

Date: March 30, 2009

To: Syllas Cranor, County Water Resources Engineer/Water Resources Advisory Committee

From: Tim Cleath, Certified Hydrogeologist

Subject: Pump test regulation review

I note that the WRAC has on its agenda a Review of Pump Test Requirements and that with its package there is a CGA Standard Practice document for pumping tests. This review appears to be focussed on pumping tests performed for a single family residence but I suspect that the issue at hand may be more related to the subdivisions and shared wells under County review. Having performed many different types of pumping tests throughout the County, I thought it appropriate to provide you with some professional input:

At this time, the County requires that a 4 hour duration pumping test with a minimum flow rate of 2.5 gallons per minute be performed by a licensed professional contractor or geologist/engineer to demonstrate that sufficient water is available to a new residence. It is my understanding that this requirement is intended to show a prospective homeowner that water would be adequate for the residence. In general, the regulation has served the County well. Some of the standard practice guidelines presented by the CGA do deserve some consideration, however. I point these out for your consideration below.

1. Water storage in a well should be considered when determining the duration or flow rate of a pumping test. The initial portion of the pumping test in part is producing water that is stored in the casing: per foot of depth, a 5-inch casing holds one gallon of water, a 6-inch casing holds 1.5 gallons, an 8-inch casing holds 2.1 gallons, a 10-inch casing holds 4.1 gallons and a 12-inch casing holds 5.9 gallons. If the well has only 100 feet of depth below the static water level, a typical 5-inch well will have 100 gallons in storage. This could mean that, with the pump set at the bottom of the hole, and a flow rate of 2.5 gpm, the first 40 minutes of the test could be just taking water out of the casing. A 4-hour test for this well would be pumping water from the aquifer for more than 3 hours, which is good. A 10-inch casing of the same saturated depth with the same pumping rate, would need to pump almost 2.5 hours to remove one casing volume, which is barely adequate. In many cases the well depth of saturation is more than 200 feet and, considering a 4 hour test of a 10-inch well, the pumping test could get by without any inflow from the aquifer. This would not be a good test of the yield from the aquifer to a well. In situations where the casing diameter is 10-inch or where the casing volume of water is more than 200 gallons, the pumping test should have a longer duration or the pumping rate should be significantly increased.
2. If an air-lift type of test is allowed, some things should be standardized. Since an airlift type of pumping test provides rough discharge rate for a certain eductor depth, it is important to document that depth and the static water level depth, and also to measure the flow rate at multiple times during a pumping test. The air-lift test is typically less than ½ hour long because it is done as a part of a well development program. For it to be of any real value, an air lift test should be done for at least one hour. The minimum flow on an air lift test should be at least double the flow for a turbine pump type of test and I would want it to be perhaps even several times the pumping test rate required for a turbine pump type of test.
3. Water level recovery should mirror the drawdown curve and in many cases 90 percent recovery will occur in the first hour after the pumping test completion. If it doesn't occur in the first day, there is a problem and it should be noted. It is good to have the water level recorded one hour after a 4-hour duration pumping test is halted to see if 90 percent recovery has occurred.
4. There are areas in the County where a well with the required capacity is very difficult to find, even with considerable exploration. This is particularly the case in the granitic hills of Parkhill and is also common in the hills near Cambria that are underlain by Franciscan metamorphic rock. Many property owners get by on very little water and some even have to haul water. Without proof of water in these areas, residences will not be allowed, according to the ordinance. If this is the intent of the ordinance, then, that is fine but the fact of the matter is that when little water is available, a residence can still be possible but it would need to be designed for the lack of resource. For example, - Williams, Arizona

has some tracts where the homes are served by a trucked water provider that is subject to Health Department regulations.

If it is a matter of liability to the County for allowing an inadequate water supply to a residence, it may be appropriate to allow for a residence to be built subject to a recording of a site condition on the deed to the property. This would allow a property owner to construct a residence and know that there is a water limitation that should be understood. I know that some counties, such as Merced County do not require pumping tests at all because they do not want to be seen as the party responsible for determining the sufficiency of the water supply to a property, because a pumping test cannot account for drought condition or interference problems or long term overdraft problems. My personal perspective is that the pumping test requirement is good and that it should be stated in a response to receipt of the pumping test that this does not infer any liability on the County's part for the adequacy of the water supply.

5. In these areas of low water yield fractured rock, an alternative pumping test may best characterize yield of a well. Madera County, which is mostly underlain by Sierra Nevada granite, requires tests that involve a lowering of the water level to the bottom of the well and the monitoring of the change in pumping rate over at least a three week duration. Analysis of the change in flow is similar to the change in water level under a constant pumping rate. This method may be more appropriate for a lot split or subdivision or shared well because of the cost of a longer duration test. This type of analysis would best be reviewed by a certified hydrogeologist for long term projections of water sufficiency.

There may be situations where other factors should be considered with respect to sufficiency of water for a single family residence. Mineral water quality as well as the currently required bacterial indicator can be critical to the use of the water. I think it would be helpful to a prospective owner to have a laboratory test for the more common mineral contaminants like total dissolved solids (salinity), chloride, hardness, nitrate, iron and manganese, sulfide, and perhaps arsenic and selenium and boron.

I present these comments for consideration, should the County want to revise the current ordinance.