NWS Northwest Water Systems
Engineering • Management • Planning
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October 15, 2024

Merrlawski Investments, LLC
Attn: Chris Merritt
PO Box 562
Packwood, WA 98361

Re: Riverside Subdivision Group B Drafting Hydrant

Dear Mr. Merritt,

Thank you for contacting us regarding the suitability of a drafting hydrant for the Riverside Subdivision Group B Water System. We understand that the fire marshal's office is requiring 2,000-gallons of water storage available to fill a fire truck. A copy of a county review letter indicates that the county is concerned that the 1,500 gpm drafting pump may collapse the drafting pipeline from the tank to the drafting hydrant.

The following calculations and design parameters will provide an appropriate framework that will demonstrate a drafting system will not damage either the pipe network or the storage tank. The project owner has reported that the fire marshal's office has confirmed that they have used similar drafting facilities at other installations. Without a copy of the pump curve for the pump(s) used by the fire department, it is not possible to ensure the drafting pump will operate effectively; however, we can demonstrate that the proposed drafting system will not be damaged by any pump the fire department might use.

Pipe collapse
The weakest pipe that could be used to construct the proposed drafting station would be schedule 40 PVC. The following external pressures (or internal vacuums) are the ratings for the corresponding pipe:

Pipe Diameter (in)	External to internal pressure differential (psi)
2	316
4	190
6	90
8	58

You will note that all of these values are greater than 14.3 psi, which is atmospheric pressure. In a worst case scenario, the soils would be completely saturated. With a three foot bury depth, this would add 1.3 psi (2.31 ft/psi). This provides us with a maximum possible pressure differential of 15.6 psi. All possible piping is rated to withstand this pressure differential. Indeed, it is actually not possible for any water pump to completely evacuate a pipe of all water and air,so the actual pressure differential would be something less than the calculated theoretical difference. Therefore, there is no danger of the pipe collapsing, regardless of what capacity, style, or configuration of pump used.

Tank Venting

While the pipes are not susceptible to collapse, the reservoir is very susceptible to collapse if put under any significant quantity of vacuum. Therefore, the screens must be sized to accommodate adequate airflow into the tank to prevent any potential damage to the tank while it is being emptied. A typical 1,500 gpm pump will pump at a lower rate when "pulling" (sucking) water rather than "pushing" water. Nevertheless, as a conservative measure, it will be assumed that the tank will empty at a rate of 1,500 gpm.

Airflow through screens is expressed in ft/s. A "safe" air velocity through a screen is 20 ft/s. Therefore, if we convert 1,500 gpm to 3.35 ft^3/s and divide that value by our maximum desired velocity of 20 ft/s, we get an open area of 0.1675 ft^2, or 24.12 in^2. However, the vent must also be screened with a 4-mesh corrosion resistant material. This type of screen typically has an open area of 73%. Therefore, the total amount of screened area required is 33 in^2. An 8-inch pipe is the smallest size with adequate cross-sectional area of 50.24 in^2. Alternatively, some other style of vent could be installed, provided the screened open area is 33 in^2, or greater.

The piping system should be designed to minimize headloss and dead storage in the tank.

Finally, the tank should be filled via an air-gap. The air gap should be a minimum of 2 inches, or two times the fill pipe diameter, whichever is greater. The air gap is measured as the distance above the lip of the receiving vessel.

If you have any additional questions or need further documentation, please do not hesitate to contact me.

Sincerely,
NORTHWEST WATER SYSTEMS, INC.

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STATE OF WASHINGTON
43190
REGISTERED
PROFESSIONAL ENGINEER

Todd Krause, PE
President/CEO