

STATE OF WASHINGTON  
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GEOLOGIC MAP GM-17

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RELATIVE POTENTIAL  
FOR DIFFERENTIAL SETTLEMENT,  
GIG HARBOR PENINSULA,  
PIERCE COUNTY,  
WASHINGTON

By

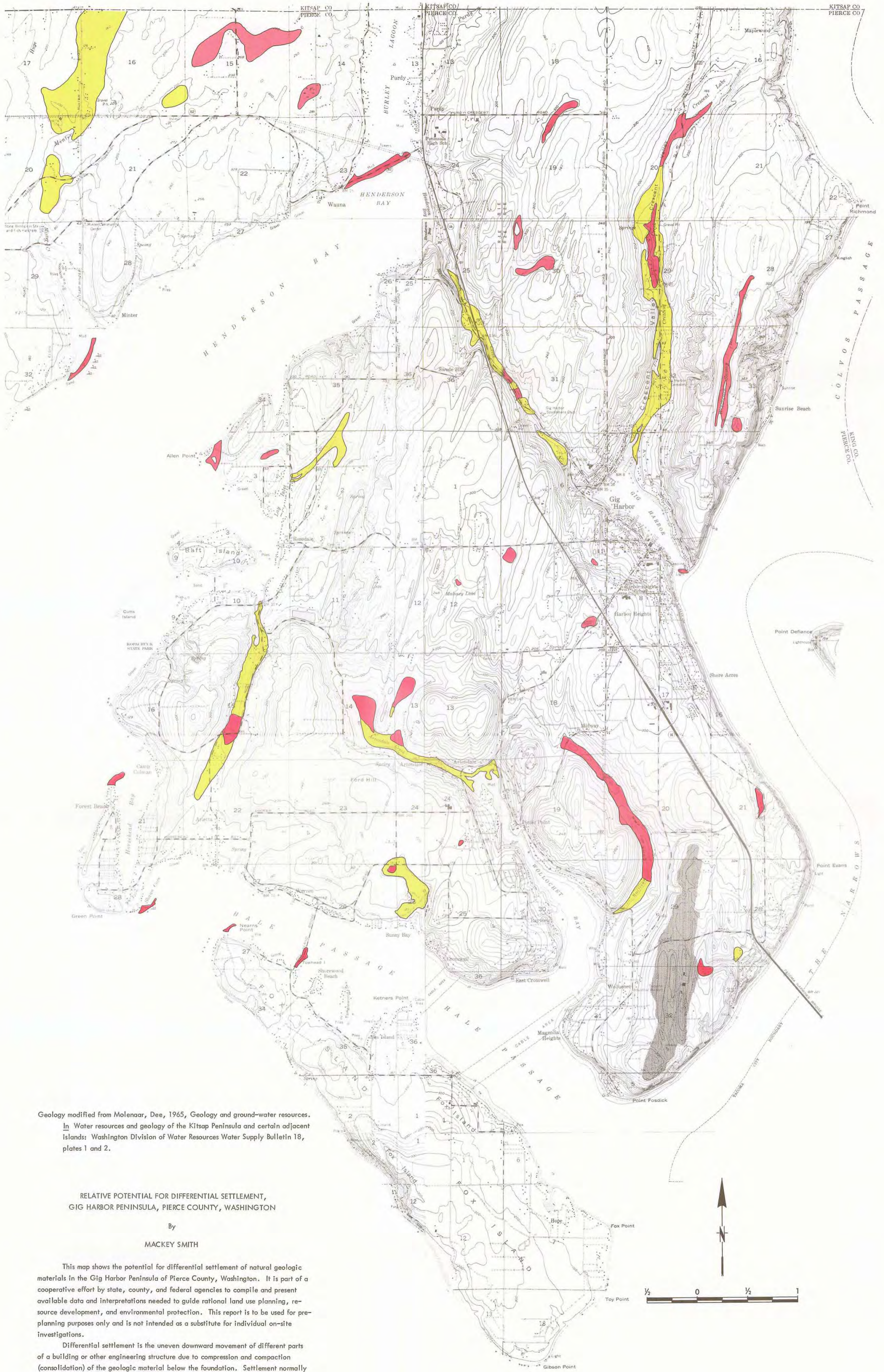
**MACKY SMITH**

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



1976

For sale by Department of Natural Resources, Olympia, Washington  
Price \$ 1.00



Geology modified from Molenaar, Dee, 1965, Geology and ground-water resources. In Water resources and geology of the Kitsap Peninsula and certain adjacent islands: Washington Division of Water Resources Water Supply Bulletin 18, plates 1 and 2.

RELATIVE POTENTIAL FOR DIFFERENTIAL SETTLEMENT,  
GIG HARBOR PENINSULA, PIERCE COUNTY, WASHINGTON

By  
MACKEY SMITH

This map shows the potential for differential settlement of natural geologic materials in the Gig Harbor Peninsula of Pierce County, Washington. 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. This report is to be used for pre-planning purposes only and is not intended as a substitute for individual on-site investigations.

Differential settlement is the uneven downward movement of different parts of a building or other engineering structure due to compression and compaction (consolidation) of the geologic material below the foundation. Settlement normally occurs at such a slow rate that it may not be immediately noticeable. Damage to structures can result when the different layers of sediment on which the structure is built compact at different rates. The rate of the settlement process may be dramatically increased by strong seismic shocks or extreme building loads.

Class 1 areas comprise glacial till and other deposits compacted by overriding of a glacier during the ice age. These areas are believed to be relatively free from the hazards of differential settlement. Most of these materials have been overridden by as much as 3,000 feet of glacial ice and have moderately high to high bearing capacities, which may reach 10,000 pounds per square foot. Class 1 includes some areas of artificial fill too small to be shown at this map scale.

Class 2 areas could be subject to differential settlement under certain conditions, such as seismic shaking or heavy building loads. These materials are mostly recessional glacial outwash, deposited at the close of the last ice age. They usually are found at lower elevations in the area. Some of the deposits in this class may have been subjected to numerous earthquakes and cycles of wetting and drying. These repeated processes may have resulted in some loss of volume, an increase in density, and a decrease in potential settlement. Consolidation tests in this type of material are extremely variable, ranging from 0 to 3 percent with loads of 2,000 pounds per square foot.

Class 3 areas consist of recent alluvium, swamps, and artificial fill and are very likely to undergo differential compaction and settling during an earthquake. A major constituent of this class is peat. Peat is mostly decomposed vegetable matter that is combined with a high percentage of water. Ground motions or building loads may displace the water, causing the ground surface to settle. Consolidation tests indicate settlement of 6 to 7 percent with loads of 2,000 pounds per square foot.

During the 1949 earthquake, which occurred in the southern Puget Lowland, the maximum destruction occurred in class 3 areas.

Where engineering tests at building sites indicate a potential for differential settlement, two solutions used to avoid settlement of foundation materials are:

- (1) Overloading of foundation materials with fill before construction to induce consolidation, and
- (2) driving piles through the compressible material into deposits that are less compressible.

Original topography disturbed by removal of some Pleistocene deposits, grading, and artificial fill.