Rainwater Harvesting. (from many sources detailed below)

*For every 1000 square feet of roof space approximately 620 gallons of water can be collected. This means on a 2000 square foot roof 1240 gallons of water can be collected from a 1" rain event.

*Rainwater can be used for any normal water usage. If being used for non-potable needs it should go through fine filtration before being stored. This process keeps the water from becoming stagnant in the cistern. If being used for potable needs it must go through an additional filtration system which typically involves a UV light and a water purification kit such as carbon filters or reverse osmosis.

*A properly designed system consists of fine filtration before the water enters the tank. This will foster the formation of a natural biofilm in the bottom of the tank that will oxygenate the water and eliminate growth of bacteria. The tank should never be completely emptied or cleaned as this would kill the biofilm. If not properly filtered, debris in the water will decompose, sucking precious oxygen from the water, which quickly causes stagnation and degradation of the water quality. When removing the water from the tank it should always be pulled through a floating suction filter positioned just below the surface of the water. This prevents disturbance of the natural biofilm on the bottom of the tank, and eliminates the opportunity of pulling any pollens that may be floating on the top. It is also important that any above ground cisterns be dark in color so that no light can get into the tank. This prevents the growth of algae.

FAQ's

1. Can I be self sufficient in water needs in the desert…

The simple answer is yes, with care and planning. But the caveat is that while the science is there, the will and the money issues make it impractical at this point. Still, we should start putting into place those necessary steps so that "In case of an emergency" we can at least hold our own or "tread water" both metaphorically as well as actually. We are putting together information on this subject as members of TTEV are on several Task Forces working on that very question.

2. Will those living at a TTEV project like "The Bridge" be required to be water self sufficient?

Ideally we will perhaps try this approach. But in all likelihood we will take it one step at a time. Example would be rainwater harvesting, application of permaculture techniques to direct any excess water into areas where it can be used naturally or into cisterns for use in waterless seasons or times.

3. Can I hook up a drip system to a cistern…

Yes, but not with a traditional automatic timer and valves. Drip irrigation connected to a rainwater cistern is by nature a manual system that relies on the gardener to manage the water. A drip system will run off of the pressure in the cistern but it needs to be designed for low pressure. Most cisterns produce less than 10 psi. Experience has shown that Rainbird 2 gallon per hour xeribug emitters or 4 gallon per hour flag-type emitters work best.

3. How much rainfall can I collect…

This depends when the rain comes. See the simple formula above. In general though, during southern Arizona's two rainy seasons, your cisterns will overflow. It is usually impractical to install enough cisterns to capture every drop. Your roof will almost always shed much more water that you can collect. The formula for figuring out how much water your roof will generate is the roof catchment area (sq. ft) times the average yearly rainfall (inches) times 550 gallons divided by 1000. If you can capture half of this number, you will be doing well.

4. Are there Graywater Regulations in Arizona…

The Arizona Department of Environmental Quality regulates domestic graywater systems and, in some instances, specific counties are involved. Rules permit single and multi-family residences to use graywater for surface irrigation under certain condition s. These conditions include DEQ approval of the design and construction of the system. The system must include a settling or holding tank to settle out the grit and heavier material from the graywater. A filtration device is also required. If the graywater is to be applied to the surface a means of disinfecting the graywater also is necessary. However, other possibilities remain that we are studying.

DEQ has delegated authority to the health departments of Pima, Maricopa, and Yavapai counties to perform this technical review of graywater use systems. The delegation agreement specifies the counties' areas of authority.

Also, graywater used for surface irrigation must meet allowable water quality and monitoring specifications. Allowable limits are set for fecal coliform and chlorine residuals. A sampling schedule also is established.

When discussing graywater use regulations, an important distinction is whether graywater application is surface or subsurface. The above rules refer to surface irrigation. The rules define surface as extending two feet below the surface, although technical review officials generally interpret surface as 16 inches.

The water quality standards for surface irrigation are more stringent than what is required for subsurface use, defined as the area below the surface level. Subsurface use must meet water quality standards for groundwater.

Some critics claim that by defining surface area as two feet below the surface, the rules essentially intend that all graywater use will be surface use. Distributing graywater below two feet greatly limits its usefulness. Some critics claim it negates its usefulness.

The application of these standards discourage many people, at least those checking on the graywater source of most popular appeal--the draining washing machine. About 90 percent of people calling DEQ about graywater use want to drain their washing machine directly onto backyard vegetation. This decidedly is graywater surface irrigation.

First of all they would be told that graywater cannot be discharged directly on the surface where ponding will occur. Rules require that first the washing machine drain into a holding tank before drainage through an irrigation system. Then the water must be filtered and, since it is for surface use, it must be disinfected to meet established water quality standards. The fecal coliform level must be sampled daily which means testing by

a state certified laboratory, at a cost of about $100 per sample. (At this point most people either give up the idea, or pursue it without official approval.) Fecal coliforms especially concern health officials because of possible surface settlement.

As would be expected this monitoring requirement discourages greater graywater use, at least legal graywater use. Some officials believe it could be changed, with no adverse health effects. They suggest that more research is needed to determine the quality of graywater coming from the various systems. The results then can be compared to regulated standards to determine if they are too high or strict.

For example, possibly a case could be made that fecal coliform sampling needn't be as frequent and that disinfection may not be needed. The fecal coliform concern historically was linked to washing cloth diapers. Today, fewer households have babies, and those that do often use disposable diapers or a diaper service.

-Home Use of Graywater, Rainwater Conserves Water--and May Save Money
some information in this article and faq's by Joe Gelt

5. How does graywater differ from water harvesting…

Rainwater from roofs are in a different classification than that being recycled after use in your home and we will address both issue in our CC&R's at TTEV. For example,. graywater is more readily stored than rainwater, with less cost. Since it is a dependable source, its storage system does not have to be very large. A typical residence could get by with about a 1200-gallon tank, the size of the standard concrete septic tank. Being infrequent, rainfall requires a larger storage capacity so supplies can carry over between desert rainfall events.

Rocky Brittain, research associate with the University of Arizona's College of Architecture, designs rainwater harvesting systems for various facilities, including private homes. He begins by conducting a complete water balance analysis by noting the location of plants to be irrigated, the monthly rainfall in the area, and the available options for concentrating rainfall directly to the plants.

By computing expected rainfall and vegetation water needs Brittain is able to determine whether storage is required and, if required, the monthly storage need. He then is able to size the appropriate storage system. Tanks are an expensive item, with the excavation cost to install a tank sometime equal to the cost of the tank.

Rainfall is stored in steel or concrete tanks. Brittain improvised a rainwater harvest storage tank using a swimming pool. A lid was installed on the pool and buried beneath a driveway. The result was a rainwater storage tank 40 ft. by 8 ft. and 8 ft. deep, with a capacity of 20,000 gallons at a cost of about $22,000 (in 2008). About one dollar per gallon is the average cost for most underground storage units.

The least expensive rainwater storage system makes use of an above-ground swimming pool, with a lid or cover to reduce evaporation. Rainwater then can be stored for about .07 cents a gallon. The financial advantages however may not outweigh the inconvenience of living with this unsightly above-ground unit taking up a large area of the backyard.

The image of falling rain may be pure and refreshing but harvested rain is not without water quality concerns. Rain in certain urban areas may contain various impurities absorbed from the atmosphere, including arsenic and lead.

Certain desert conditions also can cause rainwater quality concerns. Desert rain is infrequent and, therefore, bird droppings, dust and other impurities accumulate between rain events. They then occur in high concentrations in runoff when it does rain. As a result, the quality of harvested rainfall needs frequent monitoring if it is used for potable uses.

Various methods are used to purify rainwater. First-flush devices ensure a certain degree of water quality in harvested rainwater. The first five gallons of runoff from a gutter, roof or other surface is likely to contain various impurities such as bird droppings and dust. A first-flush device prevents this initial flow from draining into the storage tank.

In addition, use of a new innovative filter discussed in this section can make a serious difference. Check out that issue here http://www.raincatchers.net/filters/ .

Many first-flush devices are simply and cleverly designed. Such devices include tipping buckets that dump when water reaches a certain level. Also there are containers with a ball that floats with the rising water to close off an opening after an inflow of five gallons. Water then is diverted to another pipe leading to the cistern. This use of simple technology is an attractive feature of rainwater harvesting. (Water harvesting systems are not readily available on the market without some research.)

References:
Some information supplied for this portion of article comes from:
http://dot.tucsonaz.gov/stormwater/education/waterharvest.php