

11 March 2010

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Mr Richard Brown
Department of Water, Land and Biodiversity Conservation
150 Grenfell Street
ADELAIDE SA 5000

LANDSLIDE RISK MANAGEMENT, NGAUT NGAUT CONSERVATION PARK LOWER REACHES - RIVER MURRAY

Dear Richard

Introduction

As requested by the South Australian Department of Water Land and Biodiversity Conservation (DWLBC) this letter presents discussion of options for managing the risk of landslide (which in this case includes rockfall) associated with the boardwalk at Ngaut Ngaut Conservation Park (the site) near Kroehns Landing on the Lower Reaches of the River Murray.

Golder Associates Pty Ltd (Golder Associates) previously completed an assessment of landslide risk at the site on behalf of the Department of Environment and Heritage (DHE). We understand that a copy of our report (Reference 107662013-002-L-Rev0, dated 19 February 2010) has been provided to DWLBC. There were discussions of aspects of the landslide risk and possible management options in an exchange of emails (Brown/Sanders and Sanders/Brown) between 3 March 2010 and 5 March 2010.

Lyndon Sanders, Principal Geotechnical Engineer, visited site on 9 March 2010 with representatives from DWLBC and DEH and met representatives of the traditional owners of the site and the captain of the Murray Princess, a tourist boat that visits the site regularly.

Landslide Risk

Our report to DEH assessed the risk to life as a result of rockfall from above the boardwalk and the risk to life as a result of landsliding of the scree slope on which the boardwalk is founded as being similar. In both cases the risk was assessed to be higher than was tolerable by the community in general, although it might be tolerable in '*established areas where specific landslide hazards have existed for many years*' – suggesting that the risk might be tolerable to the traditional owners and occupiers of the site.

The report indicated that:

'The decision to accept or tolerate the landslide risk rests with the owners and operators of the site having regard to the acceptability or tolerance criteria that might apply to visitors to the site.'

Slope Monitoring

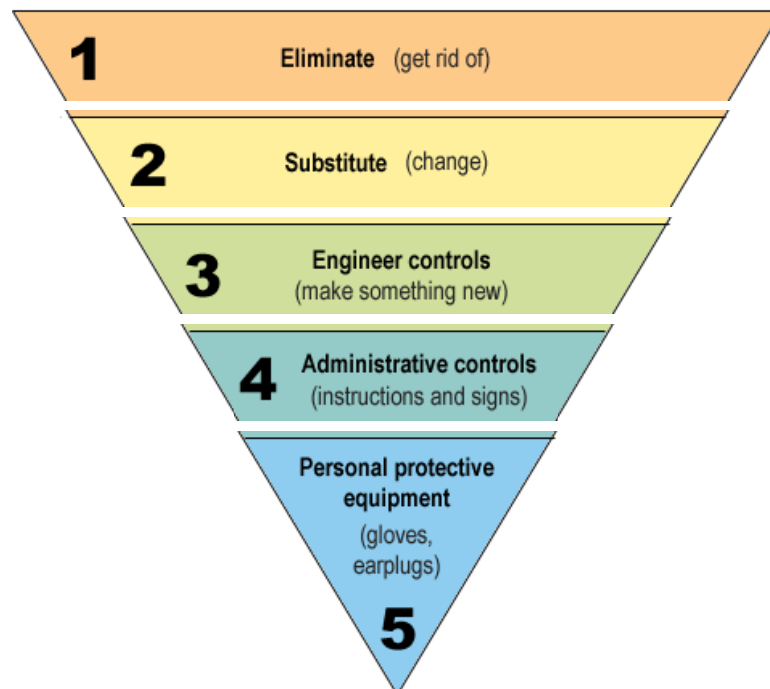
The report also recommended monitoring of the top of the scree slope to allow assessment of the extent and rate of movement. We understand that monitoring points were subsequently established for this purpose and measured at the time of establishment. One set of measurements was taken around a week later. There was some scatter in the measurements – movements of a couple of millimetres in both up- and down-slope directions were recorded. Golder Associates considers that there is sufficient uncertainty in the measurements to preclude any inference that movement is either occurring or not occurring.

We recommend continuing the measurements at weekly (or closer if possible) intervals. If the measurements indicate accelerating movement then we reiterate our recommendation that no personnel should access the boardwalk.

Landslide Risk Management

Discussions during the site meeting on 9 March indicated that the traditional owners of the site considered the landslide risk to be tolerable, on the basis of several millennia of occupation. However, the meeting also recognised that the risk would not normally be tolerable to the community in general. Various options for managing the risk were discussed.

The following diagram (taken from the Safework SA website) shows the hierarchy of control for managing practically any risk. The hierarchy indicates which control measures are conceptually more desirable than others.



Some preliminary options for managing the landslide risks at the Ngaut Ngaut boardwalk and heritage areas are discussed below with reference to the hierarchy of control.

Elimination

It is practically impossible to eliminate the landslide risk at the boardwalk and heritage areas as the risk is inherent in the geology and topography.

Substitution

Substitution of the risk would be possible. For instance, it would be feasible to construct a replica of the boardwalk and the heritage areas and place this in a location with acceptable rockfall or landslide risk – on the alluvial flats to the west, for example. However, based on discussions at the site meeting we judge that this is likely to be unacceptable to the traditional owners.

It might also be possible to substitute the risk by moving the visitor viewing areas to a less risky location still within visible range (again the alluvial flats are an example) and to broadcast images of the significant portions of the site. Again we judge that this is likely to be unacceptable to the traditional owners.

Engineering Controls

Engineering controls may be more practical than the preceding options. Potentially these might include tunnelling through the cliff to gain access to the boardwalk area, although the need to manage the impact on the heritage areas would still require some entry into the landslide/rockfall risk zone. The cost might also be prohibitive. Construction of a tunnel may also have a negative impact on the stability of the cliffs and scree slope.

Placing a protective canopy over the boardwalk will reduce the risk from rockfall with the quantum of the risk reduction dependent on the strength and serviceability of the canopy. Portions of the boardwalk are covered in shade cloth at present. Our observations suggest that the shade cloth detains some of the rockfall. However, damage to the cloth indicates that some falling particles penetrate through it.

It would potentially be possible to target risk management measures to areas of higher risk - where people congregate for longer periods – and provide a more robust protective canopy to those areas than to others where people are present for shorter times.

Administrative Controls

Some administrative controls are already in place; the boardwalk area is fenced off from the rest of the Conservation Park. Extending these might include provision of signs indicating the risk of rockfall and allowing visitors the choice of entering the risk zone, as was mentioned in the report to DEH.

Other controls might also include inducting visitors to the site, with the induction activities including a description of the risk and a requirement that, to gain access to the risk zone, visitors formally accept the associated risk (by signing an acknowledgement, for example).

Further administrative controls would also be feasible, depending on the wishes of the owners and operators of the Park.

Personal Protective Equipment

Personal protective equipment to manage the rockfall risk might include use of hard hats – the DWLBC personnel employed these during our site visit, and their use is practically ubiquitous for rock climbers in areas of rockfall. Safety boots might also be employed, although this may not be as practical as using hard hats, given that safety boots are not 'one size fits all'.

The foregoing is not an exhaustive compilation of all feasible management measures, but sets out signposts to an approach that might, under appropriate policy guidelines and protocols, allow continuing access to and use of this significant heritage site.

LIMITATIONS

Your attention is drawn to the document – "Limitations", which is included in Appendix A of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

CLOSURE

Thank you for the opportunity to contribute to this project. The work has been interesting and presented some challenges. Should you have any queries regarding this letter, or if we can be of further assistance, please do not hesitate to contact this office.

GOLDER ASSOCIATES PTY LTD



Lyndon Sanders
Principal Geotechnical Engineer

LJS/PJB/nrd

Attachments: Limitations (LEG04, RL1)

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