KEYSTONE ECOLOGICAL
Keystone Ecological Pty Ltd
abn 13 099 456 149
PO Box 5095 Empire Bay NSW 2257
telephone 1300 651 021
facsimile 02 4368 2361
email office@keystone-ecological.com.au

Andrew Lister
Hopkins Consultants
PO Box 1556
PORT MACQUARIE NSW 2444

12th June 2009

RE: MP 06-0212 Le Clos Verdun Sancrox

Dear Andrew,

I provide the following in response to the issues raised by DECC for the above project that are relevant to the work supplied by Keystone Ecological. Each item from DECC's letter of April 2009 is shown in bold and a response provided below each.

- **The timing of surveys conducted for microchiropteran bats, reptiles and amphibians was not undertaken within an appropriate season to target a majority of species. While this was noted as a limitation within the report and DECC acknowledges that the site history limits available habitat for many species, survey should have been timed inline with the Threatened Species Survey and Assessment guidelines (DEC 2004).**

Ecological survey has been conducted on this site by North Coast Forestry and Ecology Services in January or February 2004, again in January 2008 and by Keystone Ecological in August 2008.

The surveys of 2004 were intended to characterise rather than catalogue the biodiversity of the site and so did not include targeted survey for many groups. However, it is clear from Brian Salter's reports of February 2004 and January 2008 that call detection and habitat searching for amphibians was undertaken during both survey periods.

The survey work of 2008 was intended to provide a more detailed inventory of the biodiversity of the site, with an emphasis on threatened species.

It was acknowledged in the ecological impact assessment report that the timing of Keystone Ecological's survey work was not ideal for detection of many species. This is particularly so for ectotherms (e.g. reptiles), species that are most detectable when breeding in the warmer months (e.g. amphibians), species that may go into daily torpor or move to warmer areas during the colder months (e.g. some bats), or species that rely on food resources that are less available in winter (e.g. insectivores or nectarivores) or when the temperatures are low (e.g. insectivores).

Unfortunately the desire to conduct survey under ideal ecological conditions cannot always be met as time and budgets are usually limiting factors; such was the case in this project. Therefore, an analysis was made of the species likely to occur on or near the site, the conservation status of those species and the likelihood of impact by the proposal on those species or their habitats.

Such expert assessment was undertaken in this case for the groups about which DECC is concerned – microchiropteran bats, reptiles and amphibians.

Microchiropteran bats

This group of mammals was targeted for survey using an Anabat call recorder. It was judged that the most likely areas to record these mammals foraging were near the dams and along the river where insects might be encountered, within the most natural areas of woodland near the southern boundary, in the wooded ridge in the centre of the site and in and around the small rainforest patch. The wooded ridge and the woodland of the southern boundary contained hollow-bearing trees and so it was also hoped to detect animals as they emerged from roost sites.

The Anabat recorder was left a stationary position overnight in a location near one of the larger dams on the first night and in the southern woodland on the second night. Analysis of the recordings indicated that bat activity dropped off dramatically after the first few hours of nightfall, presumably when the temperatures dropped below a critical threshold. Therefore, Anabat survey during the subsequent two nights was restricted to the early evening and located near the river in the western part of the site and near the rainforest patch. Mobile recordings were also taken while spotlighting across the open grassland and within the wooded ridge.

Despite the time of year not being optimal for this group of mammals, 8 species (3 of them threatened species) were recorded foraging on the site during the August 2008 survey. Comparison of survey results from another site is of interest in determining the adequacy of this survey effort. This other site is near Laurieton, is of a similar size as the subject site and has similar environments, being bordered by a creek and a lake with fringing swamp forests and some dry sclerophyll forest interrupted by extensive open grasslands. This other site has been surveyed far more intensively over a 12 month period with Anabat sampling in every season over 960 hours (Ashby 2009). However, this level of survey for microchiropteran bats yielded only 12 species (3 being commonly recorded threatened species). Therefore, a significant (34-fold) increase in effort returned only 1.5 times as many species and did not detect any more (or different) threatened species.

As well as such comparisons, it is instructive to analyse which threatened species are likely to be found. Within 10 kilometres of the site, the following threatened species are known to occur –

- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle

Each of these species is considered in turn regarding ideal survey requirements and the likelihood of them occurring on site.

Mormopterus norfolkensis **Eastern Freetail-bat** occurs in dry sclerophyll forest and woodland, and roosts in hollows and man-made structures. The site was judged to provide potential habitat for this species. It is detectable at any time of year and was definitely recorded foraging near the central dam on the site during survey.

The potential impact of the proposal on this species and its habitat was considered.

Miniopterus schreibersii oceanensis **Eastern Bentwing-bat** roosts in caves and forages above tree canopies of woodland and forest. The site was judged to provide potential habitat for this species. It is most detectable from mid spring to mid-autumn and was not found during survey.

The potential impact of the proposal on this species and its potential habitat was considered.

Miniopterus australis **Little Bentwing-bat** roosts in caves and forages beneath tree canopies of woodland and forest. The site was judged to provide potential habitat for this

species. It is most detectable from mid spring to mid-autumn but was recorded foraging near the central dam during survey despite the survey being conducted in August.

The potential impact of the proposal on this species and its habitat was considered.

Myotis macropus **Large-footed Myotis** forages over large bodies of water and roosts in hollows or under old wooden bridges up to 10 kilometres from foraging habitat. It is detectable at any time of year and was probably recorded foraging over the central dam during survey.

The potential impact of the proposal on this species and its habitat was considered.

Scoteanax rueppellii **Greater Broad-nosed Bat** is found in a variety of forested habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. The site does not provide foraging habitat of this type.

It roosts in tree hollows and forages over creeks and other corridors within forest. While hollows and creeks are available on site, given the lack of extensive forested areas and the preponderance of high value habitat in the local area (such as in the extensive state forests and national parks), it was judged that the site is not suitable for this species and the potential impact of the proposal was not further explored.

It is most detectable from mid spring to mid-autumn and was not found during survey.

Even if this judgement was in error, the features that may be exploited by this species (the foraging corridor over Haydons Creek and hollow-bearing trees) will remain unaffected by the proposed subdivision and subsequent development of the open grassland areas.

Falsistrellus tasmaniensis **Eastern False Pipistrelle** forages and roosts in tall moist forest and the site was judged not to provide appropriate habitat for this species.

It is most detectable from mid spring to mid-autumn and was not found during survey.

Thus, it is concluded that

(i) the survey effort was not optimal as there were no samples taken in the warmer summer months when bat activity may be expected to be high and migratory species may be expected to occur;
(ii) significant increases in survey effort may not necessarily significantly increase the findings, given the habitats available and the disturbance history of the site;
(iii) the species of interest (i.e. the threatened species that are likely to occur) are considered to have been either surveyed adequately (e.g. three species were detected on site) or considered adequately for impact if the site supported potential habitat for those species;
(iv) important habitat elements for this group of mammals will largely remain intact - hollow-bearing trees will be retained as will almost all of the woody vegetation and all of the dams. The only currently available habitat to be alienated in the long term will be the cleared open grassland, but this is not a critical component of foraging habitat for any species of import.

Reptiles

This group was not targeted for survey as they are least active in the colder months. Notwithstanding that limitation, the subject site provides very poor habitat for this group of vertebrates and so the likelihood of missing an important species was considered too remote to require supplementary survey in another season. For example, the site has no rocky outcrops and almost no fallen timber, both important elements of habitat for many reptile groups.

There were no species of reptile of conservation significance recorded within 10 kilometres of the subject site and only one (*Hoplocephalus stephensii* Stephens' Banded Snake) has

been recorded from within the entire Port Macquarie – Hastings LGA. The closest of these records are limited to the heavily vegetated Broken Bago Range, south west of Wauchope.

Radio-tracking studies have shown that while this species is a forest habitat generalist, it relies entirely on large forest blocks with many large hollow trees (Fitzgerald et al. 2005). It has a broad tolerance with respect to other factors such as climatic conditions, vegetation communities and prey species. Therefore, given the extent of woody vegetation on site, its relative isolation from other vegetation and the low density of hollow-bearing trees, the subject site is judged not to provide suitable potential habitat for this species.

Thus it is concluded that

(i) the timing of survey was not optimal for this ectothermic group;
(ii) the likelihood of the subject site supporting any important species of reptile is remote to nil as the habitats available are far too simplified by a long history of disturbance; and
(iii) the habitat of least value to this group is the open grassland, which is the only habitat that will ultimately be alienated by the proposal.

Amphibians

While the Keystone Ecological survey was conducted in the winter months, Salter's original survey and supplementary survey were carried out in summer, with amphibians being a particular survey focus.

Three species are known to occur within 10 kilometres of the subject site: *Litoria brevipalmata* Green-thighed Frog, *Litoria aurea* Green and Golden Bell Frog and *Crinia tinnula* Wallum Froglet. It is considered that the subject site does not support suitable habitat for any of these species. Notwithstanding that assumption, all of the potential habitat for amphibians on site will remain and be enhanced by the implementation of vegetation management.

Therefore it is concluded that the lack of survey under optimal conditions will not detract from the conclusions drawn regarding the ultimate fate of amphibian habitat on site.

- **Flora surveys were not undertaken within the flowering period for the threatened orchid *Phaius tancarvilleae*, greatly limiting the possible identification of this on site. DECC suggests that additional species specific surveys should have been conducted for this species during its known flowering period (September-October)**

Phaius tancarvilleae Greater Swamp-orchid is a terrestrial evergreen orchid with showy flower stems up to 2 metres tall and large broad leaves with a pleated appearance, both arising from fleshy bulbs near ground level.

It is acknowledged that survey was undertaken outside of the flowering period for this species. However, it has identifiable vegetative parts at other times and no such plants were observed.

This species tends to occur in sunny positions in swamp forest ecotones (DEWHA 2008) in swampy grassland or swampy forest, including rainforest, eucalypt and paperbark forest (DECC 2009). Associated vegetation includes swamp sclerophyll forest (*Melaleuca quinquenervia* Broad-leaf Paperbark - *Eucalyptus robusta* Swamp Mahogany - *Lophostemon suaveolens*), swampy rainforest (often with sclerophyll emergents), or fringing open forest. It is often associated with rainforest elements such as *Archontophoenix cunninghamiana* or *Livistona australis* (Harden 1993, Benwell 1994, Bishop 1996).

While such habitats were surveyed by targeted random meander on the subject site with an emphasis on the ecotonal areas (due to ease of walking through these areas), it is acknowledged that the site provides potential habitat for this species and that it may have been missed. Thus the potential impact on this habitat was considered in the assessment report.

Although widespread through Asia and south into Queensland, it is seriously depleted and may be extinct in northern New South Wales (DECC 2009). While it has been collected from north of the Hastings River, it is chiefly known from north of the Brunswick Heads district (PlantNet, November 2008). Given this observed distributional pattern, it is highly unlikely to occur on site.

Notwithstanding that conclusion, the proposal is consistent with the recovery strategies identified for this specie by DECC, namely

1. Discouragement of collecting from the wild, particularly by control of access to known sites;
2. Control invasive weeds using appropriate methods that do not endanger this species;
3. Control feral pigs;
4. Protect wetland areas from frequent fire;
5. Protect wetland areas from pollution;
6. Control grazing with some of the most sensitive areas to be fenced off; and
7. Protect areas of habitat from clearing, draining or development.

Recognised threats to this species include (DECC 2009):

1. Collection for horticulture. This showy species is highly sought after;
2. Clearing and fragmentation of habitat for development, agriculture and roadworks;
3. Drainage of swamps, or pollution from nutrient run-off;
4. Frequent fire;
5. Grazing and trampling by domestic stock and feral pigs; and
6. Invasion of habitat by introduced weeds.

Similarly, the proposal will not exacerbate any of these threats and so the lack of survey within the optimal flowering period is not considered to be a major impediment to its conservation potential on site.

- **No trapping surveys were undertaken targeting the Brush-tailed Phascogale (*Phascogale tapoatafa*). While DECC acknowledges the site history has limited available habitat there is both available habitat on site and within adjacent areas of forested land for this species. Recent records also occur to the south of the site in Cowarra State Forest. No clear reason as to why targeted surveys for this species were not undertaken was included within the report.**

The best time for survey of this species is May to July, when males are roaming across large distances, looking for mates. Unfortunately, the survey was conducted in August, a time when male die-off of this species is occurring and so there is much less chance of capturing this species.

The other survey tools employed - spotlighting, hair tube sampling, predator scat collections and habitat assessment – were regarded as a satisfactory survey response given the season and the available habitat. While this species is known to occur in farmland and is most often detected as a raider of hen houses, it is a creature of dry open forest and relies on hollow-bearing trees for shelter and breeding. The amount of clearing and level of disturbance was judged to make the subject site largely unsuitable for this species.

Moreover, those parts of the site that provide habitat features that may be used by this species will be retained and managed for conservation viz. the small areas of open forest near the southern boundary and all hollow-bearing trees.

- **The endangered ecological community Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion was identified on site and is to be cle4ared through proposed earthworks. However, no offsets for this EEC have been proposed to compensate the loss of this community and, irrespective of the level of degradation of this EEC, appropriate**

compensatory habitat measures should be applied. Existing offsets do not compensate like-for-like for the loss of this area of EEC. DECC strongly recommends that the proponent provides adequate offsets and compensatory habitat measures in accordance with DECC guidelines (*Principles for the use of biodiversity offsets in NSW* available at http://www.environment.nsw.gov.au/biocertification/offsets.htm)

Specifically DECC requires a suitable offset / compensatory habitat package to be provided for the area of Subtropical Coastal Floodplains Forest in the NSW North Coast bioregion EEC to be cleared.

The area of Subtropical Coastal Floodplain Forest (SCFF) in question is very small – only 6,000 square metres. The affinity to this vegetation type was difficult to determine as it is now only comprised of a single large remnant tree of *Eucalyptus grandis* Flooded Gum and a few *Eucalyptus amplifolia* Cabbage Gum and *Eucalyptus tereticornis* Forest Red Gum saplings. The understorey is highly modified and dominated by exotic grasses (see photos overleaf).

This area has been cleared in the past, is regularly slashed for bushfire control and is probably used for recreational purposes such as picnics and for car parking when people use the boat ramp. Habitat for this vegetation type is highly restricted, occurring on the small and narrow band of Long Flat alluvial soil landscape at the edge of the Hastings River.

It is likely that many ecologists would not even recognise this as a native vegetation community in its own right given its small extent and highly modified and depauperate state. There is no other available vegetation on site to provide an exact compensatory match.

However, the Biometric Vegetation Types database lists a number of examples of this endangered ecological community within the Vegetation Class Coastal Valley Grassy Woodlands. The Turpentine – Pink Bloodwood Open Forest mapped in the southern part of the site would also qualify as equivalent to this EEC, being a form of Narrow-leaved Red Gum Woodland of the Lowlands of the North Coast.

The entire vegetation remnant in the southern part of the site is to be retained and managed for conservation purposes. As this is an area of 2.4 hectares, I propose that it is more than enough to satisfy the offsetting principles noted by DECC, giving an offset ratio of 4:1.

Subtropical Floodplain Forest on edge of Hastings River. Note the dense cover of slashed exotic grass.

The single remnant large *Eucalyptus grandis* Flooded Gum in the Subtropical Floodplain Forest area with no native understorey elements. Note the scattering of small trees.

- **Figure 4 of the ecological assessment report provides only a general location of the four EECs and the other vegetation communities identified on the site. The extent of all vegetation communities, particularly EECs, should be mapped based on ground truthing of the site.**

The mapping depicted in Figure 4 was based on ground truthing and analysis of aerial photographs. Detailed line work at a higher resolution can be provided.

- **DECC acknowledges that the proponent is proposing a "Vegetation and Habitat Management Plan" be developed for the offset areas. DECC recommends that these plans should be prepared prior to any potential approval of the subdivision. These management plans should clearly document how any retained areas or habitat features will be managed with respect to long-term conservation and viability.**

An indicative Table of Contents for this management plan has been devised and an outline of the management actions that will be required have been prepared (see over). The plan may be prepared relatively quickly prior to the subdivision approval, but there is merit in preparing such documents closer to the time that they are to be implemented as the issues to be managed as well as the procedures to be used may change. I suggest that the material provided overleaf be used as proof of the objectives of and the commitment to management of the retained areas.

I trust that this letter addresses all of the outstanding matters. Please do not hesitate to call if there is further information required.

Yours sincerely,

Elizabeth Ashby

Principal Consultant

References cited:

Ashby, E. (2009) Flora and Fauna Impact Assessment, Ocean Drive, Lakewood, Port Macquarie Hastings LGA. Unpublished report, Keystone Ecological

Bishop, T. (2000) Field Guide to the Orchids of New South Wales and Victoria. New South Wales University Press, Sydney

Fitzgerald, M., Shine, R., Lemckert, F. and Towerton, A. (2005) Habitat requirements of the threatened snake species *Hoplocephalus stephensii* (Elapidae) in eastern Australia *Austral Ecology* 30:465–474

Benwell, A.S. (1994) Recovery Plan for Swamp Orchids *Phaius australis* and *Phaius tankervilleae*. Report for Australian Conservation Agency and NSW NPWS

Department of the Environment and Climate Change (2009) Threatened species profile (http://threatenedspecies.environment.nsw.gov.au/tsprofile/home_species.aspx). Viewed 10th June 2009

Department of the Environment, Water, Heritage and the Arts (2008) Approved Conservation Advice for *Phaius tancarvileae* (Swamp Lily). Viewed 10th December 2008, http://www.environment.gov.au/biodiversity/threatened/species/pubs/2104-conservation-advice.pdf

Draft Table of Contents for Vegetation and Habitat Management Plan

PART A BACKGROUND

1. Introduction
2. Description of the site and the proposed activities
3. Native vegetation
4. Introduced fauna and flora
5. Potential environmental problems

PART B MANAGEMENT

6. Weed management
7. Feral animal management
8. Fire management
9. Public access
10. Sediment and erosion control
11. Fauna habitat
12. Monitoring
13. Works schedule

REFERENCES

FIGURES

Fig 1 – Location
Fig 2 – Management zones and actions

APPENDIX 1
Checklist for regeneration activities within threatened species habitat

APPENDIX 2
Bush Regeneration Techniques and Weeding Best Practice Guidelines

Issue		**Actions**
Weed management	Vegetation and habitat protection and enhancement	Regular sweeps across each management zone to identify major weed species
		Species-appropriate weed control responses formulated and implemented, with particular emphasis on Lantana and pasture grasses
		Removal of grazing
Threatened species habitat	Protection of existing habitat	Formal protection of existing bushland
		Hollow-bearing trees identified and protected by tree protection zones
		Dams maintained
	Enhancement of habitat	Removal of grazing
		Weed control
		Feral animal control
		Provision of nest boxes of a diversity of sizes and types
Endangered ecological community	Protection of existing habitat	Weed control
		Erosion and sediment control during all construction
		Implementation of appropriate fire regime
	Enhancement of habitat	Removal of grazing
		Control of feral animals
Feral animals	Deer	Control program in conjunction with local Catchment Management Authority
	Rabbits	Control program in conjunction with local Catchment Management Authority
	Foxes	Control program in conjunction with local Catchment Management Authority
Fire	Property protection - fire exclusion	Maintain asset protection zones in cleared areas
		Fire fighting response plan in conjunction with local Rural Fire Service
	Vegetation protection – appropriate fire regime	Determine appropriate fire regime for each vegetation type
		Exclude fire where required (e.g. Rainforest) or impose small ecological burns where appropriate

Issue		**Actions**
Public access	Vegetation protection	Provision of formal paths to minimise trampling of understorey vegetation
		Education of residents re impacts of inappropriate disposal of garden refuse
		Education of residents re impacts of garden practices on adjacent bushland e.g. use of herbicides, species with potential to become weeds
	Killing of native fauna by pets	Education of owners re need for control of domestic pets, particularly at night
	Killing of native fauna by road trauma	Speed controls on internal roads
		Education of residents
Edge effects	Vegetation protection	Isolated trees protected by implementation of tree protection zones
		Weed incursions into adjacent bushland monitored
		Species-appropriate weed control with particular emphasis along the edges of bushland
Changes to hydrology	Sedimentation hazard to downslope environments	Implementation of strict sediment and erosion control plan during all activities where soil is exposed
	Erosion hazard to downslope environments	Implementation of strict sediment and erosion control plan
		No point source delivery of stormwater runoff – use of water sensitive urban design principles such as diffuse water delivery
	Nutrient hazard to downslope environments	Siting of effluent disposal in open cleared areas distant from sensitive vegetation
Fauna habitat	Habitat protection	Hollow-bearing trees identified and protected by tree protection zones
		Formal protection of existing bushland
		Dams maintained
		Weed control
		Feral animal control
		Provision of fauna-friendly fencing
	Habitat enhancement	Provision of nest boxes of a diversity of types and sizes
		Monitor and maintain nest boxes
Monitoring		Monitor all actions on regular basis and report to Council