GEOLOGIC MAP GM-18

STATE OF WASHINGTON

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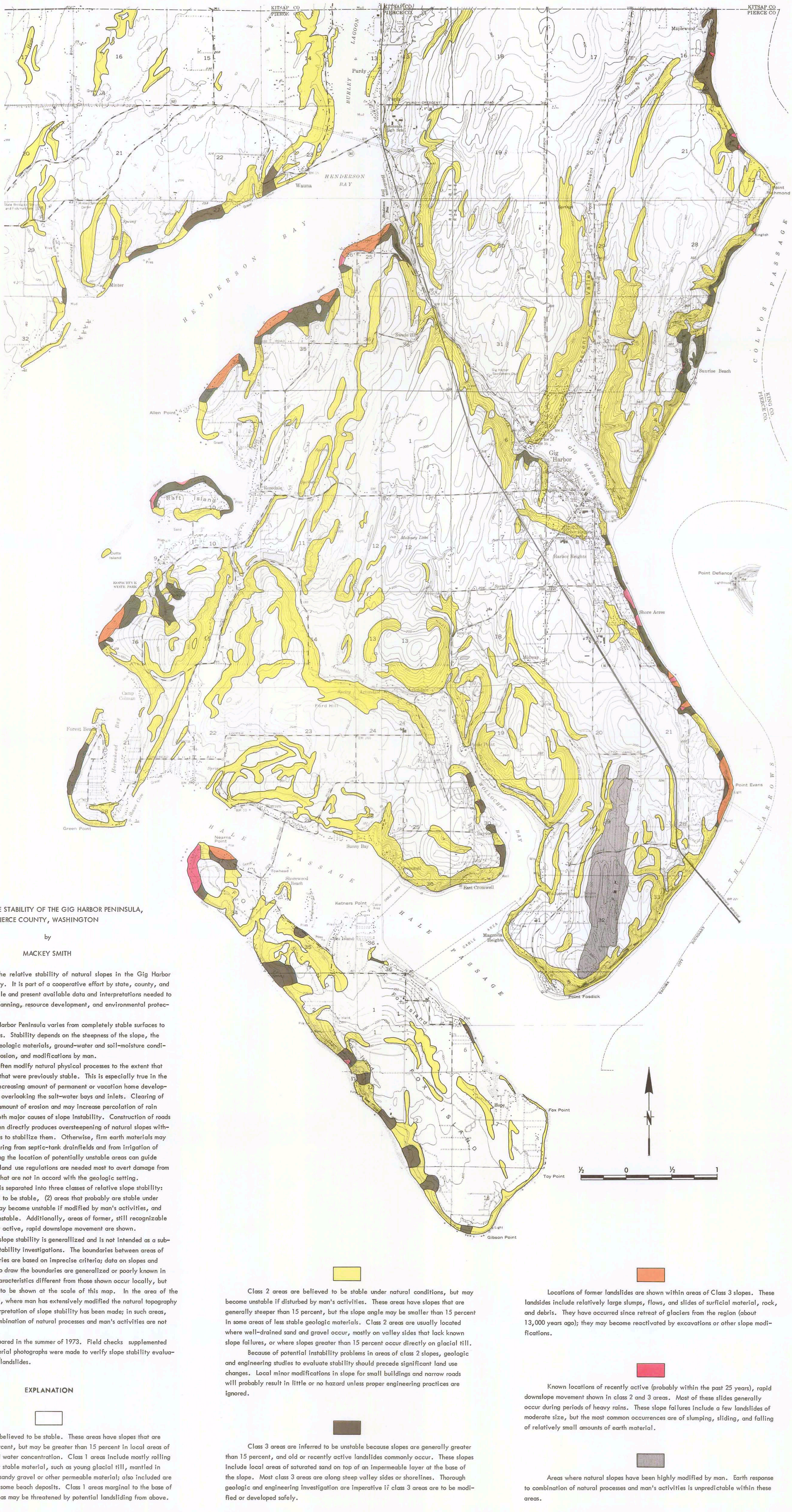
RELATIVE SLOPE STABILITY OF GIG HARBOR PENINSULA, PIERCE COUNTY, WASHINGTON

By

MACKEY SMITH

PREPARED IN COOPERATION WITH THE
U.S. GEOLOGICAL SURVEY AND PIERCE COUNTY

1976



RELATIVE SLOPE STABILITY OF THE GIG HARBOR PENINSULA, PIERCE COUNTY, WASHINGTON

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MACKEY SMITH

This map shows the relative stability of natural slopes in the Gig Harbor Peninsula of Pierce County. It is part of a cooperative effort by state, county, and federal agencies to compile and present available data and interpretations needed to guide rational land use planning, resource development, and environmental protection.

Land in the Gig Harbor Peninsula varies from completely 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 were previously stable. This is especially true in the area mapped, where an increasing amount of permanent or vacation home development is occurring on hills overlooking the salt-water bays and inlets. Clearing of vegetation increases the amount of erosion and may increase percolation of rain water into the ground—both major causes of slope instability. Construction of roads and housing sites also often directly produces oversteepening of natural slopes without compensating measures to stabilize them. Otherwise, firm earth materials may 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 developmental practices that are not in accord with the geologic setting.

The mapped area is separated into three classes of relative slope stability: (1) areas that are inferred to be stable, (2) areas that probably are stable under natural conditions, but may become unstable if modified by man's activities, and (3) areas inferred to be unstable. Additionally, areas of former, still recognizable landslides and of recently active, rapid downslope movement are shown.

The depiction of slope stability is generallized and is not intended as a substitute for on-site slope stability investigations. The boundaries between areas of differing stability categories are based on imprecise criteria; data on slopes and geologic materials used to draw the boundaries are generalized or poorly known in some areas. Stability characteristics different from those shown occur locally, but are too limited in area to be shown at the scale of this map. In the area of the Tacoma Industrial Airport, where man has extensively modified the natural topography on a large scale, no interpretation of slope stability has been made; in such areas, earth responses to the combination of natural processes and man's activities are not easily predicted.

This map was prepared in the summer of 1973. Field checks supplemented by interpretations from aerial photographs were made to verify slope stability evaluations and the location of landslides.

EXPLANATION

Class 1 areas are believed to be stable. These areas have slopes that are generally less than 15 percent, but may be greater than 15 percent in local areas of low relief and low ground water concentration. Class 1 areas include mostly 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 included are flood plains, deltas, and some beach deposits. Class 1 areas marginal to the base of steep slopes of class 3 areas may be threatened by potential landsliding from above.

Class 2 areas are believed to be stable under natural conditions, but may become unstable if disturbed by man's activities. These areas have slopes that are generally steeper than 15 percent, but the slope angle may be smaller than 15 percent in some areas of less stable geologic materials. Class 2 areas are usually located where well-drained sand and gravel occur, mostly on valley sides that lack known slope failures, or where slopes greater than 15 percent occur directly on glacial till.

Because of potential instability problems in areas of class 2 slopes, geologic and engineering studies to evaluate stability should precede significant land use changes. Local minor modifications in slope for small buildings and narrow roads will probably result in little or no hazard unless proper engineering practices are ignored.

Class 3 areas are inferred to be unstable because slopes are generally greater than 15 percent, and old or recently active landslides commonly occur. These slopes include local areas of saturated sand on top of an impermeable layer at the base of the slope. Most class 3 areas are along steep valley sides or shorelines. Thorough geologic and engineering investigation are imperative if class 3 areas are to be modified or developed safely.

Locations of former landslides are shown within areas of Class 3 slopes. These landsides include relatively large slumps, flows, and slides of surficial material, rock, and debris. They have occurred since retreat of glaciers from the region (about 13,000 years ago); they may become reactivated by excavations or other slope modifications.

Known locations of recently active (probably within the past 25 years), rapid downslope movement shown in class 2 and 3 areas. Most of these slides generally occur during periods of heavy rains. These slope failures include a few landslides of moderate size, but the most common occurrences are of slumping, sliding, and falling of relatively small amounts of earth material.

Areas where natural slopes have been highly modified by man. Earth response to combination of natural processes and man's activities is unpredictable within these areas.