NDSU EXTENSION SERVICE

water spouts

No. 200 OCTOBER 2002

http://www.ext.nodak.edu/extnews/snouts

This is the final issue of Water Spouts for 2002.
Copies of Water Spouts dating back to April 1996 are available on the Web at: *www.ext.nodak.edu/extnews/snouts/*
The next issue of Water Spouts will be in April 2003.

Mark Your Calendar for these Irrigation Workshops

Nov. 26, Tuesday **Carrington Research Extension Center**

This workshop is for new and potential irrigators. Topics will focus on the basics of getting into irrigation including water sources, water and soil quality, water permits, financing options, irrigation economics, basic water management and an introduction to common irrigation equipment.

Dec. 5, Thursday **Best Western Ramkota Hotel, Bismarck** **(formerly Radisson Inn)**

This workshop is for experienced irrigators and will cover improved irrigation management options as well as developments in irrigation.

The North Dakota Water Users annual convention is scheduled for Dec. 4 and 5 at the Best Western Ramkota Hotel, Bismarck. An irrigation workshop sponsored by the Missouri Slope Irrigation Development Association (MSIDA), the NDSU Extension Service and the N.D. Water users will be held in conjunction with the convention. As part of the convention there will be an exposition where irrigation suppliers demonstrate their products and services.

More information about the workshops will be mailed in November. An application for Certified Crop Advisor (CCA) CEUs will be made for each workshop. If you have any suggestions for workshop topics, please give me a call or send an e-mail or letter.

Tom Scherer (701) 231-7239
NDSU Extension Agricultural Engineer
tscherer@ndsuext.nodak.edu

Park Your Center Pivot in the Right Direction

When it comes to wind and sleet, the center pivot is a rather fragile machine. Center pivots that have no nearby protection such as windbreaks should be parked for the winter pointing to the **northwest** or **southeast**, not to the northeast or southwest, Figure 1. The ice storm and blizzard of April 5-8, 1997 damaged many center pivots that were parked pointing in the wrong direction.

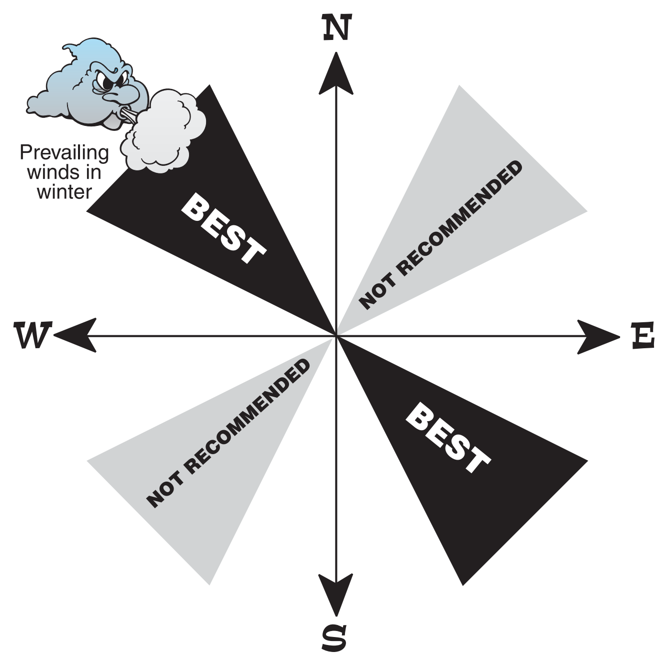

Figure 1. For the winter, point your pivot towards the northwest or southwest, not the northeast or southwest.

From October to April the worst storms and highest winds come from the northwest. Properly parking a pivot will present the smallest surface area to the wind. Make an exception to this guideline for center pivots that border windbreaks. In this case, the pivot should be parked next to the windbreak.

While you are parking your pivot for the winter, do the following checks to save some work in the spring.

1. Inspect the sprinklers. Note the location of or repair any sprinklers that are damaged or not working properly.
2. Check all gearboxes for moisture accumulation. Make sure each contains the proper amount and type of grease. Drain off any moisture. If excessive moisture is evident, drain and replace the grease. Water mixed with the grease will decrease its lubrication ability and not provide the needed protection.
3. Lubricate all fittings.
4. Check the water drain valve at each span of a center pivot system.
5. Remove and clean the system end cap. This is where sand, scale and other debris collects during the summer. Remove the sand trap, flush the system and replace the trap. Drain all water-carrying lines. Drain the booster pump case.
6. Inflate tires to their recommended pressure.
7. If livestock will be in the field with the pump and pivot, erect fences to keep the livestock away from the equipment.

Tech Tip: Does Your Flow Meter Work?

Flow meters appear to be equipment that many irrigators don't use, don't repair and constantly overlook when managing their irrigation systems. It is common to visit an irrigation pumping plant and find the flow meter not working. Often it has been inoperable for many years. North Dakota winters are hard on flow meters. The freeze/thaw cycles quickly cause the bearings and other moving parts to wear out.

Flow meters and pressure gages provide extremely valuable management information. Having an accurate measure of flow rate is important for proper chemigation, selection and modification of sprinkler nozzles, calculating the application rate of the pivot, checking the production of the well and tracking the performance of the pump.

Before the irrigation season starts, establish a program to fix or replace the flow meters on your wells. If your flow meter is working properly, consider removing the flow meter this fall and storing it in a warm place for the winter. It takes about 15 minutes to remove the flow meter and cover the hole in the pipe with a piece of tin. If you take care of your flow meter it will last a long time and provide accurate information on the performance of your irrigation system.

Tom Scherer (701) 237-7239
Extension Agricultural Engineer
tscherer@ndsuext.nodak.edu

Why Well Development is Important

I often hear irrigators say they don't want to pay for the cost of well development because it doesn't help well performance. If the well isn't developed properly, that might be true. However, if the well is properly developed at the time of construction, it will have less drawdown, save on pumping costs and have less trouble supplying water during high water-use periods.

A well provides access to the aquifer where the water is located. During pumping, if a well is functioning properly, the water from the aquifer will enter the well screen with the lowest amount of restriction possible. Anything that restricts the flow of water into the well can affect energy costs and flow rate by increasing the drawdown.

The drawdown is the difference between the static water level and the pumping water level, Figure 1. From a hydraulic point of view, drawdown is the head (pressure) required for water to flow into the well. The greatest amount of drawdown occurs within a few feet of the well where the velocity is the greatest.

Most irrigation wells are constructed with a rotary drilling rig that uses a high viscosity fluid (often called a "drilling mud") to keep the borehole open during the drilling process. Although necessary, the drilling mud seals the borehole and often penetrates into the surrounding aquifer formation. The rotary drilling process also smears the borehole surface, compacting the natural material around the borehole. The most common drilling mud uses bentonite, a naturally occurring clay mined in Montana and Wyoming. If left in place after construction, the drilling mud will seal part of the aquifer and increase the drawdown.

After the casing and screen are set in the borehole, it is very important to remove the drilling mud left in the aquifer formation, Figure 2. This operation is even more important with gravel-packed wells because the gravel pack is a barrier to removing the drilling mud. There are several methods for developing a well. They are listed in order (least first) of effectiveness and cost.

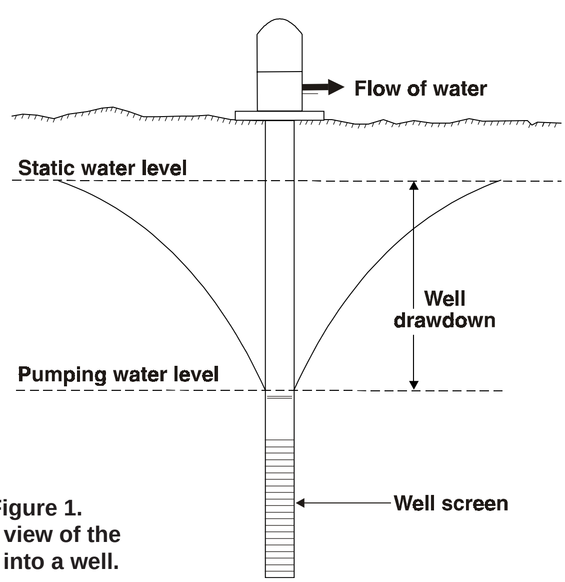

Figure 1. Side view of the flow into a well.

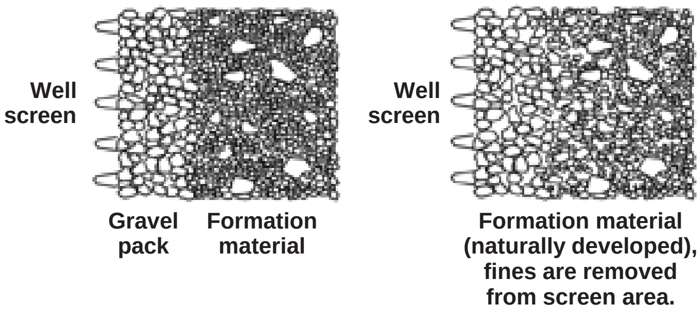

Figure 2. Side view of the materials just outside the well screen for a naturally developed and gravel pack well.

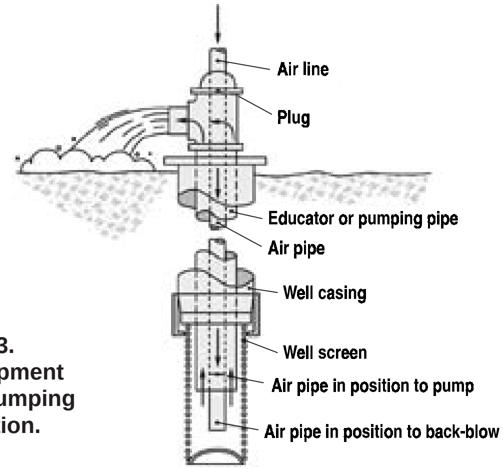

Figure 3. Well development with air lift pumping and agitation.

Air lift pumping and agitation

Air lift pumping forces compressed air through an air line to the bottom of the well, Figure 3. As air bubbles rise, they create a surging effect that carries water and fines out of the well. Air lift pumping is alternated with short periods of no pumping, which forces water out into the formation to help break up sand bridging around the screen. Well development is only effective if the water is deep enough in the well to get the surging action. Air lifting does not work if lift to the surface is too great.

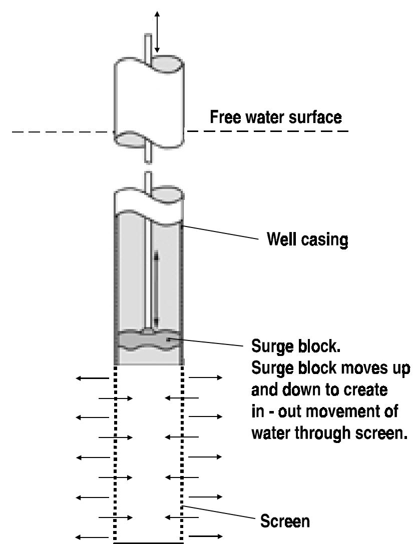

Figure 4. Well development by mechanical surging with a surge block.

Mechanical surging

Surging alternately forces water into and out of the formation through the well screen openings, Figure 4. A piston-like tool moves up and down in the well to create the surging action. The surging of the water through the well screen loosens the mud and fines in the borehole and draws them into the well to be removed by pumping or bailing. Surging is especially well-suited to cable tool drilling. While common for bridge or louvered well screens, surging is not very effective with very deep wells (over 200 feet) or those with multiple screens.

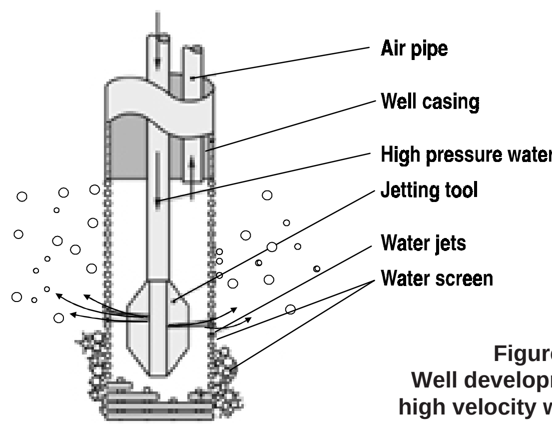

Figure 5. Well development using high velocity water jetting.

Jetting

The best well development method is high-pressure water jetting with simultaneous air lift pumping, Figure 5. High-velocity water jets through the screen and gravel pack into the formation to loosen and break down fine materials. The jetting tool rotates slowly as it is moved up and down inside the well screen. Air lift pumping removes the loosened sand and mud as they enter the well screen. The jet stream can be directed at any part of the formation around the well for selective development. Cage wound screen is best for jetting because its design allows the jet to impinge directly on the gravel pack or borehole. Well screens that use louvered or bridge openings do not respond to this type of development because the opening design interferes with the jet of water. Jetting is often the most costly development method.

Well development research

In the late 1970s, a well development research project was conducted at a research farm in Staples, Minn. The project had 10 wells constructed using different types of screens, drilling fluids and design parameters. After construction, each of the wells was developed first by over pumping. Then they were test pumped for 24 hours. Then each was developed by mechanical surging followed by another 24 hour test pump at the same flow rate as the first test pump. Then each was developed with water jetting and another 24-hour test pump was performed.

The results for the properly constructed wells showed consistent improvement. For example, well 5 was pumped at 183 gallons per minute (gpm) for all three 24-hour pumps tests. The drawdown after over pumping was 12.1 feet, after surging it was 7.2 feet and after jetting it was 6.7 feet. Development cut the drawdown almost in half.

NDSU Extension Service
Agricultural and Biosystems Engineering
P.O. Box 5626
Fargo, ND 58105-5626

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Redevelopment of older wells

As water flows into a well, it carries minerals with it. These minerals can build up on the formation materials near the well screen because that is where the water velocity is the greatest. It may sound counter-intuitive but some minerals will precipitate at the high velocities. Over time, the deposition of minerals can encrust the screen and formation, increasing the resistance to flow of water into the well. By adding a weak acid to the well and agitating the resulting solution, these mineral deposits can be dissolved and removed. By combining water jetting with acid, the well can be redeveloped and often can be brought back to almost-new levels of production. **Caution:** This method should only be used on stainless steel and plastic screen. Some older, iron screens are susceptible to acid and may collapse.

Tom Scherer (701) 231-7239
NDSU Extension Agricultural Engineer
tscherer@ndsuext.nodak.edu

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