Cisterns in the State of Florida

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Southwest Florida Water Management District
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February 1997

Protecting Your Water Resources

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Purpose

Cisterns have been used to collect and store rain water since the time of the Mayans, and are used as a primary and/or supplemental water source where a sustainable fresh water supply does not exist. Recent concerns over stressed ground water supplies within the Southwest Florida Water Management District (District) boundaries have increased the interest in rain water cisterns as a water conservation tool. The purpose of this paper is to provide cistern information and to investigate opportunities to promote their use.

Background

A cistern is any container capable of capturing and storing water, such as rain water, or grey water generated by a residence. Cisterns may be used for potable or non-potable purposes. Potable water is used for drinking, cooking, dish washing, and bathing; non-potable water is used for irrigation, toilet flushing, and laundry. Water quality and public health are the major issues concerning potable water. Grey water cisterns are not suitable for potable uses because the water collected in such a system originates from residence showers, laundries, and sinks, and contains numerous contaminants.

Within the District, Sarasota and Charlotte counties have the most cisterns, which are often located where it is not economically feasible for public utilities to provide water service, and the ground water quality is not suitable for use. The barrier islands of both counties are examples of situations where shallow wells or utility services are not available, and similar situations occur in other areas of the state, such as the Florida Keys.

Issues

Laws. Cisterns are not prohibited by local statutes or codes, and county building departments allow their construction. Although there are no specific regulations, homeowners should contact their local building and zoning office before installing a cistern. If cistern usage increases significantly, it is reasonable to expect that local authorities may develop standards dealing with construction and maintenance. For example, the State of Ohio allows cisterns if they meet certain requirements; including, but not limited to, design and construction, water sampling, bacteriological testing, and location (Fok 1982). If a county or municipality develops codes, additional personnel and equipment may be required for enforcement, which will add to the cost of the water saved.

Construction Considerations. Placing a cistern under ground in some areas will pose problems if the water table is fairly shallow. A partially filled cistern may become buoyant during times of heavy rainfall or high water tables, requiring a substantial anchoring system. Infiltration of surface and ground water may contaminate the cistern water. Deed restrictions may preclude above-ground installation.

Size. A cistern must be built to an appropriate size for its intended use, or the usage will function only as a supplemental water supply. For example, a 2,000 gallon cistern may be sufficient for indoor use, but it may not be sufficient for irrigation use because an average size yard (a 100 foot by 100 foot lot) needs approximately 4,000 gallons of water for one irrigation cycle (based on 7,000 square feet of irrigated area and one inch per week). Determining the size of a cistern is further complicated by rainfall and the amount of water that can be collected. An average house (1,700 square feet interior) with a roof area of approximately 2,000 square feet can collect 1,400 gallons of rainwater for each 1 inch of rain. From October through May, a period of 32 weeks, the District receives an average of 2 1.6 inches of rainfall. Capturing and storing all available rainfall would yield only 30,240 gallons, roughly one third of the total irrigation demand for that period. However, all available rainfall cannot be captured because of uneven rainfall distribution, resulting in periods of excess supply or minimal supply. During the summer months, when most of our rainfall occurs and when dependable replenishment of the cistern system is likely, irrigation demand is very low.

Maintenance. Maintenance of potable cistern systems is another impediment to widespread usage. "...an obstacle that will have to be overcome is inconvenience. Local people want a modem up-to-date system with the convenience of turning a tap to receive water. Therefore, catchment system design must incorporate some forms of sophistication without sacrificing simplicity if rainwater catchments are to compete favorably with other water sources" (Romeo 1982). Regular maintenance is required for the collection vessel, as well as for filters, pumps, and the collection surface. Leaves, bird droppings, and air borne pollutants are all contaminants that negatively affect water quality. Petroleum-based roof surfaces may not be well suited for rainwater harvesting due to petroleum by-products present in the runoff. Owners of such a roof may have to install more sophisticated filtration equipment to remove these by-products, or have a new roof installed. Advanced treatment needed to bring water to potable standards requires careful monitoring and constant vigilance by the homeowner in order to ensure a safe water source.

Maintenance of non-potable cistern systems is not as frequent or costly as is required for potable cisterns. Almost any collection surface will work and the advanced treatment component is eliminated because water quality is not as much of a concern. However, the collection area and distribution system must be maintained. If the water is to be utilized for non-potable uses in the home, such as toilet flushing and laundry, care must be taken to ensure that the potable and non-potable water supplies do not become interconnected. "The setup of the roof water cistern as envisioned will entail a cross-connection between the potable and non-potable sources of water. This is a potential health hazard as per the Public Utilities Act (Public Utilities Board, 1977) which stipulates that it is mandatory that such cross-connection should not be allowed" (Appan 1982).

A grey water cistern system uses wastcwater from washing machines, lavatories, kitchen sinks, and bath water. Care must be taken to ensure that fecal matter from soiled diapers or other sources does not enter the system. Grey water systems pose the greatest health concerns due to the nature of the water collected. Because of these concerns, grey water systems, as permitted in other states such as California and Arizona, are allowed only for purposes of irrigation and are required to use sub-surface irrigation systems exclusively, and are not permitted for use on vegetables.

Another consideration regarding grey water cisterns is that access to the plumbing system in many Florida homes is limited. Many Florida homes are built on a concrete slab which does not allow easy access to piping, making it extremely difficult to install a collection system for a grey water cistern.

Cost. Probably the most significant issue influencing the use of cisterns is that of economics, because other sources of water are less expensive. Current cost estimates of a professionally installed 2,000 gallon above-ground potable cxstem are between $3,500 and $3,800, and between $3,500 and $4,500 for a below-ground potable cistern. Periodic maintenance of filters, pumps, piping, and the collection area will add annual maintenance costs of approximately $360. These estimated costs result in a per thousand gallon cost for potable water of between $6.06 and $7.79, (based on a twenty year amortization of the capital costs at eight percent interest and assuming a cistern will provide 173 gallons per day). In comparison, Hillsborough County Utilities charges $2.18 per thousand gallons and the City of St Petersburg charges $1.43 per thousand gallons of potable water. As stated by Adhityan Appan, Associate Professor at Nanyang Technological Institute in Singapore, "The large capital costs for such roof water collection systems can be discouraging especially as treated water of a high order is at present a relatively cheap and readily available commodity in the local context."

Shallow wells and reclaimed water are less expensive options when compared to cisterns used for irrigation. Current cost estimates for a 4,000 gallon non-potable above-ground cistern are between $5,000 and $5,600, and between $5,000 and $7,000 for a below-ground cistern. For comparison, a shallow well can provide water for irrigation for approximately $900. The City of Dunedin will provide a homeowner with reclaimed water for approximately $1,207 and the City of Oldsmar will provide this service for between $700 and $1,300. Costs for reclaimed water vary greatly between utility service areas, and within a specific service area, depending on capital costs involved with providing reclaimed water. These costs are dependent on such things as number of customers and proximity to the water source. Yearly costs associated with these non-potable options are not significant and generally balance out.

Promotion

The use of cisterns could provide a significant contribution to our water supply. For example, if5 percent (64,355) of the households in the coastal counties within the District utilized a 2,000 gallon potable cistern system, approximately 11,101,238 gallons per day could be saved. If a household used a 4,000 gallon non-potable cistern 41 percent of the outdoor irrigation demand could be met. However, the cistern contribution would be small during periods of little rainfall. The question is, how can people be encouraged to install cisterns when they are more expensive and not as convenient compared to other sources of water?

Some counties have limited success offering incentives for cistern usage. Sarasota County provides for a reduction of approximately 11 percent in the storm water assessment for a rainwater cistern with a minimum capacity of 2,500 gallons. The average assessment for equivalent storm water units is $69.00 per residence. The economic benefit to a homeowner is $7.73 per year. Participation in this program has been minimal. Monroe County actively promotes the use of cisterns to decrease demand on a limited infrastructure. Monroe County provides for extra points in the building permit scoring matrix, used to award a limited number of permits, if a cistern is used. This incentive is offered to decrease demand on a limited infrastructure.

Because of cost, water utilities do not promote cisterns as they do other water conservation measures. For example, a rebate of $2,700 would be required to lower the cost of cistern water comparable to that of potable supply from a utility. The average estimated savings per household per day for cistern usage would equal 76 gallons. A utility could rebate two toilets at a cost of approximately $200, or distribute 8 retrofit kits at a cost of $90, to realize the same 76 gallon savings, or a utility could spend $ 15,790 to conduct one commercial water audit to identify water savings potential. It would take 285 cisterns to achieve the same water savings as identified in the commercial audit.

Several sources of information are available to the public. There are currently two demonstration sites sponsored by the District; one is located at the Florida House in Sarasota County, and the other is at the Hillsborough County Courthouse in Tampa. The Cooperative Extension Service has a "how to" publication entitled *Cisterns to Collect Non-Potable Water for Domestic* Use (AE-64). Some demonstration sites, contractors and vendors, and additional references are included on pages 6 and 7.

Conclusions

- Cisterns could provide significant water savings if implemented on a wide scale, and the greatest potential for savings is for non-potable irrigation,

- Most cisterns are used where water utilities are not available and where ground water sources are not suitable.

- There are presently no laws prohibiting cistern usage for either potable or non-potable applications. However, if cisterns become prevalent, it is possible that additional regulations will be developed. And, cisterns may be limited in certain deed restricted communities.

- Construction considerations, such as the size of the cistern, may significantly affect the water savings and cost.

- Cisterns require regular maintenance, which may be an obstacle to widespread support from the public.

- The cost of cisterns is higher than other sources of water and this issue will have to be overcome through some measure of incentives to encourage more people to install cisterns.

- Existing incentive programs, such as the one offered by Sarasota County, are not sufficient to *encourage* widespread use of cisterns.

- Utilities do not promote cisterns because they are not cost-effective when compared to alternatives such as toilet rebates, plumbing retrofits, or industrial and commercial water savings programs.

- Sources of cistern information available to the *general* public include demonstration sites, "how to" brochures and publications, and vendors

Use it again, Florida!

Demonstration Sites
Within the Southwest Florida Water Management District

The Hillsborough County Courthouse Cistern Demonstration Project
4 19 Pierce Street, Tampa, Florida
Contact: Mr. Elie Araj
Hillsborough County Engineering and Construction Services
(813) 272-5912

The Florida House Foundation, Inc.
4600 Beneva Road, Sarasota, Florida
Contact: (8 13) 927-2020

Contractors and Vendors

American Cisterns, Inc.
Post Office Box 5300, Grove City, Florida 3 4224
Contact: (941) 697-3006
(800) 771-3006

Water Works
Contact: (8 13) 343-3095

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(Note: See Appendix A for copies of these three articles.)

ADDITIONAL REFERENCES

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(5 12) 463-7950
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California Department of Water Resources
Box 942836
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