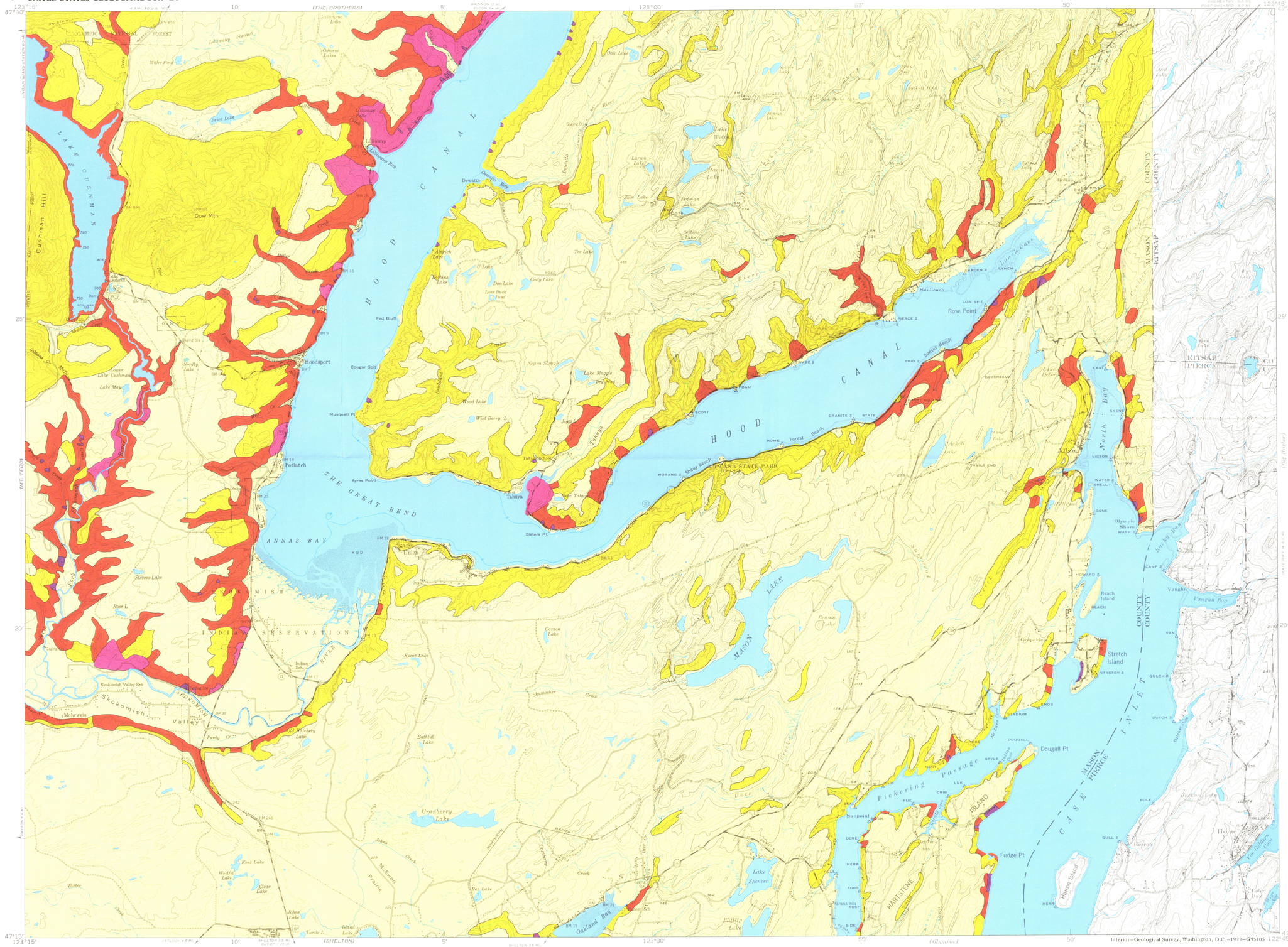
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
WASHINGTON DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND EARTH RESOURCES

FOLIO OF THE SOUTHERN HOOD CANAL AREA, WASHINGTON
MAP I–853–F



Base from U.S. Geological Survey
Potlatch, 1952 and Allyn, 1938

SCALE 1:62 500

1 ½ 0 1 2 3 4 MILES
1 .5 0 1 2 3 4 KILOMETRES

CONTOUR INTERVAL 20 AND 40 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET–DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 8 FEET

22° APPROXIMATE MEAN DECLINATION 1977

EXPLANATION

Class 1

Areas believed to be stable. Slopes generally less than 15 percent, but may be greater locally in areas too small to be shown at the map scale. Largely comprises rolling uplands underlain by very stable material such as young glacial till, mantled in places by a thin layer of sandy gravel or other permeable material; also includes flood plains, deltas, alluvial fans, and some beach deposits. Class 1 areas immediately adjacent to steep slopes of class 3 areas may be threatened by potential landsliding. Normal, proper engineering practices generally are adequate to insure stability in these areas.

Class 2

Areas believed to be stable under normal conditions, but may become unstable if disturbed by man's activities, if slope is oversteepened by erosion, or if subjected to strong seismic shaking. Slopes generally steeper than 15 percent, but may be less in some areas of weak geologic materials. Includes areas underlain by: well-drained sand and gravel, mostly on valley sides that lack known slope failures; glacial till with steep slopes; and bedrock.

Class 3

Areas inferred to be unstable because slopes, generally greater than 15 percent, are underlain by weak, unstable materials in which old or recently active landslides have occurred. Includes areas of sand and gravel on top of impermeable silt and clay, mostly along steep valley sides.

Class 4

Former landslide areas, generally within class 3 areas; include relatively large slumps, flows, and slides of soil, rock, and debris that have occurred since retreat of glaciers from the region (about 13,500 years ago). Present stability unknown, but sliding may be reactivated by excavations, slope modifications, or strong seismic shaking.

Class 5

Known areas of recently active rapid downslope movement (probably within the past 50 years) generally in class 2 and 3 areas. Includes a few cases of moderate-size landslides, but most commonly only slumping, sliding, and falling of relatively small amounts of earth material, usually occurring during periods of heavy rains. Present stability considered very poor.

DISCUSSION

This map shows the relative stability of natural slopes in the southern Hood Canal area of Mason County, Washington. It is one of a series being prepared by the U.S. Department of the Interior in cooperation with several agencies to present basic environmental information and interpretations to assist land-use planning in the Puget Sound area.

Landsliding is only one of many geologic hazards active in the southern Hood Canal area. Other hazards, some of which may be interrelated, are seismic shock, recent faulting, flooding, and differential settlement. A significant example of this interrelation is the effect of earthquakes on slope stability; seismic shock may initiate or intensify landsliding.

Land in the southern Hood Canal area ranges from stable surfaces to actively moving landslides. Stability depends on the steepness of the slope, the character of underlying geologic materials, ground-water and soil-moisture conditions, stream and wave erosion, and modifications by man.

Man's activities often modify natural physical processes to the extent that landslides occur in areas that have been stable over many centuries. These landslides are commonly associated with extensive road building and logging operations, and development of second homes on slopes overlooking lakes and Hood Canal. Clearing of vegetation can increase erosion and may result in a buildup of ground water—both major causes of slope instability. Construction of roads and housing sites often directly produces oversteepening or overloading of natural slopes. Earth materials that are otherwise firm may also be weakened by overwatering from septic-tank drainfields and from irrigation of lawns and fields. Knowing the location of potentially unstable areas can guide planners to places where land-use regulations are needed most to avert damage from these kinds of acts.

The area mapped is separated into 5 classes of relative slope stability:

1. Areas that are inferred to be stable.
2. Areas that probably are stable under normal conditions, but may become unstable if modified by man's activities.
3. Areas inferred to have poor natural stability.
4. Areas of former, still recognizable landslides, the present stability of which is unknown.
5. Areas of recently active, rapid downslope movement.

The boundaries on the map between areas of stability classes 1 to 3 are imprecise in places, because data on slopes and geologic materials are locally generalized or poorly known. Also, there are places where stability characteristics differ from the pattern shown because they are too small to be indicated at the map scale. Therefore, in any areas other than class 1, thorough geologic and engineering studies should be made before changes in land uses are undertaken.

DATA SOURCES

The part of the map south and east of Hood Canal and the Skokomish Valley was prepared by Mackey Smith, partly on the basis of mapping by Garling, Molenaar, and others (1965) and by Molenaar and Noble (1970); field checks, supplemented by interpretations from aerial photographs, were made to verify slope-stability evaluations and the location of landslides. The map area west of Hood Canal and north of the Skokomish Valley is based on detailed geologic mapping by R. J. Carson (Carson, 1973), augmented by field checking in 1974. The criteria for classifying relative slope stability are modified from those used by Miller (1973).

SELECTED REFERENCES

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Garling, M. E., Molenaar, Dee, and others, 1965, Water resources and geology of the Kitsap Peninsula and certain adjacent islands: Wash. Div. of Water Resources, Water Supply Bull. 18, 309 p.

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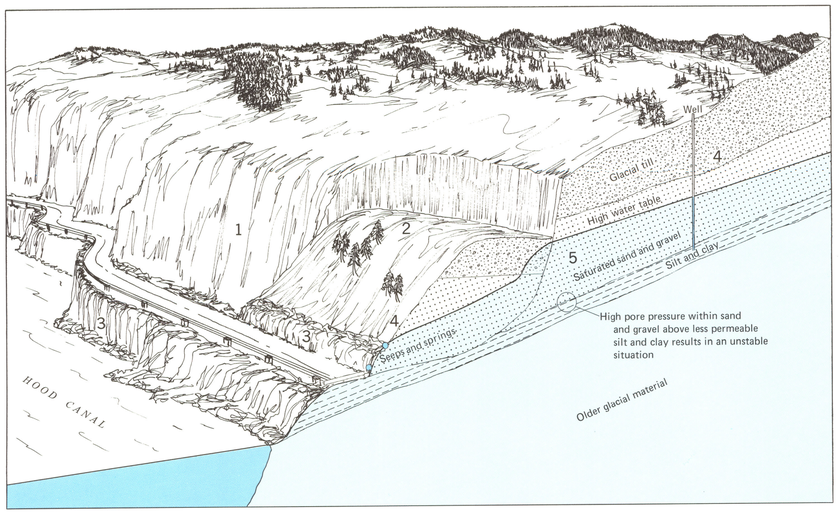
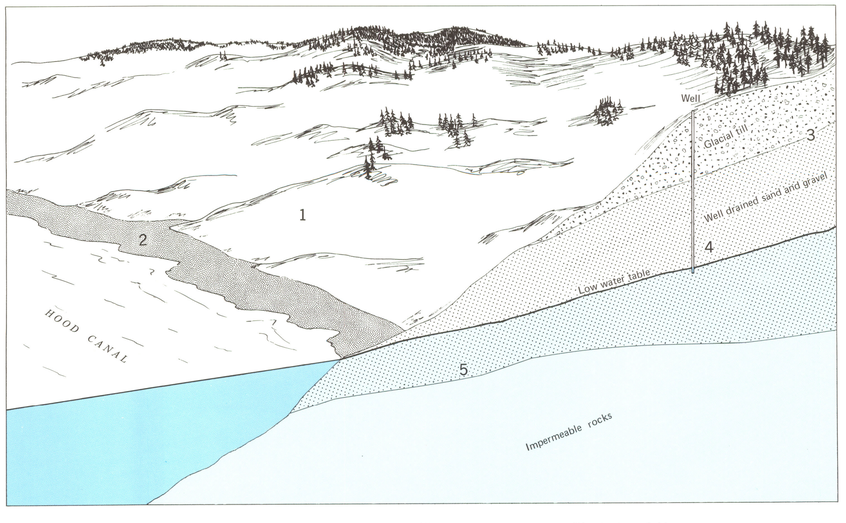
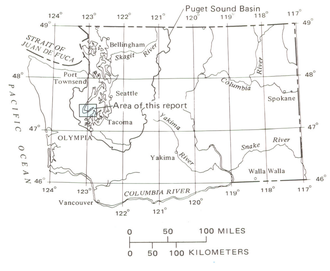


A. Conditions favoring unstable land: (1) Steep slopes; (2) presence of earlier slides, as evidenced by scarp with hummocky land below, and bent tree trunks; (3) over-steepening of slope by excavation at toe of existing slide, or active shore erosion; (4) water table and hydrostatic pressure high, as indicated by springs and water levels in wells; (5) saturated sand above impermeable layer near base of slope.



B. Conditions favoring stable land: (1) Gentle slopes; (2) little or no shoreline erosion; (3) upland mantled by thick, stable till underlain by well-drained sand and gravel; (4) water table low, as shown by levels in wells; (5) underlying impermeable layer does not extended above sea level.



MAP OF WASHINGTON

RELATIVE SLOPE STABILITY OF THE SOUTHERN HOOD CANAL AREA, WASHINGTON

By

Mackey Smith and R. J. Carson

Washington Department of Natural Resources

Division of Geology and Earth Resources

1977

Interior–Geological Survey, Washington, D.C.–1977–G75105

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