DEVELOPING WATER SUPPLIES FOR FIRE PROTECTION

Mendocino County Fire Safe Council

In rural areas, water for firefighting is often hard to find. Every year, many homes are lost because water was not available to fire personnel. The homes may have had thousands of gallons of water – but it was in tanks firefighters could not access, because the tanks lacked the correct fittings.

This pamphlet describes how to make your rural water supply accessible for fire protection. It gives general information only. *Any persons developing water supplies for fire protection should consult with their local fire department to ensure they are complying with local standards.*

CAUTION

Fighting wildfires can be very dangerous. Persons planning to defend their own homes must take this fact seriously. They must be in good physical condition, and they must have a place to take shelter if the situation gets beyond their control. The decision to stay and fight a wildfire or to evacuate must be made based on conditions at the time of the fire. If evacuation is required, allow plenty of time to reach safety. Most people who die in wildfires are trying to evacuate, too late.

DRAFT AND PRESSURIZED SYSTEMS

Water systems designed for fire protection come in two basic types: (1) draft only systems, which provide water without pressure, and (2) pressurized systems, with the pressure provided either by a pump or by gravity.

Draft Systems

The simplest type of fire protection water system consists of a tank fitted with a standard ***2 1/2" male National Hose pipe thread fitting*** (sometimes called a "fire thread" fitting) controlled by a valve. This system requires the responding fire engine to attach a suction hose to the fitting and to draft, or suck, the water into the engine's pump, where it is pressurized. Because fire engines carry only a short suction hose, the fitting must be located so the engine can park very close to it. CAL FIRE (CDF) requires this to be a maximum of 7 feet. The parking location and the approach to it should be a hard surface capable of supporting a fire engine in any weather.

If it is impossible to park an engine this close, the resident must install some form of hydrant at an accessible, suitable location. We'll discuss this later.

Although a draft system usually meets minimum requirements and is the cheapest, it limits firefighters' options and takes more time to utilize. A draft system must provide unimpeded access between the fire fitting and the water supply. No pumps can be installed on the line, and the line cannot be connected to the domestic water supply. Drafting creates a great deal of suction that could damage a domestic pump. A fire engine might be unable to establish a draft because of drawing air through the pump or domestic supply.

Draft systems sometimes use a dry hydrant. A dry hydrant is a pipe connecting a water supply below ground level (such as a tank or pond) to an above-ground hydrant. When opened, the hydrant produces no water – the responding fire engine must lift the water by creating suction. Dry hydrants can be extremely problematic and should be avoided if possible.

Much more dependable is a "flooded" or "wet" draft hydrant. Such a hydrant already contains water because the water source is located higher than the hydrant. Even though a flooded hydrant may provide no pressure, it is far easier for a fire engine to establish the draft and get water flowing when the water line and hydrant are full or "primed."

A tank slightly lower than is needed can be placed on a platform that raises it to the necessary height. Water weighs about eight pounds per gallon, so any such platform must be strongly constructed.

Pressurized Systems

There are two ways to provide pressure to a water system: using gravity, or using a pump.

Gravity Systems

Gravity systems are generally the most dependable and desirable for fire protection. The typical domestic system – which pumps water directly from a well to a pressure tank to the home – utilizes small diameter water lines and low volume pumps which are insufficient for fire protection. Further, during fires, electrical service is frequently lost, and pumps fail, just when water is needed the most. Gravity systems may cost more because they require larger pipes and more tanks. But they will not fail when the power goes out!

In a gravity system, water is collected in or pumped to an elevated tank ***before*** it is needed. This tank is kept full and water is brought down to the home through a large diameter pipe. We'll show later that gravity systems can combine both domestic and fire protection water.

Elevating a tank above the point where the water is used provides one pound of pressure for every 2.3 feet in elevation gain. A tank placed 230 feet above the house will provide 100 pounds of static pressure. A tank 80 feet above the house will provide 35 pounds of pressure -- the approximate minimum needed to protect a home.

A gravity system intended only for supplying a fire engine could have much less pressure and still be very effective, IF (1) the water line is at least 2 $^1/_2$" in diameter (preferably 3" or more) and (2) the line is short with no humps or rises that can trap air, making drafting difficult or impossible.

Portable Pumps

Small, portable water pumps are another option for providing pressure. They can be used with tanks, in-ground or above-ground pools, ponds, streams, or any available water source. Numerous styles and sizes meet virtually any need. We strongly recommend that water pumps be pre-fitted with Fire Department Connectors (FDCs) – fittings with male National Hose thread on the discharge side of the pump. A 1$^1/_2$" fitting is adequate for systems for home defense only.

Persons planning to defend their homes themselves should use a 1$^1/_2$" fitting and 1$^1/_2$" hose, as a 2$^1/_2$" hose filled with pressurized water is extremely awkward and too heavy for most persons to pull. Check with your local fire department for their preference.

Portable pumps require a suction hose with compatible fittings and enough length to access the available water source: for example, a 10-foot hose for a swimming pool 8 feet deep.

If water is being drawn from a source where dirt, gravel, or other materials might be sucked in, the pickup/intake end of the suction hose should be equipped with a strainer. Small particles may pass through a pump without a problem, but they will almost certainly clog your fire nozzle at an inopportune time! The pickup must be protected by suspending it above the bottom or placing a shovel or similar object under it.

Some strainers come with a built-in "foot valve" that prevents water from flowing

backwards out of the hose. This is very helpful in initially establishing flow through the pump and maintaining flow if you need to stop and start the pump. The discharge should be compatible with your fire department's fittings.

WATER TANK SELECTION, INSTALLATION, AND PLUMBING

Tank Selection

Water tanks come in a wide variety of sizes, shapes, and materials. The tank you select will depend on your intended use, your budget, and where it will be installed. The green plastic free-standing tanks seen in rural areas are the most common for both domestic and fire protection purposes. The cheapest storage per gallon we found was a 3,000-gallon plastic tank about eight feet wide and eight feet tall. Most of these come with a standard (non-fire) 2" discharge fitting. Larger discharge fittings can be installed, and two or more tanks can be plumbed together and merged into a larger diameter pipe if needed.

The size and number of tanks needed depends on a few factors. When building a new home, you may be required by CAL FIRE or your local fire department to provide water for fire protection, generally 2,500 gallons. You may be allowed to use the same tank for both domestic and firefighting purposes ***IF*** you place the domestic discharge high enough on the tank that the water below it meets the fire requirement. For example, a 5,000-gallon tank could have the domestic water discharge/outlet halfway up the tank. The fire discharge comes off the bottom of the tank so it can utilize all water in the tank at any time. For most rural residential properties, 2,500 gallons is plenty for fire protection - ***IF*** you have done adequate clearing of vegetation around your buildings. Contact CAL FIRE, your local fire department, or the Fire Safe Council for information about this aspect of wildfire safety.

Tank Installation

Where and how to install tank(s) depends on the system's use. A single tank from which a fire engine can draft water must be located as described above. Tanks for a gravity system, the better choice, should be located between 80 and 230 feet above the home. Typical desired home water pressure is 40 to 60 pounds, which a 90 to 140 feet elevation will provide. The 100 pounds of pressure provided by a 230 rise is too much for most home systems, but is excellent for fire protection.

If more than one tank is used, the tops of all tanks must be at the same elevation. If one tank is higher than another, the high tank will overfill the low one, causing it to discharge water from the overflow. When tanks are plumbed or manifolded together, each should have its own shutoff valve so if one tank develops a leak it can be isolated. A single draft fitting will utilize all the tanks; and if installed at the same elevation, all tanks will draw down equally as water is used.

Plastic tanks should be protected from fire by clearing around them just as you clear around your buildings. Any adjacent burnable material must be reduced so the tank can survive when that material burns. Even full plastic tanks will melt when exposed to enough heat.

Tank Plumbing

The most common problem with adapting existing systems for fire protection is the size of the water pipe. Most domestic systems use either $^3/_4$" or 1" pipe. This is enough to supply a garden hose - but not a fire hose. We recommend a minimum of 2" pipe for systems supplying 1$^1/_2$"

fire discharges and 3" pipe for 2½" systems. Systems with multiple fire discharges may require larger pipes if more than one discharge might be used at the same time.

HYDRANTS

PVC pipe is normally used to bring water to the hydrant; and PVC or galvanized iron pipe is often used for the riser/standpipe/hydrant.

Various fittings can be used for the valve and discharge of the Fire Department Connection (FDC). We recommend using a "***Wharf Valve***," also called a "***Fire Valve***," which comes in 1½" and 2½" sizes. The inlet fitting on the valve's bottom is standard pipe thread, either male or female. The discharge/outlet is 1½" or 2½" male National Hose thread. A round wheel on the top controls the valve. These valves are somewhat expensive but are quality products and relatively trouble free. Standard PVC ball valves also work well, but they are more easily damaged and have a shorter working life, particularly when exposed to sunlight. All valves and FDCs should be painted red.

Hydrants should be set in a bed of concrete, especially draft hydrants. The suction hose required to use draft hydrants is very heavy and awkward, making it easy to damage or break a PVC pipe even if the riser is galvanized. Another problem is "water hammer," which occurs when a large volume of moving water is suddenly stopped when the valve is closed. Setting the hydrant in a substantial concrete base provides stabilization to protect against both these situations.

If a PVC riser is used, a strong support must be provided, because a firefighter pulling on a hose can easily snap PVC. Support can be provided as follows. Put a sleeve of 6" PVC over the riser and set it into the concrete base as an outer shell. Then fill the space between the riser and the shell with concrete. When the concrete sets, a solid, durable 6" barrel of concrete is set into the base or thrust block as one unit. Be sure to check thoroughly for leaks before you pour the concrete. Mark the riser with blue reflectors. Consult your local fire department for their specific requirements.

Hydrants should be located a short distance from the house. CAL FIRE requires 50 feet. At this distance, if the house is on fire you can likely still access the hydrant. The ideal location will allow firefighters to park near the hydrant and reach a fire anywhere inside the home with their pre-connected, 150-foot-long hose.

Some homes may require more than one hydrant. Outbuildings may require their own. One option is multiple 1½" hydrants with a single 1½" fire hose and nozzle available to each hydrant. Inexpensive plastic fire nozzles will flow about 60 gallons per minute.

We strongly recommend storing the hose in an elevated cabinet next to the hydrant, to protect it from sunshine and the elements. We also recommend using synthetic hose, as cotton hose can rot quickly. Nozzles should be pre-connected to the hoses, and fire hose cabinets should be clearly marked and easy to access.

Hydrants should be 18 to 24 inches high. State law requires that they be placed 4 to 12 feet from any road. Be sure to keep grass and brush at least 8 feet away, so hydrants can be found and accessed during a fire.

If hydrants could be hit by vehicles, protect them with barriers such as large rounds of firewood or concrete filled tubes. Hydrant discharges should be covered with screwed-on metal caps that prevent objects or creatures from getting into the pipes and being drawn into a fire engine or hose when the water is pumped.

MODIFYING EXISTING WATER SYSTEMS

In summary, if your current system can deliver at least 40 gallons per minute, it can be easily adapted for firefighting by simply providing a 2½" male National Hose pipe thread fitting where a fire engine can access it.

- If a fire engine can park within 7 feet of the tank, put the fitting and valve at the base of the tank.
- If an engine cannot get that close, install a pipe from the tank to a location the engine can reach, generally next to the driveway or parking area, and build your connection there.

Building a Siphon

If your tank doesn't have a large enough discharge port and it isn't practical to install one, consider building a siphon using 2½" or 3" PVC pipe and elbows, as shown in the diagram.

1) Cut a length of 3" PVC pipe that is 6 inches shorter than the height of your tank.

2) Cut a length of pipe 12 inches shorter than the height of your tank.

3) Cut a 6"-12" length of pipe and connect it to the first long pipe with a 90° elbow.

4) Put this section through the top of the tank, so the long pipe's bottom is 6 inches above the tank's bottom and the short pipe rests on the top edge of the tank.

5) Connect the second long pipe (#2) to the short piece, outside the tank, with another elbow. The bottom of this pipe should be about 12" above ground level.

6) Install either a "wharf valve" or PVC ball valve on the bottom of the pipe.

7) Cut and install another short length of pipe straight below the valve.

8) Cut and install another short length of pipe and connect it with a 90° elbow. This short pipe should be angled slightly away from the tank.

9) Finish the fitting with a 2½" male National Hose thread adaptor.

These are typical instructions that may not precisely match your circumstances. See the diagram for details.

The outside siphon pipe should be secured to the tank if possible. If not, set a 4"x4" or larger post next to the tank and secure the pipe to it, being careful not to obstruct the valve or discharge fitting.

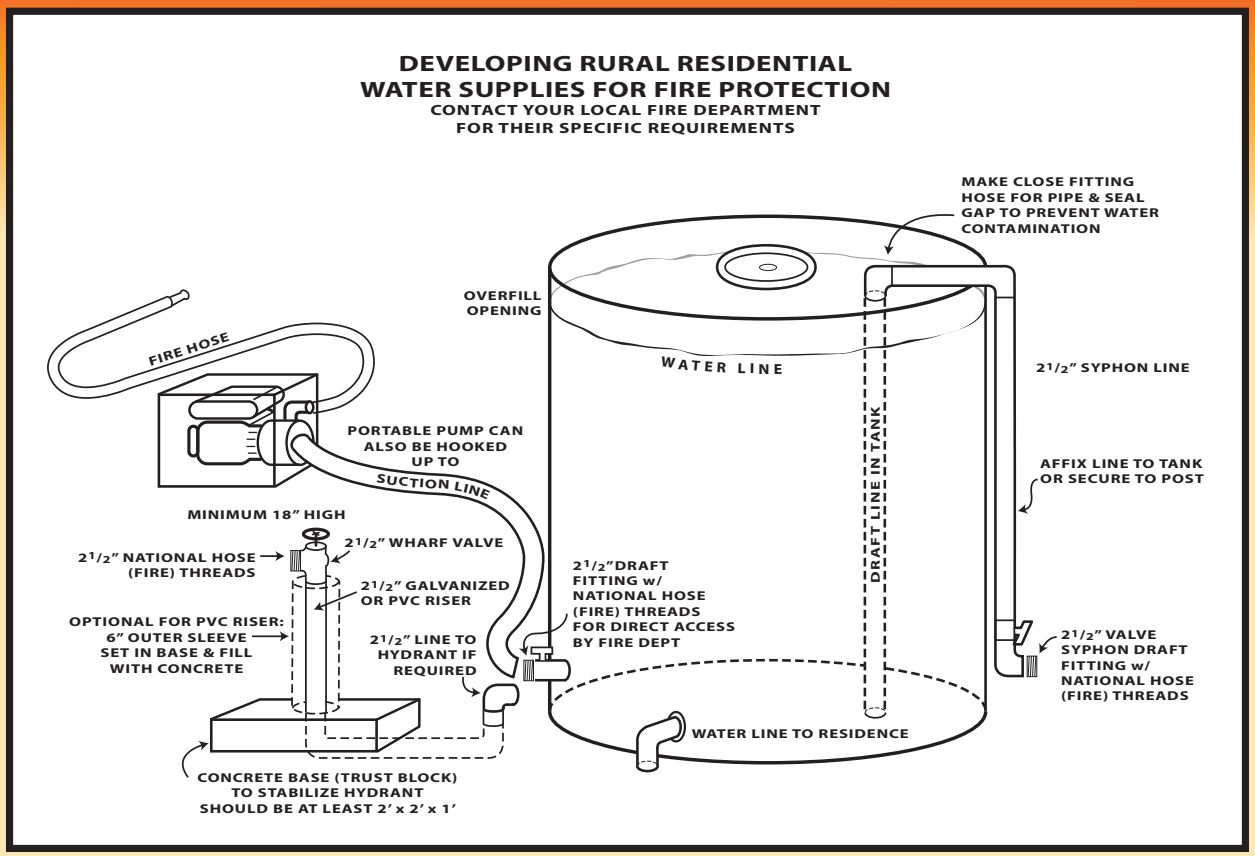
The siphon is established by pumping water into the tank through the fire fitting, then closing the valve. Once established, the siphon should take care of itself; it can be easily re-established if necessary.

If your existing system is not sufficient or adaptable, consider purchasing a tank solely for fire protection. Place the tank at least 80 feet above the house, or as high as is practically possible. Use at least a 2" water line, and up to a 3" line if affordable and the size of the water supply justifies the expense.

OTHER WATER SOURCES

Many fire engines carry portable pumps, but some do not. To make sure the fire department can use your swimming pool's water to protect your home, provide access so an engine can park immediately next to the pool and draft water from it.

A year-round creek, pond, or lake within a few hundred feet of your home can also be used for fire protection. It takes only a portable pump and a hose long enough to reach it. The farther the water must be moved, and the higher it must be lifted, the stronger the pump must be. Measure your distances and compare them with a pump's specs before purchasing one.



LABELING WATER FOR FIRE PROTECTION

Water supplies and fittings must be plainly labeled to provide quick access and identification.

1) ***Install round blue reflectors on your address post and wherever necessary to direct firefighters to your water. To a firefighter, a blue reflector means water. DO NOT use blue reflectors for any other purpose – this could lead to confusion and lost time during a fire.***

2) ***Paint or placard the word "Fire" or the abbreviation "FDC" in large letters on your water supply.*** It's helpful to include the number of gallons available. Make sure to keep the tank full!

3) ***Paint fire valves and fittings red, and place arrow(s) pointing to them if necessary.***

ROOF SPRINKLERS

Roof sprinklers should be activated only when the fire is close. Otherwise the water will evaporate and the supply may be gone before it is most critically needed. Sprinklers can be affixed to the eves as a permanent installation or just placed on the roof. Most domestic water systems provide sufficient flow and pressure to supply two large sprinklers to cover moderate-sized houses and adjoining decks.

MAINTAINING YOUR SYSTEM

Whatever water system you select, it must be maintained. Even a simple tank and draft fitting needs to be "exercised" a few times a year. Valves left idle become sticky and hard to use. Pumps need to be used periodically to ensure they start and run properly – and that you remember how to work them. Hoses must be inspected annually to make sure they haven't rotted or been chewed up. A good way to make sure your system works is to use it to wash your home in late spring. Everything gets inspected and exercised, and your memory is refreshed.

A FINAL WORD OF CAUTION

When it's time to go, it's time to go...

If you have – or intend to build – a water system for fire protection, and you plan to stay and fight the fire, you must first prepare very carefully.

(1) Have a plan in case your water system fails or anything else goes wrong. Have a shelter or place that (a) you're sure you can reach, (b) will not burn, and (c) is so far away from anything flammable that you can survive there without injury. This could be a large paved or rocked parking area, a green lawn, or a swimming pool or pond surrounded by green landscaping. The heat from a fire can burn human skin from 100 feet away, so don't take chances.

(2) Be in good physical shape. If you have ***any*** condition that impairs your ability to do hard physical work in stressful conditions, plan to evacuate.

(3) Make a "risk versus gain" decision based on how well your home is prepared, the tools you have available, and the fire conditions. Hot dry weather, low humidity, high winds, and vegetation that has dried for months can make even the best prepared home a death trap. If you don't have an area where you can "shelter" safely, with confidence that you'll survive without injury no matter what happens, plan to evacuate. Remember, most people who have died in wildland fires waited too long to evacuate.

Don't become a statistic. Prepare to be fire wise and fire safe!

For copies of this pamphlet, or information about other aspects of wildfire safety, contact the Mendocino County Fire Safe Council at (707) 462-3662, 151 Laws Avenue #B, Ukiah CA 95482, or firesafe@pacific.net. Our comprehensive publication Living with Wildfire in Mendocino County is available from our office or at www.firesafemendocino.org/livewithfire.pdf.

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