Lahar Factsheet #5
November 2006

Mt Ruapehu Crater Lake Lahar threat response

– OPTIONS FOR MITIGATING THE LAHAR THREAT

Twenty four options for mitigating the Crater Lake lahar threat were considered in an environ-mental and risk assessment presented to the Minister of Conservation in 1999. This evaluation,'Environmental and risk assessment for the mitigation of the hazard from Ruapehu Crater Lake – Assessment of Environmental Effects' (also called the AEE), provided the basis on which ongoing decisions about mitigating the lahar threat are being made. The evaluation and its recommendations were independently reviewed. This review said that the evaluation had set anew international standard for assessments of this type.

The mitigation options fell under two broad categories: strategies to reduce the hazard (by ensuring that people are not in the way of the lahar when it occurs); and removal of the hazard. The options evaluated included engineering at the crater rim, alarm systems, dams and diversion walls further downstream. These options were grouped under six headings:

1. No engineering intervention.

This would involve mitigating the lahar hazard by influencing human behaviour through land-use planning (ensuring that essential services and structures are designed to withstand the hazard or located out of the way), establishing warning systems, developing contingency plans to deal with a major lahar, and continued monitoring of the Crater Lake.

2. Intervention only in the lahar flood run-out zone.

This approach considered options involving the construction of lahar containment dams and/or bunds (stopbanks), specific engineering works to protect vulnerable infrastructure such as power pylons, bridges and highways, and the excavation of a system of lakes, basins,and canals.

3. Stabilising the dam over the Crater Lake outlet.

Several options for stabilising the Crater Lake dam were evaluated. They included cement grouting (drilling and filling holes with concrete), installing concrete culverts, tunnelling, aconcrete weir and bio-hardening

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systems.

4. Excavate a trench through the Crater Lake dam

This option involves using earth-moving machinery to excavate a trench through or partly through the tephra dam to form a channel that would allow the Crater Lake waters to drain to a safe level. The evaluation considered eight methods for creating the trench: light or heavy excavators or bulldozers, sluicing, explosives, bombing from the air and manual labour.

5. Excavate a trench into the underlying lava at the dam outlet.

This option would involve excavating a trench through the tephra dam as above, and into the lava beneath the dam. The intent would be to remove the immediate lahar threat, and substantially reduce the volume of the Crater Lake so that the size, number, effect and probability of future lahars would be reduced.

6. Other options: siphoning, barrier truss

The siphon option would involve installing and maintaining a siphoning system to keep thewater level low.A 'barrier truss' is a high-tensile fabric membrane supported by an arch-shaped frame.This would be placed across the dam outlet.When the dam failed, water between the truss and the outlet would be released quickly, but the bulk of the water behind the truss would be released at a slower rate.

SHORTLISTED OPTIONS

Options 1, 2, and 4 were shortlisted in the AEE process for further consideration.

The others were ruled out during the AEE process because they could not be guaranteed to lower the lahar hazard, would require significant ongoing maintenance, could raise or alter the hazard, or were impractical. There would be major challenges in keeping the siphon running in a rugged alpine volcanic environment, particularly in winter: calculations suggests a lift of only four metres might be acheivable at the altitude of Crater Lake (2530m) when the water is warm. By significantly lowering the Crater Lake,Option 5 was predicted to increase the chance of economically damaging ashfalls during extended eruptions and could also alter the frequency or other characteristics of Ruapehu eruptions. These options were also ruled out because they would have a significant effect on conservation principles and values. The findings of the AEE were supported by an independent review carried out at the request by the Minister of Conservation. This review found that the

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AEE had set a new international standard for evaluations of this type.

DECISIONS

The decisions taken combines options 1 and 2: installing a reliable warning system, ensur-ing emergency response systems are in place, and constructing a bund to prevent overflow into the Tongariro River (see earlier fact sheets). in addition of most important state highway bridge at Tangiwai has been raised and strengthened so it can now withstand lahars. The Tongariro Power Scheme has also been isolated by new works so that it also can survive future lahars.

Options 1 and 2 together reduce potential threats tohuman life and infrastructure to a very large extent, and will have the least impacts on high social and ecological values in Tongariro National Park and to the Tongariro River. They could also minimise risks from future larger lahars. The disadvantages are that a very small residual risk to human safety remains and in the worst case, damage to spme infrastructure (e.g. some other bridges and power pylons) may not be avoided. However replacement bridges and pylons could be in place within days, which would reduce these impacts. The Minister of Conservation has decided that there will be no engineering intervention at the Crater Lake. Engineering at the crater rim has significant disadvantages, including a major impacton extremely high natural, cultural, scientific, philosophical and other values associated with the summit area. It runs counter to National Parks Act principles, the Tongariro National Park Management Plan, and the Park's World Heritage status. Engineering would only address the risk from one lahar initiation process and has notable risks for operator safety. There are also technical considerations associated with working at altitude.