

AWS Technical Report: Sanitizing Wells, Storage Tanks, and Pump Systems by Shock Chlorination

It is important to periodically monitor private water wells periodically to see if contamination is present. The United States Environmental Protection Agency recommends: "... test private water supplies annually for nitrate and coliform bacteria to detect contamination problems early. Test them more frequently if you suspect a problem". <http://www.epa.gov/safewater/pwells1.html>

Coliform bacteria in a well or home piping system indicate that disease-causing bacteria and viruses are likely to be present. Other bacteria such as iron and sulfur bacteria, while not a health threat, can produce obnoxious odors, tastes, and color, and can cause plugging problems in pump and water systems. Shock chlorination can eliminate these disease-causing bacteria, and other nuisance organisms that cause tastes, odors and slime.



When wells are first drilled and put on line, or when submersible well pumps are serviced (right), the well, pump, pressure tank and piping system should be thoroughly sanitized with chlorine to prevent or retard bacterial and bio-film growth.

How To Test Your Water

Most water testing for chlorination purposes is done to detect the presence of coliform bacteria. Coliform bacteria tests are used as an indicator of the possible presence of disease-causing bacteria.

You can use our mail order Bacteria Check test kit, or for a certified test, take the sample to a licensed laboratory in your area. Use a sterile bottle obtained from the laboratory.

Consider Shock Chlorination for Routine Well Maintenance

Shock chlorination of the well and/or pumping, distribution or home piping system is usually recommended after:

- A new well has been constructed
- Any time a well is opened for repairs
- Floodwater has entered a well
- A new holding tank, pump or pressure tank has been installed
- A new pipeline or other piping or plumbing work has been done
- Tests indicate the presence of coliform bacteria
- Odors or slime caused by iron or sulfur bacteria are present

CAUTION: It is important to remember, while shock chlorination corrects immediate bacteria and/or odor problems in wells and piping systems, it does not correct the source of the bacteria. If bacteria are entering the well from a septic tank or other source, one should correct the problem, otherwise bacteria will redevelop.

How Shock Chlorination Works

Shock chlorination involves introducing a strong chlorine solution into the water source and plumbing system, and letting it disinfect the system for 12 to 24 hours. You can use regular household bleach (non-perfumed type) that contains 5.25 percent sodium hypochlorite, which kills bacteria and certain viruses. You can also use pool chlorine, which is 10% to 12% sodium hypochlorite and twice as

strong as household bleach, and/or calcium hypochlorite pellets. For best results don't use pool dry pellets, unless it is pure calcium hypochlorite.

Odors Caused by Bacteria

Often well waters contain odor. Sources of the odor may be from the action of bacteria and sulfates, iron or manganese. Some waters contain an excessive amount of sulfates with various strains of sulfate bacteria. These bacteria, harmless to health, will react in stagnant water that has been depleted of oxygen, and can produce hydrogen sulfide gas. These bacteria cannot grow in the presence of atmospheric oxygen, which may account for their not being noticed in cold water lines, and their presence in water heaters and hot water lines. Other types of bacteria, such as iron or manganese bacteria, utilize these elements for their cell wall production, and produce slime in wells and piping in addition to odors.

Iron and Manganese Odors

It is important to note that odors from iron and manganese (such as rusty odors, or oily odors) will not be eliminated by shock chlorination. Iron and manganese are usually found in a dissolved or clear state in well waters, and after exposure to oxygen or other oxidants such as chlorine, will color the water. In some cases, shock chlorination of waters high in iron or manganese will turn clear water into rusty, orange, red, pink, or black water depending on the water chemistry and levels of iron or manganese present.

Note of Caution:

Shock chlorination of wells or piping systems may loosen up scale, iron deposits and other materials, which can clog fixtures, appliances and valves in the piping system. Care should be taken when flushing the piping, and all aerators removed to prevent clogging. In some

extreme cases of corroded piping, the piping may fail and start to leak after this procedure. Chlorination will not remove nitrate or other contaminants.

Shock Chlorination Methods:

- 1. Liquid chlorination using household bleach (sodium hypochlorite)**
- 2. Dry pellet chlorination using 70% available (calcium hypochlorite)**

Shock Chlorination by Liquid Bleach

1. Clean the well house, springhouse or storage tank or reservoir. Remove debris and scrub or hose off any dirt or other deposits or interior surfaces. Pump to remove any suspended solids or foreign matter in the water if possible. Scrub interior surfaces with a strong chlorine solution containing $\frac{1}{2}$ gallon household bleach, or $\frac{1}{4}$ gallon of pool chlorine to each 5 gallons of water.
2. Determine how much chlorine to use to disinfect your well by consulting Table 1. If you don't know your well depth, contact your well driller as they often keep records that will show the depth of the well.

Table 1 Wells: Amount of 5.25% bleach (sodium hypochlorite) needed for disinfection to obtain approximately a 50 ppm chlorine solution in the well.

If using pool chlorine (12% sodium hypochlorite) double amounts below.

Well Casing Diameter	Distance From Water Level to Bottom of Well (Water Depth)					
	0' – 50'	50' – 100'	100 – 200'	200' - 300'	300' – 400'	400' – 500'
4"	8 oz.	½ qt.	1 qt.	2 qt.	¾ gal.	¾ gal.
6"	½ qt.	1 qt.	¾ gal.	1 gal.	1 ¼ gal.	1 ½ gal.
8" – 12"	½ gal.	¾ gal.	1 ¼ gal.	1 ¾ gal.	2½ gal.	3 gal.
12" – 16"	½ gal.	1 gal.	2 gal.	3 gal.	4 gal.	5 gal.
20" - 24"	1 gal.	3 gal.	5 gal.	7 gal.	9 gal.	11 gal.
30" – 36"	3 gal.	5 gal.	10 gal.	15 gal.	20 gal.	25 gal.

EXAMPLE: The well is 4" in diameter, with a depth of 400 feet. The water level is 100 feet below the surface. $400 - 100 = 300$ feet. From Table 1, a 4 inch well with 300 feet of water takes 1 quart of bleach.

NOTE: In applications where it is inconvenient to determine water depth, at least ½ gallon of household bleach, or ¼ gallon of pool chlorine, may be used for wells up to 8" in diameter with water estimated to be less than 80 feet deep; one gallon should be used for similar sized wells with water greater than 80 feet.

3. Mix the chlorine solution above with 10 times as much water before pouring down well. Avoid pouring strong bleach down the well.
4. Open the well cap, or if your well has a well top seal, remove the ½" plug or air vent and use a large funnel to pour chlorine down well. **CAUTION: well caps and seals are integral to the safety and integrity of your well. They are often regulated by the state and local codes. Be certain to comply with all applicable codes and licensing laws, whenever opening a well. If you are unsure of any of the following steps, seek the assistance of a qualified or licensed well driller or pump installer or contractor.**

5. Do not attempt to remove the sanitary well seal without the assistance of a qualified well driller or pump contractor. Do not loosen the bolts that compress the seal.
6. Wells equipped with a packer jet pump can be thoroughly disinfected only though the removal of the pipe, pump and jet unit from the well.
7. As you are adding the chlorine solution, take precautions to protect yourself from splashing chlorine and fumes. Protect your eyes with safety goggles, and wear protective gloves and clothing.
8. Pour the chlorine solution down the well. Avoid pouring the chlorine solution on the pump wire connectors. If in doubt, use dry chlorine pellets (see Method II).
9. If the well is relatively deep, the disinfectant may be dispersed to the bottom by alternatively starting and stopping the pump several times. If possible, place a garden hose in the top of the well, and turn on the faucet and circulate the chlorine solution for 15 minutes until a strong 50 ppm chlorine residual is detected, by using a chlorine test kit.
10. Add more bleach as needed to bring up the chlorine solution residual in the well to 50 to 100 ppm.
11. If possible, circulate the water from the well by connecting a garden hose to a nearby hose bib or sill cock, and feed the water back down into the well. This will also wash down the sides of the well and insure proper mixing. After approximately 15 minutes a strong chlorine odor should develop. To be more precise use a chlorine test kit to make sure the chlorine is over 50 ppm.
12. Water should be pumped from the well into the pressure tank and plumbing system.

13. All water faucets should be turned on in the house and all outside fixtures and hose bibs including fire hydrants, watering troughs, and other supply lines to other buildings, until a 50 ppm chlorine residual is detected.
14. At this point, turn off the fixtures and let remain in the pipes a minimum of 2 hours, up to 12 hours or overnight.
15. After the chlorine has been left in the well and the plumbing system if applicable for a minimum of two hours, the chlorinated water can be discharged. Large amounts of chlorinated water should not be discharged into the septic tank, or onto lawns or gardens. If possible, discharge as much of the water as possible through an outside faucet with hose attachment. Do not discharge the chlorinated water into streams or rivers. The small amount of chlorinated water, which remains in the household plumbing, can be discharge into the septic system.
16. Backwash water softeners; flush the water heater; and replace all filters if present.
17. For wells and piping systems that have bacterial contamination or have been flooded, resample the water and retest for coliform, after all the chlorine residual is gone.
18. If bacteria are detected again, repeat procedures above. Until a safe test result is obtained, use an alternate known safe water source, or boil all water, or use bottled water.

In case of large diameter wells, a greater quantity of chlorine solution is needed. As a general rule, it takes 1 gallon of 5% laundry bleach to treat 1000 gallons of water with 50 ppm of chlorine.

NOTE: For heavily iron-fouled wells, severe contamination with bio-films or slime, or excessive levels of hydrogen sulfide gas, apply a 100 ppm or 200 ppm residual by multiplying the chlorine bleach used by 2 or 4 times in Table 1 or the pounds of chlorine pellets being used in Table 2.

Shock Chlorination by Dry Pellets (calcium hypochlorite)

Dry chlorine pellets, containing 70% available chlorine often much easier to handle and use than liquid bleach. Dry chlorine pellets can be used for sanitizing wells, cisterns, storage tanks and piping systems. The amount of pellets used will depend on the amount of water in the system to be sanitized.

1. Keep pellet containers tightly closed and child resistant locking devices in place. Pellets may cause eye damage, don't breathe, get on skid or get in eyes. Use gloves, protective clothing, and eye goggles during procedure.
2. Never use bare hands or cloth gloves to handle pellets, use plastic scoop or container to add pellets.
3. Clean the well house, springhouse or storage tank or reservoir. Remove debris and scrub or hose off any dirt or other deposits or interior surfaces. Pump to remove any suspended solids or foreign matter in the water if possible. Scrub interior surfaces with a strong chlorine solution containing ½ gallon household bleach, or ¼ gallon of pool chlorine to each 5 gallons of water, or by crushing five pellets in five gallons of water.
4. Determine how much chlorine to use to disinfect your well or holding tank by consulting Table 2. If you don't know your well depth, contact your well driller as they often keep records that will show the depth of the well.

As a general rule, 8 oz. of dry chlorine pellets with 70% available chlorine, dissolved in 1000 gallons of water, will produce 50 ppm of total chlorine residual.

8 oz = ½ lb which = 200 pellets.

Table 2 Wells: Pounds of 1 gram dry pellets needed for disinfection to obtain approximately a 50 ppm chlorine solution in the well.

Well Casing Diameter	Distance From Water Level to Bottom of Well (Water Depth)					
	0' – 50'	50' – 100'	100 – 200'	200' - 300'	300' – 400'	400' – 500'
4"	0.1	0.4	0.8	1.2	1.5	2.0
6"	0.5	1.0	1.8	2.5	3.5	4.5
8" – 12"	1.2	2.5	5.0	7.2	10.0	12.0
12" – 16"	3.0	6.0	12.5	19.0	25.0	31.0
20" - 24"	7.0	14.0	28.0	42.0	56.5	71.0
30" – 36"	16.0	32.0	63.5	95.0	127.0	159.0

5. Drop one pellet into the well and listen to hear if it hits the water. If the pellet hits the water, drop one-half of the number of pellets needed into the well. These will sink to the bottom and sanitize the lower part of the well.
6. Mix the remaining pellets with a few gallons of water in a clean plastic container, dilute this mixture by ten times, and pour the solution into the well.
7. If possible, circulate the water from the well by connecting a garden hose to a nearby hose bib or sill cock, and feed the water back down into the well. This will also wash down the sides of the well and insure proper mixing. After approximately 15 minutes a strong chlorine odor should develop. To be more precise use a chlorine test kit to make sure the chlorine is over 50 ppm.
8. Water should be pumped from the well into the pressure tank and plumbing system. All water faucets should be turned on in the house and all outside fixtures and hose bibs including fire hydrants,

watering troughs, and other supply lines to other buildings, until a 50 ppm chlorine residual is detected.

9. At this point, turn off the fixtures and let remain the pipes a minimum of 2 hours, up to 12 hours, or overnight.
10. After the chlorine has been left in the well and the plumbing system if applicable for a minimum of two hours, the chlorinated water can be flushed out. Large amounts of chlorinated water should not be discharged into the septic tank or onto lawns, gardens, streams, rivers or lakes. The small amount of chlorinated water that remains in the household plumbing, can be discharged into the septic system.
11. Backwash water softeners; flush the water heater; and replace all filters if present.
12. For wells and piping systems that have bacterial contamination or have been flooded, resample the water and retest for coliform, after all the chlorine residual is gone.
13. If bacteria are detected again, repeat procedures above. Until a safe test result is obtained, use an alternate known safe water source or boil the water.

Sanitizing and Disinfecting Storage Tanks

1. Clean the storage tank or reservoir. Remove debris and scrub or hose off any dirt or other deposits or interior surfaces. Pump to remove any suspended solids or foreign matter in the water if possible.
2. Scrub interior surfaces of storage or reservoir if applicable with a strong chlorine solution containing ½ gallon household bleach, or ¼ gallon of pool chlorine to each 5 gallons of water.

3. Inspect the storage tank for cracks, leaks around the lid or man-way, or vents. Make sure no insects, rodents or other debris can enter the tank during normal operation of the tank and water system, by making sure the lid is tight fitting, and any vents are properly screened.
4. Use the chart below (Table 3) to add enough chlorine bleach in the tank, to bring up the chlorine residual in the tank to the desired level. If you are using tank and need to continue to use the water in the tank after chlorination, consider adding enough chlorine to bring the levels up to 5 or 10 ppm and let sit for 12 hours or more.
5. If a thorough disinfection is needed and time is short, use a 50 ppm or 100 ppm residual and let sit for 2 to 6 hours. Drain and flush tank if using these higher levels of chlorine. Don't put large amounts of chlorine residual into drains leading to septic tanks, and avoid discharge into creeks, rivers or lakes.
6. Be careful if you have a steel storage tank, as corrosion may have occurred over time, and once the tank is cleaned it may develop leaks.
7. If your well is a low producer, consider having water trucked in. Often it is cheaper to have the water trucked in, and will prevent the stress on your well to refill your holding tank.
8. For maintenance of your tank, consider cleaning and sanitizing at least once per year.

**Table 3 Storage tanks: Disinfecting with liquid household bleach
(5% Sodium Hypochlorite)**

If using pool chlorine (12% sodium hypochlorite) double amounts below.

Storage Tank Gallons	Approx. parts per million of chlorine residual achieved by adding 5% chlorine bleach, in the amounts below. For pool chlorine, cut bleach amount used in half.				
	1 PPM	5 PPM	50 PPM	100 PPM	200 PPM
10,000	10 oz.	1.5 gallons	10 gallons	20 gallons	40 gallons
5000	5 oz.	3 qts.	5 gallons	10 gallons	20 gallons
2500	2.5 oz.	1.5 qt.	2.5 gallons	5 gallons	10 gallons
1500	1.5 oz	1 qt	1.5 gallons	3 gallons	6 gallons
1000	1 oz.	12 oz	1 gallon	2 gallons	4 gallons
500	1 Table-spoon	6 oz	½ gallon	1 gallon	2 gallons
250	1.5 - 2 teaspoons	3 oz.	1 qt.	½ gallon	1 gallon
100	1 teaspoon	1.5 Table-spoons	1 pint or 2 cups	1 qt	½ gallon

Table 4 Storage tanks: Disinfecting with dry 1 gram chlorine pellets

1 cup pellets = 200 pellets = 1/2 lb

2 cups pellets = 400 pellets = 1 lb

25 pellets in 100 gallons = 50 ppm

50 pellets in 100 gallons = 100 ppm

Storage Tank Gallons	Approximate parts per million of chlorine residual achieved by adding dry chlorine pellets in the amounts below.				
	1 PPM	5 PPM	50 PPM	100 PPM	200 PPM
10,000	1 cup	2.5 cups	5 lbs	10 lbs	30 lbs
5000	1/2 cup	1.3 cup	5 cups	5 lbs	15 lbs
2500	30 pellets	2/3 cup	2.5 cups	5 cups	15 cups
1500	18 pellets	1/4 cup	1.5 cups	3 cups	9 cups
1000	12 pellets	32 pellets	1 cup	2 cups	6 cups
500	6 pellets	16 pellets	1/2 cup	1 cup	3 cups
250	3 pellets	8 pellets	1/4 cup	1/2 cup	1.2 cups
100	1 pellets	3 pellets	25 pellets	1/4 cup	1/2 cup

Useful Measurements:

1 cup = 8 fluid oz.

1 pint = 16 fluid oz.

1 quart = 32 fluid oz.

1 gallon = 128 fluid oz.

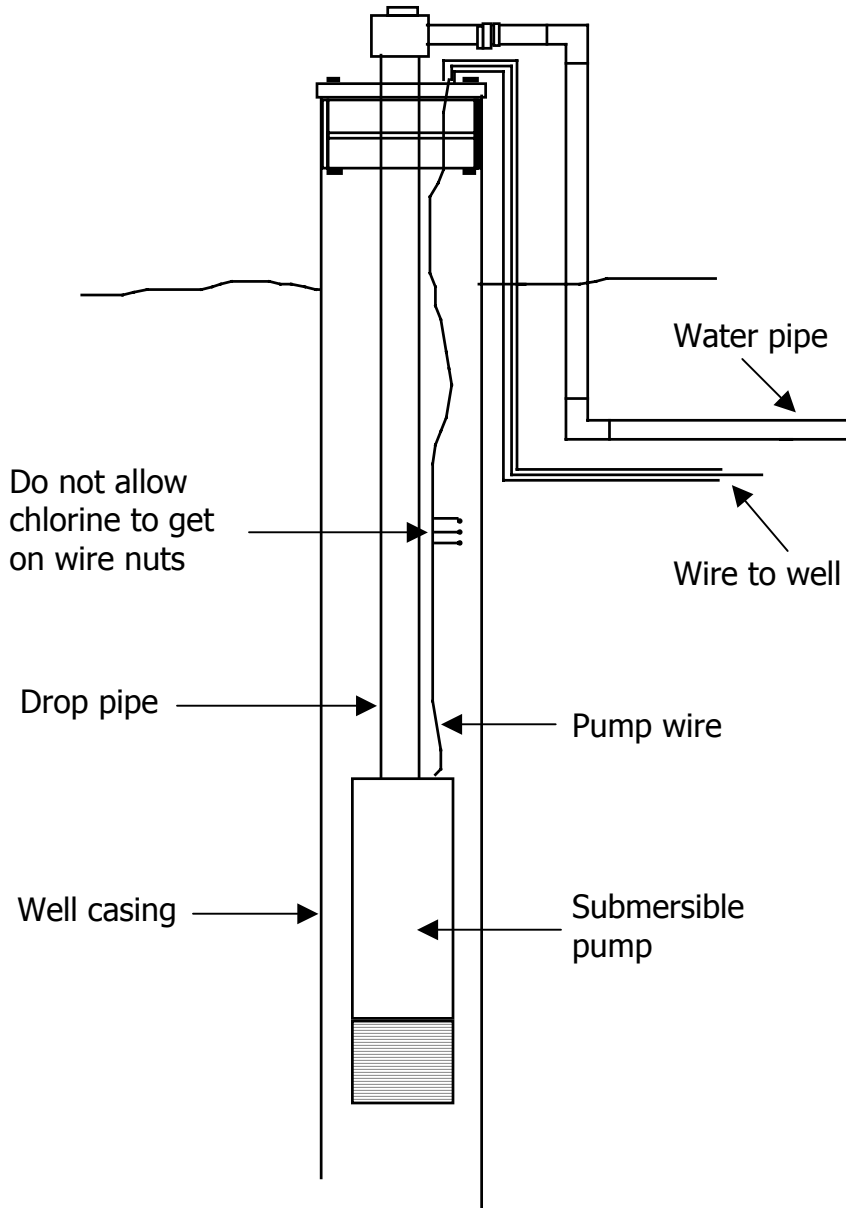
1 teaspoon = 1/6 fluid oz.

3 teaspoons = 1 tablespoon

1 fluid oz. = 29.6 milliliter (ml)

20 drops = 1 ml.

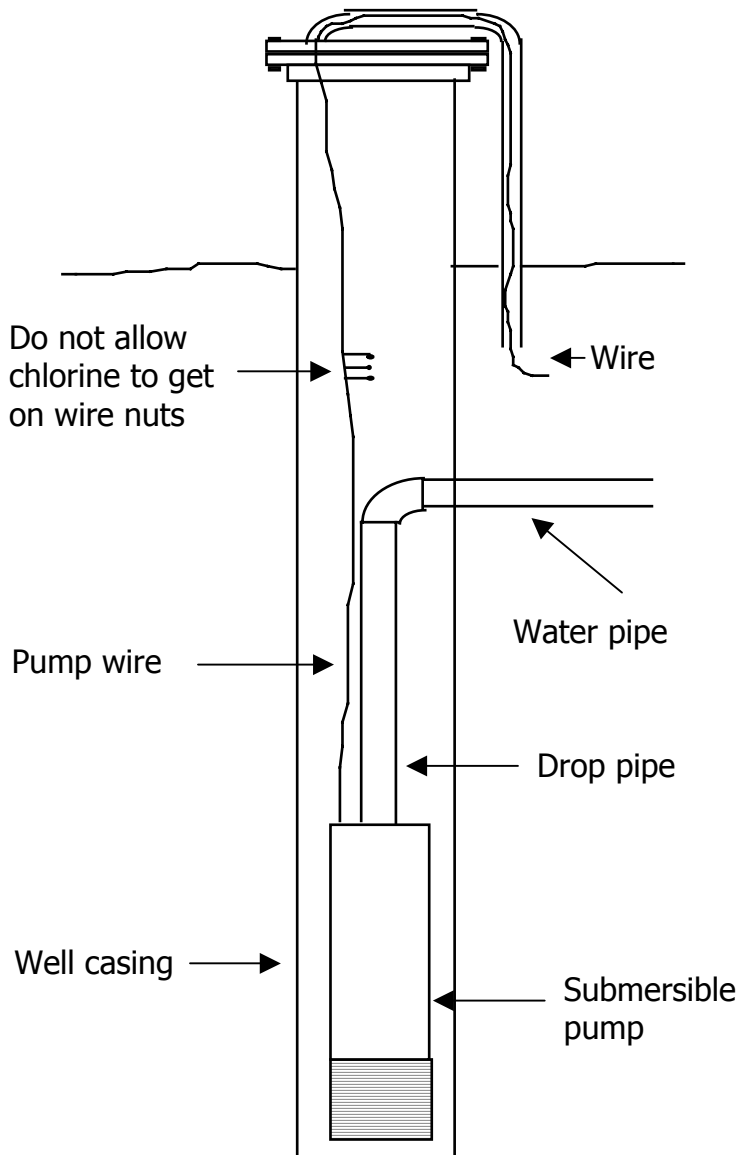
Fig. 1 Well & submersible pump: to shock chlorinate this type, remove 1/2" plug or air vent to drop pellets or chlorine down the well. DO NOT REMOVE TOP BOLTS.



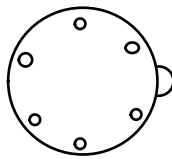
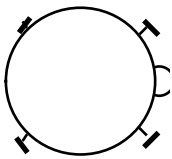
Well Seal : top of well has four bolts, one 1/2" plug, and one hole for pump wire. In this type, pump pipe or drop pipe typically comes out the top of the well cap or seal. Do not remove top bolts for access without consulting a well driller or pump installer.

WELLS EQUIPPED WITH A PACKER STYLE JET PUMP (NOT SHOWN) CAN BE THOROUGHLY DISINFECTED ONLY THROUGH THE REMOVAL OF THE PIPE AND JET FROM THE WELL. SHALLOW WELL JET PUMPS (NOT SHOWN) MUST BE DISCONNECTED IN ORDER TO DISINFECT THE WELL.

Fig. 2 Well & submersible pump: to shock chlorinate this type, open cap on top.



Well Cap Styles

Newer Model	Older Model
REMOVE 6 BOLTS AND LIFT OFF CAP	LOOSEN SET SCREWS, LIFT OFF
	

CAUTION: IF YOU ARE NOT FAMILIAR WITH YOUR WELL DESIGN OR CONSTRUCTION, DO NOT ATTEMPT TO OPEN IT OR SHOCK-CHLORINATE.

CONSULT A LICENSED WATER TREATMENT TECHNICIAN, WELL DRILLER OR PUMP INSTALLER. CALL US (831) 476 0515 OR EMAIL US AT OFFICE@advanced-water-systems.com FOR MORE INFORMATION.