

How to Replace a Submerged Well Pump

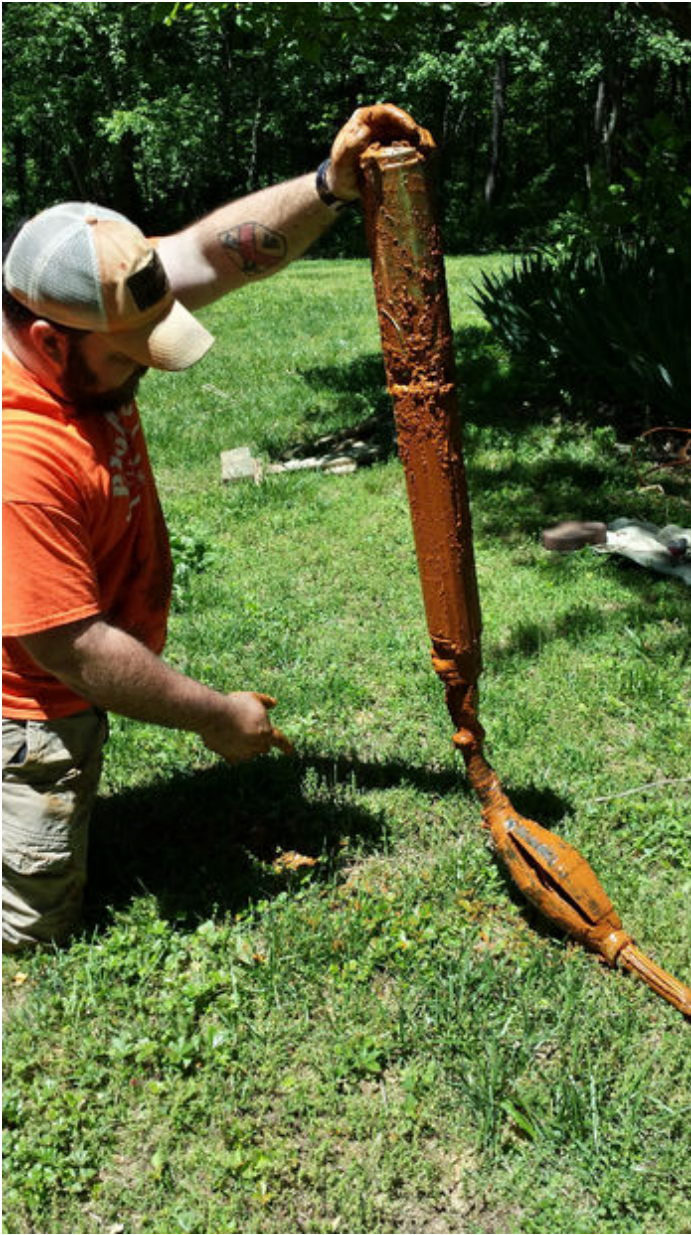
by [jamesburkefan](#) on June 4, 2015

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Intro: How to Replace a Submerged Well Pump

Ok! This is not an easy task, and I recommend that anyone thinking about doing it AT LEAST consider having the well pump identified as the failed component by a professional prior to undertaking it. In my case, the water in my house stopped working (on a Friday night, of course). I know my system pretty well, and was able to determine that the fault in my system COULD NOT BE ANYTHING BUT my well pump motor being fried, before I took any action. Guess what? I called the plumber anyway. If nothing else, you'll pay \$60 to have your diagnosis confirmed and maybe even get an estimate that will provide you with the motivation to do the job on your own. (My estimate to pull and replace the well was \$2400... By following these steps I was able to do the job myself for less than \$400!)



Step 1: Start with understanding what your well looks like, and how it works.

So this is what we start with. The drawing is not to scale, but essentially most wells look a bit like this. There are several different variations on what ends up being pretty much the same thing. In my case, the casing (which is the steel pipe that everything fits into and goes into the ground) has a 6" diameter. Some casings can be as narrow as 4". If you're doing something like this on your own, wider is better!

The well used in this example is relatively shallow. It only runs about 100'-120' deep. Some wells can run to depths of hundreds or thousands of feet. (In the case of anything deeper than about 200', I would recommend that you have it pulled by a pro.) This well was dug about 25 years ago. One of the things that happens with wells is that silt from the aquifer can seep into the base of the well and build up, over time. That's a bad thing, because as the well fills up from the bottom with silt, the well pump never changes its depth. Result: The silt builds up to a depth that's too close to the pump, and the pump ends up sucking up the silt. (You'll see the result of this kind of thing in the following pictures.)

You basically have three "lines" running down into the well. There's (1) the water tube, (2) the electrical wiring that drives the well pump motor, and (3) the safety rope, which is tied directly to the well pump and keeps it from falling down into "the abyss" if anything goes wrong. The weight of the whole pump assembly hangs on the water hose that the pump uses to push water into the house. Up near the top the water tube hits what's called a "pitless connector," where it makes a hard right turn toward the house.

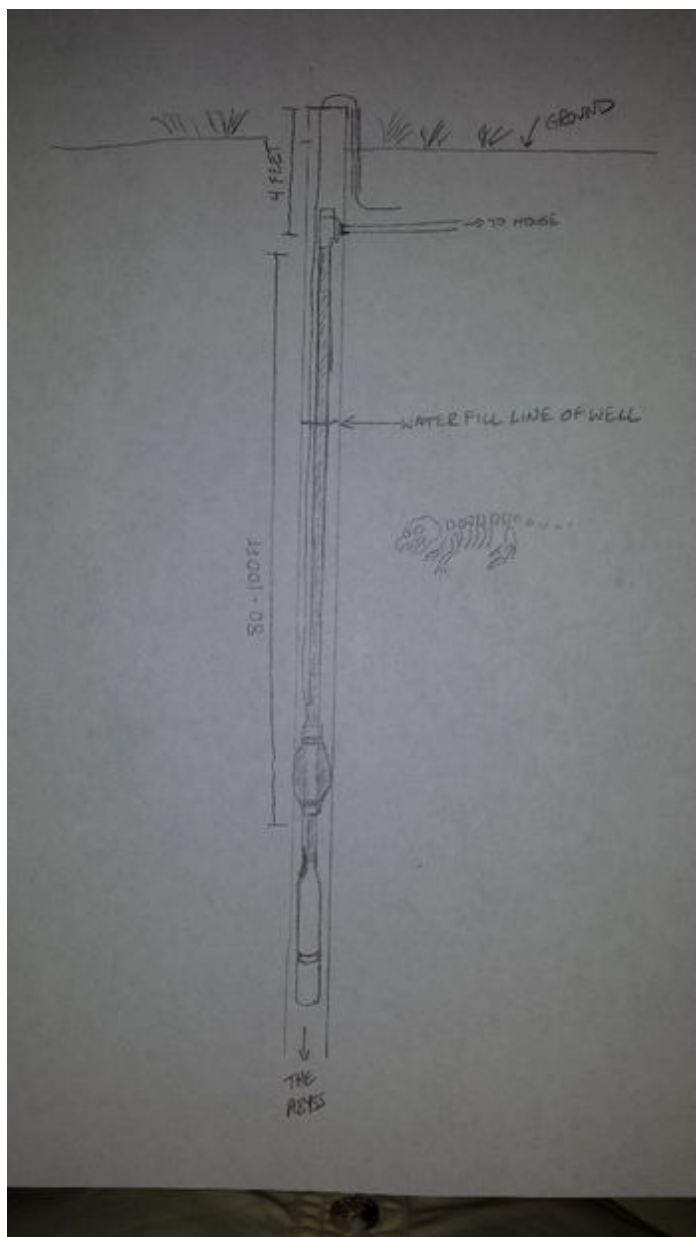
Here's how it works:

For most well systems, it's recommended that you have a pressure tank that maintains a consistent water pressure for all the plumbing in your house. When you turn on the sink to wash your hands, or flush your toilet, the amount of pressure in the tank drops. At a certain point (say you've been washing your hands for several minutes),

<http://www.instructables.com/id/How-to-Replace-a-Submerged-Well-Pump/>

the well pump switch says "I need more water up here" and kicks itself on. When it does, it applies electricity to the motor in the well pump that's sitting at the bottom of the well. The motor turns an impeller (which is kind of like a jet engine), which sucks water out of the well and pushes it up the water tube into your house. It keeps pushing that water until the well pump switch says "Ok, that's enough. We're back at nominal pressure now." The switch automatically kicks itself to the "off" position and waits for the next time the pressure gets too low.

Note how the pump looks a bit like a bottle made of two pieces? The bottom part is the motor. The top part is the impeller that sucks the water out of the well and sends it to the house.

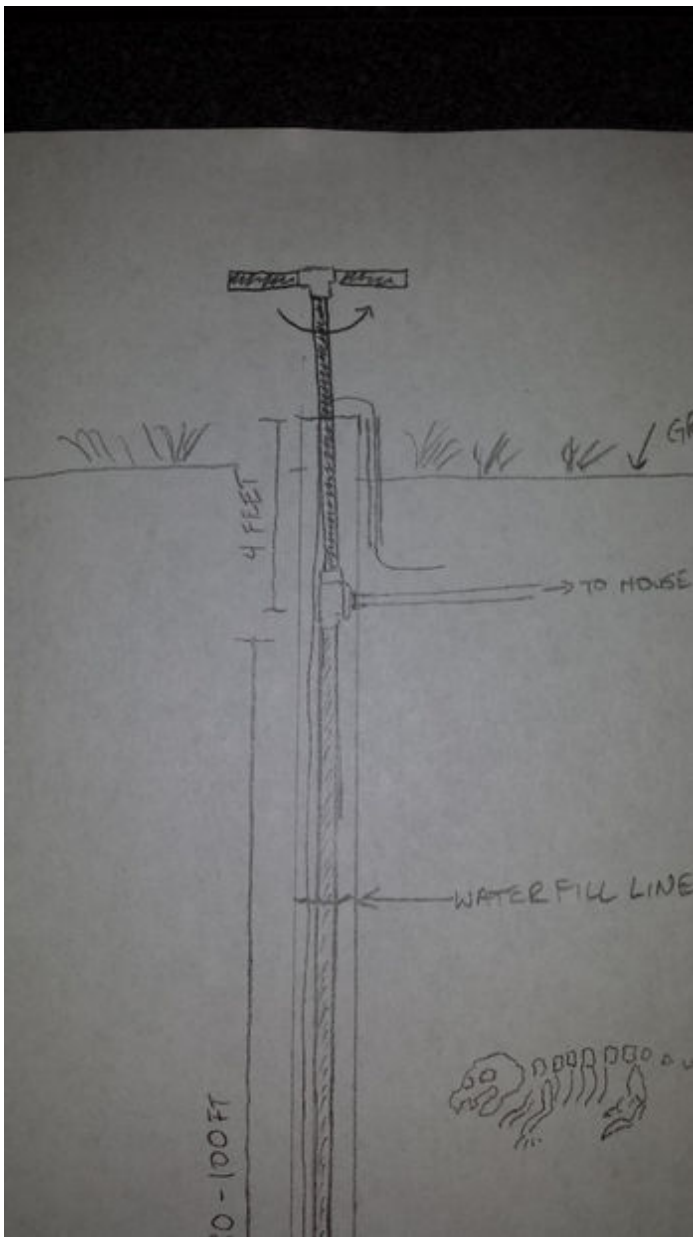


Step 2: Pulling the well pump up out of the well

In order to pull all of this stuff out of the well, you need a special tool called a "pitless adapter wrench." It's basically made of three pieces of threaded, metal pipe that you can get from any hardware store. A "T" connector holds them together.

Standard pitless connectors use a 1" threaded pipe. Mine... of course... was non-standard. It uses 3/4" threaded pipe. To make one of these wrenches you just go down to the local hardware store, buy the threaded pipes and put them together. The long one (that goes down into the hole) needs to be at least 5' long if you want it to reach.

Once you've made your wrench, you just stick it down into the well, thread it into the connector and get ready to PULL. While you do that, make sure someone is holding onto the safety rope. If anything goes wrong, and your partner is NOT holding the rope, the well pump will fall into the abyss... lost forever. *que ominous music*



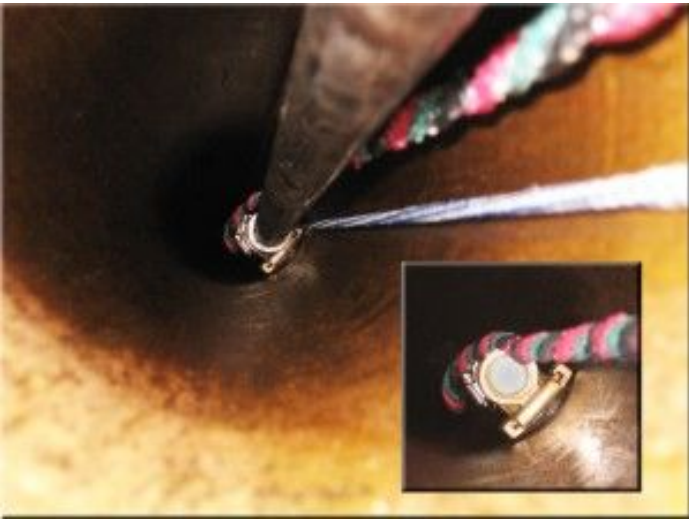
Step 3: Take the cap off the well and look inside with a flashlight.

BEFORE YOU DO ANYTHING WITH THE WELL CAP MAKE SURE YOU KILL THE POWER AT THE WELL PUMP CIRCUIT BREAKER. It should be labeled clearly. Most of them are wired for 220V.

Well caps are usually secured by three or four bolts. Loosen the bolts to the point where they *almost* come off the cap. You want to leave them threaded a bit, so you don't lose them. Then give the well cap a few "uppercut" swings with a medium-sized hammer. It should pop off without much trouble.

Once the cap is off, take a look down the well with a flashlight. You should see something that looks a little like this image (which I "borrowed" from a google search, because I forgot to take my own picture). You'll see utter and complete darkness at the bottom of the well... maybe some water, if it's shallow... and the pitless connector on the inside of the casing. You'll also see your safety rope, and the electrical wires that push power to the motor running down into the abyss.

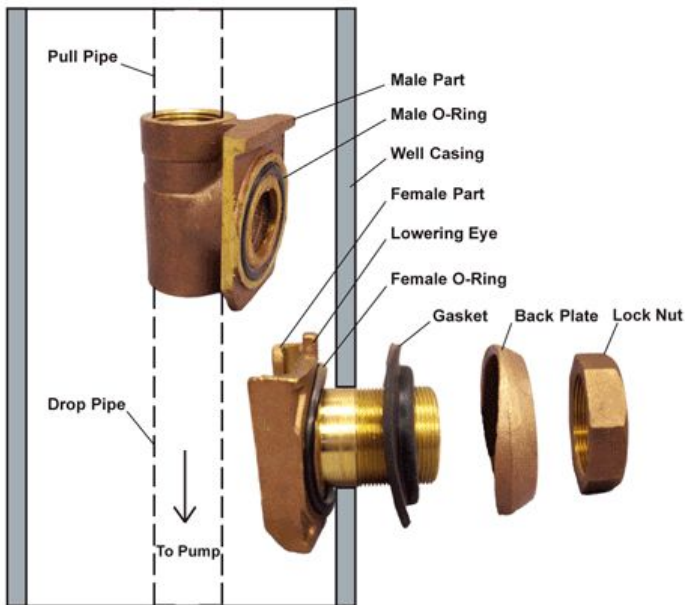
The idea is to take the pitless connector wrench, the one that you just made out of threaded pipe, and marry it up with the threaded cap at the top of the connector (the part that looks like a circle).



Step 4: Here's a closeup of what the pitless connector looks like

As you can see, the pitless connector is where the water makes "a hard right turn" out of the well and toward your house. It's a pressure fitting, and it's usually made of brass. On most wells they're about 4' down from the top of the well... which means they are usually BURIED... which is scary.

If anything happens to this connector, (like a crack or a split in the brass) you're usually going to have to replace the whole thing. I'm not sure when the last time you had to dig a 4' deep hole was, but I can assure you it's not a pleasant thing to have to do. So, it goes without saying, as you go through this process be very careful not to damage the pitless connector.



Step 5: This should give you an idea of how much digging you'll be doing if you damage the pitless connector.

*Image "borrowed" from the internet.



Step 6: Here's what it looks like to try to line the threads up on the pitless connector.

The environment inside of a well is inherently moist. This means that corrosion WILL occur, regardless of what kind of metal you're dealing with. That corrosion means the pitless connector can/will fill up with gunk that will prevent you from being able to thread the wrench into the adapter easily. The trick is to turn the wrench *extremely slowly.* You'll feel it bite. If, after it bites, it skips off the threads: You have corrosion.

I spent more than an hour *almost* getting it right. The corrosion and gunk just wouldn't let me get a good connection. That's when I decided to (go to next picture)...



Step 7: Tap Tap Tappy

... HIT IT WITH A HAMMER!!!

Seriously. Very gentle taps with a hammer as you turn the wrench should do the trick. It will allow for you to thread the pipe fully. It worked beautifully for me.

As you're doing this, it's absolutely vital to make sure that you do not:

A) Cross Thread the connector. Work slowly and get it right!

B) Try to pull it up without being 100% confident that it's got a good connection. Nice and snug! If you don't have a snug connection, you take the chance of dropping everything down to the bottom of the well. If that happens, get yourself a shovel and a checkbook.



Step 8: Up she goes!

Once we had the wrench threaded all the way it was time to start pulling. We had to give it a couple of upward whacks with the hammer, but it came loose. The first picture shows what the pitless connector looks like with the wrench threaded into it.

Start pulling up the assembly, making sure someone holds on to the safety rope.



Step 9: Keep pulling...

It's very important that you NOT get any kinks in the water line (the black tube). So, pulling the pump is definitely a two person job. As one person pulls it up out of the well, the other person walks it (in a straight line or in a curve) away from the well.

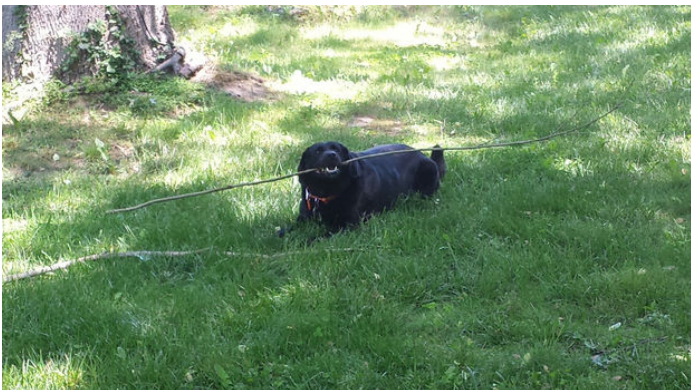


Step 10: Take time to reflect on your life choices...

Dogs are really helpful to have around when doing a job like this. Moral support is important. Especially when, after a couple of minutes pulling up the well pump, you realize that you've been making some very poor life decisions about exercise and eating habits.

Alas... I used to be a strapping young man. *weeze*

Keep in mind, the well pump (itself) usually weighs about 50 lbs. The water trapped in the tube also holds significant weight. The deeper the well, the more weight you're dealing with. Plus, there's that whole "physics and leverage" thing to deal with. Bottom line: I'm guessing that I had to pull a 70lb weight, nearly 100 vertical feet. It's quite a job. Forearms, back, hips, biceps... all of them hurt the next day.





Step 11: Eventually, it will all come up.
Make sure everything is laid out as straight as possible.

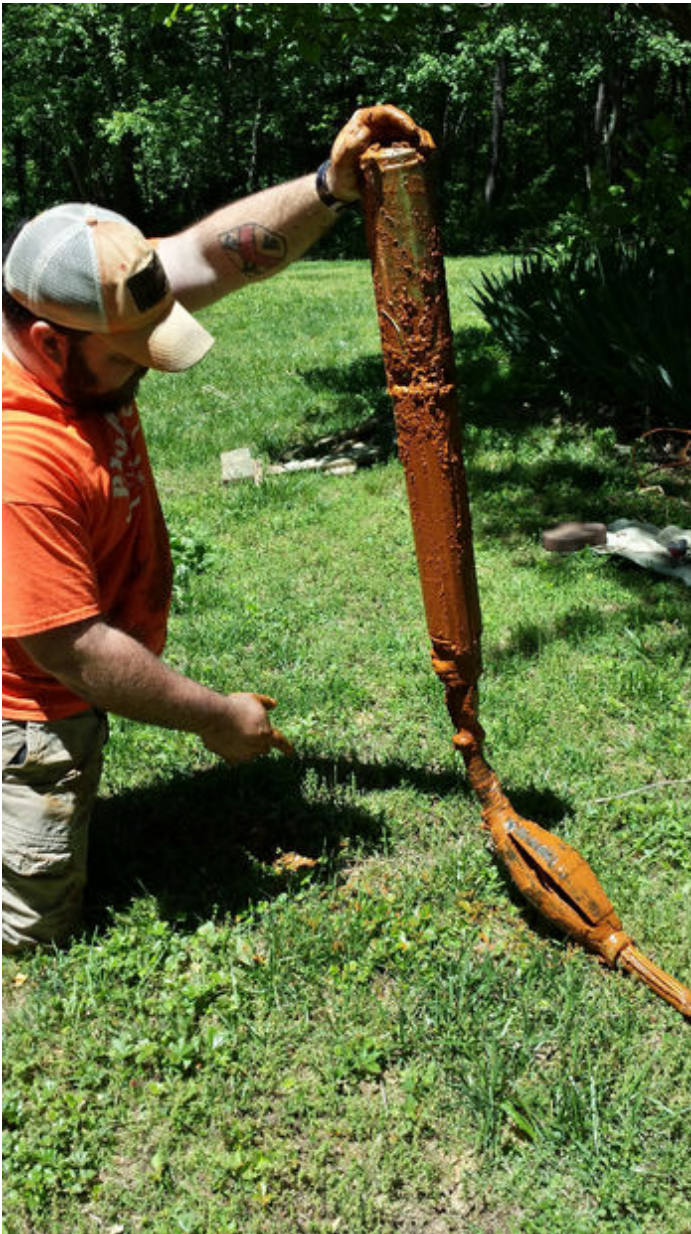




Step 12: It's out!

Do you remember me mentioning something about it sitting down in the mud? Yeah. I knew it was bad. I did not know it was THIS bad.

Furthermore, up until this point, I had no idea what kind of well pump was down there. They come in various configurations of power, voltage, number of wires, and number of gallons per minute. Normally, the Horsepower Rating is written (as a courtesy) on the underside of the well cap. No such luck here. I had to pull it up just to find out what it was. You may be in the same boat when it's time to do yours.



Step 13: Clean it off and figure out what you have.

Turns out that mine was a 3/4 HP Jacuzzi. They sold out to a company called Franklin Electric years ago. Since it was just the motor that fried, it might have been possible just to order a replacement motor (which would generate significant savings), but that might have taken days or weeks to find. Plus, this pump was so clogged with gunk that it wasn't worth taking the chance on another failure. A whole new pump was definitely required.

Note: This is one of those moments where it's good to get along with your neighbors. Thanks to mine, we were able to hose off the motor to find out exactly what the specs were. (The source of my water was sitting on the ground, hence I had no water with which to hose off the pump!) The worn out pump ran on about 8 amps, and pushed about 6.8 gallons per minute. It's a 220V, two-wire motor. That's exactly the sort of thing you need to know when you're buying a replacement. Make notes or take pictures of this information and take it with you to the store.







Step 14: Anatomy of the well pump

Let's take a look at the cleaned-off pump. You'll note the two pieces, (like in my drawing). The far left is the electric motor. The dirty cylinder in the middle-left is the impeller. The black stuff in the middle is a WHOLE LOT of electrical tape, covering the spliced electrical connections for the motor and the check valve that keeps water from flowing back into the well. The thing that looks like a bulb (toward the right) is called a "torque arrestor." Remember how I told you that my well casing is 6" wide? Well... the well pump is only 4" wide. The Torque Arrestor rubs up against the well casing and keeps the pump from spinning at the bottom of the well.

Did you notice the piece of safety rope tied directly to the pump?

Also, did you notice that everything is resting on a couple of saw horses? Yet another application in which such a simple tool can be incredibly useful. If you don't have a set I highly recommend picking a couple up for the purpose of doing this job. The ones I'm using are quite inexpensive, lightweight and strong.



Image Notes

1. Motor
2. Impeller
3. Torque Arrestor

Step 15: Start taking the failed pump apart!

In most cases there are going to be salvageable components. For mine, the torque arrestor was in pretty good shape, as were the hose clamps that held them onto the water line. Once you get them all off, set them in a safe place for later.

Then get to work on removing all of that tape!



Image Notes

1. Torque Arrestor







Step 16: Exposing the wires and the safety rope

Once all the tape was removed, we could see the electrical wiring and the safety rope (see it piled up in the corner of the first picture). Salvage the remaining hose clamps and get ready to cut the water tube.

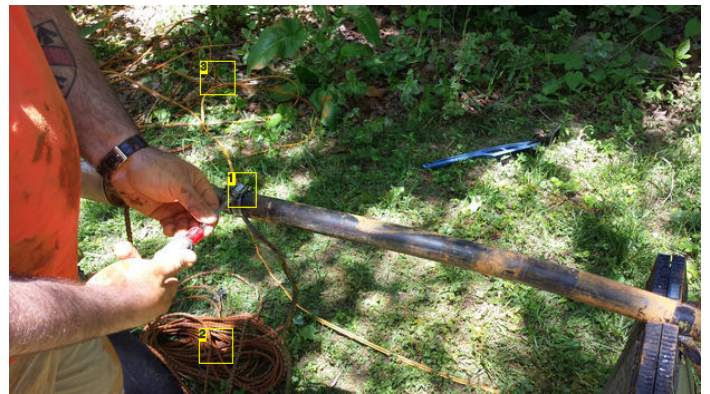


Image Notes

1. Salvage your hose clamps.
2. Safety rope
3. Electrical wiring



Step 17: Cutting the water tube

Since I knew that the well pump had been sitting in muck for who knows how long, it seemed like a good idea to shorten the length of the water tube. As you can see, I walked off about 10' of tube length from the well pump and prepared to make my cut. (By the way, I used a set of ratcheting pipe cutters. If you don't have a set of these, they go for about \$11 at home depot and they make life SO much easier when you're doing plumbing.) This would result in a shallower suspension and (hopefully) preserve the life of the new pump. I was not prepared for what I would find.

YUCK! That's a 1" tube so full of compacted muck that it really restricted the flow of water to my house. NO WONDER THE PUMP FAILED! Keep in mind, we've done testing for bacteria and a slew of other things on our well and it's always come up clean... but still. Ew!

There was no way to clean this out, so a new water line went on the shopping list for the hardware store.



Image Notes
1. Yuck.



Step 18: Cut the wires

Cut the wires and get ready to head to the store.



Step 19: OH! One more thing! Inspect the pitless connector.

Before we head to the store to buy the replacement pump, we needed to make sure that the shopping list included EVERYTHING. We already knew we needed the well pump and the water line, but what kind of shape was the pitless adapter in? I know it looks rough, but it's actually not that bad. I gave it a quick scrub under the garden hose, and inspected the O-Ring. It's not great, but it's fine.

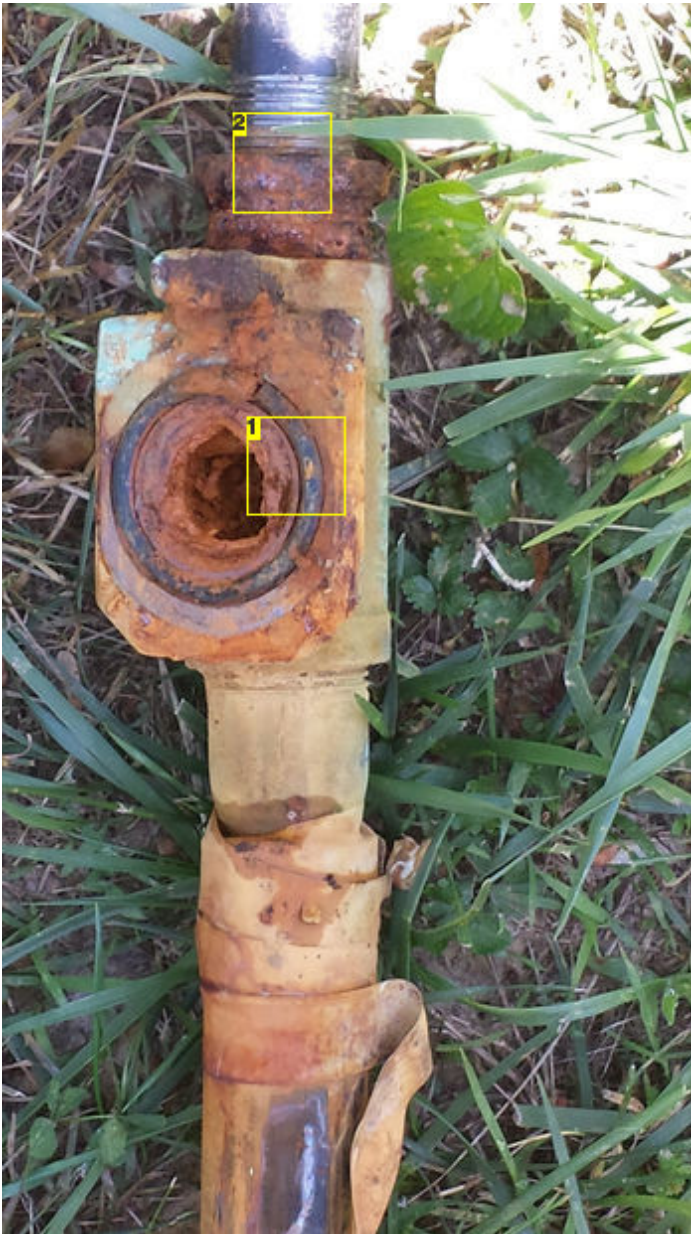


Image Notes

1. O Ring. Check this!
2. Close of up pitless adapter wrench threaded onto pitless connector

Step 20: Selecting a replacement pump at the hardware store

I genuinely recommend that you do a little searching around on the web for a replacement pump before jumping in your car and assuming that Home Depot or Lowes will have the one you need, in stock. I got extremely lucky. I didn't search before I got in the car. The nearest store happened to have the pump I needed. I later learned it was the only one in stock within 30 miles of me! As luck would have it, it also turns out that this one produces TEN gallons per minute at a lower rated amperage than the original. (Hooray for improvements in technology!)

This Flotec pump had a sticker price of under \$340. Since it was Memorial day, they gave me the 10% Veteran's discount at Home Depot, (shameless plug for businesses that respect military service). In the end, it wound up costing me a little over \$300. GOOD DEAL!

Note: This model did not come with the check valve, or the reducer needed to get down to the 1" spur I would need for the water line. Sadly, home depot didn't carry the right check valve, or spur, for this pump. I had to go somewhere else for that.... a place that did NOT offer the Veteran's discount and hence shall not be named in this instructable.



Step 21: Get the stuff home and start putting it together.

I got everything home and started throwing it together. Note that I DID NOT use pipe dope. I used Teflon tape. Pipe dope isn't always safe for potable water, so it's recommended that you just stick with Teflon.

Looking at the close-up picture of the assembly, there's a 1 1/4" stainless nipple threaded into the top of the well pump, a 1 1/4" check valve (brass) and a stainless steel reducer (aka "spur") that goes into the hose line. I used my salvaged hose clamps to secure the new water line to the reducer.

Some people may read this and wonder, "What is a check valve?" It's basically a valve that only allows fluids to move in one direction. Water can flow into your house when the pump pushes it, but it can't drain back into the well when the pump stops. This is a vital component, because when your system gets pressurized the check valve keeps all the water in your house from dumping back down into the well.

Note: If you have to do something like this DON'T use plastic components. Also, make sure you ASK a professional about galvanic corrosion. Putting the wrong metal in contact with other metals can lead to bad things happening. Putting incompatible metal in a moist environment only tends to accelerate those bad things.



Image Notes

1. Water inlets - This is where the impeller pulls water in from the well
2. Motor
3. Impeller - The inside of this is like a jet engine that sucks up water through the inlets and pushes it toward your house.
4. 1 1/4" Threaded, Stainless Steel "Nipple"
5. Brass 1 1/4" Check Valve with direction of flow -->
6. 1 1/4" to 1" stainless steel reducer (spur)
7. New 1" water line.

Step 22: Securing the electrical connections

While you're at the hardware store make sure to pick up a set of crimp connectors for the electrical connections. It should come with two connectors and some heat-shrink material. Strip a clean bit off of the wires coming from the house and crimp the connectors with a good pair of pliers. Slide the heat-shrink material over the connection and then heat it with a heat-gun, or a butane torch. (A lighter doesn't get hot enough to do a good job.)

Then start wrapping the whole thing up in electrical tape, just like you found it.



Step 23: Secure the safety rope

Secure the safety rope to the pump, itself. They have a handy little loop built into them just for this.



Step 24: Put on the torque arrestor, test the pump, and put it back down the well.

Put the torque arrestor back on. It's not pictured, but I also secured the electrical wiring and the safety rope to the water line by wrapping it with electrical tape at 12-18" intervals.

Once you get to this point, you're ready to make sure the well pump is working. I forgot to take a picture of that part, but it goes like this: Get a BIG bucket (like a 10-20 gallon plastic tub) and use your awesome neighbor's hose to fill it up with water. Then submerge the assembled well pump into the water, making sure water covers the impeller intakes.

Then put your cell phones to good use. Have your assistant go down into the basement and flip the breaker that will turn on the pump. You should immediately see it sucking water out of the tub at a rapid rate. If it does, the pump is ready to go back down in the hole!

MAKE SURE YOU KILL THE BREAKER BEFORE HANDLING THE PUMP, AGAIN!

Feed the pump back into the casing slowly, using the safety rope. Line up the pitless connector, using a flashlight. Slide it into place and then seat it fully by giving it a couple of downward whacks with a hammer until you feel it seated properly.



Step 25: Prepare the pressure tank.

You're just about ready to turn it back on, but first you have to make sure the air pressure in the pressure tank is set correctly. Unthread the cap on the top of the tank. You'll see a little nubbin, like on a bike tire.

For the pressure tank to work correctly, the ambient pressure (while completely drained) has to be -2lbs from the pressure at which you want the well pump switch to kick on. I like my water pressure to be between 55 and 75 psi. That means, the ideal air pressure for the bladder in the tank was about 53 psi. I hooked up an air compressor and filled it until it reached that point.

Not performing this step will cause a variety of problems, not the least of which is "short cycling." If you have too little (or too much) air in the tank it can throw off the actual volume of water the tank will hold. That can lead to the pump constantly switching on/off... which eventually burns out the pump, or the pump switch. Not good.



Step 26: Adjusting the pump switch

What you're looking at here is a well pump switch. They come pre-set for 30/50 and 40/60. The first number is the psi at which the switch will sense the pressure in the system is too low, and it will turn the pump on. The second number is the number at which the pressure in the system makes the switch say "Okay... that's enough. Stop pumping, well pump."

What these systems do is provide stable pressure throughout the house. If you didn't have a pressure tank like this one, every time you turn on the tap the well pump would kick on. With a pressure tank, you can flush a toilet or wash your hands without making the pump have to do any work because the tank stores water and air. The pressure stays relatively uniform. Wash your hands enough times and the pressure will drop... once it gets down to a certain point, the pump will kick on, which pulls water up from the well and allows for the system to keep a nice even pressure. When you're done with the water, the pump keeps working to get back to the top number. That way, it's ready to go for the next time you need it.

This well switch is brand new. I bought it the night before I replaced the well pump, hoping that it would fix my well problem. Obviously, it didn't.

Anyway, I don't like it when my water pressure is set for 40/60. I like it to be at about 55/75. This particular model of well switch is adjustable. With a few turns of this nut, I can raise the ratio to the place where I want it. Warning: I did this with power applied. THIS IS EXTREMELY DANGEROUS, BECAUSE THE WIRES ABOUT 1/4" AWAY FROM MY SHINY METAL WRENCH ARE PUSHING 250V!!! You have to be VERY careful when you do this, and I don't recommend that anyone try it. The reason I do

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it, is that it lets me make my adjustments without constantly having to reset the breaker. I tweak it, and let the pressure tank fill up. I then use the valve underneath to release water pressure. As I release the pressure, I watch the gauge to see what point the switch kicked on. Once I adjusted it to the point where the pump flipped on at 55 psi, I was good to go. Put the cap back on the switch and go back upstairs.



Step 27: Victory dance!

Go outside and show off your "power stance" as you spray glorious hose water all over yourself.



Image Notes

1. Happy Dude.

Step 28: Sanitize the well

Whenever you open the well cap, or replace the piping, there's a requirement to pour some bleach down there to kill off any harmful bacteria that may want to live in the water after being touched by your filthy human digits.

First, you have to calculate the volume of water that's in the well. In my case, I'm going to guess that it's about 70' of total water space in a 6" tube. Using the formula $\pi r^2 h$ ($3.14159 \times 9 \times 840$) you get a total volume of about 23750 cubic inches. That's about 102 gallons of water occupying the well at its fullest point.

Proper chlorination requires 3 pints of 5% chlorine bleach per 100 gallons of water in the well, PLUS 3 pints of the same to sanitize the plumbing inside the house. That's a total of 6 pints of 5% chlorine bleach. A gallon is 8 pints, so a single gallon will be enough to do the job AND sanitize the well cap before I put it back on.

Here's what you do: Dump about 3/4 of the gallon of bleach in the well (with the water pump still on, so you can still use your hose). Then run your hose down the well to circulate the bleach. This process WILL pull bleach water into your house, so don't plan on using the water during this process. Run the hose for about an hour to get the water from the bottom all the way back up to the top, ensuring that the chlorine mixes with ALL the water in the well. Then use the remaining 1/4 of the bottle to sanitize the well cap. Put the cap back on and go inside.

TURN ON EVERY TAP IN THE HOUSE, SEQUENTIALLY. Run cold water until you smell bleach at every tap. Give the toilets a few flushes to pull water into them, also. Once you smell the bleach, turn it off. The chlorine will sit in your pipes and kill off anything living in them.

Go to sleep. It has to sit for at least 12 hours, undisturbed. No sinks. No flushies. No washies. The next day, hook up your hoses and start purging. DON'T SUCK THE WELL DRY WHILE YOU DO IT. Also, DON'T DRAIN THE BLEACH WATER INTO THE LEECH FIELD FOR YOUR SEPTIC SYSTEM. Remember, there were about 100 gallons in the well, so figure out how many gallons per minute you push through the hoses and stop when you hit about 150 gallons through the system. In my case, that was about an hour and a half.

Once you hit that point, cut the hoses off. Then purge the inside of the house. IF YOU HAVE A SEPTIC TANK (I don't) YOU'LL WANT TO CAPTURE ANYTHING OUT OF THE SINKS WITH A BUCKET, SO THAT YOU DON'T KILL OFF THE BACTERIA IN THE SEPTIC SYSTEM. Make sure you dump the water someplace safe. Run each tap for a couple of minutes. Give the toilets a flush or two. Then test the water for chlorine content to make sure it's safe to drink with a kit you can get from the

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hardware or pool supplies store. Keep running the water until the test comes back at safe levels to drink.



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