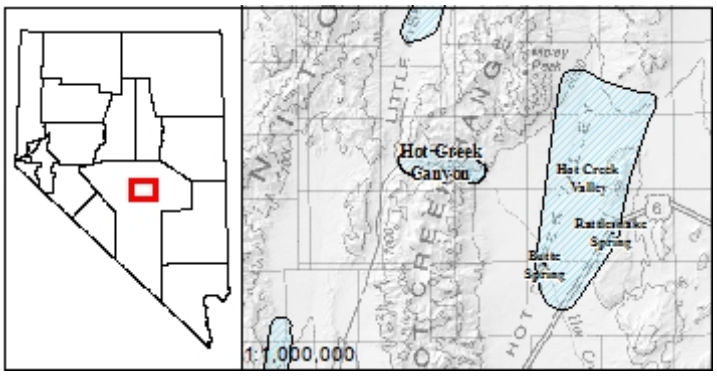
Site Description

Hot Creek Canyon
(Updated 2015)



Geologic setting:

The Hot Creek Canyon geothermal area is located approximately 140 kilometers northeast of Tonopah within north-central Nye County. The geothermal area is situated in the central Hot Creek Range along Hot Creek Canyon. The Monitor Range is located west of the geothermal area while the Hot Creek Valley and Pancake Range are located to the east.

The Hot Creek Range is composed primarily of Tertiary volcanic rocks with some Paleozoic rocks exposed along the eastern flank of the range. The range is a fault bounded block that has been lifted and tilted west. Normal faults along the eastern flank of the range are responsible for the uplift of the range and exposure of Paleozoic rocks in this region (Kleinhampl and Ziony, 1985). North of Hot Creek Canyon the range is underlain by a series of volcanic rocks associated with the Williams Ridge and Hot Creek Valley cauldron complex (Ekren et al., 1973). This cauldron complex contains a sequence of thick Tertiary tuff, minor rhyolite, and tuffaceous sedimentary rock. Rocks found within the complex are broken up by several small displacements along normal faults (Kleinhampl and Ziony, 1985). South of Hot Creek Canyon, a large north-trending anticline is observed in Paleozoic strata with the axis generally located to the east of the Hot Creek Range. Further south, a northwest plunging syncline is observed in lower Paleozoic strata. Highly faulted and broken Tertiary volcanic and sedimentary rocks unconformably overlie these folds. Extensive landslide deposits and Tertiary welded tuff are exposed in Hot Creek Canyon (Kleinhampl and Ziony, 1985).

Geothermal features: (Map)

A number of springs issue from Hot Creek Canyon (T8N, R49-50E), four of which are thermal (figure). The thermal springs have a total discharge of about 3,217 L/min and temperatures of 22-82°C. There are nine or more cold springs interspersed with the thermal springs. In 2002, six springs (12 to 86°C) were sampled and analyzed in collaboration with Dick Benoit. Reservoir temperatures indicated by the chalcedony geothermometer are 136°C, whereas the Na-K-Ca temperature is only 82°C, but the chemistry indicates that the water is not fully equilibrated (Garside and Schilling, 1979).

Hot Creek Ranch Spring: Hot Creek Ranch Spring is reposted to be a cold spring located in the eastern end of Hot Creek Canyon (Sec. 33, T8N, R50E). Temperatures reported at this spring range between 16°C and 16.5°C with fairly low quartz geothermometer values (83.38°C) (Great Basin Groundwater Geochemical Database).

Old Dugan Place Springs: The Old Dugan Place Springs are a series of warm and hot springs located near the center of the canyon, slightly west of the Old Dugan Place abandoned ranch. The springs in this cluster flow from several orifices on the north side of the canyon set in alluvium that overlies Paleozoic

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limestone. In 1967, the USGS built a gauging station that consisted of a 90 V-notch weir and water-stage recorder. Preliminary records from this gauging station indicated a steady flow of about 1,874 L/min, with a temperature of 36°C recorded shortly after installation. This spring, as us common with other hot springs in the area, is believed to originate from a deep, regional groundwater flow system (Garside and Schilling, 1979). A cold spring between this spring and the Old Dugan Place has a flow of 5.7 L/min. and a temperature of 19°C on August 14, 1967 (Fiero, 1986). This cluster of springs was sampled by NBMG in 2009; the flow rate was reported to be large – estimated at hundreds of gallons per minute. The water was sampled from a 6" irrigation pipe that was observed to lead to a large pool that may or may not be natural. During this visit, temperatures were reported to range between 19° and 39°C with low geothermometer values reported. Geothermometer readings for a 36.5°C spring were reported to be 54.67°C (Na-K-Ca), 90.5°C (quartz), and 59.87°C (chacedony) (Great Basin Groundwater Geochemical Database).

***Pat Spring**:* Pat Spring (SE¼ NW¼ SE¼ Sec. 21, T8N, R50E) is 0.8 km northeast of Upper Warm Spring and had an estimated flow of 189 L/min. and a temperature of 22°C on March 19, 1967 (Fiero, 1986). Two cold springs are located about 0.8 km downstream from Pat Spring at the Old Page Place. Cress Spring, the westernmost of the two springs, had an observed flow of about 32 L/min at 8°C (April 19, 1967; Fiero, 1986). The eastern spring, Cold Spring, was observed to flow at about the same rate was reported to have a temperature of 6°C (April 19, 1967; Fiero, 1986). This site was sampled in 2005 and was reported to have a temperature between 22.2°C and 23°C with a Na-K-Ca geothermometer of 76.12, a quartz geothermometer of 113.69°C, and a chalcedony geothermometer of 84.71°C (Great Basin Groundwater Geochemical Database).

***Upper Hot Creek Ranch Springs**:* The hot spring at the Upper Hot Creek Ranch (NE¼ SE¼ Sec. 33, T8N, R50E) is located in the eastern end of the canyon, about 183 m southwest of the ranch house at Hot Creek Ranch. Several springs emerge from orifices in a thin layer of alluvium which overlies the Cambrian Tybo Shale. The spring is fenced and ditched to take the discharge to Hot Creek and contributes to irrigation and stock needs. Preliminary U.S. Geological Survey gauging records in 1967 indicate a flow of 1,060 L/min at 76°C (Fiero, 1986). A flow of 2888 L/min at 71°C was recorded in 1966 (Everett and Rush, 1966). A spring located about 1.5 km to the east has an estimated flow of 473 L/min at 21°C (Fiero, 1986). Mariner and others report a temperature of 67ºC, and estimate a reservoir temperature of 143ºC using a silica geothermometer, and 36ºC using the Na-K-Ca geothermometer (1983, p. 99, 106). Several of these springs were sampled by the USGS in 2005 and then again by the NBMG in 2009. One of the springs sampled in 2009 was reported to have a temperature of 86°C. This spring was observed to be the hottest flowing pool not at the level of the creek. The sample was taken from a pool about 6" above creek level. There was abundant vegetation growing around the spring with travertine forming around the edges. A few gas bubbles were observed in the pool and a slight sulfur smell was noted. A Na-K-Ca geothermometer value of 81.6°C, a quartz geothermometer of 149.53°C, and a chalcedony geothermometer of 124.4°C were reported for this sample location (Great Basin Groundwater Geochemical Database).

***Upper Warm Spring**:* Upper Warm Spring (SE¼ SW¼ SW¼ Sec. 21, T8N, R50E) is the westernmost thermal spring located just north of the road up the canyon. This spring was observed to be an undeveloped spring used mostly by stock. A flow rate of 121 L/min at 34°C was recorded on March 18, 1967 (Fiero, 1986). This spring is located in Tertiary volcanic rocks which are underlain by Paleozoic

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carbonates. The springs are thought to be located along a permeable fault zone even though there is no evidence of structural control at the surface. This fault zone allows water to rise and circulate from depth, within a regional, intrabasin groundwater flow system (Fiero, 1986). This spring was sampled by NBMG in 2009 and was noted to be 10' in diameter and was easy to sample. Moving sand a few bubbles were observed due to upwelling from the bottom. The spring is located in a cow pasture and was noted to have no smell or mineral deposition. The temperature was reported to be 35°C with a Na-K-Ca geothermometer of 59.6°C, a quartz geothermometer of 95.32°C, and a chalcedony geothermometer of 62°C (Great Basin Groundwater Geochemical Databse).

Leasing information:

While there are no leased properties within the Hot Creek Canyon geothermal cluster, there were two properties, located to the east in Hot Creek Valley that had previous leases. HOV Energy leased two properties in 2010, totaling 7350.87 acres. Both properties were terminated in 2012.

Bibliography:

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