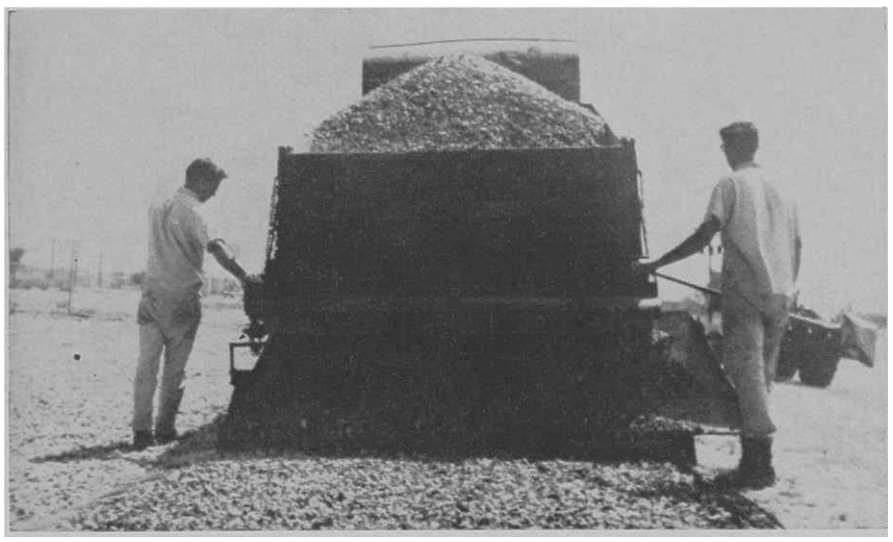
The conventional stock tank in a variable climate, such as that of Arizona, usually does not afford a dependable water supply. As noted in Part I of this series in the March-April issue, sedimentation, seepage and evaporation losses are difficult problems to solve with a conventional tank. A water harvest system as described here may, in some areas, provide a more economical method of water supply for livestock and domestic uses.

WATER HARVESTING PLAN FOR LIVESTOCK OR HOME

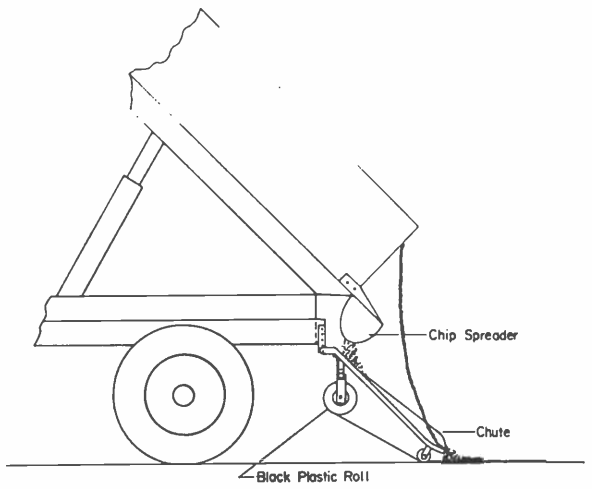
By C. Brent Cluff

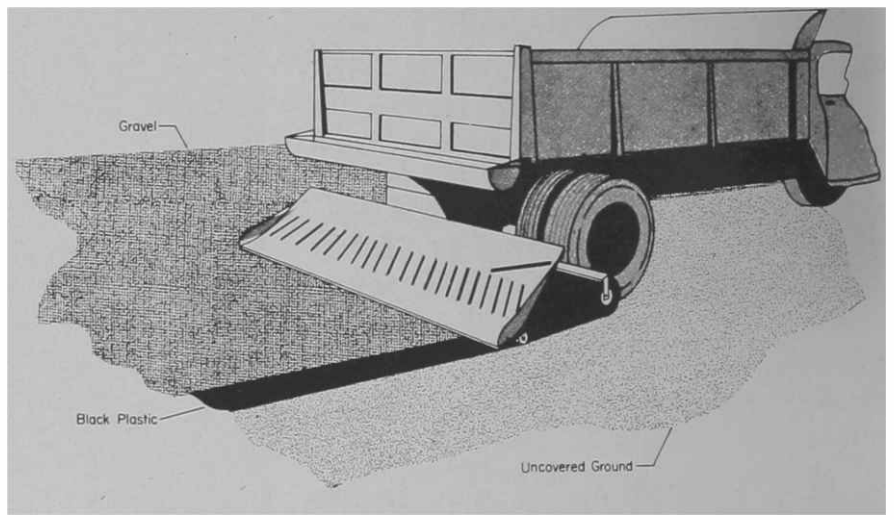
A water harvest system can be defined as a system of catching and storing rainfall until it can be beneficially used. The principles involved in water harvesting are not new. Treated catchments have been used since Biblical times for obtaining water supplies.

The chief limitation on this technique has been the high cost per unit of water produced. With advances in modern technology in the field of waterproofing chemicals, such as asphalt and plastic, costs of treatment have been greatly reduced. Use of chemically inert plastic holds considerable promise, both in treatment of catchment areas and the sealing of storage tanks.

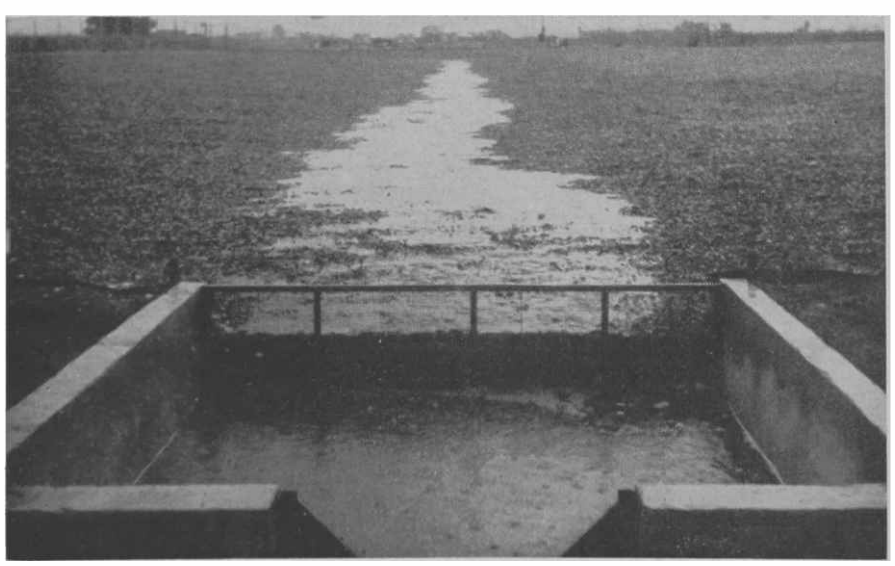


LAYING PLASTIC and covering it with gravel in one operation.





ARTIST'S DRAWING shows how the plastic-laying gravel spreader operates.



COMPLETED HALF ACRE gravel covered plastic catchment following a quarter inch rainfall.

Has Handicaps, Too

The least expensive plastic is polyethylene, which can be purchased in four-mil thickness for as little as six cents per square yard. The big limitation in the use of plastic is that it will break down if exposed to sunlight. Also, it is subject to wind damage if it is not attached to the ground.

In an effort to increase the effective life of a plastic catchment, the Water Resources Research Center began experimenting late in 1965 with a pea-gravel cover. This cover serves both to shield the plastic from sunlight and also protect it from wind damage. Use of a gravel cover also has considerable esthetic value, in that the catchment blends very well with the semi-arid landscape. Because of these advantages, an 8 x 16 foot experimental plot was established in December 1965. Six-mil black

(Continued on Next Page)

(Continued from Previous Page)

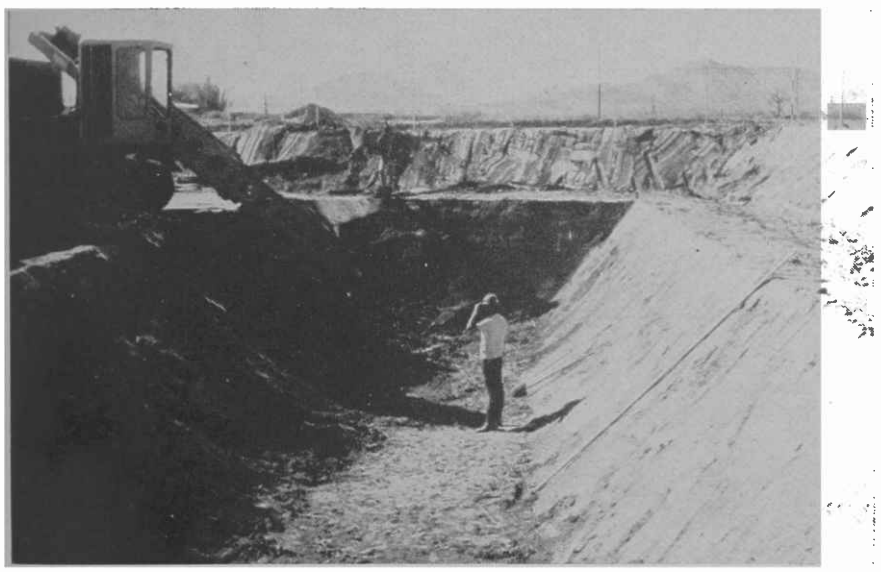
polyethylene plastic was covered with a one-inch layer of pea gravel (3/16 - 3/8 inch diameter stones).

From December 1965 to December 1966, 33 separate rainfall events were recorded totaling 12.09 inches. On 28 of the 33 rainfall events, runoff was obtained for a total of 10.58 inches or 87.5 percent of the rainfall. On a control plot only 0.69 inches of runoff was recorded on 10 of the 33 rainfall events, for a total of 5.7 percent of the rainfall.

Absorption Slight

The gravel cover, when dry, was found to absorb the first 0.06 inches of rainfall. This, however, did not affect the total yield as much as had been anticipated, as the rainfall spacing was such that the gravel did not always dry out between storms.

In April, 1965 a plastic-laying gravel spreader was developed. It was first tested by installing a half acre gravel-covered plastic catchment at the Water Resources Research Center Field Laboratory. The imported gravel was dispensed from a dump truck into a standard spreader box before dropping onto a slide.



EXCAVATING STORAGE tank with Gradall.

Plastic was dispensed under a roller on the lower part of the slide. Four-mil black polyethylene was used with no significant damage to the plastic. Side slopes on the catchment were five percent. Integration of the plastic was accomplished with a six-inch overlap. The estimated cost of the catchment was $500. The completed catchment is shown in the photo, at bottom of Page 6, following a one-fourth inch rainstorm.

100,000 Gallon Storage

Water from the half-acre catchment flows through a 12-inch butyl rubber tube into a 100,000-gallon storage tank. The tank was excavated by using a gradall. Surface dimensions of the tank are 26.5 x 86.0 feet. The tank is eight feet deep, with side slopes of 1:1, making the bottom dimension 10.5 x 70.0 feet. Dimensions of the tank are such that a single 40 x 100 foot sheet of inexpensive six-mil black polyethylene can be used as a liner. This liner is covered with a single sheet of butyl rubber. The rubber cover, which is supported by five-inch aluminum irrigation tubing, prevents evaporation losses and also protects the plastic liner from sunlight. The edges of the cover and liner are secured in a trench around the edge of the tank.

The butyl rubber is equipped with inlet valves so that rain falling on the cover can flow into the tank.

(Continued on Next Page)

TANK WITH LINER in place, ready for the cover.

Cost Analysis of Installation of 100,000-Gallon Storage Tank

Type of Operation	*Time & Rate*	*Total Cost*
Surveying and layout of reservoir site	2 man-hours @ $5.00	$ 10
Excavation:		
Gradall, including operator	14 hours @ $25.00	350
Two dump trucks, including operator, for moving soil away from pit	14 hours @ 20.00	280
Shaping and trenching	20 man-hours @ $2.00	40
Installation of liner and cover including back-filling and compacting of trench	20 man-hours @ $2.00	40
Cost of Materials* (FOB Tucson)		$1,080
		$1,800

*Does not include sales tax.

GRAVEL-COVERED plastic catchment in foreground, with completed rubber-covered storage tank in the background.

The author is an assistant hydrologist, Water Resources Research Center, University of Arizona.

As noted above, this is second portion of a two-part series.

Gain-Test Bulls Go At Excellent Prices

At termination of the UA annual beef bull gain-test trials, sponsored annually by the UA Animal Science Department, 49 young animals were sold at auction March 2, bringing a total of $25,285. Purchasers were from five states.

Top sales price was $2,475 for Amigos Dom Gold 3, a Hereford consigned by Jack Oleson of Avon, Colo., and purchased by Jim McDowell of Fairplay, Colo. The animal weighed 1,370 pounds at sale time, had a yearling weight of 993, and had averaged a daily gain of 3.55 pounds during the tests.

Second high price was $2,050 for Arizona Onward II, a Hereford consigned by The University of Arizona and purchased by American Breeders Service, Chicago.

Included in the auction were 37 Herefords averaging $537, 5 Brangus bringing an average of $494 and 7 Angus averaging $422.

This was the sixth year of UA gain-test trials and Dr. Bruce Taylor, directing the project, feels that "Considering the long drought over Southwestern rangelands, and in comparison with other sales, prices received at this Tucson sale were very good."

Top Bull in Gain-Test Sale

Amigos Dom Gold 3 brought top money when 49 young bulls which completed the UA gain-test trials were sold at public auction.

Consigned by Jack Oleson of Avon, Colo. (shown in the background, above), the bull was purchased by Jim McDowell of Fairplay, Colo. The Hereford bull weighed 1,370 pounds at time of sale, had a yearling weight of 993, and brought a price of $2,475.

(Continued from Previous Page)

Thus the tank also serves as part of the catchment. The completed tank was constructed within a period of three working days. A cost analysis of the tank installation is given in the table on Page 7.

Total cost of the system, excluding the cost of fencing, would be approximately $2,300. This cost estimate should be appropriate for use in estimating costs of this system anywhere in Arizona, if sufficient allowance is made for transportation costs to remote areas. Costs can be reduced by using a dozer for excavation, particularly if a spill area is available close to the tank site.

Has 15-Year Life

It is expected that this system will last at least 15 years before the butyl rubber and plastic would need to be replaced. Since the gravel-covered catchment provides sediment-free water, cleaning of the tank should not be necessary. Thus the replacement costs would be approximately one-half of the original cost.

This system should provide a firm supply of 100,000 gallons of high quality water per year in an 11-inch rainfall zone. If a relatively constant demand were made on the system, the 100,000-gallon tank would be large enough to store water produced from a larger catchment. It is believed that for most areas a smaller tank could be used with a half-acre catchment and still furnish an adequate supply for proper range utilization. Since the cost of the tank is approximately 80 percent of the cost of the system, any reduction in tank size would significantly reduce the cost of the total system.

Relatively Pure Water

The water supplied by this system should be suitable for domestic use with very little treatment. For instance, the 65,000 gallons of water stored since the construction of the system at the WRRC Field Laboratory in the spring of 1966, is presently being used directly without treatment in a rainfall simulator.

A recent survey in cooperation with county agricultural agents indicated that more than 1,000 Arizona families, not including those on Indian Reservations, now haul their entire domestic water supply. It is hoped that the system developed at The University of Arizona will provide a more convenient and economical water supply for these families.