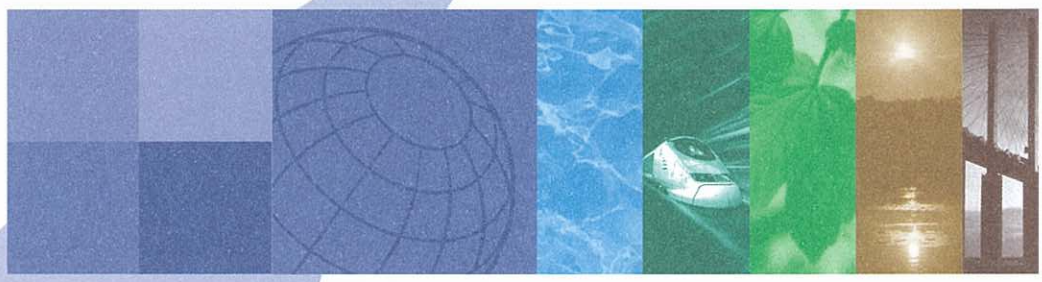
Halcrow China Limited
AGREEMENT NO. CE 18/2004 (GE)
10 YEAR EXTENDED LPM PROJECT
PHASE 5, PACKAGE H
Translocation Manual for *Philautus romeri*
Feature no. 15NW-C/C3
Location: Sok Kwu Wan, Lamma Island

July 2007



The Government of the Hong Kong Special Administrative Region Civil Engineering and Development Department Geotechnical Engineering Office

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Translocation Manual
for *Philautus romeri*
at
Feature No. 15NW-C/C3

Contract No. & Title : Contract No. GE/2005/57
10-year Extended LPM Project, Phase 5, Package H -
Landslip Preventive Works for Slopes in Outlying Islands

Report Title : Translocation Manual for *Philautus romeri*
Feature no. 15NW-C/C3
Location: Sok Kwu Wan, Lamma Island

Consulting Engineer : Halcrow China Limited

1. I certify that I am employed by Halcrow China Limited as a specialist sub-consultant to prepare this Translocation Manual.

2. I certify that this translocation manual has been prepared in accordance with Environmental Permit No. EP-149/2002.

Signed

Name Dr Michael W N Lau
Ecologist

Date 27 July 2007

The Government of the Hong Kong Special Administrative Region Civil Engineering and Development Department Geotechnical Engineering Office

AGREEMENT NO. CE 18/2004 (GE)

10-YEAR EXTENDED LPM PROJECT

PHASE 5, PACKAGE H

Translocation Manual for *Philautus romeri*

Feature no. 15NW-C/C3

Location: Sok Kwu Wan, Lamma Island

July 2007

Serial No.

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	0	1st draft	28 Apr-03	GMG
1	0	2nd draft	16 May 03	GMG
2	1	1st submission to EPD	21 May 03	GMG
3	2	2nd submission to EPD	16 Jun 03	GMG
4	3	Final	17 Jul 03	GMG
5	4	Revised final	30 Jul 07	

Contents

1 Introduction

This Translocation Manual is issued in compliance with the specific condition (Clause 2.8) of Environmental Permit no. EP-149/2002 pertaining to feature no. 15NW-C/C3, located at Sok Kwu Wan, Lamma Island.

This manual was prepared by Dr Michael Wai-neng Lau on behalf of Halcrow China Ltd., the consultant in charge of the design and construction supervision of the proposed slope upgrading works at this feature. Halcrow are employed by the Geotechnical Engineering Office of the Civil Engineering and Development Department, who are the "Permit Holder" for this project.

2 Baseline Survey, Collection and Transportation of Romer's Tree Frogs before Construction

2.1 Detailed time schedule

The above works are to be undertaken in accordance with the following timetable:

Description	Timing
Baseline survey and capturing Romer's Tree Frog	1st half of Aug & 2nd half of Aug 2007 1st half of Sept & 2nd half of Sept 2007
Reintroduction of captive Romer's Tree Frog back to the marsh	April 2009 May 2009

2.2 Detailed arrangements for collecting Romer's Tree Frog

The project site will be visited both during the day and at night once every two weeks from August to September 2007. Previous successful techniques to locate Romer's Tree Frogs, its tadpoles and eggs (Lau, 1998) will be used. These include:

- searching in all appropriate microhabitats both during the day and at night; and
- intensive search at breeding sites at night by sight and by detection of mating calls from males.

Adults and juveniles will be collected by 'imprisoning' in a curled-up hand so that the tiny, fragile frogs will not be squeezed during the process. Advanced tadpoles, i.e. those reached the free-swimming stage, (stage 25 or above, Gosner, 1960) will be collected by a dip-net with a mesh size of 1.5mm. Eggs and newly hatched tadpoles are delicate and often do not survive long, rough journeys on boats and vehicles (Lau, 1998). Instead small, plastic compartments lined with fine mesh floating in the marsh will be used to hold them temporarily until the next visit when they will

be transferred to captivity. Plant debris from the marsh will be put into these compartments to provide food and cover for the developing tadpoles.

2.3 *Arrangements for transporting Romer's Tree Frogs and tadpoles to the Holding Facility*

Romer's Tree Frogs collected will be brought back to the Holding Facility in small plastic tanks with a perforated lid immediately after each field visit. Moist grass and leaf litter will be put in these plastic tanks to maintain a high humidity in the tanks. Tadpoles will be transported in clear plastic bags half filled with marsh water and half with air. A small amount of plant debris from the marsh will also be put inside to provide food and cover. An exchange of air in the plastic bags will be carried out every hour. These are the methods used when transporting the Chek Lap Kok population in a previous study (Lau, unpublished information).

3 Keeping Romer's Tree Frogs in Captivity

3.1 *Work schedule*

The collected Romer's Tree Frogs and its tadpoles will be kept in the Holding Facility until all of them will be released, i.e. from August 2007 to May 2009.

3.2 *Set-up of the Holding Facility*

Frogs will be kept in plastic terraria with a perforated lid at a density comparable to Lau (1998), i.e. up to 1 individual per 100 cm^2. Holes will be drilled at the bottom of the terraria to allow water and wastes to drain. The set up of the terraria and the raising of the frogs and tadpoles also follows Lau (1998) in which Romer's Tree Frog were successfully kept and bred.

The substrates will be locally-collected forest soil with a top layer of leaf litter. These will be changed every six months. A tray of shallow aged tap water (up to 3 cm deep) with a few dead leaves, twigs and stones will be put into the adult tanks for egg laying. The terraria will be sprayed with aged tap water daily to increase the humidity. Air temperature should vary from 20 - 29 °C in summer and 10 - 25 °C in the winter, while water temperature from 19 - 27 °C in summer and 9 - 25 °C in winter. The terraria will either receive some dappled sunlight or light from NEC black-light fluorescent tubes to provide UV-B radiation which might be essential for the synthesize of vitamin D and the regulation of calcium (Moyle, 1989). Adult frogs will be fed a staple diet of artificially-raised young crickets and/or fruit flies once every two days. Once a week, the crickets or fruit flies will dusted with Tetra vitamin mix in order to support normal growth of the frogs (Richards & Lehman, 1980). This diet was supplemented with termites and other insects collected from the wild at least once every month.

The terraria will be checked every day. When eggs are found, the water tray will be taken from the tank and replaced by a new tray. Eggs will be checked daily and any unfertilized/dead eggs will be removed. Tadpoles will be given boiled lettuce supplemented with high-protein fish food once a week when they start feeding. The tadpoles (both wild-caught and those hatched in captivity) will be raised in trays and small plastic tanks in a density of less than 6 per 100 cm^2, a figure comparable

to some breeding sites observed in the wild. Poor water quality decreases growth (Voigt, 1991) and water will be changed daily using aged tap water. When hind limbs had developed (stage 38 onwards; Gosner, 1960), fish food applications will be increased to twice a week. At this stage, the containers will be tilted at one end to provide a dry area for the metamorphosing tadpoles.

Newly-metamorphosed froglets will be transferred to terraria with a similar set up as the adult tanks except that water tray will not be provided. They will be fed daily with a diet of very small leaf-litter arthropods until they are big enough to make use of the adult diet. The small arthropods (mainly springtails and mites) are either extracted from freshly-collected forest leaf litter or are attracted to cut potatoes placed on damp soil and leaf litter.

4 Water Quality Monitoring

4.1 Acceptable range of water quality

The water quality of breeding sites occupied by Romer's Tree Frog (Lau, 1998) and that of the Sok Kwu Wan marsh before construction will be used as the acceptable range. The parameters to be measured and the range recorded in Lau (1998) are:

- pH (6.21-7.51),
- conductivity (38.6-138 μS/cm),
- total nitrogen (0.03-6.00 mg/l),
- phosphate (0.15-19mg/l),
- BOD_5 (1.2-3.5 mg/l), and
- suspended solids (1.2-18.2 mg/l)

Water quality will be tested twice per month. If water quality deteriorates outside the acceptable range during the landslip preventive works, the source of pollutants will be located as soon as feasible. This will be reported back to the consultant and the client immediately. Further release of pollutants will be stopped and measures will be taken to prevent re-occurrence of the pollutants. The impact of any pollutants on the marsh habitat and the water quality will be monitored. Physical parameters of the marsh that will be measured include maximum depth, water area, submerged leaf litter, hydrophytes cover, presence/absence of algal bloom and iron bacteria. If there is no lasting impact on the marsh and the water quality returns to within the acceptable range before the scheduled Romer's Tree Frog reintroduction (i.e. by 1st April 2009), then no mitigation measures will be necessary.

4.2 Potential mitigation measures in case water quality deteriorates

If the marsh habitat becomes unsuitable (see section 5.1) or the water quality remains unacceptable by 1st April 2009, then appropriate mitigation measures have to be adopted. These may include:

- restoring the dead marsh vegetation,

- removing the accumulated silt in the marsh,
- providing suitable alternative breeding habitats such as creating breeding pools and the placement of breeding pots (see Lau, 1998) on site and/or,
- delaying the reintroduction until the conditions are suitable.

5 Releasing Romer's Tree Frogs back to the marsh below the Slope after construction

5.1 Acceptability of the moist vegetated area for Romer's Tree Frogs release

The habitat characteristics of Romer's Tree Frog breeding sites (Lau, 1998) and that of the Sok Kwu Wan marsh measured during the baseline surveys will be used as the acceptable range. The following habitat parameters will be measured:

- maximum water depth,
- water area,
- submerged leaf litter,
- hydrophytes cover
- presence of algal bloom,
- presence of iron bacteria and
- presence of predatory fish.

Romer's Tree Frogs and its tadpoles will only be released if all these parameters fall within the acceptable range after the completion of the landslip preventive works.

5.2 Arrangements for transporting Romer's Tree Frogs from the Holding Facility to the project site

Only frogs and advanced tadpoles (stage 25 or above, Gosner, 1960) that can survive long journeys on vehicles and boats will be released. They will be carried in containers outlined in section 2.3 above and will be released throughout the marsh in early evening when they are active.

5.3 Contingency measures if the establishment of Romer's Tree Frogs is found to be unfeasible or unsuccessful

The reintroduction of Romer's Tree Frogs is scheduled in two phases: first release in April 2009 and second release in May 2009. The mortality rate of the Romer's Tree Frog in captivity is expected to be lower than that in the wild and the frogs are likely to breed in captivity. Hence the number of captive individuals to be released is expected to be more than the number collected. However, since the frogs will only be maintained in captivity for less than a year and they have a short life cycle that averages 3 years (Lau, 1998), the increase in number will not be too high. The

Sok Kwu Wan marsh is close to many other breeding sites in the area (some less than 100 m away) and Romer's Tree Frog is known to occupy terrestrial habitats when not breeding (Lau, 1998). Some of the released frogs, especially the juveniles, are likely to disperse to surrounding suitable habitats. Therefore, it is not envisioned that the carrying capacity of the marsh will be exceeded. Eggs and very young tadpoles (below stage 25, Gosner, 1960) are not suitable to be released because they cannot survive long journeys. The egg stage normally lasts for 2-3 days while the early tadpole stage s last for 1-2 days. Hence, to ensure that no captive individuals will remain, the water trays will be removed from the terraria five days before the scheduled second release to prevent the frogs from breeding during that period.

If the frog's establishment is found to be unfeasible (e.g. the habitat parameters of the marsh fall outside the acceptable range) or if after the first release, the frog fails to establish in the marsh, then subsequent release(s) will be cancelled. If the causative factors can be determined and reversed, then the frogs and tadpoles will be maintained in captivity until the conditions of the marsh become favourable again. If the reason for the failure remains unclear, then contingency measures will be adopted. These include the provision of man-made breeding habitats (e.g. pools and breeding pots, see Lau, 1998) on site, and, releasing the captive animals in adjacent suitable habitats which will be enhanced, such as planting native trees and providing man-made breeding habitats outlined above, to increase its carrying capacity.

5.4 Arrangements to monitor Romer's Tree Frogs after release

The released Romer's Tree Frogs cannot be monitored individually and the reintroduction can only be indirectly assessed by monitoring the project site to determine if reproduction (e.g. the presence of calling males, tadpoles and eggs) has occurred. An indication of the population size may also be obtained through long-term census of calling males, which are conspicuous, and unlike tadpoles are less likely to be subjected to stochastic mortality.

These two sets of data will be used as the main criteria in determining the success of the reintroduction of Romer's Tree Frogs back to the marsh. Post-release monitoring will be carried out in June, July, August, December 2009, and, March, June 2010. Attempts will be made to locate breeding adults, other individuals, tadpoles and/or eggs in the project site. The habitat parameters listed in section 5.1 will also be measured to assess changes in the marsh, if any, that may affect its suitability for Romer's Tree Frogs in the future. Since the main breeding season of Romer's Tree Frog is from March to September (Lau, 1998), the monitoring in December is unlikely to uncover any calling males. Instead, efforts will be made to locate any frogs and tadpoles present by actively searching for them. Also the monitoring in December will provide a chance to assess the quality of the habitat during the dry season.

6 Reporting

6.1 Baseline survey

A baseline survey report will be submitted by 10 October 2007 detailing the survey results, and number of frogs and tadpoles collected. The acceptable range of water quality parameters will also be determined.

6.2 Water quality and habitat monitoring during construction

A monitoring report will be submitted by 1 April 2009 covering the habitat and water quality monitoring results. Potential mitigation measures will be detailed should the water quality and/or the marsh habitat deteriorates beyond the acceptable range.

6.3 The captive population, assessing the site condition after construction and the proposed release

A report will be submitted by 1 April 2009 to cover the captive maintenance of Romer's Tree Frog. Whether the project site is acceptable for the release of Romer's Tree Frog will be assessed. The arrangements of the two-phase release programme will also be proposed.

6.4 Post-release monitoring

A report will be submitted by 15 July 2010 detailing the findings of the post-release monitoring. The outcome of the Romer's Tree Frog reintroduction will also be assessed.

7 References

Gosner, K.L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16: 183-190.

Lau, W.N.M. 1998. *Habitat Use by Hong Kong Amphibians, with special reference to the Ecology and Conservation of* Philautus romeri. Ph.D. thesis, The University of Hong Kong, Hong Kong.

Moyle, M. 1989. Vitamin D and UV radiation: guidelines for the herpetoculturist. In *13th International Symposium on Captive Propagation & Husbandry – Proceedings*: 61-70. Uricheck, M.J. (Ed.). Phoenix.

Richards, C.M. & Lehman, G.C. 1980. Photoperiod stimulation of growth in postmetamorphic *Rana pipiens*. *Copeia* 1980: 147-149.

Voigt, M. 1991. On the effects of crowding and pollution in tadpoles of the brown-striped marsh frog (*Limnodynastes peroni*). *Herpetofauna* 21: 25-34.