

Recovery plan for the magnificent broodfrog *Pseudophryne covacevichae* 2000–2004

Prepared by K.R. McDonald, E. Bolitho, A. Dennis, N. Simpson and J.W. Winter



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2000-2004**

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Prepared by: K.R. McDonald, E. Bolitho, A. Dennis, N. Simpson and J.W. Winter.

Copies may be obtained from the:
Executive Director
Queensland Parks and Wildlife Service
PO Box 155
Brisbane Albert St QLD 4002

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Summary

This document is a five year plan for the recovery of the magnificent broodfrog *Pseudophryne covacevichae*, a species restricted to a small area near Ravenshoe, north Queensland. *P. covacevichae* has been found at 22 discrete sites with 36 populations over an area 27km by 9km. *P. covacevichae* is currently listed as vulnerable under the Queensland *Nature Conservation (Wildlife) Regulation 1994* and the *Environment Protection and Biodiversity Conservation Act 1999*. However, a recent re-assessment using the 1994 IUCN criteria indicates that the species is endangered.

The plan is to be reviewed by the Northern Queensland Threatened Frogs Recovery Team and two independent reviewers at the end of its third year.

Habitat

P. covacevichae have been found around seepage areas in eucalypt open forests and appear to be restricted to specific habitats. All records of the frog have been on the rhyolites of the Glen Gordon Volcanics above 800m in altitude. Seepage areas on the steeper slopes of the volcanics are potential sites for the frog.

Threats

Habitat loss and degradation appear to be the greatest threats to *P. covacevichae*. Ninety-seven percent of frog sites are located on unprotected land, most of which is in state forest or timber reserve. Several activities are likely to impact on the amount and quality of the frog's habitat, including grazing, logging, road works, clearing and development. The population at the Ravenshoe rubbish dump has declined. Dump activities have destroyed or modified habitat, and previously known populations are now absent.

General objective

To improve the status of *P. covacevichae* through survey for new populations and through implementing relevant management and site protection for at least 50 percent of sites within five years.

Specific objectives

1. To identify land uses and practices which may impact on habitat quality.
2. To identify and protect the known sites at greatest risk of degradation.
3. To design simple and effective guidelines and protective measures for *P. covacevichae* populations which can be implemented by land managers and users.
4. To obtain hydrological and ecological information about *P. covacevichae* affected by the impact of management actions.
5. To support further efforts to locate new populations based on the frog's habitat preference.
6. To engage local governments and community groups interested in conservation of *P. covacevichae*.
7. To involve interested community groups in locating and monitoring populations and in their management.

Criteria

1. Frog sites are protected from habitat damage.
2. Government agency, local government and community use guidelines and protective measures are established.

3. Landholders enter into voluntary conservation agreements and government agencies into Memorandums of Understanding to protect *P. covacevichae* habitat.
4. Population numbers and the number of specific habitat sites remain at existing levels or increase with more sites being located within a wider distribution area.
5. Ecological information is incorporated into management arrangements for the frog.
6. Community groups are aware of and involved with conservation of the frog.

Actions

1. Formation of a Magnificent Broodfrog Working Group.
2. Habitat protection and management.
3. Population monitoring and assessment.
4. Public information and participation.
5. Ecological and habitat investigations.

1 Introduction

Pseudophryne covacevichae is a strikingly coloured frog found only in the vicinity of Ravenshoe, north Queensland. Until recently it was only known from a few locations to the west of Ravenshoe.

The species is disjunct from any other *Pseudophryne* species and has a distribution that is very localised in comparison to other members of the genus. It is poorly represented in conservation reserves and is in an area subject to logging, mining and grazing.

As a result of concern for the future survival of *P. covacevichae*, a program involving the community, landholders and government agencies was initiated and this recovery plan was produced.

1.1 Description of species

Pseudophryne covacevichae Ingram and Corben, 1994, magnificent broodfrog.

A small frog with a snout-vent length between 24 and 28mm, it is distinguished from other members of the genus by a bright rufous, rusty brown or yellow triangular patch from the upper snout to the forehead. This colouration continues along the back and is usually bordered by diffuse dark patches. The sides and forearms of the frog are uneven grey, peppered with white and dark spots. The upper arms are bright yellow. The cloaca is surrounded by a bright yellow patch or line. The ventral surface of the frog is strikingly marbled with black and white. The skin sometimes possesses scattered tubercles above, but is smooth below (Ingram and Corben 1994, Cogger 2000).

The advertisement call is a short, squelch-like 'ark' repeated at irregular intervals although males will also give rapid chirping calls when disturbed (K.R. McDonald, unpubl. data).

The tadpole is quite distinctive appearing generally black with dark pigmentation on the upper fin and on the distal third of the lower fin. At the stage when limbs develop on the tadpole, a distinct pale patch forms where the tail meets the body. This darkens to a light yellow as the tail is resorbed (K.R. McDonald, unpubl. data). *P. covacevichae* metamorphs can be distinguished from other species by the distinctive pale yellow marking above the cloaca and cream-coloured upper arms.

1.2 Distribution

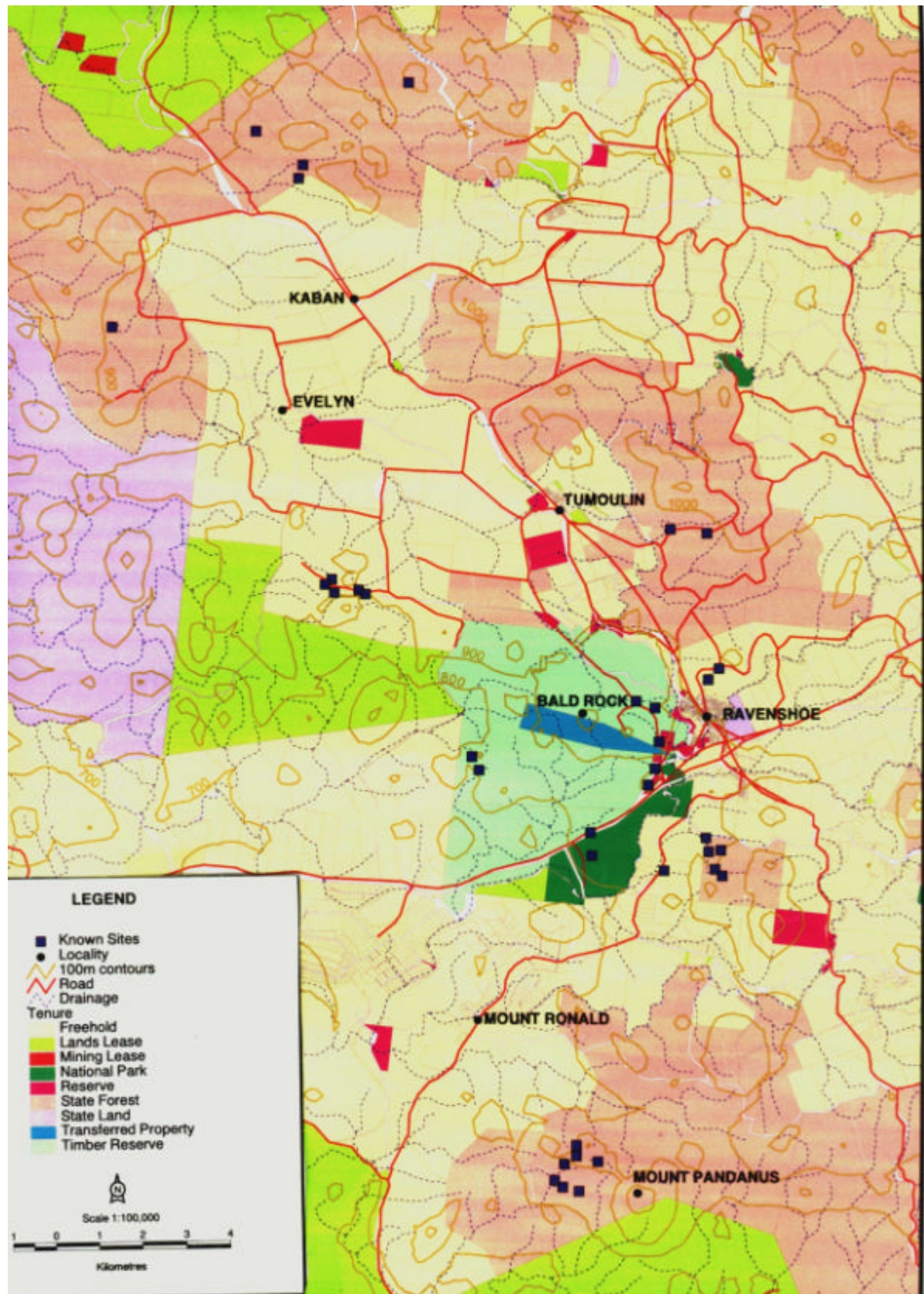
P. covacevichae is known only from a small area near Ravenshoe, north Queensland. It has been found at 22 discrete sites with 36 populations over an area 27km by 9km, from the Bluff State Forest (SF 754 - 17° 28' 42", 145° 25' 17") to Ravenshoe State Forest (SF 251 - 17° 42' 21", 145° 27' 24"). Within this area, frogs have been found on Timber Reserve 245, State Forests 754, 488, and 251, Millstream National Park and Ravenshoe rubbish dump reserve, road reserves and freehold land (K.R. McDonald, unpubl. data; J.W. Winter, unpubl. data). Table 1 lists tenures and localities where *P. covacevichae* has been found and Figure 1 shows a map of these sites.

Table 1. Localities and land tenure of magnificent broodfrog sites.

SF - State Forest; TR - Timber Reserve; NP - National Park; RR - Road Reserve; LGR - Local Government Reserve; F - Freehold land.

Locality	Lat/Long	Land Tenure	Locality	Lat/Long	Land Tenure
Bluff SF SF 754 (1)	17° 28' 43" 145° 25' 17"	SF	Timber Res 245 (3)	17° 36' 49" 145° 28' 23"	TR
Bluff SF SF 754 (2)	17° 29' 18" 145° 23' 24"	SF	Timber Res 245 (4)	17° 37' 10" 145° 26' 09"	TR
Bluff SF SF 754 (3)	17° 29' 43" 145° 21' 59"	SF	Timber Res 245 (5)	17° 37' 56" 145° 27' 32"	TR
Evelyn Ck	17° 31' 43" 145° 21' 38"	SF	Cemetery Ck	17° 37' 09" 145° 28' 20"	TR
Diddleluma Ck	17° 34' 57" 145° 24' 40"	F	Ravenshoe Rubbish Dump	17° 37' 21" 145° 28' 15"	LGR
Archer Ck	17° 34' 49" 145° 24' 20"	F	Millstream NP	17° 38' 13" 145° 27' 33"	NP
Tumoulin SF SF 438 (1)	17° 34' 12" 145° 28' 33"	SF	Bally Knob SF 488	17° 38' 09" 145° 29' 10"	SF
Tumoulin SF SF 438 (2)	17° 34' 15" 145° 28' 58"	SF	Wooroora Rd SF 488	17° 38' 24" 145° 28' 27"	SF
Monument St	17° 35' 55" 145° 29' 07"	RR	Breakoday Ck SF 251	17° 41' 47" 145° 27' 22"	SF
Timber Res 245 (1)	17° 36' 19" 145° 28' 06"	TR	Pandanus Ck SF 251	17° 41' 59" 145° 27' 38"	SF
Timber Res 245 (2)	17° 36' 24" 145° 28' 20"	TR	Gorge Ck SF 251	17° 42' 13" 145° 27' 06"	SF

Figure 1. Known distribution of *Pseudophryne covacevichae*



1.3 Abundance of the species

Since description of the species in 1994, there has been limited research and monitoring of the populations of this frog. Due to the scattered nature of the small populations and the limited data available, it is difficult to estimate the abundance of the species. The known populations cover small areas with the largest approximately 0.5ha in area. Most sites are less than 0.1ha. Estimated total area of occupancy is less than 50ha. The number of calling males at each site ranges from 1-20.

1.4 Habitat

P. covacevichae have been found around seepage areas in open eucalypt forests (K.R. McDonald, unpubl. data). The dominant species include *Eucalyptus acmenoides*, *E. citriodora*, *E. intermedia*, *E. leichhardtii*, *E. reducta*, *E. resinifera* and *Syncarpia glomulifera*. The understorey of these forests is comprised of *Themeda triandra*, *Xanthorrhoea* sp., *Gahnia* sp., *Lophostemon suaveolens*, *Allocasuarina littoralis* and *A. torulosa* (J.W. Winter, unpubl. data). Most seepage areas support tussocks of *Themeda triandra*. However, where cattle grazing has reduced this cover, the frogs have been located in leaf litter build-up within first order streams (K.R. McDonald, unpubl. data).

P. covacevichae appears to be restricted to specific habitats. All records of the frog have been on the rhyolites of the Glen Gordon Volcanics with altitudes above 800m. Seepage areas on the steeper slopes of the volcanics are potential sites for the frog. It is not known what habitat the frogs use over the dry season.

As the total population size is likely to be very small, all of the known habitat is considered to be critical for survival.

1.5 Life history and ecology

Little is known about the life history of this frog. Natural history information was gathered during surveys on reproduction and is currently being analysed (K.R. McDonald and A. Dennis, unpubl. data).

As with most species of the genus, *P. covacevichae* is primarily nocturnal although males may call on overcast days. Generally, males call on warm, wet summer and autumn nights and have been observed calling near egg clutches in seepage areas, generally at the base of grass tussocks (K.R. McDonald, unpubl. data).

Eggs are laid on moist soil in or near a seepage, usually under vegetation. Clutches from 6-82 eggs have been located in the field (J.W. Winter, unpubl. data; K.R. McDonald, unpubl. data) and in larger clutches it has been noted that eggs were at different stages of development. This may indicate that clutches contain the eggs of several females or the same female returning, attracted to a single male's call. The eggs have a thick membrane and are of a large size (approximately 2mm in diameter). It appears that the development of the eggs pauses prior to hatching (K.R. McDonald, unpubl. data). After hatching, the tadpole makes its way down the seepage or is washed into first order streams where development continues in small pools.

The diet of the frog is unknown but is likely to be made up of small ground-dwelling arthropods.

1.6 Threats

Habitat loss and degradation appear to be the greatest threats to *P. covacevichae*. Its habitat occurs on land under a variety of tenures, including national parks, state forests, local government reserves, grazing leasehold properties, crown land,

freehold lands and road reserves. Ninety-seven percent of frog sites are located on unprotected land, most of which is in state forest or timber reserve. There are several activities likely to occur on these lands which may impact on the amount and quality of the frog's habitat, including grazing, logging, road works, clearing and development. Habitat in the south-east of Timber Reserve 245 and Tumoulin State Forest has been severely affected by cattle grazing. Grazing and trampling has the potential to degrade and destroy the seepage areas used by the frogs for breeding. Similarly, erosion and subsequent siltation may cover seepage areas if future logging or clearing occurs. Roads and cuttings can alter the water quality and hydrology and may affect seepage areas and first order streams. Regrowth forest uses more water than old growth and therefore has the potential to reduce seepages.

The population at the Ravenshoe rubbish dump has declined. Dump activities have destroyed or modified habitat, and previously known populations are now absent.

1.7 Conservation status and reasons for listing

P. covacevichae was first described in 1994 as a separate species from *Pseudophryne major* (Ingram and Corben 1994). *P. covacevichae* is currently listed as vulnerable under the Queensland *Nature Conservation (Wildlife) Regulation 1994* the *Environment Protection and Biodiversity Conservation Act 1999* and the ANZECC list of threatened vertebrate fauna. However, a recent re-assessment using the 1994 IUCN criteria indicates that the species is endangered, meeting criteria B1 and B2c and d. The parameters used in determining this listing include small known distribution, fragmented populations and low population density.

1.8 Existing conservation measures

Few existing conservation measures protect *P. covacevichae*. Only three percent of known populations are protected on national parks. Land use practices permitted in areas where the remaining 97 percent of known populations occur, have the potential to damage frogs and their habitat.

QPWS is providing support for continuing frog population monitoring. Posters and a brochure have been produced and community participation encouraged through newspaper articles and consultation.

1.9 Strategy for conservation

The conservation strategy is based on the following measures.

1. Determine specific habitat requirements of *P. covacevichae*.
2. Use known habitat requirements to predict other areas of potential habitat for targeted surveys.
3. Continue to monitor populations.
4. Determine the actions needed to reduce degradation and restore known sites.
5. Implement protective procedures at high-risk sites.
6. Conduct detailed ecological studies to determine the stability of known populations, and to collect information relevant to population management.
7. Conduct exclusion trials to assess the impact of cattle grazing on *P. covacevichae* populations on state forests.

1.10 Biodiversity benefits

A number of rare and threatened species occur in the region. Actions taken to implement the recovery plan will not have any negative impact on these species and, if grazing is reduced on leases held on state forest, may benefit them. Many of the plants and animals occur in rugged rocky areas adjacent to localities for the magnificent broodfrog.

Table 2. Rare and threatened species occurring in the region.

E- Endangered, R - Rare, V - Vulnerable.

Scientific Name	Common Name	Status (NCA)
Fauna		
<i>Libythea geoffroy nicevillei</i>	purple beak butterfly	V
<i>Litoria nannotis</i>	waterfall frog	E
<i>Litoria rheocola</i>	common mistfrog	E
<i>Nyctimystes dayi</i>	Australian lace-lid	E
<i>Pseudophryne covacevichae</i>	magnificent broodfrog	V
<i>Litoria revelata</i>	whirring treefrog	R
<i>Litoria genimaculata</i>	green-eyed treefrog	R
<i>Acanthophis antarcticus</i>	common death adder	R
<i>Erythrotriorchis radiatus</i>	red goshawk	E
<i>Ninox rufa queenslandica</i>	rufous owl (southern subspecies)	V
<i>Accipiter novaehollandiae</i>	grey goshawk	R
<i>Lophoictinia isura</i>	square-tailed kite	R
<i>Collocalia spodiopygius</i>	white-rumped swiftlet	R
<i>Rallus pectoralis</i>	Lewin's rail	R
<i>Petaurus australis reginae</i>	yellow-bellied glider (northern subspecies)	V
Flora		
<i>Peripleura scabra</i>		R
<i>Macropteranthes montana</i>		V
<i>Lastreopsis walleri</i>		V
<i>Leucopogon spathaceus</i>		R
<i>Hemigenia clotteriana</i>		E
<i>Bertya polystigma</i>		R
<i>Lysiana filifolia</i>		R
<i>Acacia purpureipetala</i>		V
<i>Acacia longipedunculata</i>		R
<i>Corymbia rhodops</i>		V
<i>Eucalyptus lockyeri</i> subsp. <i>exuta</i>		R
<i>Eucalyptus lockyeri</i> subsp. <i>lockyeri</i>		R
<i>Homoranthus porteri</i>		V
<i>Dipodium ensifolium</i>		R
<i>Diuris oporina</i>		R
<i>Grevillea glossadenia</i>		V
<i>Zieria</i> sp. (Herberton J.A.Armstrong 1025)		V
<i>Prostanthera atrovioleacea</i>		R

2 Conservation objectives and criteria

2.1 Conservation Objectives

General objective: To improve the status of *P. covacevichae* through survey for new populations and through implementing relevant management and site protection for at least 50 percent of sites within five years.

Specific objectives of the conservation effort are to:

1. To identify land uses and practices which may impact on habitat quality.
2. To identify and protect the known sites at greatest risk of degradation.
3. To design simple and effective guidelines and protective measures for *P. covacevichae* populations which can be implemented by land managers and users.
4. To obtain hydrological and ecological information about *P. covacevichae* affected by the impact of management actions.
5. To support further efforts to locate new populations based on the frog's habitat preference.
6. To engage local governments and community groups interested in conservation of *P. covacevichae*.
7. To involve interested community groups in locating and monitoring populations and in their management.

2.2 Assessment criteria

The criteria for successfully achieving the objectives of the conservation plan will be:

- frog sites are protected from habitat damage,
- government agency, local government and community use guidelines and protective measures are established,
- landholders enter into voluntary conservation agreements and government agencies into Memorandums of Understanding to protect *P. covacevichae* habitat,
- population numbers and the number of specific habitat sites remain at existing levels or increase with more sites being located within a wider distribution area,
- ecological information is incorporated into management arrangements for the frog, and
- community groups are aware of and involved with conservation of the frog.

3 Conservation actions

Actions proposed for implementation of this recovery plan are:

1. Formation of a magnificent broodfrog Working Group.
2. Habitat protection and management.
3. Population monitoring and assessment.
4. Public information and participation.
5. Ecological and habitat investigations.

3.1 Magnificent broodfrog Working Group.

A Magnificent Broodfrog Working Group (MBFWG) needs to be established to undertake the actions under the recovery plan and this group will then report their progress to the Northern Queensland Threatened Frogs Recovery Team (NQTFRT). NQTFRT is made up of state and local government, community and stakeholder representatives who meet twice yearly to guide, evaluate and review work towards the recovery of threatened frog species. A member of the MBFWG will represent the group on the NQTFRT. The recovery team will review progress towards implementation of actions and copies of all reports resulting from the work will be forwarded to the recovery team.

Attempts will be made to include representation from indigenous groups on the NQTFRT so that the Working Group can take account of the interests of indigenous people.

3.2 Habitat protection and management

Given that the known habitat of *P. covacevichae* occurs under a range of land tenures, it is necessary to identify the sites at the highest risk of destruction or degradation. The 22 known sites will be visited with a view to categorising them into high risk, medium risk and low risk sites on the basis of current land use practices and level of legislative protection. Once sites at high risk are identified, the stakeholders will be informed and every effort made to encourage them to assist in managing habitat at these sites.

The actions needed to protect *P. covacevichae* sites will vary depending on tenure and current land use practices. Where the sites at high risk are on private land, QPWS officers could initiate voluntary conservation agreements with landholders. In such cases, landholders could be involved with monitoring and should regularly receive feedback. Sites at high risk in state forests and timber reserves could be gazetted as scientific reserves under the *Forestry Act 1959* or declared as conservation reserves under the *Nature Conservation Act 1992*. Grazing policy will need to be addressed where the frogs are found on state forests and timber reserves. Consultation with managers of crown lands will be required to help design appropriate conservation measures while at the same time maintaining the ecologically sustainable use of natural resources. Other forms of protection of sites could include fencing off seepage areas in heavily grazed areas and leaving buffer zones of vegetation around seepage areas and first order streams through an adaptive management program. Exclusion trials will be conducted to assess the impact of cattle grazing.

A set of guidelines will be developed to help local government and stakeholders protect populations of *P. covacevichae* when planning future development or changes in land use. The guidelines will suggest possible protective measures for frog

populations under different situations. The Department of Natural Resources is developing a Species Management Profile (SMP) for *P. covacevichae*. The SMP provides guidelines for protection of the species during forest management activities on state forests and timber reserves.

The social and economic impact of the recovery plan will be minimal. Frog sites are highly restricted in area and management actions identified in the plan will generally affect the immediate site only. Sites can be protected by actions such as fencing off the immediate area.

Project Costing over two years:

Fencing for cattle exclusion areas in State Forests	\$ 7500
Salaries (extension officer)	\$ 5250
SMP	\$ 500
Total costs:	\$13,250

3.3 Population monitoring and assessment

Regular intensive monitoring will be carried out at one site in each area with other sites being visited during the breeding season to confirm the continuing presence of the frog, and to ensure that sites are not being damaged by land use practices. Mark-recapture surveys and tadpole surveys will be undertaken during intensive monitoring and estimates of abundance of adults and tadpoles will be made during breeding season visits.

During the intensive monitoring, detailed information about individuals in the population will be collected, for example, weight, length, sex, reproductive state, microhabitat choice, activity level, population density, predators, and climatic conditions. Such information contributes to understanding the natural population dynamics and ecology of the species and may provide forewarning of any decline in numbers.

Preliminary predictions using the GIS program DOMAIN, based on known localities of *P. covacevichae*, have identified additional, potential areas which need to be searched. These areas are mainly in the steeper Glen Gordon Volcanics. Given that *P. covacevichae* has been recorded only from high altitude seepage areas on Glen Gordon Volcanic soils, efforts will be directed to survey any sites that fulfil these criteria.

Annual costs (over five years):

Vehicle costs :	\$ 1200
Consumables :	\$ 500
Community liaison:	\$ 1000
Casual Wages :	\$10,000
Total costs:	\$12,700

3.4 Public information and participation

As *P. covacevichae* has such a restricted distribution, its conservation presents an ideal opportunity for local community involvement. As a strikingly coloured frog easily identified, it provides a good subject for community ownership. If community ownership can be encouraged, conservation of the frog and its habitat will be easier. A public awareness campaign began in late 1998 with the production of a poster and a pamphlet prepared by QPWS and the Tablelands Frog Club.

Members of the local community who are interested in conserving the frog will be identified. This may be achieved through continued use of local and state media

whenever possible, extension work by QPWS officers and by targeting groups such as schools, local council, local conservation groups and tourists. Information evenings could be held by QPWS at Ravenshoe to encourage local participation in frog conservation. The Ravenshoe community has a tourist information centre which could house a display of photographs and information (updated as more becomes known) about *P. covacevichae*. This display could also be used as a contact point for people interested in helping to monitor populations. Interested members of the public can participate in the monitoring and management of *P. covacevichae*.

Responsibility: Tablelands Frog Club, Cape York Herpetological Society, Herberton Shire Council, Ravenshoe Visitor Information Centre, QPWS, DNR.

Costing:

Display:

Casual wages \$ 550

Display materials \$ 500

Total Costs: \$1050

3.5 Ecological and habitat investigations

Basic biological and ecological information is required in order to efficiently and effectively conserve *P. covacevichae*. Information about its micro-habitat requirements is very important for habitat protection. Adults have mainly been found in seepage areas but nothing is known about dry season habitat use and movement patterns, or habitat use by tadpoles and metamorphs. The most vulnerable life history stage will be identified and monitored to determine threats and ways of alleviating them. Information is required on age structure, sex ratio, gene-flow between populations and reproductive success. The diet of tadpoles and frogs will be determined through observation and faecal analysis, and populations of prey will be monitored occasionally to ensure they are being maintained. The hydrological and ecological impacts of management actions can be assessed from this base line study. Such information could be collected and analysed by an Honours or Masters student.

Costing for two years:

Stipend MSc 2 years \$32,000

Consumables \$ 8000

Total costs: \$40,000

4 Guide for decision makers

Governments should give careful consideration to the impact of existing and proposed high impact activities (including grazing, logging, road works, clearing, water extraction and development) on frog sites.

Consultation with all relevant managers of Crown lands is required in order to develop appropriate ways of using natural resources while protecting populations of the endangered frogs. For activities within the distribution of the magnificent broodfrog the following is necessary:

1. Any management action must comply with state and federal legislation, especially in relation to threatened species.

2. Environmental impact assessments must be conducted before the approval of any management activity which could adversely affect populations of the vulnerable frogs on national park and state forest.
3. Water extraction and impoundment would have significant impacts on the threatened frogs. Before any impoundment or removal of water, impacts on frog populations must be assessed. Particular attention will be given to the removal of groundwater which may affect frog seepage habitat in streams.
4. Excessive nature-based activities (e.g. ecotourism) could have significant impacts on stream environments through increases in trampling and human waste. Waste must be removed from the area. Bushwalkers and campers must be required to remove all rubbish, and the code of conduct for bushwalking and camping enacted by community groups and enforced by park and state forest staff.
5. Habitat disturbance and siltation of seepage areas, especially disturbance resulting from park and state forest infrastructure, should be minimised and must not take place in threatened frog habitat. Should activities proceed, they are to be subject to an environmental impact assessment before commencement, and formal rigorous monitoring of the impact after construction.

Local authorities.

1. The Herberton Shire Council should address potential impacts, especially on the hydrology, within frog habitat in Town Planning and development approvals.
2. Council should identify frog locations in road reserves and council lands and take appropriate action to avoid impacts.

5 Tools to assist implementation

Monitoring and assessments

Monitoring known populations of broodfrogs is required. A standardised proforma is to be used and data will be incorporated into an existing database. Regular intensive monitoring should be carried out at one site in each area with other sites being visited during the breeding season.

Searches for additional populations will be conducted. High altitude seepage areas on Glen Gordon Volcanic soils will be surveyed to determine if other populations are present.

Population management

Landholders will be advised of the presence of frogs and assisted in implementing habitat protection measures as described above (section 3.2).

Community participation

A public awareness campaign will be carried out to encourage community ownership of the species and community participation in conservation programs (section 3.4).

Annual costs (\$)

Action	Year 1 (\$)	Year 2 (\$)	Year 3 (\$)	Year 4 (\$)	Year 5 (\$)	TOTAL (\$)
Habitat protection and management	12,750	500				13,250
Population monitoring and assessment	12,700	12,700	12,700	12,700	12,700	63,500
Public information and participation	1050					1050
Ecological and habitat investigations	20,000	20,000				40,000
TOTAL	46,500	33,200	12,700	12,700	12,700	117,800

6 Monitoring, reporting and review

A detailed annual report with information on monitoring outcomes and community participation, as well as additional information from other activities will be prepared by the magnificent broodfrog working group and provided to participants. This group will report on progress to the Northern Queensland Threatened Frogs Recovery Team

The Northern Queensland Threatened Frogs Recovery Team will monitor the progress of the recovery plan.

This recovery plan will be reviewed after three years and modified where necessary with a revision to be written after five years, or earlier if new information warrants major changes.

7 References

Cogger, H.G. 2000. *Reptiles and Amphibians of Australia* (6th edition). Reed New Holland Books, Australia.

Ingram, G.J. and C.J. Corben. 1994. Two new species of broodfrogs (*Pseudophryne*) from Queensland. *Memoirs of the Queensland Museum* 37, 267-272.