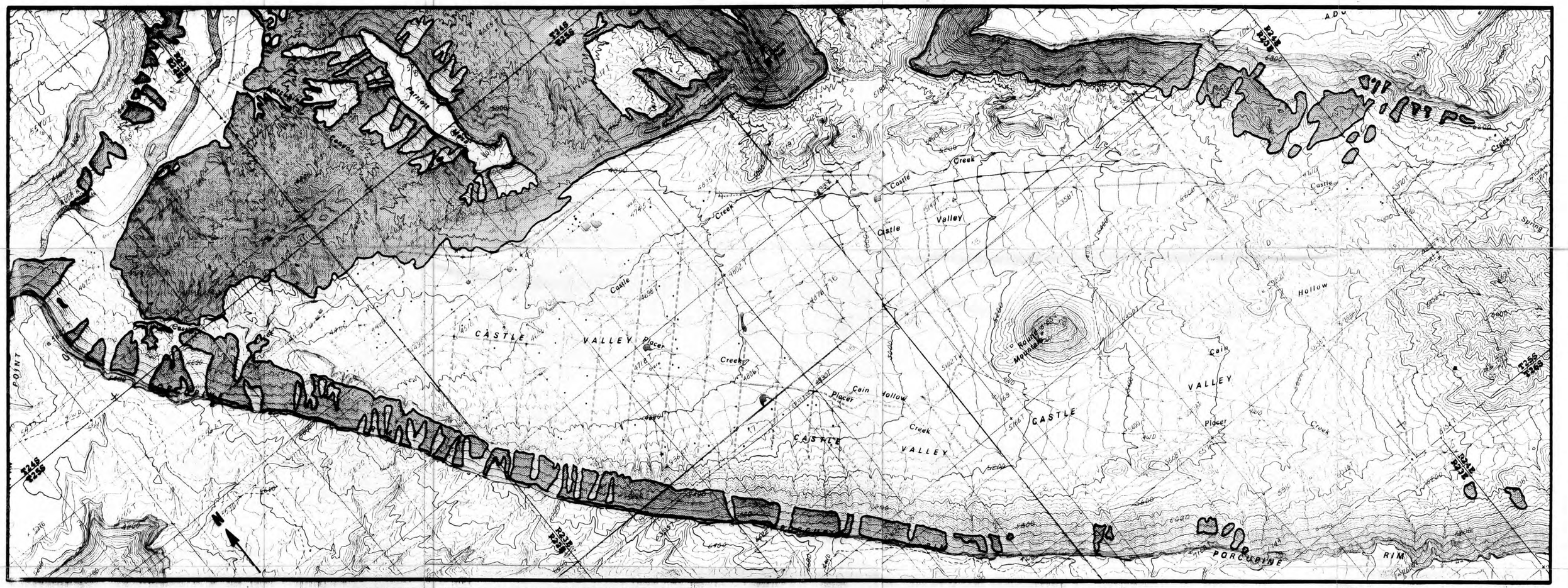

EXPANSIVE AND GYPSIFEROUS SOIL AND ROCK IN CASTLE VALLEY, GRAND COUNTY, UTAH

Utah Geological Survey
Open-File Report 238
Plate 1

by

William E. Mulvey

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SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET

Base map from USGS 1:24,000 scale topographic maps of Big Bend, Warner Lake, Fisher Towers, and Rill Creek.

Explanation

Expansive and gypsiferous soil and rock.

Hazard map based on unpublished geologic mapping by M.L. Ross and H.H. Doelling.

DISCUSSION

Expansive soil and rock in Castle Valley contains clay minerals capable of absorbing large quantities of water. The Triassic-age Moenkopi and Chinle Formations, and the soil derived from them, are the source of these expansive minerals. As moisture content changes, the clay minerals expand and contract, causing as much as a 10 percent change in volume. When clay minerals expand due to the addition of water, the expansion can be vertical and horizontal.

Problems commonly associated with expansive soil and rock are cracked foundations and severe structural damage; heaving and cracking of roads, sidewalks, and driveways; damage to pipelines; and plugging of wastewater disposal system drain fields. Single-family homes are particularly susceptible because foundation loads (1,500 to 2,500 lbs/ft^2 / 5858 to 12,205 kg/m^2) may be less than expansive pressures from clays (3,000 to 11,200 lbs/ft^2 / 14,646 to 54,678 kg/m^2), making structures subject to heave. Larger, heavier buildings are less susceptible.

Gypsiferous soil and rock are subject to subsidence and collapse due to the dissolution of gypsum, creating a loss of internal structure and volume within the deposit. Gypsum is present in localized beds in the Moenkopi Formation and soils in the immediate vicinity of the beds.

When water is introduced to gypsiferous soil or rock, such as by irrigation for crops and landscaping or wastewater disposal systems, gypsum soil grains may dissolve causing settlement. If thick gypsum beds are present, underground solution cavities may develop and collapse, causing sinkholes. Gypsum is also a weak material with low bearing strength, which can cause problems for heavy structures. In addition, when gypsum weathers it forms sulfuric acid and sulfate, which may react with certain types of cement and weaken foundations.

This map is designed to show potential hazard areas for planning purposes only. In mapped hazard areas site-specific studies are needed to evaluate the hazard and, if necessary, recommend hazard-reduction measures. The studies must be prepared by qualified professionals (engineering geologists, geotechnical engineers, hydrologists). Because of the relatively small scale of the maps (1:24,000), the possibility exists that some small hazard areas are not shown; studies are therefore recommended for critical facilities even outside the hazard areas.