

MEMORANDUM

Date: April 30, 2012
To: Water Right File 63-31354
From: medl
Re: license review

Proof of Beneficial Use was expected August 1, 2005. Proof of beneficial use was submitted on June 21, 2005, concurrent with a Beneficial Use Field Report. Certified water rights examiner, T. Scanlan (SPF Water Engineering, LLC) examined the project for beneficial use on June 15, 2004 and/or June 8, 2005. He confirmed that a system which could put water to beneficial cooling use was in place.

Source and Point of Diversion

The source of cold water for this right is groundwater from two production wells. The production wells were available as shapes in the well layer and I selected those existing shapes as the POD shapes for this right.

Water Use

The examiner's recommendations for rate and volume are based on pumping rates and pump capacity. He recorded flow rates and accumulated volumes that he saw at the injection wells on June 15, 2004 and June 8, 2005. It is not clear from the examiner's report, how much of that pumped water was utilized by the cooling system and how much was redundant capacity attributable to original design requirements.

Cooling System Schematic

The system diagram provided in the field report does not show sufficient level of detail to understand the relationship between the groundwater loop and the building's cooling system loops. To fill that gap, I requested and received a screen shot of a schematic diagram from the Water Center's building automation system. See attachment

Cooling System General Description

The Water Center cooling system consists of one, open, groundwater loop and two, closed, cooling water loops. Heat exchangers interface between the groundwater and the building's cooling systems. Groundwater is diverted from the production wells and pumped through one of the heat exchangers. The heat exchangers extract heat from the water on the building side and transfer it to the water on the groundwater side. The warmed groundwater is then discharged into the injection wells. Each cooling loop can be served independently by the three well pumps.

24/7 Cooling Loop

The Water Center has two cooling loops. One loop is dedicated to cooling two computer/server rooms. A Tranter Superchanger, plate and frame heat exchanger, serial #SH748, with a design flow rate of 69 gpm (~0.15 cfs) meets that load.

To support reliable operation and prolong the life of electronic components, server rooms require air temperatures in the range of 68 - 71 deg F. This range is below the thermal comfort range typical for offices (69-73 deg F). A server room cooling load would not be dependent on the outside temperature but would be operating year-round, even in opposition to the building heating system.

Seasonal Cooling Loop

The bulk of the building's cooling load is met by a Trane CenTraVac chiller, serial number L03G06179. *(A chiller is refrigeration unit that cools a fluid, usually water, instead of air. They are a single appliance containing two heat exchangers: a condenser and an evaporator. It is in the condenser that heat leaves the building and enters the groundwater, raising its temperature.)*

Commissioning documents indicated that the design flow rate through the condenser is 650 gpm (~1.45 cfs). Performance graphs obtained from Trane indicate that the minimum flow rate through the

condenser is 444 gpm (~0.99 cfs) and the maximum is 1628 gpm (~3.63 cfs). I believe that this custom-built unit was designed to provide cooling for additional buildings which were expected to be constructed on lot 11. That portion of the authorized place-of-use was not developed. Only a fraction of the chiller's cooling capacity of 485 ton (5,820,000 BTU) has been beneficially used. The chiller would be operated as needed with the highest use occurring during the traditional summertime cooling season.

Computer/electrical/mechanical rooms on the 1st and 2nd floors of the Water Center are cooled by unrelated, independent air condition systems.

Rate

The design flow rates for the two cooling loops total 1.60 cfs (0.15+1.45=1.6). This is the rate I recommend for the license. The examiner found that the pumping plant can provide more than this rate. But I believe that the pumping plant is oversized in a way similar to the chiller. I have no evidence that flows above 1.6 cfs were used by the cooling system during the development period.

Volume

The examiner provides an annual volume of 192.3 AF based on readings observed at the injection well totalizers. But he recommends a volume extrapolated from those readings to account for full occupancy and warmer than normal weather.

Additional volume is expected to be put to use by a water-based cooling system operating in years with more than average number of cooling days. And the department can issue a license with a volume that has been justified necessary to meet the water requirements of an extended cooling season. Although not the extreme year, both 2004 and 2005 had more cooling degree days than the period-of-record normal for Boise. A recommendation for additional volume to accommodate warmer than field exam conditions, should logically reference the climate year or climate conditions to be met by that volume. The examiner's recommendation does not.

I agree that the pumping is related to the cooling in this case, but I do not have enough operation points to define the relationship and I find that both the pumping and the cooling systems are oversized. I requested injection well records from any time subsequent to the field exam dates. None are available. I can't confirm that additional pumping occurred during the warmer post exam years. Nor can I confirm whether the cooling system operates more or less efficiently during higher demand. The examiner may have had operation or design information to support his recommendation but he does not provide it with his exam report.

The examiner does not provide adequate justification for the 20% increase in volume that he recommends. Therefore, I am recommending a license volume based on the actual readings and actual beneficial use.

On its own, the 24/7 cooling loop could use 108 AF (0.15 cfs x 365 days x 1.9835) of the 192.3 AF recorded. Optimum rates for groundwater used in cooling are 1-2 gpm per ton of A/C¹. For 273.01 ton reported in the water balance, the max optimum groundwater rate would be 546.02 gpm (1.22 cfs). Approximately 35 days of continuous operation at that rate would use the remaining 84.3 AF.

Place of Use

I created the POU shape based on the examiners map and personal experience.

Point of Discharge

Two injection wells receive the warmed groundwater discharged from the heat exchangers. The wells

¹ April 10,2010 email correspondence from Dr. Steve P. Cavanaugh, professor of Mechanical Engineering University of Alabama.



are located in gov t lot 11 (SESE) sec 10, Twp 3N, Rge 2E and are authorized by injection well permits 63-W-176 and 63-W-177 and drilling permits 772874 and 772875.

Conditions

Condition 3

The intent of this condition was to ensure that the use would be non-consumptive and I believe that it was.

Condition 7

I believe that the intent of this condition was to ensure that the quality of the ground water was not damaged by use in this cooling system. I believe that this use satisfies the intent of the condition but the groundwater is not used in a closed loop. The groundwater loop is an open loop. The building loops are closed loops.

Only the groundwater temperature is altered by this use. The entering temperature is approximately 59 deg F. The design leaving temperature is approximately 81 deg F.

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