Geog 422/522 Hazards and Resource Management in Alluvial Fan Environments

I. Water Resources
- A. Great Basin / Basin and Range Province
  - 1. Unconsolidated alluvial fans represent a principle groundwater resource
    - a. porous and permeable sand-gravel aquifers
      - (1) high porosity (30-40%)
      - (2) high permeability (K range: 10^{-1} to 10^{-3} cm /sec)
    - b. Rapid infiltration / recharge from mountain canyon systems
      - (1) Fans serve and recharge conduit into valley-fill aquifers
  - 2. Nevada Surficial Mapping Project
    - a. Recognizes alluvial fans as important aquifer resources
    - b. mapping project focuses on surficial geology / alluvial fan mapping
- B. Fan Styles
  - 1. Large-Scale Tectonic-Related Fans
    - a. Important aquifer resources
  - 2. Small-Scale Tributary-Junction Fans
    - a. limited groundwater occurrence
    - b. diamicton-dominated in humid climates

II. Hazards Management
- A. Land Development on Fans
- B. Flood Hazards Assessment
  - 1. Geomorphic Mapping
    - a. Active / Inactive Surfaces
      - (1) soils development
      - (2) paleoflood indicators
      - (3) relative age indicators
    - b. Fan-Head Trenching / Lobe Activity
  - 2. Hydrologic Analysis
    - a. Discharge-Time Series Relationships
      - (1) Recurrence Intervals / Probabilities
- C. Mountainous Habitated Regions
  - 1. Fans Common
    - a. Tributary - Debris-Flow Dominated Fans
    - b. Master Tributary
      - (1) Flood Hazards
    - c. Fan Tributaries
      - (1) Debris Flow Hazards

2. Hazards Characteristics
    a. Fan Channel / Lobe Avulsion
    b. Debris Flow

D. Hazard Identification
1. Geomorphic Mapping / Fan Classification
    a. Active vs. Inactive Fan Surfaces
2. Debris Flow Indicators
    a. debris-flow tracks
    b. paleobotanical indicators
        (1) tree scars
        (2) advantitious sprouts
    c. boulder levees / snouts
    d. woody debris jams

E. Example Hazards Classification

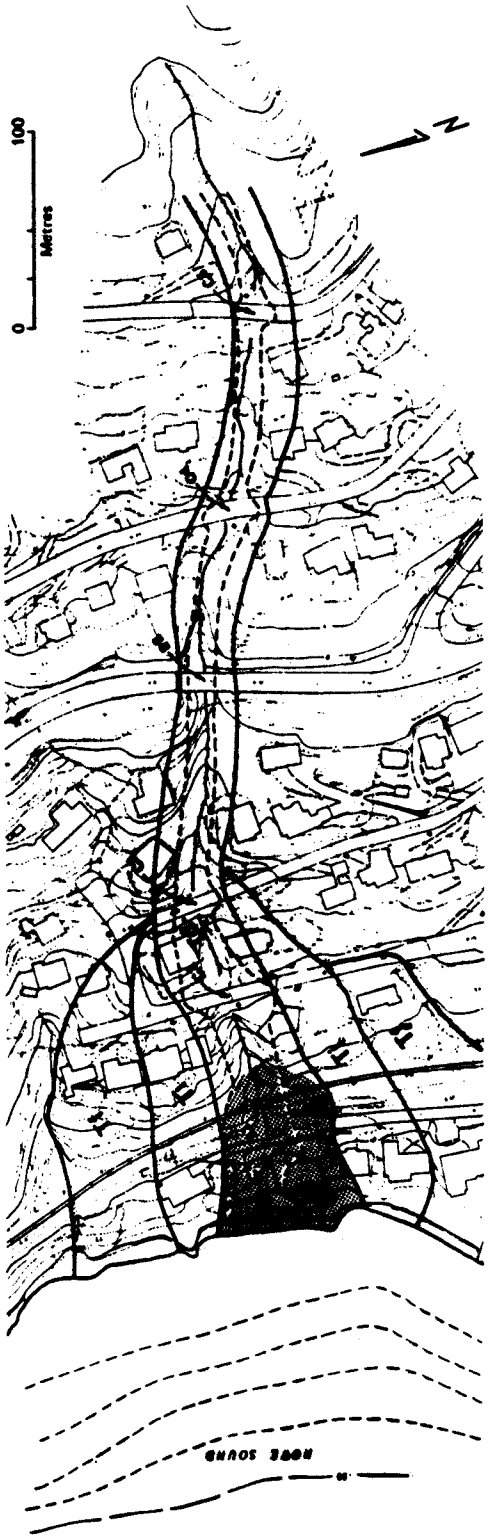

Figure 17.8. Hazard zones on the fan of Alberta Creek, as determined by Thurber Consultants (1983b)

Table 17.2. Fan hazard zone classification*

Category	Description
Td	*Direct impact zone of debris flows:* zone through which the debris surge may travel. The risk of impact damage is therefore high. Material transported through this zone could include boulders up to several metres in diameter and logs over 30 metres long.
Ti	*Indirect impact zone of debris flows:* zone through which later debris surges may be diverted and/or through which after-flow may travel. The risk of impact damage is lower. Material could include large rock and log debris, but is more likely to contain boulders of less than 1 m to fine-grained material and organic mulch.
Tf	*Flood zone due to debris flows:* zone that is exposed to flooding as a result of blockage of the main channel by debris-flow deposits. The risk of impact damage is low. Fine-grained material and mulch could be contained in the flood water.
	Area of potential deposition of debris: areas within which debris-flow materials could be deposited.
	Outline of area directly affected by known previous events: refers to historical events rather than to ones known only from morphology or stratigraphy, and of uncertain date.
Fh	*High flood hazard zone:* zone that has a high probability for flooding. In this zone, avulsions are possible.
Fm	*Moderate flood hazard zone:* zone that has a moderate to high probability of flooding. Avulsions could occur but are unlikely.
Fm	*Low flood hazard zone:* zone that has a moderate to low probability of flooding, but avulsions are unlikely.

*Modified from Thurber Consultants (1983b).

ses. The two largest fans were judged to be free from debris-flow hazard but exposed to avulsions and flooding, and were accordingly zoned into F-classes. By implication, the maximum size drainage basin which appears to be susceptible to debris-flow in the Howe Sound study area has an area of about 10 km^2. There probably are many