Knowledge is essential to keeping wellfields as valued, long-term assets

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Management of water systems -- not always getting the job done. The management at communities that operate public water systems frequently delegate the operation of the water system to their licensed water plant operators without much involvement unless something goes wrong. Water plant operators are typically highly trained in the operation and regulations of running the water plant. However, we often find that if they are operating groundwater-source water systems, operators tend to have limited knowledge of their well water systems.

We often teach and work with these operator teams to foster a better understanding of groundwater supply and managing wellfield assets, but their ability to act on recommendations is constrained by management. Unfortunately, city management is often even less informed about the functioning of a wellfield and the issues and potential problems associated with large public water supply wells. Generally, and especially when money is tight, the monitoring, maintenance, and repair necessary to maintain performance of the wellfield is not a management priority until there is a shortage of water or the wellfield is out off regulatory compliance. As with almost any maintenance scenario, run to failure and crisis ultimately is more expensive than regular, planned maintenance expenditures. The loss of confidence of the consumer is the costliest result.

Water wells, like other mechanical structures or equipment called on to operate in the natural environment, are subject to loss of performance due to a multitude of mechanisms. Natural performance degradation due to clogging and corrosion mechanisms is aggravated by design limitations and less than optimal well construction, development and completion. As a result of performance decline and corrosion, there can be 1) changes in water quality, 2) changes in wellfield output (capacity), and 3) increased operating costs. Changes in water quality can be aesthetic: those that result in consumer complaints (odor and taste), impact water plant operation (e.g., sand pumping or iron clogging), or result in health and safety issues and regulatory non-compliance (e.g., *E. coli* detection). Changes in wellfield capacity from clogging can result in periodic restrictions during peak water use seasons, or necessitate the construction of additional wells or wellfields. Increased operating costs result from deeper pumping water levels that require more electricity, or failure of the well and downstream equipment due to corrosion that requires costly replacement.

Ideally, a well is designed for specific local geologic and aquifer conditions and provides the most efficient possible contact with the aquifer. Improper design, construction and operation for the local conditions all contribute to the above-mentioned short well life, water quality issues, and higher electricity consumption. In addition to proper design and construction, post-construction testing is required to determine the performance characteristics of an individual well so the optimal withdrawal rate (or range) can be determined, a well pump with the proper performance characteristics can be selected, and a benchmark established for quantifying performance decline.

Value in regulations and design. Regulations and engineering specifications tend to restrain corner-cutting during initial well design, construction, testing and completion, when regulators and planners are watching. But after a well goes into service it is out of sight and out of mind. If it receives no funding for periodic testing or maintenance, the accelerated decay curve begins.

What investment is required for good wellfield asset management? At a minimum, records of pumping and non-pumping water levels, and accurate metering of the pumping rate for each well are needed to detect changes in performance that can be difficult to impossible to remediate if allowed to progress too far. Wells must be equipped with access or installed sensors for measuring water levels and individual flow meters. Water plant operators need support from management and should be provided with the proper equipment and the means to maintain records (computer and spreadsheets). Collecting and recording this data must be part of their job description and time allotted for it. Large wellfields or systems can utilize elaborate SCADA systems to monitor and record in real time the performance parameters of the wells, but *data collection systems are now cost-accessible even for small communities*.

If well capacity declines below set criteria for efficiency, e.g., less than 70% efficiency, then a well cleaning or rehabilitation can be performed to recover capacity. With comprehensive record keeping, the pattern of decline with time for a well or wellfield can be identified, permitting informed scheduling and budgeting for the periodic maintenance.

Establishing a new wellfield is not a small task, and maintaining the current wells in good condition is the preferred route. If a community's wellfield was constructed in the 1950's, the community has no experience with the current regulatory (and technical) hurdles that must be cleared to establish a new one. In our experience, acquiring the amount of suitable land required to meet sanitary isolation requirements is a major issue in that the land just may not be available (whether the community can afford it or not). It is difficult to compete with high corn prices.

Realistic rate structures are needed to cover current operating expenses and fund future maintenance and upgrades. Small communities particularly lack the political will to enact appropriate rate structures. Frequently water use is not metered and costs only a small set fee, and some operating expenses are subsidized

through the general fund. When there is a need to fund and make major repairs or establish a new wellfield, consumers are then confronted with daunting rate increases.

To summarize:

- Management needs to be aware of the issues associated with operating and maintaining a wellfield.
- They need to support their water plant operators by giving them the resources to track the condition and performance of the wells.
- Wells do degrade with time and corrective action needs to be taken to maintain efficiency, capacity, and safety.
- Regularly scheduled maintenance sustains the wells original performance, thus keeping operating costs at a minimum and extending into the future the time when a well or wellfield will need to be replaced.
- Realistic water rates need to be in place to operate and maintain the wellfield in the present, support professional development of operators and management, and fund repairs and upgrades in the future.

Ground Water Science offers services, training and publications (/products-a-services.html) to keep wellfields operating in an optimal way.