REPORT

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Prepared for: Engineering and Hazards Committee
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Subject: Otago Alluvial Fans Hazard Identification

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1. Introduction

Alluvial fans comprise of sediment accumulations deposited at the base of valley slopes, shaped like an open fan or segment of a flattish cone. Formed by streams losing sediment transport potential at the exit of confined valleys, alluvial fans exhibit gentle slopes when dominated by flood processes and steeper slopes when debris-dominated. Primarily formed by intense, heavy rainfall, the overall development of these features spans time scales of decades to centuries. In Otago, the streams are often ephemeral, creating an impression within the community that flood and debris flow hazard does not exist, or is insignificant. Further, the steep, incised upper parts of the catchment lead to "flashy" flood flows, often associated with concentrated, high intensity convective rainfall ("thunderplumps") which exacerbate the hazard.

The form and setting of alluvial fans often makes them an attractive location for residential development in Otago. Notable examples of this are Stoney Creek (Wanaka) and Pipson Creek (Makarora). Identifying major fans and understanding the significance of the hazards associated with each major fan is a necessary part of managing the risks associated with human occupation of alluvial fans and avoiding inappropriate development.

Earlier this year the Otago Regional Council commissioned Opus International Consultants Ltd (Opus) and the Institute of Geological and Nuclear Sciences Ltd (GNS Science) to assess and report on the risk from alluvial fans that may impact on communities in Otago. Work to date has principally involved the identification of alluvial fans throughout Otago and the subsequent classification of dominant fan formation processes for each identified fan. This regional assessment aims to provide an indication as to whether or not these events are still likely to occur, and to highlight the nature of any hazardous active processes. The findings are presented in the attached report 'Otago Alluvial Fans Hazard Identification' dated May 2007, prepared by Opus International Consultants Ltd.

2. Fan Identification

The study defines 1920km^2 of alluvial fans in Otago, which equates to approximately 6% of the land area (Figure 1). All alluvial fans larger than 0.5km^2 have been identified with boundary accuracies of either ±100m or ±200m.

The work has taken the form of a desktop exercise, verified with experience and records of known fans. Information has been derived from a number of sources, including both published and unpublished topographical and geological maps at either 1:250,000 or 1:50,000 scale.

The database that has been developed contains details on the source of each fan defined and comments on how the boundary definition translates to precision on the ground. This information ensures that the derived information is applied and interpreted in the correct context.

3. Fan – Hazard Assessment

There are 2029 areas containing alluvial fans in the derived dataset of which 1329 are classified as **active** - i.e. that flooding, deposition and/or erosion are still possible. The remaining 700 fan structures have been classified as **inactive** where they are separated from the stream and/or catchment from which they were derived, or there is sufficient evidence to classify within this category (Table 1). A fan is only allocated the activity status 'inactive' if it is assessed as not posing any further threat to infrastructure, development or life, within a time period of <500 years.

Fans have also been characterised on the basis of the predominant depositional process responsible for their formation (Table 1, Figure 2). Fans are classified as being debris-dominated, flood-dominated or composite fans, where a distinct process cannot be solely allocated to that fan. Debris-dominated alluvial fans have much greater destructive potential than flood-dominated fans due to the mobilisation of rock and sediment clasts down slopes at high velocities. This information is useful for determining the range and significance of the hazards associated with each fan.

Table 1. Shows the attributes allocated to each fan structure noting its activity status and dominant processes. The corresponding colours are located on the accompanying map (Figure 1).

Activity Status	Dominant Process	Map Colour
Active		
Flooding, deposition and/or erosion are possible within the next 500 years	Debris fans: debris flows and debris floods	Dark Orange
	Floodwater fans: sheet floods, channel floods carrying sediment, gradational to debris floods	Mid Orange
	Composite fans: indeterminable, debris or floodwater dominated	Yellow
Inactive		
Clear evidence for the absence of activity	Debris Fans	Dark Green
	Floodwater Fans	Mid Green
	Composite	Light Green

4. Data Use and Application

The study is the first phase of classifying alluvial fan activity in Otago and is regarded as a regional-scale assessment. The GIS dataset and map define likely locations and the nature of alluvial fan-related hazards, rather than defining site-specific information (Figure 1). More detailed hazard assessment and qualitative risk evaluation will require site specific investigations with fieldwork. This next phase will commence shortly and use the derived information to identify particular fans that require more detailed assessment on the basis of the scale and significance of the hazard and its potential impacts on communities.

The data and results from this study will also be integrated into future community vulnerability analyses to be undertaken by Council as well as providing a fundamental data source for Council's Regional Natural Hazards Database.

5. Recommendation

That this report be noted.

Gavin Palmer
Director Environmental Engineering and Natural Hazards