Posse+Plus, Wood County Texas

Shallow Water Wells

Unlike deep water wells, shallow water wells are limited in depth by atmospheric pressure. On shallow water wells a pump creates suction in the pipe above the surface of the water. Atmospheric pressure pushes down on the water outside the pipe forcing the water in the pipe to rise. If a pump was capable of creating a 100% vacuum, normal atmospheric pressure would push the water up the pipe over 30 feet, however no water pump is designed to create a 100% vacuum and would be very costly even to get close.

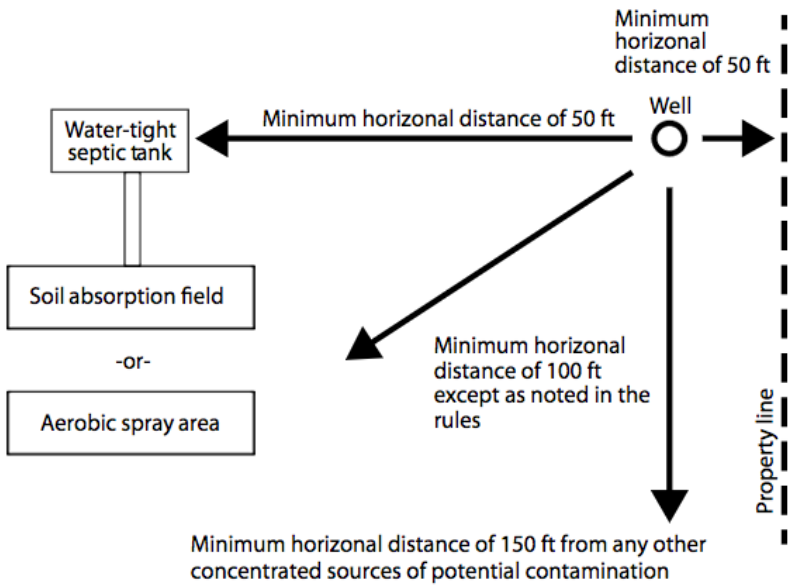
Pitcher pumps are the type of manual pump normally used with shallow wells. They are not capable of producing anything close to a 100% vacuum; therefore, pitcher pumps can only bring water up 20 feet. That is the total distance between the surface of the water and the bottom of the pump.

Jet pumps can be used when electric pumps are required. They can sometimes produce a better vacuum in the pipe over the water than a pitcher pump, lifting water as high as 25 feet.

The vertical distance between the inlet of the pump and the surface of the water in the bottom of the well pipe cannot be greater than 20 feet for a pitcher pump or 25 feet for a jet pump.

Generally speaking, the higher the altitude, the lower the atmospheric pressure. The lower atmospheric pressure lessens the height that both the pitcher pump and jet pump can lift water.

Texas Water Well Guidelines (Well Owner's Guide to Water Supply)



The state has set limits on how close a well can be to potential sources of contamination. The wellhead must be at least:

- 50 feet from any septic tank, cistern, property boundary, and/or non-potable (undrinkable) well
- 100 feet from a septic drain field or any leach field
- 150 feet from any shelter or yard for pets or livestock, feed storage facility, and pesticide or fertilizer storage
- 250 feet from a liquid waste disposal system or manure stack

In addition, every effort must be made to locate a new well where it will not be vulnerable to flooding. Floods can cause the contaminants from the surface to seep down the outside of the well casing and pollute the aquifer.

Texas groundwater law is based on the English common-law doctrine that associates groundwater with the landowner. This doctrine and its interpretation essentially provide that groundwater, once it has been captured by a well and delivered to the surface, belongs to the landowner. As such, landowners may use or sell all the water they can capture from below their land. Texas courts have consistently ruled that landowners may pump as much water as they want from beneath their land, regardless of how it affects neighboring landowners' wells. As recently as February 2012, the Texas Supreme Court confirmed that the landowners own the groundwater beneath their property. Over the years, the courts have placed only a few limitations on the rule of capture, including:

- Landowners are liable for damages if their negligent pumping of groundwater causes neighboring land to subside.
- A landowner may not drill a well on someone else's property or drill a "slant" well that crosses the property line to the adjoining property.
- Groundwater cannot be captured or used maliciously to injure a neighbor or amount to willful waste of the resource.
- Groundwater pumping may not result in polluting a groundwater reservoir by saltwater or other substance.
- Landowners may not willfully cause or knowingly permit the water from an artesian well to run off the well owner's land or to percolate through a layer above which the water is found.

Much of the groundwater is also regulated by Texas Groundwater Conservation Districts.

Texas Groundwater Conservation Districts

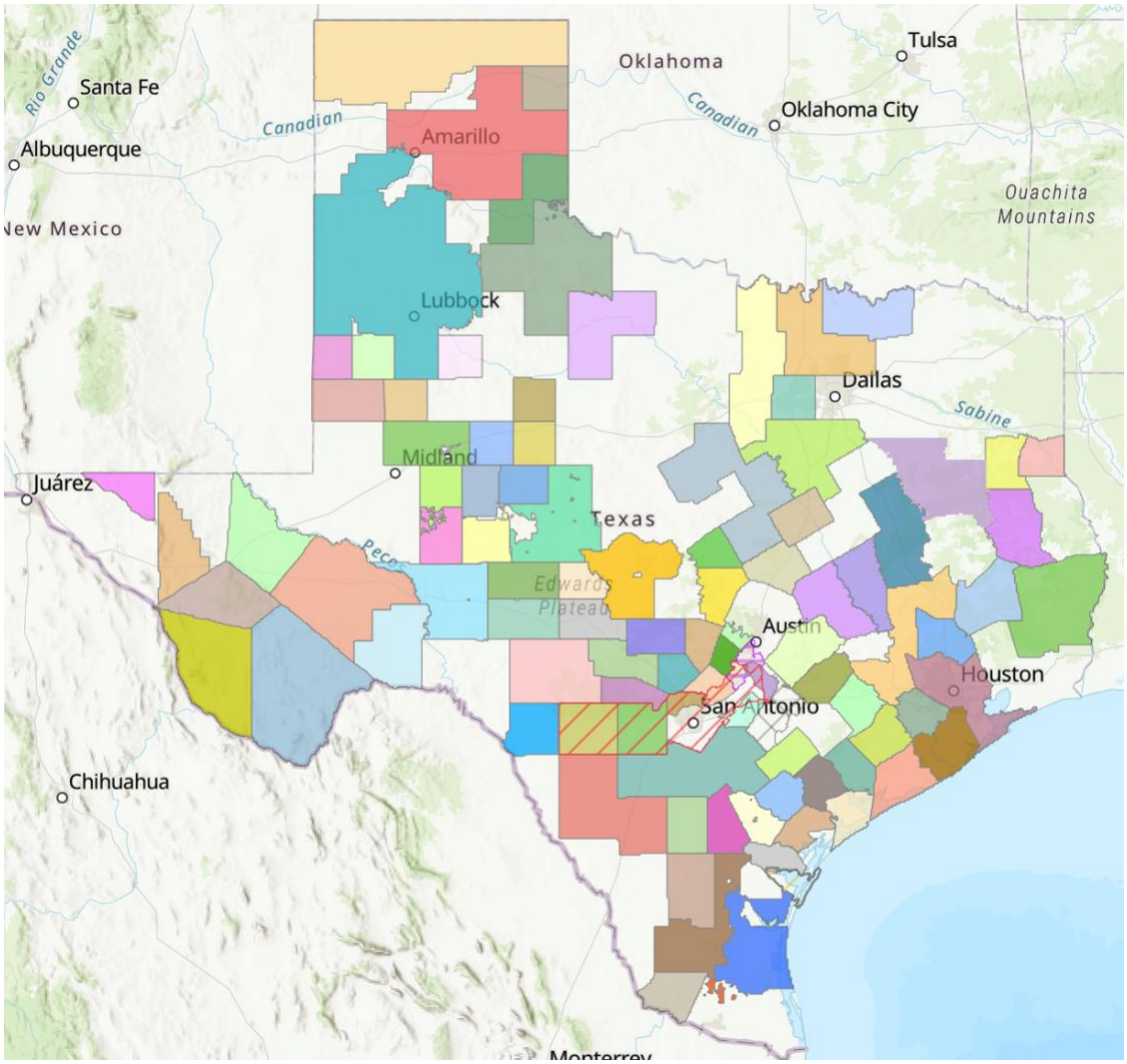
Many parts of Texas are regulated by groundwater conservation districts. Each district has a set of rules and regulations that go beyond state requirements.

Small domestic wells, small wells for agriculture or recreation, and small geothermal heat sink wells are often classified as "exempt wells" and may only require filling out a form. If a location is not a part of a groundwater conservation district only the Texas state requirements apply.

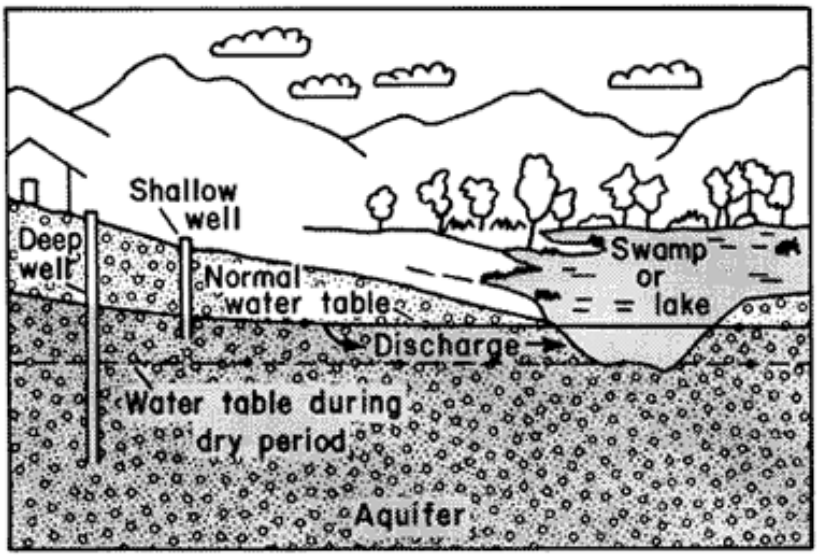
For further information refer to the websites for each Groundwater Conservation District.

Do I need to register my water well, and if so, how do I do that?

Private water well owners in Texas do not need to register their well unless the property falls within the jurisdiction of a groundwater conservation district (GCD). You can use the Texas Alliance of Groundwater Districts (TAGD) GCD Index to determine if your property falls within the boundary of a GCD.



Shallow Water Well Location



Aquifers are found below most of Texas. The distance between the surface of the land and the water below varies greatly. The easiest way to determine if the water is close enough to the surface for a shallow water well is to look for creeks, ponds, and springs that hold water year around. This means that the aquifer is just below the surface. Better yet look for one that holds water even during the severest drought. A shallow well should not be drilled too close (less than 50 feet) to a creek, or pond. If the

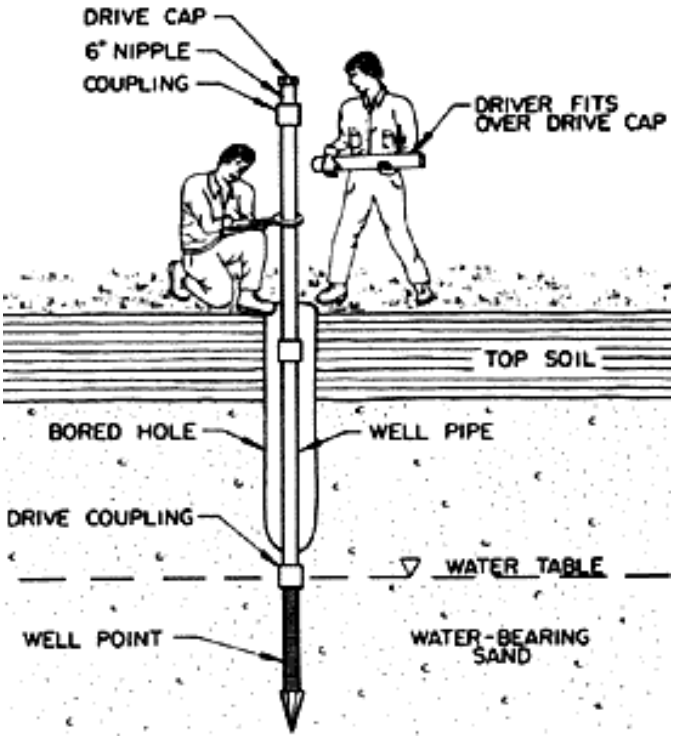
water is coming from a spring consider capturing that water in a lined gravel pit and eliminate the need for a well.

The well does not have to be necessarily close to the creek or pond but should be at a similar elevation. For example, there could be a nearby pond that stays full of water all year around but is not on your property. Look for a location on your property where the ground is no more than a few feet higher than your neighbor's pond. Do not locate the well where surface water runs or stands during a heavy rain (runoff could contaminate the well). In other words, locate the well on level ground or uphill from the lowest spot.

Consider the type of soil at the well's location. Sand is much easier to drill through than clay or gravel, and solid rock is impossible to penetrate with a hand drill.

Augers and Wellpoints

There are many different ways to drill and develop a shallow well. One of the easiest and most cost effective methods is by using an auger to dig most of the well and then drive a wellpoint to complete the bottom of the well.



The posthole auger (page 11) is designed to cup the soil in the bit as it is digging allowing the operator to pull the auger with the dug soil out of the ground one scoop at a time. Some augers can be adjusted to bore six, seven, or eight inch holes. Six inch holes work well for a shallow water well with a wellpoint. The steel shaft can be lengthened by adding 5 foot lengths of ¾ inch galvanized pipe. Seymour makes this type of auger. The steel shaft can be removed and a short nipple and coupling can be added to the bit end of the auger. This makes it easier to extend the length of the handle as sections of pipe are added. The auger and galvanized pipe for the auger could be purchased first and used to determine if the water level is suitable for a shallow well. (see the parts list on page 7)

The wellpoint is made from cast iron and stainless steel. The pointed end will be driven down through sand and clay until the entire wellpoint is several feet below the water's surface. The center portion of the wellpoint is constructed of perforated stainless steel and a screen to eliminate sand from the water. Sections of pipe are added to the wellpoint to provide an airtight connection between the wellpoint and the pump. A drive cap, coupling, and 6 inch nipple is needed to protect the threads of the pipe as it is being driven into the ground. Special drive couplings are needed between each section of well pipe. These special drive couplings allow the ends of the two connected pipes to butt up against each other lessening the possibility of damaging the pipe threads while being driven into the ground. Wellpoints can be driven into the ground with a sledgehammer or an oversized t-post driver. The oversized t-

post driver must be large enough to fit over the drive cap and is much easier to use than a sledgehammer.

Digging the Well

Use the auger to start the hole. Turn it a few times and then pull the auger out of the hole while being careful not to spill the dirt collected in the bit. Continue until the depth of the hole is reaching the length of the auger's handle. Remove the auger's handle and install a ¾" galvanized steel nipple and coupling. Add a section of ¾" 5 foot long galvanized steel pipe to the coupling. Add another coupling to the other end of the pipe and connect the auger's handle. The auger is now ready to dig another 5 feet into the ground. Continue this process adding sections of 5 foot galvanized pipe and couplings until you hit water. Never turn the auger backwards in the hole. This may cause the bit to drop into the hole. Gravel mixed with soil can be removed by adding a little water to the hole.

Just before water is reached the sand or clay being removed will be wet and heavy. When you hit water the auger will no longer be useful. The sides of the hole below the water's surface will most likely cave in if you continue to use the auger. The suction from the water makes it very difficult to remove the auger from the hole. If the hole dug by the auger is greater than 20 feet deep without hitting water, a manual pitcher pump will not work on the well. If it is greater than 25 feet deep an electric jet pump will not work. Abandon the hole if the depths are deeper than the pump's specifications and find another location.

The remainder of the well will be completed by using the wellpoint. Measure the length of the auger assembly (auger plus pipe). The wellpoint assembly should be at least five feet longer than the length of the auger assembly. Use this length to determine the number of 5 foot sections of 1¼" galvanized steel pipe that must be added to the wellpoint before sinking it into the dug hole. For example, if the total length of the auger assembly is 15 feet the wellpoint assembly (wellpoint plus pipe plus drive cap) should be at least 20 feet. When the wellpoint assembly is dropped into the hole it may drive the wellpoint several feet below the water's surface. If the wellpoint assembly is too short it may disappear below the soil surface making it difficult to continue. The wellpoint assembly is constructed by adding 5 foot sections of 1¼" galvanized steel pipe and joining them with specialized drive couplings. A 3 inch nipple and drive cap should be installed at the top of the wellpoint assembly to protect the pipe threads from damage during the driving process. Pipe thread compound should be used when joining each 5 foot section and the wellpoint.

The wellpoint assembly is now dropped point first into the hole. The wellpoint assembly will be heavy and it is best to just let it drop rapidly into the hole. The weight of the assembly should help the point penetrate the bottom of the hole. Add or remove 5 foot sections of galvanized pipe to make the pipe the proper height for driving down with either a sledgehammer or large t-post driver. Make certain the drive cap and 3 inch nipple is in place at the top of the assembly. As the wellpoint assembly is driven into the ground use a pipe wrench periodically at the top of the pipe to turn it in the direction to tighten the drive couplings. Add sections of pipe as needed. When finished the top of the wellpoint should be at least 2-3 feet below the water's surface and the top of the well pipe should be 2-3 feet above the soil surface.

Backfill the hole with the soil that was removed. Install a 1¼" plug into the "branch end" of a 1¼" tee. Remove the drive cap and install one of the "through ends" of the galvanized tee onto the well pipe. On the other "through end" of the tee add a 3 inch nipple, then a brass check valve, (the directional arrow on the check valve should face up) and another 3 inch nipple at the top of the check valve. Use pipe thread compound at every connection.

Adding a check valve is not necessary for the well to pump, but it will hold water at the top of the well for some time when the pump is not being used and adding a tee will allow the water to be drained from the pipe if there is threat of freezing. This configuration holds water in the pump cylinder between frequent uses and eliminates the need to prime the pump with each use. If a check valve is omitted then each time the pump is used it will have to be primed and water will have to be pumped up from the bottom of the well pipe before water will be discharged from the pump. A check valve will lessen the effort to get the pump to start providing water.

The plug in the tee can be used to break the vacuum in the well pipe allowing the water in the well pipe to drain to the bottom when there is a threat of water freezing in the well pipe. Afterwards water will still remain in the pipe above the check valve and in the pump. As a further precaution the pump should be removed and drained so it will not be damaged. Consider insulating exposed well pipe with pipe insulation.

A concrete pad around the well pipe will limit the possibility of contamination from water on the ground running down into the well along the well pipe.

Shallow Water Well Pumps

There are several shallow well pitcher pumps available. Most manual pumps will use leather seals and gaskets, which must be replaced periodically. Consider purchasing spare seal kits to have on hand. All of the following shallow well pumps are available with a 1¼" inlet to attach to the top of well the pipe. All shallow water well pumps require priming.

Open Top Pitcher Pump (page 12) This is the cheapest pitcher pump. The biggest drawback is that rainwater or splashed water can contaminate the water in the cylinder of the pump through the openings at the top and at the spout. A bucket can be placed over the pump to protect it from rain. In freezing weather any water left in the cylinder is likely to freeze and crack the cylinder.

Closed Top Pitcher Pump (page 12) The top and spout is closed to prevent rainwater or splashed water from entering the cylinder. The cylinder is still subject to freezing.

Better Pitcher Pump (page 12) The pump has a sanitary enclosed spout. The cylinder is made of 3" seamless drawn brass tubing, which should increase the life of the leather seals in the pump. The cylinder is still subject to freezing. Made by the Amish.

Best Pitcher Pump (page 13) The pump outlet is a hose spigot and includes a hand shutoff valve. The cylinder is 3" seamless drawn brass tubing. The rod, rod guide, and spigot are all made of brass. It has a built-in air chamber for steadier water flow. This pump was originally designed to pump water out of the well and into a second story holding tank. A water hose can

be connected to the outlet of the pump. The hose then can be used to fill a storage tank or to water plants. The pump can force water to any location. The cylinder is still subject to freezing. Made by the Amish.

Stand Pump (page 13) A stand pump works the same way as a pitcher pump. A stand is attached to the bottom of the pumping mechanism to provide additional height for the pump above the ground.

Pasture/Nose Pump (page 13) The pasture/nose pump is a pump that uses animal power to pump water. The pump can be used by cows, horses, or bison. Each pump is good for 30 horses or dry cows. The pump can lift water 26 feet in a well and can be placed up to 128 feet from the well or other water source.

Shallow Well Jet Pump (page 13) Jet pumps are electrically powered. They will lift water up to 25 feet from a well and pressurize a tank. Usually they come with a pressure switch. Water priming is required at installation. Jet pumps are often used with water sprinkler and irrigation systems.

Parts List (Expect prices to be up to twice the amount listed with spotty availability.)

Posthole Auger with Fittings, Total Cost $139

Seymour AU-S6 6 inch posthole auger, $60
¾" by 5 foot galvanized steel pipe, $16 each, quantity 4, total $64
¾" by 6 inch galvanized steel nipple, $3
¾" FPT x FPT galvanized steel coupling, $3 each, quantity 4, total $12

(note: The galvanized pipe and fittings can be purchased at Lowe's or Home Depot however Lowe's normally has precut 5 foot sections of pipe available. The auger will probably have to be purchased online from one of the following: Amazon.com, Walmart.com, Truevalue.com. Walmart and True Value stores may be able to order the auger from the store.)

Wellpoint and Well Pipe, Total Cost with Accessories $272

1¼" by 36" stainless steel and cast iron well point, $50
1¼" steel wellpoint drive cap, $13
1¼" steel wellpoint drive couplings, $8 each, quantity 4, total $32
1¼" by 5 foot galvanized steel pipe, $27 each, quantity 5, total $135
1¼" 3 inch galvanized steel nipple, $3
Consider the following accessories.
1¼" brass inline check valve, $21
1¼" FPT galvanized steel tee, $8
1¼" 3 inch galvanized steel nipple, $3 each, quantity 2, total $6
1¼" galvanized steel plug, $4

(Note: Lowes carries a better selection of 1¼" galvanized steel pipe and fittings than Home Depot. Lowes, Northern Tool, and Tractor Supply carry wellpoints. Amazon.com, Northern Tool, and Tractor Supply carry steel wellpoint drive couplings however there usually isn't

more than 1 or 2 in the Tractor Supply store. Tractor Supply can do a special order at the order desk.)

Pumps (Expect prices to be up to twice the amount listed with spotty availability.)

Open top pitcher pump, $50
Closed top pitcher pump, $180
Better pitcher pump, Hitzer Fig T, $260
Best pitcher pump, Hitzer PHB, $285
Pasture/nose pump, Rife, $382
Shallow well jet pump, Wayne, ½ hp-$160, ¾ hp-$223, 1 hp-$263

Quikrete cement, $4 each, quantity 2, $8 total

(Do not use black pipe. Water will make it rust and it will fail within a few years.)

How a Pitcher Pump Works

This pump design is based on old fashioned ingenuity that dates back more than 100 years. The pump cylinder holds a plunger with a leather cup that sets above the base flat valve that works as a flapper valve. Directly above the leather cup and inside the plunger cage the plunger weight sits on top of the threaded nut and acts as a check valve. The handle is connected to the plunger and moves the plunger up and down.

When the handle is pulled up it pushes the plunger down against the weighted flat valve (flapper valve). As the handle is pushed down it lifts the plunger, creating a vacuum inside the cylinder causing the flat flapper valve at the base to open pulling water into the cylinder. When the plunger reaches the top of the cylinder the base flapper valve closes due to the weight of the water in the cylinder and water is trapped in the cylinder.

As the handle is pulled upwards again, pushing the plunger down towards the flapper valve again, water is forced out through the plunger weight still keeping water in the cylinder. When the handle is pushed down raising the plunger again, new water is brought into the cylinder forcing the water in the cylinder to exit out through the spout. A constant pumping of the handle creates a continuous water flow at a rate of approximately 1 gallon every 10 strokes.

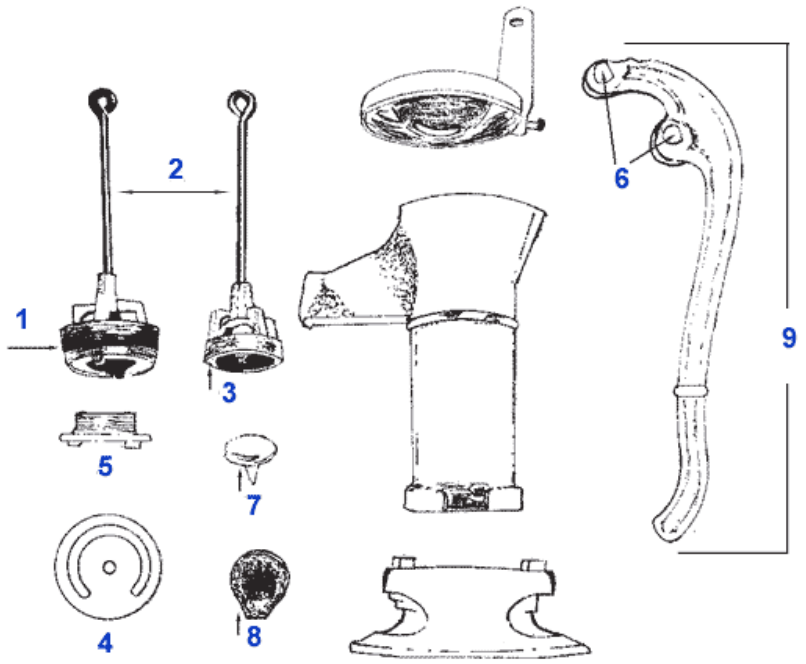
This hand operated Pitcher Pump will pump water from a water level of 24 feet or less from the bottom of the pump. This distance is measured vertically from the spout of the pump to the actual water level where the water will be pulled from. You will need to deduct 1 foot for every 1000 foot elevation above sea level, and 1 foot for every 50 feet of horizontal pipe distance used in the drop pipe. This pump can be installed on a well, a barrel, or holding tank.

The drop pipe is the piping to be used to attach to the bottom of the pitcher pump and reach into your water source. The drop pipe can be PVC (we recommend schedule 40), galvanized, copper or any other potable (drinking water grade) piping. The bottom of the pump has 1-1/4" FPT threads. For optimum water flow the drop piping used should not be smaller than 1-1/4" pipe. 1" piping can be used but will decrease the amount of water volume pumped out

through the spout. Your drop pipe should be at least 5 feet longer than the actual water pumping level. This can help to allow for changing well water levels that can happen throughout the year.

The pump should never be operated without water to eliminate damage to the leather cup. Always fill the pump with water (called priming the pump) before operating the pump. Prime the pump by pouring water in the top of the pump until it flows out of the spout. Wait 4 or 5 minutes while the leather cup swells enough to make contact with the pump wall. Using short strokes, raise and lower the handle until the suction pipe fills with water. Add more water in the top of the pump if necessary. If the pump will not prime then check for leaks on the suction side. A leak will prevent the pump from priming.

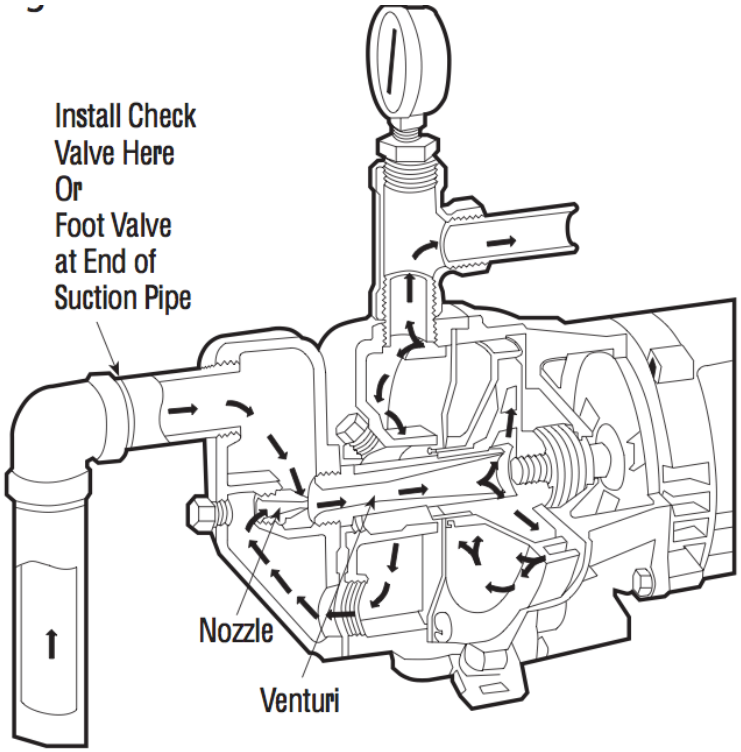
Pitcher Pump Replacement Parts



Item	Description	Price & Quantity
1	Cup leather (3" x 2") - for plunger only	$9.24 0
2	Plunger rod (6-3/4" long)	$5.98 0
3	Plunger Cage	$7.17 0
4	Flat leather (3 1/2" x 2 7/8") - for base valve	$6.43 0
5	Threaded nut for plunger cage 1-7/8" dia.	$8.80 0
6	Bolt - (3/8" x 2") - for pump handle (1ea.) - requires cotter pin (not included)	$3.98 0
7	Plunger Weight	$4.95 0
8	Weight and Screw - for flat valve	$6.29 0
9	Pitcher Pump Handle - Includes 2ea. 3/8" x 2" bolts	$17.95 0
	Faucet Grease 2oz, safe for drinking water - for use on the leather cup or base flat leather	$3.39 0

The use of a foot valve or check valve will keep water in the drop pipe and eliminate the need to prime the pump. However, if freezing conditions can exist then the pump will need to be removed from the water source during the freezing season. Or, if the foot valve is removed the handle of the pump can be left in the up position (tied up as high as possible) to cause the pump to self-drain. When the handle is lifted as high as possible the check valve (plunger weight) becomes tilted as the plunger is forced down on top of the bottom flat leather weight allowing air into the suction line to break the vacuum and drain the suction line.

Shallow Well Jet Pump



(Goulds Pumps) The Jet Assembly itself forms the suction chamber and the vacuum is created by the very high velocity of a stream of water passing through the jet. Basically, the jet assembly is composed of two parts. First, a nozzle which produces the high velocity stream of water.

This high velocity stream of water is injected through a small compartment which is the suction chamber, thereby causing the vacuum. Obviously, the suction pipe is connected to this compartment or suction chamber. The vacuum caused by the jet permits the greater pressure of atmosphere on the surface of a body of water to force water into the suction chamber.
The second basic part of the Jet Assembly is the venturi tube. It is installed in the discharge of the suction chamber. Its function is to convert the velocity of the water into pressure. This is accomplished by the shape of its water passage. Perhaps you can best visualize this by thinking of a nozzle in reverse. The nozzle speeds up the flow of the drive water converting pressure into velocity and when it has passed through the suction chamber, the venturi slows it down again converting the velocity back into pressure.

“Drive water” is that water which is piped under pressure to the jet assembly or suction chamber. The discharge from the suction chamber or jet assembly is composed of both the drive water and that water pumped from the well. The total amount pumped from the well can be used as discharge from the system and is the output or capacity.

The operation of the Jet system is dependent on the combined functions of both the Jet Assembly or suction chamber and the centrifugal pump. Also, that these two main components of the system are entirely separate and their locations with respect to each other is a matter of design.

Seymour Post-hole Adjustable Auger (¾" nipple, couplings, and 5 foot pipe sections)

All well fittings are 1-1/4 inch

Wellpoint, Drive Cap, Drive Coupling

FPT Galvanized TEE
(Branch end is on the bottom)

Brass Check Valve ($26)
(Notice the arrow)

Pumps (Expect prices to be up to twice the amount listed with spotty availability.)

Open Top Pitcher Pump

"Kant Freeze", This pump will pick up water from a depth of 20'. Place a check valve in the line to keep water close to the pump but it must be protected from freezing. Or, leave the check valve out and lift the handle all the way up to drain the drop pipe and keep pump/pipe from freezing.
$ **47.00**

Good Closed Top Pitcher Pump

"Kant Freeze" Top and spout is closed to help keep contaminants out. Pull water from 20' down. All iron with smoothly polished inner wall for stronger suction. Red, 3 3/4 in. stroke, 16" H, 13 lb, USA made
$ 179.00

Better Pitcher Pump

Sanitary closed top, enclosed spout. Red trim, 3 in. stroke, 17 1/4" H, This cylinder is made of **heavy 3-inch seamless drawn brass tubing.** Extra heavy castings and large waterways are used throughout. Only best quality leathers are used. Sanitary, closed spout prevents water splash. This pump is anti-freezing. Raise the handle to full up position to drain cylinder. Tapped for 1 1/4" suction pipe at bottom. Since the cylinder is brass, it is smoother and therefore does not wear the leather seal out as fast as one year. Note: leather seals further down. Since the cylinder is brass, it is smoother and therefore does not wear the leather seal out as fast as one year. Note: leather seals further down.
24 lb, USA, #29T
$ 259.00

Best Pitcher Pump

brass cylinder, sealed top. (For maximum of 20' water depth). Exclusive fittings let you pump up to your second floor or into a hose. Built-in air chamber for steadier water flow. Solid brass rod, rod guide and spigot. Red trim, 3 in. stroke, "Kant Freeze - put handle in the full up position", 17" H, 22 lb, USA, #291682; Since the cylinder is brass, it is smoother and therefore does not wear the leather seal out as fast as one year. Note: leather seals further down.

$ 285.00

Pasture/Nose Pump

Stand Pump

Jet Pump

1” NPT suction and discharge threads, 3/4” garden hose adapter included, 180 feet of total dynamic head, maintains pressure up to 80 PSI
Durable corrosion resistant construction
Lift water as high as 25 feet and discharge pressures from 35 to 50 PSI
1 HP; max. flow rate is 720 Gallons Per Hour
520 GPH at 10 feet of discharge lift