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Geothermal Swimming Pool Kah-Nee-Ta, Warm Springs, Oregon

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Keywords

Direct-use, swimming pool, spring water, Indian reservation

ABSTRACT

The Confederated Tribes of Warm Spring Reservation in north-central Oregon uses geothermal spring water at 128°F to heat two hot tubs, a 530,000-gallon outdoor pool and several soaking tubs. Up to 400 gallons per minute is transported from the spring to several large holding tanks in the basement of the Aquatic Center; where, the water is treated with sand filters to remove iron oxide and algae. The entire complex has a peak usage of 6.8 million Btu/hr with an installed capacity of 2.00 MWt. The annual use is estimated at 30 million Btu resulting in a savings of around \$400,000 compared to natural gas. After use, the geothermal water is dechlorinated and then disposed into the Warm Springs River.

Location

The Kah-Nee-Ta swimming pool is located on the Confederated Tribes of Warm Springs Reservation in north-central Oregon southeast of Mt. Hood. The 600,000-acre reservation was formed in 1879 and settled by Paiutes, Warm Springs and Wasco tribes. The swimming pool is located adjacent to the Warm Springs River, a tributary of the Deschutes River. The resort was started in the early 1960s, and in addition to the swimming pool includes a lodge, a RV village with condos and tepees, and more recently, a gambling casino (Figure 1). A flood in February of 1966 cause major damage to the RV park and pool area. The flood wiped out the village, tepees, the recreational vehicle parking and the guest cottages, and filled the pool with mud. The flood forced the tribes to take a planned \$3 million remodeling job and turn it into a \$10-million rebuild (Sleeth, 1997). The pool area was rebuilt and available for use in 1997. Most impressive in the remodeling, is a 40-foot high, 140-foot long water slide.

Resource

The resource is located on the eastern flank of the Cascades; where there are numerous hot springs such as Breitenbush, Bagby and Austin. Warm Springs is located east of these springs in the Columbia River basalts. These springs are associated with a high-temperature resource and issue from north-south trending fault systems. The seven warm springs have been used by the local Indians for centuries. Today, one warm spring, on the banks on the Warm Springs River, produces about 400 gpm at 128°F and is used to heat the swimming pool. None of the other facilities on the resort/casino area are heated by geothermal energy due to the limitation on the flow rate from the springs. Piping hot water to the casino would require about a 1.5-mile pipeline with several hundred feet in elevation gain.

The spring water has a pH of 8.32 and conductivity of 1370. The water is mainly a sodium-bicarbonate type. The following is the list of the major constituents in mg/L (GHC database):

HCO₃: 511, Na: 325, Cl: 155, SiO₂: 104, F: 21, K: 3.4, Ca: 3.2, B: 2.6, Li: 0.52, Mg: < 0.05, Fe: < 0.02.

Utilization

Spring water at 128°F is gravity fed from the warm spring adjacent to the river (Figure 2). The water flows first into a small concrete holding tank with a capacity of 1,400 gallons



Figure 1. Overview of the Village area and pool.



Figure 2. The spring on the bank on the Warm Springs River.

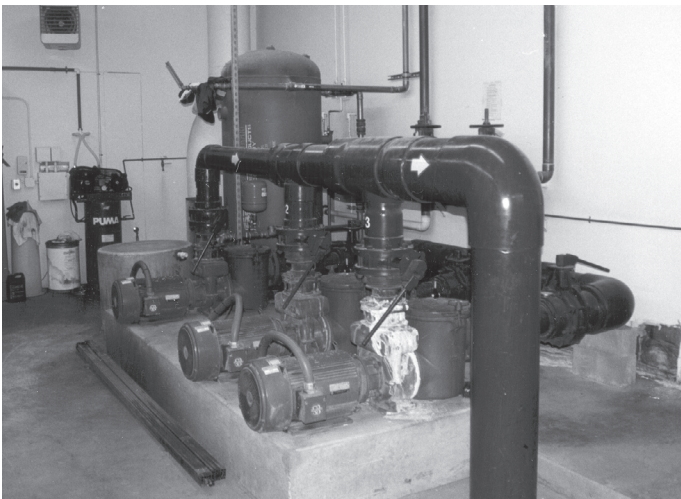


Figure 3. Basement of the Aquatic Center with storage tanks.



Figure 4. Warm Springs River.

(6x6x5 ft), and then into a larger one of 54,000 (30x30x8 ft) gallons, both located in the basement of the pool building (Figure 3). An overflow goes into a sump--then to the drain, dechlorinator and finally into the Warm Springs River (Figure 4). From the smaller holding tank, the water at 128°F is then pumped through a filter and then through a brazed-plate heat exchanger (Figure 5). The secondary side of this heat exchang-



Figure 5. Sand filter in the Aquatic Center.

er goes into a 400-gallon storage tank from which hot water is fed to the showers. Cold water, piped over the mountain from the water treatment plant at 52°F, is used to cool the shower water to 100°F and in summer, used to cool the pool water. From the larger storage tank, water at 125°F is pumped by three 20-hp pumps in parallel through a sand filter and chlorination to the hot tubs and outdoor swimming pools. The two hot tubs are kept at

103°F and the 530,000-gallon outdoor pools are kept at 90 to 94°F, depending upon the season (Figure 6).

The wastewater from the hot tubs, pools and showers are then fed through the dechlorinators and disposed into the Warm Springs River. Finally, from the smaller holding tank, water is pumped through a sand filter into three indoor tubs in the Wanapine Spa, which are kept at 103°F (Figure 7). Water is also pumped to the Tribal Bath House, for exclusive use of the tribal members, and to the Neesha Cottage, the larger rental facility on the grounds. Wastewater from these three uses is again piped through the dechlorinator and into the river. The overflow rate from the smaller concrete tank is controlled by a temperature sensor between the overflow line valve to the sump which feeds into the wastewater line. A schematic of the entire system is shown in Figure 8.

The pool and water storage has a total volume of 600,000 gallons, with a surface area of the pools at 12,286 square feet allowing a bather load of 636 persons. The turnover rate for the pool water during use varies between 4.5 hours (2222 gpm) to 6.0 hours (1667 gpm). The entire complex has a peak usage of 6.8 million Btu/hour for an installed capacity of 2.00 MWt. The annual use is estimated at about 30 billion Btu with a saving of approximately \$400,000 compared to natural gas.



Figure 6. Outdoor pool with the slide.



Figure 7. Wanapine Spa soaking tubs.

Operating Costs

Annual operating costs consist of two items: 1) electricity cost to run the various pumps, and 2) maintenance and chemical costs. The pumping cost for about 95 hp of circulation/booster pumps is estimate at \$30,000 per year. The annual maintenance costs (\$10,000), including chemicals for the chlorination and dechlorinator (\$50,000), and salary for one part-time maintenance worker (\$15,000) is estimated at \$75,000.

Regulatory/Environmental Issues

Since the facility is on reservation land and considered sovereign under federal law, the tribes are their own steward.

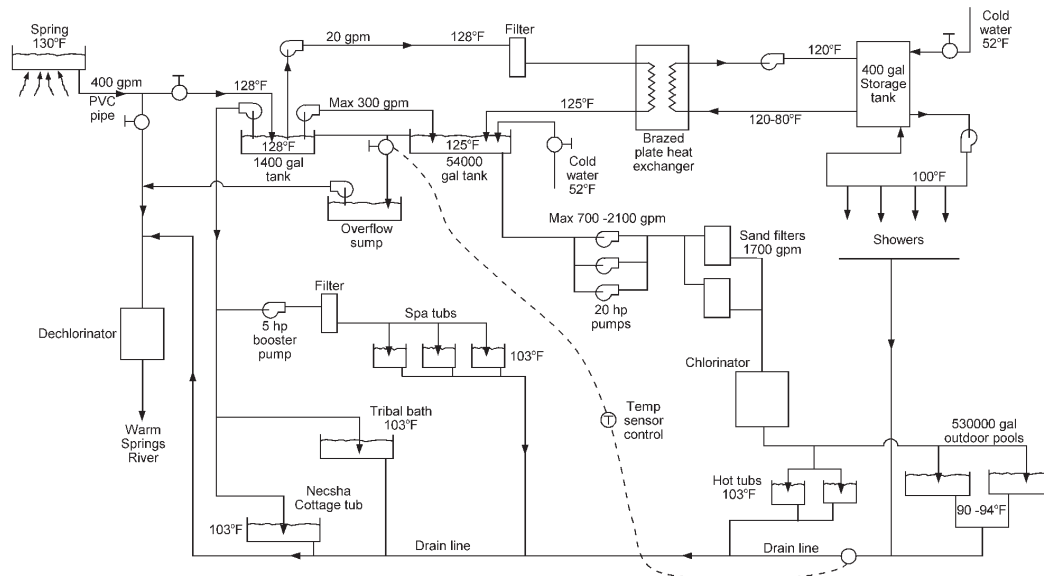


Figure 8. Schematic of the pool spring water supply system.

They, however, use the federal Environmental Protection Agency (EPA) standard concerning the discharge of wastewater into the Warm Springs River. This is accomplished by having a dechlorination filter at the end of the disposal line using sodium bisulfate to remove the chlorine. The standards set by the tribes is higher than that required by the Oregon DEQ. One of the main concerns is the restoration of trout, steelhead and salmon to the river. Recent, daily checking the wastewater before entering the dechlorination filter revealed no residual chlorine; thus, the filter is now bypassed and the water discharged directly into the river. A planned improvement, is to discharge the waste water through diffuser pipes buried in the stream bed to prevent a concentration of warm water entering the river.

Problems and Solutions

Initially, there were problems from iron oxide and algae depositions in the water. With the installation of the sand filters, this problem has been solved. After the 1996 floods, they considered providing radiant floor heating to the service buildings adjacent to the pool along with heating the concrete slabs in the tepees; however, there was not enough flow to accomplish this. As mentioned above, piping hot water to the lodge/casino complex would require a 1.5-mile line pumping water uphill, which was not considered economical. No corrosion or scaling problems have been detected in the cast iron pipelines, as the sand filters remove any detrimental chemical species.

Conclusions

The pool and village area consisting of both tepees and guest rooms along with the European-style heat spa, focuses on the family. The resort emphasis tribal designs with red and brown earth tones to match the Central Oregon desert outside. Rafting, fishing, tennis, and hiking along with the gambling at the casino on the hill provide plenty of recreational activities.

The use of geothermal enhances the experience and provides a substantial savings to the tribes.

References

Additional details can be found at their website: www.warmsprings.com.
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