GEOLOGIC MAP GM-16

STATE OF WASHINGTON

DEPARTMENT OF NATURAL RESOURCES

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RELATIVE GROUND SETTLEMENT HAZARDS OF THURSTON COUNTY, WASHINGTON

By

ERNEST R. ARTIM

Prepared in cooperation with
UNITED STATES GEOLOGICAL SURVEY

1976

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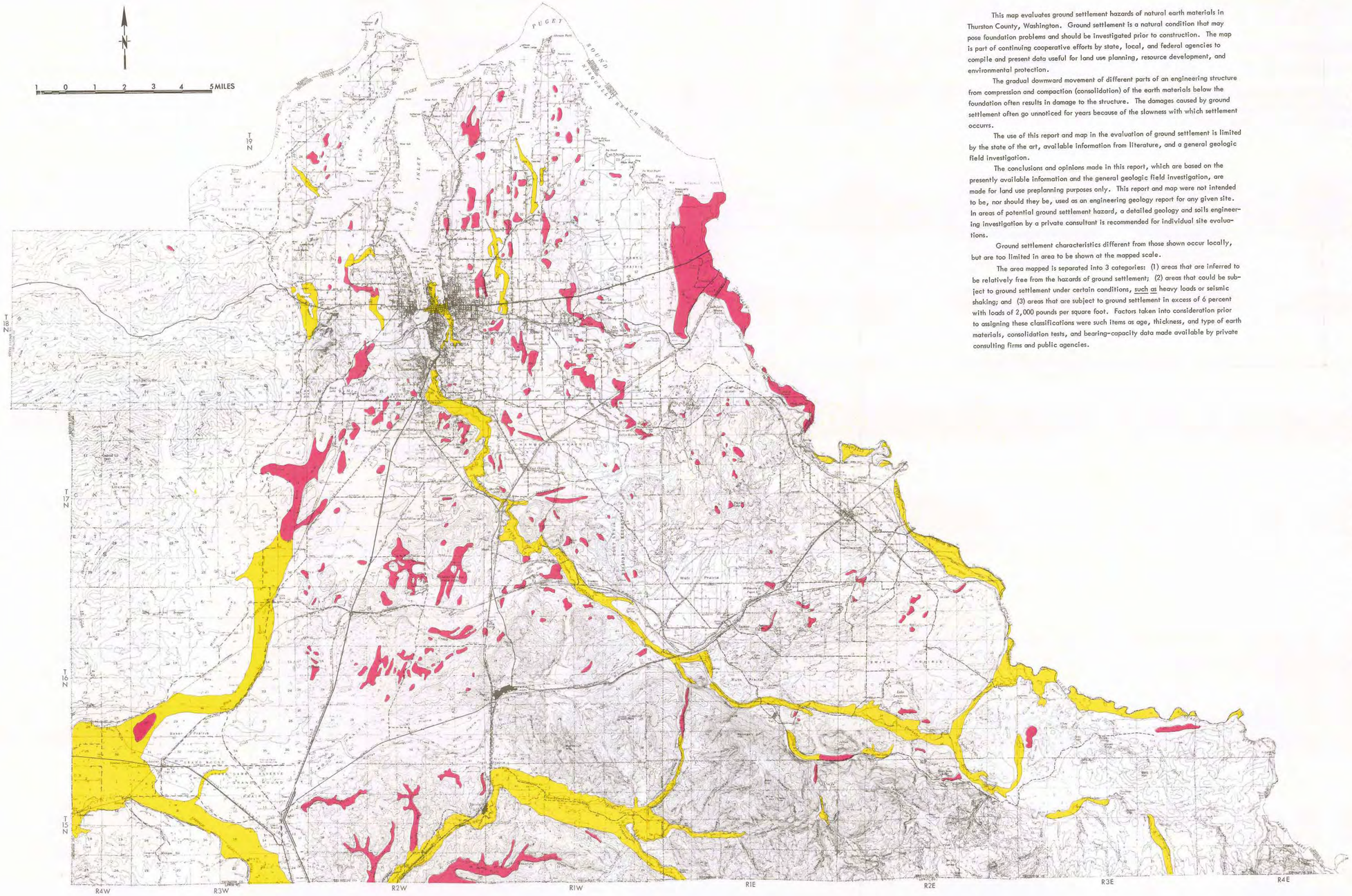

This map evaluates ground settlement hazards of natural earth materials in Thurston County, Washington. Ground settlement is a natural condition that may pose foundation problems and should be investigated prior to construction. The map is part of continuing cooperative efforts by state, local, and federal agencies to compile and present data useful for land use planning, resource development, and environmental protection.

The gradual downward movement of different parts of an engineering structure from compression and compaction (consolidation) of the earth materials below the foundation often results in damage to the structure. The damages caused by ground settlement often go unnoticed for years because of the slowness with which settlement occurrs.

The use of this report and map in the evaluation of ground settlement is limited by the state of the art, available information from literature, and a general geologic field investigation.

The conclusions and opinions made in this report, which are based on the presently available information and the general geologic field investigation, are made for land use preplanning purposes only. This report and map were not intended to be, nor should they be, used as an engineering geology report for any given site. In areas of potential ground settlement hazard, a detailed geology and soils engineering investigation by a private consultant is recommended for individual site evaluations.

Ground settlement characteristics different from those shown occur locally, but are too limited in area to be shown at the mapped scale.

The area mapped is separated into 3 categories: (1) areas that are inferred to be relatively free from the hazards of ground settlement; (2) areas that could be subject to ground settlement under certain conditions, such as heavy loads or seismic shaking; and (3) areas that are subject to ground settlement in excess of 6 percent with loads of 2,000 pounds per square foot. Factors taken into consideration prior to assigning these classifications were such items as age, thickness, and type of earth materials, consolidation tests, and bearing-capacity data made available by private consulting firms and public agencies.

EXPLANATION

Class 1 areas are believed to be relatively free from the hazards of ground settlement. The majority of these materials are either competent bedrock or have been overridden by as much as 3,000 feet of glacial ice, which compacted the materials and made them more dense. They have high to moderately high bearing capacities—up to 10,000 pounds per square foot. The remaining materials, although not as compact, are not believed to be subject to significant ground settlement. Consolidation test data indicate little or no settlement with loads of 2,000 pounds or more per square foot.

Class 2 areas could be subject to ground settlement under certain conditions, such as seismic shaking or heavy building loads. These earth materials are mostly recent alluvium deposited within the last 10,000 years, usually in the lower regions of the area. Some of the deposits in this class may have been subjected to numerous earthquakes and cycles of wetting and drying. These repeated cycles may have caused some loss of volume, an increase in density, and a decrease in potential ground settlement. Consolidation test data were extremely variable; some tests indicating no settlement, and others up to 3 percent with loads of 2,000 pounds per square foot.

Class 3 areas are subject to ground settlement. A major earth material in this class is peat. Peat is accumulated vegetative matter that is raw, disintegrated, or decomposed in varying degrees and contains a high percentage of water. A deposit may be moss peat (sphagnum), fibrous (mostly sedge), woody peat, or sedimentary peat. If peat is drained, oxygen gets to the old vegetative matter, which then begins to decompose rapidly, and the ground surface settles. Ground motions or building loads will also displace the water, and the ground surface will settle. Consolidation test data indicate settlement of 6 to 7 percent with loads of 2,000 pounds per square foot, and as high as 19 percent with loads of 8,000 pounds per square foot.

Two solutions used to avoid settlement of foundation materials are: (1) overloading to induce consolidation before construction, and (2) driving piles to deposits that are less compressible.

Overloading to induce consolidation generally involves placing enough earth fill on the proposed site to exceed the design-weight of the planned structure. The loads remain in position until settlement stops and the ground stabilizes. Material equivalent to the weight of the planned building is then removed; the structure, which is subsequently built on the remaining fill, replaces the load.

Clusters of wooden piles or concrete-filled caissons may be driven into the ground and used to provide stable foundations. The stability of driven piles depends on friction between the sides of the piles and the geologic materials, or on a compact layer to which the piles are driven. Concrete-filled caissons generally translate the weight of structure downward to stable materials.

Base map from U.S. Geological Survey 15-minute quadrangle sheets: Shelton, Olympia, Anderson Island, Rochester, Tenino, Yelm, and Ohop Valley.