The Value of Water Well Rehabilitation

Expert Discusses Diagnosing Problems, Tools Available to Fix Issues

By Alexis Brumm

Sludge on a brush in North Judson, Ind. Preventative maintenance can fend off rehabilitation and keep a well producing. *Source: Cotey Chemical*

Is water well rehabilitation worth all the effort? What about preventative maintenance? These questions are commonly asked by drillers everywhere, and Kevin McGinnis, president of Cotey Chemical Corporation in Lubbock, Texas, has the answers.

McGinnis has worked in the water well remediation industry for more than 17 years. In that time, he's delivered technical papers to Saudi Arabia's Ministry of Agriculture and Water and to the Philippine Water Works Association's International Conference. He also works with the American Groundwater Trust to provide educational workshops throughout the U.S. and technical support for water well development and rehabilitation issues.

In January, McGinnis presented a course on water well rehabilitation at the Texas Groundwater Association's 2014 convention. Afterwards, he spoke to *National Driller* about everything well rehabilitation related in order to help you prevent future problems.

Q. First of all, how do you diagnose a problem with a well?

A. When diagnosing a well problem, we like to gather as much information as possible such as the history of the well, prior rehabilitation procedures/results and specific capacity history. It's helpful to review the well log (geological formation), view a down-hole video inspection, and determine the construction materials and well design. If possible, we like to do both a scale and a water analysis, checking for potential chemical and biological well plugging problems. We don't usually spend time trying to identify specific bacteria, but we want to determine the presence of general categories of bacteria like slime producers, sulfate reducers and/or iron-related bacteria.

Q. What are the benefits of well rehabilitation?

A. One of the biggest benefits is lower energy costs. As a well screen or formation begins to plug, the water will drawdown deeper into the well when the pump is turned on. This drawdown forces the pump to work harder since it must lift the water further. This increased lift requires more energy, increasing costs and reducing the life of the pump. A successful well rehabilitation will decrease the drawdown, lower the energy costs, increase the life of the well and increase the pump life.

It's too time-consuming to detail all the benefits of rehabilitating a well, but water quality is a benefit that should definitely receive some attention. A large percentage of the United States depends on groundwater for their basic drinking supply. Well rehabilitation can restore lost water quality and improve water aesthetics. Providing groundwater that is not only potable, but also has a pleasant smell, taste and appearance is an important consideration.

Weighing cost versus benefit is an important consideration when it comes to well rehabilitation decisions. Future plans and sometimes viability of an entire company may depend on the water from a single well. In this case, losing well capacity becomes not only vital, but critical. If rehabilitation can prevent a well from losing output, the benefit usually outweighs whatever cost is incurred.

These are just a few examples of the benefits of water well rehabilitation. There are obviously many more instances in which well rehabilitation would benefit not only contractors and private owners, but also communities and municipalities.

Q. Can you talk about some of the rehabilitation methods?

A. The main purpose of water well rehabilitation is to restore lost water volume and/or quality. Rehabilitation methods fall into two main categories: chemical or mechanical. Chemical rehabilitation involves discovering the cause(s) of well plugging and adding a chemical solution designed to dissolve the plugging material. Although various chemical formulas are offered by different companies, the basic approach is the same: a successful chemical reaction in the well.

Mechanical methods have the same goal as chemical, but vary greatly in their approach. The most basic is simply running a brush down the hole and scrubbing the inside of the casing wall. A contractor may also use a "surge block," a tool designed to function like a piston. This tool pushes and pulls the water in the well to dislodge plugging material so it may be pumped to waste. Yet another mechanical method is water or air "jetting." This technique sprays water or air at high pressures from inside the well onto the well screen in order to remove deposits. There are also multiple percussion-type tools that are designed to use vibration to loosen and mobilize plugging material. Subsurface Technologies developed a method called Aqua-Freed. This process injects liquid and gaseous CO_2 into a well. Through carbonic acid development and liquid CO_2 expansion, surging and airlifting, clogged water pathways are opened so more

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water becomes available.

Combining chemical and mechanical methods is an option that is more effective than using either method alone. Using chemicals with mechanical methods gives the best of both worlds and is growing in popularity across the country. The limiting factor for chemicals is how far they can reach into the formation. A chemical solution can only dissolve that with which it comes into contact.

The limiting factor for many mechanical methods is similar. Most mechanical techniques utilize energy inside the well casing and screen, and it's that energy that cleans the screen perforations. But much of that energy is deflected inside the screen, gravel pack and/or formation and cleaning is therefore limited to the area just around the well bore. Additionally, some cement-like deposits are resistant to any mechanical method at all.

Mechanical pre-cleaning prior to injecting chemicals removes interior screen deposits and ensures more uniform chemical access outside the screen and into the formation. Putting a chemical solution into a well and adding mechanical energy allows the two methods to work synergistically. Properly used, mechanical energy can push the chemical into places it would otherwise not be able to reach while suitable chemicals can soften difficult material so a mechanical tool can remove it.

Q. What is the rehabilitation procedure?

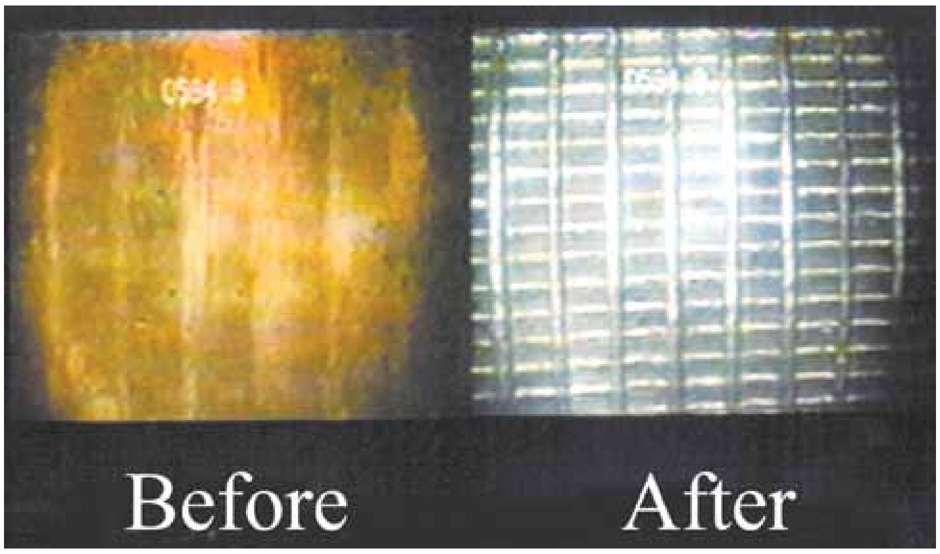
A. This is an example of a basic rehabilitation procedure (it may change based on the tools available, the design of the well and the experience of the contractor):

- Video the well.
- Pull the pump.
- Pre-clean the well with a brush, percussion tool or other tool to remove interior screen or formation deposits and allow chemical and mechanical energy to penetrate better.
- Remove the sand, silt and/or loosened material from the bottom of the well using a bailer, air-lift device or suction device.
- Pour chemical into the top of the well or premix and inject into the screen area.
- Agitate aggressively every few hours with a brush, surge block or other tool to force the chemical into the gravel pack and formation.
- When using acid, check the pH of the water often. If the pH is above 3.0, add more chemical. The pH should remain at or below 3.0 for the hour treatment period.
- Remove the chemical from the well.
- Develop the well. Spend extra time and energy to remove the sand, silt and partially dissolved material trapped in the gravel pack and formation.
- Video the well.

Q. Let's talk bacteria. What are the categories? What encourages its growth?

A. There are three general categories of bacteria that cause problems for water wells: slime forming bacteria, iron-related bacteria and sulfate-reducing bacteria. What usually encourages bacterial growth is the introduction of a food source or oxygen, or both, in groundwater.

The most basic mechanical method of rehabilitation is simply running a brush down the hole and scrubbing the inside of the casing wall. *Source: Cotey Chemical photos.*



A successful well rehabilitation will decrease the drawdown, lower the energy costs, increase the life of the well and increase the pump life.

Bacteria are naturally-occurring in groundwater and will feed on just about anything. From iron, manganese and sulfates to any carbon-based particulate, even oil from oil-lubricated turbine pumps, there is a bacterium that will use it as a nutrient. Often the only limiting factor for huge bacteria population explosions is the amount of available oxygen. However, there are some bacteria that don't need anything but a food source. Anaerobic bacteria will feed on the organic load in the water table without the need for oxygen.

Drilling a hole into a groundwater formation introduces oxygen and bio-fouling can increase dramatically. Sometimes existing water well problems exacerbate an already difficult bio-fouling issue. If, for example, the drawdown from a fouling well increases enough, part of a screen may be exposed. This traps oxygen in the formation and could cause vast increases in slime. Another issue could be a broken well casing above the water table. This break could allow seeping rains, runoff or irrigation water to cascade down the inside of the well casing to the water-bearing formation bringing a feast of nutrients to growing bio-masses.

Q. What's preventative maintenance? And why does it make "cent$"?

A. The goal of rehabilitation is to remove 100 percent of the plugging material. However, most rehab projects fall short of the goal because of:

Time limits – Many projects require procedures to be repeated until all of the plugging material is removed, but shutting down a well for more than a few days is not feasible.

Money limits – Restoring a well to its original specific capacity can be labor and material intensive, thus we settle for "good enough."

Misunderstanding well hydraulics – It's often assumed that if a well is brought back to its original specific capacity then all of the plugging material has been removed, right? Not necessarily. Specific capacity (gpm/foot of drawdown) is not a very good measurement of well efficiency nor is it a very accurate measurement of how severely a well is plugged. This is because most wells have excess production capacity – that is, most wells are able to produce more water than is demanded of them. So, when a producing zone begins to plug, other zones are able to make up the difference and there may never be a change in specific capacity. For example, a well owner might assume that with a 25 percent loss in specific capacity, the well is 25 percent plugged. But the truth is that this same well could be 40-, 50- or even 60-percent plugged and the owner would never know unless a camera was used to inspect the well. It's this type of scenario that lends more credibility to performing regular well maintenance rather than waiting until the well is plugged.

There are usually two different attitudes towards water well maintenance. The first attitude is reactive or waiting until the well is not functioning efficiently before intervening. The disadvantage is that when something must be done, expenses and down time can be daunting. Moreover, a reactive attitude is at the mercy of the well when it comes to timing. Services and supplies must be expedited, usually at much higher costs. Additionally, the longer a well is given to accumulate water-blocking material, the more difficult the material is to remove. It's possible that when a reactive well owner decides to rehabilitate the well, the buildup is so advanced that lost capacity may never be restored to where it needs to be. It's even possible to lose the well altogether!

The second attitude is proactive toward water well maintenance. This type of well owner will schedule annual well maintenance from the very beginning. The advantage is that when maintenance is started early in the life of the well, the buildup is usually thin and relatively soft. As a result, the pump doesn't have to be pulled, chemicals are less expensive, there's less down time compared to a full rehabilitation and often 100 percent of the plugging material can be removed. Since maintenance is being scheduled, it can be completed during slow or down times causing the least disruption and the lowest cost.

Well maintenance requires us well owners to change the way we think about our wells. Rather than wait until the well begins to experience production declines, we should begin annual well maintenance. Much like changing the oil in our automobile, we don't wait until the oil light comes on before we change the oil. Why do we wait until our water wells experience production declines before we take action? Performing regular well maintenance could potentially extend the life of our well indefinitely. Doesn't this make "cent$"? **ND**

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About Kevin McGinnis

Kevin McGinnis is president of Cotey Chemical Corporation, which provides products that can be easily applied by non-technical personnel for the maintenance, development or sterilization of household, industrial and irrigation water wells. He can be reached at kevin@coteychemical.com.