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Well Evaluation Report

Background

The purpose of the well evaluation is to get a better understanding of the characteristics of the well. Of prime importance is the yield of the well or its production rate. In addition, the dynamic behavior of the well is also examined as the pumping experiments proceed. The well tag has the original information provided at the time of well drilling and these data serve as a starting point for the well evaluation. The steps of the evaluation are given below.

1. Record all tag data for the well and the pump that is available
2. Hook up water meter to hose at well head and position Sonic Detector for well level measurements.
3. Measure static level of well – record this value
4. Start stopwatch at same time hose spigot is turned on
5. Record water meter data and well level measurement at one minute intervals
6. Draw the well down a significant amount based on observations and well parameters
7. Shut off all flow
8. Record well level as it refills – this is the static refill rate or static yield
9. Plot data and evaluate results.

Set-up and Methods

The data was collected from the well on 11/23/16. There was no tag at the well head so the parameters of the well determine during drilling and initial pump placement are unknown. However, static level and pump depth were determined directly in this evaluation

The equipment was set-up by inserting the Sonic Detector into the vent port of the well cap. The Sonic Detector measures the water level in the well bore using the reflection of sound waves off the surface of the water. There was a spigot at the well head to which a short hose was run to a water meter. During the water running portion of the test, the water meter and the sonic detector were read every minute.

Results

The raw data are shown in the attached table (Excel Spreadsheet - Data). Data was collected every minute. The static level of the water was measured at 37 feet at the start of the experiment. The hose



was started and the flow at the hose was about 9.1 gallons per minute (GPM) on average. As the running of the water proceeded and the level in the well dropped, the flow at the hose dropped off slightly, as expected.

After 16 minutes of running the water, the water flow ceased suddenly. This indicates that the well level had dropped to the point of the pump intake. At this point there is no water to pump and the measurement indicates that the pump is placed at about 95 feet into the well bore. The level of the well had dropped to about 95.3 feet at this point, meaning we removed 58.3 feet of water. Once the water was off, the refill data was collected every minute for about 64 minutes. The total test ran for 80 minutes.

The data were then used to calculate two parameters, dynamic well yield and static well yield. For the dynamic yield we assume that the well is a 6" diameter bore into the ground – we do not know the depth of the bore. Ignoring the volume of the central pipe itself, this means that each foot of water in the well bore equates to about 1.48 gallons of water. When the pump is activated by opening the hose spigot, water was pumped from the well at a rate of about 9.1 GPM. At this flow rate the level of the well should drop about 6.15 feet every minute if no new water is being added to the well from the aquifer during the test. The data indicate that this is clearly NOT the case here. In fact, the water level in the well dropped around 4-5 feet at the start and tapered off to around 2 feet towards the end of the water running phase of the test. This means the well was “recharging” during the running of the water. This recharge during water running is called the dynamic yield. This is determined by taking the total volume of water removed from the well by pumping (147.4 gallons) and subtracting the water loss reflected by the change in well level (85.6 gallons), then dividing by the elapsed time. This is summarized in the table below (Table 1).

Table 1. Dynamic well yield calculation

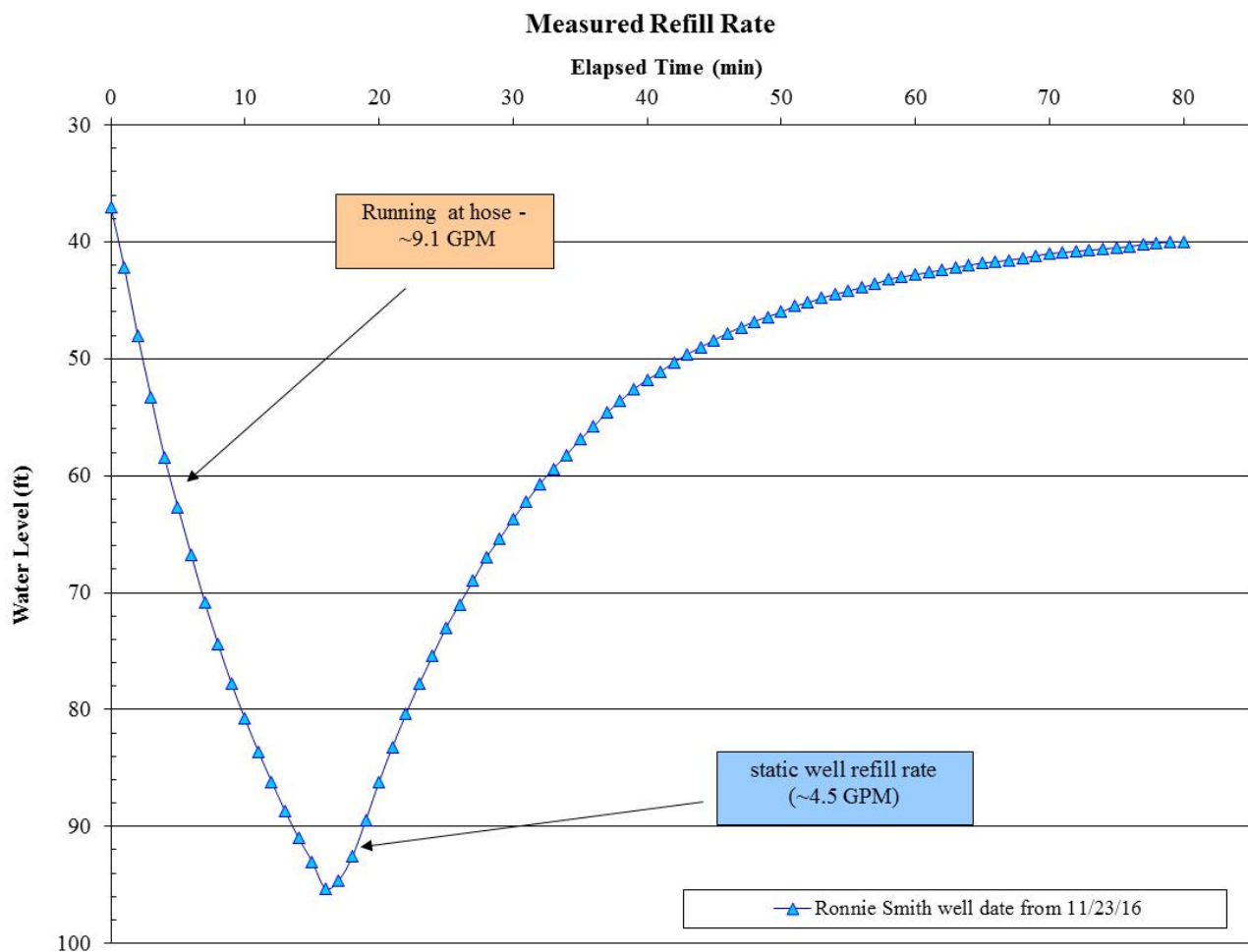
Dynamic Yield Calculation		
Total Gallons from hose	147.4	gals
Total Gallons lost by Δh	85.63	gals
Total gallons recovered by well during pumping	61.77	gals
Hose running time (min)	16	min
Dynamic Yield (Average)	3.86	GPM

From these data it is clear that while water was running out of the hose at 9.1 GPM, the well was being replenished by the surrounding aquifer at a decent rate. This rate is variable depending on how far down the water level has dropped.



Once the water stopped, the static refill rate was measured with no water running. After 66 minutes of static refilling, the well level had raised all the way back to 40.0 feet, 3 feet from the starting level. At the start of the refill, over the first few readings, the refill rate was about 4.5 GPM, which is slightly higher than the average dynamic yield. As the well continued to fill, the fill rate tapers off, as expected as the well fills up. This refill behavior follows a smooth curve that tapers off to a very slow fill rate as the well approaches static level.

Below is a graph of the data (Excel Spreadsheet Graph). On the vertical axis the well level is plotted versus the time on the horizontal axis. It is clear to see the drop in well level while running the water, including the two well pump cycles, and then the return or refill after flow stops from the spigot. The water was run until the well level reached about 95.3 feet and then refill started. You can see from the data that the well was filling up after the water was shut off.



Discussion



Based on the data collected from this well, including tag data, level data, and refill data, the following conclusions may be drawn.

1. The static level of this well is about 37 feet based on measurement. There was no tag value to compare this to. This well might fill up to higher levels if left to sit for a long period of time.
2. The measured production rate varies depending on how full the well is. Judging from the initial refill rate, the yield is about 4 to 4.5 GPM. The experiment shows that if water is used too aggressively, that the well can be run dry, as we did in this test. However, the recovery is relatively fast and under most normal water use conditions, this well should provide an adequate supply of water.
3. If additional storage and repressurization is installed for the house, this will also give a large buffer for water demand in the home and put less stress on the well. Any static storage tank system will have a float system to either shut off the production of a whole-house RO system, or a fill solenoid, depending on what setup is deployed.