Culverhouse Community Garden Water System Basics 4/17/2013

The FCCG solar-powered water system comprises two electrical systems:

- two Photo Voltaic (solar) panels are dedicated to the well pump.
- two PV panels, in conjunction with four batteries, are dedicated to the pressure pump.

I. Components:

A. **Well system:** Well, submersible pump, two solar panels in series, well-pump solar charge control and monitor, cistern with a float valve, lid combination padlock, labeled Well Pump PV panel circuit breaker, cistern dip stick for water level, and cistern gravity feed faucet outside shed.

B. **Pressure system:** Pressure pump, two solar panels and four deep-cycle batteries [located in the Battery Box] coordinated by a solar charge controller [aka 'brain'], a labeled Pressure Pump PV circuit breaker, intake (foot) valve inside cistern, canister filter, pressure gauge and pressure cut-off switch, pressure tank, red lever flow valve, labeled Pressure Pump OFF/ON electrical switch, pressure water faucet outside shed, and green flow valve outside shed.

See schematic drawing of the system at the end of this document.

II. Well pump/cistern

The well pump/cistern system is entirely dependent on sun shine. During cloudy weather there will be times when there is insufficient solar power to turn the well pump on. [Solution: If the dip stick indicates the water level is below 400 gallon mark, wait for sun shine before using hoses.]

The well pump/cistern system is automated, and besides needing sunlight, depends on the functioning of a float valve in the cistern that turns the well pump OFF when the cistern is filled, and ON when the water in the cistern is low.

The well pump solar charge controller/monitor indicates when the pump is running by a series of green lights moving up a schematic of the well and pump. When the cistern is full and no pumping is occurring, a yellow light comes on at the top of the schematic of the cistern.

In the upper right hand corner, there is a pressure sensitive on and off switch – green/red. This could be used to turn off pump, but we preferentially use the WELL PUMP circuit breaker switch when problems arise.

The well pump can be turned OFF manually by cutting its power from the PV panels using the Well Pump circuit breaker box.

Trouble shooting:

A. If the float valve fails to automatically turn the pump off when the water level reaches the top, water will spill out of the lid of the cistern. Solution: turn the well pump OFF at the manual switch.

B. If the float valve fails to automatically turn the pump on, the water level will fall below the intake valve and the pressure pump will labor and suck air. Solution: Wait until the sun shines long enough to power the pump.

Cistern: The cistern has been painted with several coats of beige paint to make it opaque. Additionally we add a cup of pool chlorine (diluted in a bucket of water) through the lid flange about once every 3-4 months. Both these actions control algae build up, preventing the intake valve from getting stuffed up. The intake valve is installed in a vertical position at about the 400 gallon level of the cistern.

The dipstick indicates the level of the water in the cistern. If the red area touches black, the water level has fallen nearly to the intake valve level. Gardeners must check to see that the well pump is running.

III. Pressure Pump, pressure tank, and piping

The pressure pump and tank system are automated but depend on the cistern water level being above 400 gallons, which is the level of the intake (*foot*) valve. If the water falls below the vertically-oriented intake valve, the pump will suck air. Symptom: hoses will sputter and gasp – water mixed with air.

A heat sensitive switch at the base of the pump turns the pump off in the case of overheating – it will not burn out.

The pressure pump is turned off manually at the labeled Pressure Pump OFF/ON electrical switch.

DO NOT turn off the pressure pump at the Pressure Pump circuit breaker as the PV panels would then be off and could not charge the batteries.

a) Pressure process:

Outside the shed: Water flows from cistern through a union near the base of the cistern and contained in an open paved box. Then it flows through an underground pipe, up the wall of shed about a foot, and inside. Attached to it is the wiring from the float valve on its way to the Well Pump Monitor box.

This pipe is fitted with a faucet which allows access to water at gravity-feed pressure.

Inside shed: Water flows through a canister filter to the pump. Blue cut-off valves on either side isolate the filter for monthly changing. Spare filters are located over the shed door frame.

Water flows out of the pump to a T in the pipe which directs water either to the pressure tank or straight out to answer hose demand.

When demand stops, the water is diverted to the pressure tank, automatically turning off when the pressure gauge reads about 42 psi. The pressure gauge switch and gauge are located at the T in the pipe.

When the hose demand lowers the water level in the pressure tank and pressure drops to about 20 psi, the pressure pump switches on. Water is delivered directly to the hoses at a reduced pressure. Approximately four gardeners can water with open hoses. Spray nozzles or drip hoses put back pressure on the pump and the supply will fall dramatically. [Solution: remove nozzles or wait until fewer gardeners are watering.]

A red lever valve is located to the left of the T in the outlet pipe and is used to cut off all water to the piping/ faucets/ hoses. When the shed is locked and the red valve closed, no water can be obtained from the outside.

Outside, an additional valve (green) is located in the outlet pipe between the red cut-off valve and the garden pipe field.

An outside faucet from the pressure system is located on the east outside shed wall. Currently it is capped with a pressure gauge and not used for water access.

b) Electrical power to pressure pump:

The pressure pump is powered by two solar panels wired in parallel with four 6-volt batteries (which are wired in series) producing 24 volts. The labeled Pressure Pump PV circuit breaker box controls only the power from the PV solar panels. Do not turn it off as the PVs cannot then charge the batteries.

The solar charge controller provides an even voltage to the pump - using all solar pewer, all battery power, or a combination of both. The labeled Pressure Pump OFF/ON switch lies between the solar controller (*brain*) and the pump. When we leave the garden, we turn the pump off by this switch. Bill Johnson of Brilliant Harvest estimates that the batteries could run the system for about a day of totally cloudy weather.

c) Surge protection:

Both the well pump and pressure pump electrical systems have surge protectors attached at the labeled circuit breakers. The entire system is grounded as per permitting requirements. Additionally the shed has a lighting ground.

d) Battery maintenance:

The batteries are maintained on a monthly basis. Specific gravity (density) and water levels are recorded and distilled water added when needed. [See clip board and record sheets above the Battery Box.] The batteries are charged automatically by 2 PV panels.

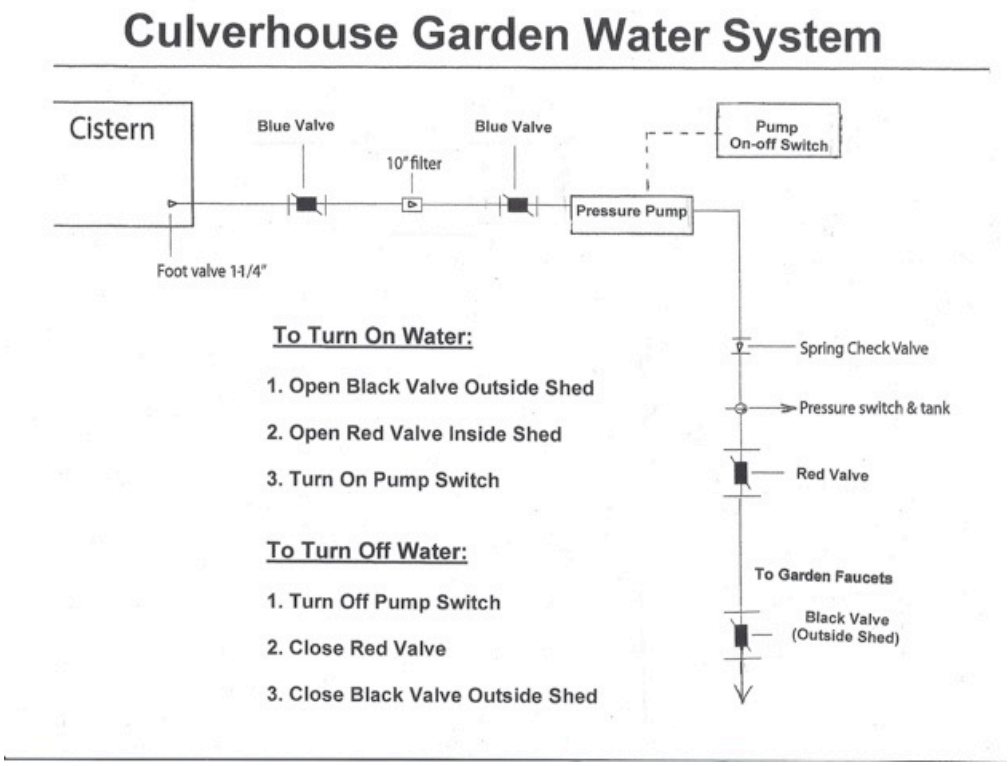
IV. Piping to Faucets: A schematic design of the piping system is attached.

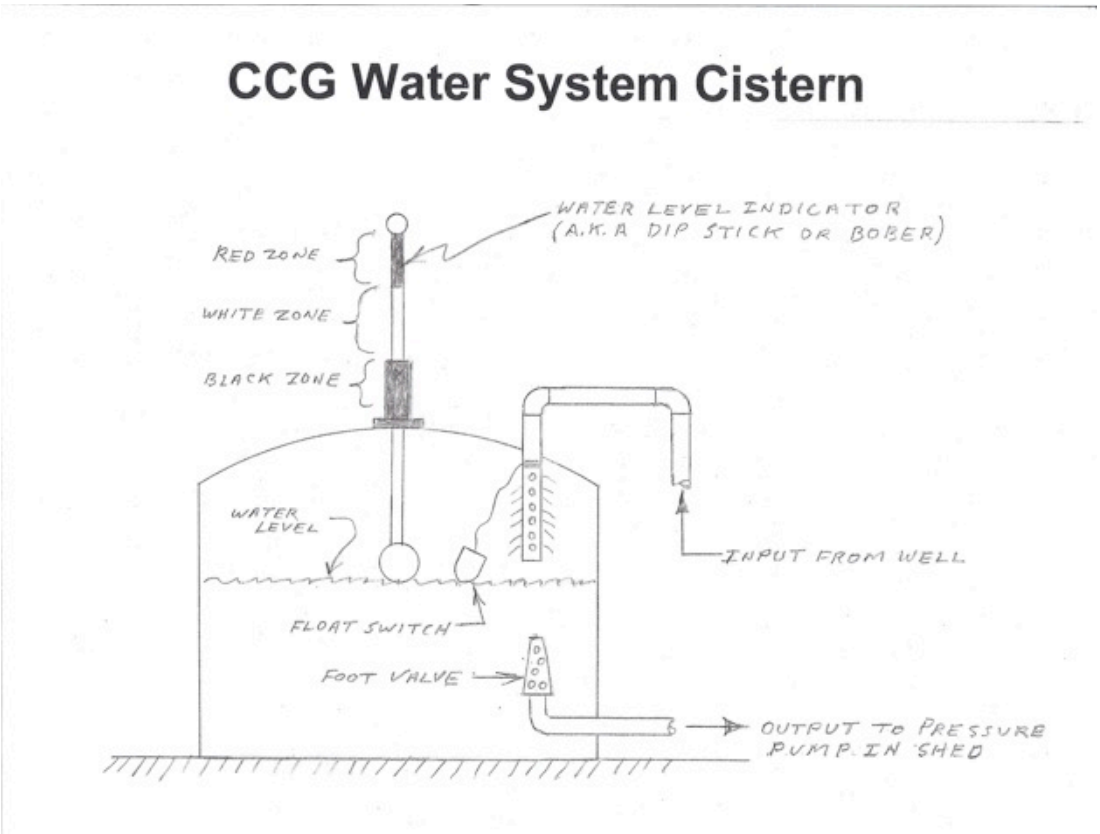
All the garden piping is buried under paths. A two-inch PVC pipe carries water from shed outlet to the center of the garden to enter a ring of 2" pipe. From it, eight 1 ½ inch pipes radiate outward with one spur added on the second path in from the outer ring of plots. Four of the radials continue into the corners of the garden to a faucet. Total, 28 faucets.

Installed at the head of each radial is an underground cut-off valve, with a lid of green plastic. This allows us to cut off water flow to one section for repairs, while allowing water to flow to all other sections.

Additionally, an irrigation green-lidded drain valve, boxed in with pavers, is located at the head of the first ray path east of the entry 8 foot path [a.k.a. I-95].

V. Drawings of the system and the field of PVC piping/faucets:





(Scanned copies of all component manuals, installation and wiring schematics, permits, etc. are available from the leadership team, as well as in print in the owner's note book provided by the installer- Brilliant Harvest. This notebook is in the shed on the top shelf.)