NATHAN DAM AND ASSOCIATED INFRASTRUCTURE

THE CRITICALLY ENDANGERED BOGGOMOSS SNAIL -

RELOCATION OF MT ROSE POPULATIONS

Report prepared for SunWater

Biodiversity Assessment AND MANAGEMENT PTY LTD

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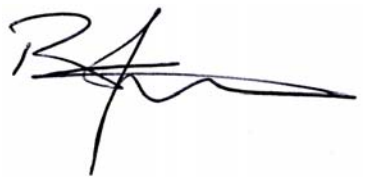

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NATHAN DAM AND ASSOCIATED INFRASTRUCTURE - THE CRITICALLY ENDANGERED BOGGOMOSS SNAIL RELOCATION OF MT ROSE POPULATIONS

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BAAM	Biodiversity Assessment and Management Pty Ltd
DEWHA	Commonwealth Department of Environment, Water, Heritage and the Arts (now DSEWPAC)
DSEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
SKM	Sinclair Knight Merz

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

The Boggomoss Snail *Adclarkia dawsonensis* is listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Only two populations of the snail were historically known from locations in the Dawson Valley, north-east of Taroom, south-east Queensland (Stanisic 1996). One is confined to riparian habitat in the vicinity of the Isla-Delusion Road crossing of the Dawson River, while a second population lives in an 0.5ha patch of boggomoss habitat on Mt Rose Station, c.45 km north-east of Taroom. This latter habitat would be inundated by the proposed Nathan Dam to be built on the Dawson River east of Taroom.

A recovery plan for the Boggomoss Snail was prepared and came into force in July 2008 (Stanisic 2008). Progress of the Nathan Dam proposal is dependent upon approval from the Minister (Department of Sustainability, Environment, Water, Population and Communities [DSEWPAC formerly DEWHA]) not inconsistent with the actions of recovery plan. Given the 'Critically Endangered' status of the snail, and the projected elimination of the Mt Rose population through inundation, the successful relocation of this population is considered a crucial mitigating action requiring detailed investigation.

In order to demonstrate that successful relocation could be achieved, it was suggested by DSEWPAC that translocation trials, under the supervision of the Recovery Team for the species, be conducted to determine the feasibility of this option.

These translocation trials would have involved the movement of a limited number of individuals from the Mt Rose population to one or more sites considered to be suitable habitat and not to be directly affected by the Nathan Dam project.

Central to the issue of relocation trials is the size of the source population from which individuals for the trials will be taken. As no detailed survey for the snail had been conducted since 1996, and because the population estimates of the time were based on the capture of just 18 live snails, it was decided to conduct a thorough survey for the snail in the greater Taroom area. Two surveys (late 2008 and early 2009) were conducted by BAAM Pty Ltd for SunWater.

As a result of these surveys (BAAM 2009a), new data emerged affecting the distribution, population size estimates and preferred habitat of the species. Especially significant was the finding that predation by mice posed a major threat to the species. The details of the more significant outcomes of that survey were as follows:

- two new populations (each consisting of only a very small number of individuals) of the Boggomoss Snail were discovered on additional boggomosses on Mt Rose Station;
- previous estimates of the Mt Rose population of < 100 individuals were revised to > 350 individuals based on available microhabitats (> 100) and the number of snails collected from a small subset of these;
- the range of the Isla-Delusion population was extended to encompass similar riparian habitat several kilometres upstream of the previously known occurrence of the species. Few individuals were recovered there in spite of considerable search effort and no new estimates of population size could be made although this was considered likely to be less than the new estimate for the Mt Rose population (Stanisic, pers. obs.);
- the preferred habitat of the Boggomoss Snail was confirmed as the alluvial flats (floodplains) of the Dawson River between Taroom and Theodore which have largely been cleared for farming. Historical records indicate these black soils supported gilgaied brigalow (a closed canopy vegetation community) which probably formed the core area of the snail's original distribution, a view supported by the habitat preference of its sister species (Adclarkia cameroni) on the Condamine River in similar brigalow communities;
- riparian and boggomoss habitats were considered secondary but significant habitats in the context of historical habitat loss; and
- predation by mice and rats was seen as a significant factor affecting the Boggomoss

Snail based on the numbers of predated shells recovered and the results of a limited trapping program run during the survey.

Using the extra information gained, a strategy for relocation trials was developed by Dr John Stanisic (BAAM 2009b) for submission to DSEWPAC. This strategy comprised a methodology for translocation trials based on overseas experiences with snail relocation (mainly New Zealand) but tailored specifically for the idiosyncracies of the Boggomoss Snail. The methodology considered all aspects of the impending trials such as timing, enclosure construction, likely ecological impacts and conservation outcome targets.

Later that year (c. mid-2009), the Boggomoss Snail was located at two additional sites by Dr John Stanisic while on a gas pipeline mapping exercise. These sites were located on "Southend" and "Kia Ora", two properties located downstream of the Isla-Delusion Reserve but notionally confluent with it in terms of the *Livistona* dominated riparian habitat. In both cases these habitats were adjacent to extensive alluvial black soil plains which had been cleared.

Subsequently (September 2009) consulting firm SKM Pty Ltd was commissioned by SunWater to conduct additional surveys in order:

- to locate any additional populations of the Boggomoss Snail throughout the Dawson River catchment, including outside the range of historic search effort and within marginal habitat areas;
- to provide an estimate of the size of the population within its distribution; and
- to provide a preliminary assessment of newly identified habitat areas for relocation purposes.

The results of this survey confirmed the presence of the Boggomoss Snail along the riparian corridor between Gyrandra Weir and "Kia Ora". Additional localities for the snail were confirmed on the Dawson at "Lagoona" situated between the Isla-Delusion Reserve and Southend (SKM 2009).

Based on the 32 live snails and 53 dead shells collected in 240 1m X 1m quadrats, it was estimated that more than 17, 000 individuals were living along the Dawson in 46.97ha of available habitat.

A further submission to DSEWPAC based on this report resulted in a decision that translocation trials would be abandoned in favour of outright snail relocation as a mitigating strategy for the impact of the Nathan Dam on the Boggomoss Snail.

1.2 AIMS AND OBJECTIVES

The aim of this report is:

- to outline a strategy for the relocation of the critically endangered Boggomoss Snail from boggomoss localities on Mt Rose Station; and
- to assess the effects of the proposed dam on the riparian populations of the Boggomoss Snail in relation to the maintenance of environmental flows in the Dawson River.

This report relies heavily on background information gained in preparing the relocation trial report (BAAM 2009b) and necessarily incorporates much of the information contained in that report, albeit in a modified form.

2.0 RELOCATION OF MT ROSE POPULATIONS

2.1 RELOCATION GUIDELINES

Successful relocations of terrestrial molluscs have been attempted elsewhere in the world with varying degrees of success. In New Zealand considerable effort has been expended on translocating the Flax Snails (*Placostylus* spp.) and Kauri Snails (*Powelliphanta* spp.). Forming the basis of these and any invertebrate relocation is basic knowledge of the species' life history, especially diet and feeding behaviour. In the case of the Boggomoss Snail knowledge of even these fundamental aspects of snail biology are lacking.

Models for successful relocation have been proposed (e.g. Meads 1994) and define the knowledge required to at least comprise:

- Natural (source) population: taxonomic position, distribution, population dynamics, conservation status, life cycle, feeding biology, breeding biology, predator/prey relationships, habitat requirements, environmental conditions.
- Receiving locality: status of predators, status of competitors, food availability, ecological and other environmental parameters, sustainability of release environment.

It is apparent from Stanisic (1996), the Recovery Plan for the snail (Stanisic 2008), and subsequent studies (BAAM 2009a,b; SKM 2009) that apart from the taxonomic position, distribution and habitat requirements, little or no hard data are currently available for the other factors concerning the Boggomoss Snail.

In summary, there is little empirical data available that would point to the likelihood of a successful relocation of the Boggomoss Snail.

However, some broad issues with methodologies in relation to the New Zealand Flax Snail relocations have been identified which have relevance to the successful relocation of the Boggomoss Snail. These include determining whether a translocated species already exists at the new site; identifying suitable new sites within the historic distribution of the species; deciding on the optimum number of secure populations; monitoring snails that occur at low densities to verify long-term success; deciding how often to restock founder populations to enhance abundance and genetic diversity; preventing transferred animals from dispersing into suboptimal habitat; and enhancing the establishment of founder populations (Sherley 1994).

Furthermore, there have been a number of accidental relocations of native land snail species in eastern Australia that have resulted in the long-term survival of the translocated populations. These would seem to indicate that, like plants which grow successfully outside their original range, native snails in spite of their idiosyncrasies also have the ability to adapt to local conditions outside than their original range.

The accidental relocations which have been identified comprise:

- the charopid *Elsothera brazieri* from the Sydney area to Lord Howe Island (Stanisic et al. 2010);
- the camaenid *Figuladra incei lessoni* from the Rockhampton-Yeppoon area to Chapel Hill, Brisbane and Dingo Beach, near Cape Gloucester, mideastern Queensland (Stanisic unpubl. data);
- *Figuladra incei lessoni* from the Shoalwater Bay area to Clear Mountain, near Brisbane (Stanisic unpubl. data);
- the helicarionid *Fastosarion griseola* from the Bundaberg-Miriam Vale area to The Gap, near Brisbane (Stanisic et al. 2010).
- the carnivorous rhytidid *Terrycarlessia turbinata* from northern NSW to Sydney, NSW (Stanisic et al. 2010).

The success of these accidental relocations relate directly to the proposed relocation of the Boggomoss Snail. This snail has shown an inherent and historic adaptability to long-term survival in marginal habitats given the right mix of microhabitat conditions. The immediate difficulty lies in finding relocation sites with suitable microhabitat conditions and sufficiently free of any threatening processes to enable new colonies to establish.

2.2 DEFINING SUCCESS IN TRANSLOCATING THE BOGGOMOSS SNAIL

It was suggested by the then DEWHA, that demonstrated success in translocating the Boggomoss Snail will be achieved by a survival rate of 70% of relocated individuals. However, Sherley (1994) suggests that evidence of a 'self-sustaining population' is prime criterion for successful relocation. Even the presence of breeding individuals is in itself not considered to constitute success (Dodd & Seigel 1991). A relocation in which successive co-horts of F1 and F2 generation juvenile snails are recruited into the population over a period of 2-3 years, is considered a more robust measure of success. Therefore the initial success, or otherwise, of the Boggomoss Snail relocation can only be determined through a 3-4 year post-relocation monitoring program.

With these facts in mind the following relocation strategy is proposed.

2.3 JUSTIFICATION

The projected inundation level of the Nathan Dam impoundment will drown those populations of the critically endangered Boggomoss Snail currently extant on the boggomosses of Mt Rose Station. The purpose of this relocation is to re-establish these snail populations in suitable habitat outside the inundation area.

Furthermore relocation of the snail, leading to establishment of additional separate viable populations, would be an appropriate conservation action for this critically endangered species irrespective of the potential impact of the proposed Nathan Dam.

2.4 STRATEGIC DIRECTIONS

The proposed relocation supports two key objectives of the EPBC Act which are to:

- conserve Australian biodiversity.

and with regard to threatened species:

- provide for its continued protection.

In relation to the project's viability, relocation of the Mt Rose populations of the snail would seem to be the only means of mitigating the impacts of the dam on the snail. This action is incidentally identified in the Recovery Plan (Stanisic 2008).

2.4.1 Management Plans and Strategies

The Recovery Plan for the Boggomoss Snail has as its overall objective the recovery of the species. The successful conduct of the relocation will provide the basis for the establishment of additional Boggomoss Snail populations within its natural range and should reduce the possibility of extinction by existing threatening processes identified in the Recovery Plan.

The threat of inundation of the Mt Rose site and the possibility of relocating the population is noted in section 5.2 (page 18) of the Recovery Plan.

2.4.2 Populations for Relocation

The main population of the Boggomoss Snail to be relocated comprises an estimated 350 or more individuals on a boggomoss located on Mt Rose Station (BAAM 2009a). This represents the largest non-riparian population of the snail currently known. The population consists of adult, sub-adult and juvenile snails living under timber debris, accumulated leaf litter and grass. This population will provide the bulk of individuals for relocation. The snail was also found in extremely low numbers on two additional boggomosses in 2008-2009 on Mt Rose (BAAM 2009a) and these will also be searched for additional relocation individuals.

2.4.3 Collection and Relocation Methods

Collection. In order to cause minimum disruption to the snail's lifecycle individuals should be collected and relocated sometime prior to their breeding season (October-February). This should coincide with the snail's aestivation (=hibernation) period and also minimise any stress due to handling on the animals. It is anticipated that the Boggomoss Snails will be able to be collected over a period of two to three weeks depending on the availability of manpower, prevailing weather and road conditions.

The snails would be hand-collected from the Mt Rose boggomosses under the supervision of Dr John Stanisic (a Boggomoss Snail expert) and placed into suitable transportable holding containers together with leaf litter and other debris from the source site.

Prior to being placed in these containers each Boggomoss Snail will be measured and the shell marked with an acrylic waterproof paint. This method of marking snails has been used elsewhere without any detrimental effects to the snail and will enable new recruits through ongoing breeding to be readily identified.

The holding containers would consist of terrariums specifically designed for housing invertebrates and commonly used for displaying snails over short periods at the Queensland Museum. These will be ventilated and stored in a cool, shady area prior to transport.

Transfer. The holding containers should be placed in eskies to avoid heat stress during

transport by vehicle to the predator free enclosures located at the relocation sites.

Each Boggomoss Snail will be carefully located in the enclosure either among moist leaf litter or under logs and timber depending on the size of the individual.

Composition of relocation groups. It is not known how many snails will be collected but each enclosure would receive approximately the same number of adult, sub-adult and juvenile snails.

2.5 RELOCATION SITES

A further inspection of the general area in which the snail occurs or could potentially occur was conducted in late September 2010. Dawson River environs from Taroom to Moura were assessed. Conditions at the time of the survey were extremely wet and many areas considered potential relocation sites were inundated by water. SKM (2009) identified sites at the Isla-Delusion Reserve and "Southend" as potential relocation sites. However, their proximity to the Dawson River (within 50m) placed them at potential risk of flooding as was evidenced subsequent to the SKM surveys in 2009.

A number of potential relocation sites were identified on the adjoining Boggomoss Station (Figs 1a-h) These were previously identified by BAAM (2009 a,b) and consist of brigalow-dominated shade lines on alluvial black soil well removed from the Dawson River and outside the predicted inundation area. The height of the trees (c. 10m), and general canopy cover would ensure that the sites are provided with adequate shade to enhance moisture retention at ground level. In addition, the ground is scattered with fallen timber and clothed in grass which provide essential microhabitat for the species. These are seen as the best available relocation sites and are probably close to what was the snail's original preferred habitat (BAAM 2009a). They have the added benefit of comparative nearness to the Mt Rose site should geographic proximity be a significant factor in the success of the relocation.

Some additional infrastructure will have to be added to the sites to make them cattle and fire proof. Fencing to exclude cattle and the installation of perimeter fire breaks are two measures that will need to be in place before the snails are relocated to the respective enclosures.

To maximise the chances of success with the relocation, it is proposed that three separate sites should be chosen for the establishment of enclosures.

2.5.1 Legal Requirements

As the proposed relocation sites are located on leasehold land, negotiations with the landowner would need to be undertaken by SunWater prior to the initiation of the project.

2.5.2 Relocation Enclosures

To meet the ecological requirements of the Boggomoss Snail, predator proof enclosures would need to be established at the relocation sites which will house the snails for the first three years post-relocation. They would need to be of sufficient height to allow for ease of human access without endangering the resident snails.

It is anticipated that these enclosures would need to be at least 5m x 3m and consist of walls made from heavy gauge, large perspex sheets braced with steel posts and fitted with a sloping steel cap to prevent the snails from escaping.

The open nature of the enclosures should allow for natural leaf fall whose decomposition would add to the snail's food supply. Microhabitat in the enclosures will consist of in situ grass and timber where possible, supplemented with extra timber logs and leaf litter as required.

In addition, a number of large wooden boards will also be strategically placed within the enclosures to provide additional resting and crawl space for the snails. Field experience has shown that snails will readily congregate under sheets of timber in the wild. These boards would also enable a ready means of inspecting the relocated population without the need to disturb other debris in the enclosures.

The perspex walls of the enclosures will be embedded in the ground to a depth of 300mm to keep out predators such as mice.

The fuel load in the area immediately surrounding the enclosures should be maintained at low levels to reduce the risk of fire. The climate and habitat at the relocation sites are within the known limits for the species as the sites are within its traditional range. The precise location of the enclosures will be selected based on the suitability of the in situ microhabitat.

Natural climatic fluctuations can have drastic impacts on snail populations. Prolonged periods of dry weather can either restrict the activity periods of snails (affecting both feeding and egg-laying) or cause death through desiccation (especially in eggs and juveniles). To ensure the success of the snail relocation optimal conditions for survival would need to be maintained in the enclosures. In order to provide these optimal growing conditions the following will be undertaken during the first two years of establishment:

the natural food supply (fungi and other biofilm) would be supplemented from time to time with commercial fungi (*Agaricus* sp.) and a bran/calcium mix especially during the first few months of the establishment period.[The species was successfully maintained in captivity by the Queensland Museum on such a mixture].

Ambient moisture in the enclosures would be supplemented with artificial watering of enclosures as conditions demand.

2.6 OPERATIONAL TARGETS (SUGGESTED)

- Collect at least 300 snails from the Mt Rose boggomosses for transfer to each of three relocation enclosures at selected relocation sites prior to the beginning of the breeding season. These constitute the F1 generation.
- Measure and mark all individuals being moved (at transfer).
- Conduct monthly monitoring of all enclosures to measure initial survival and movement of marked snails within the enclosures.
- Confirm egg-laying and clutch size through inspection of all enclosures during the first breeding season.
- Observe juvenile development (F2 generation) in the enclosures after first breeding season through the recorded presence of unmarked juvenile individuals.
- Confirm egg-laying and clutch size through inspection of all enclosures during the second breeding season.
- Observe recruitment of the second F2 generation (from F1) and the first F3 (from F2) individuals in the enclosures after second breeding season.
- Terminate monitoring program after third year.

2.7 MONITORING AND REPORTING

2.7.1 Monitoring Program

The relocated Boggomoss Snail populations should be monitored on a monthly basis during the first six months following relocation. If the relocation shows signs of being successful (low mortality rates among founder individuals, egg-laying, appearance of F2 individuals) a three monthly inspection regime for the remainder of the three year monitoring program would suffice. A regular inspection regime is considered essential not only for ensuring the ongoing viability of the snail populations but also for the ongoing 'good-order' maintenance of the relocation enclosures.

2.7.2 Reporting

Succinct written reports would need to be submitted after each inspection and a more comprehensive summary report at least every six months. A final report with recommendations would be presented at the end of the monitoring program.

2.8 THREATS

Threats or circumstances that could cause the relocations to fail and proposed mitigation measures are as follows:

Predators. Specific threats are rodents and possibly reptiles. This threat will be managed by making the trial enclosures predator proof.

Fire. The build up of fuel loads at the trial sites has the potential to encourage fires which could destroy the snail enclosures, and possibly the snails. This threat will be managed

through appropriate fire abatement programs such as reducing fuel load in the immediate vicinity of the enclosures.

Stock grazing. Cattle have the potential to damage the snail enclosures. This threat will be managed by ensuring that a cattle-proof fence is constructed around the enclosures.

Handling. There may be an associated risk to the relocated snail populations due to regular handling for monitoring purposes. This risk will assessed as part of the on-going program and if necessary the monitoring program will be reviewed.

Drying of the habitat. Snails can suffer natural attrition due to prolonged dry periods. This threat will be managed by artificial watering of enclosures as required.

Lack of food. Food is provided through natural decomposition processes. Food at the off-site enclosures will be artificially supplemented during the initial stages of the relocation. Initial selection of the enclosure locations will largely be based on a suitable micro-habitat being available, including food resources. Previous relocations (in New Zealand) have failed because leaf litter was prevented from entering the enclosure area. The design of the relocation enclosures allows natural litter fall to enter the enclosure.

Disease. Any pathogens associated with the relocated individuals would by definition also be present in the source population. At present there are no known pathogens in the source population.

2.9 CONTINGENCIES

Failure to collect the preferred number of Boggomoss Snails. If Boggomoss Snail numbers in the period allowed for collection are low then the collection period will be extended as required.

Failure to achieve any of the operational targets. As an example, the F1 relocated snails may not breed in the first year of transfer or the F2 generation may not breed in their first year. If this occurs the monitoring program will be extended for at least two more breeding seasons.

2.10 TREATMENT OF SNAILS POST MONITORING PERIOD

Dependent on the snail's successful relocation it is anticipated that the enclosures would be removed at the end of the monitoring period and that the snails would be allowed to move freely within the shade lines. However, to enhance the snail's long term viability, these shade lines would have to be totally stock-proofed (fenced) and some thought given to re-establishing connectivity between them through revegetation.

3.0 RECOMMENDATIONS

- That the populations of the Boggomoss Snail currently extant on the Mt Rose boggomosses be relocated to suitable habitats outside the dam's inundation area; and
- that the strategies for relocation and establishment of these populations are in line with those outlined in this report.

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FIGURE 1a-h. Potential relocation sites for the Boggomoss Snail. Brigalow-dominated shadelines.