ENGINEERING CONSIDERATIONS INVOLVED IN WATER SYSTEM DESIGN

I. OVERVIEW

There are five factors that any engineer must consider in designing water systems: (1) capacity; (2) complexity; (3) safety; (4) reliability; and (5) cost. This Exhibit discusses these five design factors in general terms and then seeks to address their applicability to design decisions made by Artesian Water Company, Inc. ("Artesian" or the "Company") in the four component areas of a water system: (1) source of supply; (2) treatment; (3) storage; and (4) distribution.

II. THE FIVE FACTORS

1. Capacity

Assessing the "capacity" of any given solution refers to assessing that solution's ability to supply the quantity and quality of water to meet current and future needs. Thus, assessing "capacity" is a two-fold consideration. First, it requires making sure that there is an adequate margin for error so that if the solution is not performing as expected, or there is a greater demand than expected, that solution can still easily satisfy the actual need in the face of those unexpected changes in circumstances without working the solution or system to its limits or beyond the intended use of the equipment. This analysis must also be conducted with respect to the anticipated future demand for water. Hence, the solution not only needs to satisfy current demand with an added margin for error, it also needs to be capable of meeting greater future demand; again, with an added margin for error.

2. Complexity

Assessing the level of "complexity" of any given solution recognizes the fact that the more complex a solution is, or the more "bells and whistles" the solution has, the greater the likelihood that the solution could fail due to the failure of any one of those bells or whistles. For that reason, as a general rule, the less complex the solution, the better.

3. Safety

Assessing "safety" requires taking into account the potential for any user, whether a worker or a customer, to have an accident or be exposed to an unsafe condition. No engineer wants to design or construct a system that puts a user at risk of injury.

4. Reliability

Assessing a solution's "reliability" involves measuring the solution's chances of failure. With respect to any engineered system associated with public health and safety, failure is just not an option.

5. Costs

For any given alternative solution that passes the above-mentioned "tests," the costs associated with that solution must be evaluated. Those costs include the initial capital outlay, operating costs, and the anticipated frequency of the need to replace associated equipment over time. For example, a well-designed, highly-efficient motor might cost several hundred dollars more than an average, off-the-shelf motor, but the lower costs associated with operating the more expensive motor over time as compared to the average, off-the-shelf motor might justify its purchase, even at the higher price. Similarly, a submersible pump might cost $2,000 to $3,000 whereas the alternative, to install a line shaft turbine pump, might cost $10,000

to $15,000. However, the submersible pump might have a life expectancy of three to five years, whereas the line shaft turbine pump might have a life expectancy of 20 years. So, again, the initially more expensive solution may actually prove to be more cost-effective over time, saving dollars over the course of its life cycle.

III. APPLICATION OF THE FIVE FACTORS TO THE FOUR BASIC COMPONENTS OF A WATER SYSTEM

1. Source of Supply

When Artesian seeks to serve a new customer, we must ensure that we have an adequate supply of water. In the case where the Company cannot simply extend a water main to reach that customer, we drill a test well to determine what quantity and quality of water is available. Artesian's goal is to drill to deeper aquifers to avoid potential conflict with existing users and possible contamination from surface sources such as septic systems, agricultural fertilizers, and pesticides. We also try to avoid iron contamination. We conduct a pump test to identify what the aquifer will yield and what its quality is. Once we determine that the test well is viable, we apply for a permit to convert that well into a public-supply well.

In terms of reliability, we aim to have multiple sources of supply for back-up purposes. For example, Artesian likes to have access to two wells for a single water system or, if not two wells, at least an additional pump in inventory that could readily be used to replace a failing one.

2. Treatment

We use the data we collect from the pump test to assess what treatment to the water is necessary. There are currently over 130 contaminants that are regulated by the

Delaware Division of Public Health under the Federal Safe Drinking Water Act. If we are fortunate, the water will be of high quality and will only require pH adjustment, corrosion control, disinfection, and fluoridation. If iron or manganese is present, we install removal facilities, which is a more expensive proposition. This additional treatment typically involves oxidation of iron and/or manganese using chlorine and filtration. Alternatively, ion exchange technology may also be used to remove iron. In situations where naturally occurring organics may be present, an alternative oxidizing agent, such as potassium permanganate or ozone, may be required.

As with supply, we like to have at least two, rather than just one, treatment units in place as back-up in the event one fails. In terms of costs, when the relatively fewer number of users dictates that it is more cost-effective, we prefer to use less expensive portable treatment units in place of more permanent facilities. For example, a portable treatment unit can support about 35 residential homes. Once the number of customers increases beyond 35, an additional portable unit or construction of the initial phase of what would become a permanent treatment pumping station could be warranted.

3. Storage

Storage has a number of benefits to the water system as a whole. First, it is used to maintain water pressure throughout the distribution system. Second, it is used to maintain supply during periods of peak demand. Finally, and most importantly, in cases of larger water systems, which are component parts of the Company's overall system, storage provides the added water needed for fire protection.

The storage concerns are somewhat different for larger water systems as compared to smaller ones, though both are parts making the whole of Artesian's system. With

larger systems, there are basically two storage options available, the first being elevated storage and the second being ground storage with pumping. Significant storage of one of these two types is required when a water system has at least 50 customers or reaches build-out and requires fire protection. As a general rule, we believe that elevated storage is by far the preferable means of storage. This is because elevated storage also provides pressure. Sized appropriately, elevated storage is virtually a guaranteed means for meeting both peak demand throughout the course of a day and fire protection needs. Therefore, in the event all electrical and mechanical systems fail during an emergency, gravity continues to supply water to our customers. The alternative means – ground storage with pumping – is simply a tank that is built at grade or below grade level, along with an associated booster pumping station. The booster pumping station would have to have the capability of meeting a full range of water demand levels, from very low demands to peak-day demands, all the while maintaining a minimum capacity in reserve to meet fire flow requirements. Thus, the system must be able to adjust the supply to the system to match the demand on the system. Additionally, all electrical and mechanical systems must be in working order for ground storage with pumping to work. It is a much more complex operation in comparison to elevated storage, and, as such, prone to be less reliable than elevated storage.

With smaller water systems, we typically use hydropneumatic tanks. This is a tank that is partially filled with air and is used to balance the flow of water from the well and treatment system with the actual demands on the system. As water is used by customers, the air expands and the pressure will drop. Once the pressure drops to a certain level, a switch will trigger the pump to turn on. The pump then pumps water into the tank to restore what was lost. As the air compresses, the pressure increases, and when it reaches a predetermined point, the

pump automatically shuts off. This cycle repeats itself through the course of the day. Thus, the purpose of the hydropneumatic tank is to balance the water pumping rate with water use.

Determining what form of storage to use is a product of many factors. The level of demand is critical. We cannot use an elevated tank where there is too little demand. It is expensive and quality problems tend to develop due to the quantity of water in storage. Therefore, in a smaller water system, it is preferable to use hydropneumatic tanks.

As for choosing between elevated storage and ground storage with pumping for larger water systems, we consider whether an elevated storage tank is available, and assuming it is, the cost of building such a tank relative to a ground storage tank with its associated pumping station. Typically, a ground storage tank and booster station will have a slightly lower initial capital cost than an elevated tank. Comparing ongoing operational and maintenance expenses over the life of those facilities, however, with those of elevated storage shows an elevated tank having a significantly lower life cycle cost. Of course, if property cannot be acquired where an elevated tank is allowed, ground storage would be used. Also, where the design of a permanent station would allow for the use of a ground storage tank and booster station in its design, they might be used as an interim measure until an elevated tank could be constructed.

4. Distribution

The distribution system includes the pipes that transport water from the sources of supply, treatment, and storage to the customer. We need to ensure that there is adequate pressure and flow throughout our pipes to meet the water needs of our customers. Typically, if fire protection standards are met, then customer needs are also met because fire protection flow requirements significantly exceed the flow necessary for customer water use. One very important factor in the sizing of a water distribution system is the need to ensure that future

needs in the area can be met by the water main. In most instances, water mains are laid within highway rights-of-way, where there is considerable competition for the available space among all utilities (e.g., gas, sewer, telephone, and cable television). It is extremely difficult to go back at some future date to install a larger or parallel water main to increase capacity. In those instances where it may be possible to install replacement mains, costs are typically prohibitive due to the need to install such mains under paved roadways, thereby necessitating the replacement of half of the road pavement.