CORANGAMITE WATER SKINK
Eulamprus tympanum marnieae

NATIONAL RECOVERY PLAN
1998 - 2003

ENVIRONMENT AUSTRALIA

BIODIVERSITY GROUP

prepared by

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on behalf of the National Recovery Team

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Note: An extensive survey of the distribution and habitat use of the Corangamite Water Skink was undertaken during 1997/98.
The findings of that survey are included within this Recovery Plan, and the recovery actions herein are based largely on the outcomes of the survey.

This plan has been prepared in accordance with guidelines and requirements under Commonwealth and Victorian legislation.

Disclaimer:
The views expressed are those of the author, and do not necessarily reflect those of the Biodiversity Group of Environment Australia, Canberra.

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ABBREVIATIONS

ANZECC	Australian and New Zealand Environment and Conservation Council
CMA	Catchment Management Authority
EA	Biodiversity Group, Environment Australia
IUCN	International Union for the Conservation of Nature
MZ	Melbourne Zoo
NRE	Department of Natural Resources and Environment, Victoria
NRT	Corangamite Water Skink National Recovery Team
RAG	Research Advisory Group of the Grassy Ecosystems Reference Group (GERG)
TFN	Trust for Nature

1. SUMMARY

Current Species Status

The Corangamite Water Skink, *Eulamprus tympanum marnieae*, is currently recognised as critically endangered (see Appendix A for further details). It is listed as threatened under the following international, commonwealth, state and territory legislation and documentation: IUCN (1996); ANZECC (1995); Action Plan for Australian Reptiles (Cogger *et al*. 1993); Schedule 2 of the *Flora and Fauna Guarantee Act* 1988 (Vic.); Threatened Vertebrates in Victoria - 1998 (NRE, Vic.).

Habitat Requirements and Limiting Factors

Eulamprus tympanum marnieae is a specialist inhabitant of the margins of lakes in basalt larva flows in Western Victoria, in what were once lowland temperate native grassland communities. It appears to have undergone a decline, and is extinct at least at two former localities. Only eleven extant populations are known, all from the south-western Victorian volcanic plains.

Major perceived threats are habitat loss and fragmentation, and degradation of remaining areas of habitat by a range of processes, including: changed grazing regimes, weed invasion, changed fire regimes, rock removal, changed hydrology and/or water quality, use of agricultural chemicals, and the impacts of introduced animals (foxes, cats, rabbits, mice, sheep, cattle) either by predation or by grazing. Introgression with the nominate *form (Eulamprus tympanum tympanum*) may be a problem, and 'intergrade' individuals/populations have been reported.

These threats continue, to varying degrees, at all known sites. Populations are now extremely fragmented, many are very small, and the subspecies is not known to occur in any major conservation reserve.

Primary Objective

The primary, long-term, recovery objective is to ensure the ability of *E. t. marnieae* to survive, flourish and maintain its potential for evolutionary development in the wild, across its natural geographic range.

Implicit in this is the immediate objective of ensuring the long-term survival of the subspecies throughout its extant distribution.

Primary Recovery Criteria

Viable populations of *E. t. marnieae* are maintained in systems of reserves and/or areas managed specifically for their conservation, and are able to be maintained in the long-term.

The nature of the known threats is recognised and managed to ensure the long-term survival of these populations.

Specific Objectives

1. Recovery Co-ordination. To establish and maintain regional and national forums for the planning and co-ordination of the recovery and conservation of *E. t. marnieae* across its natural distribution.
2. Survey. To determine the distribution and status of *E. t. marnieae*.
3. Ecological Research. To understand those aspects of the biology of *E. t. marnieae* which will enable effective management for the subspecies to survive, flourish and maintain its potential for evolutionary development.

4. Threats. To identify the nature and extent of the processes which threaten *E. t. marnieae* and its habitat.
5. Habitat Management. To establish a system of appropriate reserves and other managed areas such that a number of populations are maintained, which enables *E. t. marnieae* to survive, flourish and maintain its potential for evolutionary development.
6. Monitoring. To provide a basis for adaptive management, continually refine knowledge of the nature, extent and effect of the processes which threaten *E. t. marnieae* by undertaking a comprehensive monitoring program.
7. Salvage & Translocation. To determine if there is a need for salvage of individuals from doomed sites, to determine the feasibility of such measures, and to develop a protocol. To determine if there is a need for translocation, to determine its feasibility, and to develop a protocol.
8. Community Participation. To increase landholder and other community awareness and knowledge, and involve the community in aspects of the recovery program.
9. Captive Maintenance. To establish and maintain a captive population(s) of *E. t. marnieae* to support research and education elements of the Recovery Plan.

Specific Recovery Criteria

Objective 1 - Recovery Co-ordination.

- All agencies, institutions, community groups and individuals who have an interest in the conservation of *E. t. marnieae* and its grassland/lakeside habitats have opportunities to be involved in appropriate working groups and are represented on the National Recovery Team.
- The National Recovery Team co-ordinates implementation of recovery and action plans, co-ordinates projects, organise workshops, and disseminates information at the high level which has been achieved to date.

Objective 2 - Survey.

- Understanding of the distribution of potential *E. t. marnieae* habitat in western Victoria.
- Vegetation and *E. t. marnieae* surveys completed in all areas of potential habitat in western Victoria.
- Comprehensive knowledge of *E. t. marnieae* distribution in western Victoria.

Objective 3 - Ecological Research.

- Key habitat requirements have been determined and are used to establish the extent and use of potential habitat.
- Home range, densities, movements, seasonal activity patterns, and dispersal of *E. t. marnieae* are understood.
- Key elements of the life history and demography of *E. t. marnieae* are known.
- The diet of *E. t. marnieae* is known, and the influence of diet and food availability on distribution and habitat use is understood.
- The genetic variability within *E. t. marnieae*, and the geographic distribution of this variability, is understood.
- The interactions of *E. t. marnieae* with *E. t. tympanum* and other saxicoline skinks, and the influence of these interactions on distribution and habitat use, are understood.
- Appropriate research has been undertaken to enable guidelines to be formulated to reduce or eliminate the effects of threatening processes.
- Population viability analyses of selected populations have been conducted, and the results incorporated in management guidelines.

Objective 4 - Threats.

- The nature and extent of threats to *E. t. marnieae* are well understood.
- A program for ameliorating the effects of critical threatening processes is established throughout the range of the subspecies.

Objective 5 - Habitat Management

- Viable populations of *E. t. marnieae* are under secure management in reserves and other managed areas across the natural distribution of the subspecies.
- Optimum management of *E. t. marnieae* habitat has been determined and is being implemented.
- Threatening processes which modify habitat have been identified and managed appropriately.
- A stable and/or increasing total population is maintained, as determined by appropriate techniques for estimating and monitoring *E. t. marnieae* populations.

Objective 6 - Monitoring.

- A monitoring program which is efficient and causes minimal habitat and behavioural disturbance is established across the distribution of the species to continually assess the effectiveness of management measures at ameliorating threatening processes, and to identify any threats as they may arise.

Objective 7 - Salvage & Translocation.

- The need for salvage of animals has been examined.
- The feasibility and likelihood of success of salvage has been determined.
- Protocols for the circumstances under which salvage may be considered, and a methodology for doing so, have been developed.
- The need for translocation of animals has been examined.
- The feasibility and likelihood of success of translocation has been determined.
- Protocols for the circumstances under which translocation may be considered have been formulated, a methodology for doing so has been developed, and there is general agreement on these guidelines.

Objective 8 - Community Participation.

- Landholders participate in off-reserve management and conservation.
- Community is involved in National Recovery Team, and community groups take responsibility for some recovery actions and management of *E. t. marnieae* and its habitat.
- 'Web' site and other interpretive material available and widely distributed.

Objective 9 - Captive Maintenance.

- The roles of captive populations of *E. t. marnieae* have been defined and goals set.
- Source(s) of animals for captive maintenance identified. Not to compromise natural populations.

Actions

Objective 1 - Recovery Co-ordination.

- Maintain the National Recovery Team and regional working groups (3.1.1).

Objective 2 - Survey.

- Determine the broad distribution and status of potential *E. t. marnieae* habitat, by reference to existing vegetation, geological and management information (3.2.1).
- Determine the current distribution and abundance of *E. t. marnieae* in south-western Victoria, by undertaking extensive targeted surveys in areas of potential habitat identified in 3.2.1 (3.2.2).

Objective 3 - Ecological Research.

- Investigate the genetic variability of *E. t. marnieae* populations to determine what measures may be required to maintain this variability (3.3.1).
- Determine the relationship between the vegetation structure and floristics of grasslands and the distribution of *E. t. marnieae* habitat (3.3.2).
- Determine the relationship between the rock size, structure and aggregation pattern and the distribution of *E. t. marnieae* habitat (3.3.3).
- Investigate the relationship between waterbody characteristics and the presence *E. t. marnieae* populations (3.3.4).
- Investigate the effects of grazing on the habitat of *E. t. marnieae* and on the demography of the subspecies (3.3.5).

- Investigate the effects of recreational pressures on the habitat of *E. t. marnieae* and on the demography of the subspecies (3.3.6).
- Determine movements, seasonality and habitat use of *E. t. marnieae* (3.3.7).
- Determine key ecological parameters of the life history of *E. t. marnieae* (3.3.8).
- Determine the diet of *E. t. marnieae* and factors affecting food availability. (3.3.9).
- Investigate the effects of predation, particularly by introduced predators, on *E. t. marnieae* populations (3.3.10).
- Investigate the interactions between *E. t. marnieae* and other species of sympatric saxicoline skinks (3.3.11).
- Undertake population viability analyses of *E. t. marnieae* populations, to assist in determining appropriate management (3.3.12).

Objective 4 - Threats.

- Identify threats to the habitat of *E. t. marnieae* at all known sites, and determine the relative severity of these threats (3.4.1).

Objective 5 - Habitat Management

- Make a prioritised list of areas for the development of reservation proposals, management agreements and management guidelines (3.5.1).
- Consider the inclusion of multiple representative areas of the habitat of *E. t. marnieae* throughout its extant geographic range in reserves (3.5.2).
- Ensure long-term sympathetic management of *E. t. marnieae* and its habitat on non-reserve land, by developing conservation management agreements with landholders controlling *E. t. marnieae* habitat throughout the extant geographic range of the subspecies (3.5.3).
- Establish and implement appropriate interim management arrangements and guidelines for reserves containing *E. t. marnieae* (3.5.4).
- Liaise with grassland/wetland managers to establish and implement interim management guidelines for landholders responsible for non-reserve land which contains *E. t. marnieae* and/or its habitat (3.5.5).
- Periodically review guidelines for the management of *E. t. marnieae* habitat, as new information on the biology of the subspecies, and on threats and their amelioration, becomes available (3.5.6).

Objective 6 - Monitoring.

- Formulate and implement a minimum disturbance monitoring strategy to identify population trends at a representative series of sites (3.6.1).

Objective 7 - Salvage & Translocation.

- Determine the circumstances under which *E. t. marnieae* may be salvaged from doomed sites, and develop agreed protocols (3.7.1).
- Determine the potential objectives, feasibility and appropriateness of translocation (3.7.2).
- Determine the circumstances under which *E. t. marnieae* may be translocated, and develop agreed protocols (3.7.3).

Objective 8 - Community Participation.

- Provide training for land managers involved in activities which may affect *E. t. marnieae* and its habitat (3.8.1).
- Approach interested landholders and other community groups to provide a forum for community participation in recovery actions (3.8.2).
- Encourage landholder and other community involvement in projects directed at the conservation of *E. t. marnieae* and native grasslands, and where possible provide support to these groups undertaking approved projects (3.8.3).
- Publicise in various media the conservation status of *E. t. marnieae*, and encourage the reporting of any sightings (3.8.4).
- Produce a 'Web' site and other materials on grasslands, volcanic plain wetlands, and *E. t. marnieae* conservation and management, for access by community groups, landholders, and private and government organisations (3.8.5).

Objective 9 - Captive Maintenance.

- As required, use captive populations to conduct biological studies (3.9.1).
- As required, undertake research on captive animals, leading to an understanding of reproductive biology and breeding requirements (3.9.2).
- Use captive animals to heighten community understanding of the conservation of *E. t. marnieae* and its grassland habitat (3.9.3).

Biodiversity Benefits

The conservation of *E. t. marnieae* and its habitat will assist in the conservation of natural temperate grasslands, which are among Australia's most threatened ecological communities. Several threatened flora and fauna species associated with temperate grasslands will benefit greatly from the protection, management and rehabilitation of *E. t. marnieae* native habitat.

Estimated Cost Of Recovery

The costs of implementing this Recovery Plan, based on 1999 estimates, are summarised below.
(figures are $000s/year)

Action	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
3.1.1	2	2	2	2	2	10
3.2.1	1	0	0	0	0	1
3.2.2	9	0	0	0	0	9
3.3.1	40	10	0	0	0	50
3.3.2- 3.3.4	28.5	28.5	28.5	0	0	85.5
3.3.5 - 3.3.11	28.5	28.5	28.5	0	0	85.5
3.3.12	0	0	0	20	0	20
3.4.1	1.5	1.5	1.5	1.5	1.5	7.5
3.5.1	0.5	0.5	0	0	0	1
3.5.2	*potential costs unknown*					
3.5.3	6	6	6	6	6	30
3.5.4	2	5	5	8	15	35
3.5.5	19	19	19	24	32	113
3.5.6	0	0	1.5	1.5	1.5	4.5
3.6.1	5	4	4	3	3	19
3.7.1	2	0	0	0	0	2
3.7.2	2	0	0	0	0	2
3.7.3	0	2	0	0	0	2
3.8.1	2	2	2	0	0	6
3.8.2	1	1	1	0	0	3
3.8.3	5	5	5	4	6	25
3.8.4	1	1	0.5	0.5	0.5	3.5
3.8.5	2	1	1	1	1	6
3.9.1	4	2	2	2	2	12
3.9.2	1.5	1.5	1.5	1.5	1.5	7.5
3.9.3	0.5	0.5	0.5	0.5	0.5	2.5
Totals	**164**	**121**	**110**	**75.5**	**72.5**	**542.5**

2. SPECIES INFORMATION

2.1 Description

The Corangamite Water Skink, *Eulamprus tympanum marnieae* (Mitchell 1948), is a medium-sized lizard of the family Scincidae. Water skinks (only part of the genus *Eulamprus* as currently recognised - see Cogger 1994) differ from other members of the genus by the absence of supranasal scales and the absence of pigment on the palmar and subdigital surfaces. Adult *E. t. marnieae* may reach 100 mm SVL, with a tail length of up to 145 mm. The adults show little sexual dimorphism, and have a body mass up to 20 grams. The main morphological differences separating *E. t. marnieae* from *E. t. tympanum* are the higher numbers of mid-body and paravertebral scales, and the distinctive colour patterns.

Eulamprus tympanum marnieae is light to very dark brown on the dorsal surface of the head, body, tail and limbs, overlain by black markings, thus: head shields with irregularly scattered flecks; back with numerous irregular patches, generally expanded laterally to form transverse bars, some contacting the black upper lateral zone; tail with closely-spaced transverse bars better developed laterally than dorsally; limbs overlain by heavy black network. Chin shields are white, spotted with black, and the throat is grey-white with large blackish patches. The general colour is suffused with yellow; often the underside of the belly, limbs and tail is bright yellow (Hutchinson & Rawlinson 1995).

2.2 Taxonomic Significance

Eulamprus tympanum marnieae is currently recognised as a subspecies of the more widespread and variable *E. t. tympanum*. Hutchinson & Rawlinson (1995) considered that populations intermediate in characteristics between these two subspecies exist, and recent surveys have revealed at least five such populations. A study of the genetics of these populations is required to determine their status and the potential interactions between the subspecies.

Eulamprus tympanum marnieae is the only water skink occurring within the naturally treeless grasslands of south-eastern Australia.. It is restricted to Victoria.

2.3 Distribution

2.3.1 Former Geographical Distribution

Eulamprus tympanum marnieae was discovered in 1963 near Lismore, and was described in 1995. It has since been found at 29 sites, probably representing at least eleven discrete populations. It is restricted to the basalt plains of south-western Victoria, and has been recorded as a number of isolated populations between Colac in the south-east and lake Bolac in the north-west. More areas of seemingly potential habitat further west have been examined recently, with no *E. t. marnieae* found there.

2.3.2 Current Known Distribution

Recent surveys indicate that *E. t. marnieae* has undergone a decline, disappearing from at least two historic sites (Lismore and the north-eastern shore of Lake Bolac). At many of the extant sites the areas of available habitat are very small, and at most sites other land uses potentially threaten the populations. Map 1 shows the current distribution of *E. t. marnieae*, and details of all known sites and populations are included in Appendix C.

2.3.3 Tenure of land supporting *E. t. marnieae*.

No conservation reserves are currently known to support *E. t. marnieae*, and it is considered unlikely that it will be found in any existing reserves.Sites where this subspecies has been located recently are generally private land used for grazing of stock. Three sites are on or adjoin crown land (managed by the shire) used predominantly for recreational purposes. One private land site is managed primarily for conservation of natural values. The opportunity exists at a number of sites to enhance the habitat for *E. t. marnieae* without adversely effecting other values and uses.

The National Recovery Team would consider it irresponsible to condone any development at sites known to support populations of *E. t. marnieae*, or at sites from which the subspecies has been recorded in the past, until a system of reserves and managed areas is established to fulfil the primary objective of this recovery plan.

2.4 Life history and ecology

The ecology of *E. t. tympanum* has been extensively investigated. Spellerberg (1972a,b,c,d) reported on its thermal biology; Schwarzkopf and Shine (1991), Schwarzkopf (1992), and Rohr (1997) have examined its reproductive biology and life history; Blomberg (1997) examined behaviour; Brown (1983) documented diet; and Mather (1978) investigated habitat requirements. Although, *E. t. marnieae* has not received similar attention, one may expect these two subspecies to have some general ecological similarities. Much of our knowledge of *E. t. marnieae* comes from the incidental observations of many workers, the original description by Hutchinson and Rawlinson (1995), the study by Peterson (1997), and the recent surveys (reports in preparation).

Both subspecies are diurnally active, heliothermic skinks. They are both viviparous, producing between one and six live young, *E. t. marnieae* in late December and *E. t. tympanum* in late January. Ovulation in *E. t. marnieae* occurs in late October to early November. Only one litter is produced each year. Litter size and mass increase with female size; *E. t. marnieae* litter mass averages 30% of female mass. Male *E. t. marnieae* have been recorded with enlarged testes in April and September, with regressing testes in October-November, and fully regressed testes in December.

While little is known of the diet of *E. t. marnieae*, one may expect it to be largely insectivorous, like its congeners. It does, however, consume the fruit of the Tree Violet (*Hymenanthera dentata*), which may be an important component of the diet during some periods (Peterson 1997). Lizards may also play an important role in the dispersal and germination of this plant.

Unlike other water skinks, *E. t. marnieae* is an extremely shy species. Usually observed perched on a rockpile or fence, it will often take cover when a human observer is still tens of metres distant (Hutchinson and Rawlinson 1995). It can and does swim, but usually takes refuge in deep gaps and fissures in rock piles.

2.5 Habitat

Eulamprus tympanum marnieae inhabits a geographically peculiar Victorian landform, technically part of the Newer Volcanics, a region of extensive late Tertiary sheet basalt lava flows, often known as ‘stony rises’ (Hutchinson and Rawlinson 1995). The rises are basalt ridges and boulder heaps often left by the collapse of lava tunnels. Most of the area in which the subspecies probably once occurred has been extensively modified, with clearing of vegetation, widespread grazing, moving of rocks into extensive drystone walls, and, more recently, removal of boulders and demolition of drystone walls for landscape gardening.

Favoured localities for *E. t. marnieae* often have remnant shrubs (often *H. dentata*), deeply fissured pile of large basaltic rocks, and permanent (occasionally ephemeral) freshwater bodies.

It may be that the deep rock piles favoured by this species provide cool and humid refuges during the summer months, when conditions elsewhere in the basalt plains environment would be intolerable to water skinks (Hutchinson and Rawlinson 1995).

Analyses of microhabitat use by Peterson (1997) support this view; areas of high shrub density, short distance to vegetation cover, large rock aggregations and rock fissures appeared to be selectively chosen by *E. t. marnieae*, and were positively correlated with presence of the lizard. This may be explained by the coincidence of several requirements for the subspecies in such areas: refuge from predators and temperature extremes; range of opportunity for optimal thermoregulation; maintenance of appropriate humid microenvironments; and presence of an important food source.

2.6 Threats

The main factors involved in the decline of *E. t. marnieae* are thought to be habitat loss and fragmentation, and degradation of remaining areas of habitat by a range of processes, including: changed grazing regimes, weed invasion, changed fire regimes, rock removal, changed hydrology and/or water quality, use of agricultural chemicals, and the impacts of introduced animals (foxes, cats, rabbits, mice, sheep, cattle) either by predation or by grazing. Introgression with the nominate *form (Eulamprus tympanum tympanum*) may be a problem, and 'intergrade' individuals/populations have been reported. For small populations, stochastic ecological and/or genetic effects could become important, as could the potential for inbreeding suppression.

Synergistic effects of combinations of these threats may also be important. For example, cat predation may be more important in small populations close to urban developments.

These threats continue, to varying degrees, at all known sites. Populations are now extremely fragmented, many are very small, and the subspecies is not known to occur in any conservation reserve.

The population at the first site discovered (near Lismore) was probably exterminated during the rock clearing activities which produced the original specimens (Hutchinson and Rawlinson 1995).

Two elements of the habitat identified as particularly important to *E. t. marnieae* (Peterson 1997) are large rock outcrops and shrub cover. While both of these attributes may be threatened (by rock collection and grazing respectively), at many sites they could be enhanced by careful management.

2.7 Social And Economic Consequences of the Recovery Plan

2.7.1 Economic Considerations

There is a variety of conservation-based actions which may be appropriate and necessary to alleviate perceived threats and secure the conservation of *E. t. marnieae* in different land tenure situations. These actions may have economic implications for both private individuals and various government organisations/agencies. These are summarised in Table 1.

2.7.2 Social Considerations

There are both positive and negative social consequences of implementing this Recovery Plan. The major positive consequence is the long-term protection of both *E. t. marnieae* and grassland/lakeside habitat for the enjoyment of present and future Australians. Negative social consequences might include the restriction of some recreational activities in small areas.

Action	Affected parties
Altered stocking rates	Rural landowners/lessees.
Restriction on management practices, e.g. pasture improvement, clearing, rock removal.	All managers of land with *E. t. marnieae* populations.
Restriction of options for manipulation/utilisation of water bodies.	Water authorities, land owners
Restriction of recreational opportunities in some areas.	Campers, anglers.
Rejection of, or alteration to, proposed urban, infrastructure or industrial developments.	Developers. Land owners. Any parties to be serviced by the proposed developments.
Land acquisition for reservation.	State/Territory and Commonwealth conservation agencies. Rural landowners/lessees.

Table 1. Recovery actions which may have socio-economic impacts, and those parties which may be affected.

2.7.3 Practical Considerations

Many of the known populations of *E. t. marnieae* are small and isolated from other populations. As such, they may be more vulnerable to stochastic events, and they may require active manipulation to maintain their genetic variability and vigour.

All of the known populations of *E. t. marnieae* now occur in greatly modified habitats, and may be placed under increasing stress as changes continue. However, given our increasing knowledge of the habitat requirements of this subspecies, it should be possible to restore particular habitat characteristics to benefit the populations.

Most of the populations of *E. t. marnieae* are on private lands, used mainly for grazing.Nevertheless, it should be possible in many instances, given sympathetic attitudes of land managers, to modify grazing practices in the small areas occupied by the populations such that adverse impacts on the habitat are minimised with little, if any, decrease in agricultural productivity.

Conservation of the few populations occurring on or adjoining crown land may conflict with recreational use of those areas.

Land acquisition to establish a system of managed reserves is extremely expensive, and may be possible in only a few instances. Conservation of this subspecies must be viewed as a long-term and on-going process, to be achieved largely by sympathetic management of private lands via various agreements. Planning of a system of reserves and other managed areas will rely upon a thorough understanding of the distribution, habitat requirements and biology of *E. t. marnieae*. This knowledge should be gained through the research actions outlined in this Recovery Plan.

2.8 Biodiversity Benefits

In taking actions to conserve *E. t. marnieae* , there are considerable advantages for many other threatened species and communities. Natural temperate grasslands have been reduced to just 0.5% of their extent at the time of European settlement (Kirkpatrick et al. 1995). The broad habitat of *E. t. marnieae* is natural temperate grassland. Consequently, the conservation of *E. t. marnieae* involves conservation of such grassland areas and the suite of threatened species associated with them.

2.9 Previous Actions Undertaken

2.9.1 Co-ordination and communication of research and recovery actions

A National Recovery Team (NRT) for *E. t. marnieae* was established in September 1997. This team has been co-ordinating national research and management efforts since its establishment, and initiated the preparation of this Recovery Plan. Survey and other research directions are planned and acted upon primarily by the Victorian Department of Natural Resources and Environment (NRE). The National Recovery Team liases closely with university and other research groups, other relevant working groups, and recovery teams such as the Striped Legless Lizard National Recovery Team and various grassland recovery groups (e.g. GERG). The studies co-ordinated by the NRT, in conjunction with university and other workers, have provided most of the current knowledge of *E. t. marnieae* distribution and biology.

Organisations to be represented on the NRT are as follows:

Department of Natural Resources and Environment, Victoria
Environment Australia, Biodiversity Group
La Trobe University
Local conservation and landowner groups
Corangamite Catchment and Land Protection Board
Melbourne Zoo
Trust for Nature
Victorian National Parks Association
Wildlife Profiles Pty. Ltd.

2.9.2 Surveys and Research

A survey program to investigate the distribution of *E. t. marnieae* was conducted during the spring and summer of 1997-8, with initial funding from Environment Australia. Several previously undocumented populations of *E. t. marnieae* were located (see Appendix C). Remaining areas in the west of the potential distribution were examined during the spring and summer of 1998-9, with no further populations located. Sixteen monitoring transects have been established. Media releases have resulted in the detection of some populations, and have greatly increased local awareness of the subspecies.

Some aspects of the habitat and general biology of *E. t. marnieae* have been investigated recently (Peterson 1997). Further ecological studies are underway, as a postgraduate research project (G. Peterson, pers. comm.), which will address some of the actions in this recovery plan.

2.9.3 Reservation

Eulamprus tympanum marnieae is not known to occur in any conservation reserve. Three sites on or adjoining crown land are used mainly for recreation, while one private land site is currently managed primarily for conservation of natural values. The opportunity exists at a number of sites to enhance the habitat for *E. t. marnieae* without adversely effecting other values and uses.

2.10 Species Ability To Recover

Most sites where *E. t. marnieae* persists are subject to grazing by native and/or introduced herbivores. The native shrubs in these rocky grassland habitats of the subspecies may be particularly susceptible to grazing. As these shrubs have been shown to be important to *E. t. marnieae* (Peterson 1997), it is likely that heavy grazing will be detrimental to the subspecies. Appropriate grazing regimes have yet to be determined, however it may be prudent to exclude grazing from *E. t. marnieae* habitat wherever possible, but only with careful experimental monitoring of the effects.

The effect of introduced predators is not understood, but it may be significantly detrimental. High numbers of foxes and cats are present in many areas of *E. t. marnieae* habitat.

The effects of differing frequencies and timing of fires in *E. t. marnieae* habitat are unknown. Appropriate fire regimes have yet to be determined.

Because populations of *E. t. marnieae* are now severely fragmented, it is unknown whether the subspecies will persist in the long-term in reserved or managed areas, or whether active intervention will be required. This will depend upon the size of the reserves or managed areas, on the threats present, and on the management regimes implemented. Optimal management with regard to threatening processes is yet to be determined.

The sizes of most extant populations may not be large enough currently to prevent major restrictions of genetic variability, and management must be cognisant of this. Genetic research is considered a priority to guide appropriate management. Gene flow between populations is now apparently not possible naturally.

The life history of the subspecies appears such that relatively quick population growth may be possible given adequate areas of habitat and amelioration of threats.

2.11 Alternative Management Strategies

Management agreements with, and sympathetic land use by, non-government landholders will play a crucial role in the conservation of *E. t. marnieae*. It is clear that not all rural land uses have significant detrimental effects on *E. t. marnieae* populations, and that populations can persist in the long-term on rural land. Consequently, reserves are not the only solution to conserving the species, and should be viewed as only part of the management strategy for this subspecies. Currently, one private land site is managed primarily for conservation of natural values, and the opportunity exists at a number of other sites to enhance the habitat for *E. t. marnieae* without adversely effecting other values and uses.

2.12 Community Involvement

There is great potential for community involvement in the conservation of *E. t. marnieae,* natural temperate grasslands, and volcanic lakeside habitats. Because many of the remaining patches of these habitats are on private land, the involvement of the community will be critical to the successful recovery of both *E. t. marnieae* and its habitat. Landowner participation in conservation programs will be crucial.

There are already several community groups which have made great contributions to both grassland and lizard conservation. The Friends of the Striped Legless Lizard is a Victorian community group which has been involved in several conservation-oriented programs.

Trust for Nature, the Victorian National Parks Association, and LandCare groups may be pivotal in co-ordinating community efforts. All of these organisations, other similar groups, and individuals will be instrumental in the implementation of this Recovery Plan, and will be included in many actions. Organising more such groups will be a high priority as the Recovery Plan is implemented.

2.13 Further Research Overview

To gain the ecological information necessary to determine optimal management of *E. t. marnieae* populations, it will be necessary to undertake a targeted research program. The actions identified in section 3.3 address these research requirements. Briefly, the program includes:

- Further survey to determine the distribution of *E. t. marnieae* (now substantially completed).
- Genetic investigations to determine if there is a need for any genetic manipulations, and to determine the extent of genetic interactions with *E. t. tympanum*.
- Investigations of the habitat and microhabitat requirements of *E. t. marnieae,* to enable appropriate and continually refined management.
- Investigations, and manipulations, of various postulated threatening processes, to determine their impacts on populations and to determine means of ameliorating their effects.
- Investigations to determine various life history parameters of *E. t. marnieae,* to enable population viability modelling.
- Population viability modelling.
- Monitoring of populations to experimentally assess the effects of any imposed management, to detect any population changes, and to detect any changes in threats.

3. RECOVERY OBJECTIVES, CRITERIA AND ACTIONS

Primary Objective

The primary, long-term, recovery objective is to ensure the ability of *Eulamprus tympanum marnieae* to survive, flourish and maintain its potential for evolutionary development in the wild, across its natural geographic range.

Implicit in this is the immediate objective of ensuring the long-term survival of the subspecies throughout its extant distribution.

Primary Recovery Criteria

Viable populations of *Eulamprus tympanum marnieae* are maintained in systems of reserves and/or areas managed specifically for their conservation, and are able to be maintained in the long-term.

The nature of the known threats is recognised and managed to ensure the long-term survival of these populations.

3.1 Specific Recovery Objective - Recovery Co-ordination

To establish and maintain regional and national forums for the planning and co-ordination of the recovery and conservation of *E. t. marnieae* across its natural distribution.

The National Recovery Team has been instrumental in the organising of work completed to date and in disseminating information. This high level of organisation and communication must continue if this Recovery Plan is to be implemented successfully to co-ordinate research and management of habitat. The National Recovery Team must include representatives of all stakeholders - landowner participation in the recovery process is to be encouraged.

Performance criteria:

- All agencies, institutions, community groups and individuals who have an interest in the conservation of *E. t. marnieae* and its grassland habitats have opportunities to be involved in the regional working groups and are represented on the National Recovery Team.
- The National Recovery Team co-ordinates implementation of recovery and action plans, co-ordinates projects, organise workshops, and disseminates information at the high level which has been achieved to date.

3.1.1 ACTION: Maintain the National Recovery Team and regional working groups.

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRE, EA.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1 ongoing	1	Biodiversity Group #	0.5	0.5	0.5	0.5	0.5	2.5
		NRE #	1.5	1.5	1.5	1.5	1.5	7.5
		total 3.1.1	**2**	**2**	**2**	**2**	**2**	**10**

The budget associated with this action is to provide for regular participation of team members, with associated travel costs.

3.2 Specific Recovery Objective - Survey

To determine the distribution and status of *E. t. marnieae.*

Substantial surveys have been conducted in south-western Victoria. Several areas of potential habitat have been identified and some previously unknown populations have been located. Further survey to the west of the known distribution are underway.

Performance criteria:

- Understanding of the distribution of potential *E. t. marnieae* habitat in western Victoria.
- *E. t. marnieae* surveys completed in all areas of potential habitat in western Victoria.
- Comprehensive knowledge of *E. t. marnieae* distribution in western Victoria.

3.2.1 ACTION: Determine the broad distribution and status of potential *E. t. marnieae* habitat, by reference to existing vegetation, geological and management information.

This action has largely been completed during the current study.

Priority: 1
Agency(s) responsible for implementation of action: NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group						0
		NRE #	1					1
		total 3.2.1	**1**	**0**	**0**	**0**	**0**	**1**

The budget associated with this action is to support collation of distributional information by NRE personnel and university researchers.

3.2.2 ACTION: Determine the current distribution and abundance of *E. t. marnieae* in south-western Victoria, by undertaking extensive targeted surveys in areas of potential habitat identified in 3.2.1.

Targeted surveys for *E. t. marnieae* were undertaken in south-western Victoria in 1997-98. Further surveys at the western extremity of the volcanic plains are underway.

Priority: 1
Agency(s) responsible for implementation of action: NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group	1					1
		NRE #	2					2
		other (RAG[1])	6					6
		total 3.2.2	**9**	**0**	**0**	**0**	**0**	**9**

The budget associated with this action is to provide for field and vehicle expenses for university researchers to undertake the survey, in collaboration with NRE personnel.

3.3 Specific Recovery Objective - Ecological Research

To understand those aspects of the biology of *E. t. marnieae* which will enable effective management for the subspecies to survive, flourish and maintain its potential for evolutionary development.

Current knowledge of the ecology of *E. t. marnieae* is inadequate for the informed formulation of appropriate management guidelines. A program of targeted research is urgently required to address specific management questions.

NOTE: It is proposed that actions 3.3.2 to 3.3.4 will be most economically undertaken concurrently, by a single dedicated researcher, and as such are costed together (see section 3.3.4 and section 4). A postgraduate student has begun a project addressing these actions. Similarly, actions 3.3.5 to 3.3.11 would best be undertaken by a single dedicated researcher, and these are also costed together (see section 3.3.11 and section 4).

Performance criteria:

- Key habitat requirements have been determined and are used to establish the extent and use of potential habitat.
- Home range, densities, movements, seasonal activity patterns, and dispersal of *E. t. marnieae* are understood.
- Key elements of the life history and demography of *E. t. marnieae* are known.
- The diet of *E. t. marnieae* is known, and the influence of diet and food availability on distribution and habitat use is understood.
- The genetic variability within *E. t. marnieae*, and the geographic distribution of this variability, is understood.
- The interactions of *E. t. marnieae* with *E. t. tympanum* and other saxicoline skinks, and the influence of these interactions on distribution and habitat use, are understood.
- Appropriate research has been undertaken to enable guidelines to be formulated to reduce or eliminate the effects of threatening processes.
- Population viability analyses of selected populations have been conducted, and the results incorporated in management guidelines.

3.3.1 ACTION: Investigate the genetic variability of *E. t. marnieae* populations to determine what measures may be required to maintain this variability.

Knowledge of the levels of genetic variability within and between *E. t. marnieae* populations is essential to assist in determining various management requirements, such as: minimum population sizes; population area requirements; distribution of reserves/managed areas; the level and importance of interactions with the *E. t. tympanum*; the desirability/requirement for, and methodology of, any translocations. Many of the samples for use in this study have been collected.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group	20	5				25
		NRE						0
		other # (SAM^2)	20	5				25
		total 3.3.1	**40**	**10**	**0**	**0**	**0**	**50**

The budget associated with this action is to provide for the considerable laboratory and salary costs associated with genetic analyses, with a small travel component for a university researcher.

3.3.2 ACTION: Determine the relationship between the vegetation structure and floristics of grasslands and the distribution of *E. t. marnieae* habitat.

This action has been partly addressed by the current study and by Peterson (1997), now enabling a more detailed and targeted assessment to be undertaken. This is required to direct management of vegetation, particularly with respect to grazing and potential rehabilitation.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.3 ACTION: Determine the relationship between the rock size, structure and aggregation pattern and the distribution of *E. t. marnieae* habitat.

This action has been partly addressed by the current study and by Peterson (1997), now enabling a more detailed and targeted assessment to be undertaken. This is required to direct management of habitat, including mitigation of the effects of commercial rock removal, and the potential enhancement of some sites.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.4 ACTION: Investigate the relationship between waterbody characteristics and the presence *E. t. marnieae* populations.

Size, seasonal persistence, water quality, salinity, and pollution levels of waterbodies may all affect the presence of *E. t. marnieae*. Investigation of these characteristics has been partly addressed by the current study, now enabling a more detailed and targeted assessment to be undertaken. This is required to direct management of habitat, particularly with regard to optimal wetland and water management, and perhaps to direct habitat rehabilitation/reconstruction.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group	4	4	4			12
		NRE	5	5	5			15
		other # (LaTrobe[3])	19.5	19.5	19.5			58.5
		total 3.3.2 - 3.3.4	**28.5**	**28.5**	**28.5**	**0**	**0**	**85.5**

The budget associated with these actions is to provide a student stipend for a postgraduate university researcher, together with associated field, laboratory and administrative costs.

3.3.5 ACTION: Investigate the effects of grazing on the habitat of *E. t. marnieae* and on the demography of the subspecies.

It is essential to understand the effects of these disturbances on populations so that optimal management guidelines can be formulated.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.6 ACTION: Investigate the effects of recreational pressures on the habitat of *E. t. marnieae* and on the demography of the subspecies.

Recreational pressures (camping, boating and angling) are high in some areas of *E. t. marnieae* habitat. It is essential to understand the effects of these potential disturbances on populations so that optimal management guidelines can be formulated.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.7 ACTION: Determine movements, seasonality and habitat use of *E. t. marnieae*.

Seasonal differences in activity patterns and in patterns of habitat use may be important in determining appropriate management and when it should be applied. Knowledge of the extent of movements and their timing is also required to the determine where any management is best applied, and to determine the need for any population manipulations.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.8 ACTION: Determine key ecological parameters of the life history of *E. t. marnieae*.

Knowledge of key life history parameters, such as age-specific mortality, natality and migration, etc. is essential to conduct population viability modelling.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.9 ACTION: Determine the diet of *E. t. marnieae* and factors affecting food availability.

The diet and timely availability of key food items may be important in determining the distribution and population sizes of *E. t. marnieae*. Knowledge of these may enable manipulations of the habitat to increase their availability to the benefit of *E. t. marnieae* populations.

Priority: 2
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.10 ACTION: Investigate the effects of predation, particularly by introduced predators, on *E. t. marnieae* populations.

These effects are currently unknown, but may be significant, particularly given the high numbers of foxes and cats in *E. t. marnieae* habitats. The need for management of predators, and appropriate methodologies, must be determined.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

3.3.11 ACTION: Investigate the interactions between *E. t. marnieae* and other species of sympatric saxicoline skinks.

Two species of large saxicoline skink occur broadly within the habitat of *E. t. marnieae.* One of these (*Egernia saxatilis*) is narrowly sympatric with some populations of *E. t. marnieae* and *E. t. marnieae* / *E. t. tympanum* intermediates. It may have the capacity to aggressively and/or competitively exclude the smaller water skinks from some areas. Research is required to determine the level of this perceived threat.

Priority: 2
Agency(s) responsible for implementation of action: NRT to co-ordinate appropriate researcher(s).

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group	21.5	21.5	21.5			64.5
(+2)		NRE	5	5	5			15
		other # (LaTrobe[3])	2	2	2			6
		total 3.3.5 - 3.3.11	**28.5**	**28.5**	**28.5**	**0**	**0**	**85.5**

The budget associated with these actions is to provide a student stipend for a postgraduate university researcher, together with associated field, laboratory and administrative costs.

3.3.12 ACTION: Undertake population viability analyses of *E. t. marnieae* populations, to assist in determining appropriate management.

When adequate information is available from the other research actions, population viability analyses should be undertaken to enable refinement of management guidelines.

Priority: 1
Agency(s) responsible for implementation of action: EA, NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	2	Biodiversity Group #				20		20
		NRE #						0
		total 3.3.12	**0**	**0**	**0**	**20**	**0**	**20**

The budget associated with this action is to provide a consultancy fee for a suitably qualified expert biometrician.

3.4 Specific Recovery Objective - Threats

To identify the nature and extent of the processes which threaten *E. t. marnieae* and its habitat.

Apart from establishing reserves and managed areas, this is probably the most critical measure required for the conservation of *E. t. marnieae*. All threats, including, development proposals, must be identified and their potential effects assessed. Ongoing research (objective 3.3) and monitoring (objective 3.6) will be required to enable formulation and continued refinement of management measures (objective 3.5).

Performance criteria:

- The nature and extent of threats to *E. t. marnieae* are well understood.
- A program for ameliorating the effects of critical threatening processes is established throughout the range of the subspecies.

3.4.1 ACTION: Identify threats to the habitat of *E. t. marnieae* at all known sites, and determine the relative severity of these threats.

This action follows from the research component of the recovery plan, and threats currently identified are proposed for investigation within the research component of the recovery plan (Action 3.3). Interim management of threats currently identified is proposed in Action 3.5.

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRT to co-ordinate, with participation from relevant agencies.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group #						0
ongoing		NRE #	1.5	1.5	1.5	1.5	1.5	7.5
		total 3.4.1	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**7.5**

The budget associated with this action is to support collation of threat information by NRE personnel and university researchers.

3.5 Specific Recovery Objective - Habitat Management

To establish a system of appropriate reserves and other managed areas such that a number of populations are maintained, which enables *E. t. marnieae* to survive, flourish and maintain its potential for evolutionary development.

Currently no population of *E. t. marnieae* is included within a reserve or is considered secure. A system of reserves and other managed areas is urgently required to secure the conservation of the subspecies. Appropriate management of this system is essential to provide for the long-term maintenance of suitable habitat. Current knowledge of the ecology of *E. t. marnieae* is inadequate to enable optimal management to be determined, and the research actions (objective 3.3) will address this problem. However, to wait for the results of this research before implementing some habitat management measures would be unacceptable and potentially disastrous for the subspecies. Accordingly, interim management guidelines will be formulated and implemented for all areas of habitat. As further information becomes available from the research (objective 3.3), identification of threats (objective 3.4), and monitoring (objective 3.6), management guidelines will be continually refined and updated.

Performance criteria:

- Viable populations of *E. t. marnieae* are under secure management in reserves and other managed areas across the natural distribution of the subspecies.
- Optimum management of *E. t. marnieae* habitat has been determined and is being implemented.
- Threatening processes which modify habitat have been identified and managed appropriately.
- A stable and/or increasing total population is maintained, as determined by appropriate techniques for estimating and monitoring *E. t. marnieae* populations.

3.5.1 ACTION: Make a prioritised list of areas for the development of reservation proposals, management agreements and management guidelines.

A strategy for a system of managed sites will be developed by members of the National Recovery Team.

Priorities for acquiring reserves and managed areas should be governed by the application of principles to be derived from consideration of the distribution, genetic structure, extent of habitat, long-term viability, threats, composition and size of each population.

Priority: 1
Agency(s) responsible for implementation of action: NRT to co-ordinate with NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group						0
		NRE #	0.5	0.5				1
		total 3.5.1	**0.5**	**0.5**	**0**	**0**	**0**	**1**

The budget associated with this action is to support formulation of a list of priority areas for negotiation of appropriate management, by NRE personnel and university researchers.

3.5.2 ACTION: Consider the inclusion of multiple representative areas of the habitat of *E. t. marnieae* throughout its extant geographic range in reserves.

In accordance with the principles and sites identified in action 3.5.1 above, consideration will be given to establishing a series of high priority sites within formal or informal reserves.

Priority: 1
Agency(s) responsible for implementation of action: NRE.

The costs associated with this action are, at this stage, unknown. The desirability of acquiring land for reserves, and the availability of any such areas, have yet to be determined.

3.5.3 ACTION: Ensure long-term sympathetic management of *E. t. marnieae* and its habitat on non-reserve land, by developing conservation management agreements with landholders controlling *E. t. marnieae* habitat throughout the extant geographic range of the subspecies.

Most of the known sites which support *E. t. marnieae* are on private rural land or non-reserve public land. In the majority of cases, the land managers or owners have no obligation to manage the land sympathetically for *E. t. marnieae*, and they have the ability to exterminate populations through inappropriate land-use practices. Land management agreements should be made with these land managers or owners (or land must be acquired for reserves in order to adequately conserve the species across its current range – action 3.5.2 above). Private landowners must be informed about *E. t. marnieae* and native grassland/wetland conservation, and be assured that the presence of *E. t. marnieae* on their properties does not mean that they will lose their land or incur significant loss in productivity. While it is generally true that significant changes in land management practices are not advised in areas that contain *E. t. marnieae* (because their very presence indicates at least a base level of appropriate land-use history), at some sites current management may be contributing to declines, and should be altered to provide for maintenance of the populations. Furthermore, the opportunity exists at some sites for significant improvements to the habitat.

Differing mechanisms for developing co-operative conservation management agreements will be available, some examples of which include: Land for Wildlife, Conservation Covenant, Public Area Management Agreement

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1 ongoing	1	Biodiversity Group						0
		NRE #	3	3	3	3	3	15
		other (TFN[4])	3	3	3	3	3	15
		total 3.5.3	**6**	**6**	**6**	**6**	**6**	**30**

The budget associated with this action is to support negotiation of appropriate management agreements, by NRE and TFN personnel.

3.5.4 ACTION: Establish and implement appropriate interim management arrangements and guidelines for reserves containing *E. t. marnieae*.

Priority: 1
Agency(s) responsible for implementation of action: NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group		3	3	3	10	19
		NRE #	2	2	2	5	5	16
		total 3.5.4	**2**	**5**	**5**	**8**	**15**	**35**

The budget associated with this action is to provide for the costs of managing reserved areas, including largely capital expenses associated with habitat rehabilitation activities such as fencing and replanting.

3.5.5 ACTION: Liaise with grassland/wetland managers to establish and implement interim management guidelines for landholders responsible for non-reserve land which contains *E. t. marnieae* and/or its habitat.

All landholders with land supporting *E. t. marnieae* will be contacted by the relevant government conservation agency. Workshops will be held where landholders will be provided with information about *E. t. marnieae* conservation and where open discussion of the issues relevant to the landholders can lead to appropriate conservation agreements. Development of guidelines for management of native grassland on private properties has been identified as a priority of the Grassy Ecosystems Reference Group, and is being pursued by the Victorian National Parks Association.

Landholder participation in conservation management activities is to be encouraged and assisted. Interim management for which financial assistance to landowners should be provided includes: fencing to exclude grazing, revegetation programs, wetland rehabilitation, predator control.

Results of studies to date suggest that the shrub component of the habitat is particularly important to *E. t. marnieae*. Interim management at many sites could include various measures to ensure the maintenance of this vegetation, perhaps also to provide for its enhancement. Similar enhancement of rock refuges may also be possible at some sites.

Other programs of potential benefit to management of *E. t. marnieae* habitat should be investigated and utilised (e.g. LandCare). Local government bodies should be approached to include *E. t. marnieae* habitat in specific conservation zonings. Water authorities will be approached to develop management practices sympathetic to conservation of *E. t. marnieae.*

Priority: 1
Agency(s) responsible for implementation of action: NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group	12	12	12	14	22	72
		NRE #	3	3	3	6	6	21
		other (TFN[4])	4	4	4	4	4	20
		total 3.5.5	**19**	**19**	**19**	**24**	**32**	**113**

The budget associated with this action is to provide for the costs of managing non-reserve areas, including largely capital expenses associated with habitat rehabilitation activities such as fencing and replanting.

3.5.6 ACTION: Periodically review guidelines for the management of *E. t. marnieae* habitat, as new information on the biology of the subspecies, and on threats and their amelioration, becomes available.

Management guidelines will be continually refined and updated as further information becomes available from the research actions (objective 3.3), identification of threats (objective 3.4), and monitoring (objective 3.6).

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1 ongoing	1	Biodiversity Group						0
		NRE #			1.5	1.5	1.5	4.5
		total 3.5.6	**0**	**0**	**1.5**	**1.5**	**1.5**	**4.5**

The budget associated with this action is to provide for the periodic review of management guidelines by NRE personnel and university researchers.

3.6 Specific Recovery Objective - Monitoring

To provide a basis for adaptive management, continually refine knowledge of the nature and extent of the processes which threaten *E. t. marnieae* by undertaking a comprehensive monitoring program.

Monitoring of *E. t. marnieae* populations and of their habitats and threats is essential, to continually assess the effects of management actions, to enable rapid response should populations decline, and to provide feedback such that management is continually refined.

Performance criterion:

- A monitoring program which is efficient and causes minimal habitat and behavioural disturbance is established across the distribution of the species to continually assess the effectiveness of management measures at ameliorating threatening processes, and to identify any threats as they may arise.

3.6.1 ACTION: Formulate and implement a minimum disturbance monitoring strategy to identify population trends at a representative series of sites.

Sixteen monitoring transects have been established throughout the distribution of *E. t. marnieae* and at sites where *E. t. marnieae* / *E. t. tympanum* intermediates occur. These will be used to track population changes, to experimentally assess effects of imposed management, and to refine management. They will be monitored at a low intensity annually, at least for the life of this plan, but preferably for much longer. In the short-term (3 years), some of these transects will be monitored much more frequently, at a greater intensity, as part of the research program (objective 3.3).

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRE, NRT to co-ordinate appropriate researcher(s).

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1 ongoing	1	Biodiversity Group	3	2	2	1	1	9
		NRE #	2	2	2	2	2	10
		total 3.6.1	**5**	**4**	**4**	**3**	**3**	**19**

The budget associated with this action is to provide for the field costs incurred during regular monitoring of sites, by NRE personnel, university researchers and others.

3.7 Specific Recovery Objectives - Salvage & Translocation

To determine if there is a need for salvage of individuals from doomed sites, to determine the feasibility of such measures, and to develop a protocol.

Currently, the National Recovery Team believes that removal of lizards from the wild for salvage purposes should be considered only as an absolute last resort. However, periodically, development decisions may cause sites supporting populations of *E. t. marnieae* to be unavoidably destroyed. If such developments proceed, then contingencies must be made to minimise effects on the overall conservation of *E. t. marnieae*. One possible contingency is the salvage of animals, either for captive maintenance (see objective 3.9) and/or research, or for potential translocation to other sites. Clear guidelines are needed on the circumstances under which such measures might be contemplated, their potential contribution to the recovery program, and their feasibility. A protocol must be established for their conduct.

Performance criteria:

- The need for salvage of animals has been examined.
- The feasibility and likelihood of success of salvage has been determined.
- Protocols for the circumstances under which salvage may be considered, and a methodology for doing so, have been developed.

3.7.1 ACTION: Determine the circumstances under which *E. t. marnieae* may be salvaged from doomed sites, and develop agreed protocols.

An approved project, with identified facilities and other appropriate resources must be available, and any costs of removal and maintenance are to be met by the developer/proponent.

Priority: 3
Agency(s) responsible for implementation of action: NRT to co-ordinate, with resources provided by any developer or proponent of such actions.

To determine if there is a need for translocation, to determine its feasibility, and to develop a protocol.

The National Recovery Team currently believes that translocation of animals from a site should only be contemplated in exceptional circumstances. Currently, there is a much higher priority placed on adequately conserving existing populations than on restoring or creating others.

However, translocation of animals for genetic purposes or for reintroduction is a potentially valuable tool in wildlife management. It is a complex and long-term undertaking, for which rigorous protocols must be in place, in accordance with international, commonwealth and state and territory guidelines. In the case of *E. t. marnieae*, a clear need must be established before translocation(s) are contemplated. For re-introductions, it will then be necessary firstly to identify sites where *E. t. marnieae* populations were once present but have since disappeared, and secondly to understand the cause of the local extinction, and eliminate or minimise the threat.

Performance criteria:

- The need for translocation of animals has been examined.
- The feasibility and likelihood of success of translocation has been determined.

- Protocols for the circumstances under which translocation may be considered have been formulated, a methodology for doing so has been developed, and there is general agreement on these guidelines.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
3	1	Biodiversity Group						0
		NRE #	2					2
		total 3.7.1	**2**	**0**	**0**	**0**	**0**	**2**

The budget associated with this action is to allow formulation of a salvage protocol, by NRE personnel, university researchers and others.

3.7.2 ACTION: Determine the potential objectives, feasibility and appropriateness of translocation.

Priority: 2
Agency(s) responsible for implementation of action: Further investigation into the need for this work and the likelihood of success is required before substantial effort is committed to it (see objective 3.3, research). NRT to co-ordinate.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
2	1	Biodiversity Group						0
		NRE #	2					2
		total 3.7.2	**2**	**0**	**0**	**0**	**0**	**2**

The budget associated with this action is to allow determination of the need for, and feasibility of, translocation, by NRE personnel, university researchers and others.

3.7.3 ACTION: Determine the circumstances under which *E. t. marnieae* may be translocated, and develop agreed protocols.

If translocation is considered appropriate, either for genetic reasons or for re-establishing populations, an agreed protocol, will be developed according to current international, commonwealth and state guidelines. One important consideration in any translocation program is the development of effective procedures for monitoring translocated animals, without which it is impossible to determine the success or failure of the translocation.

Priority: dependent on outcome of 3.7.2
Agency(s) responsible for implementation of action: The NRT will be responsible for considering reintroduction guidelines, deriving an agreed protocol and advising relevant agencies.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
depends on 3.7.2	1	Biodiversity Group						0
		NRE #		2				2
		total 3.7.3	**0**	**2**	**0**	**0**	**0**	**2**

The budget associated with this action is to allow formulation of a translocation protocol, by NRE personnel, university researchers and others.

3.8 Specific Recovery Objective - Community Participation

To increase landholder and other community awareness and knowledge, and involve the community in aspects of the recovery program.

There is great potential for community involvement in the conservation of *E. t. marnieae*, and natural temperate grasslands, and volcanic plain wetlands. Because many of the remaining patches of these environments are on private land, the involvement of the community will be critical to the successful recovery of both *E. t. marnieae* and its habitat.

In particular, landowner participation in and support for conservation programs will be crucial. Commitment from landholders towards conservation of this species may include a range of measures such as Conservation Covenants, Land for Wildlife membership, Land Care incentives, co-operative agreements, or less formal agreements on land management practices.

There are already several community groups which have made great contributions to both grassland and lizard conservation. The Friends of the Striped Legless Lizard is a Victorian community group which has been involved in several conservation-oriented programs.

Trust for Nature, the Victorian National Parks Association, LandCare groups and local government bodies may be pivotal in co-ordinating community efforts. All of these organisations, other similar groups, and individuals will be instrumental in the implementation of this Recovery Plan, and will be included in many actions. Organising more such groups will be a high priority as the Recovery Plan is implemented.

Performance criteria:

- Landholders participate in off-reserve management and conservation.
- Community is involved in National Recovery Team, and community groups take responsibility for some recovery actions and management of *E. t. marnieae* and its habitat.
- 'Web' site and other interpretive material available and widely distributed.

3.8.1 ACTION: Provide training for land managers involved in activities which may affect *E. t. marnieae* and its habitat.

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1 ongoing	1	Biodiversity Group						0
		NRE #	2	2	2			6
		total 3.8.1	**2**	**2**	**2**	**0**	**0**	**6**

The budget associated with this action is to support training exercises to be conducted by NRE personnel and others as appropriate.

3.8.2 ACTION: Approach interested landholders and other community groups to provide a forum for community participation in recovery actions.

Priority: 1
Agency(s) responsible for implementation of action: NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group						0
		NRE #	1	1	1			3
		total 3.8.2	**1**	**1**	**1**	**0**	**0**	**3**

The budget associated with this action is to allow co-ordination of community and conservation groups by NRE personnel.

3.8.3 ACTION: Encourage landholder and other community involvement in projects directed at the conservation of *E. t. marnieae* and native grasslands, and where possible provide support to these groups undertaking approved projects.

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group	3	3	3	2	4	15
ongoing		NRE #	2	2	2	2	2	10
		total 3.8.3	**5**	**5**	**5**	**4**	**6**	**25**

The budget associated with this action is to provide assistance, both logistic and financial, to community and conservation groups involved in projects supporting the implementation of this recovery plan.

3.8.4 ACTION: Publicise in various media the conservation status of *E. t. marnieae*, and encourage the reporting of any sightings.

Priority: 1 ongoing
Agency(s) responsible for implementation of action: NRT to guide community groups.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group						0
ongoing		NRE #	1	1	0.5	0.5	0.5	3.5
		total 3.8.4	**1**	**1**	**0.5**	**0.5**	**0.5**	**3.5**

The budget associated with this action is to allow co-ordination of publicity and appropriate follow-up, such as of any consequent records, by NRE personnel.

3.8.5 ACTION: Produce a 'Web' site and other materials on grasslands, volcanic plain wetlands, and *E. t. marnieae* conservation and management, for access by community groups, landholders, and private and government organisations.

Priority: 1 ongoing
Agency(s) responsible for implementation of action: EA, NRT, NRE.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
1	1	Biodiversity Group #	2	1	1	1	1	6
ongoing		NRE #						0
		total 3.8.5	**2**	**1**	**1**	**1**	**1**	**6**

The budget associated with this action is to employ a suitably qualified consultant to construct a Web site to support and encourage public participation in the recovery process.

3.9 Specific Recovery Objective - Captive Maintenance

To establish and maintain a captive population(s) of *E. t. marnieae* to support education and research elements of the Recovery Plan.

A captive colony of *E. t. marnieae,* derived from salvaged individuals or from the off-spring of translocated animals could be held in a zoo or reptile park for scientific studies, and secondarily displayed to educate the public about the state of threatened grasslands and their component species.

Performance criteria:

- The roles of captive populations of *E. t. marnieae* have been defined and goals set.
- Source(s) of animals for captive maintenance identified. Not to compromise natural populations.

3.9.1 ACTION: As required, use captive populations to conduct biological studies.

Currently no individuals are known to be held in captivity.

Priority: 3 ongoing
Agency(s) responsible for implementation of action: The NRT will co-ordinate and direct actions in consultation with relevant agencies.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
3	1	Biodiversity Group						0
		NRE						0
		other (MZ) #	4	2	2	2	2	12
		total 3.9.1	**4**	**2**	**2**	**2**	**2**	**12**

The budget associated with this action is for the capital costs associated with the establishment of a captive facility, and its subsequent maintenance by zoo personnel.

3.9.2 ACTION: As required, undertake research on captive animals, leading to an understanding of reproductive biology and breeding requirements.

Priority: 3 ongoing
Agency(s) responsible for implementation of action: Melbourne Zoo, with guidance from the NRT.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
3	2	Biodiversity Group						0
		NRE						0
		other (MZ) #	1.5	1.5	1.5	1.5	1.5	7.5
		total 3.9.2	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**7.5**

The budget associated with this action is to support appropriate research and observations by zoo personnel.

3.9.3 ACTION: Use captive animals to heighten community understanding of the conservation of *E. t. marnieae* and its grassland habitat.

The well-interpreted display of threatened species is an acknowledged role of zoos in conservation, with the aim of increasing visitor understanding of the range of threats and their respective solutions.

Priority: 3 ongoing

Agency(s) responsible for implementation of action: : The NRT will co-ordinate and direct actions in consultation with relevant agencies.

Priority	Feasibility	Responsible Party	Cost estimates ($000s/year)					
			Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
3	1	Biodiversity Group						0
		NRE						0
		other (MZ) #	0.5	0.5	0.5	0.5	0.5	2.5
		total 3.9.3	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**2.5**

The budget associated with this action is for the costs associated with public interpretation of the captive facility, by zoo personnel.

4. IMPLEMENTATION SCHEDULE AND COSTINGS

Action No.	Task Description	Prior.	Feas.	Responsible Party	Cost estimates ($000s/year)					
					Yr 1	Yr 2	Yr 3	Yr 4	Yr5	Total
3.1.1	Recovery Team	1 ongoing	1	Biodiversity Group #	0.5	0.5	0.5	0.5	0.5	2.5
				NRE #	1.5	1.5	1.5	1.5	1.5	7.5
				total 3.1.1	**2**	**2**	**2**	**2**	**2**	**10**
3.2.1	Broad habitat distribution	1	1	Biodiversity Group						0
				NRE #	1					1
				total 3.2.1	**1**	**0**	**0**	**0**	**0**	**1**
3.2.2	Targeted surveys	1	1	Biodiversity Group	1					1
				NRE #	2					2
				other (RAG[1])	6					6
				total 3.2.2	**9**	**0**	**0**	**0**	**0**	**9**
3.3.1	Genetic variability	1	1	Biodiversity Group	20	5				25
				NRE						0
				other # (SAM[2])	20	5				25
				total 3.3.1	**40**	**10**	**0**	**0**	**0**	**50**
3.3.2 to 3.3.4	Ecological research (postgraduate study underway)	1	1	Biodiversity Group	4	4	4			12
				NRE	5	5	5			15
				other # (LaTrobe[3])	19.5	19.5	19.5			58.5
				total 3.3.2 - 3.3.4	**28.5**	**28.5**	**28.5**	**0**	**0**	**85.5**
3.3.5 to 3.3.11	Ecological research (potential postgraduate study)	1 (+2)	1	Biodiversity Group	21.5	21.5	21.5			64.5
				NRE	5	5	5			15
				other # (LaTrobe[3])	2	2	2			6
				total 3.3.5 - 3.3.11	**28.5**	**28.5**	**28.5**	**0**	**0**	**85.5**
3.3.12	Population viability analyses	1	2	Biodiversity Group #				20		20
				NRE #						0
				total 3.3.12	**0**	**0**	**0**	**20**	**0**	**20**
3.4.1	Threats	1 ongoing	1	Biodiversity Group #						0
				NRE #	1.5	1.5	1.5	1.5	1.5	7.5
				total 3.4.1	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**7.5**
3.5.1	Priority list sites	1	1	Biodiversity Group						0
				NRE #	0.5	0.5				1
				total 3.5.1	**0.5**	**0.5**	**0**	**0**	**0**	**1**
3.5.2	Reservation	1	3	Biodiversity Group	*potential costs unknown*					0
				NRE #						0
				other						0
				total 3.5.2	**0**	**0**	**0**	**0**	**0**	**0**
3.5.3	Management agreements	1 ongoing	1	Biodiversity Group						0
				NRE #	3	3	3	3	3	15
				other (TFN[4])	3	3	3	3	3	15
				total 3.5.3	**6**	**6**	**6**	**6**	**6**	**30**
3.5.4	Interim management reserves	1	1	Biodiversity Group		3	3	3	10	19
				NRE #	2	2	2	5	5	16
				total 3.5.4	**2**	**5**	**5**	**8**	**15**	**35**
3.5.5	Interim management non-reserves (fencing and signage, vegetation & wetland & rock rehabilitation, predator control)	1	1	Biodiversity Group	12	12	12	14	22	72
				NRE #	3	3	3	6	6	21
				other (TFN[4])	4	4	4	4	4	20
				total 3.5.5	**19**	**19**	**19**	**24**	**32**	**113**
3.5.6	Review management guidelines	1 ongoing	1	Biodiversity Group						0
				NRE #			1.5	1.5	1.5	4.5
				total 3.5.6	**0**	**0**	**1.5**	**1.5**	**1.5**	**4.5**
3.6.1	Monitoring	1 ongoing	1	Biodiversity Group	3	2	2	1	1	9
				NRE #	2	2	2	2	2	10
				total 3.6.1	**5**	**4**	**4**	**3**	**3**	**19**
3.7.1	Salvage protocol	3	1	Biodiversity Group						0
				NRE #	2					2
				total 3.7.1	**2**	**0**	**0**	**0**	**0**	**2**
3.7.2	Translocation feasibility	2	1	Biodiversity Group						0
				NRE #	2					2
				total 3.7.2	**2**	**0**	**0**	**0**	**0**	**2**
3.7.3	Translocation protocol	depends on 3.7.2	1	Biodiversity Group						0
				NRE #		2				2
				total 3.7.3	**0**	**2**	**0**	**0**	**0**	**2**
3.8.1	Training	1 ongoing	1	Biodiversity Group						0
				NRE #	2	2	2			6
				total 3.8.1	**2**	**2**	**2**	**0**	**0**	**6**
3.8.2	Request community participation	1	1	Biodiversity Group						0
				NRE #	1	1	1			3
				total 3.8.2	**1**	**1**	**1**	**0**	**0**	**3**
3.8.3	Support community participation	1 ongoing	1	Biodiversity Group	3	3	3	2	4	15
				NRE #	2	2	2	2	2	10
				total 3.8.3	**5**	**5**	**5**	**4**	**6**	**25**
3.8.4	Media and reporting	1 ongoing	1	Biodiversity Group						0
				NRE #	1	1	0.5	0.5	0.5	3.5
				total 3.8.4	**1**	**1**	**0.5**	**0.5**	**0.5**	**3.5**
3.8.5	Web site & interpretive materials	1 ongoing	1	Biodiversity Group #	2	1	1	1	1	6
				NRE #						0
				total 3.8.5	**2**	**1**	**1**	**1**	**1**	**6**
3.9.1	Captive studies	3	1	Biodiversity Group						0
				NRE						0
				other (MZ) #	4	2	2	2	2	12
				total 3.9.1	**4**	**2**	**2**	**2**	**2**	**12**
3.9.2	Captive reproduction	3	2	Biodiversity Group						0
				NRE						0
				other (MZ) #	1.5	1.5	1.5	1.5	1.5	7.5
				total 3.9.2	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**7.5**
3.9.3	Captive interpretation	3	1	Biodiversity Group						0
				NRE						0
				other (MZ) #	0.5	0.5	0.5	0.5	0.5	2.5
				total 3.9.3	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**2.5**
				TOTALS	**164**	**121**	**110**	**75.5**	**72.5**	**542.5**
				EA / BG totals	***67***	***52***	***47***	***41.5***	***38.5***	***246***

\# parties identified in Recovery Plan with lead responsibility.

1 Funds received.

2 Contribution of staff time and laboratory facilities.

3 Comprises postgraduate research scholarship (allocated), support funds, facilities, supervision and staff time.

4 Costs associated with administration of conservation agreements.

5. PREPARATION DETAILS

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5.3 Review date

This Recovery Plan is due for review in 2003.

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7. APPENDICES

7.1 Appendix A: Conservation status and administrative details

7.1.1 Current conservation status

International
IUCN (1996).
Endangered
ANZECC (1995)
Endangered

National
Endangered Species Protection Act 1992 (Commonwealth),
ESAC *Priority A*
Action Plan for Australian Reptiles (Cogger *et al.* 1993).
Endangered

Victoria
Schedule 2 of the *Flora and Fauna Guarantee Act* 1988.
Threatened Taxon
Threatened Fauna in Victoria – 1995 (CNR 1995).
Endangered
Threatened Vertebrates in Victoria – 1998 (NRE in prep.).
Critically Endangered

7.1.2 Relevant legislation

The following legislation has a direct impact on the conservation of *E. t. marnieae*:

- The *Endangered Species Protection Act*, 1992 (Commonwealth)
- the *Wildlife Protection Act*, 1982 (Commonwealth)
- the *Quarantine Act*, 1908 (Commonwealth)
- the *Customs Act*, 1901 (Commonwealth)
- the *National Parks and Wildlife Conservation Act*, 1975 (Commonwealth)
- the *Flora and Fauna Guarantee Act*, 1988 (Vic.)
- the *Wildlife Act*, 1975 (Vic.)
- the *Planning and Environment Act*, 1987 (Vic.)
- the *Conservation, Forests and Land Act*, 1987 (Vic.)

7.1.3 Agencies involved

National
Environment Australia

Victoria
Department of Natural Resources and Environment
Parks Victoria
Trust for Nature
Corangamite Catchment and Land Protection Board
Corangamite, Colac-Otway, Golden Plains, Pyrenees, Ararat and Moyne Shires

7.2 Appendix B: Directory of relevant past and current research

Only three studies of *E. t. marnieae* have been conducted:

- Hutchinson, M. N. and Rawlinson, P. A. (1995). The Water Skinks (Lacertilia: *Eulamprus*) of Victoria and South Australia. *Records of the South Australian Museum* **28(2)**: 185-207.

  - Description of subspecies, some details on habitat and reproduction. Speculation regarding genetics.

- Peterson, G. (1997). Ecology, evolution and conservation of the *Eulamprus quoyii* complex in central southwestern Victoria. Unpublished B.Sc. Honours thesis, La Trobe University.

  - Investigation of morphology and habitat use, information on reproduction and diet.

- Robertson, P., Peterson, G. and Malone, B. (1999). Survey for the Corangamite Water Skink, *Eulamprus tympanum marnieae*. Unpublished report to Department of Natural Resources and Environment.

  - Details of distribution and habitat use, some morphological information.

7.3 Appendix C: List of all known populations of *E. t. marnieae*, and status of sites and populations

Site	Population	Status	Area of habitat occupied (ha)	Land use
3 km N. E. of Dreeite, at the end of Hays Rd	Dreeite	Extant	0.5	Grazing
2 km N. E. of Dreeite on Hays Rd	Dreeite	Extant	0.09	Grazing
4 km N. and N. E. of Dreeite, N. of Hays Rd	Dreeite	Extant	0.24	Grazing
4 km E. of Dreeite just N. of the Dreeite Beeac Rd (two lakes)	Dreeite	Extant	0.8	Grazing
5 km E. of Dreeite on Dreeite Beeac Rd	Dreeite	Extant	0.01	Grazing
4 km E. of Dreeite on Duckholes Rd	Dreeite	Extant	0.05	Grazing
Lake Coraguluc, Alvie	Red Rock	Extant	0.23	Grazing
2 km S. W. of Alvie just off Baynes Rd	Red Rock	Extant	0.04	Grazing
Eastern shore Lake Corangamite, 4km S. E. of Wool Wool	Wool Wool	Extant	1.13	Grazing
Eastern shore Lake Corangamite Wool Wool Rd, Wool Wool	Wool Wool	Extant	0.35	Grazing
2 km E. of Wool Wool on Reads Rd	Wool Wool	Extant	0.08	Grazing
Eastern shore Lake Corangamite, Nalangil Rd, 4 km N. of Nalangil	Nalangil	Extant	0.65	Conservation
Eastern shore Lake Corangamite, Nalangil Rd, 3 km N. of Nalangil	Nalangil	Extant	0.75	No direct use
Southeastern shore Lake Ondit, 4 km W. of Ondit	Lake Colac	Extant	0.58	Grazing
Northeastern shore Lake Colac, Meredith Park, 3 km W. of Ondit	Lake Colac	Extant	0.15	Grazing/Recreation
The Points, western shore Lake Colac 2.5 km S. E. of Balintore	Lake Colac	Extant	0.9	No direct use
Rosemoyne Park, western shore Lake Colac, 4.5 km E. of Cororooke	Lake Colac	Extant	0.18	Recreation
Northern shore Deep Lake, 4 km N. W. of Derrinallum	Derrinallum	Extant	0.38	Recreation
Eastern shore Lake Logan, 5 km N. W. of Derrinallum	Derrinallum	Extant	0.24	Grazing
Lake 2 km S. E. of Vite Vite North	Vite Vite	Extant	0.08	Grazing
Mt Fyans lake Woorndoo Dundonnell Rd, 2 km S. W. of Dundonnell	Dundonnell	Extant	1.28	Grazing
Deep Lake, 4 km S. E. of Nerrin Nerrin just off the Nerrin Pura Rd	Nerrin Nerrin	Extant	0.8	Grazing
Paddy Lake, 2.5 km E. of Nerrin Nerrin	Nerrin Nerrin	Extant	0.07	Grazing
Lake 1 km N. of Lake Gellie, 4 km W. of Pura Pura	Nerrin Nerrin	Extant	0.6	Grazing
Northern shore Lake Gellie, 4 km W. of Pura Pura	Nerrin Nerrin	Extant	0.13	Grazing
Lake Bolac, just south of Lake Bolac caravan park	Lake Bolac	Extinct	nil	Recreation
East Beach Rd, Lake Bolac 2 km E. of the township of Lake Bolac	Lake Bolac	Extant	0.35	Recreation
Lismore	Lismore	Extinct	nil	Grazing
Gnarput Rd, 8 km S. of Lismore	Lismore	Extant	0.4	Grazing