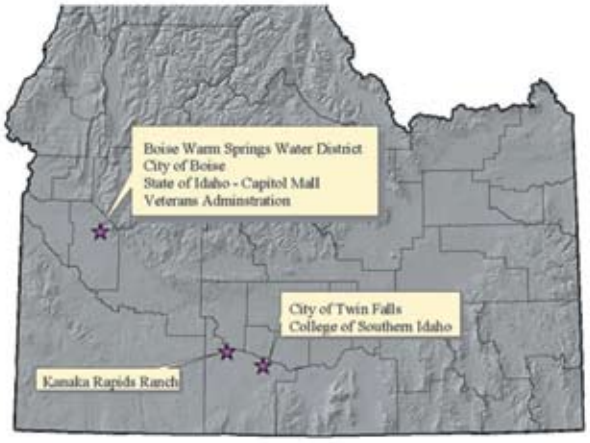
THE VETERANS ADMINISTRATION HOSPITAL DISTRICT HEATING SYSTEM, BOISE, ID

R. Gordon Bloomquist, Washington State University Energy Program, Olympia, WA



Boise Warm Springs Water District

LOCATION

The Veterans Administration Hospital District Heating System is located on the northeast side of Boise, Idaho, in Ada County of southwestern Idaho.

The hospital is within the borders of an administration district called the Boise Front Low Temperature Geothermal Resource Ground Water Management Area (GWMA). It is located in an area along the Boise Foothills known as the Boise Front. Boise is located along the northern margin of the northwest trending topographic depression known as the Western Snake River Plain. Wells in the area have water temperature ranging from about 27°C to 77°C (80°F to 170°F).

Development of geothermal water began in the Boise area in about 1890 when the Boise Water Works Company drilled an exploration well for hot water in an area about 4 km (2.5 miles) east of Boise at the location of some existing springs (Neely, 1996). In 1891 the first geothermal well was drilled near the site of the present Warm Springs Water District well house.

The first well encountered warm water at 24 meters (80 ft.) and the water became progressively hotter and the flow increased with depth. A flow of 9.5 L/s (150 gpm) of 68°C (154°F) water was encountered at a depth of 94 meters (308 ft.) Waag and Wood, 1987, quotes from the *Idaho Statesman* 1/30/1891. A second well drilled 15 meters (50 ft.) from the first was equally successful and the two wells reportedly provided an artesian flow in excess of 3,028,000 liters per day, 35 L/s (800,000 gallons per day, 555 gpm) of 77°C (170°F). This discovery resulted in the development of the Artesian Hot and Cold Water Company in 1892, later known as the Boise Warm Spring Water District.

After a period of nearly 80 years where there was no significant new geothermal development of the Boise geothermal resource, interest in further development began in 1970, and in 1977 the State Health Laboratory was converted to geothermal space heating.

In 1981 the Capitol Mall wells # 1 and 2 were completed. In 1982 nine buildings in the Capitol Mall complex were being heated by a geothermal district heating system. Boise Geothermal Limited also completed four production wells in the early 1980's in anticipation of constructing a district heating system to serve commercial and institutional buildings in the downtown area (Neely, 1996).

RESOURCE

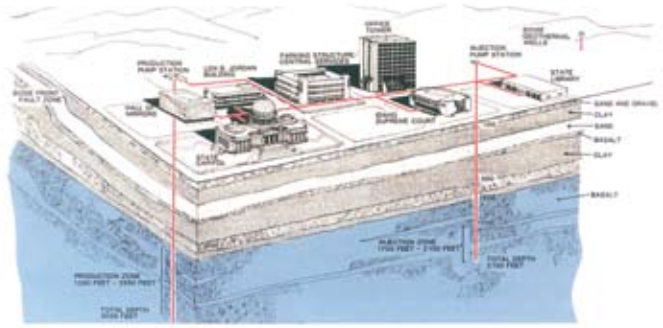
The lower Boise River sub-basin is located along the northern margin of the northwest-trending topographic depression known as the Western Snake River Plain. The Western Snake River Plain has the appearance of a northwest-trending graben associated with continental rifting (Mabey, 1982; Woods and Anderson, 1981).

The Boise Front geothermal aquifers reside in a seemingly complex series of igneous rocks and interbedded sediments underlying the "cold water" sedimentary aquifers. Depend-

ing on location, geothermal water is found in Cretaceous-aged granite of the Idaho Batholith, Tertiary rhyolite, and associated sediments, and/or Tertiary basalts and basaltic tuffs (Petrich, 2003).

Warm Springs wellhouse

Geothermal water is thought to be associated with fractures along the northwest trending fault zone that marks the northeastern boundary of the Snake River Plain. Faults, fractures, and joint systems within the volcanic units serve as conduits for horizontal as well as vertical geothermal water movement.



The Capitol Mall geothermal system

There appears to be consensus among researchers that the geothermal flow system is largely dominated by the basin margin fault-fracture zone (Petrich, 2003).

Development of successful wells located away from exposed faults along the Front including the Capitol Mall well, city injection and Veterans wells, and documented hydraulic connections between these wells, demonstrates that the aquifer is continuous to the southwest (transverse to the main fault) for some kilometers/miles (Petrich, 2003).

Although the area is in an area of high heat flow the origin of the thermal waters is not well understood. Mayo, et al., 1984, states that "most researchers agree that radiogenic decay in the granitic rocks of the Idaho Batholiths is the principal source of heat" in the geothermal system.

USE

The Veterans Administration Hospital was established in 1929. The hospital complex consists of 30 buildings and has a staff of 640. The facility has units for extended care, substance abuse, in and out patient medical care, and intensive care.

The Veterans Administration began looking at the potential to develop a geothermal system in the early 1980 following the Capitol Mall and Boise Geothermal Limited successful geothermal drilling projects.

The Veterans Administration drilled a production well in 1983 that proved capable of producing up to 78.5 L/s (1245 gpm) during a pump test. Temperature of the production well was 71.7°C (161°F). An injection well was drilled in 1987 and the system was brought online in 1988 (Petrich, 2003; Pat Flanagan, 2003).

Six of the 30 buildings are connected directly to the geothermal water while the remaining 24 are connected via a central loop.

Maximum required flow is about 70 L/s (1,100 gpm) while average consumption is approximately 38 L/s (600 gpm). Summer use, which is primarily for heating domestic hot water, averages 12.6 L/s (200 gpm).

The facility was originally served by a steam plant and all the buildings were converted to hot water. They do have a 2940 kWt (300 hp) hot water boiler to meet peak demand and provide some backup should the geothermal system fail. They also have backup generators and the well pumps are connected to the backup power supply. In total the system supplies 40,506 square meters of building space (436,000 sq. ft.) with an average of 16 air changes per hour.

The production well has a 37 kW (50 hp) pump and the injection well is equipped with a 56 kW (75 hp) pump. Distribution is via asbestos concrete pipe.

OPERATING COST

The Veterans Administration could not provide detailed cost information relative to capital cost incurred or operational cost savings. Data available, however, indicated that although the original estimate was for an 8 year payback, the payback was actually achieved in 5 years.

In 2002 the system won an energy star award from the Environmental Protection Agency, competing against 40 other federal projects of which 17 were VA hospitals (Flanagan, 2003).

REGULATORY/ENVIRONMENTAL ISSUES

Although no major regulatory or environmental issues were raised relative to the drilling of the wells or construction of the system, a serious drawdown of production wells in the area resulted in a moratorium on further development being issued in 1985 (Johnson, 2003). This had no real impact on the Veterans Administration Hospital as it was reinjecting all of the fluids withdrawn from the aquifer.

The moratorium has remained in place and in fact on December 2, 2003, the Department of Water Resources ordered

a five-year extension of the moratorium that bans new development or additional use of the Boise Front geothermal aquifer (Johnson, 2003). No other problems were reported.

CONCLUSION

The Veterans Administration Hospital has enjoyed the benefits of geothermal district heating since 1988. The system exceeded its anticipated payback of 8 years by 3 years and has operated nearly trouble-free for over 15 years. In 2002 it won an Energy Star Award from the Environmental Protection Agency (Pat Flanagan, 2003).

REFERENCES

Austin, J. C., 1978, "A Low-Temperature Geothermal Space Heating Demonstration Project", *Geothermal Resource Council Transaction, Vol. 2*, pp. 23-26.

Berkeley Group, I, 1990, *Boise Geothermal Aquifer Study Final Report*, Idaho Department of Natural Resources.

Pat Flanagan, 2003, Personal communications, Veterans Administration Hospital, Boise, ID.

Johnson, Kent, 2003, Personal comments, City of Boise, Idaho.

Mabey, D. R., 1982, "Geophysics and Tectonics of the Snake River Plain, Idaho", Bill Bonnichsen and R. M. Breckenridge, editors, *Cenozoic Geology of Idaho, Idaho Bureau of Mines and Geology Bulletin 26*, pp. 93-153.

Mayo, A. L., Muller, A. B., and Mitchell, J. C., 1984, *Geochemical and Isotopic Investigation of Geothermal Water Occurrences of the Boise Front Area, Ada County, Idaho, No. 30, Part 14*, Idaho department of Water Resources.

Neely, Kenneth W., 1996, "Production History for the State of Idaho Capital Mall Geothermal System 1983-1994", *GeoHeat Center Bulletin, vol. 17 no. 1*, Article 8, Oregon Institute of Technology, Klamath, OR.

Petrich, Christian R., 2003, "Hydrogeologic Conditions in the Boise Front Geothermal Aquifer", prepared for City of Boise, ID and National Renewable Energy Laboratory, Golden, CO, *Idaho Water Resource Research Institute, Research Report IWRRI, 2003-05*, 76 pp.

Waag, C. J. and Wood, S. H., 1987. *Analysis of Historical and Current Drawdown and Production Data from the Boise Geothermal System, Idaho* Water Resource Research Institute, Moscow, ID.

Wood, S. H. and Anderson, J. E., 1981. "Part II: Geological, Hydrological, and geochemical and geophysical investigation of the Nampa-Caldwell and the adjacent areas, Southwestern Idaho", J. C. Mitchell (editor) *Geothermal Investigations in Idaho*, Idaho Department of Water Resources.