

CLEANED UP AND CLEANED OUT - RUINED HOT SPRING RESORTS OF UTAH -

Susan Juch Lutz

Energy and Geoscience Institute, University of Utah
Salt Lake City, Utah 84108

INTRODUCTION

Although there are currently nine resorts in Utah that use thermal water for swimming pools, spas, and baths, there have been many more of these “pleasure resorts” in the past. This article discusses the history, resources, and demise of three hot spring resorts in Utah; Wasatch (Beck’s) Warm Spring in Salt Lake City, Castilla Resort at the mouth of Spanish Fork Canyon, and Pah Tempe Hot Springs in LaVerkin, southwestern Utah.

WASATCH WARM SPRINGS (BECK’S HOT SPRINGS, WASATCH SPRINGS PLUNGE)

Undoubtedly, the largest area in Utah with hot spring waters that are perfect for balneological use are the combined 50 or so springs in a 3 by 0.75 mile (5 by 1.2 km) area that make up the Wasatch Warm Springs in northern Salt Lake City. Although the original Mormon pioneers frequently bathed in the largest of these springs, the area is now overrun with an interstate highway, oil refineries, junkyards, and scrap metal recycling centers (Figure 1). The thermal water is still used to heat the old swimming pool building, currently (but not for long) housing the Children’s Museum of Utah, but the rest of the water has been diverted or piped away from the wetlands area and is considered a nuisance rather than a resource. Bathing is no longer permitted in the natural spring pools north of the building; although, the city of Salt Lake has restored and developed “Warm Springs Park” for recrea-

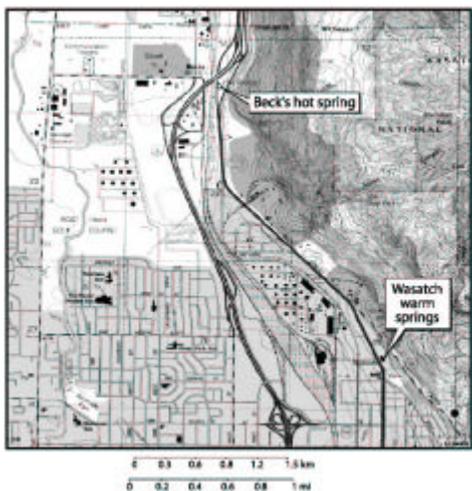


Figure 1. Present-day map of northern Salt Lake City, Utah indicating the location of Beck’s and Wasatch hot springs in the Warm Springs fault geothermal area. Beck’s hot spring is now under Interstate Highway 15.

tional use (i.e, picnic areas and soccer fields). What was once a veritable paradise for swimming, bathing, and boating enthusiasts is now Salt Lake City’s “Vanishing Hot Springs” (Pearce, 1969).

History

Much of the following account of the history of the Wasatch and Beck’s hot springs is taken from an article written by Louise Pearce of Salt Lake City for a Daughters of the Utah Pioneers (DUP) plaque dedication ceremony. Although Native Americans likely soaked in the thermal waters, the first written accounts of the springs were by the original Mormon pioneers in Utah. Thomas Bullock, a leader in the Latter Day Saints Church (LDS) and in 1847, one of the original members of the Pioneer Company, described the oldest swimming hole and her numerous sister springs that once drained into a large hot spring lake “2 or 3 miles long upon which are several thousands of snipes or plover.”

In 1860, Richard F. Burton described his entry into Salt Lake Valley as follows:

“Northward, curls of vapor ascending from a gleaming sheet- The Lake of the Hot Springs- set in a bezel of emerald green, and bordered by another lake-bench upon which the glooms of evening were rapidly gathering, hung like a veil of gauze around the mountains.”

Thomas Bullock was one of the first to dig out a place to bathe with the help of his “brethren.” He wrote:

“those who once bathe there want to go again; the water is 109 degrees Fahrenheit, strong sulpher and salt taste...These springs, like the pool of Siloam, heal all who bathe, no matter what their complaints. The air is very salubrious, and with these warm springs, I can truly say we have found a healthy country. This will prove the greatest blessing to those poor Saints who are weak, sickly, and affected. Oh what a blessing to the rheumatic; cramps, sprains, bruises, itch, every skin disease, and almost every complaint will here be healed.”

By the summer of 1850, a building was erected over the springs, with a boarded inner pool for women, and an

outer zone for men and boys. A winter swimming pool, with hot baths for all, was also constructed. An adobe dance hall with a kitchen and dining room was build as a Social Hall. LDS President Brigham Young performed the original dedication of the Bath House (Figure 2), which was also the first public place in Salt Lake City where entertainments and dances were held.



Figure 2. *Two historic photographs: the Warm Sulfur Springs Bath House, completed November 27, 1850 (top); and Beck's Hot Spring resort sometime before 1898 (bottom). At first, mule trains brought Salt Lake City residents without indoor plumbing to the bath house for washing and recreation. Later, trains of the Great Salt Lake and Hot Springs Railway Company brought Salt Lake visitors to Beck's.*

Because of the supposed healing qualities of the spring water and the location of the springs on the main north-south road through northern Utah, it also became a popular camping place for farmers, teamsters and pioneers entering the city from the north.

The Hot Spring Lake was used for launching boats on the Great Salt Lake, by way of the Jordan River. This was considered the safest place for yachting and for launching boats on the Great Salt Lake.

Being on the outskirts of the town, it was difficult for the majority of the settlers to get to the bathing and swimming pools. So in 1865, one of the first services of the Salt Lake Railroad (mule-driven cars) was to transport pleasure seekers to and from the municipal baths. The early railroads commonly owned and operated resorts on or at the end of their lines as a way of stimulating passenger traffic. When, for example, the Great Salt Lake and Hot Springs Railway Company began the construction of tracks from Salt Lake City

to Ogden in 1891, they proceeded in stages, laying track first to the existing resort, Beck's Hot Springs, four miles to the north, then going as far as Bountiful, where they built Eden Park, then moving to Farmington, where they built Lagoon, and finally, in 1908, reaching Ogden.

In 1884, a German Mormon, John Beck spent some of the fabulous wealth he had accrued from his Bullion-Beck mine in the Tintic mining district to buy 1,000 acres of land on Utah Lake and to develop warm springs there into "Beck's Saratoga Springs" (Van Wagoner, 1989). The next year in 1885, Mr. Beck purchased the property with the largest and hottest of the springs in the Wasatch Warm Springs area. He built a large resort, "Beck's Hot Springs," on the property that became known as the "coming sanitarium of the West" (Figure 2). The resort included a "plunge" (i.e., deep) bath 30 by 75 feet, a private plunge 40 by 80 feet, and 12 private plunges 10 by 10 feet, with nicely furnished dressing rooms. The resort was a grand grassy area with lawns and shade trees, and covered areas with dance floors, billiard tables, and picnic tables. The hot spring water was bottled and sold as a medicinal beverage. But in September of 1898, tragedy struck at Beck's and a disastrous fire burned the hotel and swimming pool surrounds. The hotel was not rebuilt, but the old spring was expanded into a large swimming pool and plunge.

The years of 1899-1915 were declining years for the resort, and in May of 1915, upon the Board of Health recommendation, Hot Spring Lake was drained because it had become a prolific mosquito breeding area. Most of the surrounding wetlands and smaller springs were also drained by the deep ditch that ran from Hot Spring Lake into the Jordan River and then into the Great Salt Lake. Although the pretty lake was gone, the resort continued to be popular as a health spa and swimming area. One bad incident occurred in 1921--there was a robbery where all the bathers' checked valuables were stolen. One bather said afterward, "We were cleaned out, as well as cleaned up. It was one clean sweep!"

Another fire in 1924 destroyed the covered bathhouse, and a new open-roofed structure was built to replace it. The resort experienced financial difficulties through the Depression years and was fairly rundown in the 1930s. By 1942, it went into foreclosure. A new owner, Harvey C. Woodbury, a research chemist, bought the resort in 1943 and started to replace the corroded piping and concrete with newer materials. In 1951, new regulations by the State Health Department required chlorination of all swimming pools, and all but seven swimming resorts in the state had been closed down the previous summer. It would be very expensive to chlorinate the continuous flow of fresh water into Beck's large swimming pool. The Woodbury family had plans to develop a health center with smaller flow-through pools when they received notice that the Utah State Highway Commission was to build a new highway in this narrow transportation corridor between the western escarpment of the Wasatch Mountains and the Great Salt Lake. The resort's demise became conclusive March 3, 1953, when the State of Utah acquired title to the property under threat of condemnation. Louise Pearce put it this way, "... so ends the story of Beck's Hot Springs."

The few areas of remaining openly flowing thermal water are still attractive for bathing, especially for those without their own luxury bath or hot tub. As far back as the 1950s, “Hobo Springs” was a place of bathing for railroad transients. Today, homeless people still illegally bath in the springs and bars of soap and discarded blankets from the rescue missions dot “Hot Springs Park.”

Resource and Local Geology

The fifty or so springs in the Warm Springs area occur along the trace of an active normal fault, the “Warm Springs fault.” The Warm Springs and Hobo faults associated with the springs are local names for segments of the Wasatch fault zone, which forms the boundary between Salt Lake Valley and the Wasatch Range. Wasatch Warm Springs is the southernmost of four major hot springs, located along three miles (5 km) of the Warm Springs fault zone. From south to north, the individual springs are Wasatch, Clark, Hobo and Beck’s. There are also two shallow warm water wells used by local quarry operators. Collectively this area is known as the Warm Springs fault geothermal area. The thermal springs occur at the intersections of the Wasatch fault and other structures that are perpendicular to the fault zone (Murphy and Gwynn, 1979). Discharge temperatures range from 81EF (27EC) at Clark Warm Springs, to 131EF (55EC) at Beck’s Hot Spring (Klauk and Davis, 1984; Blackett and Wakefield, 2002).

Water temperature of Wasatch Warm Springs fluctuates seasonally between 100EF and 108EF (38 and 42EC). Assuming a thermal gradient of 93EF per mile of depth (32EC per km) and an average annual outside temperature in the Wasatch Range of 40EF (4.5EC), the water must reach a depth of approximately 0.75 mile (1.2 km) to obtain the maximum temperature of 108EF (42EC) (Milligan, 2003). This is, however, a minimum estimate of the depth of circulation because the upwelling geothermal waters likely mix with cooler ground waters on their way to the surface.

Measured outflow from Beck’s hot spring is about 228 gpm (870 liters/minute), and at Wasatch about 63gpm (240 liters/minute; Cole, 1983). Chemical analyses of water samples collected in January of 1981 indicate high Ca+Mg and high SO₄ +Cl (Cole, 1983). The chemistry is consistent with mixing between low-temperature near-surface ground waters high in Ca and HCO₃, and an upwelling geothermal fluid that has become enriched in Na and Cl by water-rock interaction during deep circulation along the Wasatch fault zone (Cole, 1983). Cole also noted cyclical changes in the chemistry of the spring waters throughout the year; chemical enrichments were noted during the summer months and depletions during the fall and early winter months. The hot springs exhibit their highest surface temperatures during the summer months at times of maximum flow. Based on the chemistry of the hot spring waters and surrounding ground waters in the Warm Springs area, Cole (1983) estimated a four-to-six month time period between recharge from melting mountain snow packs in April-May and discharge as diluted spring water in September-October.

CASTILLA HOT SPRINGS

Castilla Hot Springs are located about 8 mi (13 km) southeast of Spanish Fork in Spanish Fork Canyon, along the north side of U.S. Highway 6/89 in Utah County (Figure 3). During the early part of the twentieth century there was a thriving hot spring resort that attracted trainloads of visitors. Most of the following historical account of the Castilla Hot Springs resort is taken from an article in a Utah State Historical Society Publication, “Beehive History,” written by Linda Thatcher (1981).

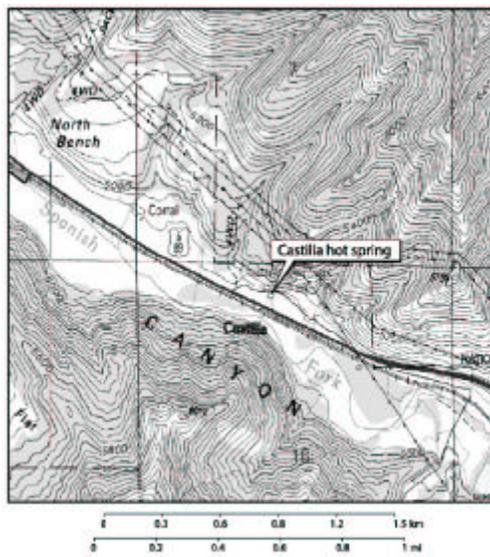


Figure 3. *Present-day map of Castilla in Spanish Fork Canyon, site of the Castilla Hot Springs resort in the early 1900s. Trainloads of visitors used to arrive by train for a day of diving, dining, drinking, and dancing.*

History

Spanish Fork Canyon was named for the Spanish priest-explorers Escalante and Dominguez who discovered the springs in September 1776 as they followed the Spanish Fork River down the canyon. They called it Rio de Aguas Calientes (“River of Hot Waters”) because of the hot springs flowing into the river. The name Castilla may have been suggested by the castle-like rock formations nearby.

In 1863, heavily armed Mormon troops traveling through Spanish Fork Canyon noted the presence of “unfriendly Indians” living around the hot springs (Jeffers, 1972). But by 1889, the Native Americans were gone and William Fuller had filed for a patent on the hot springs property with the U.S. government. He built a small house that contained a wooden tub for bathing in the mineral water. Later that year, a Mrs. Southworth felt that her health had been improved by bathing in the spring water, and she urged her two sons to buy the springs and “make a resort for people who have hopeless afflictions, that they may come and be cured.” They filled the swampy area with gravel and built a three-story, red sandstone hotel from sandstone quarried in a nearby canyon (Figure 4). Other structures included indoor

and outdoor swimming pools, a store, a dance pavilion, private bathhouses, several private cottages, and a saloon. Picnic areas, a baseball diamond, and stables were also provided.

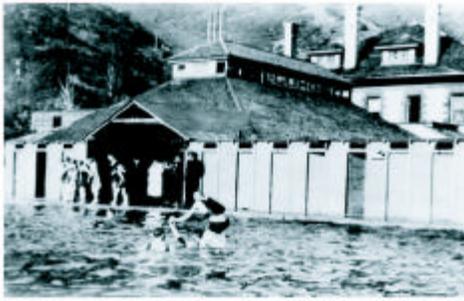


Figure 4. *Two historical photographs of the Castilla Hot Springs resort in about 1917. Elderly ladies may have come to Castilla for their rheumatism rather than recreation.*

During the summer months, the Denver and Rio Grande Railroad ran excursion trains to Castilla, and it was a regular passenger stop for many years. One of the more popular runs was the “moonlight excursion” from the Tintic Mining District in Juab County to Castilla. The train stopped at stations along the way to pick up passengers for an evening of dining and dancing.

Besides providing recreation for many Utahans, the resort was the site of several “direct-use” enterprises, including a cigar factory and a quarry that furnished silica used as a flux by the Columbia Steel Company in Ironton, Utah. However, the main attraction was still the warm, sulfuric water. Bathers come from far and wide for the relief of their rheumatism and arthritis. The springs’ water also became popular as a cure for other ailments such as alcoholism, chain-smoking, moral dissipation, and the “tendency to use profane language.”

In 1912, a noted sculptor with local ties, Cyrus Dallin bought the resort, but he had to rely on relatives to run it as he lived in Boston. The resort enjoyed a brief renewal of popularity in the 1920s, but by the 1930s, it had fallen into disuse. Work in a nearby rock quarry slowed the flow to the springs and the hotel fell into disrepair. In the 1940s, a fire destroyed most of the hotel. What remained was eventually torn down.

By the 1970s, all that was left of the old resort was a concrete tank or cistern built over the hot sulfur spring. Sometime in the 1980s, the spring was blown up by local authorities because they had trouble controlling the visitors

that frequented the springs. Nowadays, there is only a small railroad sign that says “Castilla,” and in a grassy area nearby, the remains of the soaking tubs and bits of foundation from the hotel.

Resource and Local Geology

The Castilla springs are located at an elevation of about 5,000 ft (1,525 m) within the Wasatch Mountains, not far from hot springs in the Thistle and Diamond Fork (Fifth Water) areas (Blackett and Wakefield, 2002). Klauk and Davis (1984) presented thermal and chemical data on two springs at Castilla. Temperature in both springs was 97°F (36°C). Cole (1983) measured temperatures of 108°F (42°C) and fluid discharges of 21 gpm (80 liters/minute) for the larger spring, and noted the location of the spring at an outcrop of faulted Paleozoic quartzite. The water chemistry generally appears to be of the Ca-Na-SO₄ type. Cole (1983) reports that the isotopic composition of the Castilla spring water lies on the local meteoric water, indicating that not much mixing, evaporation, or high-temperature water-rock interaction has occurred during the evolution of the thermal fluid. Not much more is known about the geology of this forgotten hot spring area.

PAH TEMPE (DIXIE, LAVERKIN) HOT SPRINGS

Pah Tempe Hot Springs Resort is located between the towns of Hurricane and LaVerkin in southwestern Utah. The springs flow from travertine mounds along the Virgin River and into the river where it cuts the Hurricane Cliffs (Figure 5). The LaVerkin (Pah Tempe) hot springs have been an active resort from pioneer times until two years ago (January 2002) when pipelines put in to divert water from the Virgin River into the Quail Creek reservoir disrupted the natural flow of hot spring water to the resort. This is not the first time that pipeline construction has damaged the geothermal resource, Pah Tempe was out of business from 1992 to 1995, and also in July of 2000 and May of 2001 when heavy equipment work in the river bed shut down the flow of hot spring water. Ken Anderson, current owner of the resort, has raged a 10-year legal war with the Washington County Water Conservancy District for damages and business losses. The Conservancy District says it owns the water rights to the Virgin River and that the Quail Creek pipeline is critical to the growing population of Washington County (*The Spectrum*, January 18, 2002). The district also claims that the high salinity spring water is polluting the Virgin River, hurting her native fish population, and decreasing the water quality of the Colorado River into which she drains. The district also suggests that even the early pioneers considered the springs to be “poison water.” Mr. Anderson states that up to 20,000 people a year have enjoyed soaking in these revered hot spring waters, and claims losses of \$1,000 a day in revenue from disappointed bathers and resort lodging (previously geothermally heated). Mr. Anderson has prepared a document entitled “Summary History of Pah Tempe Mineral Hot Springs, 1984 to the Present” dated July 1, 2001, and has put together a comprehensive website that can be viewed on-line (www.infowest.com/pahtempe).

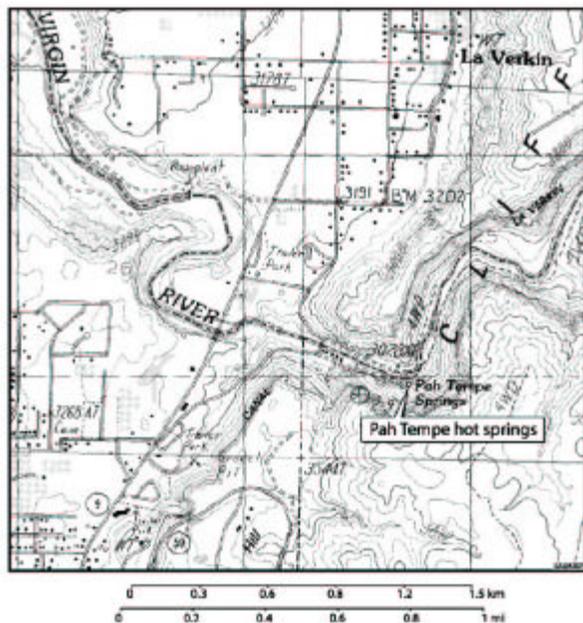


Figure 5. *Map of present-day Pah Tempe Hot Springs, near LaVerkin in southwestern Utah. The Washington County Water Conservancy District's pipeline runs through the Virgin River in the vicinity of the hot springs.*

History

The earliest human history of the LaVerkin (Pah Tempe) hot springs starts with the Native Americans. A cave located above the hot springs contained two pots in perfect condition and a broken bowl. A cave located downstream from the springs on the north side of the river, contained “the most varied trove, including a war club with two stone points cemented to the wood handle” (Hall, 2003). There was also a wood-handled dagger, a “tump strap” or head band made of braided hair and rawhide for carrying loads, a digging stick used for gardening, lots of bone awls, and a “duck jar” made by hollowing out a sandstone rock. These items are now in possession of the University of Utah. Hall (2003) also writes the following:

“The hot springs were considered sacred by the Indians and were a neutral zone. If enemies met there, they avoided conflict while together. Presumably, Navajos respected the sacredness, and wouldn't steal a child if they encountered a Paiute family.”

The Dominguez-Escalante party went through this area in 1776. They recorded the first historical account of Indians (Paiutes) utilizing irrigation to grow food and named the river “Rio Sulfureo” for the sulfur smell near the hot springs. Jedediah Smith stopped by in 1826, and the first Mormons visited in 1849. Most of the following pioneer history of the springs comes from “A Brief History of the LaVerkin Hot Springs and the LaVerkin Canal,” compiled by Ruby Webb (Daughters of the Utah Pioneers, 1986).

Thomas Judd, the first owner of the hot springs, acquired them in about 1889. The springs were used by the early settlers for recreation and for performing baptisms. The builders of the original Hurricane Canal built walls and dammed up the springs in order to soak their sore muscles at the end of the day, and for frolicking when wives (think plural, this is Utah!) came to visit on weekends. One of the wives, Rosalba Fuller recounted, “Since we had no bathtubs in those days, we really loved the sulfur springs.”

Like the Monroe hot springs near Richfield, Utah, the pioneers also used the hot waters to wash sheep. The sheep were doused in the sulfur water to prevent scabies.

Hundreds of baptisms were performed at the LaVerkin hot springs from about 1915 until into the 1940s. Thoughtful parents brought their babies to be baptized in the warm water during winter months. Later, when bathing and swimming facilities had been built, many baptisms were performed on Sunday mornings in the main enclosed pool. Sometimes the young person got to swim for a few minutes afterward. As Ruby Webb recounts, “There is an additional zest to the pleasure of swimming when it's done at a time that's normally forbidden.” Sundays were generally reserved for more sacramental activities.

A swimming pool 15 feet wide and 45 feet long was completed in 1918 by the LaVerkin Sanitarium and Resort Company. Two immediate tasks of the company were to sell additional company stock and to establish a code of decency for bathing suits. The LDS bishops of the towns of LaVerkin, Hurricane and Toquerville reached a decision; the codes for ladies called for elastic in sleeves and legs that reached below elbows and knees, plus a skirt. Men's suits could be sleeveless, but legs were to reach below the knees. A local seamstress made the suits for 15 cents a piece; they were sold by the company for \$1.50 each or could be rented for 25 cents. Rules of conduct prohibited naked bathing, dunking, throwing water, and diving from the walls. The pool was a popular attraction for individuals, families, school, scout and church groups (Figure 6); many arriving by wagon.

The resort became more of a public service than a cash cow. Though some facility improvements were made (such as the installation of electrical lighting to surprise late-night skinny-dippers), the pool eventually became privatized. In 1952, new owners gave it the name “Pah Tempe.”

The current owner, Ken Anderson, bought the resort in 1985, and made many improvements to the grotto area and pools. He created an inviting tree-lined spa with camping and bed-and-breakfast lodging. Even in these modern times, the pool continued to be used for “sulfur spring baptism” by the local people. But the Pah Tempe Hot Springs are perhaps better known internationally than they are locally. There were eighteen thousand guests from thirty-five countries during 1997. Now, the tragic story is that the resort is closed. This rare natural gem, that has provided peace, health and sanity to so many, has been ruined, but hopefully not for long. Somewhere in the riverbed and in the fractured limestone bedrock beneath it, the hot water still flows.



Figure 6. *Historical photograph of the LaVerkin (Pah Tempe) hot spring pool (top; used by permission from the City of LaVerkin). Empty grotto pools at the Pah Tempe Mineral Hot Springs (bottom), the resort has been closed since January 21, 2002 (images from Ken Anderson's Pah Tempe website).*

Resource and Local Geology

The Pah Tempe Hot Springs, also known as the LaVerkin or Dixie Hot Springs, flow from a number of vents along the Virgin River at about 108EF (42EC) near where the river crosses the Hurricane fault (Blackett and Wakefield, 2002). The springs issue from multiple vents in the fractured Permian Toroweap Limestone. Besides deep circulation along the Hurricane fault zone, there are also some very young (1,000 years B.P.) basalt flows in the vicinity of the springs which may provide local heat sources for the thermal water (Blackett and Wakefield, 2002). When the resort was open, the thermal water was channeled into a swimming pool and several therapeutic baths. The hot spring water was also used to heat the resort buildings through heat exchangers.

In 1937, the hot water was described as flowing from beneath the cliffs at the rate of 11 cubic feet per second (about 4908 gpm or 18,700 liters/minute), at a temperature of 108EF (42EC)(Webb, 1986). Measured flow rates range from 4490 gpm (17,000 liters/minute) in 1970 (Mundorff, 1970), to 4755 gpm (18,000 liters/minute) in 1978 (Cole, 1983), and 4800 gpm (18,169 liters/minute) in 1986 (Budding and Sommer, 1986). Flow rate, chemistry and temperature have varied with time. Mundorff (1970) and Budding and Sommer (1994) indicate that measured temperatures have ranged over the last one hundred years between 100 to 133EF (38 to 56EC). Total dissolved solid (TDS) contents have ranged from 8390 to 9340 mg/liter (ppm).

Before disruption by pipeline construction in 1984, the springs had artesian outflow to small caves (grottos) along the canyon wall. Damage was done to the main upwelling hot spring conduit by the blasting of trenches in the Virgin River during the pipeline installation. The blasting resulted in cracks in the limestone bedrock, rupturing the springs so that the natural artesian outflow ceased to flow from the grottos. New springs emerged at lower bank-levels along the Virgin River (Blackett and Wakefield, 2002). Flows to the original springs were partially restored after installation of a clay and cement seal in the construction area. However, a 5.8-magnitude earthquake on September 2, 1992 apparently ruptured areas in the pipeline trench that had been "repaired," again resulting in the loss of water flow in the grottos. Anderson has said that flows were easily 5,000 gallons per minute (about 19,000 liters/minute) when he first purchased the hot springs property, but more recently the flow has been reduced to 90 gallons (340 liters) per minute (The Spectrum, February 14, 2002; Figure 6).

Blackett (1994) obtained a post-earthquake spring sample collected from one of the new spring orifices where the Quail Creek pipeline crosses the Virgin River. The chemistry of the post-earthquake sample was similar to previous analyses. For 1994, Blackett and Wakefield (2002) list total dissolved solid (TDS) contents of 8907 mg/liter for the Dixie (Pah Tempe) hot spring, with 2130 mg/l Na, 760 mg/l Ca, 1238 mg/l HCO₃, 1841 mg/l SO₄, and 3195 mg/l Cl. The water is a sodium calcium-chloride, sulfate and bicarbonate type. Geothermometers suggest equilibration temperatures between 167EF and 176EF (75EC and 80EC) (Blackett and Wakefield, 2002).

SUMMARY

This is the story of three hot spring resorts in Utah. There is not a unifying theme to their demise. The Wasatch-Beck's and Pah Tempe springs are perhaps just located in the wrong place. The Wasatch Warm Springs fault geothermal area is unfortunately sandwiched in a narrow transportation corridor between the Great Salt Lake to the west and the Wasatch Mountains to the east. Two major interstates, gas pipelines, and an extensive rail system now directly overlie the original springs. Sometimes you can get a whiff of sulfur as you drive by. Castilla simply appears to have died of neglect. The closure of the Pah Tempe resort is a sad story, but hopefully not over. Although the springs are located directly next to the only perennial river and exploitable source of surface water in Washington County, the hot water is still there (as it is for the other two geothermal areas). In all three areas, the beauty of the natural hot spring environment is gone, but the resource remains.

ACKNOWLEDGMENTS

Thanks to Bob Blackett of the Utah Geological Survey for help in collecting resource data for these three areas. The historical photographs are used by permission with all rights reserved from the Utah State Historical Society; the staff there is very helpful. Thanks also to LaVerkin City for permission to use historical photos from their website, and to Ken Anderson for images of modern-day Pah Tempe.

REFERENCES

- Anderson, K., 2001. "Summary History of Pah Tempe Mineral Hot Springs, 1984 to the Present." Website (<http://www.infowest.com/pahtempe/>).
- Blackett, R. E. and S. I. Wakefield, 2002. "Geothermal Resources of Utah, a Digital Atlas of Utah's Geothermal Resources." *Utah Geological Survey Open-File Report OFR-397*, CD-ROM, ISBN 1-55791-677-2.
- Budding, K. E. and S. N. Sommer, 1986. "Low-Temperature Geothermal Assessment of the Santa Clara and Virgin River Valleys, Washington County, Utah." *Utah Geological Survey Special Studies SS-67*, 34p, 1 pl.
- Cole, D. R., 1981. "Isotopic and Ion Chemistry of Waters in the East Shore Area, Northern Utah." *Geothermal Resources Council Transactions*, v. 5, p. 63-66.
- Cole, D. R., 1983. "Chemical and Isotopic Investigations of Warm Springs Associated with Normal Faults in Utah." *Journal of Volcanology and Geothermal Research*, v. 16, p. 65-98.
- Hall, V., 2003. "A History of LaVerkin, Chapter 1: LaVerkin's Background." The LaVerkin Community Site, website (<http://news.mywebpal.com/partners/965/public/>).
- Jeffers, V., 1972. "Spanish Fork Canyon: History of the Settlement of and Use of the Canyon." Soldier Summit, Utah 1776 to 1972, Castilla Hot Springs, Utah State Historical Society.
- Klauck, R. H. and D. A. Davis, 1984. "Evaluation of Low-Temperature Geothermal Potential in Utah and Goshen Valleys and Adjacent Areas, Utah (Utah Co.); Part II: Water Temperature and Chemistry." *Utah Geological and Mineralogical Survey Report of Investigation RI-191*, 43 p., 2 pl.
- Milligan, M., 2003. "Do I Have to Travel All the Way to Yellowstone, or Can I See Beautiful Hot Springs Here in Utah?" Utah Geological Survey, Survey Notes, v. 30, n. 3, 1998, online publication website (<http://ugs.utah.gov/surveynotes/gladasked/gladspg.htm>).
- Mundorff, J. C., 1970. "Major Thermal Springs of Utah." *Utah Geological and Mineralogical Survey, Water Resources Bulletin 13*, 60 p.
- Murphy, P. and J. W. Gwynn, 1979. "Geothermal Investigations of the Warm Springs Fault Geothermal System." *Utah Geological and Mineralogical Society Report of Investigation RI-140*, 29p.
- Pearce, L. B., 1969. "Salt Lake City's Vanishing Hot Springs." *Daughter of the Utah Pioneers*, Utah State Historical Society, 14p.
- Thatcher, L., 1981. *Castilla Hot Springs: Beehive History*, v. 7. See also, Castilla Hot Springs attracted trainloads of visitors: History Blazer, October 1995, Utah Historical Society website (<http://historytogo.utah.gov/castilla.html>).
- Van Wagoner, R. S., 1989. "Saratoga, Utah Lake's Oldest Resort." *Utah Historical Quarterly*, v. 57 Spring 1989, p. 108-124.
- Webb, R., 1986. "A Brief History of the La Verkin Hot Springs and the La Verkin Canal." *Daughters of the Utah Pioneers*, Washington County Chapter.