Geothermal Resources of Nevada

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Moana Springs Area Inset

Locations of thermal wells in southwestern Reno (Trexler and others, 1982). The principal site of Moana Springs is indicated by **X**. Information listed for each well includes number, depth in meters, and temperature in °C.

D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T
1.	203	76	14.	30	98	27.	76	89	39.	88	52	56.	89	65.	82	74.	78	190	52.	91	55.	43.	104.	70.	54.
2.	239	75	15.	67	91	28.	35	77	40.	46	87	53.	139	71.	66.	165	81	79.	122	70.	92.	91	51.	105.	122.	21.
3.	175	77	16.	76	75	29.	50	90	41.	76	81	54.	91	85.	67.	247	70	80.	161	82.	93.	75.	49.	106.	94.	49.
4.	198	90	17.	122	95.	30.	40.	82.	42.	99.	86.	55.	83.	68.	73.	85.	82.	81.	134.	78.	94.	90.	50.	107.	90.	
5.	212	96.	18.	229	91.	31.	61.	86.	43.	82.	87.	57.	92.	69.	73.	85.	82.	134.	78.	95.	90.	49.	108.	99.	80.	
6.	152	93.	19.	229	91.	32.	61.	86.	44.	101.	86.	58.	90.	70.	70.	81.	80.	83.	61.	70.	96.	75.	43.	109.	50.	43.
7.	74	49.	20.	95.	93.	33.	62.	85.	45.	53.	91.	59.	58.	70.	93.	71.	124.	90.	84.	44.	97.	62.	43.	110.	152.	52.
8.	55.	92.	21.	99.	97.	34.	69.	80.	46.	53.	82.	59.	69.	60.	72.	183.	82.	85.	274.	42.	98.	67.	44.	111.	114.	82.
9.	60.	80.	22.	103.	88.	35.	64.	85.	47.	70.	87.	60.	196.	58.	73.	76.	77.	86.	228.	53.	99.	67.	49.	112.	290.	82.
10.	30.	66.	23.	81.	71.	36.	70.	90.	48.	54.	92.	61.	76.	60.	74.	76.	91.	87.	97.	59.	100.	68.	49.	113.	399.	82.
11.	61.	83.	24.	93.	78.	37.	110.	85.	49.	89.	74.	62.	201.	82.	75.	76.	88.	88.	34.	28.	101.	70.	49.	114.	286.	64.
12.	56.	82.	25.	97.	85.	38A.	60.	52.	50.	57.	85.	63.	194.	82.	76.	125.	27.	89.	93.	52.	102.	64.	48.			
13.	46.	80.	26.	36.	60.	85.	38B.	76.	85.	51.	86.	82.	64.	81.	68.	77.	94.	76.	90.	67.	48.	103.	106.	36.		

Explanation:

This map is the product of a statewide inventory of Nevada's geothermal resources conducted by the Division of Earth Sciences, University of Nevada, Las Vegas, under the sponsorship of the U.S. Department of Energy. All information available has been used in the preparation of the map. Some deep wells are shown which do not have temperature data; this information is currently unavailable due to the proprietary restrictions. However, they indicate areas of interest for high temperature geothermal resources.

Until recently, nearly all industrial interest in geothermal energy in this country was for electrical generation. Although generation of electricity is and will be an important use of geothermal energy, it is now recognized that a much greater and widespread use is for direct heat applications. Such applications include space heating and cooling of buildings, agricultural operations, and many industrial processes that require heating or cooling. The primary purpose of this map is to aid potential users in developing this important resource in Nevada.

Data Presented:

Most of the data for the wells and springs were obtained from GEOTHERM computer file and Nevada Bureau of Mines and Geology Bulletin 91, "Thermal Waters of Nevada" (Garside and Schilling, 1979). The most current data were assembled by the Division of Earth Sciences during U.S. Department of Energy sponsored Geothermal Resources Assessment Investigations.

In the accompanying table of wells and springs, the temperatures reported are the most recent available. The minimum temperature for the wells and springs shown on the map is 20°C. South of latitude 37° wells with temperatures less than 30°C are not shown. Temperature and total dissolved solids can vary with time; consequently,they should be regarded as approximate. Flow rates are even more unreliable because of seasonal variations and disturbance of hydrologic regimes by production of geothermal resources. Commonly, springs do not flow from a single orifice but from a group of orifices. In these cases, the temperature reported is the highest of the group; the flow reported is for the group as a whole. In the cases where a group of wells was drilled in a very small area, they are represented by only one symbol on the map, and the temperature reported is the highest for the group.

Availability of Additional Data

Detailed chemical data for many thermal springs and wells shown on the map are available from the computer file GEOTHERM (GEOTHERM Project, U.S. Geological Survey, 345 Middlefield Road, MS 964, Menlo Park, California, 94025). Information on drilling requirements in geothermal areas may be obtained from the Water Resources Division of the State Engineer, Department of Conservation and Natural Resources, 201 South Fall Street, Carson City, Nevada, 89710.

Thermal Springs and Wells

Thermal Springs

- Temperature greater than 50°C
- Temperature 20° to 50°C
- Temperature unavailable, but reported as hot
- Temperature unavailable, but reported as warm

Thermal Wells

- Temperature greater than 50°C
- Temperature 20° to 50°C
- Temperature unavailable, but reported as hot
- Temperature unavailable, but reported as warm

The location of hot mine waters are indicated by a spring symbol.

Low-Temperature Geothermal Waters

Dark gray. Areas with water temperature greater than 40°C or where temperatures of 40°C or greater may be encountered at depths less than 500 m.

Light gray. Area favorable for the discovery of thermal water at shallow depth (<1000 m) of sufficient temperature for direct heat application. It is probable that only small areas of this region are underlain by such thermal water; the region represents that part of the state that deserves further exploration.

Local sources of thermal water may be discovered in areas of Nevada not covered by light or dark gray. Existing data do not document the presence or lack of usable thermal water at shallow depths.

Heat Flow

Convection and conduction are physical processes that transfer heat from the earth's interior to the surface. In convection, moving fluids transport the heat; examples of convective systems include volcanoes (magma) and thermal springs (water). Heat is also transferred by conduction through rocks. Heat transfer is measured as heat flow: the amount of heat transmitted across a unit area of rock in a unit of time. Heat flow is measured in milliwatts of heat energy flowing across a square meter (mW/m²). Worldwide average heat flow is 60 mW/m².

The two determinates of conductive heat flow (Q) are rock thermal conductivity (K) (ability of rock to conduct heat) and the temperature gradient (G). The relationship is Q=-KG. Anomalous heat sources can include molten rock in the crust, unusually radioactive crystalline rock, and geothermal convection systems (circulating hot water at depth). Background heat sources are mainly the mantle and radioactive minerals in crystalline rock of the crust.

▲88 Heat flow measurement, mW/m² (Mueller, 1979).

- Known Geothermal Resources Area (KGRA) as designated by the U.S. Department of the Interior. Name of KGRA in red lettering.
- Indian reservation
- Military reservation
- Department of Energy reservation
- National forest
- National park, monument, wilderness area, wildlife refuge, wildlife management area, recreation area, state park

Private land may exist within federal boundaries.

Metric Conversion

1 meter = 3.281 feet
1 kilometer = 0.621 mile
1 liter = 0.264 gallon
1 milligram/liter = 1 part per million
1 milliwatt/meter² = 0.024 Heat Flow Unit (HFU)
°Celsius = 5/9 (°Fahrenheit – 32)
°Fahrenheit = 9/5 °Celsius + 32

°Fahrenheit: 50 100 150 200 250 300 350 400
°Celsius: 20 40 60 80 100 120 140 160 180 200

Population Key

RENO	more than 25,000
SPARKS	10,000 to 25,000
Carson City	2,500 to 10,000
Carlin	1,000 to 2,500
Minden	less than 1,000

Population indicated by size of letters.

- State capital
- County seat
- City, town, or village
- Scheduled service airport
- Corporate boundary shown for towns over 2,500 population
- County boundary
- Interstate highway
- U.S. highway
- State highway
- Other principal roads

Scale 1:500,000
1 centimeter equals 5 kilometers
1 inch equals approximately 8 miles

Kilometers 0 10 20 30 40 50
Miles 0 10 20 30 40

Contour interval 500 feet
Datum is mean sea level
1927 North American datum
Lambert conformal conic projection based on standard parallels 33° and 45°
Base map supplied by the U.S. Geological Survey

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Spring and Well Location System

Example: Well location in T1N R1E SW¼ NE SW sec 31

Selected References

Bateman, R.L., and Scheibach, R.B., 1975, Evaluation of geothermal activity in the Truckee Meadow-Lake Tahoe area, Nevada: Nevada Bureau of Mines and Geology Report 2, p. 38 p.

Benoit, W.R., Hiner, J.E., and Forest, R.T., 1982, Discovery and geology of the Desert Peak geothermal field: a new model from Nevada: Nevada Bureau of Mines and Geology Bulletin 97, 81 p.

Flynn, T., Trexler, D.T., and Koenig, B.A., 1982, The Kemp thermal anomaly: A newly discovered geothermal resource in Pumpernickel Valley, Nevada: Geothermal Resources Council Transactions, v. 6, p. 121-124.

Garside, L.J., and Schilling, J.H., 1979, Thermal waters of Nevada: Nevada Bureau of Mines and Geology Bulletin 91, 163 p.

Goldstein, N.E., 1977, Northern Nevada geothermal exploration strategy analysis: Report prepared for U.S. Department of Energy under contract no. 77-A05-ENG-48, 55 p.

Keller, G.V., and Grose, L.T., eds., 1978, Studies of a geothermal system in northwestern Nevada—part I: Colorado School of Mines Quarterly, v. 73, no. 4, 89 p.

Mariner, R.H., Rapp, J.B., Willey, L.M., and Presser, T.S., 1974, Chemical composition and estimated minimum thermal reservoir temperatures of the principal hot springs of northern and central Nevada: U.S. Geological Survey Open-File Report #74-1066, 32 p.

Muffler, L.J.P., 1979, Assessment of geothermal resources of the United States—1978: U.S. Geological Survey Circular 790, 163 p.

Olmstead, F.H., Glancy, P.A., Harrill, J.R., Rush, F.E., and Van Denburgh, A.S., 1975, Preliminary hydrogeologic appraisal of selected hydrothermal systems in northern and central Nevada: U.S. Geological Survey Open-file Report 75-76, 274 p.

Thompson, G.A., and White, D.E., 1964, Regional geology of the Steamboat Springs area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-A, p. A1-A52.

Trexler, D.T., Bell, E.J., and Roquemore, G.R., 1978, Evaluation of lineament analysis as an exploration technique for geothermal energy, central and western Nevada: U.S. Department of Energy Report NVO-067-12, 78 p.

Trexler, D.T., Flynn, T., and Koenig, B.A., 1979, Assessment of low- to moderate-temperature geothermal resources of Nevada—Final report: Nevada Bureau of Mines and Geology, DOE/NV/0105361-32, p.

Trexler, D.T., Flynn, T., Koenig, B.A., and Bruce, J.L., 1980, Assessment of geothermal resources of Caliente, Nevada: University of Nevada, Reno, DOE/NV/10039-1, 21 p.

Trexler, D.T., Koenig, B.A., Flynn, T., and Bruce, J.L., 1980, Assessment of the geothermal resources of Carson-Eagle Valleys and Big Smoky Valley, Nevada: University of Nevada, Reno, DOE/NV/10039-2, 162 p.

Trexler, D.T., Koenig, B.A., Flynn, T., and Bruce, J.L., 1981, Area specific geothermal assessment, Hawthorne, Paradise Valley, Fallon, Nevada-Final report: University of Nevada, Reno, DOE/NV/10039-3, 203 p.

White, D.E., 1968, Hydrology, activity, and heat flow of the Steamboat Springs thermal system, Washoe County, Nevada, and geology and geochemistry of the Steamboat Springs area, Nevada: U.S. Geological Survey Professional Paper 458-C, p. C1-C109.

White, D.E., Thompson, G.A., and Sandberg, C.H., 1964, Rocks, structure and geologic history of Steamboat Springs thermal area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-B, p. B1-B63.

Wollenberg, H.A., 1976, Geothermal studies in northern Nevada: University of California, Lawrence Berkeley Laboratory Report LBL-4457, U.S. Energy Research and Development Administration contract no. W-7405-ENG-48, 7 p.

Wollenberg, H.A., Asaro, F., Bowman, H., McEvilly, T., Morrison, F., and Witherspoon, P., 1975, Geothermal energy resource assessment: University of California, Lawrence Berkeley Laboratory Report LCID-3762, U.S. Energy Research and Development Administration contract no. W-7405-ENG-48, 91 p.

Key to Table of Thermal Springs and Wells

The majority of column headings below are self-explanatory. Reference number, when indicated, refers to the identification number in Nevada Bureau of Mines and Geology Bulletin 91, "Thermal Waters of Nevada" (Garside and Schilling, 1979) which has additional information concerning a given well or spring or its areal grouping. A + following the reference number designates entries not identified in Bulletin 91.

Temperature data are given in degrees Celsius. Where exact values are unavailable, temperature is indicated by hotting (B), hot (H), or warm (W). Total dissolved solids (TDS) followed by * have been calculated by multiplying specific conductance by a .0.6 conversion factor.

COUNTY | NUMBER | SPRING (S) OR WELL (W) | NAME | SECTION | LOCATION WITHIN SECTION | BASIN | TOWNSHIP | RANGE | REFERENCE NUMBER | TOTAL DISSOLVED SOLIDS (MILLIGRAMS/LITER) | FLOW RATE (LITERS/MINUTE) | TEMPERATURE (°C)

CARSON CITY

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