**Background information on Wells from Miller Well:**

A well is hole that extends to depth of where pump is set – generally right off bottom of well (allow for things like sediment to pass past where pump is set). Our well has a 6 inch casing which opens where it intersects bedrock (maybe 4-5 feet into bedrock) and then seals off casing into larger diameter hole drilled into bedrock with cement and gravel. Then, go back into the casing with a smaller bit and drill into bedrock to look for cracks and fissures in the rock. We want to get 5-10 feet below casing before we start picking up cracks to ensure vertical cracks are not going back to surface water. We don’t want to use the water that is on top of the bedrock, because it is subject to seasonal rainfall which may contain dirt and bacteria. Surface is water that is typically treated and used as ‘city water’ supply. So, we look for natural water in the granite through cracks, fissures and water bearing zones. Once we have water, ideally, 1 gal/min per recovery is recommended for every individual home connected to the system. For 50 homes, we would ideally want a well that supports 50 gal/min recovery.

Once you find the amount of water you need, you would stop drilling and water will come into the well. If water comes over the casing, people may call this an artesian well because it is flowing over top of the casing all of the time. However, the meaning of artesian just means that an artery of water is pressurized. If you have a 400 foot well full of water with a 6 inch diameter hole would have 1 ½ gallons of storage for every foot. So, if 400 feet of water, that is 600 gallons of storage. We run pump tests on the well to see if we can get the well to level off close to the pump intake and choke it down to where it is only pumping a certain gallons a minute and not pump the well dry (pumping rate).

Our situation: We have 10/12 gallon-minute output potential with a 3 gallon/minute well. So, if we tried to choke it down below 3 gallons/minute, we would be putting so much back pressure on the pipe that we would not be able to get it to level off before we blow something in two (trip to relay on the control the box, etc.). So, we use the totalized meter to complete pump test – we pump the well dry, wait 30 minutes, allow it to recover, and then pump it dry again. We check the reading on the meter to see how much was pumped out after 30 minutes. Then, when we pump it dry again, we let is sit for another 30 minutes and then we run the water until it pumps dry again and take that meter reading (do this 3-4 times) until it levels off into an average that over a 30 minute period, this is how much water is coming back into the well above the pump. The pump is located in the bottom of the well and the recovery rate is highest in the bottom of the well because as it approaches the static level, the recovery rate slows down (gravity and atmospheric pressure become equal with the hydraulic pressure forcing the water into the hole creating a static level. Our case: 200 ft static water level (normally) and a 600 ft pump set, then you would have 400 gallons above the pump – that is if it sat for a month. But, our recovery has been measured between 2-4 ½ gallons/min. Our well is set up for a recovery time of 3 gal/min in a 24 hour period. This gives us a small amount of buffer for seasonal fluctuation in recovery rate for the pump so that we do not burn the pump up and need to replace it.

As part of our managed well care agreement, complete a draw-down test once a year. Do not complete entire test and pump until dry, but pump for a period of time and compare pumping rate with the meter reading and look at draw down to determine recovery. The draw down in a 6 inch well is 1 ½ gallon per ft. Example: Meter and pumping rate = 100 gallons in 10 minutes. Draw down only 10 feet, so only 15 gallons of storage pumped out (difference of 85 gallons). Divide difference (85) by the 10 minutes spent pumping and get 8 ½ gallons estimated recovery. This does not take into account if there is a ‘cave’ of water as this is not something that they are testing for. They have completed this test several times to determine how our system should be set up to operate effectively (maximum efficient use).

Monitor usage by checking meter as part of water use reports. On average, usage over last 3 months is 100,000 gallons per month (average 3,300 gallons a day). Well runs 12x a day pumping 300 gallons each time it pumps (3,600 gallons a day) this leaves only 300 gallons for a cushion. According to the public water supply system, supposed to have a designed a storage (our tank) to be 300 gallons per house (for 25 houses, 7,500 gallons). OK, if our tank is full. But also supposed to have a back-up water supply (at least 2 wells) in case of emergency (fire). If only one well, there could be months of downtime which could pose a risk in case of emergency. Inspectors may have signed off on this with the intent to have a second well when schematics were submitted to Department of National Resources. State has inspected our well twice and have never made mention of this.

We have the ability to pump 10 gallons/minute for 30 minutes – you could possibly push this to 45 minutes, but we would not want to do this too often as not to burn up the equipment. We need cushion on storage and the ability to put water to the tank (recovery) not the output of the well (or pump). The meter tells you what the pump pushed through it. It doesn’t tell you what is coming back into the well so we may have never had more than 3 gallons/minute in the well.

**Questions for Miller Well:**

Q: What we just tested and found leak (110 now if you add it up). How much was our leak?

A: Jonathan: We measure your usage every month, and average is 100,000 gallons a month. If leak had been going on for a while, we would have been out of water months ago. Dave: When Miller was here on Monday (7/3) the production of the well is too low (2-4 gallons) and no indication of any leak. When holiday was approaching, tank was nowhere near full.

Q: Checked three different sites on longevity of wells, and time span of 20-30 years for a well. If that is the case, our well is 30 years old.

A: We have been doing business for over 40 years. In the last 10 years, we have seen wells with the original pump in them still over 40 years old. Don’t know if the well itself is going to give out – as long as nothing happens to the rock itself should be OK. A pump system would last 10-12 years, but the well should last longer.

Q: Do you have the usage statistics that we used last year and the year before?

A: Last year to this year (April, May, June) were the same and averaging 100,000 gallons/month.

Q: In your opinion, since we are using roughly the same amount of water as last year and did not have leaks at this time last year, are we at that danger zone – we should have been alright but had a leak and any leak causes us to go south. The introduction of storage tanks forces us to go a little bit further south because when we fill back up, they have been using it

A: If you had more storage space, it would take some pressure off the system, but if everything is empty in all of the storage tanks, then refilling both would take longer.

Q: So, your recommendation is a second well

A: Always. If you want more capacity, you have to have more recovery.

Q: Sounds like it takes 6-8 months (DNR to approve and find money from homeowners). What do we do in the meantime?

A: Money available through programs that will give you a 1% loan for 10 years. In the meantime – with everything open, we have 1 ½ gallons of water going somewhere (small, but half of your water).

Q: If two wells, can both feed the same tank legally?

A: Yes, on a public water supply system you can connect a second well into the same system

Q: Do we need another pump when we put in another well?

A: Yes

Commentary – had initially imagined a well as drilling down into a body of water, which is the ‘cave’ mentioned above. When in reality, ours is just a big tube with water coming at it from every direction (through cracks) and filling up the tube. Yes – thinking of an aquafir as is common in places like Florida where there are bodies of water that can be tapped into and multiple wells can be connected to this same body of water and needs to be treated. However, our water will never be shared with others.

Q: If there is leak and you have two wells pumping into the same tank, will you have the same issue? Will the well(s) go dry?

A: Yes. If you use anything in a deficit, you will run out

Q: Clarification - The problem this weekend had nothing to do with a dry well, but was contributed to electrical issues (burnt wires) and two leaks.

A: Yes. The new well would not have eliminated this issue, but would have filled up the tanks faster and reduced the amount of time we were out of water.

Q: How much does it cost to drill the well?

A: Cost for DNR well – approximately 500-600 ft well and pump 10 gal/min to the tank - $33k (equipment, parts, labor, and state required sampling) $45/foot. Need $2,500 deposit (to start on permitting/looking at property lines). Government grant money to help finance well.

Q: What is the increased cost of the service agreement with the additional well?

A: Maintenance for water system monthly service would stay the same (paid quarterly)

Q: Usage has been flat. We are barely covering what we are using, we have a little bit of cushion at the well, and the answer is the short term system is: hope there are no leaks. The long term solution is that we need a new well.

A: Yes.

Q: If we put ponds along the way, will the water filter down into the system?

A: No. You can’t have a body of standing water within 100 feet of the well as it could contaminate the well (drain fields, propane tank, etc.)

Q: I heard you say you are only monitoring by checking the meter which is what the pump is pumping up to our holding tank. So that is only half of the equation since the pump has to have water from our well. Is the pump only pumping the 3,600 gallons a day because that is all the pump can do, or because there is not enough water?

A: That is all the well can do [Because there is not enough water]. We originally did pump tests on the well – maybe 2 years ago – but the water does not change. You will not find that there is more water now than there was then.

Q: If the well doesn’t change (amount of water available) then why was it classified that it could support so many houses if it can’t.

A: There probably wasn’t but 3 houses in here when it was installed. And, whoever installed the well might have been doing just enough to get water to the houses.

Q: We have been told over the years that our well will support 30 homes – specifically Miller Well told us that when it was set up and from the state engineer (30 years ago). We are at 25 homes right now and struggling.

A: Disagree – have seen that every job we have stated that for multiple homes, we want 1 gallon/min period – no deviations.

Q: Then, we were set up all along to only support 3-4 houses, why are we regulated as a small community by the county?

A: Not just coming up – has been a long standing issue and always understood that our well would not support all of the lots.

Q: If the test (how much water the well produces) was completed 2 years ago, would we complete another test before we put in another well? I did hear you say that the water doesn’t change, but just not sure why we wouldn’t check this again?

A: We check it all the time. It was tested on Monday (pump until all the way down and pump stops – 4,800 gallons). Recovery of the well (what it is capable of putting into set amount of time) is a maximum of 4,800 gallons in a 24-hour period – it doesn’t matter the pump that you put in there as that is all the water you will have available.

Q: We have only 4 full-time resident houses and a few that some frequently. We don’t normally have everyone here all at once. Want to clarify that our issue has nothing to do with usage, but a problem (this weekend) so we have some time to implement.

A: Will take 6-8 months to implement, so we need to get information and put this in motion now.

Q: Problem is not going to go away even with a new well if we continue to have leaks and leave faucets running, etc.

A: No, but your recovery time will be faster and if there is a large leak, you may notice this on the electric meter.

Q: How much does it cost per valve to install for shut-off? Need to determine how to budget for this, as it would save money in the long run in isolating leaks. And, can the cost of the valves be included in the loan you were talking about?

A: Not super expensive – Cookie can look up the price on this. Not sure if it can be included in the loan.

Q: Can you send us a proposal with timeframe (making decision, timeline of how the process will progress and put in well).

A: A lot of work involved in it, so it will take some time.

Q: What is the difference of taking our well we have now and drilling deeper versus drilling a new well 50 yards away?

A: You would spent $1,300 – $10,000 for a hydrogeologist to come out and tell you how deep you need to go to find enough water (in addition to drilling a well). But, for $1,200 we could already start to drill a well. Yes, we could dig deeper and you could find water or not, but you lose the redundancy, and chances of finding water deeper gets harder as the rock is getting denser.

**Additional confirmations with Miller Well:**

Parts for recent well incidents – Two parts on order. Contactor that is bad and will be sending someone back up tomorrow with a new contactor to put back the wiring. Took jumper out and tested it and it does work with the contactor pushed in but the coil must be bad because of the electrical system issue so he put the jumper wire back in because the switch wouldn’t work. Once we put that back in, the float might work which is what we hoped because we thought that maybe the float switch also went bad with this electrical issue. If the float switch ever got hit by lightning, then homeowners insurance should cover this.

Meter on the holding tank – everyone’s line should be after the meter on the holding tank so that you can look for leaks and monitor usage. We do have one house that is connected directly to the holding tank. We may be able to move the meter to the base of the tank to ensure that all lines are after the meter. Will look into this further and discuss with homeowner.

Air release & vacuum release – When you turn the water back on, there is air in the lines because it traps air and pushes it into the lines and the air comes out into the houses. So at the high point, you can install a duel action air release vacuum relief valve. If you had a major water main leak with a lot of water running down the line from a house higher in elevation from the leak, it creates a vacuum above the houses because all of the valves are shut and no one is using water and will soda can your water heater. Valve is $800 – with installation $1,600. Will allow air into pipes. When water is cut back on, it will push air out and trap water below that. In addition, each house should have a pressure regulator / pressure reducing valve set to 60 psi at every home.