WCP Fire Water Flow

Harry Nelson

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1 The Problems

In their report dated Mar. 11, 2008, the staff of the Goleta Water District (GWD) concluded that the maximum fire water flow available from a West Campus Point (WCP) fire hydrant is 1464 gallons per minute (gpm). This rate of fire water flow appears to fall short of the 2007 (current) California fire code minimum for WCP of 2500 gpm per hydrant. This minimum of 2500 gpm per hydrant is strictly applicable for only two of our autocourts, the 910's and the 970's, which each have four-unit buildings of 7020 square feet.

However, our complex was built in 1985, and would have been subject to the 1982 Uniform Fire Code. I obtained a copy of that code from the UC Library System, and it refers to a procedure documented in the 'Guide for Determination of Needed Fire Flow' published by the Insurance Services Office (ISO).

Using that procedure, I evaluated the minimum fire water flow consistent with the 1982 Uniform Fire Code for the 910's and 970's to be 2000 gpm, which still exceeds the 1464 gpm hydrant fire flow evaluated by the GWD staff.

In addition, we currently have two water meters that connect WCP to the GWD system; we are interested in evaluating whether only one would be sufficient. The data (from Joy Engineering) upon which GWD based its estimate were collected with both meters open. Joy Engineering also gathered data with one meter shut (which one of the two possible meters didn't change the data).

These data imply a maximum hydrant fire water flow with one water meter open, using the same extrapolation to 20 psi residual pressure employed by the GWD, of 1320 gpm.

2 A Possible Resolution

The tests conducted by Joy Engineering used only the 2.5" diameter connection to our hydrants. However, our hydrants have a 4.0" diameter connection in addition to the 2.5" diameter connection. The approximation used in the National Fire Protection Association (NFPA) standard 291, Equation 4.7.3, suggests that the fire water flow enabled by both the 2.5" and 4.0" outlets can be estimated by scaling up by the total flow cross sectional area of the connections in use.

I believe it is common practice to use both 2.5" and 4" connections when fighting a fire. Additionally, the codes refer to the fire flow avaliable from a *hydrant*, and do not limit the flow to that available from its 2.5" connection.

Utilization of *both* connections on our hydrants increases the cross sectional area avaible for water flow by a factor of 3.6, and would allow hydrant flow up to 5212 gpm (two water meters) or 4701 gpm (one water meter), which would satisfy both the 1982 and the 2007 fire codes.

I think these estimates are inaccurate, and optimistic. The residual water pressure in our main 'sags' a bit in the presence of high water flow rates. Joy Engineering's measurements allow for calibration of this effect. More importantly, the assumptions made in extrapolating to 20 psi residual pressure neglect the pumping limitations of fire department pumps.

I assume that those pumps can reach only 10 pounds per square inch absolute (psia), or -4.7 pounds per square inch gauge (psig).

When I account for these effects, I arrive at the following estimates for the total fire water flow from one of our hydrants: 3359 gpm (two water meters, residual pressure 47 psig) and 3272 gpm (one water meter, residual pressure 43 psig).

I estimate the margin of error on the absolute flow rate to be around 200 gpm, and so, I conclude that our fire flow system exceeds both 1982 and 2007 code requirements, whether two or one water meters connect us to the GWD water distribution system.

I'd further conclude that the simultaneous usage of two water meters increases our maximum fire flow rate by 3% or 87 gpm out of the 3272 gpm which would be available if only one water meter were utilized. This increment of about 90 gpm has a much smaller margin of error than the absolute flow rate; I'd estimate the 90 gpm is reliable to 15 gpm.