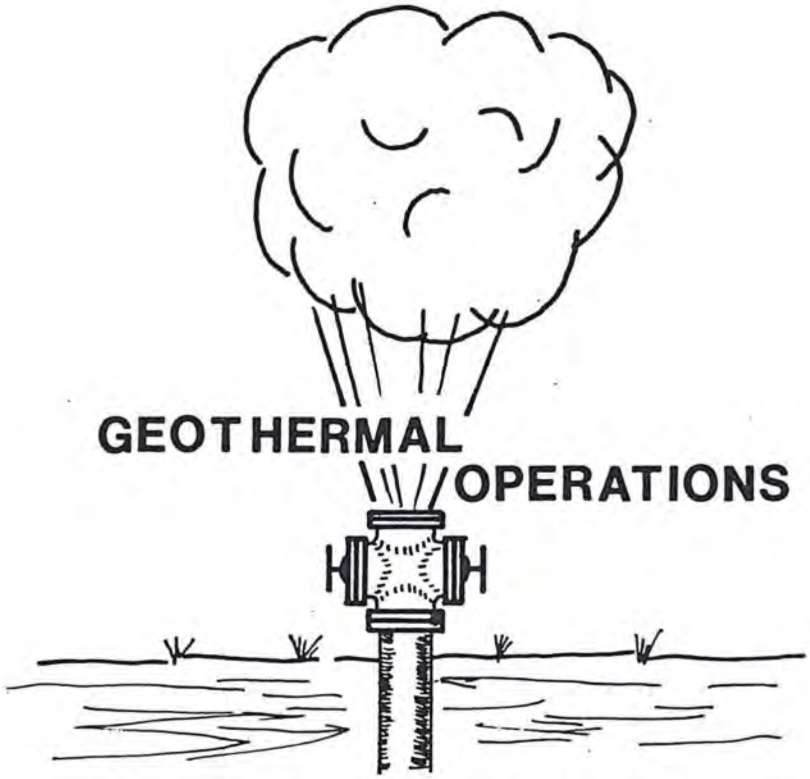
LARRY GARSIDE
NEVADA BUREAU OF MINES
UNIVERSITY OF NEVADA
RENO, NEVADA 89507

PHILLIPS PETROLEUM COMPANY



DESERT PEAK
field trip
February 14, 1977

DESERT PEAK FIELD TRIP

February 14, 1977

7:30 a.m.	Breakfast Briefing	Washoe D Room, Harrah's Reno
9:00 a.m.	Depart Reno	Transportation will be provided
10:45 a.m.	Start Well Flow	
11:45 a.m.	Return to Reno	
1:15 p.m.	Lunch	Washoe D Room, Harrah's Reno

ATTENDANCE ROSTER

United States Senate

Howard W. Cannon, Senator

State of Nevada

Arthur Baker, Dean of Mackay School of Mines
Jim Chachas, Rural Area Representative to Congressman James D. Santini
Noel Clark, Chairman, Public Service Commission
Larry Garside, Geothermal Geologist, Nevada Bureau of Mines
Norman Hall, Director, Department of Conservation and Natural Resources
Heber Hardy, Commissioner, Public Service Commission
Max Milam, President, University of Nevada
R. D. Westergard, State Engineer

ERDA

Louis Werner, Assistant Director, Geothermal Division

Southern Pacific Land Company

W. F. Herbert, General Manager, Natural Resources
T. J. Longseth, District Supervisor
W. C. McCulloch, Chief Geologist

Sierra Pacific Power Company

Keith Porter, Engineer

Nevada Power Company

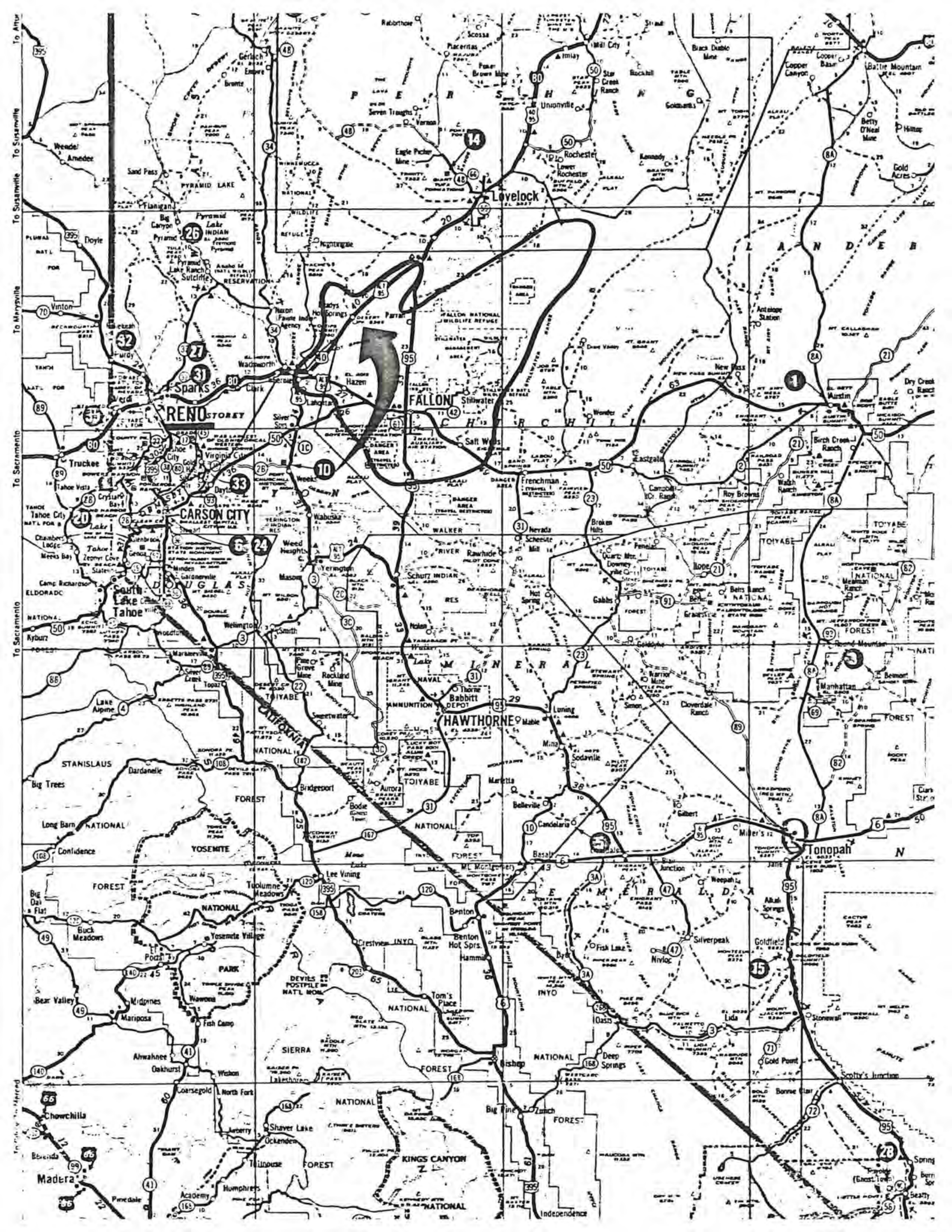
John W. Arlidge, Assistant to the Vice President

Phillips Petroleum Company

W. R. Bohon, General Manager, Energy Minerals Division
Fred Terry, Manager, Development Branch, Energy Minerals Division
C. W. Berge, Manager, Geothermal Development Branch
G. W. Crosby, Exploration Director, Geothermal Development Branch
R. T. Forest, District Manager, Reno
M. D. Garber, Federal Relations Representative
W. R. Benoit, Geologist, Geothermal Development Branch
Kurt Maurer, Photographer, Public Affairs

DESERT PEAK CHRONOLOGY

October 24, 1972	Entered into Exploration & Option Agreement with Southern Pacific Land Co. covering S.P. lands in Nevada, California and Utah.
August 11, 1973	Commenced drilling shallow temperature gradient holes.
February 14, 1974	Entered into agreement with S.P. to jointly drill Desert Peak.
March 27, 1974	Completed drilling 48 temperature gradient holes.
April 2, 1974	Spudded Desert Peak 29-1, a deep geothermal test, as 50-50 venture with S.P.
May 9, 1974	Completed drilling Desert Peak 29-1.
March 7, 1976	Commenced stratigraphic drilling program, 5 holes, 1370' to 2,000', for temperature surveys and geologic information.
July 26, 1976	Completed 5 hole program.
October 26, 1976	Spudded Desert Peak 21-1, a deep geothermal test, as 100% Phillips venture on S.P. lease.
November 6, 1976	First flow of steam and water.
November 10, 1976	Completed drilling Desert Peak 21-1.
November 24, 1976	Spudded Desert Peak 21-2, a deep geothermal test.
December 27, 1976	Completed drilling Desert Peak 21-2.



PERSHING
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Stillwater
Salt Wells
Frenchman
Eastgate
Gabbs
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Minden
Gardnerville
Genoa
Virginia City
Dayton
Weeks
Wabuska
Mason
Smith
Wellington
Coleville
Topaz
Big Pine
Independence
Mariposa
Oakhurst
Madera
Chowchilla
Shaver Lake
Pyramid Lake
Pyramid Lake Indian Reservation
Fallon National Wildlife Refuge
Walker River Indian Res
Stanislaus National Forest
Toiyabe National Forest
Inyo National Forest
Sierra National Forest
Yosemite National Park
Kings Canyon National
Devils Postpile Nat'l Mon
To Sacramento
To Susanville
To Marysville
California

The Desert Peak Geothermal Prospect is located in the northern part of the Hot Springs Mountains. This range is a relatively small horst, or uplifted block, which defines part of the northwestern border of the Carson Sink. The Carson Sink is the largest graben, or depressed block, in Northern Nevada. These horsts and graben are caused by the earth's crust being extended in a northwest-southeast direction in this area.

Bradys Hot Springs are located about 4 miles west-northwest of the two producing wells, B21-1 and B21-2. These hot springs have been extensively drilled by several companies, however, none of the holes produces enough fluid at high enough temperatures to be considered commercial for power generation purposes.

On the surface of the Desert Peak Prospect there are no hot springs, fumaroles, mud pots, or the remains of very recent volcanic activity. The only surface indications of heat at depth are small inconspicuous mineral deposits of silica and travertine left behind by hot springs which have dried up. The geology of the rocks exposed at the surface has not been helpful in locating a reservoir or in predicting the subsurface geology.

The potential of this area was first recognized by the drilling of 48 temperature gradient holes up to 500 feet in depth.

Based on the results of the shallow gradient holes several deeper, and consequently much more informative holes were drilled. It is these holes which were responsible for the siting of B21-1 and B21-2.

Both B21-1 and B21-2 produce a mixture of steam and water from fractured metamorphosed andesite (greenstone) at depths between 3000 and 4000 feet. The greenstone is interpreted to be Triassic or Jurassic, that is 180 m.y. in age.

Overlying the greenstones is a series of impermeable rhyolitic flows and tuffs of Miocene age, 17 m.y. This unit may be behaving as a caprock to seal the reservoir. Overlying the rhyolitic rocks is a basalt unit of highly variable thickness. Most of the hills in the vicinity of B21-1 and B21-2 expose this basalt. Very recent alluvium overlies all of these rocks and makes preparation of a detailed surface map in this area difficult.

With limited information from only a few deep wells there are many unanswered questions concerning the size and shape of the reservoir, the complex hydrology and geology, and the economics of this field. The reservoir temperature is thought to be in excess of 200°C. Both B21-1 and B21-2 appear to produce commercial quantities of fluid, however, the most efficient method of utilization of the fluid has not yet been determined. The fluid produced is a sodium chloride water containing about 7500 ppm total dissolved solids. This water is very similar chemically to that discharged by the only flowing spring in the area which is used by cattle and wildlife.

The next step in evaluating the field is a flow test of several weeks duration. This will hopefully give an estimate as to the size of the reservoir. Beyond that much more deep drilling is required.

(B29-1, B29-2)
Each well, $\sim \frac{1}{2}$ million lbs/hr Total flow, 20% convertable to steam, (~~both wells~~ each well about same)

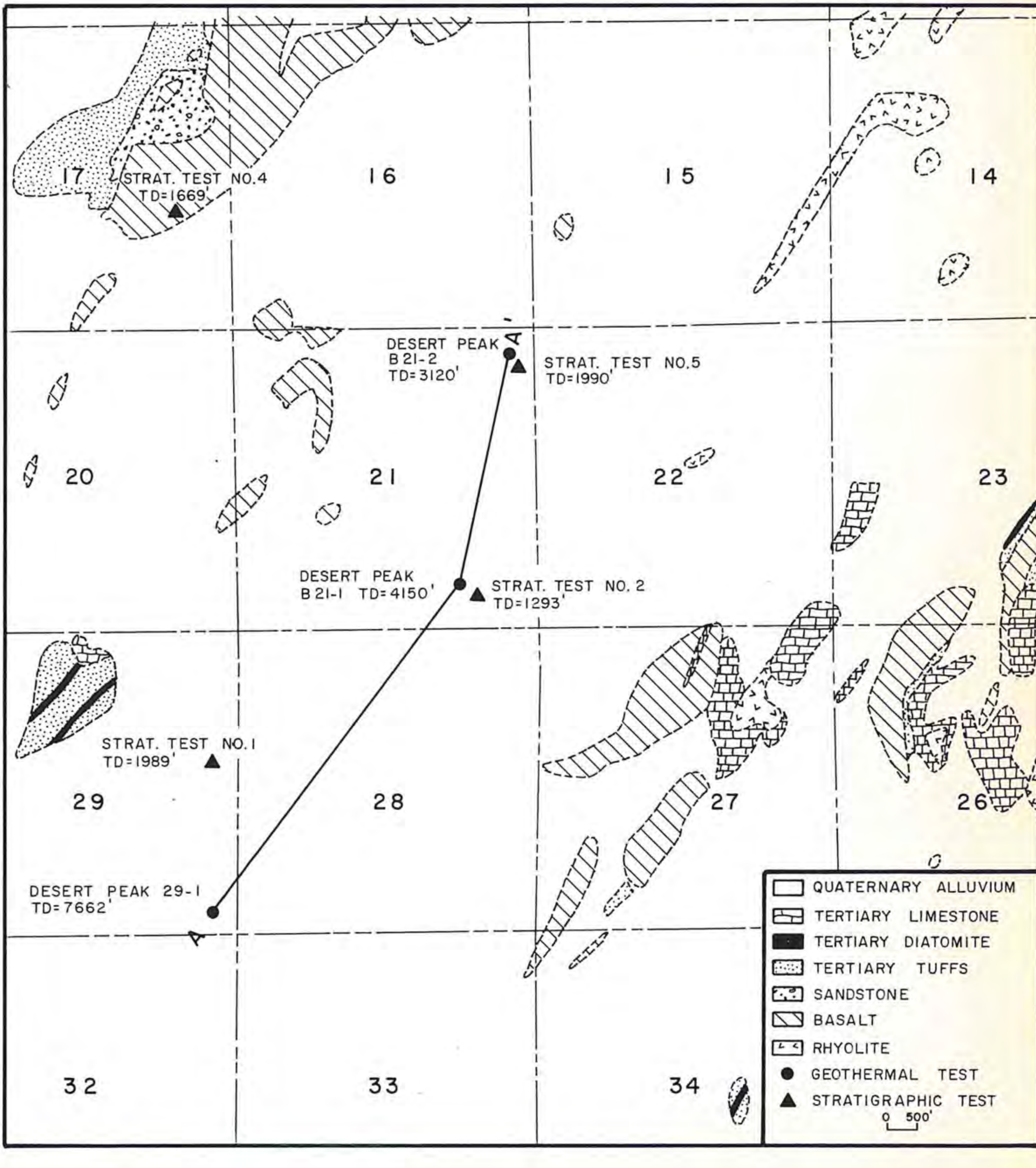
B21-1 = 7" hole & hotter, slightly greater flow
B21-2 = $9\frac{5}{8}$ hole; influx below 3000' of cold water

Each well itself commercial; don't know about size of reservoir.

Did geophysics after 29-1, Then did 2000' slim, temp. gradient holes (strat holes). If gradient is sustained at 2000', looks good – cost $40,000 vs. 500,000 for deep, big-bore test.

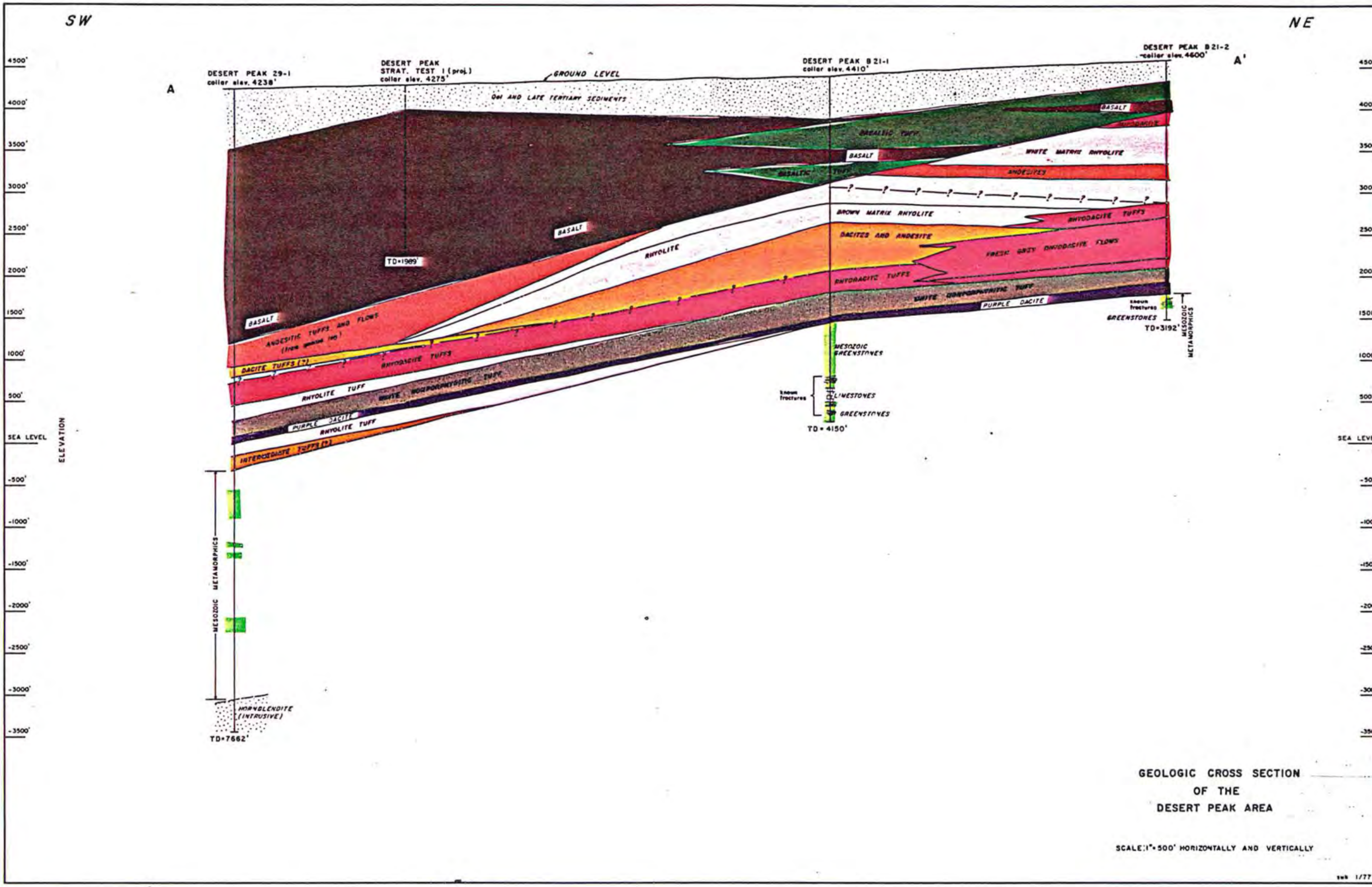
50-75 gradient holes 200-500', ground noise, deep resistivity, magneto-telluric,

Need 16 wells for 55 MW plant. (supply energy for 55,000 people).



DESERT PEAK GEOTHERMAL PROJECT

GEOLOGY AND DRILL HOLE MAP



GEOLOGIC CROSS SECTION
OF THE
DESERT PEAK AREA

SCALE: 1" = 500' HORIZONTALLY AND VERTICALLY