SHEET 2 OF 2

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT 79-963

MAPS SHOWING LANDSLIDES AND RELATIVE SLOPE STABILITY OF QUATERNARY DEPOSITS OF THE LOWER SKAGIT AND BAKER VALLEYS, NORTH CASCADES, WASHINGTON

MAP SHOWING RELATIVE SLOPE STABILITY OF QUATERNARY DEPOSITS OF THE LOWER SKAGIT AND BAKER VALLEYS, NORTH CASCADES, WASHINGTON

by Paul L. Heller
1979

This map classifies the Quaternary deposits in the study area into zones of differing slope stability. An unstable slope is one which has a significant chance of sliding. Instability due to slope modification by man is not shown and rock falls are excluded.

Slope categories were defined on the basis of field observation of landslide occurrences. These categories agree well with those used in other slope stability studies (Brabb, et al., 1972). These class characteristics are summarized in Table 1.

	MATERIAL		
SLOPE	SAND AND GRAVEL	SAND	CLAY/SILT
70%+	DEBRIS SLIDE	DEBRIS SLIDE	DEBRIS FLOW
50-70%	debris slide	debris flow or slide	DEBRIS FLOW
30-50%	stable	stable	debris flow
0-30%	stable	stable	stable

Table 1. Dominant slide types as a function of slope and material in the Lower Skagit and Baker River Valleys. Most frequent slide types are capitalized.

A slope map was prepared from available topographic maps. This, along with maps of materials and landslide distribution, was used to derive the slope stability map. On this map slopes are divided into three categories; (Class 1) terrain virtually free of stability problems; (Class 3) terrain which is naturally prone to failure; and terrain marginally stable under natural conditions (Class 2).

Map Reliability:

This map reflects regional stability and should not be used to determine stability at a specific site.

Errors are generated by:

1. Contour intervals being too large to show local variations in slope.
2. Local variations not being shown on the materials map.

Slope Classification:

Slopes are classified in terms of stability in their natural state.

Class 1: Slopes less than 50% in sand or sand and gravel; slopes less 30% in clay/silt units; and any slopes developed on bedrock. These slopes have not exhibited any landslides in the recent past and are probably not a significant hazard. They may include local failures (i.e. surficial soil slippage, sliding along stream banks, etc.).

Class 2: Slopes of 50-70% in sands, sand and gravel; and where material is unmapped; and slopes of 30-50% in clays and silts. The sands and gravels may occasionally fail as debris slides, or as debris flows if silt is present. The clay and silt are susceptible to failure as debris flows (including mud flows, though uncommon in the field area).

Class 3: Slopes of 70% or greater in sands or sand and gravel: 50% or greater in clay/silt interlayers or where sands contain extensive silt layers. Nearly all landslides in the study area occur on Class 3 slopes.

Reference Cited: Brabb, E., Pampeyan, E., and Bonilla, M., 1972, Landslide susceptibility in San Mateo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-360, Scale 1:62,500.

EXPLANATION

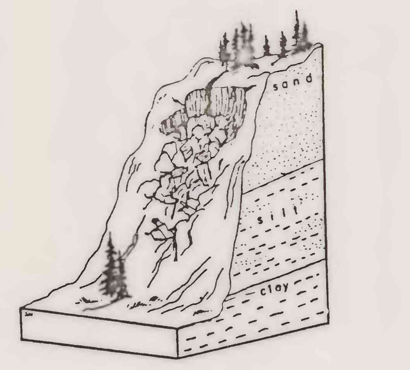
I CLASS 1 Slopes stable in their natural state; generally lower than 30 %.

II CLASS 2 Slopes marginally stable in their natural state. Slides may naturally occur on these slopes and are likely when slope is modified by man.

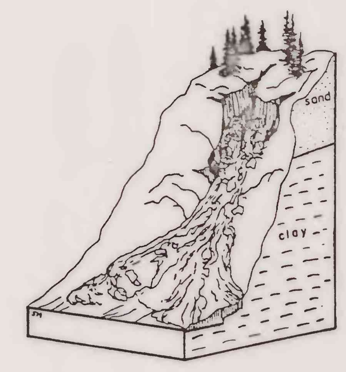
III CLASS 3 Slopes naturally unstable, extremely likely to fail if modified.

BEDROCK within ~2m of the surface. If mantled, may fail in debris slides on steep slopes. Rockfalls possible.

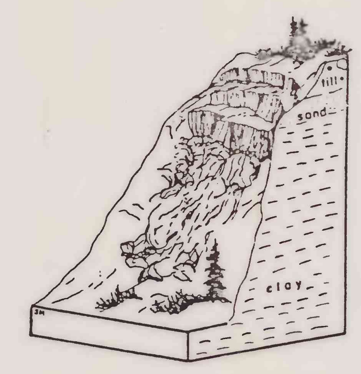
STUDY AREA BOUNDARY



Debris Slide



Debris Flow

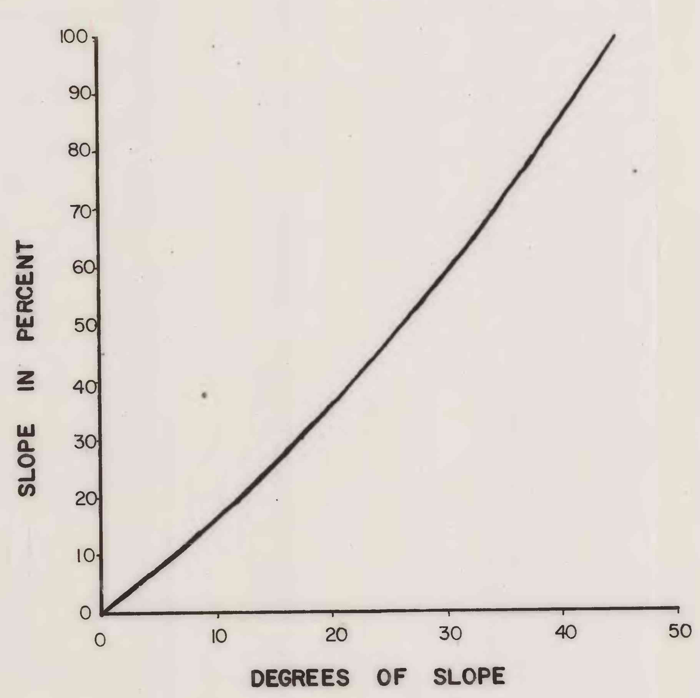


Slump/flow

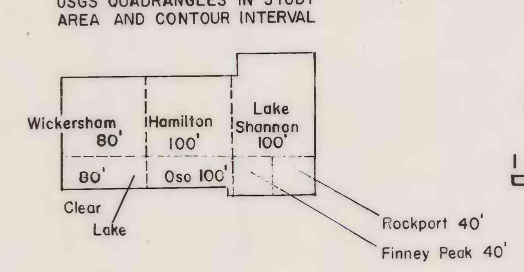
FIGURE 1. Debris slides are nearly dry, shallow mass movements that involve minimal flowage. These slides occur on very steep slopes, generally greater than 70%. Materials are composed of sand-sized or larger particles. If these dry sands enter stream gulleys, they may become saturated and move downslope as debris flows. Debris slides commonly occur in sidecast or fill material along roads, on logged slopes, and at boundaries between permeable and impermeable strata.

FIGURE 2. Debris flows are fluid mass movements that occur on moderate to steep slopes, generally greater than 50%, and may flow considerable distances from their source. Constituents range in size from clay to sand, but may include larger particles. Mudflows are considered debris flows, consisting mainly of clay and silt. Debris avalanches are flows less saturated with water, thus they flow less distance. Debris flows are often triggered by heavy rain and occur along the top of an impermeable layer.

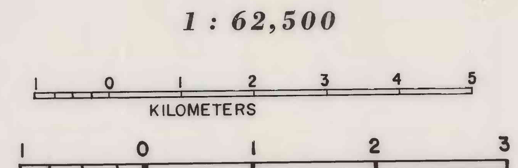
FIGURE 3. Slump/flows involve both slumping and flowage. Slumps occur when competent material fails by breaking into undeformed blocks which rotate in a downslope direction. Severely broken slump blocks will fail as debris flows. Slump/flows originate along interfaces between permeable and impermeable materials on moderate to steep slopes. Heavy rain is a causative factor.



USGS QUADRANGLES IN STUDY AREA AND CONTOUR INTERVAL



1 : 62,500



N