GEOLOGICAL SURVEY CIRCULAR 46

May 1949

INTERPRETING GROUND CONDITIONS FROM GEOLOGIC MAPS

Prepared by the

Geologic Division

UNITED S ERIOR

WASHINGTON, D. C.

Free on application to the Director, Geological Survey, Washington 25, D. C.

GPO D FSO 9.22.49 250 BOOKS

INTERPRETING GROUND CONDITIONS FROM GEOLOGIC MAPS

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Intelligent planning for heavy construction, water supply, or other land utilization requires advance knowledge of ground conditions in the area. It is essential to know:

1) the topography, that is, the configuration of the land surface;
2) the geology and soils, that is, the deposits that compose the land and its weathered surface; and
3) the hydrology, that is, the occurrence of water whether under or on the ground.

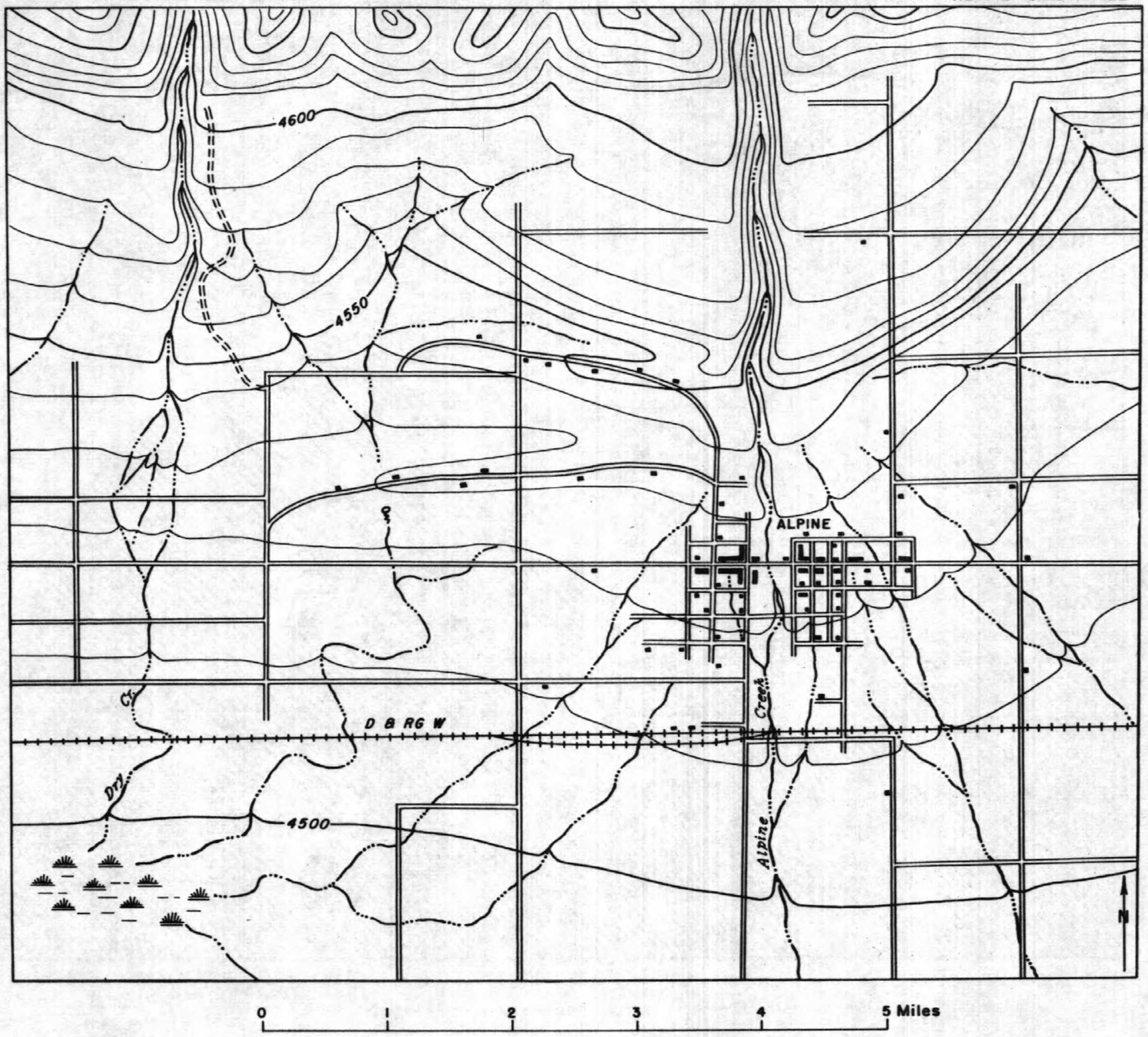
These elements usually are considered in planning land developments that involve much investment; detailed surveys generally are made of the topography, geology, soils, and hydrology at the site selected for development. Such detailed surveys are essential, but equally essential and often overlooked is the need for general surveys prior to site selection.

Only if the general surveys have been made is it possible to know that a particular site is most suitable for the purpose and that no situations in the tributary areas that might affect the project have been overlooked. Moreover, the general regional relations must be known in order to properly interpret the geology, soils, and hydrology at a particular locality. In brief, both the general and the specific are needed in order to avoid costly mistakes either during or after development.

The accompanying maps illustrate how a general geologic map can be used for interpreting ground conditions during a planning stage prior to site selection. The topographic and geologic maps, which provide the basic data, have been simplified from some existing ones. The interpretive sheets are intended to provide some examples of the kinds of information that trained persons can read from such basic maps.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALPINE QUADRANGLE



Topographic maps show quantitatively the configuration of the land surface. This is accomplished by drawing contours that represent level lines on the earth's surface. Irregularities in the contour lines reflect the ground plan shape of the land forms; the spacing between the contours measures the amount of slope. In addition, topographic maps show the works of man, such as roads, railroads, and buildings, and drainage features such as perrenial streams, intermittent streams, springs, and marshes.

TOPOGRAPHIC MAP

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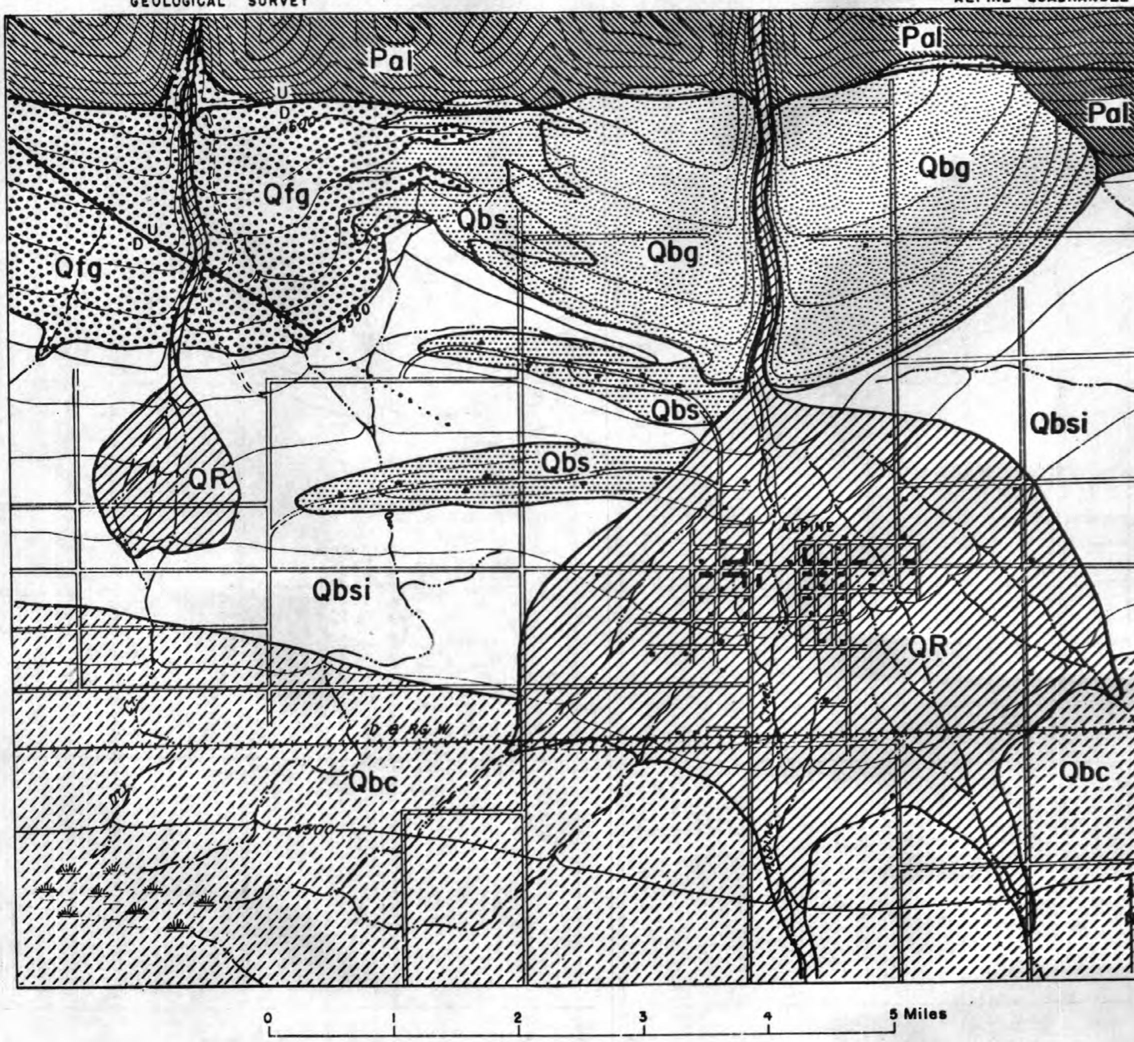


EXPLANATION

Recent

QR — Young fan deposits; gravel, with admixed sand, silt, and clay.

Pleistocene — Lake Bonneville deposits

Qbg — Gravel member; gravel and sand in delta deposits. $CO_3 > SO_3 + Cl$

Qbs — Sand member; clean sand; forms offshore bars and delta deposits. $CO_3 > SO_3 + Cl$

Qbsi — Silt member; lake bottom deposit. $CO_3 = SO_3 + Cl$

Qbc — Clay member; lake bottom deposit. $CO_3 < SO_3 + Cl$

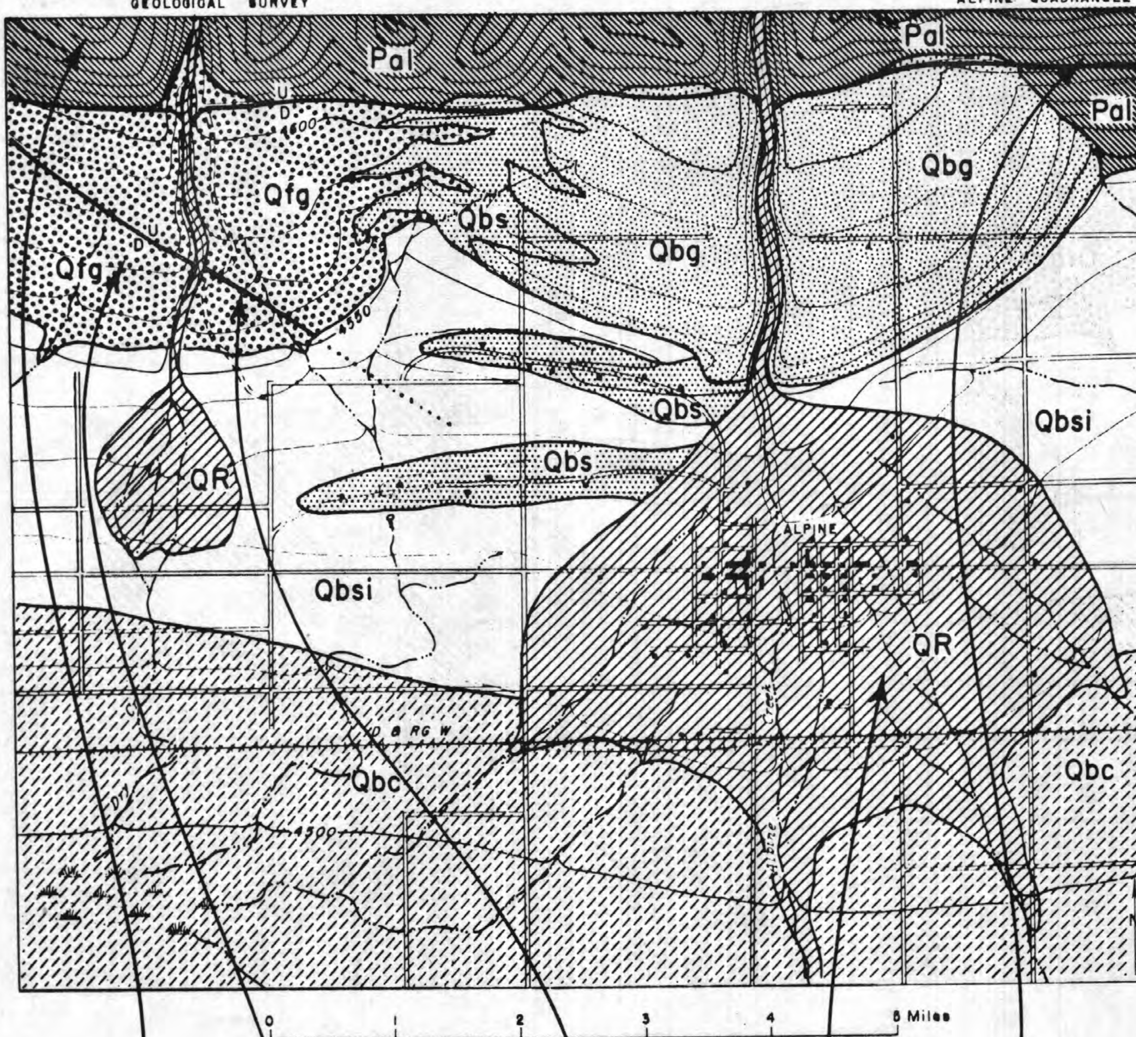
Qfg — Old fan deposits; bouldery gravel with admixed sand, silt, clay. Considerable caliche in upper layers.

Paleozoic

Pal — Bedrock; mostly limestone, some quartzite.

U / D — Fault; dotted where concealed.

GEOLOGIC MAP



FIRST EVENT:
These ancient rocks folded and faulted upward to form mountains.

SECOND EVENT:
This fan built of gravel etc. eroded from mountain.

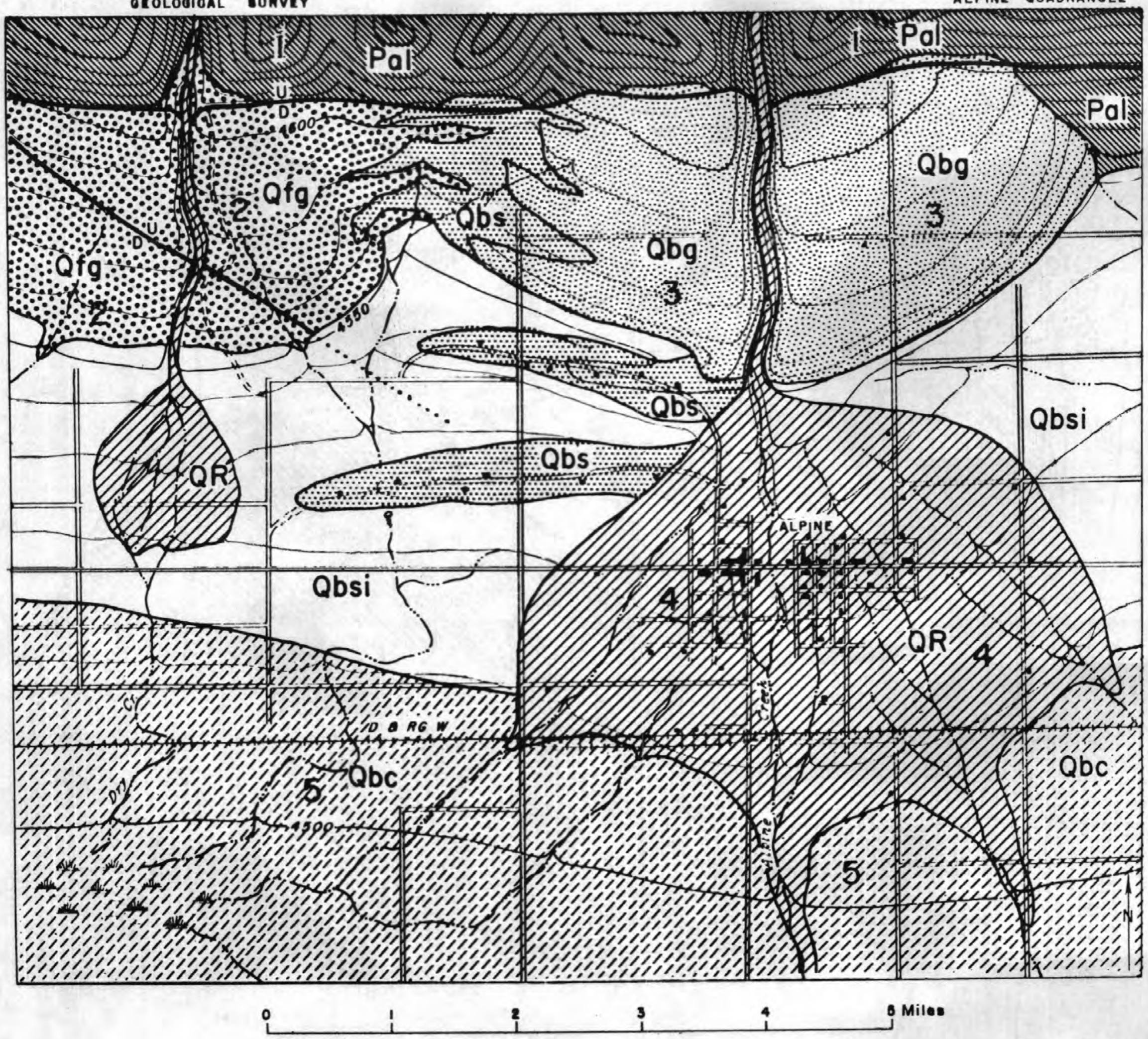
THIRD EVENT:
This fault became active; 5-10 feet of movement before Lake Bonneville time; fault extends under lake beds and may have recurrent movement anytime.

FOURTH EVENT:
Valley inundated by glacial Lake Bonneville. Delta of gravel (Qbg) built at mouth of Alpine Canyon. Shore currents moved sand (Qbs) westward on delta and in bars in front of delta. Silt (Qbsi) deposited nearshore; clay (Qbc) deposited offshore. These lake deposits are underlain by the pre-Bonneville fans which represent the second event.

FIFTH EVENT:
This fault again active; 20 feet of displacement.

SIXTH EVENT:
This fan and the small one 3 miles west were built on top of Lake Bonneville deposits after the lake had disappeared. These post-Bonneville fans are still being built.

READING GEOLOGIC HISTORY FROM THE GEOLOGIC MAP



1 Hard rocks. Good source for limestone or quartzite for building stone, riprap. Quarry operations would require drilling and blasting. Limestone suitable for cement.

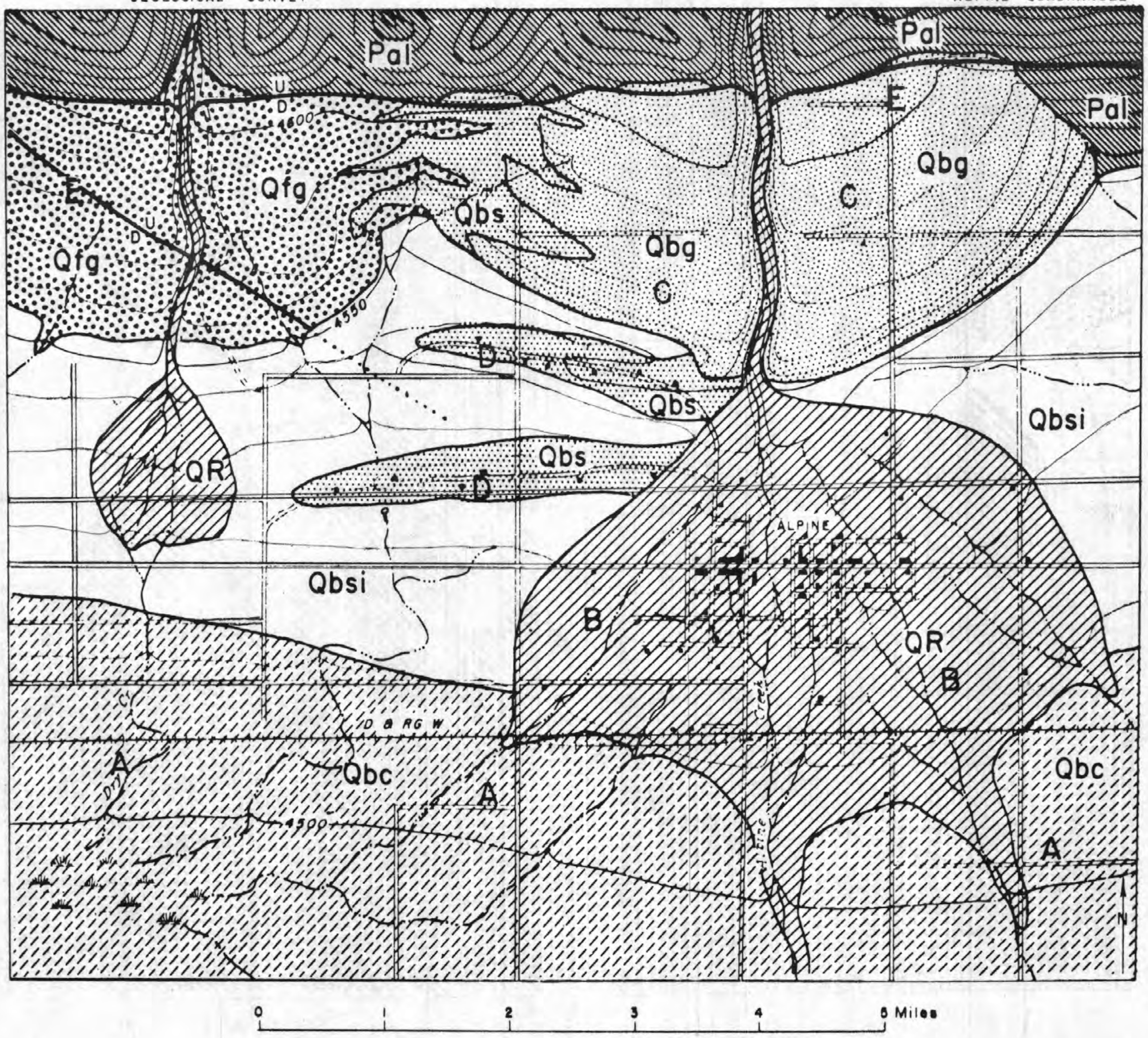
2 This gravel is angular but silty; poorly graded and contains considerable secondary lime; not suitable for concrete aggregate; poor source for road metal.

3 This gravel well rounded and well graded but contains considerable lime; not suitable for concrete aggregate; excellent road metal.

4 This gravel poorly graded; fragments in part angular and in part well rounded; deposit is free of secondary lime; best source for concrete aggregate.

5 Clay deposit contains lime and other water-soluble salts; fair source for structural clay; good source for seal clay; not suitable for high grade ceramic purposes.

THE GEOLOGIC MAP AS A GUIDE TO CONSTRUCTION MATERIALS



A Clay ground; poor surface drainage; no subsurface drainage; road metal and fill for subgrades must be hauled from area B or C. Ground easily excavated by power shovel or dozer operation. Will require subdrains.

B Gravelly and silty ground; fairly adequate surface and subsurface drainage. Good foundation for roads or buildings. Basement excavations must be shallow to avoid intersecting the groundwater perched on the underlying impermeable Lake Bonneville beds. This area lies across the projection of one of the recently active faults (see E).

C Gravelly ground with excellent subsurface drainage; ground easily excavated by power shovel or dozer. Excellent road foundation; the deposit rests against one of the recently active faults so buildings should be constructed to withstand shocks of intensity 8, R-F scale (see E).

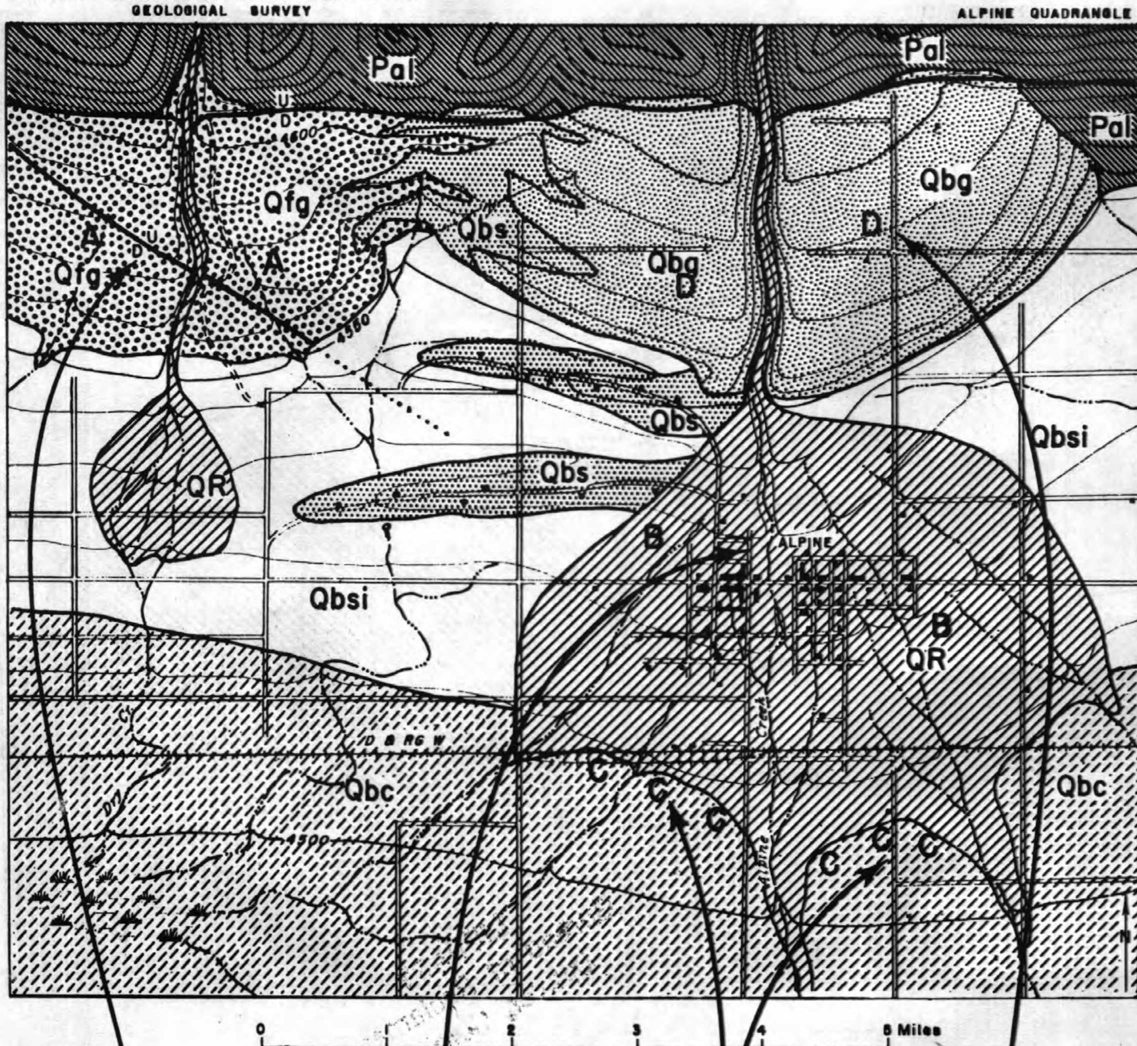
D Sandy ground underlain by silt at depths less than 8 feet; good surface drainage down to the silt. Easily excavated by hand tools. Basement excavations must be shallow to avoid intersecting groundwater perched on the silt. Good foundation for roads but clay is needed for binding sand.

E Two recently active faults. Movement on either one may be renewed at any time causing earthquakes. Buildings within a mile or so of the faults or their projection should be constructed to withstand shocks of intensity 8, R-F scale. Five miles from the faults the shocks would not be expected to exceed intensity 5.

THE GEOLOGIC MAP AS A GUIDE TO FOUNDATION
AND EXCAVATION CONDITIONS

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALPINE QUADRANGLE



A

This old fan deposit underlies all Lake Bonneville deposits. It is an aquifer that can be reached by drilling in the south part of the area.

B

Groundwater is perched on the impermeable lake beds 10-15 feet below the surface of this young fan deposit. This groundwater however is subject to pollution by town sewage.

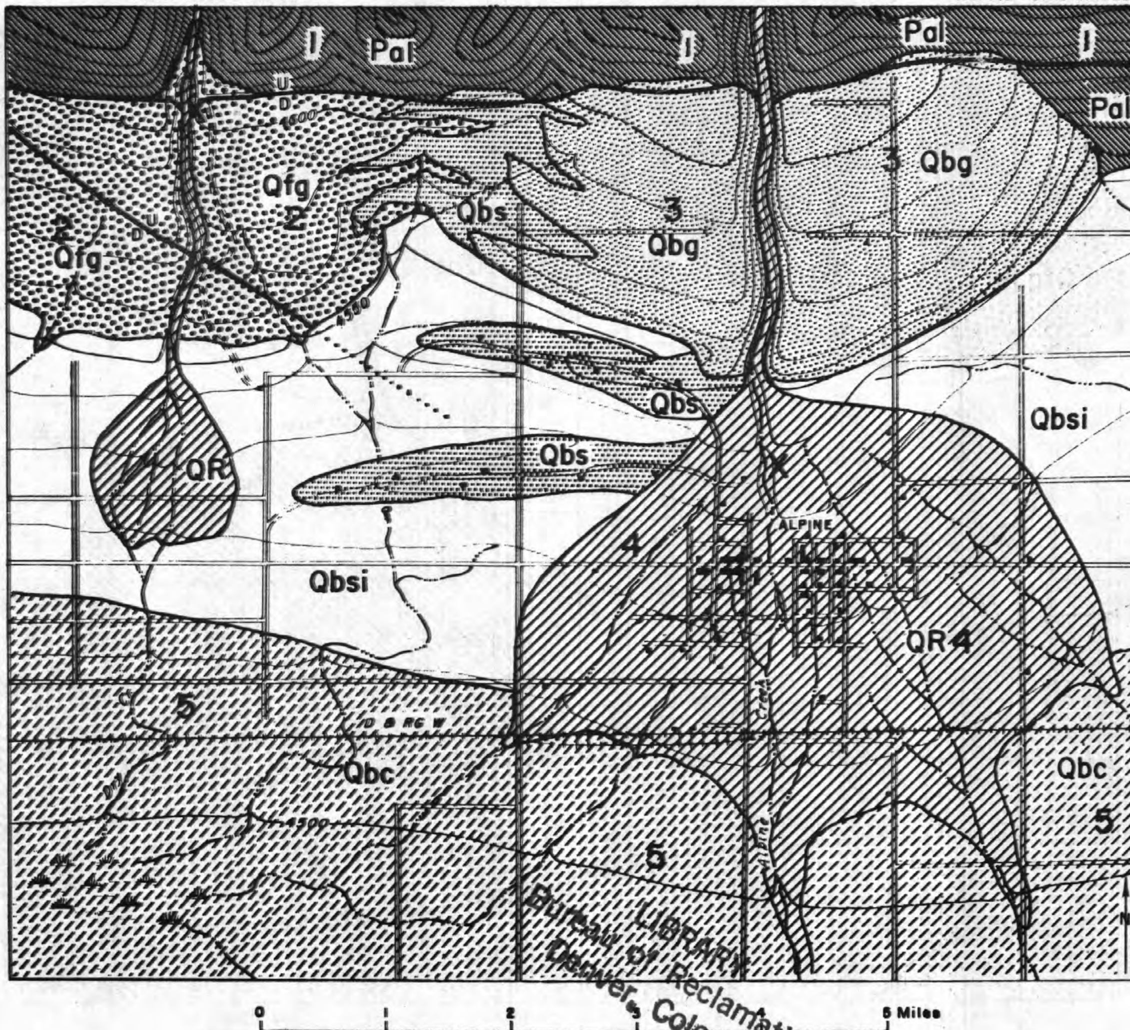
C

Zone of seeps at edge of young fan deposits where shallow groundwater (see box B) emerges at surface. Seeps polluted.

D

Moderate quantities of good quality groundwater available at base of this delta deposit, about 40 feet below surface.

THE GEOLOGIC MAP AS A GUIDE TO PROBLEMS OF UNDERGROUND WATER SUPPLY AND SANITARY ENGINEERING



Area	Permeability and slope of ground	Runoff conditions	Flood control, drainage and canal problems
1	Impermeable; slopes steep.	Maximum coefficient of runoff.	Principal source of floods that would be hazardous in valley.
2	Moderately permeable; slopes moderate	Little runoff during moderate storms; considerable runoff during severe storms.	Subject to floods from canyon; during severe storms may discharge floods from surface runoff. Moderate seepage losses can be expected from canals.
3	Highly permeable, gentle slopes.	Practically no runoff even following most severe storms.	No flood control problem. Reservoirs and canals require sealing to avoid excessive seepage losses.
4	Moderately permeable; low slopes.	Moderate runoff during severe storms.	Subject to flash floods from canyon. Moderate seepage losses can be expected from reservoirs and canals.
5	Impermeable and ground nearly flat.	Water stands in pools for long periods after rains.	Ground readily flooded and difficult to drain. No seepage losses from reservoirs or canals.

X Lower limit of perennial flow in streams draining mountain.

THE GEOLOGIC MAP AS A GUIDE TO SURFACE WATER PROBLEMS SUCH AS FLOOD CONTROL, DRAINAGE, CANAL CONSTRUCTION ETC

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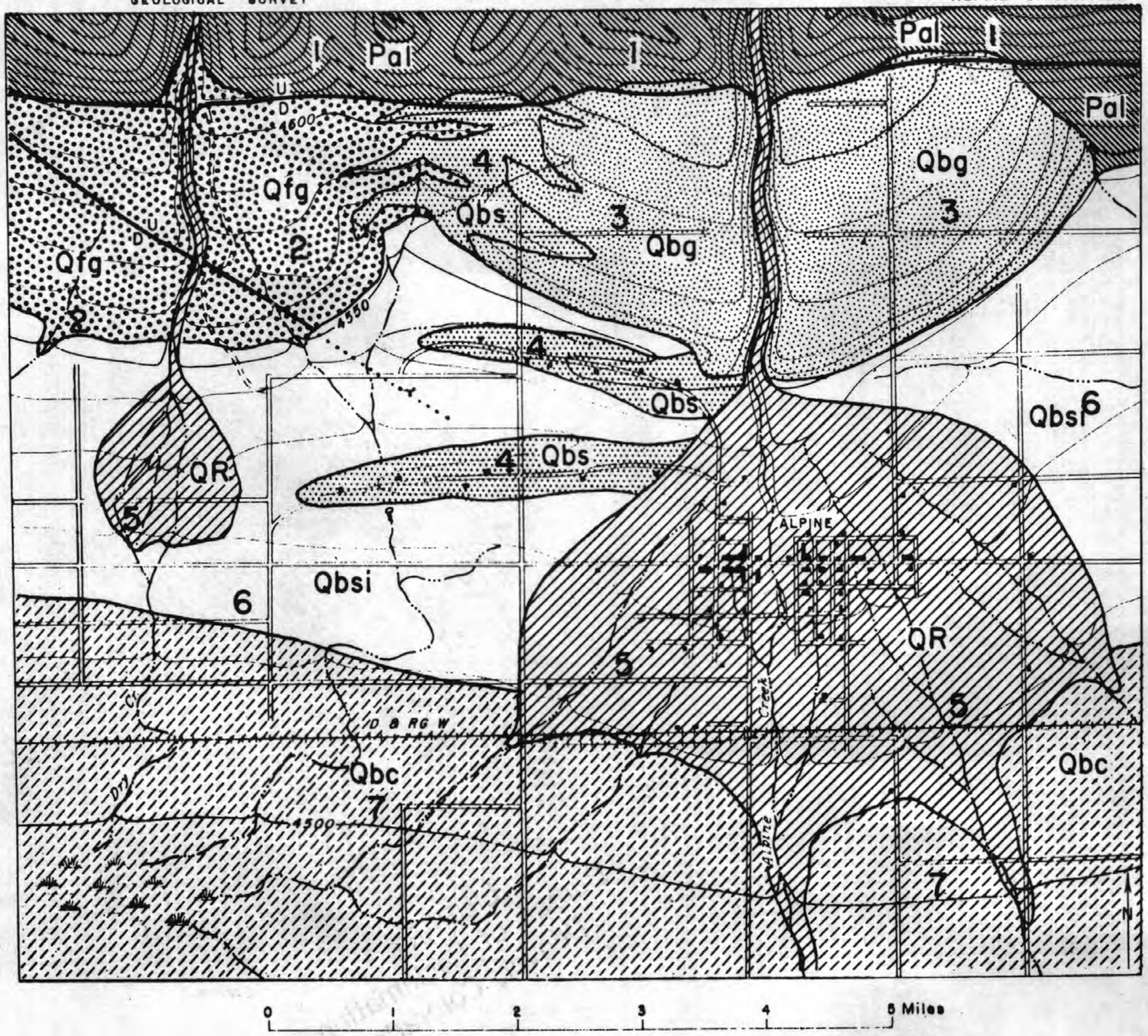

1 Mountainous area; soil generally thin and stoney. Locally there is a fossil soil having 10 feet of leached clay (an excellent source of structural clay). Principal watershed supplying valley area. Forested.

2 Stoney and in part bouldery ground. In places covered by fossil soil (See 1); locally the leached clay has been eroded exposing strongly lime-enriched gravel and silt.

3 Stoney ground. Top foot is brown windblown silt containing well rounded gravel; common large size 1 - 2 inches diameter. Five to ten feet of lime-enriched gravel beginning a foot below the surface.

4 Clean quartz sand; grains ½-1 mm diameter, well rounded, stained by iron-oxide. No silt matrix, some lime carbonate cement. Locally blown into low dunes.

5 Stoney ground, silt matrix. Slightly lime-enriched zone less than a foot thick under surface layer of leached silt and gravel 6 inches thick.

6 Silt ground. Contains about 3% of water-soluble salts -- 1.5% of calcium carbonate and 1.5% of sulfates and chlorides of sodium and potassium. These salts leached from top 6 inches, and redeposited in next foot.

7 Clay ground. Contains about 4% of water-soluble salts -- 1% of calcium carbonate and 3% of sulfates and chlorides of sodium and potassium. These salts locally form surface crusts around moist depressions.

THE GEOLOGIC MAP AS A GUIDE TO SOILS AND
LAND UTILIZATION PROBLEMS

DATE DUE
