and water quality problems. The entire Furneaux group is included within the larger NAP region identified in Tasmania. It is estimated that approximately 6.8% of agricultural land in the Flinders Municipality has visual signs of salinity, making Flinders one of the most affected municipalities in the State, second only to the Northern Midlands (Resource Planning and Development Commission 2003, Bastick and Walker 2000).

Table 4.5 Types of Soil Degradation in the Furneaux Group.

Sources: Grice 1992; Pinkard and Richley 1982; McMahon 1994; SoE 1996; Gurung 2001

Degradation Type	Occurrence/Description
Water Erosion	Generally caused by surface flow of water (rainfall or irrigation), washing away and eroding top and sub-soils. The effects are exacerbated where there is little or no vegetative cover and areas where run-off is channeled into concentrated flows. Impacts of water erosion include decreasing agricultural productivity and increasing water turbidity and silting in streams. The five main types of water erosion are: sheet, rill, gully, tunnel and stream bank erosion.
- Sheet	Removal of a fairly uniform layer of soil from the surface by runoff or raindrop splash. **Approximately half of the Furneaux Group is subject to a moderate-severe sheet erosion hazard.** The greatest risk is associated with the hilly and mountainous country of Strzelecki, Darling Ranges, Mount Tanner, the mountains of Cape Barren Island, and hills formed on the Mathina bed deposits near Brougham Sugar Loaf, Memana and Badger Corner.
- Rill	Typically occurs on recently disturbed soils and results from runoff gouging out numerous small channels or depressions up to 30 cm deep. Rills can enlarge into gullies. **Land in the Furneaux Group is subject to a nil-minor rill erosion hazard risk.**
- Gully	Caused by water that flows through it periodically, resulting in a channel deeper than 30cm. **The risk of gully erosion hazard has been classed as minor to severe.** Areas with a severe risk include land around Ranga, drains that were constructed on steeper slopes and/or in soils that are easily erodible, and in gravel pits that have not been restored
- Tunnel	Caused by the excessive seepage of water into a highly erodible sub-soil. Tunnel erosion usually reaches a size whereby they collapse and form potholes or gullies. **Tunnel erosion hazard has been classed as nil to minor.** The area most susceptible in the Furneaux Group is land around Ranga
- Stream bank	Resulting from stream flow that will erode the banks or cause them to slump. Risk increases when riparian vegetation is removed and stock graze freely in or around streams. **The drainage system, while classified as an artificial watercourse, has some severe cases of stream-bank erosion.**
Wind Erosion	This is the detachment and transport of soil by wind. The areas most vulnerable from wind erosion are quaternary coastal dune systems, given the sandy nature of the soil. **Areas that have severe wind erosion risk are around Palana, Marshall Bay, Killiecrankie Bay, Trousers Point, and small coastal areas of Cape Barren Island.** Management practices that remove vegetative cover, or overgraze will contribute to wind erosion. Coastal areas are also susceptible to wind erosion if vegetation and dune or soil structure are disturbed. Open paddock areas also experience a loss of top soil through wind erosion when paddocks are sparsely covered or freshly turned.
Salinity	The salinity problem on Flinders Island is a result of aerial salt input from the strong westerly winds, poorly draining soils, a relatively high water table (when not in drought) and extensive vegetation clearance on the eastern coastal plain during the Soldier Settlement Scheme (late 1950s – early 1960s). Susceptible areas that are not managed properly have the potential for salinity to significantly worsen.

	Areas in the Furneaux Group that have been identified with a moderate risk of salinity hazard include areas in the Memana, Lackrana and Lady Barron, and the low lying areas of the west coast from Sawyers Bay south to Trousers Point.
Soil Structure Decline	This is a change in the inherent structure of the soil as a result of certain land use practices. Examples include soil compaction from machinery and/or stock and a plough pan at the base of the cultivation layer. Impacts include reduced yields, increased run-off and greater risk of soil erosion. **The Furneaux Group has been classed with a nil-minor risk of soil structure decline hazard.**
Soil Contamination	Soil can become contaminated from leachate from tips sites, sewage wastes, chemicals and sprays. Impacts of contamination include the destruction of all beneficial soil micro-organisms, reduction in productivity, loss of vegetative cover (including pasture), poisoning of stock and incorporation of toxins within feed (including vegetables) and stock.
Acid Sulphate Soils	Much of the eastern half of Flinders Island is identified as having the potential to develop acid sulphate soils. Disturbance of these soils and consequent exposure to oxidising conditions can cause the production of metal rich acid drainage and result in serious water contamination issues. Other problems associated with acid sulphate soils include poor fertility, high vegetation dieback, surface scalding and erosion.

Removal of native vegetation and other land use change (e.g. conversion of perennial pastures to annual cropping) can result in increased soil salinity due to a reduction in plant water use (transpiration) and a consequent increase in groundwater recharge. Increases in recharge can lead to elevation of the watertable and mobilisation of salts stored in the unsaturated zone. Irrigation can also exacerbate salinity by increasing groundwater recharge or by irrigation with water containing salt which may cause salt to build up in the root zone or result in addition of salt to groundwater.

Eight types of groundwater flow systems have been mapped in the Furneaux group to assist in the management of dryland salinity. Each type of GFS has critical attributes that determine groundwater behaviour in response to land management and an understanding of each system should be used to inform salinity management and land use planning (Latinovic *et al.* 2003). A National Action Plan for Salinity (NAP) project is soon to be completed that assesses the hazard salinity presents to a region's assets, including natural and agricultural assets. The results of this project will be provided to the relevant councils, including Flinders Council to inform salinity management in their municipality.

Much of the eastern half of Flinders Island has been identified as one of the areas in Tasmania that contains sediments (i.e. Holocene sediments in low-lying coastal areas as well as inland bogs, lagoons and backswamps) with the potential to host acid sulphate soils. Limited survey work conducted in 2001 did not locate any actual acid sulphate soils on the island but did reveal the potential for acid sulphate soils (PASS) (Gurung 2001). The most up to date mapping of acid sulphate soils is available on the ASRIS (Australian Soil

Resource Information System) website. Further survey work has been planned by scientists at CSIRO and DPIW to take place in the next year or so. Generally management should aim to avoid the development of areas that have the potential to develop acid sulphate soils (Charman and Murphy 2000).

Some of the quarry sites on Flinders Island have suffered extensive soil degradation, mainly due to wind and water erosion. In the past extractive practices have occurred at the quarries with no, or very little, rehabilitation and revegetation activities. Since 1999 on-ground some work has been undertaken to rehabilitate and re-vegetate sites within quarries according to a quarry codes of practice (FNRMS Project 2003).

Some of the outer islands are also suffering severe soil degradation. One of the great threats to the sustainability of the outer islands is "the loss of soil through erosion process[es] as a result of soil disturbance" (PWS 1998a). This may have occurred due to past land management practices (decades in some cases) and/or current practices such as overstocking. Cape Barren geese may also place pressure on pasture on the outer islands, promoting soil degradation due to decreased vegetative cover and root matting.

Various initiatives have been undertaken to address soil degradation issues since 1999. At a State and Federal level a range of activities have been undertaken which have relevance in the Furneaux. These include:

- An assessment of the extent and impacts of salinity in Tasmania, including the Furneaux Group (Bastick and Walker 2000)
- A survey of the distribution of actual and potential acid sulphate soils in Tasmania (Gurung 2001)
- The production of a number of documents to guide land managers including: *Soil Management - A Guide for Tasmanian Farmers.* (Hamlett 2002); and *Trees and Shrubs for Salinity Management in Tasmania* (Finnigan and Poulton 2005)

At a more local level many initiatives have been undertaken including:

- Land capability mapping of the Lady Barron map sheet and Flinders Island

- Revegetation activities to decrease wind and water erosion, stablise topsoil etc.
- Revegetation activities in strategic areas (e.g. recharge zones) to reduce salinity risk
- Fencing activities to exclude stock from degraded and susceptible areas
- Promotion of sustainable management techniques through the Flinders Island Productivity Group
- Development of a code of best practice in soil management relevant to local conditions
- Development and implementation of a quarry code of best practice and
- Establishment of piezometer bore system for monitoring salinity.

Priority Areas/Locations

Soil degradation to varying degrees can be found throughout many of the agricultural districts on Flinders Island. Specific areas include Martins Hill, Thule and Palana.

Outer Islands: on some islands poor management/neglect, overstocking and/or drought have lead to instances of severe soil degradation.

4.2.2. Waste Management

The management of waste is an important issue in maintaining the long-term quality of the natural environment in the region. Waste management includes the disposal and/or recycling of domestic and commercial waste. There are currently two official tip sites on Flinders Island and one on Cape Barren Island, and an unknown number of individual farm tips. In the past aluminium and lead products have been recycle in the region but currently only used batteries and oil are collected for recycling off the island. The production of waste that is not re-used or recycled represents a waste of precious natural resources. Refuse disposal sites, current and historical have the potential to contaminate soils, rivers/streams and groundwater through the leaching of pollutants.

4.3. Management Directions

This section presents Community Aspirational Statements and recommended Resource Condition Targets (RCTs), Management Actions Targets (MATs), and Management Actions for the asset of Land. These targets ad actions are focused on the key issues associated with the asset of land. It is important to recognise that land does not exist in isolation from other natural values in the Furneaux. To successfully manage land, there must also be adequate management of the environment as a whole including water, biodiversity, coasts, estuaries and marine environments and issues related to people and management. It is therefore important to note that management actions listed below are intended to be read and implemented together with those presented in Chapters 3, 4, 5, 6 and 7.

Community Aspirational Statements for Land

Managed development and growth to maintain unspoilt natural features.

A diversified, economically and environmentally sustainable agriculture industry producing quality products with a unique marketing identity for the benefit of future generations.

Table 4.6 Targets and Actions for Land

Issue	Resource Condition Targets (RCTs 10- 20 years)	#	Management Action Targets (MATs 1-5 years)	#	Management Actions	Key Partners
Soil Condition	LR1: Maintain soil condition within the desirable SCEAM condition range for each important soil/land use combination in agricultural areas by 2027	LM1	Reference sites for the most important specific soil land use combinations are established and targets determined for their condition by end of 2008 (i.e. SCEAM project)	LA1	As part of state-wide SCEAM project set up reference sites and collect relevant data from the most important soil land use combinations by end of 2008	DPIW
		LM2	Sites where soil condition is currently below desirable levels (as determined by experts) are identified by 2008	LA2	Determine targets for the most important specific soil land use combinations in the Furneaux by the end of 2008	DPIW
		LM3	Management strategies are implemented to reverse decline in soil condition at sites where current soil condition is below desirable levels by 2012	LA3	Develop and implement specific management strategies at sites where soil condition is below desirable levels, to, where possible, reverse decline in soil condition	DPIW, NRM North, Community
Acid Sulphate Soils	LR2: All areas identified at risk of developing acid sulphate soils are being managed to prevent their oxidisation and consequent local and offsite impacts by 2020	LM4	Areas are identified which are at risk of developing acid sulphate soils by 2009	LA4	Carry out research and survey activities to identify areas at high risk of developing acid sulphate soils by 2009	DPIW
		LM5	50% of land managers in areas identified as a high risk of developing acid sulphate soils are aware of the issue and have adopted management practices to reduce the risk by 2012	LA5	Implement an acid sulphate soils awareness raising and education program targeting land managers in high risk areas by 2011	DPIW, NRM North, FC, Community

Salinity	LR3: The rate of increase of (i) groundwater height and salinity concentration and (ii) the area of salt affected land in high priority groundwater flow systems (GFS)/catchments will be reduced compared with trends established by 2020	LM6	By 2008, groundwater flow systems/catchments with highest salinity have been identified	LA6	Identify the groundwater flow systems/catchment with highest salinity hazard by 2008	DPIW, NRM North
		LM7	By 2012,key reference sites and a monitoring program is established to establish the trend in land salinity in high hazard groundwater flow systems by 2020	LA7	Establish key reference sites and monitoring a program to enable monitoring of trends in salinity in high risk groundwater flow systems/catchments by the end of 2012	DPIW, NRM North
				LA8	Undertake a survey of existing salinity affected areas and a review of the existing bore monitoring program, to identify salt affected areas which warrant rehabilitation and to refine the monitoring program to improve its effectiveness and ensure it includes those areas identified with highest salinity hazard by 2009	DPIW, NRM North
		LM8	Rehabilitation activities have commenced on 50% of the existing salinity affected areas as identified in surveys by 2012	LA9	For existing salinity affected areas identified as warranting rehabilitation, begin activities to rehabilitate by 2010	NRM North, Community
		LM9	By 2012, 30% of managers in identified high risk salinity areas are adopting best practice salinity management	LA10	By 2008 develop and distribute a land managers salinity training toolbox which will facilitate the adoption of best practice salinity management on Flinders Island (this toolbox is currently being developed under NAP and will only need minor modification for Flinders Island)	DPIW, NRM North

Geo-conservation	LR4: By 2020, the condition of sites of geoconservation significance (as listed on the Tasmanian geoconservation database) will be maintained or improved when compared to benchmark levels (benchmark levels to be set by 2011)	LM10	By 2012 baseline condition and risk of degradation has been established for all sites listed on the Tasmanian geoconservation database which are located in the Furneaux Group	LA11	Establish baseline condition and evaluate risk of degradation for all geoconservation sites listed on the Tasmanian geoconservation database which are located in the Furneaux Group by 2012	DPIW, NRM North, PWS
		LM11	By 2012, at least 50% of private land and 30% of public land in the Furneaux has been systematically surveyed/investigated to identify the presence of sites of geoconservation significance	LA12	Undertake systematic survey/s to identify geoconservation sites of significance on private and public land by 2010 and nominate these sites for listing on the Tasmanian geoconservation database	DPIW, NRM North, Community
		LM12	Best practice management to minimise degradation to listed geoconservation features is being adopted at 50% of sites at risk of degradation by 2012	LA13	Implement a program to raise awareness and educate land managers (public and private) of geoconservation values and support implementation of best practice geoconservation management by 2010 (ongoing)	NRM North, DPIW, PWS, FC, Community
Waste Management	LR5: By 2017, there is a measurable reduction in the quantity of waste being deposited at landfill sites in the Furneaux	LM13	By 2012, strategies are being implemented to substantially reduce, re-use and recycle waste	LA14	Investigate and implement strategies to reduce, re-use and recycle waste	FC, NRM North, Community

Chapter 5. WATER

5.1. *Water - Description of the Asset*

This section focuses on rivers and streams, groundwater and wetlands. Only waters upstream of the tidal limit are examined. Estuaries are discussed under the Coastal, Estuarine and Marine chapter.

5.1.1. Surface Water

Due to the low rainfall and relatively small size of the catchments in the Furneaux Group the flows of rivers, streams and creeks are highly seasonal, with very few permanent running watercourses.

The main rivers or watercourses on Flinders Island are Pats River, North East River, Samphire River, and the drainage schemes (discussed below), with smaller rivers and streams running from the Strzelecki Peaks, Darling Range and Mt Tanner to the coast (Figure 5.1).
The main rivers on Cape Barren Island are Modder, Lee and Rices rivers, with smaller rivers and streams running from the peaks to the coast. Clarke Island's two main waterways are Thomas Creek and MacLaines Creek.

Freshwater springs occur along many areas of the coast where limestone occurs with granite underlying it. On many of the outer islands these springs rise to the surface forming soaks, providing vital water for stock.

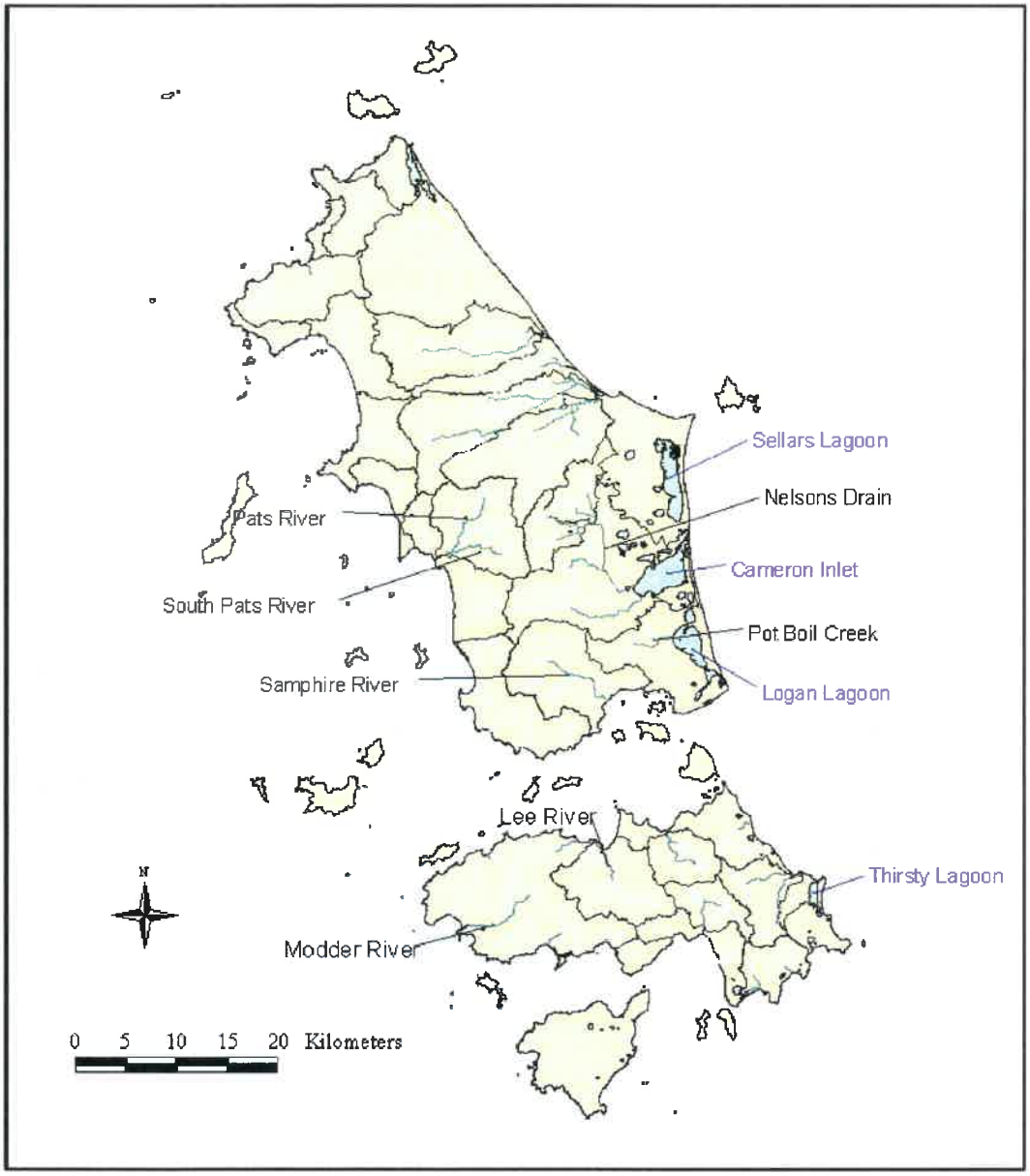

Figure 5.1 Main waterways and catchments in the Furneaux Group.

Source: CFEV 2006

5.1.2. Groundwater

Groundwater studies have been undertaken on Flinders Island by Mineral Resources Tasmania (formerly the Dept. of Mines) and by the Agricultural Bank. Mineral Resources Tasmania stated that groundwater is most plentiful on Flinders and Cape Barren Islands in areas underlain by Cainozoic sediments (Matthews 1975; Kied 1949). These sediments consist of

limestones and sandstones and generally occur on flat or slightly undulating country that is (or was) often swampy.

Matthews' 1975 groundwater study focused primarily on locating suitable quality groundwater for domestic use at Whitemark, Lady Barron, Palana, North East River and Emita. The study concluded that while groundwater appeared plentiful on Flinders Island it was very variable and many locations would have only been suitable for restricted use. For example, he stated that the salinity and hardness of the groundwater around Whitemark would be unsuitable for drinking and hot water services, but could be used for gardens and cold water supplies.

The Palana area appeared to have a more unreliable groundwater supply with the exception of one well that was used by the Air Force during the 1940s. However, Matthews did state that further tests assessing water quality and quantity should be undertaken before extracting water from the area.

Records from the Agricultural Bank indicate that bores put down on a property in the Emita area were not very satisfactory because they were either too salty or the bores silted up. Matthews (1975) states that small quantities of reasonable quality groundwater could be obtained from bores, wells or seepages around the beach areas of Emita. He also states that the sand dunes bordering Marshall Bay may be capable of supplying groundwater.

North East River appeared to have little surface evidence of groundwater, with the exception of some small seepages in isolated areas (Matthews 1975).

Lady Barron was subject to further investigations by Matthews in 1978 with the prime purpose of locating a town water supply. Drilling indicated the presence of groundwater in coarse pebbly sand beds 1.5 km north of Lady Barron in quantities large enough to supply the town. This site is a high quality, shallow groundwater resource and is the current town water source along with household rainwater tanks.

Drilling by the Agricultural Bank in the Memana and Lackrana areas resulted in flows achieving 30-45 litres per minute at depths of 6-30 metres. A hydrological survey of this area (Armstrong and Drury 1997) stated that there is ample evidence of substantial groundwater quantities on the flats of Flinders Island but flows were not sufficient for most types of irrigation systems.

The quality of groundwater on Flinders Island is very variable (Armstrong and Drury 1997). An audit of carried out by the Northern Water Monitoring Program in 2005 found groundwater depth ranged from 0.4m to 2.6m below the surface and electrical conductivity ranged from 0.437 to 12.3 dS/M (Northern Water Quality Monitoring Program 2005). This represents a range from medium saline water to which sensitive crops may be affected to highly saline water which is unsuitable for irrigation (refer Table 4.1). Approximately 0.8 dS/M is the desirable limit for human consumption. The Lady Barron town water supply is drawn from groundwater resources and is of consistently good quality.

Table 5.1 Farm Water Quality.

Notes: 1. dS/M = deci-Siemens/Metre conductivity; 2. ppm = parts per million (Adapted from Armstrong and Drury 1997)

Class	Electrical Conductivity (Salinity)	Total Dissolved Solids	Comments
Class 1	0-0.28 dS/M	0-179 ppm	Low salinity water, few limitations.
Class 2	0.28- 0.80 dS/M	179-512 ppm	Medium salinity water, sensitive crops may be affected.
Class 3	0.80-2.3 dS/M	512-1472 ppm	High salinity water, cannot be used on soils with restricted drainage; salt tolerance of plants must be considered.
Class 4	2.3-5.5 dS/M	1472-3520 ppm	High salinity water not generally suitable for irrigation.
Class 5	> 5.5 dS/M	> 3520 ppm	Very high salinity water generally unsuitable for irrigation.

None of the studies or investigations above actually tried to determine the quantity of groundwater reserves in the Furneaux Group or where the recharge zones are. A project has recently been initiated (managed by the Department of Primary Industries and Water) which will develop a groundwater model for an area in the south east of Flinders Island. This project should significantly increase understanding of groundwater resources on Flinders.

5.1.3. Wetlands

"A wetland can include areas of marsh, fen, peatland or water, permanent or temporary, with water that is static or flowing, fresh, brackish or salty,

include areas of marine water of which low tide does not exceed six metres, and may be natural or artificial" (ANCA 1996). Wetlands are diverse and changeable environments and are capable of supporting a diverse range of flora and fauna that have adapted to their seasonal fluctuations. For example, the wetlands/lagoons along the east coast of Cape Barren Island are considered to be of special botanical interest as they contain some species that are rare on a state and national level and are relatively undisturbed.

Wetlands are considered a conservation priority in the Flinders Bioregion for their importance as amphibian, bird and fish habitat as well as their unusual flora and plankton (Gouldthorpe and Gilfedder 2002). In the Furneaux Group there are 14 wetlands (Table 5.2 and Figure 5.2) listed on the Directory of Important Wetlands in Australia (ANCA 1996). All are located along the eastern coastal plains of Flinders and Cape Barren islands. To be listed in the directory each wetland must meet certain criteria. Many more wetlands in the region are considered to be of sub-regional significance (Dunn 2005).

Australia is a signatory to international treaties that seek to conserve wetlands of international importance, especially as waterfowl habitat (e.g. the Ramsar Convention). Ramsar listed wetlands in the Furneaux Group are Logan Lagoon (southeast Flinders Island) and East-Coast Cape Barren Island Lagoons (consisting of numerous wetlands, of which five are listed in the directory as nationally important).

Most of the wetlands in the Furneaux are considered to be in near pristine condition but declining (Dunn 2005, Table 5.2). Key threatening processes recognised for wetlands in the region include grazing, changed hydrology, off-road vehicles, feral pigs, weed invasion and the pathogen *Phytophthora cinnamomi* (Gouldthorpe and Gilfedder 2002).

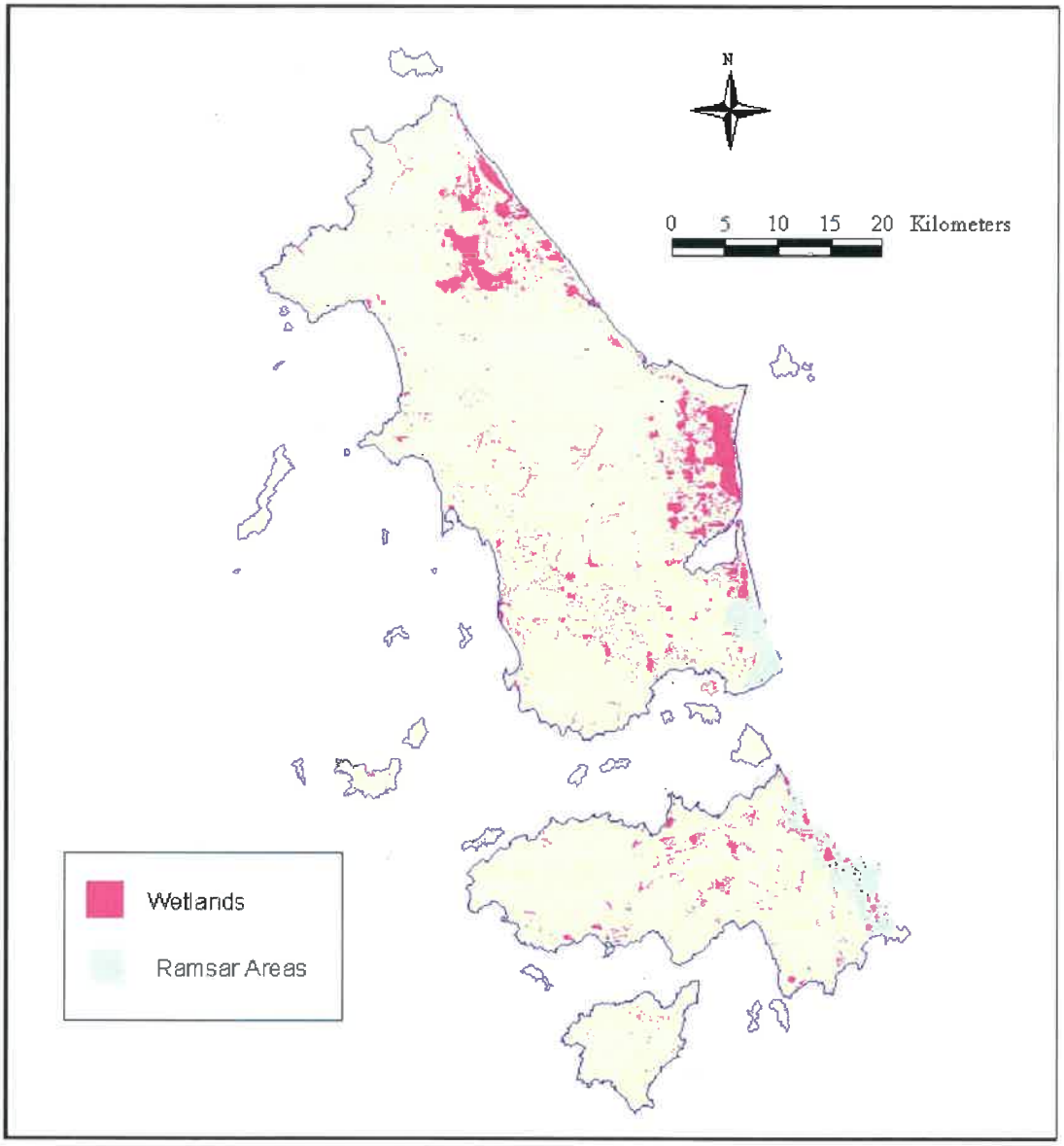

Figure 5.2 Wetlands and Ramsar Areas in the Furneaux Group.

Source: CFEV 2006

The flow of water into the wetlands along the eastern coastal plain of Flinders Island has been significantly modified through the development of the agricultural areas on the eastern flats. An extensive drainage system was constructed as part of the Soldier Settlement Program during the late 1950s and early 1960s (refer to section 5.14 fro more information on drainage cchemes). Rainfall run-off within these catchments is diverted and channelled through the drainage system and exit at certain inlets, estuaries or lagoons, significantly diminishing the replenishment rate of the wetlands in this area.

Two exceptions are Cameron Inlet and Logan Lagoon, both being discharge points for main and medium sized drains.

Draft management plans have been developed by the Parks and Wildlife Service for the Logan Logan Conservation Area (2000) and the North East River Game Reserve (1998) but these still need to be finalised.

Table 5.2: Wetlands of National Importance in the Furneaux Group

Source: Adapted from ANCA 1996 and Dunn 2005. The assessment of condition and trend in Dunn was derived from expert opinion using the most recent and best possible knowledge available when the audit was undertaken in 2001.

Wetland Name	Type	Reason for Inclusion	Condition	Trend
Fergusons Lagoon	Fresh water lagoon in the coastal zone	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Flyover Lagoon 1	Brackish to saline lagoon or marsh with 1 or more relatively narrow connections with the sea	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Flyover Lagoon 2	Brackish to saline lagoon or marsh with 1 or more relatively narrow connections with the sea	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Hogans Lagoon	Fresh water lagoon in the coastal zone	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Little Thirsty Lagoon	Brackish to saline lagoon or marsh with 1 or more relatively narrow connections with the sea	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Logan Lagoon	Fresh water lagoon in the coastal zone	It is a good example of a wetland type occurring within a biogeographic region in Australia. It plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex. It is a wetland that is important for habitat of animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions prevail, such as drought. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Static
Sellars Lagoon	Brackish to saline lagoon or marsh with 1 or more relatively narrow connections with the sea	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Stans Lagoon	Peatlands; forest, scrub or open bogs	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Syndicate Lagoon	Brackish to saline lagoon or marsh with 1 or more relatively narrow connections with the sea	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining

Thompsons Lagoon	Peatlands; forest, scrub or open bogs	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Unnamed Wetland (eastern Flinders Is.)	Peatlands; forest, scrub or open bogs	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Unnamed Wetland (eastern Flinders Is.)	Peatlands; forest, scrub or open bogs	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Near pristine	Declining
Unnamed Wetland (SE Cape Barren Is.)	Brackish to saline lagoon or marsh with 1 or more relatively narrow connections with the sea	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Unknown	Unknown
Unnamed Wetland (SE Cape Barren Is.)	Fresh water lagoon in the coastal zone	The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at a national level.	Unknown	Unknown

5.1.4. Water Use and Manipulation

The three largest towns on Flinders Island and the main township on Cape Barren Island all have community water supplies. Whitemark's water supply is sourced from in-stream reservoirs on Pats River. Killiecrankie and Cape Barren Island's supply are derived from catchment dams. Lady Barron's water supply is derived from an underground aquifer. The size of this aquifer is currently unknown but the council is looking at initiating a study to investigate its size and recharge rates. All households in the region collect rainwater for drinking and washing purposes.

Flinders Council has two water supply systems under its responsibility as listed in Table 5.3. While Lady Barron has satisfactory microbiological results the supply is not disinfected, therefore a boil water notice has been issued for the drinking water system to inform consumers that if contamination does occur there are no "safety barriers" such as a disinfectant to protect public health (DHHS 1999). Whitemark's water supply does not meet water quality guidelines and is also subject to a boil water notice. Neither of these supplies is used for potable use but is used for gardens, bathing, washing and toilet flushing.

Mineral Resources Tasmania has records of 87 bores on Flinders Island (Mineral Resources Tasmania 2007). These bores are primarily used for stock watering. There are no large-scale irrigation/farm dams in the region.

Table 5.3 Flinders Council Water Supplies

Source: Director of Public Health 2005.

Water Supply System	Consumers	Adequate Sampling	Meets Microbiological Standards	Boil Water Alert Required	Boil Water Alert Issued
Whitemark	390	Yes	No	Yes	Yes (permanent boil water alert)
Lady Barron	220	Yes	Yes (no disinfection)	Yes	Yes (permanent boil water alert)

Drainage Schemes

Two drainage systems were constructed on Flinders Island, namely Furneaux and Bootjack. The Furneaux Drainage Scheme is the only system currently actively managed. The Furneaux Drainage Scheme is the largest of seven proclaimed drainage areas within Tasmania and covers an area of 39,000 hectares, of which 34,000 hectares is considered prime grazing land (Giblin 1996). It extends from north of Back Line Road along the eastern coastal plain to Fern Hill in the south of the island, covering approximately 30% of the Flinders Island's total area. The drainage area can be divided into four catchments, three of which drain to sea at Foochow, Middle and Patriarch Inlets in the northern half of the scheme. The southern half of the scheme drains into Cameron Inlet. There is approximately 550 km of main drainage lines servicing 131 properties. The drainage scheme was constructed in the 1950s and 1960s by the Commonwealth Closer Settlement Board under the War Service Soldier settlement Scheme (Giblin 1996). The Bootjack Scheme covers approximately 10,000 hectares and drains to Logan Lagoon and Adelaide Bay.

There are a number of outlets on the eastern side of Flinders Island that are sensitive and important conservation areas. For example, one drain flows into a Ramsar site (Logan Lagoon) and four other drains discharge into estuaries/inlets that have been assigned a Class B conservation status, the second highest ranking (Foochow, Middle, Patriarch and Cameron Inlets). The quality of the water exiting the drains is therefore an important element to the integrity of these sites. Problems include bank erosion, siltation and

sedimentation problems due to stock accessing the drains (over 95% of the drains have no significant vegetation to stabilise the bank structure).

Protected Environmental Values (PEVs)

Protected environmental Values (PEVs) are the current values and uses of a water body for which water quality should be protected. Under the *State Policy on Water Quality Management 1997* PEVs must be set for all Tasmanian surface waters including estuaries and coastal waters. PEVs were set for the catchments in the Flinders Municipal Area in 2001/2002 and are documented in a report available on the DPIW website.

PEVs identified for surface waters flowing through private or Aboriginal land fall into four categories:

- A: Protection of Aquatic Ecosystems
- B: Recreational Water Quality and Aesthetics
- C: Raw Water for Drinking Water Supply (Pats River offtake and storage Dam and Cape Barren Island offtake)
- D: Agricultural Water Uses (irrigation and stock watering)

PEVs identified for other surface waters and estuarine waters fall into the first two categories only.

The Board of Environmental Management and Pollution Control is responsible for determining water quality objectives which maintain or enhance water quality to ensure the protection of PEVs. Management of all surface waters within the catchment should focus on the achievement of these water quality objectives. However, to date water quality objectives have not been determined for the Furneaux and no water management plans have been developed. There is no timeframe in place for this to occur.

5.2. *Managing Water- Threats and Priority Issues*

This section outlines the key issues and threats which impact upon the condition of water in the Furneaux Group. These issues and threats have been identified from the existing literature and during consultation with technical experts and Furneaux community.

The threats and issues discussed in detail in this chapter fall under the three headings: water use and availability; inland water quality; and sedimentation and erosion of drains. It is important to note that threats and priority issues discussed in other chapters may also impact upon the asset of water.

5.2.1. Water Use and Availability

This issue is concerned with the management of inland waters, rainfall runoff and groundwater to ensure that the region's water resources are utilised in a beneficial manner for the environment, agriculture and town/household supplies.

Rainfall in the Furneaux Group is very seasonal with the majority of rains falling between May and August. The highest average recorded rainfall for the region is 838 mm at Lackrana, Flinders Island. In recent times the Furneaux Group has experienced a period of very low rainfall. The Bureau of Meteorology estimated that the entire region experienced severe rainfall deficiency in 2006 (i.e. rainfall is among the lowest five per cent for the period in question) and a serious deficiency over 2005-2006 (i.e. rainfall lies above the lowest five per cent of recorded rainfall but below the lowest ten per cent for the period in question).

The two main aspects of this issue are:

1. Water availability and storage for agricultural and/or urban purposes; and
2. Maintaining or improving the health of the region's wetlands and waterways.

Very little information is known about the size and recharge sites of the groundwater aquifers in the region. The effects of continued and increasing rates of groundwater use within the region are not known. If excessive

quantities of groundwater are drawn then the aquifers may decrease at a faster rate than are being replenished, creating problems and issues in the future. The *Development of Models for Tasmanian Groundwater Resources* project has recently been initiated by the Department of Primary Industries and Water. The project will develop models for groundwater in a number of areas in Tasmania including the south-east of Flinders Island. On Flinders, the aim is to undertake groundwater and surface water interface modelling for the area that encompasses the surface water sub-catchments that recharge the east coast lagoons system from Sellars Lagoon to Logans Lagoon, including Camerons Inlet. This area has been targeted as a priority for Flinders Island as it includes a large proportion of the intensive production area on the island as well as a Ramsar site and other significant wetlands. This work should increase understanding and provide valuable information that can be used to develop sustainable use, development and management strategies for the area including a groundwater management plan.

A hydrogeological survey and water audit conducted in 1997 (Armstrong and Drury) concluded that "water resources on [Flinders] Island are limited". Potential dam sites identified on Flinders Island through a community survey include Leventhorpe Creek, Thule and some other sites in the foothills of the Darling Range. These sites would require further investigation to determine whether or not they are viable in terms of costs, catchment yields and available materials. A potential site with an estimated capacity of 500 Ml located at the headwaters of Bowmans Creek was investigated but was considered unsatisfactory as no clay suitable for construction was found nearby and the area had a small catchment yield of only 0.15 Ml/hectare (catchment yields on the Tasmanian mainland are generally about 0.90 Ml/ha) (Armstrong and Drury 1997).

The health of the region's wetlands and waterways is also of great concern. While all wetlands and waterways are at the mercy of the seasons and weather cycles, the east coast wetland and lagoon systems on Flinders Island are also impacted upon by the drainage systems.

A total 49,000 ha of land on the eastern and southern coastal plains has been significantly modified through the development of an extensive drainage system. The east coast wetlands are replenished through rainfall and surface

water runoff. However, the yield from run-off has been decreased through the construction of drains throughout the eastern flats, which redirect the water flows to six discharge points (Foochow, Middle, Patriarch and Cameron inlets, Logan Lagoon, and Adelaide Bay). Before the construction of the drainage system the surface water runoff would have flowed into the coastal wetland and lagoon network, allowing them to be replenished by much greater volumes of water than is now occurring. Very little of the water flowing through the drains is utilised before flowing into inlets, lagoons or the sea.

Cameron Inlet, a 1,400 ha coastal lagoon, is the discharge point for approximately 13,400 hectares of the Furneaux Drainage Scheme. The area north and south of Cameron Inlet has a high concentration of wetlands (Chain of Lagoons, Sandy Lagoon etc.). Little surface water runoff is reaching these wetlands as it is trapped within the drainage system and channelled to the exit point at the western end of Cameron Inlet (Nelson Drain and Chew Tobacco Creek). Intermittent overflows from Cameron Inlet assist in replenishing these wetlands. During wet seasons the volume of water that Cameron Inlet receives significantly raises the water level. In the past the sandbar at the mouth has been artificially breached to prevent water backing up into the drainage system, flowing over and flooding surrounding agricultural land. The practice of artificially draining Cameron Inlet has been a contentious issue in the past as there has been little consideration given to the impact of this practice on other values in the area and the surrounding wetlands.

Since 1999, a Cameron Inlet Catchment Water Management Committee was formed and a study commissioned into the hydrology of the inlet and drainage system. Following this study, on ground works were undertaken to manage excess water by redistributing it to Sellars Lagoon via a culvert. Short term management arrangements were put in place under the guidance of the Management Committee but no longer term planning was undertaken.

Priority Areas/Locations

Agricultural areas without sufficient water storage (especially Memana and Lackrana).

Wetland and lagoon systems on Flinders Island's east and south-eastern coast.

5.2.2. Inland Water quality

The most common causes of declining water quality for inland waters and wetlands include: erosion of watercourses (caused by stock access and the clearing of riparian vegetation), salinity, impact of fire, land clearance, extraction of water for consumptive use, urban pressures, agricultural run-off (chemical contamination, nutrients) and contamination from sewage and wastewater. The condition of local waterways is an important indicator of the overall catchment health.

Water quality requirements vary according to their usage. For example, the key parameters when assessing drinking water are levels of micro-organisms and other contaminants while for irrigation water the turbidity and salinity levels are used. Parameters used to measure the quality of rivers, streams, wetlands etc. to ensure a healthy aquatic ecosystem include pH, nutrients, temperature and dissolved oxygen.

Water bodies have individual characteristics dependent upon their physical and chemical properties. For example, some wetlands and lagoons are naturally saline. The quality of water within Cameron Inlet and Logan Lagoon is also influenced by the agricultural activities within the drainage area as these water bodies are exit points for some of the main drains (e.g. erosion of the drains will lead to an increase in siltation and turbidity levels). Soil particles and/or surface runoff can also lead to transportation of chemicals and nutrients into these water bodies.

Riparian vegetation plays a vital role in maintaining water quality and river health. Vegetation helps maintain or improve water quality by acting as a buffer/filter strip for pollution and sediment and roots help control and stabilise bank and bed erosion. Riparian vegetation also plays an important ecological and conservation role for the stream environment and the terrestrial animals and birds living along the river bank or adjacent areas. There are sections of many rivers and streams in the region that have had all the riparian vegetation removed from the river banks, consequently resulting in degraded water quality.

Refuse disposal sites, current and historical, also have the potential to contaminate soils, rivers/streams and groundwater through the leaching of

pollutants. Roadside practices can have an adverse impact on water quality as the water that runs-off roads is usually channelled along drains, building up flow and quantity. Pollutants and sediments from runoff have the potential to enter river systems and groundwater aquifers.

The quality of groundwater is also an important factor within the region as many farmers use this for stock. Groundwater quality on Flinders Island varies, ranging from good quality at the Lady Barron aquifer to very saline levels on some areas of the eastern coastal plain. Most groundwater used on Flinders Island is from shallow aquifers, which are the most prone to contamination from activities occurring on the land above or in recharge areas. Potential sources of groundwater contamination include landfill sites, agricultural chemicals and fertilisers, and leaking fuel storage tanks. The greatest concern is contamination of the Lady Barron aquifer from septic tank effluent. While there is a potential for contamination of the aquifer posing a serious health risk, no evidence of faecal coliform contamination from the flooding of septic tanks has been detected through testing.

The Whitemark water supply is not used for drinking but it is still essential to maintain the water quality level. Upstream of the reservoir stock have had access to the river, which will decrease water quality by increasing sedimentation and turbidity. It is also advisable to ensure that no spraying activities are conducted in and around the dams to prevent any chemical contamination.

Priority Areas/Locations

Water courses with no or little riparian vegetation.

Medium to main drains upstream of Cameron Inlet and Logan Lagoon

Potential point sources of pollution including refuse disposal sites

Water Quality Data

There is very limited data on water quality in the Furneaux Group. Current water quality levels and trends are difficult to establish in the region due to the lack of baseline and ongoing monitoring data. Previously the only running streams or rivers in the region for which water quality data were collected Pats River and Samphire River. The Pats River reservoir is the source of Whitemark's water supply and this is monitored for microbes by Flinders

Council (see section 5.1.4). Testing for Samphire River (upstream of Unavale Creek) was conducted by the DPIWE and occurred between November 1989 and December 1996 (22 samples in total). There appears to be no consistent pattern to their sampling periods and the parameters tested. The average conductivity for Samphire River is 563 microS/cm with a range of 443 – 828 microS/cm (n=15, reference temperature 25°C) (DPIWE 1999). The water temperature averaged 12.1°C (n=21) and pH averaged 6.1 (n=8). The pH of fresh water usually lies between 6.5 to 8.2, although wide variations can occur due to catchment geology.

Table 5.4 Salt levels in water.

Source: Dell (2000)

Salt level (micro-siemens/cm)	Use
0	Distilled water
800	Desirable limit for human consumption Reduced yield and growth possible from irrigation at this level
2500	Maximum limit for humans
3000	Maximum for tomatoes
5500	Limit for couch grass
6000	Limit for poultry
6500	Level at which water is considered saline
10 000	Limit for horses, ewes and lambs
16 500	Limit for beef cattle
23 000	Limit for adult sheep on dry feed
5 4000	Seawater

More recently a limited amount of monitoring concentrating on salinity has been undertaken by Waterwatch and the Northern Water Quality Monitoring Program (NWMP) in cooperation with local landholders. Ideally surveys would be conducted on a monthly basis but currently NWMP undertake annual surveys. In 2002 approximately 60 piesometers bores were installed on private property on Flinders Island to monitor ground water salinity and depth on private property. The quality of data collected from these piesometers is variable and there are proposals to refine the monitoring system to enable more accurate and consistent measurements. An audit of the bores carried out in 2005 found that groundwater depth groundwater depth ranged from 0.4m to 2.6m below the surface and electrical conductivity

ranged from 437 to 12300 micro-S/cm (Northern Water Quality Monitoring Program 2005).

An audit of electrical conductivity of surface waters was also carried out by NWMP in 2005. Thirty six sites were surveyed on Flinders Island and Cape Barren Island revealing wide variations in salinity. Electrical conductivity ranged from 395 micro-S/cm to 440 micro-S/cm on Flinders Island and from 520 micro-S/cm to 1840 micro-S/cm on Cape Barren Island (Searle 2005).

With little base line data for watercourses and water bodies in the region it is very difficult to quantify any problems (if any) associated with declining water quality. The health of watercourses and waterbodies is usually a good indication of activities and practices that are occurring within the catchment. Usually any detrimental activities within the catchment will show up in water quality data. By starting a monitoring program in the region, the community and stakeholders will be able to get a clearer picture of catchment health in the region. Through a water monitoring program, deterioration and trends in water quality can be identified relatively quickly and lead to correction of the underlying cause or activity. Suggested monitoring sites for Waterwatch groups are shown in Table 5.4.

Table 5.5 Suggested Monitoring Sites for Waterwatch Groups

Source: taken from Bayley (1999)

Location	Island	Reason for Site to be Monitored
Cameron Inlet	Flinders Is.	A major part of the Furneaux drainage system flows into this inlet, there is currently no data on the impact of agricultural inputs/run-off into inlet. Refer 'Issue 1: Water Quantity' for more information regarding issues surrounding Cameron Inlet.
One of wetlands in Chain of Lagoons system and/or Sandy Lagoon	Flinders Is.	There are wetlands of national significance in this area. There are claims that these wetlands are deteriorating and drying up. There is no data for these wetland areas to make an informed decision regarding their deterioration.
Pats River-(up and downstream of the town reservoir)	Flinders Is.	Town water supply and flows near the Flinders Island District High School. Stock have access to river in certain places. Done in conjunction with Flinders Council.
Officers Creek	Flinders Is.	Near one of main municipal tips on the island. Currently there is no data on the downstream impact of the tip site. Recommend test sites above and below tip site.
Samphire River	Flinders Is.	Some data already exists.
Modder River Lee River	Cape Barren Is.	Two of largest rivers on the island that are relatively accessible by the school.
Eastern Wetland system	Cape Barren Is.	Very undisturbed area with no significant wetland data collated; Contains a RAMSAR site and several Wetlands of National Significance.

5.2.3. Sedimentation and erosion of drains

Both of the drainage schemes on Flinders Island have sedimentation, erosion and siltation problems. Erosion of the drain beds and banks are caused by stock, lack of vegetative cover/support, the gradient of the drains and the nature of the clay/soil substrate. The eroded soil particles/sediment travel downstream to an accumulation point on the flatter ground where problems are created for farmers (e.g. flooding and waterlogging of land, clogged and ineffective drains and salinity). Water quality is also compromised in estuaries, inlets and lagoons at the discharge points.

There are a number of drainage outlets on the eastern side of Flinders Island that are sensitive and important conservation areas. For example one drain flows into a Ramsar site (Logan Lagoon) and four flow into estuaries/inlets that have been assigned a Class B conservation status (Foochow, Middle, Patriarch and Cameron Inlets) (Edgar *et al.* 1998). The quality of the water exiting the drains is therefore an important element to the integrity of these sites

Repairs and maintenance of the drainage areas are essential in improving water quality downstream, halt bank and bed erosion, decrease flooding, water logging and salinity issues associated with the drains. Stock access for main drains is restricted to sheep and for the purposes of fire/fuel reduction purposes. Current repairs and maintenance include rock drop structures.

It must be noted that the majority of these problems go back to the development of the drains during the Soldier Settlement Scheme of the 1950s and 1960s. The majority of medium – main drains that were developed do not follow the contours and have a gradient that is too steep, causing many of erosion and sedimentation problems. The few drains within the system that follow the contours are still in good condition, however these are in the minority.

The Rivers and Water Supply Commission (RWSC) currently administer rates and maintenance programs for the Furneaux Drainage Scheme. Repairs and maintenance of drains within the Bootjack scheme is the sole responsibility of landholders. The Rivers and Water Supply Commission are keen to transfer management of Furneaux Drainage Area over to a local management

authority and negotiations are continuing with Council and the Furneaux Drainage Area Advisory Committee. Current expenditure on maintenance and repairs is approximately $30 000 per year and is funded by rates received from land holders. An engineer is engaged to undertake annual surveys of the drains and identify priorities for management. In consultation with the local landowners works are recommended and undertaken by local contractors including weed spraying, repairs to threatened drop structures, grader works on contour drains, de-silting of drains and construction of new drop structures where required (RWSC 2006). The RWSC does not undertake any water quality monitoring.

Two reports stress the importance of maintaining the current drainage infrastructure. The first is McMahon's (1994) salinity report for Memana and Lackrana. McMahon emphasises the importance of maintaining the existing system alleviating current salinity problems and preventing any future salinity issues from occurring. The second report, *Regional Environmental Initiatives Study for the Northern Region of Tasmania: Flinders Bioregion*, lists the rehabilitation and maintenance of the land drainage system as an issue within the region. It recommends de-silting, revegetation activities and stock exclusion.

Priority Areas/Locations

Medium to main drains on the eastern and southern coastal plains.

5.3. *Management Directions*

This section presents Community Aspirational Statements and recommended Resource Condition Targets (RCTs), Management Actions Targets (MATs), and Management Actions for the asset of Water. These targets and actions are focused on the key issues associated with the asset of water. It is important to recognise that water does not exist in isolation from other natural values in the Furneaux. To successfully manage water, there must also be adequate management of the environment as a whole including the assets of land, biodiversity, coasts, estuaries and marine environments and issues related to people and management. It is therefore important to note that management actions listed below are intended to be read and implemented together with those presented in Chapters 3, 4, 6 and 7.

Community Aspirational Statement for Water

A good understanding of our water resources which enables the sustainable and efficient use of water for private (household and agricultural), public and environmental needs

Table 5.6 Targets and Actions for Water

Issue	Resource Condition Targets (RCTs 10- 20 years)	#	Management Action Targets (MATs 1-5 years)	#	Management Actions	Key Partners
Sustainable Water Use	<u>WR1:</u> In high use areas, groundwater extraction does not exceed sustainable yield by 2027 (sustainable yield to be determined)	WM1	An ongoing groundwater monitoring program is in place by 2010	WA1	As informed by findings of the "Development of models for Tasmanian Groundwater Resources" project establish an ongoing monitoring program to monitor groundwater levels and usage by 2010.	DPIW, NRM North
		WM2	Groundwater management plans are being implemented for the southeast region of Flinders Island by 2013	WA2	Use information provided by the "Development of models for Tasmanian Groundwater Resources" project to develop a groundwater management plan for the southeast of Flinders by 2012	DPIW
				WA3	Support the development of mechanisms to regulate the use of groundwater including the sinking of bores	DPIW
		WM3	Reduce water consumption for current uses by 15% by increasing the efficiency of water use and increasing water re-use and recycling	WA4	Promote and provide incentives for increased water use efficiency, re-use and recycling by all users including households, agriculture, government and industry	FC, NRM North, Community
Inland Aquatic Ecosystem Integrity (wetlands)	<u>WR2:</u> The extent and condition of priority wetlands (as defined in Dunn and CFEV) will be maintained or improved above baseline levels (benchmark levels to be set) by 2027	WM4	Benchmarks are set for the condition and extent of the highest priority wetlands by 2012	WA5	Identify priority wetlands where management plans should be developed as a priority (use results from '**Atlas of Tasmanian Wetlands**' project as a starting point)	DPIW, NRM North, PWS, FC
				WA6	Set benchmarks for the condition and extent of priority wetlands by 2012	DPIW, NRM North
				WA7	Investigate the performance of the drainage scheme and its impact on wetlands and determine whether modifications can be made to reduce its impact (e.g. can water be used more effectively? i.e. by diverting to wetlands?)	RWSC, PWS, Landholders
		WM5	Management plans are being implemented for the highest priority wetlands by 2012	WA8	Develop management plans for priority wetlands by 2010	DPIW, NRM North, PWS, FC, Community

		WM6		WA9	Facilitate the implementation of management plans for priority wetlands by securing investment, support and funding for priority actions by 2012	NRM North, PWS, FC, Community
Inland Aquatic Ecosystem Integrity (waterways)	WR3: The condition of key streams with impacted condition (as indicated by their benchmarks) will be improved by 20% over benchmark levels (benchmark levels to be set)	WM7	Condition benchmarks (based on the "River Condition Index") and environmental flow provisions are established for key waterways by 2012	WA10	Establish benchmarks for "River Condition Index" for key waterways by 2012	DPIW, NRM North
		WM8	30% of riparian land currently in good condition and at risk of degradation is protected by 2012	WA11	Undertake activities (e.g. fencing for stock control and education) to protect riparian land currently in good condition and at risk of degradation	NRM North, FC, PWS, Community
		WM9	Rehabilitation activities have been undertaken on 30% of identified problem areas	WA12	Identify degraded/declining areas and undertake strategic rehabilitation activities to protect and improve the condition of key waterways (e.g. stabilizing eroding banks and channels)	NRM North, FC, PWS, Community
Water Quality (Nutrients and/or turbidity/suspended solids and/or other contaminants in aquatic environments)	WR4: The region will achieve a permanent reduction in baseline concentrations and total loads of nutrients, sediment and salinity at key stream and drainage channel monitoring sites compared to benchmark levels, unless required as part of ecosystem maintenance and health (baseline levels to be determined) by 2027	WM10	Major point and diffuse sources of pollution entering waterways are identified by 2008	WA13	Identify major diffuse and/or point sources of pollutants entering waterways by 2008	DTAE, NRM North, FC
				WA14	Targeting major sources develop and implement a program to reduce the input of pollutants to waterways by 2010	NRM North, FC, Community
		WM11	Program/s are being implemented to reduce the input of pollutants from identified major point and/or diffuse sources by 2010	WA15	Undertake activities (e.g. fencing off and revegetating drain banks) to reduce erosion of drains by 2010	NRM North, RWSC, Community
				WA16	Develop and implement best practice guidelines and development standards for new developments to reduce the input of pollutants to waterways	FC, DTAE
		WM12	Key waterways in the region have catchment specific water quality objectives and monitoring in place consistent with national water quality (i.e. ANZECC) and river condition guidelines by 2010	WA17	Establish a program to monitor water quality at key sites in the Furneaux Group and determine water quality objectives consistent with national water quality and river condition guidelines (e.g. ANZECC) and protected environmental values by 2010	DTAE, DPIW, NRM North, Community

Chapter 6. BIODIVERSITY ASSET

6.1. Biodiversity- Description of the Asset

Biodiversity, or biological diversity, is defined as the variety of all life forms it includes:

- Genetic diversity: the variety of genetic information contained in all of the individual plants, animals and microorganisms that inhabit the earth. It occurs within and between populations of individual species as well as among species.
- Species diversity: the variety of living species on the earth.
- Ecosystem diversity: the variety of habitats, biotic communities and ecological processes (Department of Environment, Sport and Territories 1996).

It is extremely difficult to place a value on biodiversity but the benefits of conserving biological diversity are numerous (refer Table 6.1).

This section describes the biodiversity of the Furneaux, focusing largely on terrestrial flora and fauna, estuarine and marine flora and fauna are further discussed in the chapter on Coasts, Estuaries and Marine. The land area of the Furneaux Group falls within the 'Furneaux' IBRA boundary (Interim Biogeographic Regionalisation for Australia) while the surrounding waters are included in the Flinders Marine Bioregion. A list of rare and threatened species is provided in appendix C.

Table 6.1 Value of Biodiversity.

Adapted from North East Regional Catchment and Land Protection Board 1997

Ecosystem Services in Terms of:
- Protection of water resources
- Soil formation and protection
- Nutrient storage and cycling
- Pollution breakdown and absorption
- Contribution to climate stability (both locally and globally)
- Maintenance of ecosystems
- Recovery from unpredictable events e.g. wildfire
- Ecosystem stability
Biological Resources in Terms of:
- Food resources
- Medicinal resources
- Wood products
- Ornamental plants
- Breeding stocks, population reservoirs and genetic diversity
Future Resources
Social Benefits in terms of:
- Research, education and monitoring
- Recreation
- Cultural values
Value of Diversity:
- Foundation for continued existence
- Greater resilience for systems
- Ability to adapt to change
- Resource values
- Stability

6.1.1. Flora

The flora of the Furneaux Group is regarded as a major asset as it supports many important species and vegetation communities. The region is considered very significant biogeographically (the spatial distribution of plants and animals) as it is the southern most limit of some mainland species and the northern most limit for some Tasmanian endemic plant species. Some vegetation types for Tasmania are restricted to Bass Strait islands while others found in the Furneaux Group are closely related to vegetation types on granites and coastal sands in north-eastern and eastern Tasmania, however they are fairly distinctive because of their species complement.

Table 6.2 Threatened vegetation communities present in the Furneaux Group.

Notes: Listed as threatened under the *Nature Conservation Act 2002*. R = rare, V = vulnerable, E = endangered. Source: Natural Values Atlas 2006.

TASVEG Code	Area (hectares)	Vegetation Community Title	Conservation Status	Vegetation Group
DGL	122	Eucalyptus globulus dry forest and woodland	V	Dry Eucalypt Forest and Woodland
DOV	13	Eucalyptus ovata forest and woodland	E	
DVC	1398	Eucalyptus viminalis - Eucalyptus globulus coastal forest and woodland	R, V	
DVF	954	Eucalyptus viminalis Furneaux forest and woodland	R, E	
MDS	89	Subalpine Diplarrena latifolia rushland	R	Moorland, Sedgeland, Rushland and Peatland
NAL	424	Allocasuarina littoralis forest	R	Non-Eucalypt Forest and Woodland
NBS	11	Banksia serrata woodland	R, E	
NCR	163	Callitris rhomboidea forest	R	
NME	1539	Melaleuca ericifolia swamp forest	R, E	
AHF	858	Fresh water aquatic herbland	V	Saltmarsh and Wetland
ASF	2186	Fresh water aquatic sedgeland and rushland	V	
AHL	529	Lacustrine herbland	V	
AHS	1533	Saline aquatic herbland	V	
AWU	641	Wetland (undifferentiated)	V	
SHC	365	Heathland on calcarenite	R, V	Scrub, Heathland and Coastal Complexes
SCW	1662	Heathland scrub complex at Wingaroo	R	
SRI	51	Riparian scrub	V	
SRC	30	Seabird rookery complex	R	

TASVEG mapping is available for most of the Furneaux group. Fifty-five vegetation communities have been identified in the region, these are listed in appendix B, threatened communities are listed in Table 6.2 and the broad vegetation groupings are shown in Table 6.3. More than half the vegetation is classified within the scrub, heathland and coastal complexes group, with dry scrub and lowland sedgy heathland communities predominating. Non-eucalypt forest and woodland including *Allocasuarina verticillata* forest makes up a further 7% of native vegetation and dry eucalypt forest and woodland a further 6.5%. Native vegetation has been removed from approximately a quarter of the land area largely for agricultural purposes.

Table 6.3 Vegetation groups present in the Furneaux Group.

Source: TASVEG 1.1

Vegetation Group	Area (hectares)	% of total
Scrub, Heathland and Coastal Complexes	100 072	51.8
Agricultural, Urban and Exotic Vegetation	51 221	26.5
Non-Eucalypt Forest and Woodland	13 773	7.1
Dry Eucalypt Forest and Woodland	12 558	6.5
Saltmarsh and Wetland	6 310	3.3
Native Grassland	5 751	3
Other Natural Environments	3 569	1.8
Moorland, Sedgeland, Rushland and Peatland	91	<1
Rainforest and Related Scrub	6	<1

The flora of the outer islands of the Furneaux has been comprehensively documented in a book produced in 2001 by the Tasmanian government as a contribution to the International Biodiversity Year (Harris *et al.* 2001). One hundred islands were surveyed and a total of twenty-nine non-forest and five forest communities were mapped and 437 vascular plant species recorded.

Broad vegetation types occurring in the Furneaux are outlined below (Ladd, Orchiston and Joyce 1992; Underwood 1998; Underwood 1999; Tasmanian Vegetation Management Strategy 1999, Harris and Kitchener 2005).

Eucalyptus Communities

Four eucalypt species are native to Flinders Island, all forming distinct plant communities. The species are Tasmanian blue gum (*Eucalyptus globulus*), Smithton peppermint *(E. nitida*), black/swamp gum (*E. ovata*) and white gum (*E. viminalis*).

Smithton peppermint forms a low forest and usually intergrades with heath and scrub communities. This complex in confined to the larger islands of the Furneaux Group. It occurs on granite substrates on slopes and ridges, on metamorphosed Mathinna series mudstones and on flats with Quaternary sands and gravels.

Forests dominated by white gum have a limited distribution in the region. They occur on sheltered mid and upper slopes and deep gullies on Broughmans Sugarloaf, Mulligans Hill, Darling Range, and around the Strzelecki Range on Flinders Island, and on Mt. Munroe on Cape Barren Island.

Communities dominated by Tasmanian blue gum are widespread but localised, occurring on the Strzelecki Range, south of Pitchford Hill and from the west coast hills to the lagoon edges of the east coast on Flinders Island. The threatened subspecies, *E. globulus spp. pseudoglobulus* is found in northern Flinders Island.

Black/swamp gum is usually restricted to poorly drained sites on limestone (calcarenite) country. This species has been noted for being particularly robust and has proved useful in direct seeded shelter belts on farms at Lackrana and Memana (*pers comm.* R. Cox 2007).

Non-eucalypt forest and woodland communities

Four Allocasuarina species are native to the Furneaux Group: drooping sheoak (*A. verticillata*), Tasmanian sheoak (*A. monilifera*), A. paludoas, and bull oak or black sheoak (*A. littoralis*) which is a Tasmanian endemic. Drooping sheoak is the most common species and more drought resistant than eucalypt species. It often forms closed forests in coastal areas and exposed headlands such as at Trousers Point and Cape Frankland on Flinders Island.

Rainforest species occur in the wetter areas around the Strzelecki Range (southern Flinders Island) including *Dicksonia antarctica, Pittosporum bicolor, Acacia melanoxylon, Tasmannia lanceolata, Notelaea ligustrina* and *Atherosperma moschatum.*

Oyster Bay pine (*Callitris rhomboidea*), more commonly known as Cape Barren pine in the region, is a fire sensitive species that is confined to the Furneaux Group and eastern Tasmania. Approximately 163 hectares of *Callitris rhomboidea* forest occurs in the Furneaux Group (see appendix B). It is the only conifer to be found in the Furneaux Group and is drought resistant. Oyster Bay pines can be found as the dominant tree in forest and woodland, with dense stands occurring on the east coast of Flinders Island. It also forms an understorey component of eucalypt forest, and occasionally

occurs in heath. Since European contact the frequency of this species in the Furneaux Group has declined, probably due to increased fire frequency and land clearing.

Other woodland and forest communities are dominated by Acacia, Bursaria, Melaleuca and Banksia species, including the rare and endangered *Banksia serrata* woodland and *Melaleuca ericifolia* swamp forest.

Scrub, Heathland and Coastal Complexes

Scrub, heathland and coastal complexes are the dominate vegetation group in the Furneaux Group. This vegetation group refers to vegetation less than 8 metres in height occurring in lowland coastal areas and offshore islands (Harris and Kitchener 2005).

Seventeen TASVEG vegetation communities in this category have been mapped in the Furneaux. The three largest communities are: dry scrub; lowland sedgy heathland and heathland on granite. On Flinders Island dry scrub communities are dominated by species including *Leptospermum glaucescens, L. scoparium* and a low mallee-form of *Eucalyptus nitida.* Lowland sedgy heathland is extensive on Cape Barren Island, occurring on shallow soils where fire frequency has been high or where Phytophthora cinnamomi has invaded.

Two communities in this vegetation group occur only in the Furneaux Group: heathland scrub complex at Wingaroo and heathland scrub mosaic on Flinders Island. Other communities such as heathland on calcarenite are largely confined to the Furneaux Group.

Grassland Communities

Grasslands occur on the eastern and western coastal margins of Flinders Island. While they predominately occupy coastal headlands they are also found inland, such as around Logan Lagoon in southeastern Flinders Island. Two TASVEG vegetation communities have mapped for grasslands in the Furneaux Group: lowland *Poa labillardierei* grassland and coastal grass and herbfields.

Saltmarsh and Wetland

Wetlands can be defined as vegetated areas that are subject to tidal inundation or are submerged by water for at least one month of the year (Harris and Kitchener 2005). Four non-saline TASVEG wetland communities have been mapped in the Furneaux: fresh water aquatic herbland, lacustrine herbland, freshwater aquatic sedgeland and rushland and undifferentiated wetland.

Saltmarshes are saline wetlands that predominately occur on low-energy coastlines such as sheltered river estuaries subject to frequent covering by tides. On Flinders Island saltmarsh occurs around Adelaide Bay, Logan Lagoon, Long Point, Foochow Beach and the North-east River estuary. Four TASVEG saltmarsh communities are mapped in the Furneaux: saline aquatic herbland, saline grassland, succulent saline herbland and undifferentiated saltmarsh.

The distribution and status of wetlands is discussed in greater detail in the Water chapter

Non Vascular Plants

Non vascular plants include lichens and mosses. Of 762 taxa included on the Tasmanian Lichen Flora lists 33 taxa are believed to be confined to the Bass Strait islands. Some of the rarer lichens include *Leptogium crispatellum* and *Porina whinrayi* (*pers comm.* Whinray 1999).

6.1.2. Fauna

Mammals, Birds and Reptiles

In the Furneaux Group there are 19 species of native mammals. Mammals include echidna, wombat, Bennetts wallaby, pademelon, potoroo, water and swamp rates, New Holland mouse, three species of bats and four seal species (three are vagrants). The species of wombat found on Flinders Island is a unique sub-species (*Vombatus ursinus ursinus*) once found throughout the Bas Strait Islands but now restricted to Flinders Island. Species such as the Tasmanian devil, eastern and tiger quolls, eastern barred bandicoots, forester

kangaroo and three rat and mouse species once existed in the region but have since become extinct (RPDC 1999).

The varied habitats within the region account for the large diversity of bird species over a relatively small area. Habitats include heaths, wetlands, coastal, forest communities and the outer islands. Over 160 bird species have been recorded on Flinders Island with at least 144 of them being native birds. The lagoons of the east coast are significant habitat for waders and waterfowl, with Logan Lagoon and the eastern Cape Barren Island wetlands being listed as RAMSAR sites for this reason. Fourteen migratory wader species that are listed under the Japan-Australia Migratory Birds Agreement (JAMBA) and China-Australia Migratory Birds Agreement (CAMBA) have been recorded on the east coast wetlands and lagoons (RPDC 1999). As Cameron Inlet is the only lagoon in the southern section of Flinders Island with permanent water during extremely dry periods it is considered as important as Logan Lagoon for feeding habitat of migratory waders (RPDC 1999). The rare fairy tern uses Cameron Inlet as a breeding site, one of only seven sites in Tasmania.

The outer islands are important environments for many bird species, particularly sea birds, and provide bird breeding habitat of international significance (PWS 1998a). The islands provide important habitat for birds listed as rare, vulnerable or endangered including the little tern (*Sterna albifrons*), fairy tern (*Sterna nereis*) and the white fronted tern (*Sterna striata*). Many of the Outer Islands have muttonbird (*Puffinus tenuirostis*) rookeries and are important sites for 'birding' during the season. There are only two mutton bird rookeries on Flinders Island.

The beaches and estuaries in the region are significant habitat for several shorebirds, including the hooded plover (RPDC 1999) which although no longer listed as vulnerable under the *EPBC Act* it is protected under this act as a marine species. Cape Barren geese, which were nearly hunted to extinction between the mid 1800s and early 1900s, were fully protected in 1929 and had a population of around 600 in 1960. Numbers in the Furneaux region have increased to about 14,000 and at present the species is not considered threatened, although they remain one of the rarest geese species in the world (DPIW 2007).

At least 14 species of reptiles exist within the region. These include the three snake species that are common to mainland Tasmania (tiger, copperhead and

white-lipped whipsnake), 8 species of skinks (including the rare glossy grass skink), mountain dragon and the blotched blue-tongue lizard. The population of tiger snakes found on Chappell Island is renowned for being the largest in Australia reaching lengths of over 2m (Greer 2006).

Six of the 11 Tasmanian frog species occur in the Furneaux Group, with the green and gold frog listed as vulnerable.

Nine native species of freshwater fish species occur on Flinders Island, with the dwarf galaxias listed as rare in Tasmania (RPDC 1999). While an accurate figure cannot be given for salt water species some surveys have been conducted within the region. An assessment of the abundance and distribution of commercial fish species associated with inshore soft-bottomed habitats around Tasmania included four sites in the Furneaux Group (Kent Bay, Prime Seal Island and two sites in Franklin Sound) (Jordan *et al.* 1998). Twenty-five different species were recorded; this is considered a conservative figure as some of the sampling techniques were not reliable for faster moving pelagic species. Another study surveyed fish, invertebrates and plant species of shallow rocky reef sites around Tasmania, including 20 sites in the Flinders marine bioregion (Edgar *et al.* 1995). The mean number of fish and plant species collected at the sites in the Furneaux Group during this study was 13 and 19.3 respectively. The maximum number of species recorded at the sites in the region was 22 fish species and 29 plant species (Edgar *et al.* 1997).

Invertebrates

While invertebrates in the Furneaux Group have been relatively well collected most of the material has yet to be identified. Seven freshwater and 27 terrestrial taxa have been recorded on Flinders and Cape Barren islands (RPDC 1999). These include nine native earthworms and some unusual species; a 'living fossil' dragonfly, two rare cave crickets and a rare cave slater.

One millipede is known to be confined to Flinders Island and some velvet worms are believed to be endemic to the region (RPDC 1999). Streams and creek lines in the Darling Range, Strzelecki Peaks (both Flinders Island) and Mount Kerford (south east Cape Barren Island) are known to provide habitat

for the threatened Strzelecki or Furneaux burrowing crayfish (*Engaeus martigener*).

Saltwater invertebrates have been surveyed in shallow rocky reef sites around Tasmania, including 20 sites in the Flinders marine bioregion (Edgar *et al.* 1995). The mean number of invertebrate species collected at the sites in the Furneaux Group during this study was 10.5, with the maximum number recorded at any one site being 17. However, these figures are conservative as the study was not considered a thorough investigation of invertebrate diversity.

A study of calanoid copepods (zooplankton) was conducted on Flinders, King and Kangaroo islands in the early 1990s (Bayly 1996). From 11 locations around Flinders Island the study found seven species. Flinders Island had a higher occurrence of calanoid species than both King and Kangaroo islands (three and five species respectively). While this difference is difficult to explain, Bayly believes that a significant factor may be that native habitat destruction has occurred to a lesser extent on Flinders Island than the other two islands.

The rocky shores and tidal platforms of the western coastal margin support a wide range of molluscs and crustacea (e.g. limpits, periwinkles and whelks) (RPDC 1999). The sub-tidal zone supports important commercial species such as the green-lipped and black-lipped abalone, crayfish and scallops

6.2. *Managing Biodiversity - Threats and Priority Issues*

This section outlines the key issues and threats which impact upon the condition of biodiversity in the Furneaux Group. These issues and threats have been identified from the existing literature and during consultation with technical experts and Furneaux community.

The threats and issues discussed in detail in this chapter fall under the seven headings: habitat loss and modification; native vegetation loss; weeds; nuisance fauna; disease; fire management; and climate change. It is important to note that threats and priority issues discussed in other chapters may also impact upon the asset of biodiversity.

6.2.1. Habitat Loss and Modification

Habitat is the term used to define the place or type of site in which an organism naturally occurs. Maintaining habitat is a key to ensuring the region's biodiversity is secure as it helps preserve the ecosystem and the associated processes that each organism depends upon for its survival. Broad habitat groupings include wetlands, forest, grasslands, heathlands, seagrass communities, rocky reefs etc.

The major threat to biodiversity in the region is the loss, degradation, modification and fragmentation of habitat. The clearance or degardation of habitat will have an immediate impact upon all species that exist within or depend upon that habitat for survival.

Flora and fauna habitat modification involves a change to local ecosystems resulting in an adverse impact on biodiversity. Habitat modification generally occurs slowly so the impacts may not be noticed until many years later. Habitat modification can be caused by many processes including inappropriate grazing techniques (e.g. stock access and damage to remnant vegetation), inappropriate fire regimes, erosion and sedimentation of watercourses, weed invasion, nuisance fauna, and changes in nutrient profiles in streams. Recreational activities can also have a detrimental impact upon habitat and biodiversity. For example, some shore birds nest and breed above the high water mark in the coastal areas and careless 4WDs can disturb and destroy their nesting habitat.

Habitat fragmentation poses a threat to biodiversity as natural ecosystems occurring within these fragments are generally more susceptible to adverse influences (such as weed invasion, animal pests, grazing, wind etc.), which diminish the habitat value for flora and fauna. Habitat fragments suffer from the fringe or edge effect whereby the vegetation on the boundary is impacted first and dies, with the process continuing deeper into the area.

Underwood (1998) outlines four management considerations regarding the needs of vegetation communities growing on Ranga soil on Flinders Island; firewood collection, unrestricted grazing, *Phytophthora cinnamomi* and fire. However, her considerations can easily apply to habitat and biodiversity concerns throughout the entire Furneaux Group.

All of Flinders Island's fire wood requirements are met through cutting and collection on the island. This can lead to areas of concentrated activity and cause habitat disturbance/loss, or worse the damage and destruction of threatened species.

Unrestricted grazing refers to the roaming and grazing of livestock across differing land areas or habitats. Unrestricted grazing can lead to several problems (Underwood 1998):

- Trampling of vegetation and ground compaction;
- Weed invasion from exotic seed on coats of animals or in their dung ;
- Browsing of seedlings may result in a scarcity of species in the understorey and failure of regeneration ; and
- Erosion in loosely consolidated areas.

The influence of fire, weeds and *Phytophthora cinnamomi* on habitat and biodiversity in the Furneaux Group and are discussed in greater detail under the relevant issues headings.

It is important to note that habitat problems not only occur on land but also in the marine environment. For example, seagrass beds are recognised as a vital part of the marine ecosystem, being significant breeding, nursery and feeding grounds for many types of fish species (both recreational and commercial). Degradation or destruction of sea grass areas will have a negative impact upon both commercial and recreational fishing in the area and the region's marine biodiversity.

A great deal of habitat was cleared from the Outer Islands during the 1800s when leases were taken up and the land was 'developed' for agricultural purposes. Bird breeding habitat is "in general the most important conservation value found on the islands, particularly for seabirds" (PWS 1998a). Major threats to the habitat include disturbance by stock, which can easily be addressed by fencing off important habitat.

6.2.2. Native Vegetation Loss

Under the Federal Government's Soldier Settlement Scheme during the late 1950s and early 1960s there was extensive land clearance on the eastern and southern coastal plains of Flinders Island. Apart from pasture there are large areas without any vegetation (native or introduced) and other areas with very fragmented and isolated vegetation. The extensively cleared area on the eastern coastal plain is the middle zone of the island's largest catchments. The upper (Darling Range) and lower (east coast heaths, forests, woodlands and wetlands) zones of these catchments consist of large tracts of native vegetation and habitat. The extensive clearing of the middle zone has cut off all connections and natural corridors between the upper and lower zones.

Table 6.4 The Importance of Native Vegetation.

Source: Gallagher 1998.

Ecological Value	**Economic Value**
• Protects water resources • Forms and protects soil • Storage and cycling of nutrients • Maintaining biodiversity • Provides carbon sinks that absorb greenhouse gases • Helps maintain regional rainfall patterns • Oxygen production **Cultural and Social Benefits** • Provides a sense of identity and place • Provides places for recreation • Aesthetic value	• Provides timber and other commercial products such as flowers and honey • Deep rooted vegetation helps maintain water table levels and prevents salinity • Shade and shelter for stock • Windbreaks for crops improve productivity • Reduces peak run-off and helps control soil erosion • Habitat for bird and insect predators of crop pests • Maintain micro-climates which assist water retention and water quality • Provide sites for tourism and recreation • Conserves genetic resources for future development of pharmaceutical or agricultural products

Native vegetation cover is important as it stabilises soils, slopes, river banks, reduces soil compaction and is essential for biodiversity (Table 6.4). It slows the speed at which water runs off the land surface after rains, thereby allowing greater moisture to enter the soils. It is also acknowledged that the retention and regeneration of existing/remnant native vegetation is easier and cheaper when compared with trying to re-establish vegetation. Revegetation activities can be extremely difficult in areas that are open and exposed (e.g. eastern coastal plain and the Outer Islands) due to strong salty winds, long periods of dry weather and severe insect outbreaks.

In addition to land clearance in the Furneaux Group, native vegetation loss occurs due to tree decline, stock damage and the disease *Phytophthora cinnamomi.* Tree decline is the accelerated death of trees. Most of the private land in the Furneaux Group has been classed with a nil-minor risk of tree decline (Grice 1992) but some areas of private land on Cape Barren Island are classed as moderate and extreme risk. These include an area from Bungs Point past Old Township Cove, Apple Orchard Point, and around Doris Hill. *Phytophthora cinnamomi* is discussed in section 6.2.5.

The following issues have been listed as a priority under the Vegetation Management Strategy for Tasmania: Flinders Bioregion and are relevant to 'Native Vegetation Loss':

- Tree Decline/Dieback.
- Loss and fragmentation of vegetation through past clearance.
- Protection of habitat for threatened species.
- Weed invasion (with an emphasis on pampas grass). There is a great deal of concern regarding pampas spreading into the large tracts of diverse native vegetation and habitat of the east coast heaths, forests, woodlands and wetlands, and the Darling Range.
- Degradation of native vegetation through inappropriate wild flora harvesting (e.g. seed and fire wood collection, *Xanthorrhoea* spp.).
- Protection and enhancement of offshore island vegetation.

Large scale native vegetation loss has also occurred on the Outer Islands due to the impact of European occupation and consequent land management practices since the 1800s.

6.2.3. Weeds

Weeds are pest plants that pose a serious problem to the region's agricultural areas, native environment and built-up areas (e.g. road sides, townships). The impact of weeds is widespread as they decrease farm productivity, threaten biodiversity, degrade waterways, bushland and agricultural land and invade backyards. Weeds also seriously reduce the conservation, aesthetic, recreational and scientific values of native bush, coastal areas, heathlands, wetlands and rivers. Weeds are spread by wind, birds, water, stock, native fauna, and human activities. As weeds are easily dispersed and have a capacity to readily colonise areas they can be very difficult to control and need to be attacked in a coordinated manner.

Weeds can be classified as agricultural and/or environmental. Environmental weeds are aggressive plants capable of invading native ecosystems and out-competing native plant species. Impacts from environmental weeds include displacement of native species, degrading the habitat of native fauna and increasing the risk of fire. Agricultural weeds are of more tangible economic concern. Impacts from agricultural weeds include a loss of yields, contamination of crops and/or wool; competition with commercial crops and pasture and increased costs (in $s and labour) for controlling weeds. Significant weeds in the Furneaux Group are listed in Table 6.5.

Table 6.5 Significant Weeds in the Furneaux Group.

Adapted from Welsh 1998 and Duncan 2002. FWMG = Furneaux Weed Management Group. Declared weeds are those declared under the Tasmanian Weed Management Act 1999.

Weed Name	Scientific Name	Weed of National Significance	Declared weeds	Identified as priority weed by the FWMG 2002	Considered possible to eliminate by FWMG 2002
African Boxthorn	*Lycium ferocissimum*	Yes	Yes	Yes	No
Amaranth/red root	*Amaranthus retroflexus*	No	No	Yes	Yes
Asparagus Fern	*Asparagus scandens*	No	Yes	Yes	No
Blackberry	*Rubus fruticosus aggregate*	Yes	Yes	Yes	Yes
Blue Butterfly Bush	*Psoralea pinnata*	No	No	Yes	No
Blue Periwinkle	*Vince major*	No	No	Yes	No

Bridal Creeper	*Asparagus asparagoides (= Myrsiphyllum asparagoides)*	Yes	Yes	Yes	No
Broom (English)	*Cytisus scoparius*	No	Yes	Yes	No
Broom (Montpellier)	*Genista monspessulana*	No	Yes	Yes	No
Brassica weeds/wild tunip	*Brassica spp*	No	No	Yes	No
Cape Ivy	*Senecio mikanioides*	No	No	Yes	No
Cape (Leeuwin) Wattle	*Paraserianthes lophantha*	No	No	Yes	No
Cape Weed	*Arctotheca calendula*	No	No	Yes	No
Cape Tulip	*Homeria spp.*	No	Yes	Yes	No
Chickory	*Chicorium intybus*	No	No	No	Not assessed
Espartillo	*Achnatherum caudatum*	No	Yes	Yes	No
Fennel/Aniseed	*Foeniculum vulgare*	No	Yes	Yes	No
Foxglove	*Digitalis purpurea*	No	No	Yes	Yes
Gorse	*Ulex europaeus*	Yes	Yes	Yes	Yes
Horehound	*Marrubium vulgare*	No	Yes	Yes	Yes
Horned Poppy	*Glaucium flavum*	No	No	Yes	Yes
Greater Mullein	*Verbascum spp.*	No	No	Yes	No
Marram Grass	*Ammophila arenaria*	No	No	Yes	No
Marshmallow	*Malva sp.*	No	No	Yes	No
Mignonette (wild/cut leaved)	*Reseda luteo and R. luteola*	No	No	Yes	No
Mint/Penny Royal	*Mentha spp.*	No	No	Yes	Yes
Mirror Bush	*Coprosma repens*	No	No	Yes	No
Nightshade (black)	*Solanun nigrum*	No	No	No	Not assessed
Nightshade (white/silver-leaf)	*Solanum elaeagnifolium*	No	Yes	Yes	Yes
Onion Grass	*Romulea rosea var, australis*	No	No	Yes	No
Onion Weed	*Asphodelus fistulosus*	No	Yes	Yes	No
Parramatta Grass	*Sporobolus africanus*	No	No	Yes	No
Pampas Grass	*Cortaderia spp.*	No	Yes	Yes	Yes
Patterson's Curse	*Echium plantagineum*	No	Yes	Yes	Yes
Pheasants Eye	*Adonis microcarpus*	No	No	Yes	Yes
Ragwort	*Senecio jacobaea*	No	Yes	No	Not assessed
Sand Rocket	*Diplotaxis tenuifolia*	No	No	Yes	Yes
Sea Spurge	*Euphorbia paralias*	No	No	Yes	No
Spiny Emex	*Emex australis*	No	Yes	Yes	Yes
Thistle (Californian)	*Cirsium arvense*	No	Yes	Yes	Yes
Thistle (Scotch)	*Cirsium vulgare*	No	No	Yes	No
Thistle (Slender)	*Carduus tenuiflorus and C. pycnocephalus*	No	Yes	Yes	No
Thistle (Variegated)	*Silybum marianum*	No	No	Yes	No
Three cornered garlic	*Allium triquetrum*	No	No	Yes	Yes
Wild Sage	*Salvia verbenacea*	No	No	Yes	

It is important to note that pampas grass has been exempt from past eradication programs that have been undertaken throughout Tasmania. The exemption has occurred due to the reliance that landholders place on pampas grass for stock shelter and the absence of other shelter in the eastern farming districts. Planting of pampas grass was also recommended as a shelter plant to landholders in the early 1990s by DPIWE (then DPIF). There is ongoing work to limit the spread of this species into the reserved eastern lagoon/wetland areas.

Many of the outer islands have serious weed problems. Box thorn is on many of the islands in high densities and is used for windbreaks/shelter. Mirror bush occurs in major infestations on many of the small islands of Franklin Sound. Sea spurge is found on many of Flinders Island beaches and on most of the outer islands and is starting to creep inland from the coastal areas. Other weeds on the outer islands include white horehound, slender thistle and capeweed.

The Tasmanian Weed Management Strategy, WeedPlan, states that the primary responsibility for weed management rests with individual land and water managers. For weed management to be successful there is a need for a cooperative approach that involves industry, resource managers, landholders and the community working with all levels of government. The State Government has three regional weed officers in the State and limited resources for them to drive and coordinate weed management programs, consequently community and stakeholder support are essential for effective weed management. Further support is provided by the weeds coordinator at NRM North.

Since 1999 a Furneaux Weed Management Group has been established with key stakeholders in the community and a *Furneaux Region Weed Strategy* was developed in 2002 (Duncan 2002). The regional support and driving force behind active weed management in the region should occur through the Furneaux Weed Management Group (FWMG), however this group is currently not active. Nonetheless a range of weed control activities continue to occur many coordinated by the current Furneaux NRM facilitator. Recent activities include:

- The mapping of all of the bridal creeper on Flinders Island and provision of funding by NRM North for a 2 year eradication program.

- an NRM North funded box thorn management program in dunes at Palana and Fotheringate Beach which is currently being planned by the NRM Officer.
- Activities undertaken by the local land care group to control box thorn on Royden Island
- Weed control activities undertaken by Parks and Wildlife staff as part of their ongoing weed management program.

Flinders Council also takes a role in the control of weeds as part of their roadside management practices although there is no current code of practice or weed management plan in place. As roadside management practices are a significant factor in weed dispersal the cooperation of the Council, Aurora and weed spraying contractors are critical for successful weed management.

It is important to note that it will be impossible to eradicate all weeds in the Furneaux Group. There are some small and concentrated infestations of specific weeds that may be possible to eradicate from the region and these should be regarded as a priority (Table 6.5). Some weeds may be eradicated from specific areas in the region but impossible in areas where they are widespread and in high concentrations. Weeds that are more prevalent throughout the region and have little chance of being eradicated will need continued management to keep under control. Pampas grass has the potential to be a major problem on the island as it has been elsewhere in Australia and New Zealand. It is essential that pampas is monitored, especially in the large tracts of native vegetation along the eastern coastal plain. Alternatives for pampas grass as a wind break and shelter for stock also need to be encouraged.

6.2.4. Nuisance Fauna

Nuisance fauna are animal that have an adverse impact on the region's biodiversity and agribusiness. This section focuses on terrestrial nuisance fauna, marine pests are discussed in the Coasts, Estuaries and Marine chapter.

Nuisance fauna can be broken down into three categories:

- Introduced Pests: These include fauna that are not native to the Furneaux Group, having being introduced and are currently adversely impacting upon the environmental and/or economic/agricultural resources. Introduced pests include: feral pigs, feral cats, turkeys, peacocks, and starlings.
- Native Pests: These can be defined as native wildlife that are considered a pest or problem. What some sectors of the community consider a native pest, others do not. Native pests include: wallaby, pademelon, wombat, Cape Barren geese, possum, wild duck, and swan.
- Invertebrate Pests: This category includes all native and/or introduced invertebrates and insects that are considered a pest or problem in the region. Invertebrate pests include: white Italian snail, grasshoppers, cockchafers, and army grubs.

The fauna in the region that are considered to have the greatest impact and are hardest to control by the community include wallaby, Cape Barren geese, feral cat, grasshopper and feral pig (Bayley 1999, refer Table 6.6). Wallabies (including pademelon), Cape Barren geese and grasshoppers have the biggest impact upon agricultural enterprises. Other pests of concern include European wasps, peacocks and European starlings.

Wallaby are seen as a problem for most of the year and current methods of control include shooting, poisoning and fencing. Land clearance for agriculture has created a mosaic of bush, pasture and crops and is seen as the main reason for major population increases of the wallaby and pademelon on Flinders Island.

The native game not only place pressure on pastures and crops but also upon native vegetation and habitat. They can have a significant impact upon vegetation re-growth and the regeneration capacity of native vegetation communities.

Table 6.6: Major Nuisance Fauna in the Furneaux Group

Nuisance Fauna	Ave. Months/Yr. Considered a Pest	Damage/Problems Caused	Current Control Methods
Wallaby and Pademelon	11 - 12	• Agricultural: pasture loss, fence damage, control costs. • Environmental: Loss of regrowth or regenerating capacity in native bushland due to pressures from increased populations of native wildlife. • Other: danger to drivers.	Shooting, poisoning, fencing
Cape Barren Geese	5 – 7	• Agricultural: pasture loss, fouling of water supplies. • Environmental: foul waterbodies.	Shooting
Feral cat	10 – 12	• Agricultural: spread of disease. • Environmental: large impact on native fauna (especially birds and small mammals).	Shooting, trapping
Grasshopper	3 – 4	• Agricultural: pasture loss, destroy young shelter belts, costs of control. • Environmental: pressure on native seedlings.	Spraying, predation chooks and turkeys
Feral pigs	7	• Agricultural: minimal. • Environmental: soil erosion, loss of regrowth, destroy flora, spread *Phytophthora*.	Shooting, trapping

It is estimated that there are 14,000 Cape Barren geese in the Furneaux Group, representing 60% of the world's total wild population (PWS 1998b). In the 1960s Cape Barren geese were regarded as a rare species and in danger of extinction. The populations have increased markedly over the years to the current levels where they are considered a pest by farmers because of competition with stock for pasture and by fouling waterholes. However they are still one of the rarest geese species in the world. A regulated cull is undertaken annually as the main method of control, some egg harvesting has also been undertaken in the past. On the outer islands Cape Barren geese are also a problem due to high population levels, adversely impacting pasture. During summer the geese fly to Flinders Island where they further impact upon agricultural activities in the region.

Feral cats and pigs have a greater impact on the native fauna and flora than on pasture and livestock. Feral cats occur on Flinders Island and many of the outer islands. The only place that feral pigs occur in Tasmania is on Flinders Island. Damage by pigs from rooting the ground leads to the spread of *Phytophthora cinnamomi* (rot root), soil erosion and loss of seedlings, herbaceous plants and regenerating forest plants. Feral pigs are causing the

greatest damage in the wetter areas and gullies in and around the Strzelecki National Park. Feral pigs have also caused damage along the east coast wetlands and lagoons and Darling Range. In 1987 it was estimated that there were a total of 975 feral pigs on Flinders Island (Statham and Middleton 1987). The *Vegetation Management Strategy for Tasmania: Flinders Bioregion* lists the impact of feral animals (mainly pigs) on native bush values as a priority issue for Flinders Island.

The population of feral cats is not known but believed to be high. In 1991 during a 15 week period 189 cats were caught and shot on Great Dog Island, approximately 390 hectares (Gould 1991). Feral cats occur on Flinders, Cape Barren and Clarke Islands and many of the outer islands (including Prime Seal, Little Green, Goose, Vansittart and possibly a few left on Great Dog) and are known primarily for their devastating effects on bird and small mammal populations.

Feral cats and pigs are shot and/or trapped on the island. Control of feral cats is minimal as they are less of an attraction to hunt or trap than pigs. PWS actively traps and shoots feral pigs in and around the Strzelecki National Park. Recently a *Feral Pig Management Plan* (2002?) was produced which outlines a Strategy and programs for the monitoring and control of feral pigs.

Currently there are no rabbits on any of the islands in the Furneaux Group except for Passage and Clarke Islands. The rabbits have caused a great deal of damage on Passage Island in the form of soil erosion and destruction of vegetation. On some occasions rats have reached plague proportions and had a devastating impact upon some of the Outer Islands. Rats eat bird eggs and invertebrates.

Other pests of particular concern to the agricultural sector include grasshoppers, cockchafers and the white Italian snail (*Theba pisana*). Animals that may be a potential threat to the region if introduced or allowed to turn feral are: goats, deer and stock that run wild.

6.2.5. Disease

The main disease of concern in the Furneaux Group is *Phytophthora cinnamomi* (cinnamon fungus). The threat of new diseases being introduced into the region is also of great concern. These include disease such as the frog disease Chytrid fungus and the abalone disease ganglioneuritis,

Phytophthora cinnamomi is a fungus that travels in the soil attacking the root systems of plants and killing susceptible species and is listed as a key threatening process under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999.* The fungus is causing a substantial decline in many susceptible plant species and modifying the structure and composition of plant communities particularly within moorland, heathland and heathy dry sclerophyll vegetation types (Schahinger 2003). While many plant families are susceptible to *Phytophthora cinnamomi* species from Epacridaceae, Fabaceae, Myrtaceae, Proteaceae and Dilleniaceae are particularly affected (Barker 1994). Of greatest concern are susceptible species that are listed as rare or threatened under State and/or National legislation.

Thirteen TASVEG communities have been identified as highly susceptible to *P. cinnamomi,* eight of these communities occur in the Furneaux region (Table 6.7). These communities represents more than 20% of all native vegetation in the Furneaux. A further 21 mapping units are considered moderately or 'variably' susceptible and one of these occurs in the Furneaux.

Proven infestations and symptoms have been recorded at many sites in the Furneaux. Cape Barren Island is considered to have one of the worst cases of the disease in Tasmania (*pers comm.* S.Harris 1999) and the disease is also thought to be widespread on Clarke Island (*pers comm.* T. Rudman 2007). Flinders Island has many sites infected with the disease, including sites at; Wingaroo, Darling Range, Pillingers Peak, Wallanippi and Settlement Point.

Table 6.7 Vegetation communities in the Furneaux which are considered highly or moderately susceptible to *Phytophthora cinnamomi*.

Source: Adapted from Schahinger *et al.* 2003

TASVEG Code	Hectares	Vegetation Community Title	Vegetation Group	Susceptibility
DNF	9676	Eucalyptus nitida Furneaux forest	Dry Eucalypt Forest and Woodland	High
NBS	11	Banksia serrata woodland	Non-Eucalypt Forest and Woodland	High
SCH	2204	Coastal heathland	Scrub, Heathland and Coastal Complexes	High
SCW	1662	Heathland scrub complex at Wingaroo		High
SHF	211	Heathland scrub mosaic on Flinders Island		High
SHG	12836	Heathland on granite		High
SHW	485	Wet heathland		High
SSC	3575	Coastal Scrub		High
ORO	2612	Lichen lithosere (Rock)	Other Natural Environments	Moderate

The fungus is spread through water travelling through the soil, track building, soil particles on bush walker's boots, horse's hoofs, some native animals and vehicles (e.g. 4WD, trail bikes). Due to the difficulty of monitoring and controlling the spread of the disease management is currently focused on protecting key sites currently not infected. As part of this approach systematic mapping of symptoms in certain areas in the Furneaux was undertaken to identify areas free of the disease and three priority management areas were established in the Furneaux, as part of a State wide plan to protect representative examples of those plant species and communities considered most at risk (Schahinger 2003). The two areas on Flinders Island are managed by PWS and the third area is located on Clarke Island.

The potentially lethal frog disease, Chytrid fungus is considered a serious threat to native frog populations. It currently occurs on the mainland of Tasmania but is not known to be present on Flinders Island. The movement of live frogs and tadpoles by humans is thought to present the highest risk for spread of the disease and thus the use of frogs and tadpoles as bait and the collection and release of frogs and tadpoles are likely to be two of the most common means of introducing the disease into new areas. The introduction of

frogs with the import of fresh produce also presents a risk of disease spread (Obendorf 2005).

In December 2005, the presence of a disease that causes Ganglioneuritis was detected in a number of land based and offshore abalone farms in Victoria. Soon after, in May 2006, the disease was found in wild Victorian abalone populations. In response to this a Temporary Abalone Closure was put in place off Port Fairy in Victoria (Department of Primary Industries Victoria 2007). In August 2006, the Tasmanian government was informed that the disease had been found in abalone outside the current control area. As a precautionary measure DPIWE closed the part of the Tasmanian fishery closest to Victoria from 9 August 2006 until the 28 February 2007 (Figure 6.1). Restrictions were also placed on the use of vessels to further minimise the risk of the disease spreading into Tasmanian abalone (DPIWE 2007).

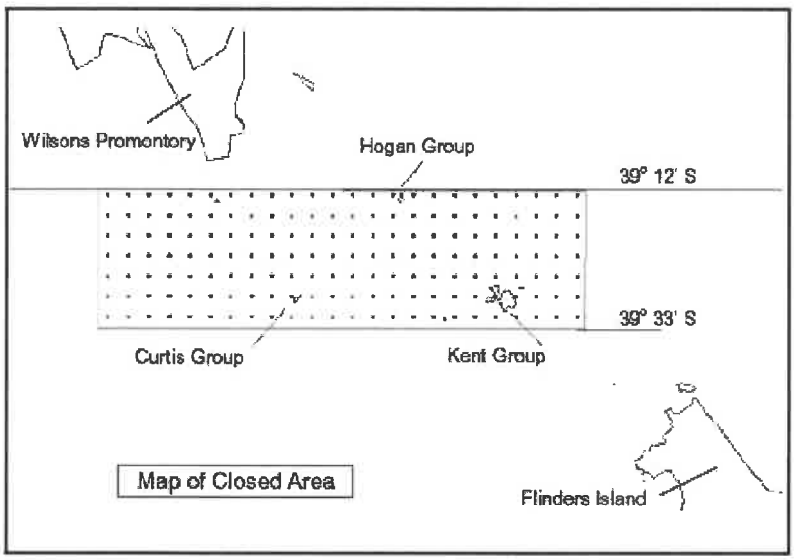

Figure 6.1 Area closed to abalone fishing in Tasmania.

Source: Taken from DIPW (2007).

Priority Areas/Locations

Sites currently free of *Phytophthora cinnamomi* particularly those identified as priority management areas at Wingaroo, the Northern Patriarchs and on Clarke Island.

Abalone fishing areas.

6.2.6. Fire management

Fire (incidence, intensity or lack of) has influenced the current distribution of many vegetation communities in the region. Some plant communities require fire to maintain their structural and floristic composition, while others are unable to regenerate after fire. Fire frequency and intensity are key elements in any fire management regime designed to protect biodiversity values. The Furneaux Group has many rare or endangered plant species and ad hoc fire management practices in the form of burning off and reduction burns could adversely impact upon these species. Fires of high frequency or intensity can change the composition of vegetation and even leave areas with bare earth, causing soil erosion (as on the slopes of Mt. Munro, Cape Barren Island) and/or provide ideal sites for weeds to colonise.

Another example of the threat posed by inappropriate fire regimes to biodiversity is highlighted when rivers/streams are impacted on by fire. Stream sediment and turbidity are usually adversely impacted upon for 3-4 months after extensive and intense fires. This is of particular concern in areas of the Strzelecki Peaks, Darling Range and southeastern Cape Barren Island where the threatened freshwater burrowing crayfish is found. High sediment and turbidity levels, smokey water and raised water and ground temperatures can kill the burrowing crayfish.

The Furneaux Group is a relatively dry region with large tracts of native bushland. The majority of agricultural and urban areas are surrounded, at least in part, by this native vegetation. Generally there are higher fuel loads on the native bushland than on agricultural land. Due to the lack of resources allocated to active fire management practices on Crown Land and the threats to private property if the fires burn from Crown Land there is a greater level of concern with regards to fire within the region. Severe fires pose a serious threat to life and property as well as environmental values. A number of large fires have occurred in the last few years in the Furneaux, including large fires on Flinders Island in 2003 and Cape Barren Island in 2006. However, there is no comprehensive and accurate fire history for the Furneaux Group.

Landholders/managers are responsible for controlling fire on property/land under their responsibility. Fire management responsibilities within the Furneaux Group are vested in the Furneaux Fire Management Area Committee (FFMAC). Similar committees exist for each Fire Management Area within the State. Under section 20(1) of the Fire Service Reform Act 1995, Fire Management Area Committees have the following functions in its area:

- To prepare a fire protection/management plan for its Fire Management Area and to review it regularly;
- To provide the State Fire Commission with advice on matters pertaining to fire (e.g. fire permit periods, fire services, fire breaks and trails);
- To provide advice to Councils in the area, with advice on the removal of hazards.

A fire management plan was completed in 1991 by the local Fire Management Area Committee (then known as the Furneaux Group Special Fire Area Committee). However, this plan has not been approved by the State Fire Commission. The lack of a recognised fire management plan is also a problem for Cape Barren Island and many of the Outer Islands. A fire management plan for Clarke Island was written by Park and Wildlife Service in 1996. It was due to be reviewed in December 2005.

6.2.7. Climate change

Recent climate change has been exacerbated by human activities which have increased emissions of greenhouse gases, such as carbon dioxide, into the atmosphere. Since 1900, the average surface temperature of the world has risen by 0.6 ± 0.2 °C. In addition, oceans are warming, glaciers and sea ice are retreating, there have been fewer frosts, sea level has risen 10-20 cm, the number of heat waves has increased and heavy rainfall has increased in many regions. Further climate change is projected as emissions of greenhouse gases into the atmosphere continue to increase (NRMCC 2004).

Climate change has the potential to impact on all facets of the natural values of the Furneaux and the basic physical and ecological processes which support the regions biodiversity and maintain the current character of the region.

There are range of impacts climate change may have on biodiversity values. Climate change may result in reductions in the range of some species (particularly those whose distribution is extremely limited by climate) or changes in the location of species habitat. Changes in the timing of species lifecycles (e.g. earlier breeding as a result of warmer temperatures) has been documented in many parts of the world. Changes in physical conditions such as air and water temperature, terrestrial moisture availability and salinity levels directly affect the physiology of species and can result in changes in population dynamics and survival. For species that are already vulnerable (e.g. species with limited climatic ranges, limited dispersal ability, specialised habitat requirements, small populations and/or low genetic diversity) climate change may increase the risk of extinction. At a community scale climate change may facilitate the expansion of weeds and pests and result in changes in the structure and composition of ecological communities and ecosystems (NRMCC, 2004).

Several initiatives have recently been undertaken to address issues associated with climate change. The *National Biodiversity and Climate Change Action Plan 2004-2007* (NRMCC 2004) was developed to help focus and coordinate efforts at a State and National level to minimise the impacts of climate change on species, communities and ecosystems including estuaries. A *Draft Climate Change Strategy for Tasmania* was released by the Tasmanian government in October 2006

The document *Indicative Mapping of Tasmanian Coastal Vulnerability to Climate Change and Sea-Level Rise: Explanatory Report* (2nd edition, Sharples 2006) and accompanying maps were commissioned by the Department of Primary Industries and Water to indicate Tasmanian coastal areas, including the Furneaux Group, that are potentially vulnerable to increased storm surge flooding and other hazards related to climate change and sea-level rise.

The report by Sharples (2006) is an indicative or "first pass" assessment, more detailed studies such as regional (or "second pass") indicative assessments and site specific assessment, monitoring and modeling will be required to provide reliable information on the degree and rate at which a particular site is likely to be impacted.

The Tasmanian Shoreline Monitoring and Archiving Project (TASMARC) aims to provide continuous monitoring of shoreline position at a selected group of

Tasmanian beaches. This monitoring will provide information on short-term (monthly, seasonal) and long-term (years, decades) patterns in shoreline movement and in particular the effects of sea level rise. The monitoring techniques used are relatively simple and could be readily completed by volunteer groups such as Coastcare (Hunter *et al.* 2004).

Atmospheric pollution is the cause of accelerated climate change, however management of atmospheric pollution is outside the scope of this plan. Thus the recommended management actions in respect to climate change focus on minimising the negative impacts climate change may have on the natural resources of the Furneaux Group. Nonetheless, it must be recognised that continued greenhouse gas emissions and consequent climate change presents one of the most serious long term threats to the regions natural resources, and thus it is important that measures to reduce emissions are urgently implemented within the Furneaux Group as well as at a State, National and Global level.

6.3. *Management Directions*

This section presents Community Aspirational Statements and recommended Resource Condition Targets (RCTs), Management Actions Targets (MATs), and Management Actions for the asset of Biodiversity. These targets and actions are focused on the key issues associated with the asset of Biodiversity. It is important to recognise that biodiversity does not exist in isolation from other natural values in the Furneaux. To successfully manage biodiversity, there must also be adequate management of the environment as a whole including the assets of land, water, coasts, estuaries and marine environments and issues related to people and management. It is therefore important to note that management actions listed below are intended to be read and implemented together with those presented in Chapters 3, 4, 5, and 7.

Community Aspirational Statement for Biodiversity

Human activity is managed to reduce its impact on biodiversity

Table 6.8 Targets and Actions for Biodiversity

Issue	Resource Condition Targets (RCTs 10- 20 years)	#	Management Action Targets (MATs 1-5 years)	#	Management Actions	Key Partners
Native vegetation loss	BR1: The rate of clearance/conversion and degradation of all native vegetation communities is reduced by 2017	BM1	A 50% increase in the area of private land that is being managed to protect the integrity of native vegetation by 2012	BA1	Support programs which monitor the rate of clearance/conversion and the condition of native vegetation communities such as the Tasmanian Vegetation Monitoring and Mapping Program (TASVEG) including the Tasmanian Vegetation Monitoring Vegetation and Extent Project and the Vegetation Condition Assessment Project	DPIW, NRM North
				BA2	Develop and implement a program to increase participation in property planning to improve biodiversity conservation by 2010	NRM North
				BA3	Promote and support incentive programs and other programs which encourage the protection of natural values on private land as well as strategic revegetation for biodiversity outcomes (e.g. Protected Areas on Private Land program, Land for Wildlife, fencing off remnant vegetation etc.)	NRM North, FC, DPIW
		BM2	The region has an endorsed fire management plan/s by 2009	BA4	Prepare a fire management plan/s for the region (that incorporates social, ecological and economic requirements) by 2009	FFMAC, TFS, PWS
Threatened species and ecological communities	BR2: Maintain and improve the extent and condition of priority vegetation communities by 2017 (both Bioregional and State priority communities)	BM3	40% of the priority vegetation communities and habitat for priority fauna on private land is being managed to ensure the protection of natural values by 2012	BA5	Planning and policy frameworks (e.g. Council planning scheme) are in place to protect and mitigate fragmentation and clearance/conversion of priority native vegetation communities and habitat for priority fauna by 2010	FC
				BA6	Develop and implement education and awareness programs which promote the values of biodiversity	NRM North, FC, Community
	BR3: The range, area, number of locations, condition and conservation status of significant native species (including listed threatened species) and their habitats, will be maintained at or above benchmarks levels by 2027	BM4	Priority actions within threatened species recovery plans, that are applicable to the Furneaux region, have been implemented by 2012	BA7	Promote the State Climate Change Strategy to local government and key stakeholders and assist local government to develop and implement local strategies to minimise the impact of climate change on biodiversity values in the region	DPIW, NRM North, FC, Industry, Community
				BA8	Support the implementation of recovery plans for threatened species and threatened ecological communities	DPIW, PWS, NRM North, FC, TSN,Community

Weeds, pests and disease	BR4: No increase or reduction in the baseline extent and impact of regionally significant weeds, pests and diseases by 2027	BM5	Active management programs are in place to manage all priority weeds, pests and disease by 2010	BA9	Re-establish the Furneaux Weed Management Committee and continue to implement the Furneaux Weed Management Strategy (including coordination, education/awareness and integrated weed management activities)	FC, NRM North
				BA10	Support the implementation of an integrated feral cat management program	NRM North, PWS, Community
		BM6	Mechanisms are in place for the early detection, reporting and management of new weed species, outbreaks of existing weeds and emerging weed problems by 2010	BA11	Review current quarantine measures and if necessary establish adequate controls, enforcement mechanisms and educational signage	FC, DPIW
		BM7	A reduction of 90% in the abundance of feral pigs by 2012	BA12	Support the continued implementation of the feral pig management plan	PWS, FC, Community
		BM8	Blackberry, bridal creeper and asparagus fern are reduced to negligible amounts by 2012	BA13	Support coordinated programs/activities to eradicate bridal creeper, asparagus fern and blackberry	Land Managers, NRM North, FC, PWS, DPIW
		BM9	"Priority Management Areas" for *Phytophthora cinnamomi* remain free from the disease (ongoing)	BA14	Ensure "Priority Management Areas" for *Phytophthora cinnamomi* are being adequately managed to prevent establishment/spread of the disease	PWS, DPIW

The coastal, estuarine and marine environments are important elements of the Furneaux Group's identity, economy and recreation. Maintaining the health of these environments is essential in securing the future of the regions biodiversity and maintaining, improving and promoting the local fishing and aquaculture industries.

7.1.1. Coasts

The Furneaux Group has a large variety of coastal formations. These include hard rock coasts, beach and bay formations, estuaries (discussed below) and open inlets. While coastal wetlands and closed inlets (e.g. Cameron Inlet and Logan Lagoon) can be technically classed in this section they have been discussed in greater detail under the heading of 'Wetlands' in the Water chapter. Many of the sites listed in the Furneaux Group with geoconservation significance are within the coastal zone (for more information see section 4.1.4).

The coastal area of the Furneaux Group consists of five broad terrestrial vegetation communities. These communities are wetlands and saltmarshes, beach and dune systems, heathlands, coastal woodlands and forests.

7.1.2. Estuaries

Generally estuaries are seen as the tidal mouth of a river, where sea and fresh water meet. However, Edgar *et al.* (1998) broaden this definition to include coastal aquatic environments that are semi-enclosed or periodically closed and are "affected by the physical and chemical characteristics of both fluvial drainage and marine systems". This definition therefore includes coastal lakes, lagoons and rivers upstream to the limit of tidal influence.

Estuaries are highly productive environments and act as nurseries for many marine species and consequently support large numbers of invertebrates, fishes and birds. For these reasons estuaries are highly significant for commercial and recreational fisheries and biodiversity. Estuaries are also popular sites for tourism and recreational activities.

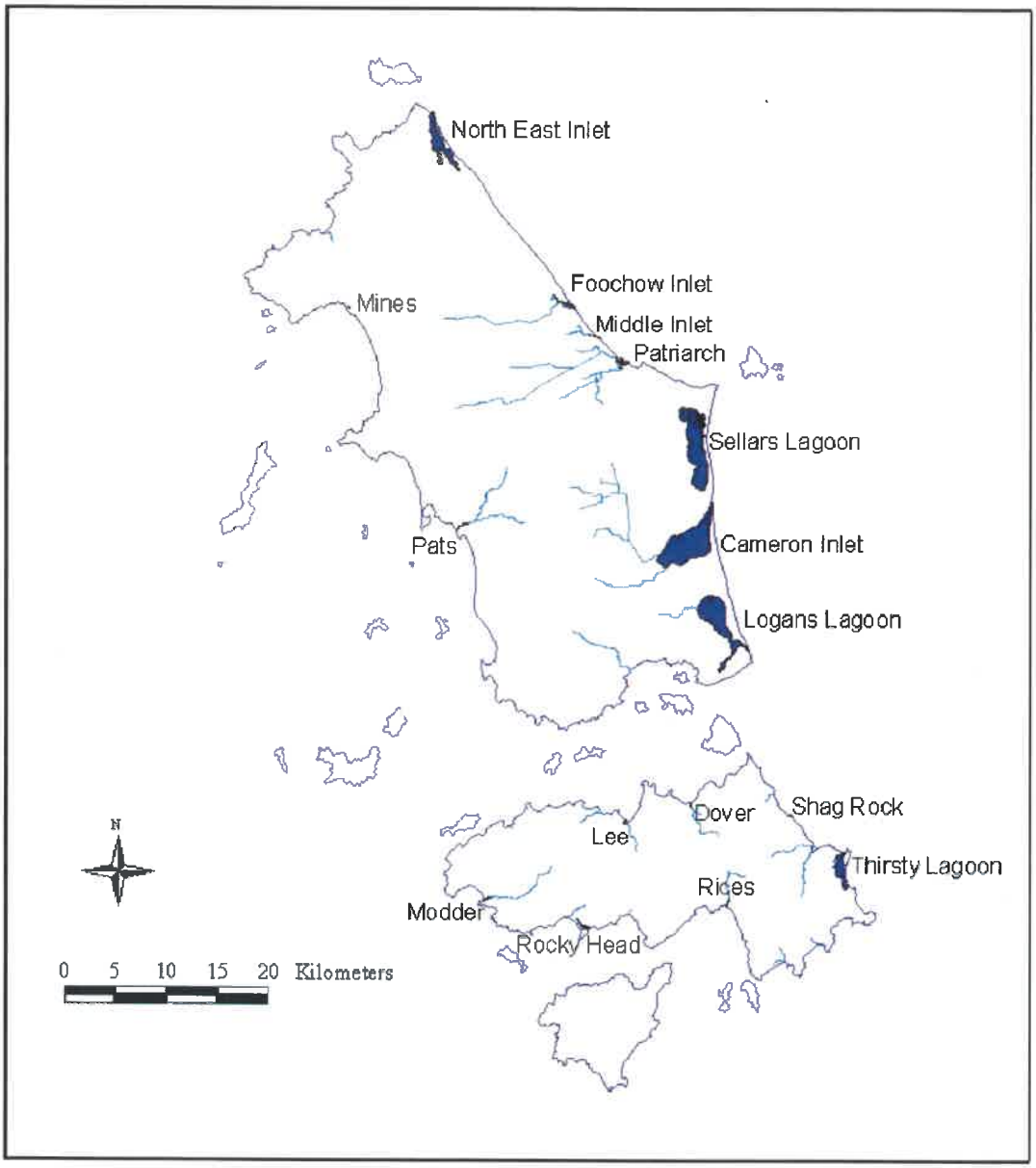

Figure 7.1 Location of recognised estuaries in the Furneaux Group.

Source: CFEV

A Classification of Tasmanian Estuaries and Assessment of their Conservation Significance (Edgar *et al.* 1998) recognised 16 estuaries in the Furneaux Group (Table 7.1 and Figure 7.1) of conservation significance from a total 111 surveyed around Tasmania. This study aimed to assess the conservation significance of Tasmanian estuaries by analysing physical and ecological attributes, population and land use. Results from the study discovered that 1 plant taxon, 33 invertebrate and 6 fish species were only

found within the Furneaux Group, emphasising the importance of estuaries in the region at a state-wide scale.

Table 7.1 Recognised Estuaries in the Furneaux Group

Source: (Edgar *et al.* 1998)

Name of Estuary	Estuary Type/Grouping	Class (Conservation Significance)	Estuarine Area (km^2)	Perimeter (km)
North East River	Marine Inlet and Bay	Class A	4.0	23.0
Thirsty Lagoon	Hypersaline Lagoon	Class A	2.1	10.7
Rock Head	Hypersaline Lagoon	Class B	0.2	3.2
Sellars Lagoon	Hypersaline Lagoon	Class B	11.8	33.7
Logan Lagoon	Hypersaline Lagoon	Class B	9.7	32.3
Cameron Inlet	Hypersaline Lagoon	Class B	13.5	21
Mines	Barred, Low Salinity Estuaries	Class B	<0.1	1.6
Middle Inlet	Barred, Low Salinity Estuaries	Class B	0.1	2.7
Shag Rock	Barred, Low Salinity Estuaries	Class B	0.2	2.7
Modder	Barred, Low Salinity Estuaries	Class B	0.1	2.5
Foochow Inlet	Small Open Estuary	Class B	0.2	3.3
Dover	Small Open Estuary	Class B	<0.1	1.3
Lee	Small Open Estuary	Class B	0.1	2.9
Rices	Small Open Estuary	Class B	0.1	2.8
Patriarch	Small Open Estuary	Class B	0.4	7.0
Pats	Small Open Estuary	Class C	<0.1	2.3

Notes:

1. Class A: Critical conservation significance (11 in total, 2 in Furneaux Group)- estuary and associated catchment show minimal effects of human activity, or has exceptional fish and invertebrate diversity.
2. Class B: High conservation significance (37 in total, 13 in Furneaux Group)- estuary and associated catchment area remain relatively pristine or contain an unusual range of species.
3. Class C: Moderate conservation significance (34 in total, 1 in Furneaux Group)- estuaries and associated catchment area are effected by human habitation and land clearance but have not been badly degraded.
4. Class D: Low conservation significance, moderately degraded (21 in total, 0 in Furneaux Group).
5. Class E: Low conservation significance, badly degraded (8 in total, 0 in Furneaux Group).

Of 9 types of estuaries identified in the State, four occur in the Furneaux Group. These are:

1. Marine Inlets and Bays;
2. Hypersaline Lagoons;
3. Barred, Low Salinity Estuaries; and

4. Small Open Estuaries.

Two estuaries in the Furneaux Group were given the highest conservation ranking, a Class A rating (North East River on Flinders Island and Thirsty Lagoon on Cape Barren Island), thirteen were given a Class B rating and one a Class C rating (Class E being the lowest rating).

The study found that the estuary at North East River has an exceptionally high diversity for both fish and invertebrates, with numerous species not recorded elsewhere in the State. Surveys at North East River recorded 40 different fish species, 2 different plant taxon and 120 invertebrate species. Of these, three fish species, one plant taxa and 30 invertebrate species were found only at North East River. As a compromise to accommodate recreational and conservation interests in the estuary the study recommended that: a Marine Protected Area be established near the mouth of the estuary in which the taking of all aquatic life would be prohibited; and a number of other restrictions on fishing in the estuary. It also recommended that an estuarine protected area should be established to prevent the taking of aquatic flora and fauna at Thirsty Lagoon (Edgar *et al.* 1999).

7.1.3. Marine

The marine environment surrounding the Furneaux Group consists of off-shore reefs and deep trenches and holds huge deposits of soft sediments and sand. There is a mass of sand and sediments covering the sea-floor between Tasmania and Victoria that is gradually moving eastwards, replenishing the west coast beaches or flowing off the continental shelf to the deep ocean floor (SoE 1996).

Seagrass beds are an important component in the life-cycle of many marine species. They provide habitat, food sources and are nurseries for many marine species and also help stabilise sand sediments. The seagrass beds consist primarily of *Posidonia australis* with small amounts of *Amphibolis antarctica, Posidonia angustifolia, Heterozostera tasmanica, Zostera muelleri* and *Halophila australia* (Jordan *et al.* 1998 and Marine Resources Division 1999). As seagrass beds are very productive areas, they contain a high diversity and abundance of fish species.

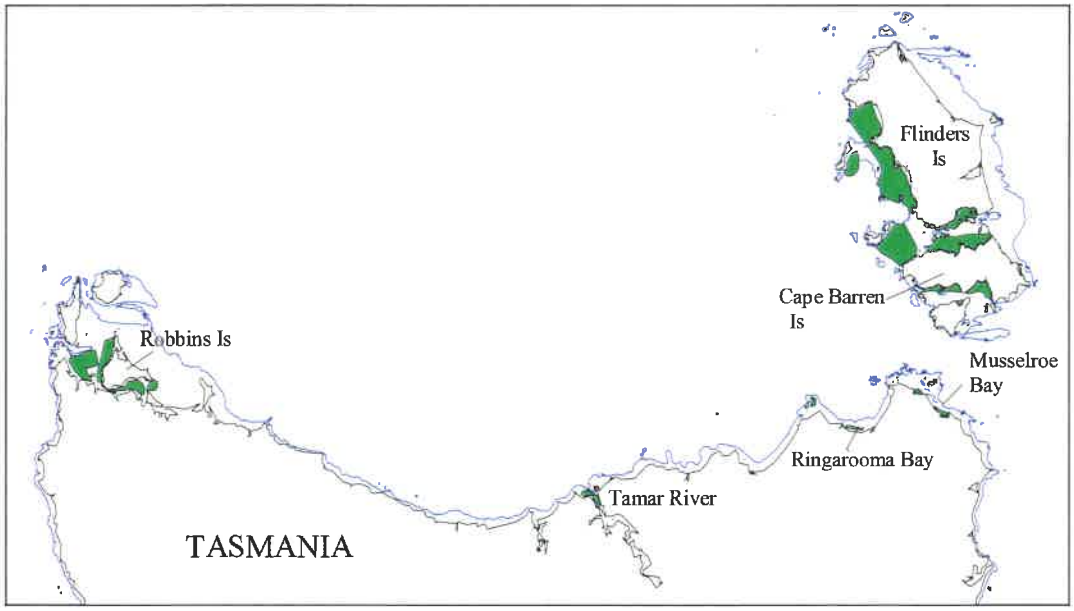

Figure 7.2 Mapped seagrass beds (green shading) off the north coast of Tasmania

Notes: Contour line presents the 20 m depth. No mapping has been done off the eastern coast of Flinders and Cape Barren Islands, but extensive seagrass beds are known to exist there. Source: Jordan *et al.* 1998

Seagrass beds in the Furneaux Group that have been studied are shown in Figure 7.2. No mapping has been done off the eastern coast of Flinders and Cape Barren Islands, but extensive seagrass beds are known to exist there. A study of inshore habitats around Tasmania found two aspects of note regarding seagrass beds in the Furneaux Group (Jordan *et al* 1998). The first was the discovery of extensive beds of *Posidonia australis* in depths of up to 20 m off the east coast of Prime Seal Island, which is the deepest this species has been discovered and is attributed to the very clear waters in the region. While 20 m was the limit of the survey it is believed that the beds may extend into deeper water due to the high standing stock of *P. australis*. Also of note was the discovery of *P. angustifolia* in the seabeds within the Furneaux Group, extending the eastern boundary of its distribution from South Australia to eastern Bass Strait.

In the Furneaux Group seagrass beds play an important part in the tidal food chain for commercial and recreational species such as garfish, flounder and flathead. However, it was discovered that un-vegetated beds were a more

important nursery area for juveniles of these commercial species (Jordan *et al 1998*). It is important to note that seagrass beds are a significant nursery habitat for many other fish species. Loss of seagrass is a major concern as there is strong evidence showing that there is little or no return of *Posidonia australis* to beds that are destroyed beyond a certain level (Marine Resources Division 1999).

Jordan *et al.* (1998) stress that it is important to manage and minimise impacts on both seagrass beds and un-vegetated beds throughout the marine environment because both habitats play significant roles in the survival of many fish species. Fish abundance and diversity was consistently higher in areas of seagrass density.

The main threats to seagrass beds and other soft sediment habitats around Tasmania include; increased nutrient levels and turbidity (from urban and industrial discharge and general catchment discharge of nutrients, chemicals etc.) and the introduction of exotic species (e.g. northern Pacific seastar). Both threats have the potential to alter the structure and composition of these habitats (Jordan et al. 1998). Throughout Tasmania, many seagrass communities have declined significantly, with the greatest declines occurring around urban, industrial and agricultural areas.

Rocky reefs provide habitat for many marine species (Edgar *et al.* 1997). Reef sites are very productive areas and provide important habitat for many marine species not adapted to seagrass or un-vegetated environments. Important commercial species that require reefs include abalone, crayfish, banded morwong and snapper. The distribution and composition of biota at reef sites are influenced by wave exposure, temperature and depth. The highest level of dissimilarity detected between reef communities occurred between sheltered and exposed sites.

7.2. Managing Estuaries Coasts and Marine - Threats and Priority Issues

This section outlines the key issues and threats which impact upon the condition of coasts, estuaries and marine environments in the Furneaux Group. These issues and threats have been identified from the existing literature and during consultation with technical experts and Furneaux community.

The threats and issues discussed in detail in this chapter fall under four headings: It is important to note that threats and priority issues discussed in other chapters may also impact upon the asset of coasts, estuaries and marine.

7.2.1. Marine pests

The Tasmanian State of the Environment Report recognises introduced marine pests as one of the most significant natural resource management issues facing Australia (RPDC 2003).

A survey for introduced marine pests was conducted at the Port of Lady Barron by the Centre for Research on Introduced Marine Pests (CRIMP) in 1997 (with the report printed in 1998). Six introduced marine species were recorded around the port and adjacent coast. These species are: the European shore crab (*Carcinus maenas*), the bryozoans (*Bugula dentata*), the hydroids (*Clytia hemispaerica* and *Obelia dichotoma*), the half-crab (*Petrolisthes elongatus*), and the ascidian (*Botrylloided leachi*).

The European shore crab is the only introduced species in the report listed by the Australian Ballast Water Management Advisory Council as a targeted pest species. It is a voracious predator and is capable of colonising a wide variety of habitats, from estuaries and salt marshes through to exposed rocky shores (CRIMP 1998). It predates on gastropods, bivalves, crustaceans, polycheate worms, some marine plants and juvenile fish. The crab has also been shown to be a cause of major mortality in a number of commercially important species, including cockles, mussels, scallops and plaice.

All the other introduced pests listed above are not recognised as having a significant impact on native species except *Botrylloided leachi*. *B. leachi* is a dominant space competitor and can cover large amounts of area. The impacts caused by this species on native encrusting communities are likely to be small and restricted to competition for space (CRIMP 1998).

Exotic marine species are likely to have been introduced to the Furneaux Group by one of three mechanisms (CRIMP 1998):

- Natural range expansion of species introduced to other parts of southern Australia or northern Tasmania.
- Direct introduction to the region by historic shipping using the ports or passing through.
- Domestic translocation from fishing and recreational vessels.

Total eradication of introduced marine pests in the Furneaux Group by physical removal is not a realistic option (CRIMP 1998). To prevent any new introductions into the port area CRIMP recommends that the Flinders Island Port Authority establish a database of all shipping activities within the port. They also recommend that the authority initiate a program of periodic inspections of vessel hulls using the slipway to ascertain the amount of material being brought into the region. Further information regarding these recommendations can be obtained from the CRIMP report.

Further research will help determine the spread of established marine pests in the region and the introduction of any new species. The establishment of a community-monitoring program in the Furneaux Group may also provide invaluable information on the spread of marine pests and provide an early detection mechanism for the introduction of new pests. Such a program may involve Coastcare groups, the Quarantine Officer, FIFA, recreational and professional fishers, and Fishcare groups (if any are established in the Furneaux Group).

The Flinders Island Port Corporation (a subsidiary of Tasports) should also be aware of the potential for the introduction of marine pests (including disease and weeds) in the region through ballast water exchange from certain shipping vessels.

Since 1999 a number of initiatives have been implemented to manage the marine pest issue including:

- The introduction, in 2001, of mandatory ballast water management regulations to reduce the risk of introductions from international vessels through ballast water by the Australian Quarantine and Inspection Service (AQIS);
- The development of National Introduced Marine Pests Coordination Group (NIMP CG) management plans for a number of species including some found in the Tamar; and
- The development of Draft Environmental Management Guidelines for Operational Best Practice at Slipways and other Boat Repair and Maintenance Facilities (DPIWE 2003). These guidelines are currently being updated and will be released for further consultation in 2007 before being finalised.

A considerable amount of information on marine pests can be accessed online on the Marine Pests webpage of the DPIW website (http://www.dpiw.tas.gov.au), the Australian Governments Introduced Marine Pests webpage (http://www.deh.gov.au/coasts/imps/), and CSIRO's Introduced Marine Pests webpage which includes marine pest information sheets (http://www.marine.csiro.au/crimp/).

7.2.2. Estuarine and marine water quality

Potential sources of pollution or activities that may adversely affect coastal, estuarine and marine water quality include:

- Urban effluent and stormwater runoff from Whitemark and Lady Barron;
- Runoff from agricultural areas;
- Septic tank effluent;
- Wharf areas (e.g. refuelling, stock yard effluent);
- Marine debris (i.e. rubbish from commercial, recreational and cruising vessels);

- Wastewater from fish processing factories (mainly from the cleaning of facilities) contains suspended solids, organic matter and nutrients (SoE 1996);

- introduction of marine pests carried in by boats from outside the region (e.g. ballast water, attached to boat's hull etc.).

Runoff from agricultural inputs and activities is further discussed in the chapter on Water.

Septic tank effluent has been known to rise to the surface at a number of points along Franklin Parade (Lady Barron) (<100 m from the coastline) in winter months due to a high water table (Sinclair Knight Merz 1997). This problem not only poses a serious health risk in the area but also the possibility of septic tank effluent to run down to the coastline at Adelaide Bay, thereby reducing coastal water quality. Septic tanks are a valuable on-site system but can fail due to unsuitable site conditions, poor design and construction, and inadequate operation and maintenance. It is estimated that between 40% and 60% of septic tank systems fail, that is they do not function properly (Bayley 1998).

Activities that occur within the wharf area such as refuelling and washing down of stockyard have the potential to pollute surrounding coastal areas. Litter and discharge from commercial and recreation vessels is also another source of marine and coastal pollution.

Marine farming activities also have the potential to adversely impact on water quality and the seabed surrounding the farm. Generally finfish farming has a greater impact upon the environment than shellfish farming due to the addition of organic material in the form of fish feed and excretory products being released into the seabed and surrounding waters. The settling of this organic matter is a greater problem in areas of low current flow and increases the risk of toxic algal blooms and disease outbreak (Marine Resources Division 1998). There is an incentive to eliminate or minimise these risks in order to maintain a quality product.

Priority Areas/Locations

Lady Barron and Whitemark wharf areas

Adelaide Bay

7.2.3. Coastal zone degradation

As the Furneaux Group consists of over 50 islands and many rocky reefs there is a large amount of coastline and associated coastal zone. The coastal zone is a dynamic area where the land meets the sea. Natural processes which affect the coastline (e.g. strong wind, large swells) can cause coastal change and erosion. However human activities can also result in erosion and other adverse impacts on the coastal zone. For example, uncontrolled grazing, some recreational activities (e.g. four wheel driving, access to sensitive beach areas), indiscriminate development (e.g. land clearing and building) can lead to erosion and weed invasion.

The coastal zone of the Furneaux Group is an important recreational area for the local community and tourists. To date the coastal zone is relatively well looked after by users. However, there are certain areas that are degraded due to greater activity and pressures on them. On the east coast there are numerous access tracks to the beach which disturb the habitat/vegetation, destabilising sand structures in the coastal zone allowing sand blows to occur. The right of access to coastal areas should not be denied, however, the number of access points could be reduced to minimise and concentrate any adverse impacts.

Other sites of concentrated use are some of the more popular picnic sites around Flinders Island. Fire wood collection at these sites can be an issue and for this reason wood barbecues are gradually being replaced with gas barbecues.

The Palana sand blow covers an area of 1 – 1.5 km^2 south and east of Palana Beach. The blow covers both unallocated Crown and private land. The sand blow pre-dates European settlement but activities such as firing, grazing and recreational activities along the fore dune have disturbed vegetation and increased the activity of the sand blow (Dixon and Houshold 1996). Dixon and Houshold (1996) believe that the blow will remain relatively stable if the limestone face, the stable berm and native vegetation are left undisturbed (so as not to reactivate the sand movement from the beach area).

Unrestricted grazing, particularly in sensitive areas such as coastal environments, can result in damage to native vegetation, soil compaction and erosion and the spread of weeds. These impacts are discussed in more detail in the chapter on Biodiversity. Since 1999, much work has been undertaken to fence off sensitive coastal areas and thus in many areas damage caused by unrestricted grazing has been greatly reduced.

Priority Areas/Locations

Areas where grazing occurs on coastal zone (including Outer Islands)

Beach access tracks between Patriarch and Cameron Inlet.

Coastal picnic areas

Palana sand blow (access point at western end)

7.2.4. Protecting coastal, estuarine and marine species and habitats

The 1999 FNRMS stated that "there is a great deal of anecdotal evidence suggesting a decline in fish, shellfish and crustacean numbers throughout the region. This concern was further expressed in a community survey on natural resource management issues in the Furneaux Group where over 30% of respondents expressed concern with regards declining stocks in the region (FRS 1999). Unfortunately there is very little research data on population numbers and trends specifically for the Furneaux Group". Discussion of this issue with the Furneaux NRM committee in February 2007 suggested that this issue was of reduced concern due to the decline in the commercial fishing industry in Flinders over the last decade or so. However illegal fishing particularly on the outer islands is still considered as an issue of concern.

Sea fishing activity in the Furneaux Group includes commercial fisheries (wild), recreational fisheries and marine farming. Important fishery species in the Furneaux Group include: abalone, Australian salmon, barracouta, flathead, flounder, garfish, banded morwong, trumpeter, wrasse, warehou, tuna and shark.

The Tasmanian State of the Environment Report (1996) states that the issues of most concern for Tasmania's fisheries include: over fishing, introduced marine pests, wasted by-catch, illegal fishing, damage to the seabed and

habitat from fishing equipment, effects of marine farms on the ecology of an area, and rubbish and debris from fishing activities. All these issues have the potential to impact on fish, crustacean and shellfish numbers in the Furneaux Group.

At least one species targeted by commercial and recreational fishers in Tasmania is considered over fished, five species are fully fished and the status of a further 13 species is unknown (Table 7.2) (RPDC 2003).

Table 7.2 Assessment of top 20 valued commercial fisheries, 1996-00.

Source: State of the Environment Report (RPDC 2003)

Over Fished	Fully Fished	Stocks improving	Unknown
Scallops	Blacklip abalone	Rock lobster	Jack Mackerel
	Greenlip abalone		Australian Salmon
	Giant crab		Garfish
	Banded morwong		Striped trumpeter
	Blue warehou		Octopus
			Wrasse
			Flounder
			Calamari
			Bastard trumpeter
			Arrow Squid
			Flathead
			Whiting
			Barracouta

The long-term future of the State's fisheries is dependent upon the fishing sector adopting sustainable practices (SoE 1996) under the guidance of State and Federal Governments. It is fair to say that a greater degree of research is required into most commercial fisheries to ensure that harvesting is sustainable. Maintaining the health and state of breeding and feeding habitats (e.g. seagrass beds, rocky reefs, estuaries, kelp beds) is also vital to help ensure that fish, shellfish and crustacean populations are sustained into the future. Preventing damage or disturbance to these areas is a much more effective and cheaper method of maintaining population numbers than through restoration or restocking.

The *Tasmanian Marine Protected Areas Strategy* (Marine and Marine Industries Council 2001) aims to "establish and manage a comprehensive, adequate and representative (CAR) system of marine protected areas, to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems, and to protect Tasmania's biological diversity."

Currently there are no Marine Protected Areas within the Furneaux Group. An investigation was conducted between 1992 and 1994 to identify representative marine protected areas within each marine bioregion. This report stated that while inadequate survey work had been conducted within the Flinders bioregion the best location was considered to be at the western entrance of Franklin Sound, from Badger Corner to Trousers Point and

extending 1 km offshore. This area contains the greatest range of habitats, including sand and reef habitats in both shallow and deep water, and extensive *Posidonia australis* and *Amphibolis antartica* seagrass beds (Edgar *et al.* 1995). A high biodiversity was also recorded in this area during earlier surveys and it could be seen as a natural extension of the Strzelecki National Park.

Edgar *et al* (1999) also recommended Marine Protected Areas should be established to protect the two estuaries in the Furneaux considered to be of critical (Class A) conservation significance: North East River and Thirsty Lagoon.

Priority Areas/Locations

Important breeding and feeding habitat surrounding the Furneaux Group (i.e. seagrass communities, rocky reefs and estuaries).

7.3. Management Directions

This section presents Community Aspirational Statements and recommended Resource Condition Targets (RCTs), Management Actions Targets (MATs), and Management Actions for the asset of Coasts, Estuaries and Marine. These targets and actions are focused on the key issues associated with the asset of Coasts, Estuaries and Marine. It is important to recognise that this asset group does not exist in isolation from other natural values in the Furneaux. To successfully manage coasts, estuaries and marine environments, there must also be adequate management of the environment as a whole including the assets of land, water and biodiversity and issues related to people and management. It is therefore important to note that management actions listed below are intended to be read and implemented together with those presented in Chapters 3, 4, 5, and 6.

Community Aspirational Statement for Coasts, Estuaries and Marine

Human activity is managed to maintain and enhance the quality of coasts, estuaries and marine environments for all marine/coastal/estuarine life while retaining public access to these environments for recreational and cultural pursuits and supporting a sustainable fishery industry.

Table 7.3 Targets and Actions for Coasts, Estuaries and Marine

Issue	Resource Condition Targets (RCTs 10-20 years)	#	Management Action Targets (MATs 1-5 years)	#	Management Actions	Key Partners
Estuarine, coastal and marine habitat integrity	<u>CR1:</u> The areal extent, distribution and condition of key coastal, estuarine and marine habitats will be maintained at, or improved above benchmark levels by 2022 (benchmark levels to be determined)	CM1	Key coastal, marine and estuarine assets have been identified and their condition established by 2012	CA1	Littoral and inshore marine habitats are mapped by 2010 (e.g. using SEAMAP)	TAFI/UTAS
				CA2	Baselines are established on areal extent, distribution and condition of significant marine, estuarine and coastal habitat by 2012	TAFI/UTAS, DPIW
				CA3	Identify key coastal, marine and estuarine assets by 2012 and support the process for the establishment of Marine Protected Areas, where appropriate.	TAFI/UTAS, DPIW, RPDC
Marine Pests		CM2	Legislation to prevent the spread of marine pests via ballast water by domestic trading vessels is being implemented by 2012	CA4	Support the development and implementation of legislation to prevent the spread of marine pests via domestic trading vessels	DAFF, DPIW and Industry
				CA5	Promote the adoption of best practice guidelines to all marine sectors (including aquaculture, commercial and recreational fishing, commercial shipping, ports/slipways, non-trading commercial vessels and recreational vessels) to prevent biofouling (guidelines being developed by the NIMPCG)	DPIW, DAFF, NRM North, Industry
		CM3	A measurable increase in the number of operators who have adopted best practice guidelines to prevent biofouling by 2012	CA6	Conduct a program to raise awareness in the general boating and fishing community regarding general marine pest issues and the identification and reporting of target marine pests. The program should include establishing signage at marinas and slipping facilities and the distribution of marine pest information materials in collaboration with DPIW.	DPIW, DAFF, NRM North, Fishcare, Industry
				CA7	Investigate opportunities for marine pest research and control activities	DPIW, NRM North
		CM4	An ongoing marine pest monitoring program is in place by 2012	CA8	Undertake a follow up minor port survey of marine pests by 2009	DPIW
				CA9	Investigate feasibility of establishing a community monitoring program for marine pests by 2010	NRM North, DPIW, Fishcare

Estuarine and marine water quality	CR2: Maintain or improve estuarine and marine water quality at key estuary and inshore monitoring sites above benchmark levels (benchmark levels to be determined)	CM5	Key catchments draining into estuaries and coastal waters have catchment specific water quality targets and monitoring in place consistent with national water quality guidelines by 2010 (link to water MAT)	CA10	Identify key catchments which contribute the most significant loads of nutrients, sediments and other pollutants by 2008	TAFI, NRM North
				CA12	Establish a monitoring program in key catchments and determine water quality objectives consistent with national water quality guidelines (e.g. ANZECC) and protected environmental values by 2010	DTAE, DPIW, NRM North
		CM6	Major diffuse and/or point sources of pollutants entering estuaries and coastal waters are identified by 2008	CA13	Identify major diffuse and point sources of nutrients, turbidity and other pollutants entering estuaries and coastal waters by 2008	DTAE, NRM North, FC
				CA14	Targeting major sources develop and implement a program to reduce the input of nutrients, turbidity and other pollutants by 2010 (link)	NRM North, FC
		CM7	A program(s) is being implemented to reduce the input of pollutants from identified major sources by 2010	CA15	Investigate and implement actions to reduce septic tank and absorption trench failures/seepages in coastal areas, especially Lady Barron Area	FC
				CA16	Educate and raise awareness in the boating community about the pollution caused from boat waste and slipways. Promote the *Draft Environmental Management Guidelines for Operational Best Practice at Slipways and Other Boat Repair and Maintenance Facilities* to the community.	NRM North, FC, DTAE

Chapter 8. IMPLEMENTATION

8.1. Implementation of the Strategy

Successful implementation of the Furneaux NRM Strategy will require the involvement of many stakeholders including private landholders; businesses and agricultural, fishing and tourism industries; local, state and federal governments; and other organisations such as NRM North, research institutions, reference groups etc.

This Strategy has been developed to provide direction and a blueprint for NRM activities in the region but also importantly as a means to leverage investment and support from key stakeholders. It is anticipated that NRM North, together with the Furneaux NRM Facilitator, Flinders Council and the NRM Special Committee of Flinders Council will be key drivers in the implementation of the Strategy. The Key Partners column of each action table identifies stakeholders who will most likely need to be engaged in some way to ensure successful implementation of the action. These partners may provide financial, technical and administrative support, resource sharing, volunteer time or other forms of in-kind support to facilitate successful implementation of the Strategy. The type of contributions made will largely reflect the resources available to different stakeholders and the implementation requirements of particular actions. As part of implementation of the Strategy it is recommended that an annual work plan and implementation schedule be developed which focuses effort on actions of highest priority.

8.1.1. Developing Management Priorities

It is recommended that, in line with action MM1, the actions contained in this Strategy are prioritised to provide further direction for implementation.. Selection of a Multiple Assessment Criteria (MCA) analysis may be the most effective means to rank and prioritise each of the actions. This would involve consideration of multiple criteria which may include: contribution to improvement in the condition of the asset; value for money; the level of community and stakeholder support; time criticalness; the level of complexity

involved in implementing the action; and contribution to social, cultural or economic values. Prioritisation is commonly undertaken in a workshop setting with participants who collectively have the technical expertise and local knowledge required to adequately assess each criterion. MCA has been recognised as an effective tool for performing a qualitative assessment when there is more than one attribute to assess and when the costs for the various parameters are not available in dollar figures.

8.1.2. Monitoring and Evaluation

The complexity of natural systems and the inherent uncertainty associated with their management means that monitoring and evaluation is an essential part of all natural resource management.

Throughout the life of the FNRMS 2007 it is critical that ongoing monitoring and evaluation takes place to enable the assessment of: 1) the progress towards implementation of the Strategy (i.e. implementation of the actions); 2) the effectiveness of the actions in achieving MATs and RCTs; and 3) the need to modify management. To undertake such an assessment it will be necessary to develop indicators to measure progress towards achieving MATs and RCTs.

Considerable gaps exist in the information required to establish baseline condition of, and trends in, the natural resources of the Furneaux Group. Therefore many of the actions contained in this Strategy recommend that baseline surveys are undertaken or ongoing monitoring programs are established. Without the implementation of such actions it will be difficult to accurately assess the progress of the Strategy towards achieving improvements in resource condition. Such information is also necessary to inform an adaptive management approach in which management aims to learn from the implementation of policies and strategies and then use the new knowledge to inform decision-making processes and improve management. In addition, effective monitoring and evaluation is necessary, and increasingly being required, to be accountable to investors including the Australian and Tasmanian governments.

In line with national NRM frameworks, this Strategy includes measurable targets that can be used to assess the Strategies progress and effectiveness over time. Each target in the Strategy should be assigned a corresponding

indicator. Generally these indicators should be consistent with those recommended by the national Monitoring and Evaluation Working Group (MEWG) which has developed indicators specifically to measure the performance of investments in NRM activities funded through programs such as NHT and NAP. These indicators have been developed in consultation with relevant experts and jurisdictions and are continually being updated. Currently indicators developed by MEWG are not comprehensive and further consultation will be required to select additional indicators required for the measurement of all the targets in this Strategy.

This Strategy should not be viewed as a static document and the results of ongoing monitoring and evaluation should be used, as part of an adaptive management approach, to further develop and improve its effectiveness. The Strategy has been designed for a lifespan of approximately five years and it is recommended that the Strategy undergoes a formal and comprehensive review every five years. Table 8.1 outlines recommended MATs and management actions for monitoring and evaluation.

Table 8.1 Targets and Actions for Monitoring and Evaluation

Issue	#	MAT (Management Action Targets 1-5 years)	#	Management Actions	Key Partners
Monitoring and Evaluation	MM1	Actions contained in this Strategy are prioritised by 2008	MA1	Prioritise actions contained in this Strategy	NRM North, FC, Community
	MM2	A review of this Strategy has begun by 2012	MA2	Review the Furneaux NRM Strategy on a five yearly basis	NRM North, Community
	MM3	Where data is available baselines have been established for indicators of asset condition by 2009.	MA3	Undertake a study to review/audit all information on the condition of natural values in the Furneaux. Where possible establish baselines for indicators of asset condition and identify gaps where information for key indicators is not available.	NRM North, DPIW, DTAE

References

Armstrong, D. and Drury, N., 1997. *Hydrogeological Survey: Farm Business and Water Audit*, prepared for Flinders Island Irrigation Group.

Australian Nature Conservation Agency (ANCA), 1996. *A Directory of Important Wetlands in Australia* (second edition), ANCA, Canberra.

Australian Bureau of Statistics (ABS), 1997. *Basic Community Profile: Flinders (M) (LGA)*, 1996 Census of Population and Housing, ABS, Commonwealth of Australia.

ABS (2001). *2001 Census Data by Location: Flinders (M) (Local Governement Area*, Australian Bureau of Statistics. Accessed: March 2007 Address: http://www.abs.gov.au/websitedbs/d3310114.nsf/Home/census

Australian Water Resources Council, 1983. *Land Capacity for Septic Tank Effluent Absorption, Field Technical Paper No. 80, Research Project No. 78/118*, Department of Primary Industries and Energy, Australian Government Publishing Service, Canberra.

Banks, A.J., 1999. Regional Natural Resource Management in Tasmania: A Framework for Developing Strategies and Setting Priorities, DPIWE, Hobart.

Baker 1986. The Biology and Control of White Snails (Mollusca: Helicidae), Introduced Pests in Australia, Division of Entomology Technical Paper No. 25, CSIRO.

Barker, P.C.J., 1994. '*Phytophthora cinnamomi*: The susceptibility and management of selected Tasmanian rare species', Forestry Tasmania and Australian Nature Conservation Agency.

Bastick, C. and J. Walker (2000). *Extent and impact of dryland salinity in Tasmania.* Department of Primary Industry, Water and Environment, Hobart.

Bayely, S. (1999). *Furneaux Natural Resource Management Strategy.* A project funded by the Natural Heritage Trust., Flinders Island.

Bayley, S. (2002). *Land Capability Survey Flinders Island.* Furneaux NRM, Whitemark.

Bayley, S., 1998. *The Use of Constructed Wetlands as an Alternative Form of On-site Wastewater Treatment in a Temperate Climate*, Masters Thesis, Department of Geography and Environmental Studies, University of Tasmania.

Bayly, I.A.E., 1996. 'Inlandwater Calanoid Copepods of Kangaroo, King and Flinders Islands: Biogeography and Ecology', *Transaction of the Royal Society of South Australia*, 120(1), pp. 1-6.

Bureau of Meteorology, 1999. Climatological data for Furneaux Group.

Bureau of Rural Sciences (2003). *Land Use in Tasmania*

Cassidy, M. (ed.), 1996. *Waterwatch Tasmania: Field Handbook*, DPIWE, Tasmania.

Dell, M. (2000). *Hydrogeological setting of areas subject to soil salinity in Tasmania.* Tasmanian Geological Survey Record 2000/05. Mineral Resources Tasmania, Hobart.

Department of Environment, Sport and Territories, 1996. *The National Strategy for the Conservation of Australia's Biological Diversity*, Commonwealth Department of Environment, Sport and Territories, Canberra.

Department of Health and Human Services (DHSS), 1999. Annual Report on the Quality of Tasmania's Drinking Water: Director of Public Health (30th June 1997 – 30th June 1998), DHSS, Tasmania.

Department of Premier and Cabinet (2004). *Land Management Audit: Crown Land parcels on Cape Barren Island, Clark Island and Goose Island, Furneaux Group, Tasmania.* A report to the Aboriginal Land Council of Tasmania, Launceston.

Department of Primary Industries and Water (2006). *Natural Values Atlas (formerly GTSpot).* Hobart. Accessed: August - December 2006 Address: https://www.naturalvaluesatlas.dpiw.tas.gov.au/pls/htmldb/f?p=400

Department of Primary Industries and Water (2007a). *Cape Barren Goose.* Hobart. Accessed: March 2007

Department of Primary Industries and Water (2007b). *Closure of Abalone Fishery in Northern Bass Strait Islands.* Tasmania. Accessed: March 2007 Address: http://www.dpiw.tas.gov.au/inter.nsf/WebPages/SCAN-6SQ2XE?open

Department of Primary Industries and Water (2007). *LISTmap version 1.0.* Hobart, Department of Primary Industries and Water. Accessed: February 2007

Department of Primary Industries, Water and Environment (DPIWE), 1994. *Quarry Code of Practice,* Division of Environmental Management, Tasmania.

Department of Primary Industries, Water and Environment (DPIWE), 1999. Data from water quality database.

Department of Primary Industries Victoria (2007). *Abalone Disease.* Accessed: March 2007 Address: http://www.dpi.vic.gov.au/dpi/nrenfaq.nsf/LinkView/C5360C2028FA31E2CA2572330021C4BED45F5C300E5D2ED54A2567D700236463

Director of Public Health (2005). *Annual Report Drinking Water Quality Tasmania 1 July 2004 - 30 June 2005.* Department of Health and Human Services, Tasmania.

Department of Tourism, Sport and Recreation, 1989. *The Furneaux Islands, A Tourism Study,* Research and Development Division, Department of Tourism, Sport and Recreation, Tasmania.

Dimmock, G.M., 1957. *Soils of Flinders Island, Tasmania,* Soil and Land Use Series no.23, Division of Soils CSIRO, Melbourne.

Dixon, G., 1996. *A reconnaissance inventory of sites of geoconservation significance on Tasmanian islands,* A report for the Parks and Wildlife Service (Tasmania) and Australian Heritage Commission, Department of Environment and Land Management, Hobart.

Dixon, G., and Houshold I., 1996. Internal Memo regarding Palana Sand Blow, Earth Sciences Section, Dept. PIWE, Tasmania.

Duncan, A. (2002). *Furneaux Region Weed Strategy.* Furneaux Natural Resource Management

Dunn (2005). *Assessing the Condition and Status of Tasmania's Wetlands and Riparian Vegetation: Summary of Processes and Outcomes of a Component of the National Land and Water Audit.* Nature Conservation Branch Technical Report 02/09, Department of Primary Industries, Water and Environment, Tasmania.

East Gippsland Regional Catchment and Land Protection Board (RC&PLB), 1997. *East Gippsland Regional Catchment Strategy,* East Gippsland RC&PLB, Vic.

Edgar G.J., Moverley J., Peters D. and Reed C., 1995. Regional Classification of Tasmanian Coastal Waters and Preliminary Identification of Representative Marine Protected Area Sites, Ocean Rescue 2000 Project D705, Parks and Wildlife Service, Tasmania.

Edgar G.J., Moverley J., Barrett N.S., Peters D. and Reed C., 1997. 'The Conservation-Related Benefits of a Systematic Marine Biological Sampling Programme: The Tasmanian Reef Bioregionalisation as a Case Study', *Biological Conservation,* Issue 79, pp. 227-40.

Edgar, G.J., Barrett N.S., and Graddon D.J, 1998. A Classification of Tasmanian Estuaries and Assessment of their Conservation Significance: and Analysis using Ecological and Physical Attributes, Population and Land Use. A Report to Environment Australia from Parks and Wildlife Service DELM (now DPIWE) as part of the Ocean Rescue 2000 Program.

Edgecombe, J., 1986. *Flinders Island and Eastern Bass Strait,* J.M Edgecombe, Sydney.

Finnigan, J. and R. Poulton (2005). *Trees and shrubs for salinity management in Tasmania.* Australian Forest Growers and PURSL, Launceston.

Flinders Council, 1998. *Water Quality Report,* Council Report, unpublished.

Flinders Council, Flinders Island Aboriginal Association and Flinders Island Lodge, 1998. 'Waste and Stormwater Wetland Treatment System, Lady Barron', Coastcare application.

FNRMS Project (2003). *Review of Furneaux NRM Strategy Key Issues and Actions.* Furneaux NRM Startegy Project, Whitemark.

Furneaux Drainage Trust Advisory Committee, 1996. Correspondence to DPIF regarding investigation local ownership options of Furneaux Drainage Trust.

Furneaux Regional Strategy (FRS), 1999. 'Furneaux Regional Strategy Survey Results', summary report of community survey on natural resource management issues in the Furneaux Group as part of the Furneaux Natural Resource Management Strategy process.

Gallagher, S., 1998. Coal River Catchment Management Strategy

Giblin M., 1996. *Furneaux Drainage Area: Options for Local Ownership.* Report to the Furneaux Drainage Trust Advisory Committee, Catchment Development Branch, Department Primary Industries and Fisheries (now DPIWE).

Giblin M., 1998. A Discussion Paper- Integrated Catchment Management Plan for Cameron Inlet on the East Coast of Flinders Island (second draft), Department of Primary Industries, Water and Environment, Tasmania.

Gould R., 1991. *Feral Cat Control on Great Dog Island*, internal report, [then] Dept. of Primary Industry, Tasmania.

Gouldthorpe, J. and L. Gilfedder (2002). *Bioregional Summaries of the Biodiversity Component of the National Land and Water Resources Audit.* Nature Conservation Branch Technical Report 02/07, Department of Primary Industries, Water and Environment, Hobart, Tasmania.

Greer, A. L. (2006). *Encyclopedia of Australian Reptiles*, Australian Museum Online. Accessed: Version date: 7 August 2006 Address: http://www.amonline.net.au/herpetology/research/encyclopedia.pdf .

Grose, C. (Senior Land Resource Assessment Officer, DPIWE), 1998. Correspondence regarding Land Capability and Agricultural Potential for the Furneaux Group.

Gurung, S. (2001). *Tasmanian Acid Drainage Reconnaissance: Distribution of Acid Sulphate Soils in Tasmania.* Mineral Resources Tasmania, Department of Infrastructure, Energy and Resources, Hobart.

Hamlett, A. (2002). *Soil Management - A Guide for Tasmanian Farmers.,*. Departmentof Primary Industries, Water and Environment, Launceston, Tasmania.

Harris, S., A. Buchanan and A. Connolly (2001). *One hundred islands: the flora of the outer Furneaux.* Department of Primary Industries, Water and Environment, Tasmania.

Harris, S., 1988. *A Catalogue of Some Cultural Relics in the Outer Furneaux Islands,* a report to the Director- Australian National Parks and Wildlife Service.

Harris S. and Reimer A., 1994. *Flora and Fauna of Clarke Island, Furneaux Group,* Parks and Wildlife Service, Tasmania.

Hocking G.J., 1997. Harvest Quotas for Bennetts Wallaby and the Tasmanian Pademelon on Flinders Island, Tasmania, Parks and Wildlife Service, Tasmania.

Hunter, J., W. Hennecke, R. Coleman and C. Sharples (2004). *Tasmanian Shoreline Monitoring and Archiving Project (TASMARC),* CRC for Antarctic Climate and Ecosystems and University of Tasmania. Accessed: 2006 Address: http://www.acecrc.org.au/uploaded/117/797286_52tasmarc.pdf

Jordan A.R., Mills D.M., Ewing G. and Lyle J.M., 1998. *Assessment of Inshore Habitats Around Tasmania for Life-History Stages of Commercial Finfish Species.* FRDC Project No. 94/037, Marine Research Laboratories, Tasmanian Aquaculture and Fisheries Institute, University of Tasmania.

Kied, H., 1949. *Underground Water Supplies on Flinders and Cape Barren Islands,* Unpublished Report Department of Mines Tasmania (now Mineral Resources Tasmania), pp. 55-73.

Ladd, P.G., Orchiston, D.W. and Joyce, E.B., 1992. 'Holocene vegetation history of Flinders Island,' *New Phytologist,* **122**, pp. 757-67.

Latinovic, M., W. L. Matthews, C. Bastick, S. Lynch, P. Dyson and E. Humphries (2003). *Tasmanian Groundwater Flow Systems for Dryland Salinity Planning.* Mineral Resources Tasmania, Tasmania.

Lyle, J.M. and Jordan, A.R., 1999. *Fishery Assessment Report: Tasmanian Scalefish Fishery Assessment – 1998*, Tasmanian Aquaculture and Fisheries Institute, University of Tasmania.

Lynch, S. (2005). *Modelled Land Capability Classes of Tasmania, Lady Barron 1:100,000 map.*, Department of Primary Industries Water and Environment, Tasmania.

Marine and Marine Industries Council (2001). *Tasmanian Marine Protected Areas Strategy*. Department of Primary Industries, Water and Environment, Tasmania.

Marine Environment Section (2004). *Tasmanian Marine Farming Environmental Monitoring Report 1997-2002*. Department of Primary Industries, Water and Environment, Hobart, Tasmania.

Marine Resources Division, 1998. *Draft Marine Farming Development Plan: Furneaux Islands*, Department of Primary Industries, Water and Environment, Tasmania.

Matthews, W.L., 1975. *Groundwater Investigations, Flinders Island*, Technical Report Department of Mines Tasmania (now Mineral Resources Tasmania), 20, pp. 252-82.

Matthews, W.L., 1978. *Groundwater at Lady Barron*, Department of Mines Tasmania (now Mineral Resources Tasmania), 8, pp. 8.1-8.15.

Mineral Resources Tasmania (2007). *Groundwater Database*. Tasmania, Department of Infrastructure, Energy and Resources. Accessed: March 2007

Mooney N., 1996. Internal report on estimated effects on waterfowl of draining Cameron Inlet.

Noble, K., 1992. *Land Capability Survey of Tasmania: Land Capability Handbook*, Department of Primary Industries, Tasmania.

North East Regional Catchment and Land Protection Board, 1997. *North East Regional Catchment Strategy*, North East Regional Catchment and Land Protection Board, Victoria.

Northern Water Monitoring Program (2005a). *State fo the Region: Water quality and stream condition in Northern Tasmania.* NRM North and Launceston Environment Centre

Northern Water Monitoring Program (2005b). *State of the Region: Water quality and stream condition in Northern Tasmania.* NRM North Water Monitoring Team and Launceston Environment Centre.

NRM Special Committee of Flinders Council (2006). *Priorities Table.* Attachment to minutes of NRM Special Committee Committee Meeting 1 May 2006., Whitemark.

NRMMC (2004). *National Biodiversity and Climate Change Action Plan.* Natural Reource Management Ministerial Council, Department of the Environmnet and Heritage, Australian Governement., Canberra.

Obendorf, D. L. (2005). *Application of field and diagnostic methods for chytridiomycosis in Tasmanian frogs.*, Central North Field Naturalists Inc., Tasmania.

Officer R., 1999. *Tasmanian Abalone Fishery 1997/1998,* Tasmanian Aquaculture and Fisheries Institute, University of Tasmania,

Parks and Wildlife Service, 1998a. *Draft Policy for Sustainable Management of the Furneaux Outer Islands,* Parks and Wildlife Service, Tasmania.

Parks and Wildlife Service, 1998b. *A Plan to Harvest Cape Barren Goose Eggs in the Furneaux Group,* Parks and Wildlife Service, Tasmania.

Pinkard, G.J. and Richley, L.R., 1982. *Land Systems of Tasmania: Region 2,* Department of Agriculture, Tasmania.

Podger, F.D., Palzer, C., and Wardlaw, T.J., 1990. 'A Guide to the Tasmanian Distribution of *Phytophthora cinnamomi* and its effects on native vegetation', *Tasforests,* 2, pp13-20.

Resource Development and Planning Commission (RPDC), 1999. *Inquiry into unallocated Crown land on Flinders Island, Tasmania: Background Report,* Resource Development and Planning Commission, Tasmania.

Resource Planning and Development Commission (2003). *State of the Environment Tasmania 2003.* State of the Environment Unit, Resource Planning and Development Commission, Tasmania.

RWSC (2006). *Forty Eight Annual Report for the Year 2005-2006.* Rivers and Water Supply Commission, Tasmania.

Schahinger, R., T. Rudman and T. Wardlaw (2003). *Conservation of Tasmanian Plant Species and Communities Threatened by Phytophthora cinnamomi: Strategic Regional Plan for Tasmania.* Nature Conservation Branch Technical Report 03/03, Department of Primary Industries, Water and Environment, Tasmania.

Searle, D. (2005). *Northern Tasmanian Water Quality Monitoring Surface Water Salinity Audit Flinders Island and Cape Barren Island.* Report to Furneaux NRM.

Senate Rural and Regional Affairs and Transport References Committee, 1998. *The Incidence of Ovine Johne's Disease in the Australian Sheep Flock*, Senate Printing Unit, Parliament House, Canberra.

Sharples, C. (2006). *Indicative Mapping of Tasmanian Coastal Vulnerbaility to Climate Change and Sea-level Rise: Explanatory Report, 2nd Edition.* Consultant report to Department of Primary Industries and Water, Hobart.

Sinclair Knight Merz, 1997. *Lady Barron Sewerage Strategy Plan*, Sinclair Knight Merz, Hobart.

Sustainable Development Advisory Council, 1996. *State of the Environment Report Tasmania, Volume 1 – Conditions and Trends*, compiled by the State of the Environment Unit, Land Information Systems, Department of Environment and Land Management, Tasmania.

Statham M. and Middleton M., 1987. "Feral Pigs on Flinders Island", *Papers and Proceedings of the Royal Society of Tasmania*, Volume 121.

Tasmanian Fire Service (TFS), 1995. *TFS Fire Management Planning Method: Instructions*, TFS document.

Tasmanian Vegetation Management Strategy, 1998. *Vegetation Management Strategy for Tasmania: Guidelines for determining Bushcare priorities*, prepared by Environment Australia and Department of Primary Industries, Water and Environment, December version.

Tasmanian Vegetation Management Strategy, 1999. *Draft Vegetation Mapping Units for* ***TASVEG2000****: Abridged Version for Flinders Island*, compiled

with expert input, Department of Primary Industries, Water and Environment, Hobart, November 1999.

Tourism Tasmania (2001). *Flinders Island 2000 Travel Survey.* Industry and Market Research, Tourism Tasmania.

Tourism Techniques and Rob Tonge & Associates, 1994. *Flinders Island Tourism Study and Marketing Plan,* Tourism Tasmania.

TWMS Working Group, 1996.WeedPlan: A Tasmanian Weed Management Strategy, DPIWE, Tasmania.

Tyler, P., 1999. *An Appraisal of Natural Heritage Values of Freshwater Lagoons of Bass Strait Islands- Draft,* a National Estate Grant Project (project NEGP 9111), School of Ecology & Environment, Deakin University, PO Box 432 Warrnambool, Victoria 3280.

Underwood, S., 1998. *Synecology and Conservation of Vegetation on Aeolian Calcarenite, Flinders Island, Bass Strait,* BSc Hons. thesis, Department of Geography and Environmental Studies, University of Tasmania.

Underwood. S., 1999. *The Vegetation of Unallocated Crown Land, Flinders Island, Bass Strait,* unpublished report commissioned by the Resource Planning and Development Commission to aid their inquiry into unallocated Crown Land on Flinders Island.

Whinray, J., 1999a. "Dune Snails", *Island News,* 5th March.

Whinray, J., 1999b. A Survey of Rare and Endangered Plants in the Eastern Straits, unpublished report.

Personal Communications:

Connors, L., General Manager, Flinders Council. 1999

Cox, R. Furneaux NRM Facilitator, 2007.

Harris, S., Senior Botanist, Parks and Wildlife Service, DPIWE. 1999

Jordan, A., Research Scientist, Tasmanian Aquaculture and Fisheries Institute. 1999

Rudman, T. Protection Officer (Flora), Biodiversity Conservation Branch, DPIW. 2007.

Whinray, J., Local naturalist, Flinders Island. 1999

Appendices

Appendix A – Geoconservation Sites

Table A.1. Geoconservation Sites in the Furneaux Group listed in the Tasmanian Geoconservation Database.

Source: Natural Values Atlas (DPIW 2007) with management notes from Dixon 1996. There are also restricted sites within the Furneaux Group which are not included in the table. Details of these sites can be obtained from the Earth Science Section of DPIW. Each site is given a sensitivity score ranging from 2, most sensitive to least sensitive 9.

Code	Name	Significance	Sensitivity	Management Notes (Dixon 1996)
FLI01	Badger Island Granodiorite - Mathinna Group Contacts	Regional	9	Robust
FLI02	Badger Island Limestone Pavement	Tasmania	5	Could be damaged by human and stock traffic.
FLI55	Big Reedy Lagoon Lunette	Tasmania	4	Intensive firing of the area will destroy vegetation cover and promote instability and erosion.
FLI50	Cameron Inlet Offshore Fossil Locality	Australia	3	Outstanding for Australia.
FLI58	Cameron Inlet Pleistocene Coastline	Regional	8	While currently little disturbance the area is very sensitive to disturbance. Intensive firing may destabilise.
FLI04	Cameron Inlet Spit	Local	6	Relatively robust, however, periodic breaking out of lagoon is undertaken and 4WD use may degrade the site.
FLI60	Cape Barren Dunes	Local	5	Sensitive sand feature and intensive firing may destabilise old dunes and/or promote further activity in young sands.
FLI59	Cape Barren Tufa	Local	4	Significant disturbance to sands (which provide carbonate source) and local hydrology will degrade feature, however seems unlikely under current uses.
FLI05	Cape Frankland Tourmaline Nodules	Tasmania	3	Souveniring of nodules.
FLI56	Castle Rock Granite Tor	Local	7	Robust
FLI06	Cave Beach Karren and Caves	Tasmania	2	Surface features are rea.dily broken as the rock is soft and fragile. Grafitti present.
FLI49	Cave Beach Palaeosol and Hardpan	Regional	5	Surface features are readily broken as the rock is soft and fragile.
FLI65	Centre Creek Lowland Fluvial System	Tasmania	4	

FLI61	Crows Beach lagoons	Local	6	
FLI16	Deep Bight Raised Intertidal Notch	Local	5	
FLI46	Egg Beach Boulder Beach	Local	3	Many 'eggs' have already been removed, reducing the range of sizes in the area.
FLI51	Emita Dolines	Local	7	Some depressions have become rubbish dumps and these may cause pollution to underground drainage channels
FLI25	Fergusons Creek Pleistocene Limestone Dunes	Local	6	Particular exposures may be obscured or degraded by agricultural or other activity (e.g. road maintenance)
FLI44	Foochow Beach Parallel Dune System	Tasmania	6	Whilst a very large feature it is very sensitive to degradation from land clearance, 4WD, firing and track construction
SWA09	Forsyth Island Stabilised Longitudinal Dunes	Local	6	
FLI09	Fotheringate Bay Coastal Karst	Tasmania	2	Surface features are readily broken as the rock is soft and fragile and trampling is a concern.
FLI10	Goose Island Granitic Coastal Geomorphology	Local	8	Robust.
FLI62	Harleys Point Whale Bones	Unknown	3	
FLI11	Hogan Lagoon Lunette - Beach Ridge Relationship	Local	4	Vulnerable
FLI12	Holts Point Hybrid Zone	Tasmania	7	Robust.
FLI13	Key Island Bay Phenocryst Accumulations	Local	7	Robust.
FLI14	Killiecrankie Topaz ("Diamond") Locality	Tasmania	3	A designate fossicking area, nevertheless unrestricted collecting is unwise.
FLI15	Lascars Point Tertiary Basalt	Local	8	Robust
FLI07	Little Creek Pleistocene(?) Shoreline	Local	8	Robust
FLI17	Logan Lagoon Holocene Shorelines	Local	6	Sandforms are inherently fragile. Local degradation caused by 4WD use, or by erosion promoted by fire.
FLI18	Long Beach Granitic Dykes and Synplutonic Contact	Tasmania	7	Robust
FLI19	Long Island Mafic Dykes	Local	7	Robust
FLI57	Long Point Tied Island and Intertidal Wetland	Local	4	Disturbance or pollution of local drainage may degrade biological (at least) aspects of wetland, ultimately effecting other aspects.
FLI54	Long Point Weathering Pits	Local	5	Robust
FLI53	Mount Killiecrankie Cliff	Local	8	Robust

FLI21	Mount Killiecrankie Granite Pluton	Regional	7	Robust
FLI22	Mt Boyes Dune-dammed Streams	Local	5	Vulnerable
FLI45	Narrung Pleistocene Beach Deposits	Local	5	Vulnerable
FLI23	Nelson Lagoon Lunette	Local	7	Generally still well vegetated and is crossed by only 2 roads, however its an inherently sensitive landform.
FLI24	North East River Late Pleistocene Sedimentary Section	Regional	5	Natural sand slumping is obscuring part of section and trampling of slope has the potential to cause or accelerate degradation.
FLI47	North East River Spit	Local	6	
FLI26	Palana Sand Blow and Subfossil Site	Regional	4	Vegetated foredune (several small blowout runnels are developing) and limestone outcrops are causing starving of blowout, with progressive stabilisation occuring at western end. Marram grass infests some areas.
FLI27	Petrifaction Bay Basalt and Silcrete Locality	Local	3	Vulnerable
FLI28	Petticoat Ridge Granite Joint-controlled Caves	Local	7	Robust
FLI08	Planter Beach Coastal Barrier System	Tasmania	5	Land clearance, firing, 4WD use and track construction may all degrade the site.
FLI64	Preservation Island Dunefields	Regional	5	
FLI30	Ranga Cave Fossil Site	Regional	3	Vulnerable
FLI32	Rooks River Secondary Cassiterite Deposits	Local	7	Vulnerable
FLI33	Samphire River "Oil" and Lagoonal Peat Locality	Regional	4	Vulnerable and site has been burnt.
SWA14	Sandy Lagoon Palaeosol	Local	4	
FLI34	Sellars Point Cuspate Foreland (and Sunmarine Tombolo)	Tasmania	6	Vulnerable
FLI35	Settlement Point Synplutonic Intrusive Zone	Regional	7	Robust
SWA10	South Head Contact Migmatite	Tasmania	8	
SWA15	Southwest Clarke Island Granite Tors	Local	7	
SWA11	Spike Bay Rhizomorphs	Local	2	
FLI36	Stackeys Bight Arches	Tasmania	2	Vulnerable
FLI37	Strzelecki Peaks - Razorback Granite Geomorphology	Local	7	Robust
FLI52	The Dock Pocket Beaches	Local	8	Robust
FLI38	The Patriarchs Residual Granite Hills	Regional	8	Robust
FLI31	Thule Road Laterite	Regional	6	Vulnerable
FLI39	Thunder and Lightning Bay Tufa and Springs	Local	4	Vulnerable
FLI63	Tin Kettle Island Longitudinal Dunes	Local	5	Sand landforms are inherently sensitive to disturbance. Excavation or instability may threaten feature.
SWA13	Turtle Creek Granite Contacts	Local	8	
FLI40	Vansittart Shoal - Pot Boil Tidal	Tasmania	10	Robust

	Delta			
FLI41	West Patriarch Swamp Palynological Site	Regional	6	Potentially vulnerable to excavation etc.
FLI42	Wingaroo Lagoonal Peats	Tasmania	4	Vulnerable
FLI43	Wingaroo Parabolic Dunes	Local	4	Inherently sensitive, especially by intensive burning.

Appendix B - Vegetation Communities

Table B1 TASVEG communities mapped in the Furneaux Group (TASVEG 1.1).

TASVEG Code	Area (hectares)	% of total area	Vegetation Community Title	Vegetation Group
AHF	858	0.4	Fresh water aquatic herbland	Saltmarsh and Wetland
AHL	529	0.3	lacustrine herbland	
AHS	1533	0.8	saline aquatic herbland	
ARS	423	0.2	Saline grassland	
ASF	2186	1.1	Fresh water aquatic sedgeland and rushland	
ASS	114	0.1	Succulent saline herbland	
AUS	27	0.0	Saltmarsh (undifferentiated)	
AWU	641	0.3	wetland (undifferentiated)	
DGL	122	0.1	Eucalyptus globulus dry forest and woodland	Dry Eucalypt Forest and Woodland
DNF	9676	5.0	Eucalyptus nitida Furneaux forest	
DOV	13	0.0	Eucalyptus ovata forest and woodland	
DOW	302	0.2	Eucalyptus ovata heathy woodland	
DVC	1398	0.7	Eucalyptus viminalis - Eucalyptus globulus coastal forest and woodland	
DVF	954	0.5	Eucalyptus viminalis Furneaux forest and woodland	
DVS	93	0.0	Eucalyptus viminalis shrubby/heathy woodland	
FAG	46522	24.1	Agricultural land	Agricultural, Urban and Exotic Vegetation
FPF	395	0.2	Pteridium esculentum fernland	
FPL	444	0.2	Plantations for silviculture	
FRG	2702	1.4	Regenerating cleared land	
FUM	130	0.1	Extra-urban miscellaneous	
FUR	148	0.1	Urban areas	
FWU	880	0.5	Weed infestation	
GHC	5564	2.9	Coastal grass and herbfield	Native Grassland
GPH	0	0.0	Highland Poa grassland	
GPL	186	0.1	Lowland Poa labillardierei grassland	
MDS	89	0.0	Subalpine Diplarrena latifolia rushland	Moorland, Sedgeland, Rushland and Peatland
MRR	2	0.0	Restionaceae rushland	

NAD	8	0.0	Acacia dealbata forest	Non-Eucalypt Forest and Woodland
NAF	2	0.0	Acacia melanoxylon swamp forest	
NAL	424	0.2	Allocasuarina littoralis forest	
NAV	11188	5.8	Allocasuarina verticillata forest	
NBA	438	0.2	Bursaria - Acacia woodland and scrub	
NBS	11	0.0	Banksia serrata woodland	
NCR	163	0.1	Callitris rhomboidea forest	
NME	1539	0.8	Melaleuca ericifolia swamp forest	
ORO	2612	1.4	Lichen lithosere (Rock)	Other Natural Environments
OSM	957	0.5	Sand, mud	
RMS	6	0.0	Nothofagus / Phyllocladus short rainforest	Rainforest and Related Scrub
SAC	1118	0.6	Acacia longifolia coastal scrub	Scrub, Heathland and Coastal Complexes
SBR	498	0.3	Broadleaf scrub	
SCA	2058	1.1	Coastal scrub on alkaline sands	
SCH	2204	1.1	Coastal heathland	
SCW	1662	0.9	Heathland scrub complex at Wingaroo	
SDU	42886	22.2	Dry scrub	
SHC	365	0.2	Heathland on calcarenite	
SHF	211	0.1	Heathland scrub mosaic on Flinders Island	
SHG	12836	6.6	Heathland on granite	
SHL	30536	15.8	Lowland sedgy heathland	
SHS	2	0.0	Subalpine heathland	
SHW	485	0.3	Wet heathland	
SLW	178	0.1	Leptospermum scrub	
SMR	1377	0.7	Melaleuca squarrosa scrub	
SRC	30	0.0	Seabird rookery complex	
SRI	51	0.0	Riparian scrub	
SSC	3575	1.8	Coastal Scrub	

Appendix C – Threatened Flora and Fauna

Tale C.1 – Threatened Flora Species in the Furneaux Group

Source: Natural Values Atlas (DPIW 2006).

Group	Scientific Name	Common Name	TTSPA 1995	EPBC 1999
Gymnospermae				
CUPRESSACEAE	*Callitris oblonga subsp. oblonga*	south esk pine	Vulnerable	Endangered
Dicotyledon				
APIACEAE	*Hydrocotyle comocarpa*	fringe-fruit pennywort	Rare	
ASTERACEAE	*Bedfordia arborescens*	blanket leaf	Rare	
	Calocephalus lacteus	milky beauty heads	Rare	
	Chrysocephalum baxteri	fringed everlasting	Rare	
	Cotula vulgaris var. australasica	slender cotula	Rare	
	Senecio squarrosus	leafy groundsel	Rare	
	Senecio velleioides	forest groundsel	Rare	
	Taraxacum cygnorum	coast dandelion	Rare	Vulnerable
	Bedfordia arborescens	blanket leaf	Rare	
BIGNONIACEAE	*Pandorea pandorana*	wonga vine	Rare	
BORAGINACEAE	*Cynoglossum australe*	australian hound's tongue	Rare	
BRASSICACEAE	*Geococcus pusillus*	earth cress	Rare	
	Lepidium hyssopifolium	basalt peppercress	Endangered	Endangered
	Lepidium pseudotasmanicum	shade peppercress	Rare	
CAMPANULACEAE	*Lobelia pratioides*	poison lobelia	Vulnerable	
CARYOPHYLLACEAE	*Stellaria multiflora*	rayless starwort	Rare	
CHENOPODIACEAE	*Atriplex suberecta*	sprawling saltbush	Vulnerable	
CONVOLVULACEAE	*Calystegia soldanella*	sea bindweed	Rare	
	Wilsonia rotundifolia	roundleaf wilsonia	Rare	
CRASSULACEAE	*Crassula moschata*	musky crassula	Rare	
CUCURBITACEAE	*Sicyos australis*	star cucumber	Rare	
DILLENIACEAE	*Hibbertia obtusifolia*	hoary guinea flower	Endangered	
DROSERACEAE	*Drosera glanduligera*	scarlet sundew	Rare	
ELAEOCARPACEAE	*Elaeocarpus reticulatus*	blueberry ash	Rare	
EPACRIDACEAE	*Acrotriche cordata*	coast ground berry	Vulnerable	
	Brachyloma depressum	spreading brachyloma	Rare	
	Leucopogon esquamatus	swamp beard heath	Rare	
FABACEAE	*Eutaxia microphylla*	common eutaxia	Rare	
	Gompholobium ecostatum	dwarf wedge pea	Endangered	
	Hovea montana	mountain hovea	Rare	
	Lotus australis	austral trefoil	Rare	
	Pultenaea prostrata	prostrate bush pea	Vulnerable	
FRANKENIACEAE	*Frankenia pauciflora var. gunnii*	sea heath	Rare	
GENTIANACEAE	*Centaurium spicatum*	australian centaury	Rare	
GOODENIACEAE	*Goodenia geniculata*	bent goodenia	Rare	
	Scaevola albida	pale fanflower	Rare	
GYROSTEMONACEAE	*Gyrostemon thesioides*	broom wheel fruit	Rare	
HALORAGACEAE	*Haloragis myriocarpa*	prickly raspwort	Rare	
	Myriophyllum muelleri	hooded water milfoil	Rare	
LAMIACEAE	*Westringia brevifolia var. raleighii*	native rosemary	Rare	
LENTIBULARIACEAE	*Utricularia australis*	yellow bladderwort	Rare	
	Utricularia tenella	pink bladderwort	Rare	
LOGANIACEAE	*Phyllangium distylis*	tiny mitrewort	Rare	
MALVACEAE	*Gynatrix pulchella*	common hemp bush	Rare	
MIMOSACEAE	*Acacia retinodes var. uncifolia*	wirilda	Rare	

	Acacia ulicifolia	juniper wattle	Rare	
MYOPORACEAE	*Myoporum parvifolium*	creeping myoporum	Vulnerable	
MYRTACEAE	*Melaleuca pustulata*	cranbrook paperbark	Rare	
POLYGONACEAE	*Rumex bidens*	mud dock	Rare	
PROTEACEAE	*Banksia serrata*	saw banksia	Rare	
	Conospermum hookeri	variable smoke bush	Vulnerable	
	Hakea ulicina	furze hakea	Vulnerable	
	Isoetes drummondii subsp. *drummondii*	plain quillwort	Rare	
	Isopogon ceratophyllus	horny cone bush	Vulnerable	
RANUNCULACEAE	*Ranunculus pumilio* var. *pumilio*	ferny buttercup	Rare	
	Ranunculus sessiliflorus var. *sessiliflorus*	annual buttercup	Rare	
RHAMNACEAE	*Pomaderris intermedia*	tree pomaderris	Rare	
	Pomaderris paniculosa subsp. *paralia*	shining pomaderris	Rare	
	Spyridium parvifolium var. *molle*	soft furneaux spyridium	Rare	
	Spyridium parvifolium var. *parvifolium*	australian dusty miller	Rare	
	Spyridium vexilliferum	winged spyridium	Rare	
RUBIACEAE	*Asperula minima*	grassy woodruff	Rare	
	Asperula subsimplex	water woodruff	Rare	
STERCULIACEAE	*Lasiopetalum baueri*	slender velvet bush	Rare	
	Lasiopetalum discolor	coast velvet bush	Rare	
STYLIDIACEAE	*Stylidium despectum*	small trigger plant	Rare	
	Stylidium perpusillum	tiny trigger plant	Rare	
THYMELAEACEAE	*Pimelea curviflora* var. *gracilis*	slender curved rice flower	Rare	
	Pimelea curviflora var. *sericea*	curved rice flower	Rare	
TREMANDRACEAE	*Tetratheca ciliata*	pink bells	Rare	
URTICACEAE	*Parietaria debilis*	pellitory	Rare	
ZYGOPHYLLACEAE	*Zygophyllum billardierei*	coast twin leaf	Rare	
Monocotyledon				
CENTROLEPIDACEAE	*Aphelia gracilis*	slender aphelia	Rare	
CYPERACEAE	*Bolboschoenus caldwellii*	sea club-rush	Rare	
	Lepidosperma forsythii	stout rapier sedge	Rare	
	Schoenoplectus validus	river club sedge	Rare	
	Tricostularia pauciflora	needle bog sedge	Rare	
HYDATELLACEAE	*Trithuria submersa*	trithuria	Rare	
ORCHIDACEAE	*Calochilus campestris*	copper beard orchid	Endangered	
	Chiloglottis trapeziformis	broad-lip bird orchid	Endangered	
	Cryptostylis leptochila	small tongue orchid	Endangered	
	Cyrtostylis robusta	large gnat orchid	Rare	
	Diuris palustris	swamp diuris	Endangered	
	Hydrorchis orbicularis	swamp onion orchid	Rare	
	Microtidium atratum	yellow onion orchid	Rare	
	Orthoceras strictum	horned orchid	Rare	
	Prasophyllum pyriforme	graceful leek orchid	Endangered	
	Prasophyllum secutum	northern leek orchid	Vulnerable	Endangered
	Pterostylis sanguinea	banded greenhood	Rare	
	Pterostylis tunstallii	tunstall's greenhood	Endangered	
	Thelymitra holmesii	holmes' sun orchid	Rare	
	Thelymitra jonesii	sky-blue sun orchid	Endangered	Critically endangered
	Thelymitra malvina	mauve-tufted sun orchid	Endangered	
	Thelymitra mucida	plum orchid	Rare	
	Thynninorchis huntiana	elbow orchid	Endangered	
POACEAE	*Austrostipa bigeniculata*	double-jointed spear grass	Rare	
	Deyeuxia densa	heath bent grass	Rare	

Table C.2. Threatened Fauna Species in the Furneaux Group.

Source: Natural Values Atlas (DPIW 2006)

Scientific Name	Common Name	EPBC Act 1999	TSPAct 1995
Aquila audax subsp. fleayi	Wedge-tailed eagle	Endangered	Endangered
Cavernotettix craggiensis	Craggy Island cave cricket		Rare
Echinodillo cavaticus	Flinders Island cave slater		Rare
Engaeus martigener	Furneaux burrowing crayfish	Endangered	Vulnerable
Galaxiella pusilla	Dwarf galaxias	Vulnerable	Rare
Haliaeetus leucogaster	White-bellied sea-eagle		Vulnerable
Halobaena caerulea	Blue petrel	Vulnerable	
Lathamus discolor	Swift parrot	Endangered	Endangered
Litoria raniformis	Green and golden frog	Vulnerable	Vulnerable
Macronectes giganteus	Southern giant petrel	Endangered	Vulnerable
Numenius madagascariensis	Eastern curlew		Endangered
Pachyptila turtur subsp. subantar	Fairy prion southern sub-species	Vulnerable	Endangered
Pardalotus quadragintus	Forty-spotted pardalote	Endangered	Endangered
Parvotettix rangaensis	Cave cricket		Rare
Pseudemoia rawlinsoni	Glossy grass skink		Rare
Pseudomys novaehollandiae	New holland mouse		Endangered
Sterna albifrons subsp. sinensis	Little tern		Endangered
Sterna nereis subsp. nereis	Fairy tern		Rare
Sterna striata	White-fronted tern		Vulnerable

	Lachnagrostis aequata	even blown-grass	Rare	
	Lachnagrostis billardierei tenuiseta	small-awned blown-grass	Rare	
	Lachnagrostis robusta	tall blown-grass	Rare	
	Poa halmaturina	kangaroo island grass	Rare	
	Poa poiformis var. ramifer	island purple grass	Rare	
	Sporobolus virginicus	salt couch	Rare	
	Triglochin minutissimum	tiny arrow grass	Rare	
POTAMOGETONACEAE	*Potamogeton pectinatus*	fennel pondweed	Rare	
ZANNICHELLIACEAE	*Lepilaena preissii*	slender water mat	Rare	
Pteridophyta				
DENNSTAEDTIACEAE	*Hypolepis muelleri*	harsh ground fern	Rare	
LYCOPODIACEAE	*Phylloglossum drummondii*	pygmy clubmoss	Rare	
PSILOTACEAE	*Tmesipteris parva*	small fork fern	Rare	
Lichen	*Teloschistes flavicans*	golden-hair lichen	Rare	