THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 1 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | January, 1980

VOTERS SEAT DIRECTORS, COUNTY COMMITTEEMEN

A new voice will soon be injected into the business of overseeing High Plains Underground Water District affairs. The new face belongs to Mack Hicks, recently elected to his first two-year Board term as a Director.

A total of three Directors were elected to the Board according to unofficial returns from balloting conducted January 19. James Mitchell and Malvin Jarboe were each re-elected to their third term. Also elected in the three District Director's Precincts balloting this year were 24 County Committeemen.

Mack Hicks will represent Director's Precinct Two which covers Cochran, Hockley and Lamb Counties within the Water District's service area. Mack is an irrigation farmer in a big way. He manages 12 thousand acres of mostly irrigated cotton and milo on the Whiteface Farms near Pettit. Mack started with the Whiteface farms over 20 years ago upon completion of high school. He and his wife Neta live in Levelland where he grew up.

James Mitchell, the serving Board President, was re-elected from Director's Precinct One which includes Lubbock, Crosby and Lynn Counties. This will be Mitchell's third term on the Board. He farms 16 hundred acres in Lubbock and Lynn Counties of which nearly two-thirds is irrigated.

Malvin Jarboe was elected to the Board of Directors from Precinct Five. He will represent Floyd and Hale Counties within the District, serving his third Board term. Malvin has over a thousand irrigated acres near Floydada to oversee.

The 24 Committeemen elected in each of the eight counties voting in this year's election are as follows:

LUBBOCK
- Don Bell—Wolfforth
- Ronald Schilling—Slaton
- Granville Igo—Shallowater

LYNN
- David Wied—Wilson
- Wendell Morrow—Wilson
- Leland Zant—Wilson

CROSBY
- Tommy McCallister—Lorenzo
- Edward Smith—Lorenzo
- Pat Yoakum—Lorenzo

COCHRAN
- Donnie Simpson—Morton
- Richard Greer—Morton
- Hershell Tanner—Morton

HOCKLEY
- Leon Young—Ropesville
- W. C. McKee—Sundown
- Robert Phillips—Levelland

LAMB
- Larry Lockwood—Littlefield
- P. A. Washington—Springlake
- Jack Stubblefield—Spade

FLOYD
- C. O. Lyles—Floydada
- Cecil Jackson—Floydada
- D. R. Sanders—Floydada

HALE
- Harold Newton—Petersburg
- Jim Byrd—Petersburg
- Ray Potter—Petersburg

DISTRICT AWARDED ENERGY GRANT TO TEST PUMP PLANTS

The Board of Directors of the High Plains Underground Water District have approved the acceptance of a 20 thousand dollar matching energy conservation grant from the Texas Energy and Natural Resources Advisory Council (TENRAC) to evaluate the efficiency of irrigation wells on the Southern High Plains of Texas.

The grant comes from the U.S. Department of Energy through TENRAC to the District. The District in turn expects to conduct irrigation efficiency tests on at least 60 randomly selected wells in their 15 county service area this spring and summer. Preliminary calculations indicate that hundreds of thousands of dollars in savings could be achieved by High Plains irrigators by making improvements in the efficiency of their pumping plants.

The District has several objectives in accepting the energy conservation grant. The first is to convey to the irrigator the importance of considering pump plant efficiencies as a potential area for energy and cost savings. Secondly, the project will demonstrate those potential savings and develop a simple procedure for evaluating irrigation well pump plant efficiencies.

The District further appreciates that this project can only scratch the surface of the job to be done, and will work to establish a training base of experienced resource people who can continue this spearhead effort. The grant

continued on page 4—IMPROVE

WATER, Inc. *Invites You...*

Texas House Speaker Bill Clayton will give the keynote address at Water, Inc.'s 13th annual membership meeting in Amarillo on February 9. Other distinguished program speakers include Texas Representative Bob Simpson who introduced before the House the water importation legislation which passed last session; Harvey Davis, Executive Director of the Texas Department of Water Resources, and John Specht, President-elect of the National Water Resources Association. Thirteenth District Congressman, Jack Hightower, member of the powerful House Appropriations Committee, will address the luncheon session.

Seven at-large Directors will be elected at the meeting. Registration begins at 8 a.m. Saturday at the Amarillo Villa Inn. Duncan Ellison, Executive Director of Water, Inc., extended a special invitation to everyone who has even the slightest interest in water to attend this meeting.

And after 13 years, Water, Inc., recently moved their offices in Lubbock to the Park Place Building, 1409 19th Street, Suite 204. Their phone and p.o. box remains the same.

Feds Claim Water Rights

A unanimous and firm objection bellowed from five western governors and a number of state water agency representatives in December over the feds latest encroachment on state water rights involving initiatives by the Department of Interior into "non-reserved" water rights.

On June 23, 1979, Interior Secretary Andrus released a legal opinion prepared by Interior Solicitor Leo Krulitz (who has since left federal service), in which the Solicitor examined the existing status of federal reserved water rights (the implicit federal right to water to fulfill specific purposes for which federal lands are reserved) and also introduced a new concept of a federal "non-reserved" water rights doctrine. According to the opinion, which Secretary Andrus has instructed all Interior agencies to implement, "non-reserved" water rights are those

continued on page 4—WATER RIGHTS

IRONING OUT KINKS, USGS regional mappers representing New Mexico and Oklahoma met recently with the Texas Dept. of Water Resources hydrologists and engineers and with the High Plains, North Plains and Panhandle Water Districts, all participating in the US Geological Survey Ogallala Aquifer Study. The Water Districts are subcontracted to TDWR to provide geohydrologic data. TDWR has contracted with USGS to provide data for the Texas portion of the study. Parties discussed mapping methods, definitions and parameters of the Ogallala aquifer system.

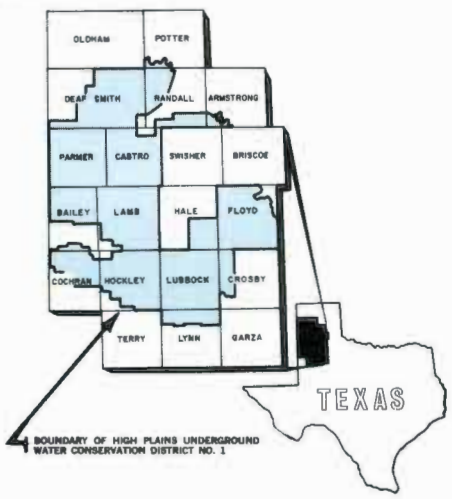
THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1
2930 Avenue Q, Lubbock, Texas 79405
Telephone 762-0181

PATRICIA BRUNO, Editor

Second Class Postage Paid at Lubbock, Texas
District Office at Lubbock



NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

INCREASING WATER

By LARRY D. HAUSCHEN
Agricultural Economist
Federal Reserve Bank of Dallas

The reappearance of gasoline lines and skyrocketing petroleum prices this past summer once again reminded Americans of the exhaustibility and increasing scarcity of petroleum. Yet, a problem that is unknown to many and at the same time is critically important to others lies in the threat of a shortage of a resource even more basic than oil. That resource is water.

The problems and the issues surrounding water have been receiving attention recently, especially in the arid and semiarid western half of the nation, where rapidly increasing demand threatens to surpass available supplies. A recent issue of *The Economist* states, "Of the shortages that face Americans, petrol may be the most alarming at present but water may be the most serious in the long run."

The threat of a serious shortage of water is different from oil shortages in at least two respects. One, water is absolutely essential to life itself and is required at some point, in one form or another, to produce nearly everything. Unlike petroleum, water has no substitutes, and, thus, development of alternatives does not have potential. Second and somewhat ironic is that water, unlike petroleum, is not an exhaustible resource. Precipitation is the ultimate source of all freshwater supplies, and in an absolute sense, this country has as much water now as it did a century ago. And barring any drastic changes in weather patterns, it will have as much a century from now as it has today.

The threat arises, of course, because population and economic activity have grown rapidly, and the demand for an increasing number of uses now threatens to surpass the naturally renewable supply. An important implication lies in this contrast. In the case of oil, no realistic level of conservation can prevent eventual depletion, but conservation and efficient use of water can ensure continued supplies of usable-quality water indefinitely. Indeed, since available supply can be augmented only to a point, conservation and efficient use will prove essential to avoiding shortages of water in the future.

The importance of water and the threat of water shortages are not unfamiliar to the Eleventh Federal Reserve District. The rapid economic growth that this region, as well as other parts of the Sun Belt, has experienced in recent years has depended to a significant extent on the development and maintenance of adequate water supplies to meet agricultural, industrial, municipal, and recreational needs. As can be seen from the accompanying precipitation map, only the eastern edge can be classified as having a humid climate, and a major part of the District is either arid or semiarid. Thus, the solution of current and potential problems surrounding water use is vital to continued growth of the region. Suggestions for alleviating water shortage fall, naturally enough, in two categories: ways to increase the supply of water and methods of reducing the demand for water.

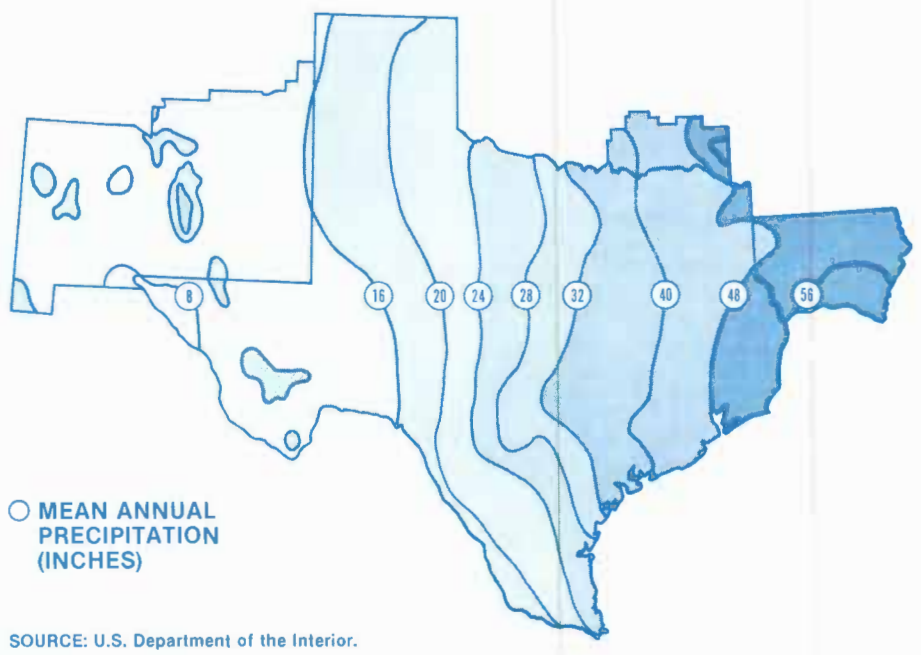
Supply Augmentation

A number of possibilities for augmenting the supply of water have been suggested. Three important ones are interbasin transfers, precipitation enhancement, and desalinization.

Interbasin Transfers

Interbasin transfers of water—importation from water-surplus areas by water-deficient areas—at first glance have the greatest potential, at least in the short run, and certainly have received the widest public attention. The concept of interbasin transfers is not new. Such transfers are common in the eastern half of the nation to meet municipal water needs of large cities, and a significant number take place in the West as well. Importation of water to the Texas and New Mexico High Plains is currently receiving a considerable amount of attention. An import authority has been established

Precipitation in the Eleventh Federal Reserve District



SOURCE: U.S. Department of the Interior.

SCARCITY: SOME PROBLEMS AND SOLUTIONS

in Texas and is charged with determining potential sources of water and establishing guidelines for importation. Unfortunately, the opportunity costs of exporting water may be very high, and residents of potential exporting regions tend to be extremely skeptical about agreeing to give water to other regions.

Precipitation Enhancement

Research into methods of increasing the proportion of moisture in the atmosphere that reaches the earth has been going on at least 30 years. However, past research has not been very successful in developing a solid understanding of the processes of increasing precipitation. A paper presented at a recent symposium on western water resources noted that research is fairly advanced in the technique of seeding winter clouds as they move upward over mountains. The technique increases snowfall and, in turn, runoff in the spring. This process would raise costs of maintaining highways and might increase dangers arising from avalanches.

(Cited: Theodore M. Schad, "Western Water Resources—Means to Augment the Supply," paper presented at Western Water Resources Symposium sponsored by Federal Reserve Bank of Kansas City, Denver, Colo., September 27, 1979.)

Progress has been much slower in developing successful methods of seeding clouds in the summer. Even if improved techniques are developed, two significant problems will be encountered. One, the environmental impact of increasing summer rainfall could be severe; and second, there exists a tremendous potential for conflict over whether artificially induced rainfall in one area may deprive another area of precipitation that would have fallen naturally.

In short, the potential for precipitation enhancement in the long run cannot be ascertained. But this method of augmenting water supplies clearly will not be an important solution in the near future.

Desalinization

Nearly 30 years of research on desalinization technology have not brought success in developing a technique that can compete, from a cost standpoint, with other methods of developing water. Most existing plants rely on distillation, a process that is extremely sensitive to changes in energy prices.

A relatively new process, reverse osmosis, may improve the economic feasibility of desalinization projects. However, while desalinization may have immediate potential for very high value economic uses, such as manufacturing, and may indeed have potential in the long run for other uses, it also is unlikely to solve any near-term water problems.

Since the promise for augmenting water supply sufficiently to solve potential shortages appears limited at best, the search for solutions to the water problems of the West must turn to factors thatt affect the demand for water. Generally, these solutions involve pricing, structural changes, and conservation. Emphasis will be placed on solutions that would reduce the demand for water in agricultural irrigation, which accounts for 90 percent of the consumptive use of water in the West.

Pricing

Past policy has led to pricing water far more cheaply than would be the case in a market environment where all alternative uses and costs are reflected. The Reclamation Act of 1902, which provided for the sale of public lands to construct irrigation projects for family farms, intended for the capital costs of irrigation, as well as operation and maintenance costs, to be repaid by the beneficiaries of the irrigation water. And until 1939, irrigators did pay all project costs but without interest. That year, the Reclamation Project Act allowed a ten-year development period before repayment was to begin. The act also set the stage for "basin account" transactions by allowing other beneficiaries, such as power customers, to be required to pay part of the irrigation costs.

Today, hydroelectric customers pay as much as 80 percent of project costs, and the debt farmers repay is spread over a 50-year period, with no repayment due in the 10-year development period and the debt repaid over the remaining 40 years without interest. At current interest rates, the interest subsidy alone represents a significant transfer payment from general taxpayers to irrigating farmers.

While there is a significant difference of opinion regarding the extent of the subsidy, a study that examined some 5,000 water projects and programs has indicated that agricultural water supply projects repay only 19 percent of project costs. The subsidy from reclamation water provided to farms in the Westlands Water District of Central California has been estimated to run as high as $1.4 million per 640-acre farm per year. The General Accounting Office estimates the subsidy in the Westlands district ranges from $20,000 to $100,000 per year for a 640-acre farm, compared with an average of $500 per year for farms of the same size in the rest of the nation.

(Cited: Ronald M. North and Walter P. Neely, "A Model for Achieving Consistency for Cost Sharing in Water Resource Programs," *Water Resources Bulletin* 13 (October 1977): 1004. "Senate Water-Use Bill Pits Big Firms Against Small Farms," *Congressional Quarterly Weekly Report*, September 29, 1979, pp. 2121, 2123.)

Full-cost Pricing

Whatever the extent of the Federal subsidy, it has serious implications for the problem of impending water shortages. It is an accepted economic principle that a good priced below cost will not be used efficiently. Artificially low prices necessarily lead to waste, in that more of the resource is used relative to the optimum amount, given the true cost of the resource.

It follows that an obvious way to reduce the demand for water and to cause water to be used efficiently is to impose full costs on users and allow high-value users to take water away from low-value users. That is what would occur if the resource were allocated by an efficient market.

There is no question that the implementation of this approach would cause serious conflicts. Pricing water at its market value would have an immediate detrimental impact on long-time recipients of subsidies. A wealth loss would be imposed on farmers who have already paid for the subsidy in the form of higher land prices. Considerable conflict could arise between efficiency and equity considerations if direct beneficiaries are forced to pay all costs, ignoring the indirect benefits generated. Additionally, the issue will be further complicated by the fact that the general taxpayer does receive some return benefits from the subsidy in the form of cheaper food prices. For example, 30 percent of the nation's fruits and vegetables are produced on land supplied with federally developed water.

"Water Bank"

Water in the West is generally allocated by a system of water law known as the prior appropriation doctrine (see the accompanying Appendix). Under this doctrine, a party acquires a right to use water by making a claim to divert a specified quantity of water from a particular source for a given purpose. The applicant has priority over later claimants but may lose the appropriation through nonuse of the water. In other words, conservation may lead to loss of rights. Clearly, then, the appropriation doctrine not only fails to encourage efficient use but encourages inefficient use. Some institutions have been developed to alleviate this problem, but one rather obvious solution has largely been ignored. That solution is the creation of a water "brokerage" or "bank."

Water administrators could significantly increase the efficiency of water use by establishing an institution to which an appropriator could sell unneeded water. This institution, the water bank, could, in turn, sell the water to other users. The price could reflect supply and demand conditions and could serve to reallocate water to high-value users by allowing low-value appropriators to sell water, on a nonrecurring basis, for more than the water could earn if applied to their enterprises.

The water bank transaction would entail no conflict, in the same manner a true marketplace entails no conflict, since all parties involved would be at least as well off as they would have been without the transactions. The incentive for conservation would be considerable, as users would be rewarded for consuming less water at any particular time without sacrificing the right to their full appropriation at any time in the future. Water banking has been successfully implemented in some instances in California and is worthy of serious consideration elsewhere.

Structural Changes

Even if steps are taken to increase the role of market-type forces in increasing efficiency of water use, the fact remains that water will continue to be allocated for the most part by government policy.

One of the major problems lies in the complexity and diversity of water rights in the different states. Courts continually make decisions, case by case, that add new elements to a state's water law. Under the present system, resolution of conflicts is possible primarily through adjudication of specific cases. For major issues pending in Texas, it is anticipated that the adjudication process will not be completed for another decade.

Several suggestions seem appropriate. To the extent that the Federal Government involves itself in water policy, it should coordinate the basic elements of that policy, rather than allow institutions responsible to different congressional committees to act individually. Careful attention must be paid to the fiscal responsibility for projects. For example, some have suggested the manner in which benefit-cost analysis has been used in the past should be evaluated. To the extent that Federal involvement in front-end financing of water projects continues, continuation of the substantial subsidy provided in the past must be reconsidered.

States can attempt to improve the allocation of water by making the laws governing water use in the state uniform across the state and by trying to eliminate the tremendous divergence of state laws. States should pay increased attention to the criteria for efficiency of use. The permit system can be used to increase the efficiency of allocation by restricting permits to a specific time span and by including a condition that reevaluation of water use take place periodically. Such a system could enable the state to reallocate water to higher-value uses as economic conditions change.

Conservation of Farm Water

Whatever the changes implemented in the water allocation process in the West, it is certain that the largest consumer of water, the irrigating farmer, will be affected. Any reallocation of water will almost certainly involve a transfer out of agriculture. Water has been priced below its market cost in the past, and farmers have had inadequate incentive to use it efficiently.

The ability of the irrigating farmer to adapt to changes will depend largely on the ability to reduce water use and increase water use efficiency. It is interesting to note that particular attention has been, and continues to be, given to many of these methods in the High Plains of West Texas, where farmers irrigate by pumping from the continually declining Ogallala aquifer. Energy costs to pump water in this area are five times the total cost of water in some federally subsidized projects. The following are a few methods of reducing water use that are available to the irrigator.

Reprinted from the December 1979 issue of the Voice of the Federal Reserve Bank of Dallas, El Paso, Houston and San Antonio.

This article will continue in the Cross Section examining methods of reducing the demand for water and the diversity of water rights in different states.

"YOU CAN'T JUST SUE THE IRS..."

FOR THE RECORD. Marvin and Mildred have stacked up an impressive collection of trial documents and clippings.

WATER RIGHTS . . . continued from page 1

which Interior agencies (such as the Bureau of Land Management, National Park Service and Fish and Wildlife Service) would perfect under state laws either for secondary uses on reservations or for Congressionally-authorized management objectives on multiple-use public domain lands.

The Solicitor further stated, however, that in acquiring "non-reserved" rights, the federal agencies would not necessarily be restricted by substantive state law. In other words, if a federal agency pursued a "non-reserved" water right, and a particular state did not recognize such right either because of provisions of its laws or because it planned for other uses of the water, the federal agency could nevertheless assert a "non-reserved" right and appropriate the water.

Andrus is now considering whether or not to withdraw the "non-reserved" water rights position, or to select one or more 'test cases' and litigate to determine if the so-called "non-reserved" doctrine would withstand judicial scrutiny. — From *Texas Water* newsletter, TDWR.

Marvin Shurbet is a water legend in his own time. Most folks remember him as the farmer who took on the IRS—and won. His name and face appeared in nearly every paper in the state. The story made *Time Magazine*. But Marvin enjoys most telling that it even made *Playboy* (Sept. 1966). It also made water history in Texas. The Shurbets' test case was a landmark decision favoring irrigation farmers with a tax credit for the depletion of the underground water they "mined" in their business of agriculture. That ruling has saved area taxpayers from three to five million dollars a year in cost-depletion deductions on capitol investments in groundwater exhausted to produce income.

Marvin muses back that "there were at least six other boys who had agreed to be the guinea pigs, and all of them looked like better prospects. But I'm the guy who "got hitched."

Attorneys filed suit in February of 1961 against the United States of America naming Marvin and Mildred Shurbet plaintiffs. It took five years and several hundred thousand dollars to secure the final decision.

"You can't just walk in and sue the internal revenue," smiled Marvin, "It cost me a lot personally. But we were entitled to it because if we made anything on the crop we made it because of the added cost of water for irrigation, and then we had to turn around and pay that to the internal revenue."

Marvin remembers being on the stand two full days. The case took seven days to try. He recalls soaking a suit of clothes a day, the attorneys rolling in whole filing cabinets on dollies, and the judge appearing to be asleep. "But that judge never was sleeping, he was thinking all the time."

The Shurbets lived in a small community in Floyd County; the people didn't all accept what they were doing. "Some people were even afraid we would win. I guess they thought it was pretty nervy; asking for trouble by challenging the IRS."

"Some people offered to help. A guy called me just yesterday to say thanks, even now. One neighbor called Mildred one morning after the trial and wanted to know my shirt size. Then here he came with a short sleeve shirt and bow tie."

Marvin has earned the respect of many water leaders across the state. That's not surprising. He has had a little promoter and a little prophet in him most of his life. He recalls his first water fight at 21.

> **"...about the ground water. I own it, by golly. And if you want what's mine you're going to pay me for it."**

"I made my first meeting in Plainview to protest an Austin Judge who'd come up here and was going to take over groundwater and run it for us. Before there was even a water district we went to Austin to defeat legislation and keep ownership of groundwater away from the state. After we went a couple of times our legislators said we'd better go home and get something done of a positive nature, so we formed the Water District."

Marvin served on the High Plains Water District Board from 1954 through 1957 when he resigned because of his appointment to the Texas Water Development Board.

"We created it. There was no Water Development Board then. I was first appointed by Price Daniel, then Connally. Preston Smith made me chairman. I tried to talk him out of it, but without much luck."

Marvin served on that Board for 16 years and says he missed four monthly meetings. The Board had access to 400 million state dollars for loans. It gave no grants, and in all that time Marvin says it made no bad loans. He approved some of the state's major water projects.

"There are literally hundreds of projects that I helped bring about in this area. My pets are White River and MacKenzie. Greenbelt in Childress was the first. I'd help the boys in East and South Texas with their projects and they have helped me with mine, because I would take their word for what was going on down there. I was interested in their projects because I wanted them to be interested in mine."

Marvin's foresight was not confined to setting state board policies. He promoted some pretty visionary projects back home. For example, he got five of his neighbors to put in the same amounts of money to drill a deep well and test waters in the Triassic formation.

"I took my money and said the first one is on me if it's a good one. So we drilled. But the water was brackish and 75 gallons a minute was all it could give."

Although the results were disappointing, Marvin commented, the effort was important "because we needed to know."

Another project which Marvin supported was artificial recharge to the Ogallala from playa lakes. He provided the test hole site, the playa, and the "selling job" to Pioneer Gas, who, with the Water District did the testing. The only hitch in the research was the same as remains today—silt clogging.

There's one more big idea Mr. Shurbet was promoting over 20 years ago, water importation. He convinced the California water engineering firm of Ralph Parsons and Co. to include the High Plains in their design of a massive water importation plan known as the North American Water and Power Alliance.

"I got the study for free. They were that interested. It wasn't just for this area, but it fit this area perfectly. I got Mr. Mahon here for the presentation. But it was finally dismissed lightly."

On the prophetic side, asked if he was comfortable with water policy today, Marvin lit up.

On water importation: "I haven't decided it won't work. It will work. But it will be slow. I won't see it in my time."

On water rights: "You're going to hear more about that all the time. Oh, they'll come back and they'll come federal . . . I think about the groundwater. I own it, by golly; and if you want what's mine you're going to pay me for it. They will, too. Because if they don't, they'll get to take the groceries out of your refrigerator, too."

IMPROVE PUMP PLANT EFFICIENCIES . . . .

continued from page 1

calls for developing a procedural manual to train the staff of the District and its cooperators in how to conduct these efficiency tests and to make proper interpretations of the test data.

There are over seventy thousand wells on the Southern High Plains. This grant can only represent a good start. But the Water District Board feels that it is a service they can provide, and it offers tremendous potential for energy and cash savings to producers who are continually impacted by the escallating energy crunch. Those estimated savings from improvements on many wells have a potential payback time of often less than one year and can mean a slash of ten to fifty percent on the annual fuel bill.

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 2 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | February, 1980

The Torch Is Passed

James Mitchell, Malvin Jarboe and Mack Hicks have affirmed their acceptance of the duties of office as Directors of the High Plains Underground Water Conservation District. The Honorable J. Q. Warnick, Judge of Lubbock's County Court at Law number Two, administered the oath to the three newly elected Board members who were accompanied by their wives for this solemn ceremony.

The swearing-in ceremony also formally marked the conferring of representative responsibilities to Precinct Two Board member-elect Mack Hicks from retiring ten year Board veteran Selmer Schoenrock. The Board presented a memorial plaque to Selmer citing his service and dedication and honoring him for the wealth of leadership he has provided.

District staff and guests witnessed the celebration. George McCleskey representing the Texas Water Development Board, challenged Board members in his remarks to "continue to set a standard of forward thinking and action for water organizations as befits the first, the biggest and the brightest" water district in Texas.

By unanimous vote of the Board, the slate of officers remains unchanged for 1980. James Mitchell of Wolfforth accepted the vote of confidence to serve a second year as Board President, as did Vice President Malvin Jarboe of Floydada and Secretary-Treasurer Jim Conkwright of Hereford.

A GRIPPING MOMENT, Mack Hicks (top left) and his wife Neta receive hearty congratulations from Maurine and Selmer Schoenrock. Selmer is retiring from the Board after ten years. Mack replaces Selmer as Precinct Two representative for Hockley, Cochran and Lamb Counties. During swearing-in ceremonies (lower left) Judge J. Q. Warnick raised a solemn arm to administer the oath of office. Accepting that office as witnessed by their wives are Mack Hicks and Neta, Malvin Jarboe and FloElla, and James Mitchell and Sylvia.

Feds Study Privately Owned Resources

Your participation in a March 4, 1980, Soil and Water Resources Conservation Activities Meeting at the Lubbock Memorial Civic Center may prove to be one of the most important meetings you will attend and participate in during the next few years. At this meeting, beginning at 9:30, the future needs for soil and water resources conservation activities for privately owned lands in the nation will be discussed and methods by which these needs can be met will be explored.

There are numerous strategies proposed by federal study committees to implement the needed conservation programs, some of which you may find desirable but others less so as they may encroach on your rights as a private landowner and/or operator.

The proposed objectives and proposed activities to accomplish these objectives as well as estimated costs will be discussed at the meeting. Brief descriptions of the objectives and strategies to achieve these objectives are as follows:

RESOURCE AREAS AND OBJECTIVES

Soil Resource Quantity and Quality
- Reduce soil erosion on agricultural land
- Retain prime and unique farmland
- Maintain soil quality
- Improve the condition of rangeland

Water Quality
- Reduce the levels of toxic pollutants and dissolved solids
- Minimize pollution from nutrients and organic wastes
- Reduce sediment

Water Supply and Conservation
- Increase the efficiency of water use in agriculture
- Increase agricultural water supplies

Fish and Wildlife Habitat
- Reduce the loss of wetlands
- Increase instream water flow
- Improve upland wildlife habitat

Upstream Flood Damages
- Reduce upstream flood damages
- Develop new technology to reduce damages
- Prevent loss of wetlands and prime agricultural land

Energy Conservation, Production
- Reduce energy use in agriculture
- Increase energy production on agricultural land

Related Natural Resources
- Increase the use of organic wastes
- Reduce downstream flood losses and sediment from construction sites
- Reduce the loss of prime and unique farmland to urban uses

ALTERNATIVE STRATEGIES

The U.S. Department of Agriculture has proposed seven conservation strategies for public consideration.

Redirect Present Programs

USDA would continue its 34 existing conservation programs, but it would redirect funds and personnel toward new national objectives for conservation.

Cross Compliance

Farmers and ranchers would be required to solve conservation problems in order to receive assistance under certain USDA farm programs.

Regional Resource Projects

USDA programs would be directed toward urgent and chronic regional resource problems of national importance. Project plans would be the basis for USDA assistance.

State Leadership

State governments would develop their own conservation programs. After approval by USDA, states could receive grants to ensure achievement of national conservation objectives.

continued on page 3 . . . FEDS

INCREASING WATER SCARCITY: SOLUTIONS

This article continues from January's Cross Section, examining methods of reducing the demand for water and the diversity of water rights in different states. It is reprinted from the December 1979 issue of the VOICE of the Federal Reserve Bank of Dallas. Its author, Larry D. Hauschen, is now Director of Research, Federal Land Bank of St. Paul, Minnesota.

Changing the Irrigation Method

For years the primary method of irrigation was furrow, or gravity, flow, in which water is released from an impoundment and allowed to flow down the furrows of the field. This irrigation method is extremely wasteful of water and is gradually being replaced by far more water-efficient sprinkler systems. Today, attention is being directed toward the adoption of low-pressure sprinkler systems, which have significantly lower energy requirements and evaporation loss than the high-pressure systems. Trickle, or drip, systems, which apply small amounts of water near plant roots at frequent intervals, use 50 percent less water than other sprinkler systems. Currently, these systems require substantial initial investment and have been limited primarily to high-value crops, such as fruits. However, increasing water costs and energy prices, coupled with additional research, may make the low-pressure systems more attractive in the future.

Pumping Plant Efficiency

Farmers can significantly reduce energy and water consumption by carefully monitoring the efficiency of their pumping plant, both the pump and power station. In the past, when both energy and water were abundant and relatively cheap, farmers typically did not pay particular attention to the efficiency of the plant. As prices for water rise, farmers will increasingly find it profitable to keep the pumping plant in efficient working condition.

Irrigation Scheduling

Research has shown that timing of irrigation is extremely important to crop yields. In the past, farmers generally have applied a larger than optimum quantity of water. Excessive irrigation not only costs the farmer more for water and energy but also increases soil erosion and nutrient loss in the plant root zone. Irrigation scheduling entails the farmer utilizing detailed information on such factors as soil moisture capacity and levels, infiltration and evaporation rates, and the timing of individual-crop water requirements in order to determine the optimal amount and timing of irrigation. Computer programs that have been developed in Nebraska are able to analyze vast amounts of relevant information and predict water needs. There is a tremendous potential for saving water through adoption of this management technique. Some studies have estimated water use can be reduced 25 percent by using irrigation scheduling.

Tailwater Recovery

Anytime water is applied at a faster rate than a soil's infiltration rate or the amount of water applied exceeds a soil's capacity, runoff results. A study of High Plains Underground Water Conservation District No. 1, which encompasses nearly half the irrigated acres in the Texas High Plains, has estimated that 20 percent of irrigation water leaves the farm as tailwater. Tailwater recovery systems that have been developed can capture, store, and return the lost water cheaper than the original water can be pumped.

Tillage Practices

Limited-till or no-till production techniques are usually recognized as energy-saving devices. However, water loss from the seedbed is reduced significantly in some soil types. By one report, preplant irrigation for grain sorghum following a wheat crop can be eliminated, thereby saving about 20 percent of total irrigation water.

Basin Tillage

Basin tillage amounts to nothing more than shaping mounds of soil in the furrows to form water-impounding basins. The basins reduce runoff from precipitation by holding the water in place longer for infiltration into the soil. Basin tillage can also be utilized to increase the infiltration of sprinkler irrigation. The practice can be adopted with minimal investment, requiring only a modification of planting or cultivating equipment, and has been shown to increase dryland yields of cotton 25 percent in the Lubbock, Texas, area.

Water Conveyance

Significant water loss occurs through infiltration and evaporation as water is transported through irrigation ditches. The use of underground pipeline to convey water can greatly reduce this loss. Again pointing to the Texas High Plains, some 10,500 miles of underground pipeline in High Plains Underground Water Conservation District No. 1 are estimated to save 700,000 acre-feet of water per season, or 21.8 million gallons of water each year per irrigated farm in that district. One experiment showed the amount of water pumped could be reduced about 16 percent by using underground pipe.

These are only a few of the actions farmers can take to reduce water consumption. The extent to which any particular method reduces water use in any particular area will depend on the characteristics of that area, such as soil types, topography, and weather.

Technological developments reflect relative prices of inputs. In the past, water has been relatively cheap, and, hence, motivation to save it was not strong. That will change in the future, and as the cost of water rises, farmers and others will develop ways to use the resource more efficiently.

Water scarcity promises to be a major source of conflict in upcoming decades, especially in the western half of the nation. Increased demand resulting from rapid economic growth and the need for alternative energy sources threatens to surpass the available supply; and traditional methods of augmenting that supply, primarily the construction of dams, are becoming increasingly unproductive and expensive.

While alternative methods of developing water supply have potential, any solution to water shortages for several years must involve demand reduction. Economic incentives to conserve this resource have been inadequate, and, hence, significant potential for more efficient use of water exists. It is particularly important that irrigating agriculture, the largest user of water in the West, adopt more efficient techniques of water use. Cooperation and coordination of all involved in promoting efficient management and use of water resources are essential to the prevention of serious water shortages in the future.

To be concluded next issue, with a look at Laws Governing Water Use.

THE CROSS SECTION (USPS 564-920)

Average Total Change in Feet For All Water Level Observation Wells Measured In The Following Counties For Time Period Indicated

	*No of Observation Wells in County	1970-1980	1975-1980	1979-1980
Armstrong	9	—10.49	— 5.47	—1.49
Bailey	74	—12.44	— 6.82	—0.78
Castro	89	—28.22	—14.48	—2.82
Cochran	53	— 2.21	+ 0.50	+0.87
Crosby	20	—19.80	—10.13	—0.01
Deaf Smith	89	—24.20	—11.01	—2.10
Floyd	97	—19.82	— 8.54	+0.51
Hale	27	—12.19	— 5.35	+1.40
Hockley	90	— 1.80	+ 0.21	+1.21
Lamb	94	—21.15	—10.99	—1.33
Lubbock	119	— 6.18	— 1.18	+1.49
Lynn	31	+ 0.21	+ 0.88	+1.25
Parmer	97	—28.86	—15.85	—2.55
Potter	6	—11.91	— 7.46	—1.86
Randall	41	—13.60	— 5.20	—1.01
District Average		—14.20	— 6.72	—0.48

*Records for some wells do not cover the entire period of record(s) indicated. Therefore the water level records for these wells were not used in the averages.

ANNUAL WATER LEVEL DECLINE RATE DECREASE MEASURED

Measurement of water levels in the network of over 900 wells measured annually by the High Plains Underground Water Conservation District No. 1 in its 15 county service area showed an average change of 0.48 foot lower from January 1979, to January 1980.

Because 1979 was an abnormally moist year over most of the surveyed area, the 0.48 foot change compares favorably with the five year average annual change of 1.34 feet and the ten year average annual change of 1.42 feet. Water District officials attribute the reduced rate of decline to improved water conservation practices, the high cost of energy to pump water and the presence of unusual natural moisture. The abnormal rise in water levels in some wells probably reflects filling of the cones of depression around these wells other than substantial recharge to the aquifer.

The average depth-to-water below land surface in the water level observation wells measured in late 1979 and early 1980 was 165.54 feet.

OUTLINE FOR EXPANDING PRODUCTIVITY REPORTED

WASHINGTON (AP)—The Agriculture Department has issued a report, "Prospects for Productivity Growth in U.S. Agriculture," in which the authors look at the possibilities of expanding productivity through the year 2000 and beyond.

One important indicator is called "total factor productivity" which expresses as a percentage the ratio of output to all the labor, land, capital and other "inputs" required to produce food and fiber.

As an illustration, the report said 40 years ago one American farmer produced enough food to feed 11 persons. Today, the farmer produces enough for 59.

Over the past half century, it said, farm productivity has increased about 1.5 percent a year, on the average.

From 1939 to 1960, productivity grew at an annual rate of 2 percent a year, but then slowed to 0.9 percent annually in the decade of the 1960s before picking up again. Some authorities have suggested farmers may be approaching a limit on further productivity growth.

The report said the growth of productivity will continue at about 1.1 percent a year if "the historical rate of support for research and extension" is maintained and "no new and unprecedented technologies emerge" to boost yields.

"We seriously question the hypothesis that agricultural productivity will reach a 'limit to growth' by the turn of the century," the report said.

The report was written by Yao-chi Lu and Leroy Quance of USDA's Economics, Statistics and Cooperatives Service, and Philip Cline of Washington and Lee University, Lexington, Va.

A central issue is world population growth in the next 20 years. Citing various studies, the report noted:

—Populations of the world's poorest or "developing" countries, now totaling 2.8 billion, may reach 4.8 billion by the turn of the century.

—The total population of the richer "developed" countries may increase to 1.5 billion from 1.2 billion, according to a 1976 analysis by the International Finance Corp.

"To feed this growing world population, even at current nutritional levels, annual world foodgrain production must increase from the current 1.3 billion metric tons to about 2.0 billion metric tons," the report said.

"If nutritional gains are to be made in developing countries, annual foodgrain production will have to reach about 3.0 billion metric tons."

Although it focused on productivity, the report mentioned two other ways of increasing the over-all output of agricultural products:

—Increasing crop acreage. The United States potentially has about 266 million acres of land not now in crops that could be suitable for crops.

Of those, about 96 million acres are of a medium-to-high potential for crops, and, by 1985 could be used to increase the acreage of corn by one-fifth, wheat by two-fifths, soybeans by one-third and cotton and citrus by two-thirds.

"However, choosing this option might decrease pastureland (for cattle and other livestock) by 60 million acres," the report said.

—Increasing the use of capital inputs such as fertilizers, pesticides and machinery. Farmers have increased the use of those dramatically, including a five-fold increase in fertilizer between 1950 and 1975.

Although the report did not analyze this aspect, the costs of those inputs have bitten deeply into farm profits in recent years, particularly since the energy crunch.

The report, however, said the third option involves what it called the "greater productivity of farm inputs" that could be attained through new technology and its efficient application.

Assuming a "high technology scenario" in which an all-out push was made in research and getting the practical information to farmers, productivity might be able to increase at an annual rate of 1.3 percent, the report said.

Of the technology possibilities cited in the report, three "are considered to have an unprecedented potential" for increasing productivity. They include:

—Enhancement of photosynthesis efficiency of plants by genetic modification, including the process by which they form carbohydrates, and enabling some like corn to absorb nitrogen from the air.

—Bioregulators or natural and synthetic compounds which regulate the ripening and maturing of crops for harvest.

—Twinning of beef cattle through breeding and selection of animals that have genetic traits for producing twins, by artificial harmone control and by implants of calf embryos.

"It is unlikely, however, that all of the three . . . would be ready for commercial adoption until the 1990's," the report said. "Therefore, their projected impact on agricultural productivity by 2000 is small.

"However, if projections are extended to 2025 to allow time for widespread adoption, the productivity growth rate would be 1.5 percent annually—which equals the historical rate for the past 50 years."

FEDS STUDY PRIVATELY OWNED RESOURCES . . . .

(continued from page 1)

Regulation

Local, State, and national regulations would be coupled with financial and technical assistance to solve conservation problems according to USDA standards.

Conservation Performance Bonus

Bonus benefits would be paid to farmers and ranchers who voluntarily solve conservation problems on their land. Bonuses could take the form of higher support payments, cost sharing, or favorable interest rates on loans.

Natural Resource Contracts

Farmers and ranchers would receive annual payments for reducing erosion, conserving water, and applying other conservation measures.

WHAT YOU CAN DO

Get more information on RCA materials and proposals from your local SCS and ASCS offices. Attend your local RCA meeting where USDA will provide more information on conservation objectives and strategies. Attend your regional RCA meeting or send written comments.

Mail your comments directly to USDA. Don't be concerned about style or length. Just get your thoughts on paper and mail them by March 28 to:

USDA RCA-Response Analysis Center
P.O. Box 888
Athens, Georgia 30603

TIMING: KEY TO PREPLANT WATERING

LUBBOCK—It's time for farmers to start thinking about preplant irrigation, and timing is what it's all about.

Deciding on the right time for preplant irrigation is not easy. If preplant irrigation is too early, then there is a possibility that there may not be any moisture left in the soil by planting time. If it is too late, then the soil may get compacted during planting operations and reduce infiltration.

A Texas Tech University agricultural engineer reminds farmers of a list of "don'ts" which could make the job easier.

"Don't get over-anxious about preplant irrigation; don't irrigate because your neighbor is doing it; don't irrigate before you determine the need; and don't practice excessive tillage after irrigation," said Marvin J. Dvoracek, chairman of the Department of Agricultural Engineering.

Most of Dvoracek's don'ts are easy to follow, except the determination of the need for preplant irrigation.

"Even that can be done by taking soil samples from six, 12 and 18-inch depths, weighing the soil in a can and comparing that weight with the weight after the can has been left in a heated oven for several hours to remove the moisture in the soil," Dvoracek said.

Dividing the loss in weight by the dry weight of the soil and multiplying that figure by 100 gives the percentage of moisture in the soil, he added.

If the moisture percentage is more than 20 percent at all three depths, then there is no need for preplant irrigation.

Soil moisture below the 18-inch mark is of little consequence for germination of plant growth or maturity.

But the process of determining soil moisture needs to be repeated several times during the early winter months to find out if the moisture level is increasing or decreasing, the Texas Tech agricultural engineer said.

A decrease below 14 percent in any of the three levels could indicate that the soil needs additional moisture.

"For a totally dry soil three inches of water per acre would provide the necessary soil moisture to a depth of 18 inches, although most preplant irrigation efforts will not need that much water," Dvoracek added.

Farmers need to remember also that preplant irrigation does not guarantee seed germination. It is one of the several agricultural practices, including seed bed preparation and using the right quality seed, that lead to increased production.

PROFILES OF LEADERSHIP

JAMES P. MITCHELL
President

Wolfforth residents know James as a community leader, active in city council, school board, 4-H, FFA and a number of co-ops. But James says he's really motivated by his concern for kids. One of his favorite investments in youngsters is hogs. Mitchell has been raising hogs in Wolfforth for about 40 years. He specializes in raising show pigs for 4-H and FFA girls and boys to groom and show, and his hogs have earned a reputation as winners.

"I wouldn't do it if it were just for the market," says Mitchell. "I think its a great thing for kids to learn to care for an animal and have feeding projects, responsibility for grooming, and the challenge to learn to be a winner." James got started himself at 4 or 5 years old when his grandmother gave him a little gilt. He got his first registered Poland-China gilt in 4-H at age nine, winning an essay contest sponsored by the Sears Roebuck Foundation.

James claims that with the exception of two years in the service, he's always had from one to 60 registered gilts for an average of 20 breeding hogs. His interest has paid off, especially for the youngsters.

"We sell our pigs twice a year as prospective projects for 4-H and FFA'ers, he explained. "A little girl from Springlake bought one of our pigs for $365 and sold it in Houston for 25 thousand."

"I think the competition is good for kids," James nodded. "We've bred gobs of champions."

Mitchell bred the grand champion barrow at the Houston Fat Stock Show in 1979. He bred the grand champ and reserve champ in 1972 and the grand champ at the Dallas Fair for three different years.

MALVIN JARBOE
Vice President

Malvin is every inch a farmer like the community he serves. He represents Floyd and Hale counties whose recent ballot vote of confidence returned him to a third term on the Water District Board.

Malvin says he's never lived beyond a ten square mile area from his home town of Floydada. But his influence and experience as a leader and thinker far exceed those boundaries. He has served as Vice President and continues to serve on the Federal Land Bank Association in Floydada and the Board of Consumers Fuel Association. He has worked on the Tax Board of Equalization for the Independent School District for over 12 years. Before accepting his post on the Water District Board, Malvin served as a Floyd County Committeeman for seven years. And he is now in his second year as Vice President of the District Board.

He built a 2,080 acre farm out of a 160 acre start 40 years ago which he farmed part time while working for the ASCS and SCS offices. Back then he also did "a little custom work" plowing people's land for a dollar an acre.

"I had a friend who had faith in me and rented me 800 acres," recalls Malvin. "I put down a couple of wells and bought more land whenever I had the money for the down payment."

Today he still works that 800 acres. He rents out some of his land and with the help of his son-in-law, works additional land that he rents from others.

"I try to work for the community, especially in the area of water conservation. We're a pretty close community," he mused. "Real neighborly. Everybody takes care of everybody else."

JAMES C. "JIM" CONKWRIGHT
Secretary-Treasurer

"Citizen of the Year" honors were bestowed on Jim Conkwright by the Hereford Chamber of Commerce during banquet ceremonies on January 31. Jim is a Deaf Smith County rancher, civic leader and Director of the High Plains Underground Water Conservation District.

The Hereford Noon Lions Club honored Conkwright for his desire to serve not only on a local level, but on the state and national levels as well. The Hereford native holds an animal science degree from Texas Tech University and ranches 15 miles north of Hereford producing Registered Hereford cattle and farm crops.

Conkwright, 37, is Secretary-Treasurer of the High Plains Water District and President of the Llano Estacado Council of Boy Scouts. He also serves as Chairman for the Governmental Affairs Committee of the Deaf Smith County Chamber of Commerce and a Director for the Texas Hereford Association.

In 1974 he was chosen as one of 20 persons across the nation to meet with President Gerald Ford on agriculture and in 1971 he was elected president of the Texas Hereford Association, the youngest to serve in the organization's history.

Conkwright is also a past president of the Hereford School Board and past president of the Deaf Smith County Chamber of Commerce.

The High Plains Underground Water District extends congratulations to Jim as an outstanding leader in many areas, well deserving of such recognition.

WEBB GOBER
Member

Webb says he's just an average farmer working his 480 acres of irrigated corn and wheat nine miles northeast of Farwell. He doesn't admit to being a community leader, but credits his father's long service and experience in local civic affairs as the good example for his own community involvement.

Webb will tell you he does it because he enjoys the people. But that dedication to people, including little people, accounts for over 13 years of service as a school board trustee, four years as a cub scout leader, any number of years as a director for several co-op gins, twelve years on the board of the Deaf Smith rural electric co-op, and eight years on the board of the High Plains Water District.

"It's work, and sometimes it means doing things you don't like," says Webb, "but I really enjoy the people."

Webb is also serving as a Board member of the Texas Water Conservation Association, evidence of his commitment to water conservation planning and education statewide as well as for his local community.

In directing Water District activities, he demonstrates the insight and foresight that have characterized his leadership and have put him in the offices of Secretary-Treasurer, Vice President and President of the Water District Board.

Webb commented that his work with the High Plains Water District has been a highlight in his activities. "I'm tickled by what's been accomplished," he says, "we need to keep on progressing as we have in past years."

Webb Gober's continued contribution to the Board will help ensure the progress.

MACK HICKS
Member

The newest member of the Board, Mack Hicks, is a manager. He runs an operation of twelve thousand producing acres owned by White Face Farms, Inc., in a 20 square mile area of northwest Hockley County. He got started 21 years ago when Mack came home on his first college semester break and two days later had talked himself into the business of learning the ropes at the White Face Farms offices. That business sense continues to work for him.

Mack not only made his way through the ranks at White Face Farms, but simultaneously attended two years at Levelland Junior College and then graduated an agricultural economist from Texas Tech in 1962.

He immediately came home to Hockley County as assistant manager for the Farms and was elevated to manager in 1967, the post he has held now for thirteen years. He oversees 14 tenant farms renting ten thousand acres, and farming two thousand himself.

Along the way, Mack opened a small commercial fertilizer business and was an early promoter of its use in Hockley County. He became part owner in a cattle feeding operation and also owns Hicks Equipment Company, as an implement broker.

"I just stay after it," was his explanation, "and every venture has been agriculturally related."

"I realize the problems tenant farmers are facing. We can't just flow the water down the row and wait for it to get to the other end," says Hicks. "There's not much management in that. I'm really interested in promoting and improving good water management on the High Plains."

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 3 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | *March, 1980*

HIGH STAKES measure for Dr. Wendt and research assistants the dramatic difference in plant growth between PIX treated and untreated cotton.

Plant-Water Breakthrough Coming

EDITOR'S NOTE: The Water District has set its sights on the frontiers of research that promise to optimize agricultural water use and conservation, with an active commitment to promoting local water-related research efforts at the Texas Agricultural Experiment Stations at Lubbock and Halfway.

In 1979 the District purchased equipment valued at $44 thousand dollars and loaned it to the experiment stations for their use in investigating several soil-plant-water and irrigation studies. The District also participated in funding approxmately half of a 24 thousand dollar cotton research project with PIX to examine the possibility of reducing plant water use while maintaining or even increasing yields with the application of chemical plant growth regulators.

The results of the pilot investigation were so promising that the Board of Directors have agreed to fund two additional plant growth regulator studies at TAES on cotton and grain sorghum. The Directors have committed a total of 34 thousand dollars to continue the research effort.

One grant of 14 thousand dollars will support work to measure the performance of PIX in cotton under field conditions on producer's farms. This on-farm study is the field application phase of the research and is an attempt to cut the lag time between basic research and product availability to the producers. PIX is not approved for growers, but has been conditionally cleared for on-farm test plots.

Directors also funded a 20 thousand dollar research proposal to examine another plant growth regulator, BAS 105 00 W, in grain sorghum on research plots at the Lubbock station under dryland, limited and full irrigation. It will test the plant growth regulator's influence on water use relations and yields.

The following is an account of where and how the Water District's research investment is reaping high returns.

High Plains agriculture may be on the verge of a possible breakthrough in plant water conservation with the application of a new class of growth regulators to the old job of making plants more water use efficient. Results of initial research at the Texas Agricultural Experiment Station in Lubbock, applying a new group of plant growth regulators in cotton to study its influence on water relations and yields, indicate that the treated cotton stressed less and produced a shorter plant with a smaller amount of leaf surface which resulted in a reduced rate of evapotranspiration. The treated cotton had higher yields and had slightly better staple length and fiber than the untreated cotton.

The study began in 1979 to determine the effect of PIX, a plant growth regulator, on the water relations and yield of cotton under the three moisture levels of dryland, intermediate and excessive irrigation. Growth regulators are not new to agriculture; they have been around since the 1920's as a natural or synthetic compound applied directly to a plant in small concentrations to enhance yields, improve quality or facilitate harvesting. The current

continued on page 3 . . . RESEARCH

Dammed Water Stays Put

It's an idea whose time has come. As water depletion continues and the cost availability gap in energy widens, the practice of basin tillage makes more and more cents.

Basin tillage is a method of mechanically mounding dirt into a series of earth dams or dikes in the furrow at regular intervals to trap water. Regardless of whether you sprinkle irrigate, furrow irrigate or dryland farm, basin tillage will save more water for your crop. It will substantially reduce or eliminate runoff and will maximize rainfall utilization in row crop farming.

About 75 to 80 percent of West Texas rainfall occurs after planting, and the rate of precipitation is normally much greater than the soil infiltration rates. The range of infiltration is from two inches per hour in sandy soils to one tenth of an inch per hour in tight clay soils, according to Dr. Charles Wendt, plant soil scientist at the Texas A&M Agricultural Experiment Station in Lubbock. "At our rates of rainfall," he says, "we can easily lose half of our water to runoff in some soils. But with dikes I am convinced we can virtually eliminate runoff."

Furrow dikes keep the rain where it falls, allowing the maximum natural moisture to soak into the soil profile. By damming the soil, erosion is prevented and the wetted areas and depths are increased.

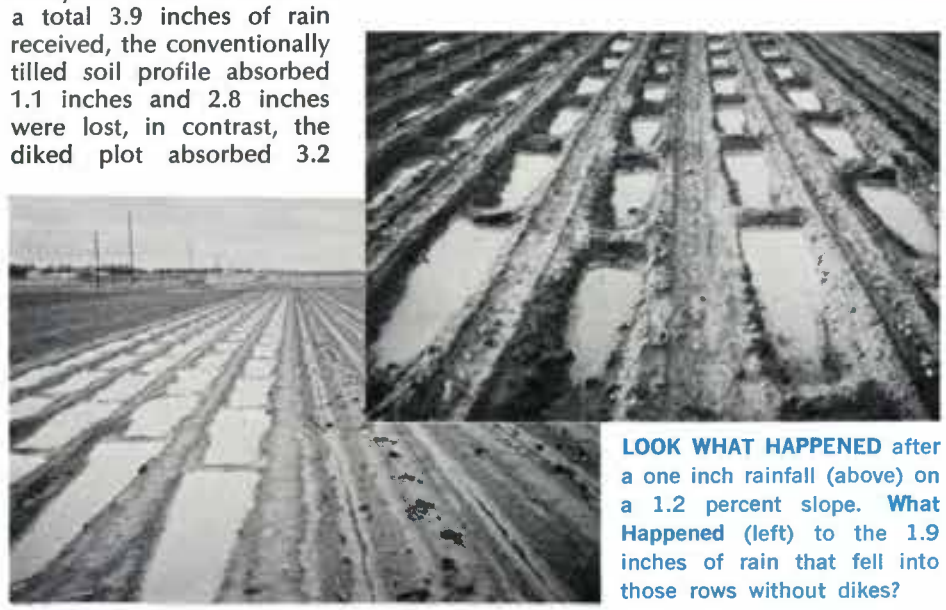
In one case, Dr. Elmer Hudspeth, USDA cotton engineer cooperating with TAES, and J. D. Bilbro, USDA agronomist, measured a test field near the Lubbock experiment station during 8 days of excessive rain. Of a total 3.9 inches of rain received, the conventionally tilled soil profile absorbed 1.1 inches and 2.8 inches were lost, in contrast, the diked plot absorbed 3.2 inches of moisture into the soil. Dr. Hudspeth has spent four years in research at the experiment station using furrow diking on a one and a half percent slope in Amarillo sandy loam soil, diking every other row in dryland cotton and grain sorghum. His results consistently produced a significant yield increase of about 11 percent in both crops, and a four year average increase of 40 pounds to the acre in cotton.

The evidence is there, and so is the technology. Forty years after a Colorado farmer built a lister to scoop up the soil into water holding dams along his furrow, technology has caught up. You don't have to settle for the rough, teeth jamming ride, loping along at a snails pace. Today's research has produced several basin tillage implement models which are simple in design and construction, capable of higher speeds, trouble free operation, and which attach to existing equipment, often adjustable for dam spacing and height.

Dr. Bill Lyle, an agricultural engineer at the Texas Agricultural Experiment Station at Lubbock, recently pioneered research to develop a basin tillage implement. He successfully designed a hydraulic paddle wheel that scoops the furrow into mini-dams. Several commercial companies are now marketing variations on Dr. Lyle's work. Dr. Hudspeth is aware of diking equipment dealers in Lamesa, Lockney, Plainview, Petersburg and Tulia, Texas, and in Stockton, California.

There are currently three model types: a trip model, a paddle wheel,

continued on page 4 . . . MINI-DAMS



LOOK WHAT HAPPENED after a one inch rainfall (above) on a 1.2 percent slope. **What Happened** (left) to the 1.9 inches of rain that fell into those rows without dikes?

Water Rights Doctrine Examined

APPENDIX

Laws Governing Water Use

Water resources are typically classified as either surface water or groundwater. Precipitation is considered diffused surface water until it reaches a lake, river, or other watercourse. Once the water reaches a defined watercourse, it becomes surface water. Thus, surface water consists of all natural streams, lakes, and ponds as well as man-made reservoirs and impoundments. Groundwater can take the form of an underground stream flowing along some defined channel, an underground reservoir of water formed through hundreds of years of percolation and contained within layers of sand and gravel or between layers of rock, or percolating waters not confined to any channel whatsoever.

Surface Water Law

The laws and regulations governing the use of surface water in the United States vary considerably from state to state. However, all fall under two general doctrines of water rights: riparian doctrine and prior appropriation doctrine.

THE CROSS SECTION (USPS 564-920)

Riparian Doctrine

Under the riparian, or common law, doctrine, the owner of land bounded or crossed by a river, stream, spring, or other natural body of water has certain riparian rights regarding use of the water. Riparian owners have the right to use the water for a number of purposes deemed "natural" uses, including domestic and household needs, livestock watering, fishing and recreation, even the generation of power.

In the strictest sense, riparian law gives the landowner a right to have the water undiminished in quantity and quality and uninterrupted in the duration of flow. This right is qualified only by the right of upstream riparian owners to use the water for domestic needs and livestock watering. The riparian owner does not have a property right in the water, in that except for domestic uses and livestock watering, no more water can be taken or diverted from the watercourse than will be returned to it.

Most states adhering to the riparian doctrine have modified it. A common variation is the "reasonable use" doctrine, which permits riparian owners to take water for "extraordinary and artificial" uses so long as those uses do not interfere with the natural rights of riparian owners downstream. Under this modification, municipalities, industry, and irrigating farmers, for instance, can divert water as long as enough water is available to downstream riparian owners for "natural" uses. Riparian rights are not restricted in time; they cannot be lost through misuse or nonuse.

Some states permit riparian owners to obtain "prescriptive" rights, which grant them the authority to use water for some extraordinary use even if the rights of lower riparian owners are infringed upon. For example, a city might obtain a prescriptive right for municipal water needs. It should be emphasized, however, that the prescriptive right applies only to downstream riparian owners. For example, while a city may deprive a downstream riparian owner of some water, a riparian owner upstream could deprive the city of any water required for natural uses, such as livestock watering.

Prior Appropriation Doctrine

While the water laws in the eastern states adhere to the riparian concept, the usefulness of the doctrine in allocating the limited supply of water among a growing number of competing uses was exhausted early in the settlement of the arid West. The Mormons appropriated surface waters 130 years ago without regard for riparian rights when they began irrigating the Salt Lake valley in Utah. Gold miners in California began practicing the doctrine, and by 1900 nearly all the western states had adopted the prior appropriation doctrine of water law.

Under the prior appropriation doctrine, a party acquires a right to use water by making a claim to divert and use a specified quantity of water from a particular source for a given purpose. When the claim is made and water is diverted, a priority is established, with first claimants receiving priority over later claimants. This is appropriately referred to as a "first in time, first in right" doctrine.

The claimant must apply the water to a beneficial use, and riparian and nonriparian owners have an equal right to make a claim. Thus, a nonriparian landowner with a prior claim to water from a given source has the right to use the quantity of water established in the claim to the exclusion of a riparian landowner with a later claim or no claim at all. The right to use water is subject to the needs of prior appropriators and, thus, is not a guaranteed right per se. A claimant may divert the specified amount of water only if its intended use will not infringe upon the supply of water to prior claimants. However, once that condition is met, a claimant can divert the specified quantity of water even if doing so exhausts the water supply.

Unlike the riparian right, the appropriation right can be lost through misuse or nonuse. Also, unlike the riparian right, the appropriation right is a property right and, as such, has value and can be exchanged.

The prior appropriation doctrine implicitly requires a system of administration to effect its rule. In the absence of any Federal water laws, the individual states have established a wide variety of rules, modifications, and guidelines that are administered by various agencies and organizations. Such a collection forms a state's water law. In the administration of the prior appropriation doctrine, most western states have adopted a permit system, in which a claimant must request permission from a state agency to divert and use a certain quantity of water under a certain set of conditions. The agency has the authority to grant the permit as requested, grant it in a modified form (such as for a restricted time period), or reject it altogether.

The permit system allows some states to allocate water among the competing uses not only by priority in time of filing but also by priority as to proposed uses of the water. The priorities assigned to various uses differ among states, however, and several states assign no priorities at all.

Some states have modified the appropriation doctrine as it applies to agriculture by imposing a "statutory duty" on water. This criterion restricts the amount of water that can be applied to an acre of farmland. The purpose, of course, is to prevent waste through excessive use.

Groundwater Law

Most western states have adopted the prior appropriation doctrine for groundwater as well as surface water. However, three other groundwater doctrines exist: absolute ownership, reasonable use, and correlative rights. Under the doctrine of absolute ownership, a landowner has a right to use any amount desired of the water lying below his land. Texas is the only western state that abides by this doctrine.

Under the reasonable use doctrine, each landowner must use the underlying water in a reasonable manner, showing regard for the rights of the other landowners using the water. Under the correlative rights doctrine, landowners are required to put the water to a reasonable use so long as the supply is adequate but to use only a quantity of water proportionate to the percentage of an owner's land overlying the particular underground

RESEARCH IS SPREADING WATER THINNER FOR BIGGER YIELDS

(continued from page 1)

studies are introducing a new group of compounds to determine if growth regulators can aid in increasing plant-water-use efficiency. This is a new twist in the research and a potentially explosive one.

Results of the first plant treatment studies by TAES conducted last year with Water District support, indicate that PIX does indeed help plants use water more efficiently. PIX proved effective in controlling vegetative growth of cotton and showed potential for increasing cotton maturity and yield. Data also confirmed that the plant growth regulated cotton showed less stress. PIX cotton was shorter, had a decreased leaf area and lost less water to evapo-transpiration.

YARDSTICKS tell the story. PIX cotton grew up shorter with less leaf area.

There was little difference in the amount of water used by the treated and untreated plots, but a significant difference in the productivity of that water. The value of the yield per acre as estimated at loan values on the PIX cotton increased by $19 per acre in the dryland plot, by $13 in the excessively irrigated plot and by $5 in the intermediately irrigated plot. The treated plots produced a slightly increased staple length and yield and more white cotton than the untreated plots.

Dr. Charles Wendt, TAES plant soil scientist conducting the research, believes there is tremendous potential for maximizing plant water use efficiency with growth regulators. However he says, "we will have to know under what specific conditions a plant growth regulator will work more than any other compound. Right now it seems to respond best during periods of stress and under extreme wet conditions, but not in between. There will be a place relative to water conditions where plant growth regulators will do well. We just have to find it."

Dr. Wendt and others at the experiment stations at Lubbock and Halfway have been investigating several areas of water related research in the areas of plant treatments, plant breeding lines of cotton and sorghum, anti-transpirants, plastic moisture barriers, surfactants, plant stresses, soil treatments and irrigation applications. The High Plains Water District is contributing to these studies by providing some of the basic testing equipment needed as well as several of the more sophisticated data collection instruments now being shared by investigators in virtually all of these research projects.

TAES recently summarized the results of its work with soil-plant-water use in a brief report which was presented to the Water District.

The PIX research findings were presented first among the data, but other significant results were also reported in another phase of the plant treatment study which is evaluating low concentration herbicides for their potential to change the growth of cotton.

In a greenhouse-controlled environment study Roundup, Banvel, A-Rest, and Atrazine were evaluated. Of these chemicals only Roundup showed promise, and further work is planned.

Work was also done with emulsified polyethylene. In recent years, techniques have been developed to make water soluble emulsions out of the material used in polyethylene sheeting. TAES conducted its study to determine if emuslified polyethylene has any potential to increase the water use efficiency and yield of crops. This anti-transpirant was first observed in potatoes and later in cotton, using three different levels of concentration of the material. A 4% concentration appeared most promising. Yield increases ranged from 26 to 34 dollars per acre, but the cost for the amount of material applied was high. More work is needed in reduced applications.

Drs. Wendt and Quisenberry have been cooperating for two years on plant breeding evaluations of drought tolerance in an exotic line of cotton from Mexico. It has been found to have a deeper root system that uses more soil water (one to two inches), no wilting during the growing season, and less water use per unit leaf area. This cotton line could enhance the water use efficiency of High Plains cotton grown under dryland or with limited irrigation water.

Grain sorghum lines have been found that are resistant to early season stress. They apparently grow deeper root systems earlier than other lines. Lines that are resistant to late season stress remain green while those that are not resistant die. Efforts are being made to combine these resistance characteristics into one strain.

A two year surfactant study was conducted at Halfway to determine the potential of using the Amway adjuvant to increase the water use efficiency and yield of grain crops. In both years, there was a small increase in water movement into the soil when the material was sprayed on the soil surface, but no benefits were obtained when the material was injected in the irrigation water. Since yields were not affected in sorghum or corn, Dr. Wendt does not recommend this for crop use.

A study of underground plastic barriers installed one to four feet below the soil surface in the sandy soils in the sand hills area was to determine yield affects. The plastic barrier kept water from moving below the root zone in forage sorghum, corn and potatoes under limited irrigation. Although yields were increased, they were still low. Some results were achieved with limited irrigation and the visual difference was dramatic between the test and control plots.

Another water holding capacity study using a starch derivative called "Super Slupper" which holds three thousand times its weight in water, is still in the laboratory research stage. It shows some promise for increasing water holding capacity in certain soils. It affects sand more than clay. But no field studies have yet been done.

An important two year research work by Drs. Wendt and Tom Archer at Halfway, studied irrigation application in corn to determine if irrigation could be decreased without affecting yield and to study whether there is a relationship between plant stress and spider mite damage. It was found that cutting stress during pollination cut mite damage. The study also found that irrigation prior to tasseling and after grain filling could be eliminated with the least affects on yield.

The report concluded with a summary of work with automated irrigation. It noted that the technology has been developed to use sensors to turn sprinkler systems on and off based on soil moisture, rainfall, and wind speeds. One of the problems with using soil moisture sensors in the Texas High Plains is that few irrigation systems can pump enough water to supply crops during hot dry periods. The rain and wind sensors may have a place where the irrigation systems are remotely located.

On a final note, Dr. Wendt reported that an additional research effort this year is investigating the use of tallow, a byproduct of the beef rendering industry, to see if it can be used as an anti-transpirant. A study is underway to develop techniques to emulsify tallow into water soluble solutions. The solutions will then be evaluated for their potential to cut plant water loss on potatoes in the greenhouse and possibly under field conditions.

He further outlined the 1980 plant-soil-water research program at TAES as follows:

Plant treatments with growth regulators will include a laboratory study to determine the influence of PIX on the photosynthesis and internal water relations of cotton. This study should provide information concerning the activity of PIX that will enable better decisions to be made concerning its use under field conditions. A field study will be continued to determine the effect of PIX on the photosynthesis, water use efficiency and yield of cotton.

Plant breeding work will continue in cotton and grain sorghum.

Dr. Quisenberry, cotton geneticist, has made crosses between an exotic line from Mexico (T-25) and locally adapted cottons. A greenhouse study will be conducted to determine which backcrosses have the deep rooting characteristic of T-25. The lines with the deep rooting of T-25 will be further evaluated under field conditions to see if the backcrosses will use as much soil water as T-25. The overall goal of this research is to breed a cotton that will use limited water resources more efficiently.

Cooperative work will be continued with Dr. Darrel Rosenow, grain sorghum breeder, to develop grain sorghum that will use the area's water resources more efficiently. These studies will be conducted at Halfway, Lubbock, and Big Spring.

There is considerable interest in using sweet sorghums for gasohol production. A small cooperative study with Dr. Rosenow will be conducted at Halfway to determine if differences exist among varieties and/or breeding materials in water use efficiency.

Soil treatment research will include greenhouse studies to evaluate the potential of various compounds to decrease soil water evaporation. Compounds to be investigated include emulsified plastic, tallow, and fatty alcohols. The overall goal of this research is to develop formulations that can be applied in the irrigation water or sprayed on the soil surface to conserve water from irrigation or rainfall.

The studies initiated in 1979 to determine the influence of cotton compost on the physical and chemical properties of soil, and yield and quality of cotton will probably be continued.

The influence of the starch derivative on the water holding capacity of soils will also be continued.

---

water source when supply becomes inadequate. California has adopted the correlative rights doctrine.

This appendix concludes a 3 part article by Larry D. Hauschen on "Increasing Water Scarcity: Problems and Solutions," taken from the VOICE of the Federal Reserve Bank of Dallas.

A Lucky Find . . .

Roxanne York is every bit as Irish as her name suggests, and a pretty new addition to the Water District staff as our receptionist-secretary.

Roxanne comes to the District from Texas Tech University where she had been a psychology student on the Dean's list. She is an outdoor girl who grew up skiing and camping and moving often. Her father's oil company work took the family to five states and Indonesia.

Roxanne says she learned about poverty during her four month Indonesian visit, and that she learned about accounting during her four years of high school in Corsicana, Texas. During all that time she worked for a professional accounting firm and still graduated a National Honor Society student.

Roxanne has quickly learned to handle the District's cost-in-water income tax depletion information and says she fully enjoys the contact with the landowners.

"I'm learning more about their problems and issues," she blinked widely. "It's hard work being a farmer."

The District is delighted to welcome Roxanne to its staff. Roxanne is replacing Charmone Bednarz who recently moved with her husband to bigger and better things in Wichita Falls.

Inventor Converts Electric Current Into Convenience

The newest "hot" idea in irrigation management is so simple and practical it will leave you asking why you didn't think of it. Or maybe you have. It is an electrical center pivot monitor, a little animated black box that tells you whether your pivot system is operating normally or malfunctioning.

LITTLE BLACK BOX will go beep night or day to alert you.

It is designed to save time and energy by eliminating the daily need to ride herd on your center pivot irrigation equipment.

Whether you own one rig, five, or twenty, they can each be tied to a central monitoring console that lets you see at a glance whether your systems are working.

The pivot monitor system consists of a battery backed encoder and decoder signaling on CB channel 23. The units operate on water pressure. Should a pivot fail, water pressure in the line would go down, causing a switch to activate which signals the monitor with a sustaining alarm light and a temporary buzzer in order to command immediate attention.

The monitor can be installed anywhere there is house current, from headquarters to housequarters. This makes it convenient for anyone in the family to monitor. And it provides the added advantage of allowing you to discover a downed sprinkler immediately. This could make the difference between getting same-day repairs or losing time, and perhaps even some yield if the crop is in a stress stage.

The encoder rides over the center pivot rig pulling juice off the slip ring and pulsing a signal up an antenna and back to the decoder. The antenna towers from 28 to 50 feet above the ground depending on its ability to project an unobstructed signal. The signal is strongest within a five to twenty mile radius of the decoding receiver station, but that radius can be expanded to a range of 40 miles if a 220 volt power source is used. With the added power, the decoding monitor can handle a pretty extensive sprinkler operation.

The decoder consists of the CB unit mounted over an electric power panel. Its board signals a power light, alarm light, alarm horn and a reset switch for each sprinkler system monitored.

TOWERING IN FURROW, the antenna rides a sprinkler system broadcasting a signal.

This equipment can also be adopted to work on internal combustine engine powered pivots.

The electric pivot monitor has been available only for a short time. It cost about 15 hundred dollars and already 15 units are in place with fifty orders pending.

The man behind this electronic brainchild is Ronnie Shepherd, an electrical engineer with Brandon & Clark Electric. He says a customer got him thinking about it. He's grappled with the idea for four years to work out the electronics with professional help. His is one of those simple solutions that comes only after a complete inventive process, but that's often the path of a great idea.

Hot Line

The government has a "hotline" on alcohol fuels, an information center to answer all sorts of questions regarding production of gasohol, etc.

The toll-free number is (800) 525-5555. Experts will man the phones from 8 to 5, Mountain Time, every working day, Monday through Friday. Lines will stay open outside of working hours. Callers will be able to leave recorded messages that will be answered the next working day.

If you'd rather write than call, send your questions to: National Alcohol Fuels Information Center, 1617 Cole Blvd., Golden, Colorado 80401.

MINI-DAMS KEEP THE WATER WHERE YOU WANT IT

(continued from page 1)

and a roll model. One point to consider in selecting a model is whether the equipment builds a dam that will be higher than your furrow bed, because a good rain could wash out that dam at its edge and allow runoff.

Dikes are practical in both dryland and with sprinkler irrigation. Diking in conjunction with sprinklers will allow higher water application without runoff. Hedspeth says an estimated three quarters of a million acres were dammed last year and he observed that, at the moment, dikes are being used more on cotton than on anything else because it is a short crop. He claims that under most conditions increased yields will more than pay for the cost of the furrow diker in one year.

TICKLED to be here, left, SCS Texas State Conservationist George Marks from Temple tours the Field Water Conservation Lab with Lubbock Area Conservationist, Mickey Black; Deputy State Conservationist Budd Fountain, and Bob Arhelger, District Conservationist in Lubbock, prior to a local RCA hearing.

"You don't need a huge increase in yield," he said. "Forty pounds more per acre, even under irrigated conditions, will cover it." Dr. Lyle believes basin tillage stops runoff as effectively as bench leveling, is more practical, and is much cheaper.

There are several approaches to basin tillage, from diking every row to alternate row diking. Alternate row dikes are most common with furrow irrigation since the diked row can still catch rainfall while allowing for alternate row watering down the furrow. Under sprinkler irrigation every row can be diked, however this usually requires a sweep to plow up existing dikes in front of the tractor tires for a smoother ride.

Whatever model and method you choose, basin tillage will definitely save water.

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 4 Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas April, 1980

SIMPLE "FEEL" TEST SHOWS

HOW TO MEASURE SOIL WATER NEEDS

You can make a reasonable estimate of how much irrigation water you need to add to your soil to bring it to field capacity without investing in a lot of costly special equipment.

The "feel and appearance" method of determining soil moisture levels is a reliable and common alternative by which an irrigator can gauge moisture conditions in his soil to within ten to fifteen percent accuracy with just a little experience and judgment. The feel method will tell you what is the current moisture condition in your field in relation to its field capacity. From this you can estimate how much water you need to apply.

The feel method requires taking soil samples at several depths in the field. Soil measurements should be made into the zone from which the plant roots extract their moisture. This implies the need to know the moisture extraction pattern of your crop. Figure 1 shows the general moisture extraction from various root zone depths.

By feeling the soil and observing the signs at different levels of moisture, it is possible to make a good estimate of when to irrigate. Several soil samples are needed. The first measurement should be taken from the upper quarter of the root zone and one or two more measurements taken at lower levels. If the optimum moisture extraction depth of a given crop is 48 inches, for example, then samples should probably be taken at 6, 18, and 36 inch depths. During the first stages of root development, however, a six inch sample is probably adequate for predicting when to irrigate most crops. More samples are required as the maturing plant begins developing root structure at greater depths.

The only equipment needed to get a good soil sample is a shovel or a "sharp shooter spade" in some soils, or for best results use a soil auger or sampling tube.

continued on page 3 . . . FEEL

core sampler

cork screw auger

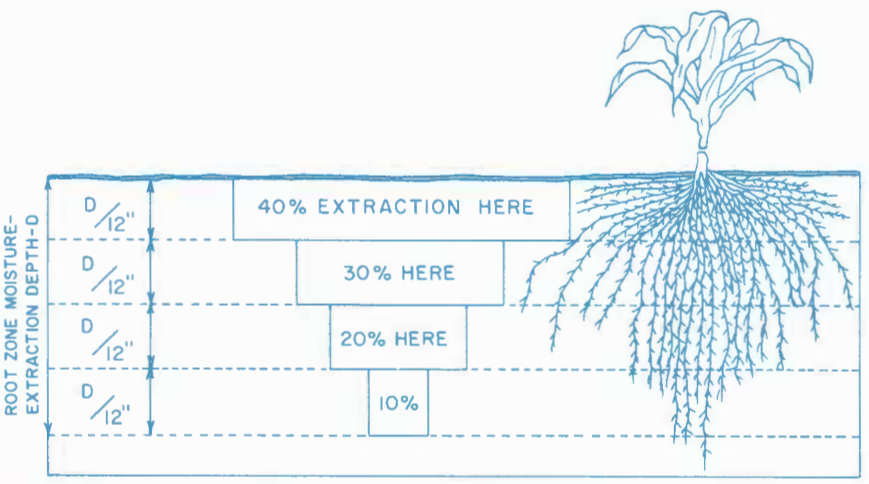


FIGURE 1—Average moisture-extraction pattern of plants growing in a soil without restrictive layers and with an adequate supply of available moisture throughout the root zone.

PANHANDLE'S FIRST MANAGER STEPS ASIDE

Felix Ryals commands a driving energy. His retirement this spring closed 23 years of energetic work as the first manager of the Panhandle Ground Water Conservation District.

During his tenure, Felix instituted many district service programs. He authored a long standing local weekly water news column and a monthly district publication, represented the district at water meetings throughout the state and nation, in water associations, in water policy planning sessions and task forces and handled virtually every district task at one time or another, from measuring water levels in wells to collecting water quality samples and staking well sites.

Nor was Felix done when the work was. He also dedicated 23 years to fraternal and civic club work. He served as president of the Pampa Shriner Association, Deputy Grand Master of the 99th Masonic District, district executive board member and serious campaigner for the American Cancer Society, and as a staunch Lions service club booster to name just some of his credits.

Folks described him as a colorful figure, always in an overpowering hurry to get it done and get more going. He has a warm spot for kids which he acquired during 18 years in the Arkansas public schools as a coach, teacher, principal and superintendent, and as the superintendent of a state reformatory.

Felix leaves a great record of service as he retires. He has taken that tremendous energy fishing and back to Arkansas, but not before imparting some measure with his young successor, Richard Bowers, the new manager of the Panhadle Groundwater Conservation District.

FELIX RYALS (right) and Richard Bowers, management past and present for the Panhandle Water District.

STATE WATER LEADER RETIRES

His West Texas cowboy appearance and manners are often deceptive. His friends say that Buck does a lotta thinking and not much talking, but when he does, it makes a lotta sense.

J. W. "Buck" Buchanan is a veteran water leader whose 25 years of public service command great respect both locally and nationally. He retired in April from nearly 25 years of managing the North Plains Ground Water District, to again seek a seat in the Texas State Legislature. He had held that office from 1959 to 1963.

"Buck" Buchanan

In addition to his prior service as a state representative, Buck served on numerous governmental water task forces, national water boards, executive committees and professional associations. He continues to serve on several educational water organization boards and is a local civic leader.

Buck led the development of sound, sustaining water policies to assure the growth of this region and the state. This included support in the areas of irrigation, water pollution control, well drillers licensing, water project funding and research to name some.

Buck dedicated most of his career to fostering and protecting Texas water rights, particularly groundwater. Wayne Wyatt, manager of the High Plains Water District and a long time friend, testified of Buck that "for any controversial water issue Buck was always present, separating the wheat from the chaff and arguing persuasively in the interest of the groundwater user."

Orville Allen

His record of contributions have been widely recognized and honored. Such work offers a tremendous legacy for the new North Plains Water District manager, Orville Allen.

MODERATELY FINE TEXTURE—Clay Loams & Silty Clay Loams

0 TO 25% AVAILABLE MOISTURE — Crumbles readily, will hold together but "balls" with difficulty and breaks easily.

25 TO 50% AVAILABLE MOISTURE — Does not crumble, forms readily, will "ball with pressure.

50 TO 75% AVAILABLE MOISTURE — Forms "ball" readily, will "ribbon" out between thumb and forefinger. Somewhat slick feeling.

75 TO 100% AVAILABLE MOISTURE — Easily "ribbons" out. Has "slick" feeling.

MEDIUM TEXTURE Loams & Silt Loams

0 TO 25% AVAILABLE MOISTURE — Crumbles easily, tends to hold together from hand pressure.

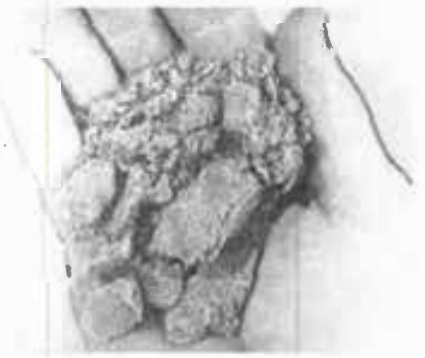
25 TO 50% AVAILABLE MOISTURE — Somewhat crumbly, will hold together in hand with pressure.

50 TO 75% AVAILABLE MOISTURE — Forms "ball" readily, will "slick" slightly with pressure.

75 TO 100% AVAILABLE MOISTURE — Forms "ball" easily, fairly friable, "slicks" readily.

COARSE TEXTURE—Sandy Loams & Loamy Sands

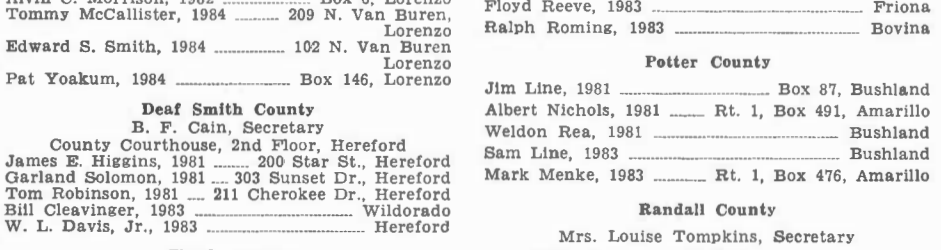
0 TO 25% AVAILABLE MOISTURE — Dry, loose, flows through fingers.



25 TO 50% AVAILABLE MOISTURE — Looks dry, will not form ball with pressure.

50 TO 75% AVAILABLE MOISTURE — Will form loose ball under pressure, will not hold together even with easy handling.

75 TO 100% AVAILABLE MOISTURE — Forms weak ball, breaks easily, will not "slick."



THE CROSS SECTION (USPS 564-920)

BOARD OF DIRECTORS

Precinct 1
(CROSBY, LUBBOCK and LYNN COUNTIES)
James P. Mitchell, President ..... Wolfforth

Precinct 2
(COCHRAN, HOCKLEY and LAMB COUNTIES)
Mack Hicks ..... Levelland

Precinct 3
(BAILEY, CASTRO and PARMER COUNTIES)
A. W. Gober ..... Farwell

Precinct 4
(ARMSTRONG, DEAF SMITH, POTTER and RANDALL COUNTIES)
Jim Conkwright, Secy.-Treas. ..... Hereford

Precinct 5
(FLOYD and HALE COUNTIES)
Malvin A. Jarboe, Vice President ..... Floydada

COUNTY COMMITTEEMEN

Armstrong County
Carroll Rogers, Secretary
Wayside, Texas

Guy Watson, 1981 ..... Wayside
Bill Heisler, 1981 ..... Wayside
M. L. McGehee, 1981 ..... Wayside
James Bible, 1983 ..... Wayside
James Stockett, 1983 ..... Wayside

Bailey County
Doris Wedel, Secretary
H&R Block, 224 W. 2nd, Muleshoe

Eugene Shaw, 1981 ..... Rt. 2, Muleshoe
David Stovall, 1981 ..... Rt. 2, Muleshoe
Ernest Ramm, 1981 ..... Rt. 2, Muleshoe
D. J. Cox, 1983 ..... Enochs
Marshall Head, 1983 ..... Muleshoe

Castro County
Garnett Holland, Secretary
City Hall, 120 Jones St., Dimmitt

Jackie Clark, 1981 ..... Rt. 1, Box 33, Dimmitt
W. A. Baldridge, 1981 ..... 608 W. Grant, Dimmitt
Frank Wise, 1981 ..... Rt. 4, Box 10, Dimmitt
George Elder, 1983 ..... Dimmitt
Floyd Schulte, 1983 ..... Dimmitt

Cochran County
W. M. Butler, Jr., Secretary
Western Abstract Co., 108 N. Main Ave., Morton

Keith Kennedy, 1982 ..... Star Route 2, Morton
Robert Yeary, 1982 ..... Route 2, Box 66, Morton
Hershel M. Tanner, 1984, Route 2, Box 36, Morton
Richard Greer, 1984 .... Star Rt. 1, Box 4, Morton
Donnie B. Simpson, 1984, 292 SW 3rd St., Morton

Crosby County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Mike Carlisle, 1982 ..... Route 1, Box 274, Lorenzo
Alvin C. Morrison, 1982 ..... Box 6, Lorenzo
Tommy McCallister, 1984 ..... 209 N. Van Buren, Lorenzo
Edward S. Smith, 1984 ..... 102 N. Van Buren Lorenzo
Pat Yoakum, 1984 ..... Box 146, Lorenzo

Deaf Smith County
B. F. Cain, Secretary
County Courthouse, 2nd Floor, Hereford

James E. Higgins, 1981 ..... 200 Star St., Hereford
Garland Solomon, 1981 .... 303 Sunset Dr., Hereford
Tom Robinson, 1981 .... 211 Cherokee Dr., Hereford
Bill Cleavinger, 1983 ..... Wildorado
W. L. Davis, Jr., 1983 ..... Hereford

Floyd County
Verna Lynne Stewart, Secretary
Floyd Co. Abstract, 215 W. California, Floydada

Charles Huffman, 1982 ..... Route 1, Lockney
Gilbert L. Fawver, 1982 ..... Route 4, Floydada
C. O. Lyles, 1984 ..... Route 4, Floydada
Cecil Jackson, 1984 ..... Route 3, Floydada
D. R. Sanders, 1984 ..... Star Route, Floydada

Hale County
J. B. Mayo, Secretary
Mayo Ins., 1617 Main, Petersburg

Gaylord Groce, 1982 ..... Box 314, Petersburg
Bill John Hegi, 1982 ..... Route 2, Petersburg
Harold W. Newton, 1984 ..... Box 191, Petersburg
Jim Byrd, 1984 ..... Route 1, Petersburg
Ray Porter, 1984 ..... Box 193, Petersburg

Hockley County
Jim Montgomery, Secretary
609 Austin Street, Levelland

J. E. Wade, 1982 ..... Route 2, Littlefield
Jack Earl French, 1982, Rt. 3, Box 125, Levelland
W. C. McKee, 1984 ..... Box 514, Sundown
Leon Young, 1984 ..... Route 1, Ropesville
Robert Phillips, 1984 ..... 218 Redwood, Levelland

Lamb County
Robert Richards, Secretary
402 Phelps Avenue, Littlefield

Billy J. Langford, 1982 ..... Box 381, Olton
Edward Fisher, 1982 ..... Box 67, Sudan
P. A. Washington, 1984 ..... Box 124, Springlake
Jack Stubblefield, 1984 ..... Box 397, Spade
Larry Lockwood, 1984 ..... Star Rt. 2, Littlefield

Lubbock County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Owen Gilbreath, 1982 ..... 3302 23rd St., Lubbock
Clifford Hilbers, 1982 ..... Route 1, Box 14, Idalou
Don Bell, 1984 ..... Box 114, Wolfforth
Ronald Schilling, 1984 ..... Route 1, Slaton
Granville Igo, 1984 ..... 1304 8th St., Shallowater

Lynn County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Gary Houchin, 1982 ..... Box 54, Wilson
Freddie Kieth, 1982 ..... Box 283, New Home
Leland Zant, 1984 ..... Route 1, Wilson
David R. Wied, 1984 ..... Box 68, Wilson
Wendell Morrow, 1984 ..... Route 1, Wilson

Parmer County
Pat Kunselman, Secretary
City Hall, 323 North Street, Bovina

Troy Christian, 1981 ..... Rt. 1, Farwell
Dalton Caffey, 1981 ..... P.O. Box 488, Friona
Ronald Elliott, 1981 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Friona
Ralph Roming, 1983 ..... Bovina

Potter County
Jim Line, 1981 ..... Box 87, Bushland
Albert Nichols, 1981 ..... Rt. 1, Box 491, Amarillo
Weldon Rea, 1981 ..... Bushland
Sam Line, 1983 ..... Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

Randall County
Mrs. Louise Tompkins, Secretary
Farm Bureau, 1714 Fifth Ave., Canyon

Harry LeGrand, 1981 ..... 4700 S. Bowie, Amarillo
Jack Brandt, 1981 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1981 ..... Box 56, Bushland
Bill Dugan, 1983 ..... Happy
Roger B. Gist, III, 1983 ..... Happy

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

Table 1. Guide For Judging How Much Moisture Is Available For Crops

	Loamy Sand	Sandy Loam	Loam and Silt Loam	Clay Loam or Silty Clay Loam
Inches of water per foot soil will hold at field capacity	1. to 1.25 inches	1.25 to 1.50 inches	2. to 2.25 inches	2.25 to 2.50 inches
Available soil moisture remaining	**Feel or appearance of soil and moisture deficiency**			
0 to 25 percent	Dry, loose, single grained, flows through fingers.	Dry, loose, flows through fingers.	Powdery dry, sometimes slightly crusted but easily broken down into powdery condition.	Hard, baked, cracked, sometimes has loose crumbs on surface.
inches per foot to be added:	.90 to .70	1.3 to 1.0	2.0 to 1.5	2.2 to 1.65
25 to 50 percent	Appears to be dry, will not form a ball with pressure.	Appears to be dry, will not form a ball.	Somewhat crumbly but holds together from pressure.	Somewhat pliable, will ball under pressure.
inches per foot to be added:	.70 to .45	1.0 to .65	1.5 to 1.0	1.65 to 1.10
50 to 75 percent	Appears to be dry, will not form a ball with pressure.	Tends to ball under pressure but seldom holds together.	Forms a ball somewhat plastic, will sometimes slick slightly with pressure	Forms a ball, ribbons out between thumb and forefinger.
inches per foot to be added:	.45 to .20	.65 to .30	1.0 to 0.5	1.10 to .55
75 percent to field capacity (100 percent)	Tends to stick together slightly, sometimes forms a very weak ball under pressure.	Forms weak ball, breaks easily, will not slick.	Forms a ball, is very pliable, slicks readily if relatively high in clay.	Easily ribbons out between fingers, has slick feeling.
inches per foot to be added:	.20 to .00	.30 to .00	0.5 to .00	.55 to .00
At field capacity (100 percent)	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.
inches per foot to be added:	.00	.00	.00	.00

FEEL . . .

continued from page 1

As a first step, take a handfull of soil from the area where the plant roots are located and squeeze firmly several times. The moisture condition of the soil type will be apparent as pressure is released, generally according to how firm and lasting a dirt ball is formed by the soil. Each soil type will have certain "tell tale" signs which can be seen or felt at particular moisture deficiency levels.

Table 1 describes the general characteristic signs and identifies the percentages of moisture present in four types of soil. Soil can store only a certain amount of water per foot of depth. Once you have determined the amount of readily available moisture in your soil, then the inches of water needed per foot to refill the soil profile at each level can be found on Table 1 as inches or fractions of inches to be added. These figures were calculated for each given soil type by measuring moisture deficiencies with the oven dry-weight method and with commercial soil moisture indicators which accurately determined the field capacity of each soil type at each level.

A rule of thumb is to water when the average moisture deficiency in the root zone falls below fifty percent. If you follow these procedures you should be able to fill the root zone, and that's good water management practice.

WHAT IS YOUR WATER APPLICATION EFFICIENCY?

HOW TO USE THIS CHART: The net irrigation requirement (NIR) for a particular crop is 24 inches and water application efficiency (WAE) is 60 percent. Find the *gross* irrigation requirement on the chart by reading chart under "net irrigation requirement for 24" and drop down vertically to 60% water application efficiency. The gross irrigation efficiency is 40".

The percent of savings is based on 80% and 90% water application efficiency. If your present water application efficiency is 60% and it is possible to raise the water application effciency to 80%, then you would reduce the amount of water now being pumped by 25 percent. Also, your present energy costs would be reduced by 25 percent at the same operating plant efficiency and lift.

Gross Irrigation Requirement Versus Water Application Efficiency

	Net Irrigation Requirement in Inches									80% SAVINGS	90% SAVINGS
WAE %	**6**	**9**	**12**	**15**	**18**	**21**	**24**	**27**	**30**		
90	6.67	9.89	13.33	16.67	20.0	23.33	26.67	30.0	33.33		
85	7.06	10.59	14.12	17.65	21.18	24.71	28.24	31.76	35.29		5.6
80	7.5	11.25	15.0	18.75	22.50	26.25	30.0	33.75	37.5		11.1
75	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0	6.25	16.7
70	8.57	12.85	17.14	21.43	25.71	30.0	34.29	38.57	42.86	12.5	22.2
65	9.23	13.85	18.46	23.08	27.69	32.31	36.92	41.54	46.15	18.7	27.8
60	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	25.0	33.3
55	10.91	16.36	21.82	27.27	32.73	38.18	43.64	49.09	54.55	31.3	38.9
50	12.0	18.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0	37.5	44.5
45	13.33	20.0	26.67	33.33	40.0	46.67	53.33	60.0	66.67	43.8	50.0
40	15.0	22.5	30.0	37.5	45.0	52.5	60.0	67.5	75.0	50.0	55.6
35	17.14	25.71	34.29	42.86	52.43	60.0	68.57	77.14	85.72	56.3	61.1
30	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	62.5	66.7

$$\text{WAE} = \text{Water Application Efficiency \%} = \frac{\text{Net irrigation requirement}}{\text{Gross irrigation requirement (water pumped)}} \times 100$$

$$\text{SAVINGS \%} = \frac{X_2 - X_1}{X_1} \times 100 \quad \text{when } X_1 = \text{gross irrigation requirement for 80 or 90 \% WAE}$$

X_2 = gross irrigation requirement for other WAE %

Lubbock County Committeeman Talks About Water District Services To His Community

Wolfforth taxpayers in the Frenship School District are saving themselves $7500 dollars a year in interest on school bonds sold this year, and Don Bell had a lot to do with it.

Don is a Frenship school board member and Water District Committeeman for Lubbock County. He was alert to a key consideration related to the school district's need for a recent re-evaluation on their bond rating. That consideration was water. At Don's suggestion the school board received from the High Plains Underground Water District a comprehensive report on the current and projected water resources for the Frenship/Wolfforth area.

"We needed to be sure to indicate to the bonding agency that we didn't have a water problem serious enough to affect our growth," Don said. "And as it turned out this water question was in fact an important consideration."

When the evaluation was over, the Frenship school district received more than a favorable bond rating, their rating was raised one point. The school board's financial consultant assured the board that their water presentation was very helpful if not decisive in securing that raise.

Don Bell's response was simply, "when you're associated with someone who you know could be helpful, it's easier to call on them when you're in need." Don was explaining what keeps him coming back to seek the Water District's involvement in his local community affairs. He inadvertently expressed the logic that keeps the District seeking new channels in which to apply its growing knowledge and expertise.

Don Bell's community provides a striking example of how folks use the Water District to their best advantage. They find a surprising number of opportunities to apply the District's expertise and services. "It starts with people finding out they've got a problem," says Don. "The city of Wolfforth needed to know its water future. I was familiar with the Water District's municipal water assessment studies so I recommended that the city council ask for such a study."

Wolfforth has not been unique in its request, the District has made over a dozen such local water assessments during the past two years as a result of requests from similar communities. These studies assess the groundwater reserves under the cities corporate limits and evaluate the adequacy of these reserves to satisfy future needs. Another service which the city of Wolfforth has requested from the Water District recently concerned a unique water quality problem.

"We've had an occasional problem with manganese in our city water," commented Bell. "The District came out, analyzed it and made recommendations on how to handle it. They've been very cooperative in trying to help solve the problem and identify the cause."

"Another service that I'm particularly grateful for is the bacteriological analysis of domestic wells," Don added. "I asked the District to come out to check one of my wells, and sure enough, it was bad. Once I knew it, I could do something about it. But that gets back to getting people's attention. Probably more people would use this service if they knew it were available." The District analyzes water from domestic wells for bacterial contaminents such as fecal coliform on request. District staff are covering the entire District offering this service and giving notice on a community by community basis, but in the meantime they have encouraged individual inquiries.

Don mentioned still another new service of the District in commenting that several producers around Wolfforth have requested an irrigation efficiency test from the Soil Conservation Service. The irrigation efficiency test program is one of the District's several joint activities with the SCS and other local and state agencies to make the most of the remaining water resources. Three field water laboratories, which are trailers loaded with soil/water monitoring and measuring equipment, are now servicing the Lubbock, Amarillo and Muleshoe areas with on-farm irrigation evaluations by SCS and District staff. They evaluate a producer's total water management program for its overall efficiency and for the specific performance levels of each component of his system. The trailers were equipped for training and pilot testing with SCS and District personnel, who are now demonstrating to farmers how they can evaluate and improve their own water management practices.

Don said that he had talked with growers who participated in the demonstrations and thought that it's a good idea. "We're at a place now where the net return on commodities is dictating our use of water," Don commented. "We've tried to implement everything in our operation that's economically feasible to save our water. So this program will help us fine tune our water management techniques. It looks like it could give us that little edge."

DON BELL—"It's a simple fact, when we all band together we're a lot more successful . . ."

Don Bell's school district is working on another edge; the education of their youngsters to water conservation. They have requested a classroom set of a new District publication, *An Introduction To Water and Water Conservation With Emphasis on The High Plains of Texas*, which is a supplemental water text for eighth grade earth science youngsters, to study conservation and the wise use of water resources from the unique vantage of the Texas High Plains. Their vocational agriculture teachers have also been provided copies of Water District reports for use in teaching their students about water, on-farm irrigation management techniques, cost of irrigation ditch losses from deep infiltration and evaporation, etc.

But to the present, the service in which Don feels the District has played the most important role is in the regulation of well spacings. "It has benefitted us all and we have taken it for granted," he remarked.

Don told the story of his grandfather who drilled a good well right on the edge of his farm in Terry County. "Without any regulations to keep his neighbor from drilling next to him, sure enough, the neighbor did just that and as a result neither one of them has a good well. Regulation has helped us in the District to at least maintain a level of water that we would not otherwise have. I think that's one of the greatest things the District has done through the years."

"It's just a simple fact that when we all band together to do a certain job we're a lot more successful than when we try to do it individually."

> ***To conserve a resource means to manage it in such a way that it lasts far longer than it would without management. To conserve means to reduce waste to a minimum, to increase reuse to a maximum, and to achieve the best balance possible between the immediate use of that resource and anticipated long-term human needs.***
>
> (excerpted from HPUWCD supplemental water text, An Introduction to Water and Water Conservation With Emphasis on the High Plains of Texas, 1980, page 33.)

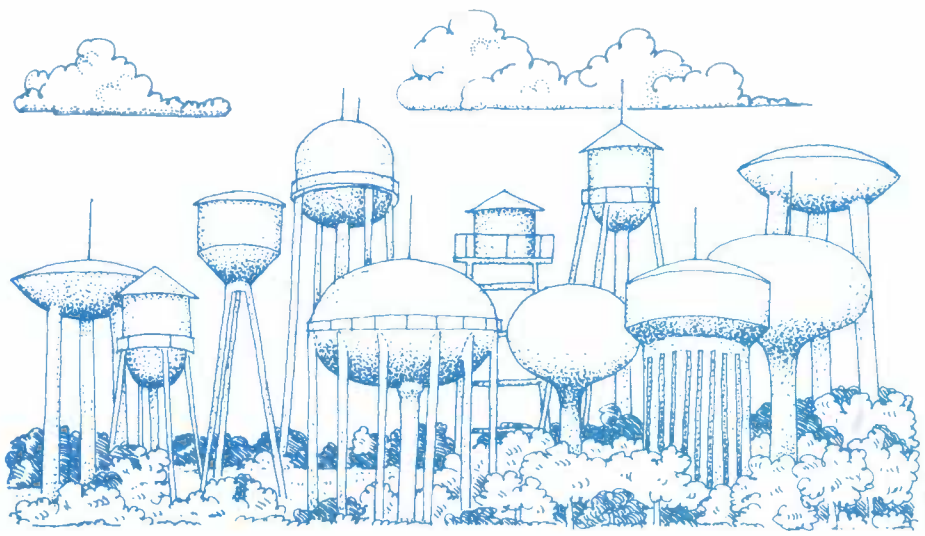
THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 5 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | May, 1980



HOLDING THE LINE ON CITY WATER INVESTMENTS

An adequate water supply for future city growth and prosperity is a prime responsibility of every city administration. And at least a few Texas mayors have been "run out of town" for allowing municipal water supplies to fall short of this goal.

Often cities with surplus water for their present populations and industries attract new industries until they become water-short cities. For this reason, many city administrators constantly search for additional sources of water—new well fields, new reservoirs, or new legal rights to surface water.

Texas cities are finding it increasingly difficult, however, to supply adequate fresh water for their growing, ever-thirstier, populations. Some of the reasons for their difficulties include:

- Texas is a water-short state. Texans currently use about 17 million acre-feet of water a year even though the safe annual yield of both groundwater and surface water is, according to the Texas Department of Water Resources, only 15 million acre-feet.
- Groundwater sources — on which a majority of Texas towns and cities depend—have diminished in quantity and quality because cities and other water users have removed more water in recent years than nature has replaced.
- Competition for surface water among cities and with other water users such as irrigators and power companies has become fierce in this water-short state.
- Water supply reservoirs are extremely costly to build and require more than a decade to complete.
- New stringent federal regulations for drinking water quality and wastewater treatment generally mean increased treatment costs both before and after water is distributed through a city.
- Soaring energy costs have also contributed to municipal water supply headaches.

An Alternative

A few city councils and city water departments around the state, however, are taking a new stand on solving their water supply dilemmas. Rather than selling voters on the need for bigger and better water supply, distribution, or treatment facilities, they are encouraging water customers to use less water by adopting more water efficient ways. By reducing water use per person, cities can at least delay the

continued page 2 . . . CITY

TEST $$$s GRANTED

The Texas Department of Water Resources has been authorized by the Texas Water Development Board to grant a $30,000 contract to the Water District for irrigation efficiency tests in the High Plains area.

The Water District will test at least a hundred irrigation delivery systems within a 45 county area and provide data on system efficiency improvements and water conservation and use to the Department of Water Resources for its planning studies.

Over 200 area irrigators have already requested an evaluation of their system efficiencies from the District.

TWDB LOSES CHAIRMAN BLACK

A. L. Black recently stepped away from his chairmanship of the Texas Water Development Board as his six year term expired. He will continue to serve as Governor Clement's representative to the Six-State High Plains Study Council, however.

Black was appointed to the Water Board by Governor Dolph Briscoe in 1974 and named its chairman in 1976. He feels the most important Board action accomplished during his tenure as chairman was the merging in 1978 of Texas' three state water agencies, the Water Quality Board, the Water Rights Commission, and the Water Development Board, into the Department of Water Resources.

Black continues to be an expert representative to the Six-State High Plains Study Council which is a key project for Texans. It is charged with guiding a federal study to examine local, state and national impacts of continued depletion of the natural resources (including water and energy) in the Ogallala Aquifer region. Black has served on the Study Council since its organization in 1976 and served as its second chairman.

"The Six-State Study may not be the answer, but it is the best tool that the High Plains and the State of Texas have for analyzing and solving their water problems," says Black.

A. L. BLACK

Water leaders will no doubt continue to confer on water problems with Black who is respected for his long and formidable commitment to water and soil conservation programs. "He is also respected for practicing what he preaches," says HPWD manager, Wayne Wyatt. "He is highly commendable as a community leader who's respected because he not only promotes good soil and water conservation techniques, but practices those techniques in his own operations."

Black has been widely honored with and for his long leadership in water posts. The Panhandle agribusinessman began as a locally elected Soil and

continued page 4 . . . BLACK

SOIL INTAKE RATES

MAKE WATERING AN ART

A poor field watering habit can be tough to break. But whether you are overwatering or underwatering, you're pouring money down a hole if you haven't considered the rate at which your soil type will absorb and hold water.

Last month's *Cross Section* offered a guide to help you judge how much moisture you need to fill a soil profile. Once you decide to put that amount of water into your soil it is time to reckon with infiltration rates, that is, the time in inches per hour, it takes water to move into your soil type and fill it to field capacity to a given depth. Once you determine your field's water need, you cannot just dump on the water and expect it to stay in place until it has soaked in without losses to runoff, evaporation or deep drainage. You can, however, apply irrigation water based on knowledge of your soil's intake rate and current field conditions and have substantial control over your water resource.

Water enters the soil through pores, cracks, worm and decayed root holes, and cavities introduced by tillage. Water penetrates different soils at different rates depending on their porosity and texture. Changes in field conditions can also affect a soil's water intake rate, dramatically in some cases. And, as a general rule, soils in their native state have higher infiltration rates than they will after being cultivated for a number of years.

Surface sealing, soil compaction, cracking, tillage, crop rotation, chemicals, sediments, erosion, land leveling and even temperature will change water intake rates. For example, surface sealing or crusting will restrict water intake. It can be reduced with a mulch or other permeable surface protective material or by a light culti-

continued page 3 . . . SOIL TYPE

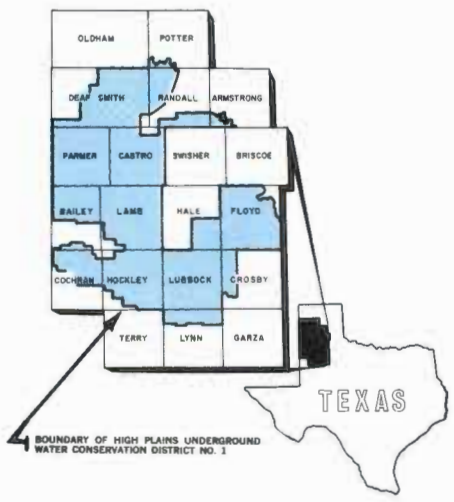
THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1
2930 Avenue Q, Lubbock, Texas 79405
Telephone 762-0181

PATRICIA BRUNO, Editor

Second Class Postage Paid at Lubbock, Texas District Office at Lubbock



BOARD OF DIRECTORS

Precinct 1
(CROSBY, LUBBOCK and LYNN COUNTIES)
James P. Mitchell, President ..... Wolfforth

Precinct 2
(COCHRAN, HOCKLEY and LAMB COUNTIES)
Mack Hicks ..... Levelland

Precinct 3
(BAILEY, CASTRO and PARMER COUNTIES)
A. W. Gober ..... Farwell

Precinct 4
(ARMSTRONG, DEAF SMITH, POTTER and RANDALL COUNTIES)
Jim Conkwright, Secy.-Treas. ..... Hereford

Precinct 5
(FLOYD and HALE COUNTIES)
Malvin A. Jarboe, Vice President ..... Floydada

COUNTY COMMITTEEMEN

Armstrong County
Carroll Rogers, Secretary
Wayside, Texas

Guy Watson, 1981 ..... Wayside
Bill Heisler, 1981 ..... Wayside
M. L. McGehee, 1981 ..... Wayside
James Bible, 1983 ..... Wayside
James Stockett, 1983 ..... Wayside

Bailey County
Doris Wedel, Secretary
H&R Block, 224 W. 2nd, Muleshoe

Eugene Shaw, 1981 ..... Rt. 2, Muleshoe
David Stovall, 1981 ..... Rt. 2, Muleshoe
Ernest Ramm, 1981 ..... Rt. 2, Muleshoe
D. J. Cox, 1983 ..... Enochs
Marshall Head, 1983 ..... Muleshoe

Castro County
Garnett Holland, Secretary
City Hall, 120 Jones St., Dimmitt

Jackie Clark, 1981 ..... Rt. 1, Box 33, Dimmitt
W. A. Baldridge, 1981 ..... 608 W. Grant, Dimmitt
Frank Wise, 1981 ..... Rt. 4, Box 10, Dimmitt
George Elder, 1983 ..... Dimmitt
Floyd Schulte, 1983 ..... Dimmitt

Cochran County
W. M. Butler, Jr., Secretary
Western Abstract Co., 108 N. Main Ave., Morton

Keith Kennedy, 1982 ..... Star Route 2, Morton
Robert Yeary, 1982 ..... Route 2, Box 66, Morton
Hershel M. Tanner, 1984, Route 2, Box 36, Morton
Richard Greer, 1984 .... Star Rt. 1, Box 4, Morton
Donnie B. Simpson, 1984, 292 SW 3rd St., Morton

Crosby County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Mike Carlisle, 1982 ..... Route 1, Box 274, Lorenzo
Alvin C. Morrison, 1982 ..... Box 6, Lorenzo
Tommy McCallister, 1984 ..... 209 N. Van Buren, Lorenzo
Edward S. Smith, 1984 ..... 102 N. Van Buren Lorenzo
Pat Yoakum, 1984 ..... Box 146, Lorenzo

Deaf Smith County
B. F. Cain, Secretary
County Courthouse, 2nd Floor, Hereford

James E. Higgins, 1981 ..... 200 Star St., Hereford
Garland Solomon, 1981 .... 303 Sunset Dr., Hereford
Tom Robinson, 1981 .... 211 Cherokee Dr., Hereford
Bill Cleavinger, 1983 ..... Wildorado
W. L. Davis, Jr., 1983 ..... Hereford

Floyd County
Verna Lynne Stewart, Secretary
Floyd Co. Abstract, 215 W. California, Floydada

Charles Huffman, 1982 ..... Route 1, Lockney
Gilbert L. Fawver, 1982 ..... Route 4, Floydada
C. O. Lyles, 1984 ..... Route 4, Floydada
Cecil Jackson, 1984 ..... Route 3, Floydada
D. R. Sanders, 1984 ..... Star Route, Floydada

Hale County
J. B. Mayo, Secretary
Mayo Ins., 1617 Main, Petersburg

Gaylord Groce, 1982 ..... Box 314, Petersburg
Bill John Hegi, 1982 ..... Route 2, Petersburg
Harold W. Newton, 1984 ..... Box 191, Petersburg
Jim Byrd, 1984 ..... Route 1, Petersburg
Ray Porter, 1984 ..... Box 193, Petersburg

Hockley County
Jim Montgomery, Secretary
609 Austin Street, Levelland

J. E. Wade, 1982 ..... Route 2, Littlefield
Jack Earl French, 1982, Rt. 3, Box 125, Levelland
W. C. McKee, 1984 ..... Box 514, Sundown
Leon Young, 1984 ..... Route 1, Ropesville
Robert Phillips, 1984 ..... 218 Redwood, Levelland

Lamb County
Robert Richards, Secretary
402 Phelps Avenue, Littlefield

Billy J. Langford, 1982 ..... Box 381, Olton
Edward Fisher, 1982 ..... Box 67, Sudan
P. A. Washington, 1984 ..... Box 124, Springlake
Jack Stubblefield, 1984 ..... Box 397, Spade
Larry Lockwood, 1984 ..... Star Rt. 2, Littlefield

Lubbock County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Owen Gilbreath, 1982 ..... 3302 23rd St., Lubbock
Clifford Hilbers, 1982 ..... Route 1, Box 14, Idalou
Don Bell, 1984 ..... Box 114, Wolfforth
Ronald Schilling, 1984 ..... Route 1, Slaton
Granville Igo, 1984 ..... 1304 8th St., Shallowater

Lynn County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Gary Houchin, 1982 ..... Box 54, Wilson
Freddie Kieth, 1982 ..... Box 283, New Home
Leland Zant, 1984 ..... Route 1, Wilson
David R. Wied, 1984 ..... Box 68, Wilson
Wendell Morrow, 1984 ..... Route 1, Wilson

Parmer County
Pat Kunselman, Secretary
City Hall, 323 North Street, Bovina

Troy Christian, 1981 ..... Rt. 1, Farwell
Dalton Caffey, 1981 ..... P.O. Box 488, Friona
Ronald Elliott, 1981 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Friona
Ralph Roming, 1983 ..... Bovina

Potter County
Jim Line, 1981 ..... Box 87, Bushland
Albert Nichols, 1981 ..... Rt. 1, Box 491, Amarillo
Weldon Rea, 1981 ..... Bushland
Sam Line, 1983 ..... Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

Randall County
Mrs. Louise Tompkins, Secretary
Farm Bureau, 1714 Fifth Ave., Canyon

Harry LeGrand, 1981 ..... 4700 S. Bowie, Amarillo
Jack Brandt, 1981 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1981 ..... Box 56, Bushland
Bill Dugan, 1983 ..... Happy
Roger B. Gist, III, 1983 ..... Happy

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

CITY . . . continued from page 1

necessity of expanding supply, distribution systems, or treatment plants.

Cities encourage lower water consumption by: (1) promoting consumer education and awareness, (2) changing water metering and pricing systems, (3) adopting regulations in ordinances and building codes, (4) reducing waste in city water use, and (5) encouraging reuse and recycling.

Several Texas cities have consumer education programs underway to make water users aware of the value of the water resource and why it should be used wisely. Short brochures mailed with water bills contain facts and tips on how to save water and are the most common education method used by Texas cities. The Dallas Water Utilities conducted the most impressive program of this type of any city utility in Texas.

Other educational programs conducted by some of the larger water utilities in the state include television and radio interviews and programs presented by utility personnel. Programs presented to school and civic groups teach economic and environmental benefits of lower water consumption.

The El Paso Water Utilities Board conducts a unique program each year to encourage planting of native vegetation which requires less water than traditional lawns and gardens. The city cosponsors a contest with the El Paso Council of Garden Clubs to spotlight the most effective and attractive use of what they call "Southwestern Landscaping."

Metering And Pricing

Most Texas towns and cities meter the volume of water going to each individual residence and business, so charges can be based on the amount of water used rather than on a flat monthly rate. Cities which do not install meters to measure water use actually encourage water waste because the more water a consumer uses, the cheaper the price per gallon.

Some cities have reduced consumption by as much as thirty percent by installing meters and eliminating a flat rate billing system. A measure of just how effective metering can be was discovered by the Galveston Municipal

How Does Your Community Rate?

The following questionnaire is suggested as a tool to help raise your community's awareness of its municipal water consumption, water needs, and conservation options. The survey provides an opportunity not only to collect information but to educate residents of your community.

Be creative. Encourage community participation and response through your city council, chamber of commerce, your local radio station or newspaper, through your junior high or high school earth science teachers and students or community service clubs.

Let us know what the results of your survey accomplish.

COMMUNITY PUBLIC OPINION SURVEY

1. As a responsible adult in our community, have you been taking steps to make sure that there will be an adequate water supply for our community in future years?
   Yes ____ No ____ Haven't thought about it ____
2. Do you feel that our city leaders are taking the necessary steps to assure adequate water supplies for our city's future needs?
   Yes ____ No ____ Don't know but intend to find out ____
3. What should our city's policy be toward future growth?
   Minus growth (encourage people to leave) ____
   No growth (do nothing about growth) ____
   Controlled growth (increase the number of water and sewer connections by a limited number each year) ____
   Unlimited growth (actively seek more residents, businesses and industries) ____
4. Do you think your present water bill is
   Very high____ High____ Moderate____ Low____ Very Low____
5. Would you be willing to have your water rates substantially increased to conserve water and to help assure our city of an adequate future water supply?
   Yes ____ No ____ No opinion ____
6. What sort of water rate structure do you favor for your city?
   Lower rates for large water users ____ Same rate for all ____
   Lower rates for small water users ____ No opinion ____
7. What do you think of our city levying a sewer charge to help finance an adequate future water supply?
   Favor ____ Against ____ No opinion ____
8. What do you think of our city levying a garbage charge to help finance an adequate future water supply?
   Favor ____ Against ____ No opinion ____
9. What measures for reducing your city's water consumption would you favor if they would conserve present water supplies and allow comfortable growth for our city?
   Ordinance penalizing obvious, observable waste (such as watering streets, flooding yards, etc.) ____
   Recycling as much water as is economically feasible ____
   Regulation eliminating yard watering ____
   Regulation reducing outdoor water use ____
   Substantial raise in water rates for large users ____
   All of the above ____
   None of the above ____

Other ____

Utilities when it conducted a comprehensive meter testing and repair program. Residential meters had been reading low by 11 percent and the commercial meters reading low by approximately 39 percent. As meters were replaced or repaired and customers began paying for the full amount of water used, Galveston water consumption was reduced by over 10 percent.

Costs of meter installation, maintenance, and billing may seem prohibitive to small towns with adequate water supplies, but cities that meter generally levy a minimum charge for all accounts to cover the billing costs and fixed service costs. On top of this minimum, cities have various structures which tend to encourage or discourage efficient water use.

All but a few Texas cities are still pricing water to give a break to the large water user. As one water superintendent described his city's water pricing: "Our rate structure is still directed by the old rule of the more a person uses, the cheaper the water is." The system, called a declining rate and designed to encourage industrial development, not only penalizes the small volume consumer now, but all future water customers. For as present water supplies are consumed, new supplies will be many times more costly than present sources.

Types of rate structure designed to encourage water conservation are the uniform, inclining, and lifeline rates. A uniform rate is easy to understand and administer: every customer pays the same price per gallon no matter how much water he uses.

Inclining rates mean that rates for water increase as volume increases and are generally used only in cases of water shortages. A more common rate structure is the lifeline rate charging a small amount per gallon for the amount of water necessary in a small home or apartment. Customers using more than this base amount pay more per gallon for the water consumed above the lifeline amount.

Ordinances And Building Codes

Few cities plan a cohesive water conservation program to include land use, design, and building restrictions. Such a program can require zoning provisions to make land parceling more amenable to low-water-use plantings. Minimum lot size, distance from pavement, and lot drainage requirements, for instance, can encourage water-saving landscaping.

City ordinances restricting the reuse of water should be reviewed and revised by all Texas cities in light of new wastewater treatment methods. Cities can and should encourage reuse of wastewater near the discharge points of municipal treatment plants. Examples of wastewater reuse in Texas include agricultural irrigation, power plant cooling, recreational lakes, and golf course irrigation.

A few cities have adopted ordinances requiring the installation of low-water-requiring fixtures and faucets in all new construction. San Antonio, for instance, adopted revisions to the plumbing code to require water saving devices in new construction and restrict the water requirements on plumbing fixtures such as flush toilets. Under the new code, adopted in September 1979, flush toilets in new buildings cannot use more than three gallons of water per flush; lavatory sink faucets and shower heads cannot permit more than three gallons per minute.

All residential water supply agencies should consider similar regulations. The Texas Department of Water Resources estimates that Texans can save more than 10,000 acre-feet of water each year for the next 20 years by installing water saving fixtures in new construction.

City Water Use

Cities can cut their own water use by eliminating waste and inefficient water use. Leaks in water distribution systems waste an average of ten percent of a city's water budget each year, so a regular maintenance program to detect and repair leaks should be implemented in every town and city in the state.

Cities can also evaluate their use of water in parks and around public buildings. Many cities create an image of "water to spare" by maintaining acres of lush green lawn and large water fountains in their parks, but present city planners must consider aesthetically pleasing alternatives to water-demanding park areas.

Water-short El Paso has initiated a program to reduce water waste in its existing city parks. The parks department has evaluated park irrigation practices and is now experimenting with irrigation scheduling and fertilizer applications in order to use the least amount of water to maintain green areas. El Paso has also recently eliminated a regular waste of water by installing special caps on fire hydrants to prevent loss of water due to vandalism of fire hydrants.

Time To Rate

- Will your area experience a significant decrease in ground water supplies in the next 20 years?
- Has water consumption in your city increased or decreased in the last five years?
- Has the population increased or decreased?
- Has the per person consumption increased?
- Is your city re-using any of its waste water?
- Has your community leadership made any effort to teach its residents to conserve water?
- Do people in your community have any idea that water conservation is the most efficient and least costly way to significantly extend their existing water supplies?
- Does your city have a program to reduce per capita water consumption?
- Does your city meter all water sold or are there flat rate customers?
- Does your city use water wisely in parks? around and in public buildings?
- Does your city's pricing system favor the large user? encourage waste? give a lifeline discount to small volume users?

Many Benefits

As much as 30 percent of a city's water consumption can be cut simply by adopting the preceding measures. Many of these measures will become mandatory for Texas cities seeking federal grants or loans as President Carter's National Water Policy is implemented. His administration views water conservation as a resource management technique that has never had the emphasis and priority it deserves. Conservation now has a prominent place in future water resources decisions. "Water conservation," according to the policy statement issued in 1978, "offers a means for making better use of existing supplies and avoiding unnecessary capital and operating costs for both water supply and wastewater disposal."

Some city administrators argue that a reduction in water use will actually force an increase in water rates. This is a very real problem because reduced consumption does reduce income from water sales. The following benefits, however, will far outweigh a temporary reduction in city revenue and will "buy time" for state water planners to solve major water deficiencies in the state. Those Texas cities successful in reducing per capita water consumption will:

- Add years to the present water supplies.

continued page 4 . . . CITY WATER

SOIL TYPE AFFECTS WATER INTAKE: TIME & DEPTH

continued from page 1

vation before irrigation. Tillage can cause compaction and create a plowpan which impedes water movement. Subsoiling helps to improve water flow, particularly if the soil has an impermeable sublayer that can be broken up.

Sprinkler irrigation is similar to rainfall because its water moves vertically into the soil. A soil that surface seals under rainfall will likely also seal under a sprinkler on a bare or newly seeded field, reducing intake. In furrows, where water moves both vertically and laterally, the intake rate depends on the wetted perimeter of the furrow, the larger the better.

Since so many factors affect water intake it is no surprise that rates vary widely among soils. Because several soil types can occur in the same field, intake characteristics of a given field will vary from place to place, from irrigation to irrigation, from season to season, and from one irrigation method to another. That means that the water intake rate of a given soil will seldom be a constant number until the surface soil at least is gradually saturated.

There is however, a general intake rate guide prepared by the Lubbock area Soil Conservation Service which you can use to estimate intake rates for the time water will take to fill a certain depth in a particular soil type.

Soils with similar characteristics are grouped into "intake families" according to the intake rate that most nearly represents its usual condition and infiltration speed. Soils in the same intake family will follow a similar water intake curve for a given water application method.

In the High Plains area, the most common soil types reside in three intake families as the chart illustrates.

The exceptions to this are the heavy clay soils such as the Pullmans and Lofton clay loam of this area which dry and crack. These cracks will initially take water at a pretty fast rate for several hours or until they begin to swell. Eventually the cracks swell completely closed and cut off virtually all water intake. Because the heavier clays are so eratic, you cannot over irrigate them, but you can over apply water.

The best way to apply water to these soils is to set an irrigation time, normally a 12 to 18 hour set, let the soil take in all the water it will in that time and stop.

By following the intake guide the irrigator can control the amount of water that goes on his soil by varying the length of time water flows over the field. The relationship between total intake and time helps to determine the speed with which the wetted front advances across the field and thus to a great degree controls the permissible length of run for the greatest efficiency.

If you need information to identify the soil types in your field, the SCS in cooperation with the Texas Agricultural Experiment Station, publishes a Soil Survey for each county in Texas. Your local county agent can help you find your soil type and match your irrigation design system to its intake characteristics.

GUIDE TO INTAKE FAMILIES FOR SURFACE IRRIGATION DESIGN

INTAKE RATE (inches p/hr)	SOIL TYPE	SOIL TEXTURE	NET DEPTH OF APPLICATION IN INCHES 1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0
0.3	Olton	loam	62	129	208	296	392	604	841	1100
0.5	Acuff	loam	38	75	119	166	217	328	450	580
	Berda	loam								
	Estacado	loam								
	Portales	loam								
	Amarillo	fine sandy loam								
1.0	Amarillo	loamy fine sand	20	38	59	82	106	158	214	273
	Patricia	loamy fine sand and fine sand	(time in minutes)							

FINDING THE RIGHT SEED FOR THE RIGHT SOIL

The economic survival of a farmer during a drought depends on the physiological survival of a crop and its ability to use water efficiently.

Studying drought tolerance and water-use efficiency is a complex process, but the ultimate aim is to produce a better seed.

According to Dr. Daniel R. Krieg, Texas Tech University crop physiologist, the problem lies in identifying the genes, or plant genotypes, which control mechanisms that lend drought tolerance characteristics and water-use efficiency in plants.

Krieg is interested in understanding those mechanisms in cotton and sorghum.

"The studies are critical for the Great Plains, which cover more than 600 million acres of semi-arid crop land from western Texas to the Dakotas. The area is continuously faced with droughts and the problems of declining underground water supplies," Krieg said.

"Progress has been made in defining the mechanism used by cotton and sorghum in controlling water-use efficiency and drought tolerance, but we are yet to understand how much genetic variability exists in the control of those mechanisms," Krieg added.

"Once we understand how genotypes differ, we can then try to match a specified genotype with a particular soil type in a particular climatic region," Krieg added.

"Matching the genotypes with the environment will allow expression of the drought-tolerance and water-use efficiency characteristics in the plant."

Ultimate result of the research, he said, will be the incorporation of water-use efficiency and drought tolerance characteristics into desirable crop varieties and hybrids by the commercial seed companies.

With $170,300 provided by the United States Department of Agriculture's (USDA) Science and Education Administration (SEA), Krieg and a team of scientists are investigating genotype-environment interactions and soil and climate variations, and how these affect water-use efficiency.

Krieg, project leader, will be assisted by Dr. Frank M. Hons and Dr. Richard E. Zartman, both of the Texas Tech Plant and Soil Science Department. Dr. Bobbie L. McMichael and Dr. Jerry Quisenberry, USDA scientists, will also work with the team.

"The research will be conducted under semi-controlled greenhouse conditions and natural field conditions. At least two field sites will be used to provide different soil and climatic influences," Krieg said.

CITY WATER . . . continued from page 3

- Reduce the cost of wastewater treatment.
- Save energy—the fastest rising expenditure in city water budgets.
- Postpone or eliminate the expansion of water treatment and distribution systems.
- Discharge less wastewater into Texas rivers and streams.

For these reasons, water conservation is indeed an attractive alternative for any city in Texas.

reprinted with kind permission from TEXAS WATER RESOURCES, February, 1980.

BLACK . . . continued from page 1

Water Conservation District supervisor in Parmer County, working his way through every office to two years as State President, and to service as a national Director of the Association of Soil and Water Conservation Districts.

Along the way, Black helped found and direct Water, Inc. He was serving as its chairman when appointed to the TWDB in 1974. He was named a Texas representative to the Western States Water Council in '78, and has chaired the National Association of Conservation District's Great Plains Committee. NACD honored Black for outstanding contributions to conservation of natural resources in '77, and the Amarillo Chamber of Commerce named him "Panhandle Man of the Year" in '78. Black also accepted an "Outstanding Agriculturalist Award" in '75 from the Texas Tech University College of Agriculture faculty and student agricultural council.

A. L. Black has been chairman of the Board of the Friona State Bank since 1968, and is continuing chairman of the Board of Friona Industries, a diversified agribusiness industry, developed in 1962.

HPWD Awarded

The High Plains Water District was recently recognized by the Lubbock County Soil and Water Conservation District with a special award for outstanding soil and water conservation accomplishments. A. Wayne Wyatt, HPUWCD manager, accepted a handsome irrigation water conservation plaque from F. H. Griffin, Chairman of the Lubbock County SWCD at their annual award program.

The High Plains Water District was honored for "wholehearted support and assistance" given to SWCD and the Soil Conservation Service in a cooperative field water conservation management efficiency program. The District constructed and equipped a field water laboratory and is providing technical assistance for training and on-farm irrigation efficiency evaluations.

A. WAYNE WYATT, F. H. GRIFFIN

PROMOTING CONSERVATION. WPRS Planners Ervin Zavlney and Bill Seth jaw with James Mitchell on irrigation efficiency test results.

BRAINSTORMING:

The Water and Power Resources Service is scouting out an active role in irrigation and energy conservation efforts on the High Plains. Southwest Regional Planning officer Bill Seth and WPRS Planning Assistant Ervin Zavlney were favorably impressed by the Water District's pumping plant efficiency and field water conservation efficiency test programs as a "practical approach with a high potential for short-term pay off."

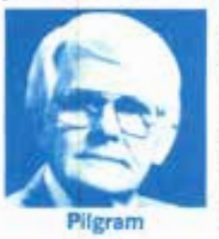
Seth and Zavlney were in Lubbock recently to get an update on local activities in order to avoid duplication and determine how the various agencies could work together to reach the common objective of promoting conservation of energy and water.

New Policy Makers Appointed

Governor Bill Clements has announced two new six-year term appointments to the Texas Water Development Board. The most recent addition is Louis Beecherl, Jr., of Dallas, who succeeds former Chairman A. L. Black of Friona whose term expired. Lonnie "Bo" Pilgram of Pittsburg will fill the place formerly held by Milton Potts, a Board member since 1963 whose last term expired December 31st.

Beecherl

Beecherl, 54, is former chief executive officer of Texas Oil and Gas Corporation. He retired two years ago after twenty years in that post, to engage in oil and gas and ranching interests. Beecherl holds degrees in mathematics and petroleum engineering from Tulane University and UT Austin. He was named TWDB chairman by Clements. His term expires December 31, 1985.



Pilgram

Lonnie "Bo" Pilgram is president and chairman of Pilgram Industries, established in 1950 as Pilgram Feed Mills, a facility for the manufacture of poultry and livestock feeds. He has also served as president of the Midwest Feed Manufacturing Association, headquartered in Kansas City, and is currently director of the National Broiler Marketing Council. Pilgram serves as board chairman of the First State Bank of Pittsburg.

THE CROSS SECTION (USPS 5[illegible]20)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 6 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | June, 1980

Cut Your Pump Plant Input To Lower Cost

You got your pre-plant irrigation energy bill and you're still in a state of shock. More bad news may be in store as energy suppliers are indicating that we can expect prices to continue pryamiding, up by 80 percent during the next two years on electricity, and by about 30 percent annually on natural gas. Consequently, your future energy bills may be even more shocking.

Now the good news. You don't necessarily have to live with the high cost of energy consumption. There is something you can do to cut your expenses and reduce your energy or fuel costs, dramatically in some cases. That something is to improve the efficiency of your pumping plant.

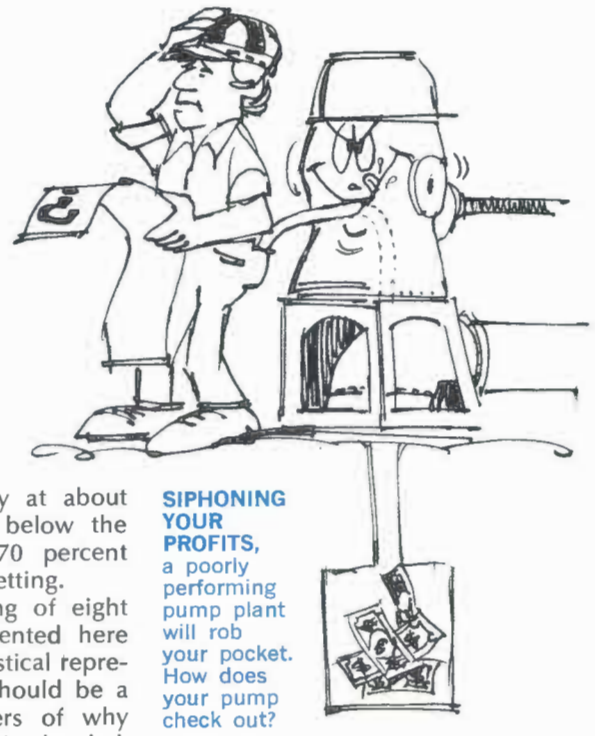
Results of the first batch of pump plant efficiency tests conducted in May and June by the High Plains Water District with partial funding by the Texas Energy and Natural Resources Advisory Council, indicate that there are tremendous opportunities to upgrade pumping unit efficiencies and realize substantial dollar savings. They also indicate that the potential savings in fuel costs (at TODAYS rates) normally will justify the cost of making adjustments, repairs or replacements IF you can get your pumping efficiency up to about 70 percent.

The example of pump efficiency figures in the table generally agrees with data compiled by Leon New, irrigation specialist and agricultural engineer headquartered in Lubbock with the Texas Agricultural Extension Service. Leon has been working with county extension agents in the High Plains area for many years testing wells and conducting numerous workshops on irrigation pump plant efficiencies. A Texas Tech University study testing a large sample of pumps in the High Plains several years ago, pinpointed the average pumping efficiency at about 41 percent. That is well below the practical and achievable 70 percent which irrigators could be getting.

While the small sampling of eight efficiency test results presented here does not claim to be a statistical representation for the area, it should be a graphic example to farmers of why they can't afford to remain in the dark about their overall pump plant efficiencies while an energy hobgoblin may be eating away their profits.

The question is no longer whether you can afford to make your pumping plant more efficient; the question is, "Can you afford not to?" "Low efficiencies may be the product of multiple causes, but the number one problem we are seeing in these efficiency tests is a mismatch in pump selection—the wrong pump for the job," says staff agriculturalist Ken Carver.

A pump that was quite efficient when installed may have a much lower rating today if conditions have changed. It may be the result of a change in GPM or pumping lift or both. It may be the lack of adequate well testing and knowledge of the well's characteristics that resulted in incorrect pump selection. But every pump has its limitations and they must match the well for maximum performance. Installing a new pump bowl assembly will often jump GPM and efficiency output dramatically.



SIPHONING YOUR PROFITS, a poorly performing pump plant will rob your pocket. How does your pump check out?

Another common mistake robbing the irrigator of pump performance is the use of a pump in a way in which it was not designed. A growing number of irrigators are attempting to convert their open discharge irrigation systems to sprinklers without modifying their pumps. The added load is sapping energy efficiency. Each additional pound of pressure on the pump is equal to adding 2.3 feet of lift.

Efficiencies are also hurt by improper well construction, by poor operating procedures and maintenance, or by incorrect power unit selection. Power unit efficiency does significantly affect overall performance. Your engine's efficiency may suffer from wear, poor compression, lack of a tune up, or improper sizing for the load. The efficiency of electric motors is determined by design and size and is not generally affected by hours of use. Fossil fuel engine efficiencies, on the other hand, do decline with hours of use and need proper operation and maintenance. Altitude will also affect performance by three percent per thousand feet, and temperature will take its toll at one percent per ten degrees ferenheit rise over 60 degrees. A good power unit efficiency range is 90 to 95 percent for electric motors,

continued on page 4 . . . PUMP PLANTS

EXAMPLES OF PUMP EFFICIENCY TESTS MADE IN MAY & JUNE 1980

Based on 2000 Hours of Operation at .4 cents per KWH for Electricity or $2.50 per MCF for natural gas

TEST NUMBER	PUMP EFFICIENCY	Projected COST in fuel annually at CURRENT efficiency	Projected COST in fuel annually at 70% efficiency	Projected SAVINGS to upgrade pump to 70% efficiency	POWER TYPE	YIELD IN GPM
1.	29.69	$3830.00	$1624.47	$2205.53	Natural Gas	415
2.	64.25	5295.00	4860.05	434.95	Natural Gas	810
3.	24.08	2637.80	905.68	1727.12	Electric	182
4.	60.24	7540.00	6488.70	1051.30	Electric	800
5.	59.68	4285.70	3653.86	631.84	Natural Gas	480
6.	33.95	691.71	335.78	355.93	Electric	90
7.	44.66	770.70	494.03	276.67	Electric	120
8.	28.45	2910.40	1182.87	1727.52	Electric	200
AVG.	43.13	$3245.16	$2443.18	$1051.36		

McFARLAND— "GONE FISHING"

By A. WAYNE WYATT
Manager HPUWCD #1

Tom McFarland announced his retirement from the Texas Department of Water Resources effective June 1, 1980. He began his professional career in the water business in 1951 as Manager of the High Plains Underground Water Conservation District, and worked in this capacity to 1969, a span of 18 years. Since then, Tom has served in numerous capacities for state government, all associated with water. He served Governor Preston Smith as a water advisor, worked at the Texas Water Quality Board, and completed his water career at the Texas Department of Water Resources.

TOM McFARLAND

Tom's water career actually began as an irrigation farmer. He was very instrumental in writing and passing laws which provided the legal mechanism for creating and operating underground water conservation districts in Texas. When the law was passed, he was serving as Manager of the Deaf Smith County Chamber of Commerce. In this capacity he helped hold public meetings and spoke for the creation of the Water District. After the District was created by popular vote in those areas it serves, Tom was appointed to serve on the original Board of Directors of the District. The other Board members persuaded him to accept the position of its manager shortly after creation.

continued from page 2 . . . McFARLAND

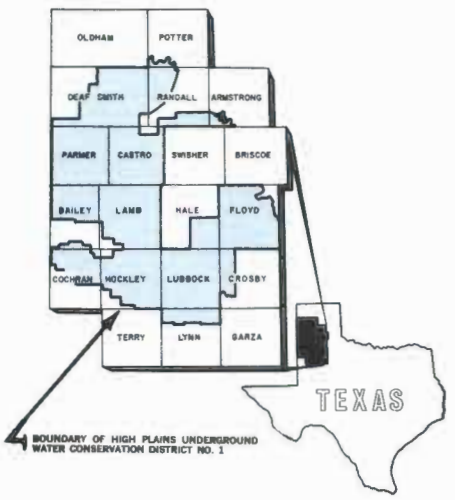
THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1
2930 Avenue Q, Lubbock, Texas 79405
Telephone 762-0181

PATRICIA BRUNO, Editor

Second Class Postage Paid at Lubbock, Texas District Office at Lubbock



BOARD OF DIRECTORS

Precinct 1
(CROSBY, LUBBOCK and LYNN COUNTIES)
James P. Mitchell, President ..... Wolfforth

Precinct 2
(COCHRAN, HOCKLEY and LAMB COUNTIES)
Mack Hicks ..... Levelland

Precinct 3
(BAILEY, CASTRO and PARMER COUNTIES)
A. W. Gober ..... Farwell

Precinct 4
(ARMSTRONG, DEAF SMITH, POTTER and RANDALL COUNTIES)
Jim Conkwright, Secy.-Treas. ..... Hereford

Precinct 5
(FLOYD and HALE COUNTIES)
Malvin A. Jarboe, Vice President ..... Floydada

COUNTY COMMITTEEMEN

Armstrong County
Carroll Rogers, Secretary
Wayside, Texas
Guy Watson, 1981 ..... Wayside
Bill Heisler, 1981 ..... Wayside
M. L. McGehee, 1981 ..... Wayside
James Bible, 1983 ..... Wayside
James Stockett, 1983 ..... Wayside

Bailey County
Doris Wedel, Secretary
H&R Block, 224 W. 2nd, Muleshoe
Eugene Shaw, 1981 ..... Rt. 2, Muleshoe
David Stovall, 1981 ..... Rt. 2, Muleshoe
Ernest Ramm, 1981 ..... Rt. 2, Muleshoe
D. J. Cox, 1983 ..... Enochs
Marshall Head, 1983 ..... Muleshoe

Castro County
Garnett Holland, Secretary
City Hall, 120 Jones St., Dimmitt
Jackie Clark, 1981 ..... Rt. 1, Box 33, Dimmitt
W. A. Baldridge, 1981 ..... 608 W. Grant, Dimmitt
Frank Wise, 1981 ..... Rt. 4, Box 10, Dimmitt
George Elder, 1983 ..... Dimmitt
Floyd Schulte, 1983 ..... Dimmitt

Cochran County
W. M. Butler, Jr., Secretary
Western Abstract Co., 108 N. Main Ave., Morton
Keith Kennedy, 1982 ..... Star Route 2, Morton
Robert Yeary, 1982 ..... Route 2, Box 66, Morton
Hershel M. Tanner, 1984, Route 2, Box 36, Morton
Richard Greer, 1984 ..... Star Rt. 1, Box 4, Morton
Donnie B. Simpson, 1984, 292 SW 3rd St., Morton

Crosby County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock
Mike Carlisle, 1982 ..... Route 1, Box 274, Lorenzo
Alvin C. Morrison, 1982 ..... Box 6, Lorenzo
Tommy McCallister, 1984 ..... 209 N. Van Buren, Lorenzo
Edward S. Smith, 1984 ..... 102 N. Van Buren Lorenzo
Pat Yoakum, 1984 ..... Box 146, Lorenzo

Deaf Smith County
B. F. Cain, Secretary
County Courthouse, 2nd Floor, Hereford
James E. Higgins, 1981 ..... 200 Star St., Hereford
Garland Solomon, 1981 ..... 303 Sunset Dr., Hereford
Tom Robinson, 1981 ..... 211 Cherokee Dr., Hereford
Bill Cleavinger, 1983 ..... Wildorado
W. L. Davis, Jr., 1983 ..... Hereford

Floyd County
Verna Lynne Stewart, Secretary
Floyd Co. Abstract, 215 W. California, Floydada
Charles Huffman, 1982 ..... Route 1, Lockney
Gilbert L. Fawver, 1982 ..... Route 4, Floydada
C. O. Lyles, 1984 ..... Route 4, Floydada
Cecil Jackson, 1984 ..... Route 3, Floydada
D. R. Sanders, 1984 ..... Star Route, Floydada

Hale County
J. B. Mayo, Secretary
Mayo Ins., 1617 Main, Petersburg
Gaylord Groce, 1982 ..... Box 314, Petersburg
Bill John Hegi, 1982 ..... Route 2, Petersburg
Harold W. Newton, 1984 ..... Box 191, Petersburg
Jim Byrd, 1984 ..... Route 1, Petersburg
Ray Porter, 1984 ..... Box 193, Petersburg

Hockley County
Jim Montgomery, Secretary
609 Austin Street, Levelland
J. E. Wade, 1982 ..... Route 2, Littlefield
Jack Earl French, 1982, Rt. 3, Box 125, Levelland
W. C. McKee, 1984 ..... Box 514, Sundown
Leon Young, 1984 ..... Route 1, Ropesville
Robert Phillips, 1984 ..... 218 Redwood, Levelland

Lamb County
Robert Richards, Secretary
402 Phelps Avenue, Littlefield
Billy J. Langford, 1982 ..... Box 381, Olton
Edward Fisher, 1982 ..... Box 67, Sudan
P. A. Washington, 1984 ..... Box 124, Springlake
Jack Stubblefield, 1984 ..... Box 397, Spade
Larry Lockwood, 1984 ..... Star Rt. 2, Littlefield

Lubbock County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock
Owen Gilbreath, 1982 ..... 3302 23rd St., Lubbock
Clifford Hilbers, 1982 ..... Route 1, Box 14, Idalou
Don Bell, 1984 ..... Box 114, Wolfforth
Ronald Schilling, 1984 ..... Route 1, Slaton
Granville Igo, 1984 ..... 1304 8th St., Shallowater

Lynn County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock
Gary Houchin, 1982 ..... Box 54, Wilson
Freddie Kieth, 1982 ..... Box 283, New Home
Leland Zant, 1984 ..... Route 1, Wilson
David R. Wied, 1984 ..... Box 68, Wilson
Wendell Morrow, 1984 ..... Route 1, Wilson

Parmer County
Pat Kunselman, Secretary
City Hall, 323 North Street, Bovina
Troy Christian, 1981 ..... Rt. 1, Farwell
Dalton Caffey, 1981 ..... P.O. Box 488, Friona
Ronald Elliott, 1981 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Friona
Ralph Roming, 1983 ..... Bovina

Potter County
Jim Line, 1981 ..... Box 87, Bushland
Albert Nichols, 1981 ..... Rt. 1, Box 491, Amarillo
Weldon Rea, 1981 ..... Bushland
Sam Line, 1983 ..... Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

Randall County
Mrs. Louise Tompkins, Secretary
Farm Bureau, 1714 Fifth Ave., Canyon
Harry LeGrand, 1981 ..... 4700 S. Bowie, Amarillo
Jack Brandt, 1981 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1981 ..... Box 56, Bushland
Bill Dugan, 1983 ..... Happy
Roger B. Gist, III, 1983 ..... Happy

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

McFARLAND . . . continued from page 1

The High Plains Underground Water Conservation District No. 1 was the first water district of its type in the United States. Tom recalls that he and the Board, in writing the original rules and regulations of the District and in organizing its work plan, had nothing they could use as a pattern and had to originate virtually everything they did.

Tom credits the Water District's accomplishments while he was Manager primarily to having Board members who were super people dedicated to the principles of water conservation and to a good staff of highly dedicated people.

During Tom's 18 year tenure as Manager, the District accomplished many things. Tom's pet projects included an educational program which began with a newsletter and evolved into this publication, *The Cross Section*. It included an educational comic book, *Chief Running Water's Story of High Plains Water,* which has been republished several times and is currently used in the public school systems. Tom made hundreds of presentations to civic clubs, farm groups and as a matter of fact, to anyone who would listen to his story on the need to conserve water.

Protecting the quality of ground water was also tremendously important to Tom. He led the fight in Texas to persuade the Railroad Commission to pass a state-wide order to stop the disposal into unlined surface pits of the salt water produced with oil because it was contaminating the underground aquifers.

In recent years Tom has privately expressed his displeasure at the conduct of the long-haired, white tennis-shoed environmentalists who, he says, "often appear at public meetings to protest, generally armed with few facts but with a tremendous amount of emotion to protest the action of we older citizens in destroying the environment. Tom says it's difficult not to resent these types after having worked hard most of his life along side many other dedicated people to preserve the environment. "We did our homework; we knew what we were talking about." He admits to using emotional pleas, but he claims that was generally after all the facts were laid on the table.

It was Tom who directed the Water District's involvement in the Shurbet case against the Internal Revenue Service to obtain a cost-in-water income tax depletion allowance for landowners who use ground water in the business of irrigation farming. He believes that the millions of dollars this action has saved local taxpayers is not the most important result of the case. Rather the most important thing has been its forcing the landowner to look at his "water bank balance" each year to see how much he used and how much he has left. This, Tom believes, has resulted in selling conservation to those who can truly do something to make it happen.

Tom's work in the water industry also extended to the national level. He contributed much to the betterment of water and mankind in his 29 year career. We at the Water District thank him for his contributions and wish him much happiness in his retirement. Tom said he is going to spend a great deal of time fishing, traveling and writing. He still believes that God does not count those days spent fishing against your alloted time on earth.

I knew Tom McFarland only casually before the water depletion testimony was being prepared. I testified about the lowering water table on an irrigation well near Lubbock. Soon after that Tom asked me to consider running for director of High Plains Underground Water Conservation District No. 1. He told me I was knowledgeable about water problems and that I was needed. Tom could be very persuasive, and thus I spent several years on the board of directors and met an interesting and dedicated group of people who dealt with one of our most vital resources.

And dedicated they must be! Most water people quietly supply water or water-related services to the public at minimal cost. There is no room for big deals and razzle-dazzle. Nobody is going to get rich or famous furnishing water services to a public which takes water for granted as a sort of right to life. But water is much too precious to be taken for granted.

Water people, the professional ones, usually start off either in public relations or in technology, and eventually they seem to blend into a third type, dedicated to the gospel of intelligent water use. Among these people Tom McFarland stood tall. He was innovative, imaginative, forceful, and he stood by his principles. Here was a new David challenging Goliath! He took on the United States Internal Revenue Service with the depletion case, a move which shocked most mortals. One doesn't disturb the IRS in its citadel! On a more regional basis he tackled the Texas Railroad Commission for continuing to allow open-pit disposal of oilfield brines, a practice which increasingly was causing lawsuits over contamination of fresh water aquifers. The TRC should have moved sooner to limit the practice, but it dallied while the HPUWCD #1 slapped a ban on the practice within its jurisdiction. The TRC reacted with disbelief followed by outrage at the thought of a peanut agency usurping its authority. At a subsequent hearing in Austin an oil company lawyer browbeat a technical witness with the question, "Are you daring to imply that the Texas Railroad Commission has been derelict in its duty"?

The witness hesitated. He was a working consultant whose business could have been harmed by a hasty answer. But from the back of the room came the answer from Tom McFarland's backers: "Yes"!

Soon after that the TRC instituted a statewide ban on open-pit disposal of oilfield brines where water sands could be damaged.

Tom's life has been no bed of roses. One of the roughest times was in a prison coal mine near Hiroshima at the end of World War II. All of us who have admired Tom over the years are hoping for his happy retirement. No one could deserve it more.

Russell Bean

Crop Water Use Researched

EDITOR'S NOTE: Research is a thing of wonder and there are many wonders developing at Bushland's USDA Agricultural Research Laboratory. Staff scientists and engineers are examining several areas of water related research projects often in cooperation with staff at the Amarillo Texas Agricultural Experiment Station. I recently visited the Bushland Research Center and enjoyed the cordial hospitality of Dr. B. A. Stewart and staff and a detailed look at many of their water related projects. As space here does not permit a complete account of work in progress, the following are some highlights of the research on water management and delivery systems. For more information contact the USDA Southwestern Great Plains Research Center at Bushland, Texas.

Start by assuming that a farmer has less water than land. He has two practical avenues for cashing in on his limited water. One is to find the best crop and cropping pattern for the water he has, the other is to know when and how to water or not water the specific crop for optimum yield.

These thoughts were the makin's of a bunch of research into water management systems, water delivery systems, and plant-water-use at the Bushland USDA Research Lab. Scientists are looking at soil water storage and crop use, managing water application and stressing effects on crop development, water application methods, planting sequences, and at delivery system efficiencies. They are working primarily in Pullman clays and clay loam soils typical of 2-3 million irrigated acres on the High Plains, with wheat, sorghum, corn, and a new crop on the research row this year, the sunflower. Researchers are taking a new look at irrigation delivery systems and their losses and at fresh approaches to plant-water management.

DR. STEWART measures furrow runoff in conjunctive use study

Dr. B. A. Stewart, director of the Center, is developing a novel system at Bushland for efficient use of both irrigation and rainfall for furrow irrigation on grain sorghum. He suggests this approach may also apply to other drought tolerant crops. Stewart has labeled this study conjunctive use of irrigation and rainfall. Don Dusek and Jack Musick are working with Stewart on the project which began in 1979. The design used a limited water supply to irrigate a larger area than could be fully irrigated. It thus reduces the area in dryland sorghum where a farmer is producing both.

In the new system, a normal length field was divided into three water management sections. The upper half of the field was managed as fully irrigated. The next one-fourth was managed as a "tailwater runoff" section using furrow runoff from the fully irrigated section. The lower quarter was managed as a dryland section to retain and use any runoff from either irrigation or rainfall from the rest of the field.

Furrow dams were placed about every ten feet throughout the length of the furrow after planting. These washed out under irrigation partially down the furrows.

APPLIED irrigation water in notched, diked furrows

Another novel aspect of this study was the varying of seeding rates which was reduced down the field. Nitrogen applications were also reduced on the lower sections to correspond with anticipated yields. The reduced seeding rate and increased plant spacings moderated the severity of plant water stress on the drier, lower field segments.

Stewart saw the varied seeding rate as a potential drawback to the system but is testing for modifications here. He recognized the disadvantage to fertilizing this system, but considered "fertigating" or distributing fertilizer with the water at the same rates as a potential solution.

The real advantages of this approach relate to the water applications and runoff prevention. Stewart watered every other furrow and notched a slight cup in the top of each dam in these rows so the top of the dike was a little lower than the top of the bed. This approach integrates irrigation with rainfall potential and puts on a fixed amount of water based on irrigation pumpage. The result is something that comes close to an automated system in which the farmer schedules his irrigation and sets the water without looking to see what's coming off the field. The system "adjusts itself" according to Stewart, and relys on mother nature to provide her probable above average rainfall half the time and in those usually heavier amounts measured in June through September.

JACK MUSICK sites Bushland on NASA satellite photo

The system is designed around a 75% probability of getting more than five and less than eleven inches of rainfall during most years.

"The system can't work every year in every location because you can't fool mother nature," says Stewart. "A gullywasher could override it, but otherwise it has a good strong potential to help you hedge your bets."

On another series of research rows, Jack Musick is watching crop responses to limited irrigation, plant water stress and cropping sequences in wheat, grain sorghum and sunflowers. The best news for limited irrigation cropping for maximum water use efficiency is with sunflowers. Results of a one year study suggest sunflowers have strong potential as a third crop for limited irrigation production in conjunction with winter wheat and grain sorghum, or as an additional crop for cotton.

Sunflowers have a good water stress tolerance, are more adaptable to cool temperatures which allows for early planting, have a relatively short growing season and are compatible with wheat, sorghum or cotton in a cropping sequence to permit separate irrigation seasons. They can also root to the 6 to 8 foot zone for deep soil water extraction. Sunflowers can be planted as early as March to avoid conflicts in seasonal water demands. Musick reports that the yield from one early-planting irrigation on sunflowers was almost identical to one with three late planting irrigations. "Insecticide applications for control of headmoth, however, are more important with early planted sunflowers," says Musick.

He is also looking at all three crops for critical stage plant water stress. Musick is measuring the crop yield return to water for management efficiency and for the effects of plant water stress at different development stages. He found that watering during early vegetative stages are less critical to yield than irrigating prior to and through pollination when a wheat irrigation at this time can double the yield from that irrigation. In corn an irrigation applied prior to tasseling and silking will prevent stress at that time which could reduce yield by as much as 40 to 50 percent.

NOLAN CLARK testing mechanical transfer from wind turbine to pump gearhead

While Bushland scientists are watching irrigations and stressing effects in their fields, so is the National Aeronautics and Space Administration. Another study soon to fly at Bushland is an aerospace remote sensing project for assessing ground crop conditions as affected by water deficiency. NASA is developing satellite technology for monitoring crop growth, development and yield in different crops over the world. Bushland is one of many sites cooperating in this program by taking ground data with hand-held sensing technology to confirm and verify similar satellite instrument readings. If the space technology can be adapted, it offers potential for developing models to predict world cropping conditions and yields.

One thing the High Plains has plenty of is wind. Engineers at Bushland have been testing wind turbines for pumping irrigation water. The project, under the direction of Dr. Nolan Clark, is actually a wind assisted system which uses both a vertical axis wind turbine and an electric motor to run a conventional vertical turbine pump. It is presently the only system of its kind in the world to marry wind and electric power. The wind machine puts power into the pump whenever wind speeds exceed a minimum cut in level of about 12 miles per hour at the turbine height. The constant power supply is electric. But since electricity supplies only part of the power it is also saved by reducing the load rather than totally replacing it.

ANOTHER Darrieus wind turbine under test

This system's advantages over relying on wind power alone are first, a constant pumping rate for water regardless of the wind power level, and secondly, the use of a conventional irrigation well and vertical turbine pump without need for modification.

Researchers are expecting to produce some wind power for irrigation at Bushland at least 70 percent of the time, and up to half the needed power for irrigation during about 18 percent of the year.

Clark says the machine is now saving thirty to forty percent in electric energy, or about $3,000 in fuel a year. So that if a system could be bought reasonably an irrigator could write off the investment in three to five years. But developmental work for an off-line commercial unit is still three to five years away according to Clark, and for that the research needs to be done now.

Clark is also working on design modifications to match machine size and load. He has plans to redesign the pump to match the power output characteristics of the wind turbine rather than of the electric or gas engine.

Dan Undersander, a Texas Agricultural Experiment Station agronomist, is working with Noland Clark, USDA Agricultural Engineer, and Tom Marek, TAES agricultural engineer, on a joint state/federal project on pivot sprinklers

UNDERSANDER and Marek plan sprinkler evaluation

continued on page 4 . . . RESEARCH

RESEARCH . . . continued from page 3

to determine the application efficiencies of high and low pressure systems.

One high pressure and one low pressure sprinkler each are located at the Bushland Lab and at the Texas A&M North Plains Research field at Etter, Texas. The two sets of pivots will be compared at each site and at exactly the same speeds with the same quantities of water pumped through the lines, for how much water is absorbed into the soil profile under each system, and for yield.

The research will look at effects of losses to surface runoff, evaporation and wind, and the effects of practices such as furrow dikes and residue management for reducing losses. Undersander and colleagues hope to determine optimum management practices associated with each system and the difference in physiological responses of plants grown under each system.

"We know low pressure is cheaper to operate," says Undersander, "but for the same water pumped at both high and low pressures, we don't know which system under what management will net the best yields."

The next phase of sprinkler research planned is a probe of how fast to run the pivot around the field. Further down the road researchers will analyze the application efficiencies and plant response processes of same pressure, variable speed data.

"The industry has been putting out these systems now for 15 years," says Marek, and we still don't have any data on the trade offs involved in varying the application rate and system pressure for the best application efficiencies."

Another thing many farmers still don't have is a reading on the potential for increasing the efficiency of their pumping plants. Dr. Arland Schneider is working with Leon New, a Texas Agricultural Extension Service engineer, on a new set of measurements for existing irrigation pump plant efficiencies to see if they have changed appreciably since the last study done by the Texas Tech University Agricultural Engineering Department in 1968. Results are showing that average efficiencies on natural gas and electric motors have changed very little since then. Schneider expects to have 40 to 50 pump test results by the end of this irrigation season and to begin an economic analysis of the data. But the findings to date leave little doubt that there is room for substantial improvement. For example, Schneider cites TTU's 1968 study of existing versus attainable efficiencies as follows:

ARLAND SCHNEIDER deplores poor well efficiencies

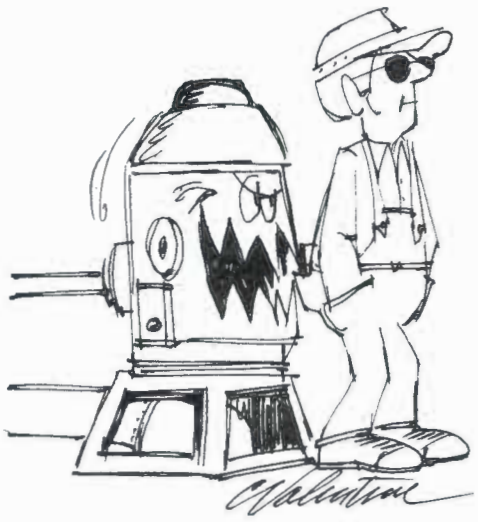
Existing and attainable efficiencies for irrigation pumping equipment in the Texas High Plains.

Equipment	Existing efficiency	Attainable efficiency
	%	%
Electrically-Powered Pumping Systems*	48.6	67
Natural Gas-Powered Pumping Systems**	10.8	17
Vertical Turbine Pumps	52.2	75
Natural Gas Engines (Thermal Efficiency)	19.8	24

*Estimated electric motor efficiency is 89%.
**Estimated right angle gear drive efficiency is 95%.

"But the determining factor is still cost," says Schneider. "Farmers are not in the business of saving energy, they're in it to make a cash crop. They have to be able to determine whether the energy savings will cover the cost of repairs." Schneider has a rule of thumb formula to gauge energy savings, but to plug in the factors a farmer must know his current efficiency. Schneider doesn't expect farmers to be eager to compute all the figures themselves, but he is encouraged that power suppliers and private industry are beginning to offer the service of conducting these tests.

TUNISIA'S Ahmed Khouadja, Director of Soil and Water Resources (center), exchanges solutions to common water problems of semi arid lands with Don Smith through Mohamed Zaier.



Watch your rear

PUMP PLANTS . . . continued from page 1

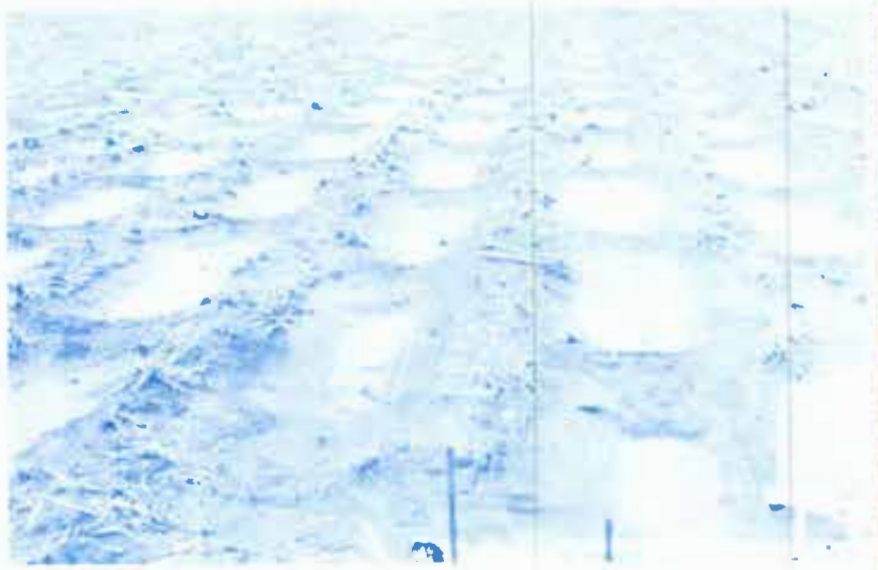
21 to 23 percent for natural gas engines, and 27 to 29 percent for diesel.

While overall pumping plant efficiency equals the efficiency of the pumping unit times the power unit, the biggest dollar payoffs are coming from pump overhauls. Even major pump adjustments are costing less in many cases, than the extra energy needed to irrigate with inefficient equipment. And the payback on the cost of repairs is often recouped in one season.

Chances are about even, according to A. D. Halderman, a University of Arizona extension engineer, that your pump needs repair. He says in the 1978 fall issue of *Furrow* magazine that a new pump, properly adjusted should use roughly 150 kilowatt hours of electricity to lift one acre-foot of water 100 feet. If it takes around 200 or more kilowatt hours, it's probably time to repair the pump.

Low pump efficiency not only begins to eat your profits in pumping costs, it can make less water available when needed and cause crop damage. It wastes energy and increases the investment for your power unit. It inflates the power supplier's capacity requirements and investment. And if your farming operation is marginal, it can make or break you.

WOULD YOU BELIEVE: It may be possible to cut ground water use in half and still maintain the same production level in the High Plains of Texas? Research points in this direction with use of FURROW DIKES for optimum precipitation use and for maximizing the efficiency of irrigation application with low pressure sprinklers.



CASE IN POINT: In 1980 furrow blocking research at the Etter Station, a heavy rainfall (5.7 inches) on May 27 - 28th and another 2.2 inches on June 10th, the open furrows recorded runoff of 5.1 inches while the diked furrows metered only 2.4 inches of runoff. Considerable settling and flattening of the beds was noted but overtopping of the furrow blocks did not erode the dams in the gently sloping clay loam soil.

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 7 Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas *July, 1980*

Are Cities Serious About Conserving Water?

The heat wave only aggravates the already serious water woes of many West Texas municipalities. City managers are nursing more than headaches over how to keep up with water demand.

The first sign of a migraine is runaway consumption. Many West Texas communities have more than doubled their water use this June and July over last year with a higher percentage of that water going to lawns. Predictably, everybody is opening the spigot at the same time which causes city water pressure to take a dive. As local water supply facilities are strained to capacity and beyond, impassioned calls for conservation issue from city hall; then the threat or imposition of water rationing (on your honor). We have seen pleas for both in recent headlines, often accompanied by the facts and figures on how much water we are consuming and what it costs in dwindling reserves, system limitations and needed improvements, expansions and new water reserves.

Relentless 24 hour peak demands are seriously depleting even emergency reserves, draining storage tanks which cannot "catch up" at night, taxing already too small pipeline and sewer systems, overheating water pumps and motors and boosting water bills.

City planners say they are doing something about it . . . and indeed they are. Odd-even day water rationing has been called for in many area towns to keep up pressure. Several cities are using a night watering program for city parks and encouraging residents to do the same. Virtually every city on the High Plains has recently or is currently making plans to raise water rates. In some cases the increase will be dramatic. Lubbock residents, for example, will soon vote on a 21 million dollar water bond and absorb a corresponding 84% "giant leap" in water rates over the next few years to finance an upgrading of its existing water system.

HOT OFF THE PRESS, Friona's water assessment study is assembled by staff.

Many towns are seeking expert advice to evaluate their current water reserves. The Water District has completed a dozen assessments of groundwater reserves under corporate limits and/or ground water rights areas to evaluate the adequacy of these reserves to satisfy towns future water needs. They include Abernathy, Anton, Bovina, Canyon, Farwell, Floydada, Friona, Idalou, Shallowater, Texas Boys Ranch, Wilson and Wolfforth. A study of Lorenzo's reserves is now in progress by request from the city council.

Consulting water engineers are covered up with planning projects to improve, expand and project needs for municipal water systems into the next century. Wherever feasible these blueprints include acquisition of new water rights in land, wells or pipelines. Amarillo, for example, is planning a multi-million dollar improvement to its fifty year old water and sewer system over the next five years in new lines, tanks and wells. Engineers in neighboring Canyon are proposing at least a three million dollar pipeline project to link Amarillo water to Canyon, and these figures do not include costs for pumping and storage facilities. Improvements are also on the drawing board if not underway in several other local communities including Muleshoe, Levelland and Tahoka.

Financing these vitally necessary improvements inevitably calls for raising water rates even higher and passing more bond elections in the future. That would suggest that residents are apparently committed to paying the price for good water management. Appearances are deceiving.

West Texas cities are still encouraging tradeoffs of increased water usage as the cushion against growing revenue needs. They resist promoting water conservation that would result in reduced city revenues and require them to raise rates, because it appears to penalize residents for using less. The irony of that attitude is the lesson of "Robbing Peter to pay Paul." Financing long term major improvements without practicing water conservation is to pay at both ends of the ride and raise the fare for the next go 'round.

When demand is encouraged communities pump and pay more in energy and treatment costs, depleting reserves sooner, and requiring larger volumes of new reserves with more costly distribution systems, all of which will be more expensive than present supplies.

The alternative that most communities are ignoring is the first and cheapest form of water management—conservation. But few communities see the wisdom of paying less for less, for example through rate restructuring. Inclining, uniform or lifeline water rates are designed to promote conservation. They shift the increased costs of water to the larger volume water users, thereby encouraging conservation. These rate structures help to cut waste by realistically metering demand for a more accurate projection of future demands.

Plainview is one city that has adopted lifeline rates for its residential

continued on page 4 . . . MYTHS

Amarillo Looks Ahead—$$$

The city of Amarillo is out to raise water well efficiencies to improve their overall system delivery and cut costs. It sounds like they have done it. C. H. Scherer, city water reclamation superintendent, says that in two days during recovery operations this month he was able to increase the capacity of three of the city's oldest wells by ninety percent.

He did it by 'percussioning' the three old wells, suspected of having encrusted, clogged slots and screens in the 27-year-old structures. The blasting apparently jarred clear the openings and allowed a dramatic increase in flow to boost pumping production from the three wells.

Scherer is expecting still more returns from his efforts. He expects to save 440 thousand dollars in energy costs over the next six to eight years by making the repairs and/or replacements needed to existing pumps to increase efficiency and better match the well capacity to the pumping units.

City water officials did not just speculate on how and where they will concentrate their efforts. They began last fall with a thorough study of all wells in the city's water well fields. The probe was intended to provide them with information to use as the basis for scheduling equipment repairs. It was also to be used to develop an efficient and cost effective scheme of operation and use of the entire water supply system.

City water staff spent four months getting data on the current status of equipment, water levels, current reserves and well capacities, current production in each well versus its dependable yield, and efficiency and cost of operation figures on all 103 wells in the city's three water well fields.

The idea of the program apparently evolved out of the existing workload. Staff had been picking away at collecting similar data as time would permit over several years, according to Scherer. They had suspicions about system inefficiencies. This was the impetus behind the all out effort to get comprehensive data on the system.

continued on page 4 . . . AMARILLO

views

We invite YOUR views, comments, and opinions on any issue addressed in the Cross Section or elsewhere that bears on the future of this nation's water resources.

By Arthur W. Young, Professor Emeritus in Agronomy
Texas Tech University. July 1980.

After spending more than forty-five years in the High Plains and attending many irrigation conferences and many soil conservation meetings it seems rather clear that the importation of water for irrigation on the High Plains is still many years ahead, if ever. Those who are responsible for planning and guiding the future of agriculture for the region must take a realistic view of the irrigation situation. The water supply is dwindling. The possibilities for importation for irrigation seem remote, at least improbable in the next two or three decades. Reason dictates that we should now be preparing for the gradual reduction of irrigated acres of cropland and the increasing of non-irrigated crop production.

A well planned, practical program whereby the farmer can have guidance in making the change-over from irrigated to non-irrigated farming will help reduce the social and economic shock which could occur if the domestic and industrial demands on our remaining underground water eventually makes necessary the cessation of irrigation in part or all of the High Plains area. Population growth, while demanding more food production, also increases the demand for both domestic and industrial water use.

THE CROSS SECTION (USPS 564-920)

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

It was noted in the May 1980 issue of the Cross Section, published by the High Plains Underground Water Conservation District No. 1, that the Water and Power Resources Service is scouting out an active role in irrigation and energy conservation. Perhaps this organization or some similar group can use the available experimental information and combine it with the present day farming know-how and provide the needed blueprint for the coming change-over to more non-irrigated crop production as pumping costs for irrigation water increase and water availability decreases.

During recent automobile trips over the Texas High Plains and as far north as Iowa and South Dakota, I saw much evidence of excessive runoff with serious surface soil losses in many fields where row crops were emerging. These observations included fields which had been planted to cotton, corn, soybeans and grain sorghums. Undoubtedly most of the farm operators where the water loss and soil erosion occurred did not intend for such losses to take place. Their present farming programs and management practices did not include adequate measures to prevent the losses under the existing intensities of rainfall.

Perhaps the Water and Power Resources Service might bring together available information on efficient and effective use of both rainfall and irrigation water. The next step could be the development of guidelines which the farmer could use to plan better water use on his individual farm. These guidelines should take into consideration different conditions and factors such as soils, topography, crops, cropping practices, water resources (irrigation and rainfall), energy sources, economic status, etc. Such guidelines could then be used by a farmer to develop his unit so as to effectively use his available moisture resources for crop and livestock production. Model farming demonstrations could be developed to show the best available planning for effective use of the annual rainfall as well as using the available irrigation water.

The farm operators with limited irrigation water are probably in as favorable a position to start building the necessary water saving and utilizing systems as they are apt to be in the years immediately ahead. Some farmers in the Lubbock area have already done planning and soil modification to prevent water loss by runoff. Some, due to dwindling supplies of irrigation water and increased cost of pumping and distributing the water, have found it is more profitable to stop irrigation and produce their crops on the available rainfall.

This situation can be expected to be repeated over and over again as pumping costs increase and available irrigation water decreases. At some point the farmer will realize that the expense of producing the limited irrigation water is costing more than the returns he obtains from application of the water to his cropland.

Plans for the change-over from marginal irrigation of crops to non-irrigated crop production should be developed to assist those farmers who will find themselves facing these problems in the years ahead. Guidelines to help the farmer determine the time when it will be more profitable to change-over are near and are needed now. Most farmers will find that it is not physically or economically possible to make the necessary soil modifications (levelling, terracing, etc.) in one year. By planning ahead and extending the changes over a three to five year period they can build a farm setup where runoff losses are largely eliminated and necessary adjustments can be made in equipment and management.

When a farmer has carefully analyzed his situation where he is faced with a yearly dwindling water supply and an ever increasing cost of getting the irrigation water on his land, he can gradually reduce his irrigated crop production and increase his non-irrigated cropland. A gradual change-over will be more easily accomplished than to try to make the adjustment in one or two years. A method of analysis of the farming operations which the farmer can use as a guideline for planning the necessary change-over must be made available by competent agricultural leaders if the farmers are to make a smooth and timely change to an industry facing the loss of one of its most important resources, irrigation water.

Planning ahead, using a well designed system which recognizes the limitations involved as well as producing a practical approach with a good potential for a profitable pay-off is needed. Planning and execution of the change-over from the present irrigated farming to a largely non-irrigated farming in the High Plains will involve the effective and dedicated participation of the personnel of all local, state and national agricultural agencies and organizations to get the job done. Someone is needed to take the lead for the years ahead. Our rich productive acreages of cropland in the Texas High Plains and the surrounding area should continue to be used and protected from erosion and loss of fertility during the years ahead until some break-through makes irrigation again possible in this area.

This suggested change-over will extend over a term of years with some irrigation continuing for many years. It is not too soon for development of a "blueprint" for the changes which seem inevitable and already at the door of the agricultural industry of the High Plains of Texas. The best minds of hydrologists, agronomists, climatologists, economists, farm managers and allied fields should be asked to contribute to this blueprint for the change-over.

LOADIN' THE WATER WAGON with samples, Butch Bates and Obbie Goolsby are helping Frank Bilberry and Steve Moore from the Texas Department of Water Resources. The District and TDWR have cooperatively maintained a ground-water quality monitoring network for 15 years in the Water District's service area. Periodic samples are collected here and analyzed in Austin to detect contaminations. Data is shared.

ECONOMICS–ETHICS–ECOLOGY: THE ROOTS OF PRODUCTIVE CONSERVATION

By DR. SAM CURL, Dean
College of Agricultural Sciences,
Texas Tech University

EDITOR'S NOTE: This is the first of a two part, edited text from Dr. Sam Curl's keynote address to the Fourteenth Annual Meeting of the Texas Council of the Soil and Water Conservation Society of America in San Angelo, July 10-12, 1980.

Today, perhaps more than ever before, there is a pressing need to utilize the knowledge and skills of scientists from a host of disciplines to solve complex resource management and community development problems. Some of the most important resources in this state are prime farm land, rural communities, watersheds, wetlands, rangelands and forests. A wide variety of developments is causing extreme pressure to be placed upon our land and water resources.

Higher energy prices, changing transportation patterns and resultant life styles, and the often drab and hostile elements of many of our large cities make rural life more attractive to a growing number of families. People who once forsook the rural areas are now moving back in search of basic values and opportunities.

Take these current concerns and add to them the age-old problems of erosion control and water conservation, and we find that there is no shortage of problems for today's conservationist. The theme of our annual meeting *ECONOMICS — ETHICS — ECOLOGY: ROOTS OF PRODUCTIVE CONSERVATION* brings together some very timely issues.

Efficiency Of The U.S. Agricultural Producer

There is no other group of people in any industry in this nation or worldwide that can match the magnificent success story of the American farmer and rancher. For example, output per manhour on the farm has increased about 65% since 1967, while output per man hour in non-farm business since 1967 has increased only by 18%. Many of you have heard the figure that each agricultural producer in the U.S. will produce enough food in 1980 for 93 people. This figure is even more astounding when the part-time farmer is not included. Those producers who have annual sales over forty thousand dollars will produce enough so that one farmer feeds 351 people.

While we talk about great strides in agricultural production, let's continue to acknowledge the plight of the producer. Production input costs have continued to increase, while the price for farm products continues to fluctuate and not in any significant upward trend. Since 1967, interest costs have more than quadrupled, farm wages are up by more than 150%, and taxes have doubled. The costs of production goods such as seed, feed, fertilizer, fuel and machinery are almost 2½ times greater than in 1967. This type of situation puts much economic pressure on the producer with regard to the application of conservation practices.

World Population/ Food Production

Worldwide, population continues to grow. It reached 4 billion in 1975 from 2 billion in 1932—only 43 years to double. It will reach an estimated 6.2 billion by the year 2000, only 25 years from the 4 billion mark. At the present rate of growth, population will double in about 41 years.

Fortunately, there is more food available per person for the world's 4.4 billion people in 1980 than there was in 1960 for 3 billion. Per capita food production has increased, thanks to improved technology. But the potential for crisis of astonishing proportions always exists. Food supplies worldwide are precariously low and widespread drought could bring on great problems.

We must continue to be concerned about the world population/food production problem and do our best to insure that the specter of worldwide starvation never becomes reality. To be sure that this does not happen, *CONSERVATION* is a word that must be an important part of *PLANNING* with regard to the population/food production situation.

That one word—conservation—may hold the key to our future capability to feed both our nation and supply food on the world market. We, as a nation, must be concerned about conservation not only of soil, but of all our natural resources.

Erosion Control

The first and most obvious concern of conservationists has to be erosion control. The primary goal is protecting the soil. Our concern is with the optimum use of the land, producing at maximum levels from an economic profitability standpoint while minimizing soil loss.

Massive soil erosion has a tremendous impact, as witness the effects on the deep South of the horrendous gully erosion occurring 50 to 150 years ago and the effects on the southern Great Plains of wind erosion of the 1930's. Even more important than the dramatic appearance of massive gullies and of dust storms that turn day into night is the insidious impact of seemingly small amounts of sheet erosion that may go on unnoticed for decades.

The average soil loss tolerance is reportedly five tons per acre per year. This past year an estimated 100 million acres of U.S. cropland experienced rates of erosion in excess of five tons per acre per year from sheet and rill erosion alone.

Texas has one of the highest average annual wind erosion losses of about fifteen tons per acre per year—three times the loss tolerance value for cropland.

Much has been done in the U.S. to develop soil and water conservation practices that permit successful dryland farming in areas that formerly were too hazardous for continuous cultivation. However, adoption of conservation measures lags far behind the development of improved practices, and wind and water erosion continue to be very serious problems.

Land Use

While soil erosion control is a relatively old issue, land use is one of the most recently emerging issues of concern to many segments of our society.

Many articles, talks, and committee meetings have addressed the subject of land-use planning. The concepts differ depending upon whether you are a farmer or rancher, an academician, a politician, a federal employee, an environmentalist or just a plain citizen. Problems are numerous: urban development and use of prime farmlands, outdoor recreation areas, housing developments in flood plains, waste disposal, preservation of wildlife species, and on and on.

This is an area in which emotions become involved and controversy can be quickly generated. There is a wide spectrum of philosophies related to land use planning and it is often difficult to enumerate those activities that result in "good land use." Leadership is needed in this society and throughout agriculture to insure that federal and state land use policies facilitate proper land use while still providing for the needs and rights of individuals to properly manage their resources for their own profits and satisfaction.

Energy

Energy has suddenly been thrust upon us as a third area of major concern. Conservation must be a key word in its use.

We must, of course, develop alternative energy sources, and the amount of energy that can be produced from agricultural products can be substantial. The suggested goal of agricultural energy self-sufficiency by 1990 is, in my opinion, a formidable goal which will not be easy to reach. However, if conservation is practiced and if research is properly funded, it can be done. As we seek energy self-sufficiency using agricultural products, we must be certain that we don't regress in our conservation efforts by increasing susceptibility to wind and water erosion by removing surface protection and depleting soil organic matter. The extensive use of plant residues for energy production is a topic which should be of concern to both conservationists and producers.

Water

A fourth primary issue is water. Water has to rank close to soil erosion as an item of major concern as we move toward the twenty-first century. Agriculture is the single largest user of water in this country. Twelve percent of our cropland is irrigated, and that 12% produces a quarter of the total value of the nation's crops.

We must do more to encourage the conservation of our water supplies. Perhaps the greatest economic incentive to encourage water conservation came in the 70's when the price of energy and the costs of pumping escalated. Water is obviously essential for arid and semi-arid agriculture. Without it, much of our nation's productive capacity is greatly diminished. Land use changes to dryland farming or pasture. The loss of irrigated land necessitates more intensive cropping on more erodible land, thus enhancing erosion problems.

It has been predicted that water rather than land will be the first limiting factor in producing the food needed for our rapidly expanding population. Leaders in agriculture must become more concerned with the efficient use of water and address its multi-purpose uses.

Other Issues

Food production continues to be a major concern to the nation. Our tremendous agricultural resource is obviously an important political tool in the world today. At the same time, we are committed to providing assurances of a food base for the ever-increasing world population. Agricultural commodities play a major role in our balance of trade. Some have predicted that the current energy crisis might appear relatively insignificant when compared to the food crisis which could occur if we were to experience two years of severe drought in the principal grain-producing regions of the world.

The conversion of *prime agricultural lands* to urban sprawl, highways, and industry expansion is continuing at a rate that is highly undesirable. Almost 100 million acres are now occupied for these purposes. And about three million more acres, a million of which are prime farmland, are being lost each year to urban and transportation uses. Because prime farmland generally requires less energy on a net output basis than other cropland, this issue of prime lands conversion has captured the public's interest and will be an item of concern for years to come.

Plant and animal resources continue to be among our prime renewable natural resources. Plant and animal breeders must continue to maintain and improve our valuable stocks of germplasm and do their best to better adapt these resources to unfavorable environments.

Wildlife and recreation continue to become of greater importance to society. Farmers and ranchers have become more aware of the potential for income from land used for wildlife and recreation. Our scientists are determining the combinations of practices which are most desirable for such land use, as well as for its associated aesthetic values.

Urban lands are receiving increased attention, not so much from a conservation standpoint, but from the point of planning. Soil scientists and conservationists provide know-how on the use of soil survey data for engineering, structures, road bases and municipal park and recreation planning.

Organic wastes, particularly animal manure and urban sewage and sludge, have the potential for increasing the productivity of land while decreasing its erosion susceptibility. These organic wastes can be changed from being a disposal problem to a very valuable resource.

(to be continued)

AMARILLO . . . continued from page 1

Utility officials had more than one objective in tackling the project. The first priority was to determine current well efficiencies from readings of flow, pump heads, lift and power demand figures. These results would help determine and schedule equipment repair or replacement needs on a long term plan. The superintendent also expected to locate those wells needing to be abandoned, reworked or replaced with similar, smaller or larger pumping units, and to determine the economically recoverable reserves in the well fields. He was looking at establishing cost effective pumping schemes for all well fields. An equally important need for the study was to establish a long term plan for developing new wells.

"The results told us we were in a little better condition than we thought," says Scherer. "And the increased pumpage from those three refurbished wells is sure going to help us."

The report concluded that if every pumping unit were sized to exactly fit the theoretical dependable yield in its area, Amarillo could probably increase overall output by about 14 percent to 83 million gallons pumped per day. Immediate scheduling of repairs and replacement was recommended for most of the older pump equipment which is wasting money in "moderate to very inefficient" operation.

Scherer says he expects it will take only six or seven years to pay out the city's investment. But the most important outcome of the study for city water providers was the development of a long range work plan for updating the quality of the city's entire water system. City staff now plan to update the study at least once a year.

KEEP YOUR POWDER DRY

The vigil to watchdog the feds over proposed permit requirements for playa basins is not over. A "memorandum of understanding" which Congressman Hance's office was told to expect from a recent meeting in Dallas between the Environmental Protection Agency and the Army Corp of Engineers is now not expected until next January. And initial reports of an agreement are now being contradicted. That memorandum was to state what agreement had been reached by these agencies in determining whether the playa basins are waters of the United States and subject to permitting. Language was expected to exclude from regulation all water bodies containing less than 100 surface acres of water in them consistently during five consecutive years. This would have excluded most or all of the playa basins on the High Plains. However, the Dallas office of EPA now says that was not agreed upon, the figure was "kicked around" but there has been no decision on a number limitation.

The agencies did agree on conducting a jointly funded and Corp directed socio-economic impact survey of the playas to be initiated in late August or September and completed before the end of the year. This study reportedly will determine the commercial importance of the playa basins in West Texas and "their genuine impact on interstate commerce." This study will be the basis for determining if playas are waters of the United States and subject to regulation, according to the Corp. EPA also stated they will conduct public hearings in Lubbock, Amarillo and Midland prior to the adoption of any proposed regulation.

BITING THE BULLET

A law calling for statewide registration of all wells, a pump tax, and mandatory conservation for farmers is now in effect in Arizona. Recently adopted "wide-ranging sweeping reform" in Arizona's ground water management laws is the result of months of negotiations among the state's three leading water interests: the mines, agriculture and the cities. The law targets four areas including Tucson, Phoenix, Prescott and Pinal County, an agricultural region.

The Water Information Center's June 30 *Ground Water Newsletter* reports that the law also calls for the latest conservation techniques for mines and industries, and it gives the director of the new Department of Water Resources the power to set per capita consumption limits for cities. The law prohibits growth in areas where developers cannot assure a water supply for at least a hundred years. Under a "grandfather clause," farmers already engaged in irrigating their crops are exempt from the conservation statutes and they are allowed to sell their water rights with their land. However, no new irrigated agriculture will be allowed in the management areas.

MYTHS . . . continued from page 1

water users and adopted uniform inclining rates above that. City manager John Hatchel says, "it's hard to calculate the relative financial benefits of conserving water versus conserving it so effectively that the city would have to raise rates to pay for its water treatment system."

Many towns are still guilty of allowing water for city parks or other public buildings to go unmetered. This further distorts the picture of actual consumptive use as does an unchecked system of water line losses. Those losses can be detected by comparing quantities of water produced from groundwater or taken from reservoirs against residential and industrial meter readings. If losses exceed ten percent, there is a serious problem, according to most engineering consultant firms. Several firms have commented that they have found line losses of as much as forty percent in municipal water systems.

A regular meter maintenance program is another paying conservation measure. Incorrect readings contribute to excessive water use and revenue losses to a city. So do timer automated sprinkler systems for lawns and parks that commonly irrigate during or just after a rain storm, frequently soak the pavement, or routinely blow the wrong way in West Texas winds. These need to be monitored closely or replaced.

Water rationing for odd-even day lawn watering is false conservation. It may save pressure, but it creates a false sense of saving water and can in fact lead to more water wasted. Residents who realize they cannot water tomorrow tend to water today "just in case" the lawn might dry out. They may use more water than if their habits weren't scheduled.

A recent editorial "urging conservation now" in Canyon reminded officials they have a responsibility to help residents conserve water, even ahead of pricing mechanisms and shortages that mandate conservation. Exemplary positive behavior is a first incentive; actively promoting consumer education is important; and adopting and enforcing regulations and ordinances can also be effective. Amarillo's Daily News reported that they have a city ordinance stating it is "unlawful to permit water to be wasted" when irrigating lawns or shrubs in Amarillo. It did not report they had ever used it, however.

The community of Idalou is taking a tough approach. It is still abiding by a resolution passed two years ago declaring a moratorium on all new taps or meter connections outside the existing city limits until they can solve their supply problems.

The community of Shallowater is considering seeking support for a pilot community water conservation plan that might serve as a model to other small High Plains towns. The suggested program now under consideration would actively promote conservation in several ways in the community. Citizens could receive a mailing of water saving tips; request a homeowners water saver kit containing flow restrictors for shower and faucet, a moisture probe to check yard moisture, a container to measure yard sprinkler application, and more; and get assistance from local plumbers in repairing leaky faucets and commodes. The city would get a check of its water distribution system and establish a meter maintenance and repair program. These are just a sample of what might be included in the community pilot project.

Certainly, there is more that can be done in consumer awareness, wastewater reuse, landscape design, and building codes to encourage conservation and maximize our water resources. So let's stop paying lip service to conservation and start saving water.

Bits & Briefs:

Dr. Herb Grubb, Director of the Texas Department of Water Resources Planning and Development Division; "The major reservoirs are in reasonably good shape. Many major cities, however, are having trouble meeting demand, and small cities and suburban areas have problems because they lack dependable reservoirs or use ground water from shallow aquifers which aren't being recharged. We've had less than half of the precipitation expected by this time of year." (Texas Water Report—July 17, 1980)

The Nebraska Supreme Court, in a historic decision reversing a 1936 ruling against transbasin diversion of water, ruled it is legal. The court decision seemed to include recognition of the needs of basins of origin when it addressed the legality of transbasin diversion where surplus or unappropriated waters exist in one basin. The June 24 decision also prescribed that the Nebraska Department of Water Resources must determine those instances when such diversion would not be in the public interest. (Nebraska Water Letter—July 2, 1980)

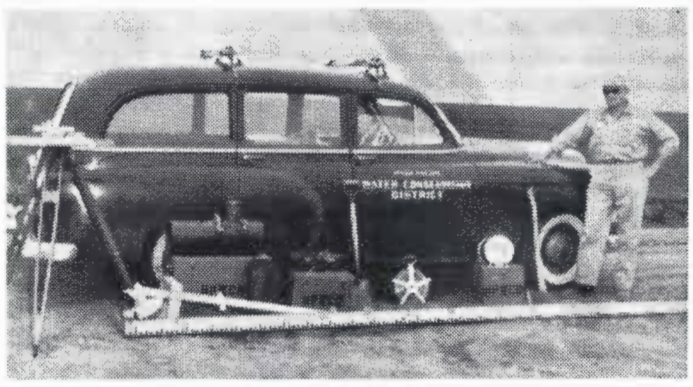
THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 8 Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas *August, 1980*



YOU'VE COME A LONG WAY . . .

IN 1954 the June Cross Section issue featured G. W. "Doc" Willis with the District's Water Wagon. It was a red station wagon equipped with an alidade, stadia rod, three Sparling flow meters, two water level testers, steel tape and various hand tools. "Doc" worked as a geologist for the District.

26 YEARS LATER the District's water wagon is the mini-field water conservation laboratory, packed with irrigation monitoring equipment from meters, gauges, augers and probes to sophisticated instruments and hand tools.

TAES Field Day

Water management research, the low energy precision application (LEPA) irrigation system, and crop insect and weed control are some of the bill of fare for this year's annual Texas Agricultural Experiment Station field day tour on September 9. The host station this year is Halfway. The research facility is located 14 miles west of Plainview on U.S. Hwy. 70.

Also featured on the demonstration tour will be tests being conducted at the Halfway station on crop varieties, soil fertility and mite control.

Specialists will also be on hand at a plant clinic to diagnose problems of plants brought by visiting homeowners, gardeners or agricultural producers. Tours begin at 12:30 and end at 5 p.m.

Mini Field Water Labs Coming

We are expanding on an idea that has been paying off for over a year. Demand for irrigation efficiency evaluations from area farmers continues to outstrip the availability of the three demonstration Field Water Conservation Labs and SCS field teams to meet all the requests. The popularity of this free service with its documented benefits to irrigators in detecting water losses and low efficiencies in their irrigation systems, has resulted in a flood of requests coming into the SCS area field offices. The initial results of the field evaluations suggest the value of the service to irrigators in water saved, fuel saved, or increased yields could be tremendous.

In response to the growing demand, we're building and equipping 16 mini-trailers to add to the "fleet." They are smaller and more compact than the large demonstration labs, but the mini-labs are outfitted with all the necessary equipment to allow SCS teams to perform irrigation efficiency tests in the field and help operators evaluate their overall management systems and detect water losses. The mini-labs are being equipped and delivered to County SCS work units now.

A mini-field lab or a large demonstration lab will be available in all 15 counties in the High Plains Water District's service area, as well as in the North Plains and Panhandle Underground Water District areas.

Distribution of the Field Water Conservation Laboratories located at SCS field stations are as follows:

1) Cochran County SCS—one mini field lab; 2) Hockley County SCS—one mini field lab; 3) Lubbock County SCS—one mini field lab and one large field lab, the mini lab is to be shared with Lynn County and the large field lab is to be shared with all adjoining counties; 4) Lynn County is to share in the use of the mini field lab of the Lubbock County SCS; 5) Bailey County SCS—one mini field lab and one large field lab, the larger lab is to be shared with adjoining counties; 6) Hale County SCS—one mini field lab; 7) Floyd County SCS—one mini field lab to be shared with Crosby County SCS; 7) Crosby County SCS is to share in the

continued on page 3 . . . MINI LAB

MOVIN 'EM OUT, SCS staff from several county field offices hitch up the mini-labs to head back.

RAISING THE SOCK, Carl Butler checks the flow from his sprinkler.

New Sprinkler Design Gets High Efficiency

Would you believe a 99.6 percent efficiency rating on an irrigation distribution system? Carl Butler got it with his modified sprinkler system, low pressures, drop lines and canvas socks under a center pivot.

Butler's unique system is circling a 640 acre tract in Hockley County a mile east and four and a half miles south of Anton. It is an original idea and it is drawing a good deal of attention from farmers and irrigation manufacturers alike.

Butler has modified his irrigation system with a series of pipes, joints, and flanges. He rigged the pipes to connect from the original water outlet on top of the transmission line. He has positioned drop lines to fall directly over the furrow row to be watered and to bring the water within two feet above the land surface. A 20 inch, swiveling, adjustable tube positions the water in the center of the furrow. The tube is plugged with a plastic cap which has a precision cut hole in it. The hole at each drop is a different size: smaller where water pressure is highest close to the tower at the water intake point, and larger at the end of the line where pressure is lower. This allows the same amount of water to be released into each row. The plastic cap is covered with a flexible plastic pipe and a canvas sock which drags in the furrow and lays the water right down in the row in a diffused distribution pattern which prevents soil erosion and virtually eliminates loss to evaporation in the water application.

Butler has also incorporated another unique feature into his operation. He has plowed his rows in a circle to conform to the center pivot's modified watering system. He is farming two rows in and one out and delivering his water between the two rows. The pivot covers the entire section except the corners which he furrow irrigates conventionally.

Butler says he had no problem with side draft while listing the circular beds. His rows were not pulled or widened, he says, because he used wide equipment. He also planted 36 straight rows from one end of the field

continued on page 2 . . . SPRINKLER

Opportunity Knocked


Pennye Newberry

She's moving upward and onward. The District is losing a long time, valuable staff member this month. Pennye Newberry, who has been employed at the Water District headquarters for seven years, is taking a wealth of experience to a new opportunity in banking. She recently accepted a position as a loan secretary with a major Lubbock bank.

Pennye says she developed and sharpened many skills during her district tenure and hopes to apply them in her new job. "And I've learned a lot about geology, topography and legal descriptions, and map reading, and a little about hydrology, water well drilling and the mechanics of irrigation farming," she says.

"I've especially enjoyed working with irrigation farmers. I have seen some real changes."

The District has indeed changed over the years with the expansion of its educational and service programs. Pennye has been a part of that pace setting growth since 1973.

She came to the District as a business college graduate and accepted the responsibilities of a secretary/receptionist. She went to work immediately providing landowners with cost-in-water income tax depletion information under both the older mapping system and the newly adopted parcel system of assigning decline values to individual land parcels for landowners.

As she further sharpened her secretarial skills and became familiar with district procedure, Pennye was promoted to executive secretary to the District Manager with expanded responsibilities.

She recalls one of the major events of the 70's was the relocation of District headquarters. "It was a five year dream realized. Each staff member contributed to the design of the district's new building, and the move was very exciting. It meant we wouldn't be so cramped and we could give everyone more and better service."

Pennye continued to tackle the growing demand for cost-in-water depletion information along with her other duties. She also key punched each year's data from observation well water level measurements for the District's annual update of its income tax depletion allowance information.

In 1978, Pennye was again promoted under a special contract assignment to technical secretary for staff geologist and Chief of the Technical Division. As a contract team member, she spent the past two years collecting, compiling and tabulating information from 4,890 selected wells into a 15 volume report for a Texas Department of Water Resources/US Geological Survey study of the High Plains Ogallala Aquifer.

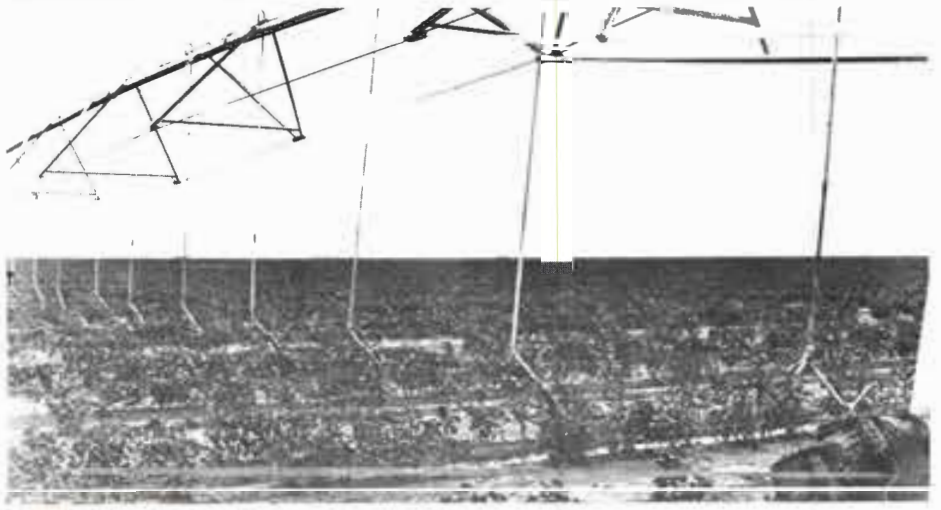
The District is proud of Pennye's many accomplishments and we appreciate her dedication to the job. We wish her every success in her new career, and we'll miss her.

THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.



CIRCULAR ROWS are furrow watered under a center pivot by drop lines dragging water soaked sox in the row.

SPRINKLER . . . continued from page 1

to the other through the pivot's center tower area.

The straight rows reduce the need for tight center circles and provide a turn row area and escape route for water should his system go down and water overflow the holding tank. Butler has three wells tied into his tank for a total output of 1040 gpm. To further cut his evaporation losses, Carl has covered his holding tank with canvas which also keeps out the bugs he says stop up his equipment.

At first appearance from the road, Carl Butler's modified center pivot doesn't look like it is even running. The water is not spraying the crop. The circle row pattern hides from passersby the 30 yard strip of water-soaked furrow trailing behind the pivot and disappearing into the soil.

"In fact, it's so efficient," Carl laughs, "a farmer who passed by for several weeks while I irrigated, finally stopped to ask, 'say, when are you gonna run that thing?'

"I'm on my third irrigation."

The system's speed control panel allows Carl to apply from as little as a quarter inch up to five inches of water for any one application. He applied three and seven-tenths inches on every third row in 12 days, and four and six-tenths inches in 14 days. Now he's about half way around another 14 day set.

Carl explained why his crop still doesn't look its best. "I was hailed out once. I didn't get to prewater the second crop, and it was hailed on pretty hard recently."

Butler estimates that his modified system is allowing him to cover at least a third more area for the same available water and dry conditions than with another system. He says, "for a year like this one, the difference may even be fifty percent more acres."

A technique that was not successful this year for Carl was furrow diking. He tried diking his rows to hold the irrigation water in place, but the dikes overflowed and discharged over the rows. He has since broken out the dikes to allow water to flow down the furrow.

Carl readily admits his system isn't perfect yet. But he's still trying. It is hard to beat the 99.6 percent rating for application efficiency the Levelland Soil Conservation team recently gave Butler after evaluating his irrigation system.

He has also purchased a lateral sprinkler which is similarly modified with drop lines, nozzles and socks. It is furrow gating a 320 acre tract a half mile wide and a mile long. He has an unusual complaint about that system. He says he needs another half section to keep the sprinkler in use full time. Its capacity to deliver water is twice what his crop size requires.

"They're coming from all over to see this," says Carl. "They tell me it will make me famous, all over the world. They don't say anything about it making me rich."

Just in case, Carl has applied for a patent on his idea.

ECONOMICS---ETHICS---ECOLOGY: THE ROOTS OF PRODUCTIVE CONSERVATION

By DR. SAM E. CURL, Dean
College of Agricultural Sciences,
Texas Tech University

EDITOR'S NOTE: This is the continuation of a two part, edited text from Dr. Sam Curl's keynote address to the Fourteenth Annual Meeting of the Texas Council of the Soil and Water Conservation Society of America in San Angelo, July 10-12, 1980.

Economics

The economics of conservation means different things to different people. Producers must obviously be concerned about profit—near-term, long-term, or both—while society in general is much less concerned whether the cost/benefit ratio is high or low.

In considering the economics of conservation a producer can be considered as a resource manager. Others, such as park planners and recreation managers, are also resource managers. These resource managers are responsible for making a series of investment and resource allocation decisions. The resource manager can only maximize the total value of his resources by choosing some best combination of inputs and outputs over a long-term planning horizon. The mix of products includes not only conventional market commodities, such as cotton or livestock for the producer, but also increasing quantities or recreation or leisure-related commodities.

The producer, or resource manager, must deal with calculations involving both renewable and non-renewable resources. The resource manager is guided in his utilization of non-renewable resources over time by his perception of future prices relative to current prices and by his choice of a discount or interest rate. As the value of the discount rate is increased, more of the production and consumption of non-renewable resources is moved into the present and the near-future, and lesser amounts are held for future generations. Notable among the essentially non-renewable resources important to agriculture are fossil fuels, water from non-recharging aquifers, and topsoil.

The resource use decisions must be made within an institutional framework of laws, property rights, and public conservation programs. The bulk of the decisions involving resource use and conservation are made and will continue to be made by private individuals. The private decision maker will tend to weigh most heavily those costs and returns which most directly affect him at the present or in the immediate future. Thus, he may sometimes fail to provide the appropriate weight for the welfare of future generations. Equally important, the private decision maker may not fully consider benefits and costs which accrue to other users for which he receives no direct benefit nor pays any costs. For example, the resource manager who has a secure tenure situation and hence may expect to receive benefits over a longer time period is more likely to invest in terrace construction for conservation purposes than will a manager with a less certain tenure. While there are a great number of individuals instilled with a conservation ethic, it seems unrealistic to expect the vast majority of private resource managers to undertake conservation investments at a level in excess of that for which they receive direct compensation.

Policies and programs of the public sector such as cost sharing, direct payments, or credit arrangement for terrace construction, are means of offering compensation to the private resource manager for benefits accruing to the public sector. A wide range of alternative strategies which might be used to accomplish specific conservation goals is described in the USDA review draft of the Soil and Water Resources Conservation Act.

Ethics

The ethics of conservation is a topic which has been discussed by many individuals since conservation began. Our forefathers in this nation had a "love-of-the-land" ethic—that the land was holy, a God-given resource that had to be revered. George Washington, Thomas Jefferson and Teddy Roosevelt each had a significant impact on conservation practice. H. H. Bennett of the Soil Conservation Service and Gifford Pinchot of the Forest Service greatly influenced today's conservation programs.

The ethic related to conservation should go back to the word management—management of the environment, management of our natural resources, management of the soil and water. The word protection cannot be in our ethic, because that means "hands off," "to shield," or "let nature take her course." If we did that, plants would be covering the streets of our cities within 20 years, or perhaps sooner. Nature can actually be vicious. It can be destructive.

Therefore, let's continue to keep the word management in our conservation ethic. Conservation must continue to be management oriented. The definition of conservation should continue to be "wise use." Management should include research, education, understanding, analysis and planning.

Arable land is still our single most valuable resource, a fact often forgotten in our urban society. A civilization that elects to pass on a diminishing resource base to successive generations is only living for the moment, and is treading on a dark path that ultimately leads to disaster.

Ecology

One of the significant developments of the '60's and the '70's is the nationwide interest in environmental improvement. The study of Ecology as a science in the field of Biology has been with us for a long time. Ecology is defined as a study of the relationship of one organism with another and their relation to the total environment.

From the science of ecology, we have learned that man has influenced and continues to influence the environment everywhere on the earth's surface and perhaps beyond. Man is the great accelerator of change. He has used his unique powers of reasoning to add millions of acres to the world's production potential. He had made forests more arid by removing timber and letting sunlight reach the earth's surface. He has made arid regions productive by irrigation, by developing cropping systems that leave protective cover, and through good cultural practices. He has drained swamps in some cases and pumped water from deep underground sources in others.

In areas where the environment has been difficult to modify, man has adapted to the environment and modified the biological organisms using the area. He has developed drought-resistant plants, bred animals to withstand climatic extremes, and learned to cooperate with the climate.

At the heart of all environmental issues, including the world food problem, is the population explosion. Whether we look at energy resources, land use, water, chemicals, or other requirements for food and fiber production, all nations must become more concerned about irresponsible population growth and its impacts on the world's environment. Population control, therefore, becomes a necessity for man's survival.

Man lives in a delicate natural balance with other organisms and the physical factors of the environment. As more people are added to the population base, as the developing nations adopt modern technology, as man continues to deplete non-renewable resources, we move closer and closer to the ultimate limits of the environment.

The intelligent use of soils, streams, lakes, rangeland, forests and wildlife is not only everyone's privilege but is everyone's responsibility. Human reason is the strongest tool we have to achieve conservation of resources. The approach to such management and conservation cannot be born of hysteria and emotion but must be one of "common sense" ecology—one which will assure a sustained productivity of the benefits of these resources to total society.

Texas Tech University Programs

The College of Agricultural Sciences at Texas Tech University is aware of its role and responsibility in providing leadership for effective natural resource management. Through our research programs, we are attempting to develop an information base from which ecologically sound concepts in management can be developed and the technology extended to our constituents.

As an illustration, in the Department of Range and Wildlife Management, the major research emphasis centers about the control of Noxious Brush and Weeds on Texas rangelands. If the scope of this program were only to study the impact of chemicals, machines, or fires on mesquite and other undersirable range plants, we could be accused of inadequate planning and a narrow vision in looking at research needs. Instead the research program involves a broad "ecosystem" approach to problems of brush control. We are concerned not only with techniques of combating mesquite and other brush species, but our researchers are also investigating the effects of the various treatments on insects, upland game birds, migratory waterfowl, small mammals, big game, and fish, as well as on the performance and behavior of domestic animals.

Summary

A national emphasis on conservation of rural areas was announced by President Carter in December of 1979. A major element of that program directive involves conservation of soil and water resources as well as maintenance and enhancement of the quality of life and the cultural integrity of rural communities. We at Texas Tech University, through the College of Agricultural Sciences, are deeply committed to the goals of this directive through teaching, research and public service programs in many areas dealing with the planning, design and management of renewable natural resources. Programs addressing erosion control, energy problems, water use, land and water resources for parks and open space, landscape planning, watershed management, range and wildlife management, and natural resource economics are conducted in our nationally recognized department.s

Progress is being made in soil, water and energy conservation, but many problems still exist. Wiser and more efficient use of our natural resources must continue to be encouraged. We can all make a contribution to this common goal.

The contemporary issues in conservation today, such as erosion control, water conservation, energy, and land use planning, are interwoven among the topics of economics, ethics, and ecology—the roots of productive conservation. Those of us in the universities have a responsibility for research, teaching and public service. Soil and water conservation districts have a responsibility in implementing conservation programs. True, aggressive leadership must come from the soil conservation districts and the universities and in so doing, we must try to always keep facts separated from emotions. The public also has a responsibility to share concern and costs of managing and conserving our natural resources. Our generation must be willing to pay the costs that are necessary to make the sacrifices needed for conservation of natural resources.

Let's keep conservation a key word in all of our programs and activities.

MINI FIELD WATER LABS COMING (continued from page 1)

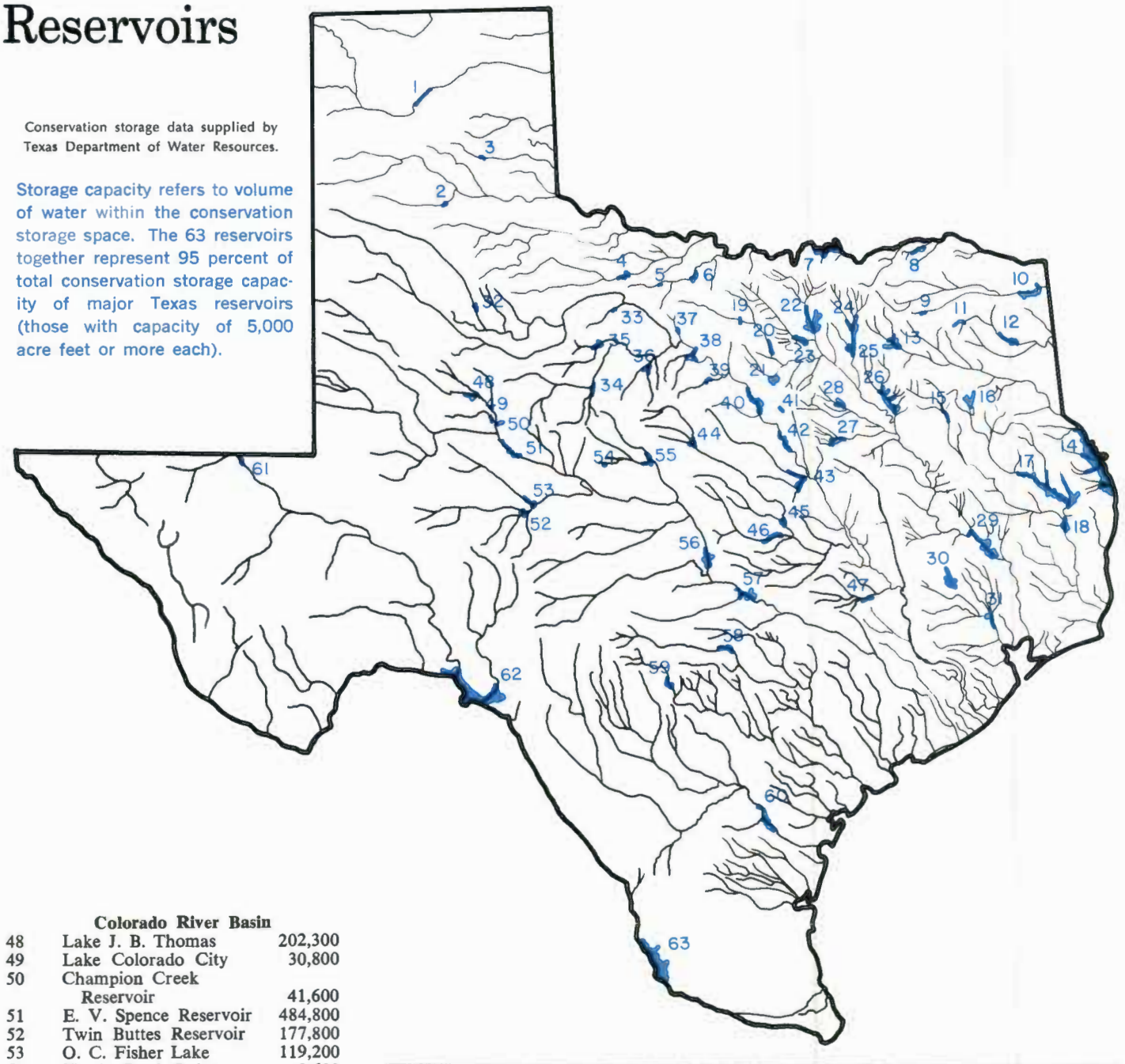
use of the mini field lab of the Floyd County SCS; 8) Potter County SCS—one large field lab to be shared with adjoining counties and one mini field lab; 9) Parmer County SCS—one mini field lab; 10) Castro County SCS—one mini field lab; 11) Deaf Smith County SCS—one mini field lab; 12) Lamb County SCS—one mini field lab; 13) Randall County SCS—one mini field lab to be shared with Armstrong County SCS; 14) Armstrong County SCS is to share the use of the Randall County SCS mini lab. The small field labs financed by the North Plains District (3) and the Panhandle District (1) will be stationed in their respective Districts.

Major Texas Reservoirs

No. on Map	Name of Lake or Reservoir	Conservation Storage Capacity (acre-feet)
	Canadian River Basin	
1	Lake Meredith	821,300
	Red River Basin	
2	MacKenzie Reservoir	46,250
3	Greenbelt Lake	58,200
4	Lake Kemp	319,600
5	Lake Kickapoo	106,000
6	Lake Arrowhead	262,100
7	Lake Texoma	2,722,300
8	Pat Mayse Lake	124,500
	Total	3,638,950
	Sulphur River Basin	
9	Lake Sulphur Springs	13,520
10	Wright Patman Lake	142,700
	Total	156,220
	Cypress Creek Basin	
11	Lake Cypress Springs	66,800
12	Lake O' the Pines	252,000
	Total	318,800
	Sabine River Basin	
13	Lake Tawakoni	936,200
14	Toledo Bend Reservoir	4,472,900
	Total	5,409,100
	Neches River Basin	
15	Lake Palestine	411,300
16	Lake Tyler	73,700
17	Sam Rayburn Reservoir	2,876,300
18	B. A. Steinhagen Lake	94,200
	Total	3,455,500
	Trinity River Basin	
19	Bridgeport Reservoir	386,400
20	Eagle Mountain Reservoir	190,300
21	Benbrook Lake	88,200
22	Lewisville Lake	464,500
23	Grapevine Lake	187,700
24	Lavon Lake	443,800
25	Lake Ray Hubbard	490,000
26	Cedar Creek Reservoir	679,200
27	Navarro Mills Lake	60,900
28	Bardwell Lake	53,580
29	Lake Livingston	1,750,000
	Total	4,794,580
	San Jacinto River Basin	
30	Lake Conroe	429,900
31	Lake Houston	140,500
	Total	570,400
	Brazos River Basin	
32	White River Lake	44,300
33	Millers Creek Reservoir	25,520
34	Fort Phantom Hill Reservoir	74,300
35	Lake Stamford	52,700
36	Hubbard Creek Reservoir	317,800
37	Lake Graham	45,000
38	Possum Kingdom Lake	569,380
39	Lake Palo Pinto	42,200
40	Lake Granbury	151,300
41	Lake Pat Cleburne	25,300
42	Whitney Lake	622,800
43	Waco Lake	151,900
44	Proctor Lake	59,300
45	Belton Lake	457,300
46	Stillhouse Hollow Lake	234,900
47	Somerville Lake	160,100
	Total	3,034,100
	Colorado River Basin	
48	Lake J. B. Thomas	202,300
49	Lake Colorado City	30,800
50	Champion Creek Reservoir	41,600
51	E. V. Spence Reservoir	484,800
52	Twin Buttes Reservoir	177,800
53	O. C. Fisher Lake	119,200
54	Hords Creek Lake	8,600
55	Lake Brownwood	143,400
56	Lake Buchanan	955,200
57	Lake Travis	1,144,100
	Total	3,307,800
	Guadalupe River Basin	
58	Canyon Lake	385,600
	San Antonio River Basin	
59	Medina Lake	254,000
	Nueces River Basin	
60	Lake Corpus Christi	269,900
	Rio Grande Basin	
61	Red Bluff Reservoir	307,000
62	Intl. Amistad Reservoir (Texas)	1,965,500
63	Intl. Falcon Reservoir (Texas)	1,563,200
	Total	3,835,700
	STATE TOTAL	30,251,950

Conservation storage data supplied by Texas Department of Water Resources.

Storage capacity refers to volume of water within the conservation storage space. The 63 reservoirs together represent 95 percent of total conservation storage capacity of major Texas reservoirs (those with capacity of 5,000 acre feet or more each).



CONFERRING on cooperative projects are James Mitchell, Water District board president; Dr. Bill Ott, director of Lubbock's Texas Agricultural Experiment Station, and Dr. Neville Clarke, statewide director over all of Texas' Agricultural Experiment Stations.

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

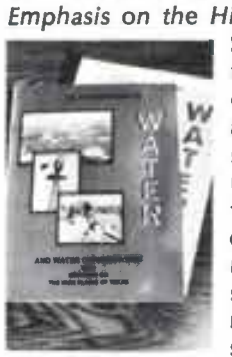
Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 9 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | September, 1980

WATER WHIZZ KIDS: Levelland students in Mary Beth Barton's Junior High earth science classes compete for first prize in a water conservation T-shirt contest after studying with the district's water text this spring.

TEENS DEVELOP WATER AWARENESS

Now every school district in the High Plains Water District service area has requested classroom sets of the district's water textbook, *An Introduction to Water and Water Conservation with Emphasis on the High Plains of Texas.*



Science coordinators and teachers contacted in all 50 area school districts say they are already using or have plans to use the text as a curriculum supplement with their seventh, eighth or ninth grade earth science and life science students during the 1980-81 school year. Amarillo ISD science coordinator Jim Reynolds reports that every seventh grade teacher used the textbook in their science class last school year, and that this year water and water conservation have been incorporated into the scope and sequencing of their seventh grade earth science course. He requested additional copies this semester to replace lost or worn out books and to supply enough classroom sets for Amarillo's present seventh grade enrollment of 1,900 plus science students.

In all, over five thousand texts have been distributed to teachers in 15 counties since January, 1980. Texas requires every child to study earth science in his seventh, eighth or ninth school year. Introducing the water text at either of these grade levels ensures each and every child an opportunity to learn more about water than just the bare facts. They can learn to recognize the unique characteristics of this area's water resource, to relate the hydrologic cycle to their own environment, and to realize the special importance of the Ogallala Aquifer to the whole nation. These youngsters are a captive audience of eager learners ready to build water saving habits. We hope the use of these text books will capitalize on that readiness.

In addition to the text books, the water district developed a teacher's guide of quick and ready quizzes, puzzles and activities for teachers to supplement their classroom study. Approximately one teacher's guide for each set of 30 classroom texts is provided. Also included in the guide is an order form to obtain a set of color maps from the district, a page of suggestions for local water topic speakers, and a list of water conservation/education films available to the teachers through their regional Educational Service Centers.

Three different films were selected for use by the teachers as an additional audio-visual aid in teaching their students about water and water conservation. These films and their Educational Service Center loan numbers are:

Water Follies, a 16mm seven minute cartoon in full animated color. It speaks in the universal language of music and visual humor, and takes a laughable look at a day in the life of a water waster. The film compares good and bad water use habits and how easy it can be to save water. This film is suitable for all ages: MP 55 110 in Lubbock, and MP 20 0731 in Amarillo.

Ground Water: America's Buried Treasure is a 20 minute 16mm color film which describes the hydrologic cycle and the importance of conserving our natural resources. It emphasizes the need for conservation and the problems of cleaning up water pollution. Beautifully photographed, it is suitable for junior high or high school science students: MP 55 108 in Lubbock, and MP 02 4302 in Amarillo.

continued on page 3 . . . FILMS

Moisture sensors monitor

WHERE CROP WATER GOES

In Bailey County where just three years ago virtually nobody used soil moisture monitors, Texas Agricultural Extension Service County Agent Spencer Tanksley estimates today about a third of the county's irrigators use them. It happened this way.

Tanksley, who has been the agent in Bailey County for about eight years now, got interested in tensiometers back in 1976 when he says he tried his first field demonstration project. With the help of Leon New, TAES area irrigation specialist, he installed a totally automated electric irrigation system for John Young using two sets of soil moisture monitors to control waterings.

Sensors set at the 15 and 18 inch soil depth were each wired to start or stop the wells' electric motors and the center pivot sprinkler after soil moisture was decreased or increased to a predetermined level of 40 centibars. That year's demonstration returned John Young 8,250 pounds of corn per acre, enough to convince him to repeat the tensiometer demonstration program for several more years.

By 1977 Tanksley had convinced Calvin Meissner to install a tensiometer at the 24 inch depth in half his row watered corn and water every other row whenever the instrument read at 50 centibars. Calvin watered the rest of his corn every other row on a ten to fourteen day schedule. Calvin's corn yields were 11,006 lbs. per acre from the tensiometer monitored field and only 10,280 lbs. for the rest of the field; a 725 pound difference. That convinced him. The first thing he had observed was that the tensiometer told him to water way before it looked like he needed to.

"The top looked wet," says Calvin, "but the tensiometers said the root zone was dry, and if I had waited till the top dried out I would have put the corn in stress." He discovered that his 10 to 14 day irrigation schedule did not necessarily get water to the crop when it needed it.

In 1979 Calvin installed his tensiometers in the middle third of his row where he says it gets driest the soonest. This time his corn yield from the same demonstration methods was 12,000 lbs.

continued on page 4 . . . WATER SENSORS

WATER FOLLIES: "a soak opera"

A DANDY TOOL: Spencer Tanksley is encouraging irrigators like Calvin Meissner to gain first hand experience with tensiometers.

Great Plains Conservation Program Extended

Congress has made one of the most successful government agricultural programs in history even better. It recently extended the life of the Great Plains Conservation Program (GPCP) to September 30, 1991, doubling its funding limit to 600 million dollars and doubling its cost sharing limit to 50 million dollars.

This program gives assistance under long term contracts to land users in 469 designated counties of 10 Great Plains states. Its purpose is to provide needed protection and improvement of soil, water, land, plant and wildlife resources of the Plains area, which is plagued with recurring drought and wind erosion problems. The program assists landowners to install complete systems on farms and ranches which help stabilize individual enterprises and consequently the local economy.

The Great Plains program is voluntary and gives farmers and ranchers added incentive to apply permanent conservation measures to their land by providing them with the technical and financial assistance to ensure their soil and water resources are protected. A landowner can enter into a long term cost sharing agreement for a minimum three year to maximum ten year period to apply conservation measures to every acre of his farm or ranch. He works with the Soil Conservation Service to develop a conservation plan and contract which fits his land and his ability to maintain the conservation design practices, and applies those practices at his discretion.

The GPCP will pay from 50 to 80 percent of the cost of the developmental work. The percentage of cost sharing varies with the practice, and generally covers the average rather than the actual cost of the conservation measure. There are about 29 cost sharing approved conservation practices being applied in Texas, designed to conserve soil and water and to lessen the impact of drouth.

A landowner's soil type, slope, and past erosion patterns are considered in determining what kind of soil conservation requirements are needed in this area. The operator may agree to one of several good alternatives, according to which suits his budget and labor limits. A reasonable amount of flexibility allows for later changes in the conservation program design if circumstances dictate. Modifications in the plan can be made during the annual fall contract status review with the SCS representative.

Landowners can and do receive the full amount of cost sharing funds within a given year. This can mean a real saving in their cost of developmental work. Howwever, they must carry out the conservation practices for the full length of the contract or forfeit the full amount of the cost sharing grant.

Once a farm is under contract it is not again eligible for cost sharing unless a major land use change or new technical advance makes previous work obsolete. However, new land purchased under a single operating unit may be contracted for a total conservation program. Rental operations do not enter in.

The Great Plains program addresses several conservation priorities on the High Plains due to this area's limited rainfall, wide open area with few wind breaks and past erosion patterns. Moisture conservation, dryland erosion prevention and grassed waterway development are key programs. Some of the many conservation practices in this area currently cost shared under GPCP are bench and land leveling, terraces, diversions, water ways, tailwater pits, irrigation pipelines, pasture planting, brush control and management, range seeding, livestock water pipelines and facilities, cross fences, and some pollution abatement practices.

Practices are approved each year by a Great Plains Committee in each county who also establish each year's average costs based on the previous year's bills. GPCP is coordinated with other federal, state and local agencies through these established state and county GPCP committees. Soil Conservation districts review all contracts, set planning priorities, and serve on county GPCP committees.

Any landowner is eligible for an SCS inventory and evaluation of their conservation problems, and should contact their local Soil and Water Conservation District for more information.

THE CROSS SECTION (USPS 564-920)

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

VIEWS:

South Plains Association of
Soil and Water Conservation
Districts
August 21, 1980

Board of Directors

Wayne Wyatt, Executive Director
High Plains Underground Water Conservation District #1
2930 Avenue Q
Lubbock, Texas 79405

Gentlemen:

It has been the privilege of a number of the Soil and Water Conservation Districts in our South Plains Association of SWCDs to use the Field Water Conservation Laboratory Equipment in evaluating irrigation efficiency for some of their Cooperators.

The findings in these tests have been quite dramatic, being positive proof to the farmers that they need constant vigilance in the efficiency of their irrigation operations, and there has been good acceptance and demand for the use of the equipment. It has been the best tool ever available to demonstrate to them the need to develop better irrigation efficiency.

We wish to commend the High Plains Underground Water Conservation District No. 1 for the development of this equipment, and to thank the District for making the Labs available to our cooperators through the Soil Conservation Service.

Unanimously agreed in Regular Meeting, August 21, 1980.

South Plains Association of SWCDs
C. L. Gayle, President

FILMS HELP MAKE WATER CONSERVATION STUDIES FUN

(continued from page 1)

You Never Miss the Water runs 30 minutes, and is also a 16mm color film. It stars Joan Fontaine in a nuts and bolts consumer education show on how to cut water use in every sink in the home in half without any change in flow. The film suggests ways to save more than 2,000 gallons of shower water every year and 20,000 gallons per year for each water closet. It is very suitable for junior high and high school science students: MP 55109 in Lubbock, and MP 02 4292 in Amarillo.

Three copies of each film have been provided by the District to each of the Educational Service Centers in Lubbock and Amarillo for distribution. To date, the Educational Service Centers reports that they have had 59 requests for the films.

Near the end of the same 1979-80 school term the District began an effort to provide Vocational Agricultural teachers in our service area with water conservation information to include as subjects in their classroom education programs. In all, 68 Vo.-Ag. teachers were provided a set of pamphlets, maps, bulletins and reports appropriate for their county's current water practices and conditions.

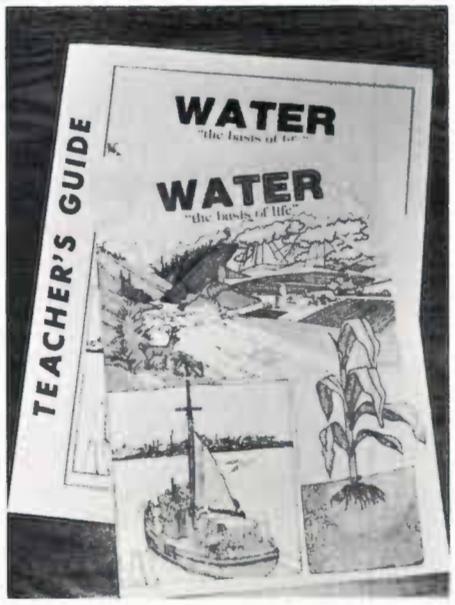
We provided order forms for their use in requesting classroom sets of these materials. Some vocational agriculture teachers responded immediately, ordering additional materials late last semester. A follow-up reorder form mailed again this semester has already begun returning new requests for reports and maps by vocational agriculture teachers.

These teachers may also order a special film for their students which the District has purchased in several copies and provided to the Lubbock and Amarillo Educational Service Centers for distribution. As indicated by the number of inquiries already received by our office, this film should get its share of good use this year.

Titled, *Water on Demand,* the film was partially made here on the High Plains. It illustrates different types of well drilling techniques. It also shows how water moves through the formation to a well, the cone of depression created by pumping a well, and how the cones of depression created by pumping wells spaced too closely will affect well yields, increase pumping lifts, and increase energy costs. The film catalog order numbers are MP 55 111 in Lubbock, and MP 02 5062 in Amarillo.

An awareness of the latest water and energy management techniques are important for any student with an interest in an agricultural related career. The Water District, in cooperation with the Soil Conservation Service, is offering to Vocational Agricultural teachers and their students an opportunity for a first hand look at some of the best efforts we are making toward on-farm water and energy savings by improving irrigation efficiencies. Teachers can request that their local Soil Conservation Service representative arrange an in-school display of a Field Water Conservation Laboratory or mini-lab which are being used in 15 High Plains counties to help evaluate on-farm irrigation efficiencies. Teachers can also arrange field trips for in-field demonstrations to see the tests conducted and hear how irrigators are using them to evaluate their total water management systems.

In another cooperative activity with the Soil Conservation Service, the District recently purchased 20,000 copies of a newly released education comic book, *WATER: the basis of life,* published by the Soil Conservation Society of America. Five hundred teachers guides to accompany the text were also purchased. This publication has been recommended for use at the fifth and sixth grade levels. The District has an agreement with the local Soil Conservation Service for them to distribute free classroom sets of the comic book to schools in our service area. Over 16,000 copies have already been placed in school classrooms.



Near the end of this past school year, the Water and Power Resources Services released a water resource education guide for fourth, fifth and sixth grade teachers. The title of this publication is *Teaching About Water.* It is currently being made available free of charge to schools in our service area. To inform elementary science teachers of the availability of this teacher's guide, the Water District sent a letter to elementary school principals in our service area to advise them of the publication and provided them with postcards for requesting copies of the guide. The Water and Power Resources Service reports that over 400 requests for copies of the guide had already been filled by the beginning of this school term.

Much more work needs to be done to help educate our young people about water and the need for water conservation. We are continuing to develop programs and materials to meet those needs and are interested in any exchange of ideas or materials to enhance the students' water awareness opportunities.

STUDY COUNCIL RESOLUTION OFFERS STATES ASSURANCE

"Only those amounts of water estimated to be surplus to present uses and future needs will be recognized as being potentially available for exportation to the High Plains-Ogallala Aquifer Region," Herb Grubb told members of the Missouri River Basin Commission at a July meeting in Bismarck North Dakota. Grubb, director of the Planning and Development Division for the Texas Department of Water Resources, was citing one of several provisions included in a resolution adopted in January by the High Plains Study Council which is commissioned to study possible supplemental sources of water for the six state High Plains Region.

The Study Council, along with the U.S. Army Corps of Engineers, the Economic Development Administration, and others, is looking at four possible diversion points for water from the Missouri River at the South Dakota-Nebraska border; from the Missouri in northern Kansas; and from the Arkansas-White-Red River system, with service to states in the region whose water resources are approaching depletion.

In its January resolution, the High Plains Study Council which includes the six states of Nebraska, Kansas, Oklahoma, Texas, Colorado and New Mexico; stated eight diversion concepts and assurances with regard to the transfer of water from river systems to the east of the region. They include:

1. The present uses and prospective future needs for beneficial purposes for the forseeable future in the potential basin(s) of origin of surplus water will be considered as having prior rights to the waters involved . . . Only those amounts of water estimated to be surplus to these present uses and future needs will be recognized as being potentially available for exportation to the High Plains-Ogallala Aquifer Region.
2. Existing compacts, water rights, contracts and commitments will be considered to remain in effect in estimating exportable surpluses.
3. Future upstream depletions and future downstream flow requirements for instream uses will be estimated in calculating potential surpluses. Instream uses to be considered include, but are not limited to, fish and wildlife, navigation, quality control, hydropower generation, recreation, and aesthetics.
4. State water plans of downstream states for development and utilization of the waters in the stream(s) involved will be taken into account.
5. Needs of potential exporting states for early project development on the stream(s) involved for instate purposes will be examined in discussions with those states, in terms of compatibility and possible integration with a water transfer system. Where feasible, early financing and equitable cost sharing of such projects will be considered as a part of any interbasin transfer plan. The possible integration

continued on page 4 . . . STUDY

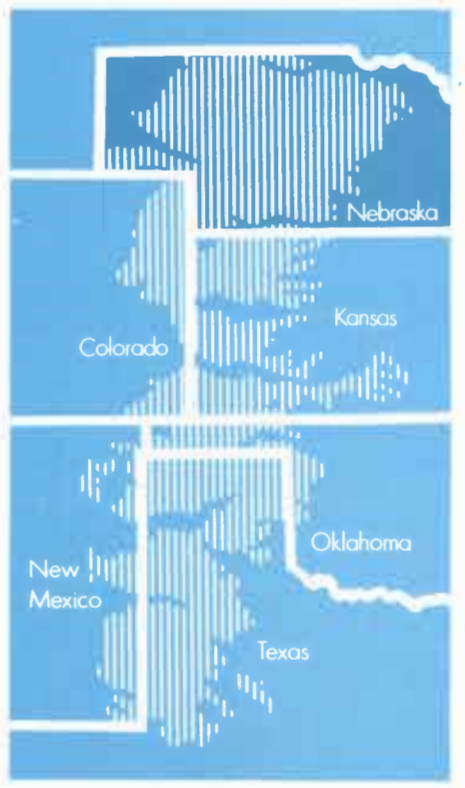
HIGH PLAINS OGALLALA AQUIFER REGIONAL STUDY

"Lying near the heart of the nation and nourishing its vital agricultural economy is the fertile High Plains Region, a corridor 200 miles wide touching vast expanses of Colorado, Kansas, Nebraska, New Mexico, Oklahoma and Texas. Beneath the 225 thousand square mile area lie petroleum deposits and the Ogallala Formation. The Ogallala Formation, one of America's major aquifers, contains on the order of two billion acre feet of water in storage; but over most of the area, water is being withdrawn for irrigation in excess of the rate of natural replenishment."

Congress mandated a study of the depletion of the natural resources of the Ogallala Formation underlying the six state region in 1976. Its intent was to assure an adequate supply of food to the nation, to promote the economic vitality of the High Plains Region, and to examine the feasibility of various alternatives to provide adequate water supplies to the area to assure the continued economic growth and vitality of the region. Thus the High Plains Study Council was formed.

Now a brochure is available which outlines the problems faced by this mid-section of the nation, the intent of the High Plains Ogallala Aquifer Regional Study, its objectives, responsibilities, and the available difficult choices for solutions. Also available is a separate analysis for each of the six states involved in the study, of related economic factors which apply to that state.

In Texas, distribution copies may be requested from the Texas Department of Water Resources Library, P.O. Box 13087, Austin 78711.



Water Sensors Used In Cropping

(continued from page 1)

per acre in the monitored rows, and 10,175 lbs. in the scheduled rows, almost a 2,000 pound difference.

"I'm sold on 'em," says Calvin. "I use the tensiometers to help me make management decisions on how to crop my acres and plant crops I know I can water and maintain."

This year Calvin Meissner's tensiometers told him he needed to start irrigating his corn fully ten days early, and to put on one more watering than he had applied during the past two years. While he knows his yields will be down because of the drought, he expects to see higher yields in his tensiometer watered rows for the third straight year.

Meanwhile, Tanksley had persuaded several more irrigators to install tensiometers for demonstration purposes. From these results he says he found that you cannot write a rule of thumb for when to put on water by a standard centibar reading. It depends on the moisture profile and soil type.

Robert Hunt, for example, got less than 5,000 pounds of corn per acre in 1978 by row watering in grey soil when his 24 inch depth tensiometer registered 50 centibars. In 1979 he reduced his acres to half corn and half cotton, changed to a center pivot, pulled his tensiometer up to 12 inches and watered when it registered only 35 centibars. The change to putting on less water more often in a more shallow root zone and watering based on a wetter soil moisture profile made him nearly 8,000 pounds of corn per acre.

Tanksley says that because 1978 was a "most normal" year, it probably gave them more accurate information, but it

"I'm sold on 'em."—MEISSNER

also taught them much about learning to use tensiometers properly.

In 1979 he expanded his demonstration program with tensiometers into alfalfa to learn from what depth alfalfa pulled the most moisture. By now several more irrigators were beginning to see the value of soil moisture monitors and installing tensiometers in their own fields. Valley Grain Products, an area white corn contractor, also saw the potential for tensiometers to help their contract growers increase yields. They furnished each of 27 Bailey County white corn growers under contract with a set of 18 and 36 inch depth moisture sensors and have been helping the growers to monitor their readings.

Ted Harrison is another irrigator who uses tensiometers as the result of a demonstration in his hay. He commented, "They help. They tell us when it is dry and when it is wet. They do not tell us how to put out any more water."

"But we are trying to figure every way to hold down expenses and we are searching for any way to find a crop we can grow and have enough water to make it profitable."

The tensiometers are helping these producers look at whether they have enough water to continue to grow corn, determine how much acreage they should plant to obtain optimum yields, and judge when is the best time to apply their water. Tanksley says a decision today about how much corn to grow must be related to how many gallons per minute (gpm) a farmer's well(s) will produce. He believes that to realize an average or better corn yield, a producer must be able to pump 900 plus gpm under a full circle.

Spencer Tanksley's agricultural demonstrations with tensiometers have provided several years of test results. The charts graphically illustrate a potentially common problem for Bailey County irrigators with declining ground-water reserves. The curves delineated by plotted tensiometer data points confirm that once the root zone profile dries out beyond its ability to supply the crops moisture needs, it is pretty difficult if not impossible to put down enough deep water to ever catch up.

"Most farmers tell us their irrigation energy costs this summer ran around $100 per acre. They cannot afford to pay these prices for anything less than good yields."

Says Tanksley, "We may not ever be able to write a set of guidelines for reading and watering with tensiometers; farmers will just have to learn to use them by applying them to his individual farm situation."

The sooner they start, the better.

"They tell us when it's dry and when it's wet."—HARRISON

STUDY . . . continued from page 3

with existing systems will also be investigated.

6. The possibility of integration with existing and prospective water resource systems within the state(s) through which an interbasin transfer aqueduct would pass, will be explored, including the potential for equitable cost-sharing and for joint financing of future projects.
7. Where there appear to be potential benefits to be achieved, discussions will be held with states of origin, concerning possible exchanges between and among hydrologic systems. Consideration of such exchange would accord full recognition of water rights in making water available for export.
8. No interbasin transfer will be recommended for the High Plains-Ogallala Aquifer Region, except on the basis of full and frank discussions with potential exporting states and other states directly involved, of all relevant issues of water availability, equity, present commitments, mutual benefits and assurances considered necessary by such state(s) for protection.

(Edited from Texas Water, a publication of the Texas Dept. of Water Resources.)

U.S. SENATOR JOHN TOWER (R-Tex)

Bill To Mandate "Common Sense"

Texas Senator John Tower has introduced legislation again this session to obtain a Congressional mandate to "instill common sense in the Corps of Engineer permit procedures by limiting its jurisdiction over waters which are neither navigable or critical to navigation." His bill, S 2970, is aimed squarely at the Fish and Wildlife Service's latest $70,000 study attempting to include the High Plains' 16,000 playa basins under the 1972 Federal Water Pollution Control Act's Section 404 definition of wetlands. This section authorizes the Corps to issue permits for activities in navigable waters involving the discharge of dredged or fill material.

This is not the first time a federal agency has attempted to gain regulatory control over the playas. Tower introduced similar legislation to limit the Corps' jurisdiction over navigable waters in 1975 and 1977. This time the U.S. Fish and Wildlife Service is seeking jurisdiction over these High Plains farm ponds in the interest of migrating waterfowl.

Calling it a gross misinterpretation of Congressional intent, Tower expressed concern that this country is faced with a growing regulatory scheme covering not just the wetland of the nation, but virtually all surface waters. He asked, "Where will it stop—the invisible hand of government will someday approach the point where draining a backyard swimming pool would require a permit under PL 92-500."

THE CROSS SECTION (USPS 544420)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 10 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | October, 1980

West Texas Chamber Targets City Water Supplies

West Texas cities face a serious challenge to provide long term water supplies to their communities. The current water reserves of many rural West Texas communities are projected to run short within twenty years, and for some cities, the projected life of current reserves is less.

If the challenge is to be met, West Texas municipalities need to act now on sound information and realistic assessments of their municipal water needs.

The West Texas Chamber of Commerce has taken a lead role to help West Texas cities look at their water futures. The Chamber has given program priority to examining municipal water issues in its upcoming Mid-Year Membership Meeting Pre-Legislative Conference slated for November 19 through 21, at the South Park Inn in Lubbock. The conference agenda offers a program of nuts and bolts information on the "Mechanics of a Water Project," from the financing and engineering to the legal aspects involved; an overview of the current water situation in West Texas and statewide, including population projections and state planning progress; and the findings of a municipal water survey conducted by the West Texas Chamber's Water Development Committee.

The Committee has asked local member business and industrial leaders to get involved in planning and developing solutions to their communities' long term water supply problems, and to begin by taking a good look at what is already there. The survey requests information to identify member communities' current and future water supply needs as well as sources of supplies with their projected capability to satisfy each city's future water needs. Additional questions survey the level of community water awareness based on rate structures, ordinances, and system maintenance programs, and special water problems that need to be addressed.

Survey results will be presented during the conference by Arthur Duggan, Chairman of the West Texas Chamber of Commerce Water Development Committee, and prime architect for the special program emphasis on water issues facing West Texas. Duggan has been a moving force in the arena of state water issues since the 1940's.

continued on page 4 . . . WATER

COSTING A SURFACE WATER PROJECT

"Rule of Thumb" estimates to arrive at current day cost for construction of a surface water project. (Note: At current inflation rates, these costs can be expected to double in about six years.)

Reservoirs: Including cost of dam and land—$600,000 to $1,000,000 per million gallons per day of yield.

Pipelines: Including cost of pipe, rights-of-way and installation—$2.25 per inch of diameter per foot of pipe. Example—1 mile of 12 inch diameter pipe would cost about $142,560.

Treatment Plants: $750,000 per million gallons capacity per day.

Storage Tanks: Ground Storage—50 cents per gallon of storage
Elevated Storage—$1.50 per gallon of storage

Time Tables: Planning —Six months to one year
Obtaining water rights permits from state and federal government—one to two years
Geo-technical work—eight to 12 months
Construction—two to two and one-half years

TOTAL: Four to six and one-half years

Major Water Project Components: Legal Financial Engineering

TAES STUDIES BEEF TALLOW

Beef tallow, a fat byproduct of the beef production industry, is both abundant and cheap. An estimated 3½ billion pounds of unused tallow in the United States is currently waiting for a market. It may have found one in West Texas. Tallow is one of the newest resources being examined for possible use as an antitranspirant to decrease plant water requirements.

Dr. Charles Wendt, plant-soil-water expert with the Texas Agricultural Experiment Station at Lubbock, and his research colleague Michael Gerst, are the first to successfully put tallow into a water solution for plant application. Dr. Wendt says it took several months of trial and error to emulsify the fat/water mix into a concentration of tallow and soap solution that would not burn plant materials.

Dr. William Lipe worked with Dr. Wendt and Mike Gerst on the preliminary study, applying a tallow-water emulsion on potatoes to establish tallow's value as an evaporation suppressant.

The study's objectives were to determine the phytotoxicity, or suceptibility of plant leaf to burn, for several mixtures of tallow-water emulsions under field conditions and to determine its effect on water relations and yield on potatoes grown under different field conditions.

Tallow concentrations of 1.5 percent, two, three and six percent were compared to identical concentrations of Folicote, a commonly used antitranspirant, and sprayed on potatoes grown under two different soil moisture levels at Lubbock and Hill Farms, Texas.

continued on page 2 . . . TALLOW

SPREADING THE FAT, in a green house treatment, tallow is used as an antitranspirant on potatoes.

Texas Agriculture In The 1980's

By NEVILLE P. CLARKE, Director
Texas Agricultural Experiment Stations

Texas agriculture today faces both short- and long-term problems which literally threaten its future production potential. The cost-price squeeze brought on by increasing energy prices and unprecedented inflation has created a short-run income and liquidity crisis for farmers. In the long run, the limitation of energy and water supplies threatens not only to curb expansion but could actually result in reducing the level of agricultural production in major agricultural areas of the State such as the High Plains.

These problems can and must be addressed by an expanded program of targeted research and extension education—targeted to solve the problems of Texas agriculture. Given adequate emphasis and direction, such research and extension programs can allow this State to take advantage of its unique natural resources and production capability.

Failure to address the issue of maintaining the productivity of Texas agriculture may have serious implications for all Texans and the Nation as a whole. Since 1972 it has become more apparent that the world food supply-demand balance is becoming increasingly tight. It has also become apparent that the productivity of U. S. agriculture has begun to lag. The productivity of Texas agriculture has fallen sharply relative to the pre-1960 period. In both the short run and the long run, this means higher production costs, lower farm incomes, and higher food and fiber prices for all consumers.

A major cause of our reduced productivity is inadequate appropriation of resources at both Federal and State levels for agricultural research and extension programs. The payoff to Texans of agricultural research and extension has been massive relative to the size of the investment. However, State and Federal support for agricultural research and extension, in real dollars, has declined substantially in the 1970's, over 22 percent since 1978. A major new State initiative in developing new technology for agriculture is urgently needed in Texas.

A brief summary of the nature of agriculture in Texas, its importance to the economy of the State and Nation, and some of the critical issues facing

continued on page 4 . . . AGRICULTURE

THE Cross SECTION

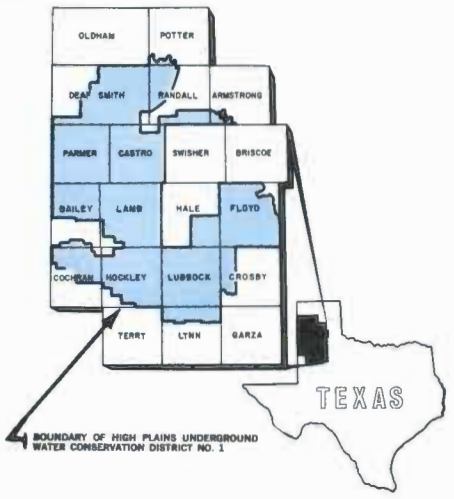
THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

2930 Avenue Q, Lubbock, Texas 79405
Telephone 762-0181

PATRICIA BRUNO, Editor

Second Class Postage Paid at Lubbock, Texas District Office at Lubbock



BOARD OF DIRECTORS

Precinct 1
(CROSBY, LUBBOCK and LYNN COUNTIES)
James P. Mitchell, President ..... Wolfforth

Precinct 2
(COCHRAN, HOCKLEY and LAMB COUNTIES)
Mack Hicks ..... Levelland

Precinct 3
(BAILEY, CASTRO and PARMER COUNTIES)
A. W. Gober ..... Farwell

Precinct 4
(ARMSTRONG, DEAF SMITH, POTTER and RANDALL COUNTIES)
Jim Conkwright, Secy.-Treas. ..... Hereford

Precinct 5
(FLOYD and HALE COUNTIES)
Malvin A. Jarboe, Vice President ..... Floydada

COUNTY COMMITTEEMEN

Armstrong County
Carroll Rogers, Secretary
Wayside, Texas

Guy Watson, 1981 ..... Wayside
Bill Heisler, 1981 ..... Wayside
M. L. McGehee, 1981 ..... Wayside
James Bible, 1983 ..... Wayside
James Stockett, 1983 ..... Wayside

Bailey County
Doris Wedel, Secretary
H&R Block, 224 W. 2nd, Muleshoe

Eugene Shaw, 1981 ..... Rt. 2, Muleshoe
David Stovall, 1981 ..... Rt. 2, Muleshoe
Ernest Ramm, 1981 ..... Rt. 2, Muleshoe
D. J. Cox, 1983 ..... Enochs
Marshall Head, 1983 ..... Muleshoe

Castro County
Garnett Holland, Secretary
City Hall, 120 Jones St., Dimmitt

Jackie Clark, 1981 ..... Rt. 1, Box 33, Dimmitt
W. A. Baldridge, 1981 ..... 608 W. Grant, Dimmitt
Frank Wise, 1981 ..... Rt. 4, Box 10, Dimmitt
George Elder, 1983 ..... Dimmitt
Floyd Schulte, 1983 ..... Dimmitt

Cochran County
W. M. Butler, Jr., Secretary
Western Abstract Co., 108 N. Main Ave., Morton

Keith Kennedy, 1982 ..... Star Route 2, Morton
Robert Yeary, 1982 ..... Route 2, Box 66, Morton
Hershel M. Tanner, 1984, Route 2, Box 36, Morton
Richard Greer, 1984 .... Star Rt. 1, Box 4, Morton
Donnie B. Simpson, 1984, 292 SW 3rd St., Morton

Crosby County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Mike Carlisle, 1982 ..... Route 1, Box 274, Lorenzo
Alvin C. Morrison, 1982 ..... Box 6, Lorenzo
Tommy McCallister, 1984 ..... 209 N. Van Buren, Lorenzo
Edward S. Smith, 1984 ..... 102 N. Van Buren Lorenzo
Pat Yoakum, 1984 ..... Box 146, Lorenzo

Deaf Smith County
B. F. Cain, Secretary
County Courthouse, 2nd Floor, Hereford

James E. Higgins, 1981 ..... 200 Star St., Hereford
Garland Solomon, 1981 .... 303 Sunset Dr., Hereford
Tom Robinson, 1981 .... 211 Cherokee Dr., Hereford
Bill Cleavinger, 1983 ..... Wildorado
W. L. Davis, Jr., 1983 ..... Hereford

Floyd County
Verna Lynne Stewart, Secretary
Floyd Co. Abstract, 215 W. California, Floydada

Charles Huffman, 1982 ..... Route 1, Lockney
Gilbert L. Fawver, 1982 ..... Route 4, Floydada
C. O. Lyles, 1984 ..... Route 4, Floydada
Cecil Jackson, 1984 ..... Route 3, Floydada
D. R. Sanders, 1984 ..... Star Route, Floydada

Hale County
J. B. Mayo, Secretary
Mayo Ins., 1617 Main, Petersburg

Gaylord Groce, 1982 ..... Box 314, Petersburg
Bill John Hegi, 1982 ..... Route 2, Petersburg
Harold W. Newton, 1984 ..... Box 191, Petersburg
Jim Byrd, 1984 ..... Route 1, Petersburg
Ray Porter, 1984 ..... Box 193, Petersburg

Hockley County
Jim Montgomery, Secretary
609 Austin Street, Levelland

J. E. Wade, 1982 ..... Route 2, Littlefield
Jack Earl French, 1982, Rt. 3, Box 125, Levelland
W. C. McKee, 1984 ..... Box 514, Sundown
Leon Young, 1984 ..... Route 1, Ropesville
Robert Phillips, 1984 ..... 218 Redwood, Levelland

Lamb County
Robert Richards, Secretary
402 Phelps Avenue, Littlefield

Billy J. Langford, 1982 ..... Box 381, Olton
Edward Fisher, 1982 ..... Box 67, Sudan
P. A. Washington, 1984 ..... Box 124, Springlake
Jack Stubblefield, 1984 ..... Box 397, Spade
Larry Lockwood, 1984 ..... Star Rt. 2, Littlefield

Lubbock County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Owen Gilbreath, 1982 ..... 3302 23rd St., Lubbock
Clifford Hilbers, 1982 ..... Route 1, Box 14, Idalou
Don Bell, 1984 ..... Box 114, Wolfforth
Ronald Schilling, 1984 ..... Route 1, Slaton
Granville Igo, 1984 ..... 1304 8th St., Shallowater

Lynn County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Gary Houchin, 1982 ..... Box 54, Wilson
Freddie Kieth, 1982 ..... Box 283, New Home
Leland Zant, 1984 ..... Route 1, Wilson
David R. Wied, 1984 ..... Box 68, Wilson
Wendell Morrow, 1984 ..... Route 1, Wilson

Parmer County
Pat Kunselman, Secretary
City Hall, 323 North Street, Bovina

Troy Christian, 1981 ..... Rt. 1, Farwell
Dalton Caffey, 1981 ..... P.O. Box 488, Friona
Ronald Elliott, 1981 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Friona
Ralph Roming, 1983 ..... Bovina

Potter County
Jim Line, 1981 ..... Box 87, Bushland
Albert Nichols, 1981 ..... Rt. 1, Box 491, Amarillo
Weldon Rea, 1981 ..... Bushland
Sam Line, 1983 ..... Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

Randall County
Mrs. Louise Tompkins, Secretary
Farm Bureau, 1714 Fifth Ave., Canyon

Harry LeGrand, 1981 ..... 4700 S. Bowie, Amarillo
Jack Brandt, 1981 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1981 ..... Box 56, Bushland
Bill Dugan, 1983 ..... Happy
Roger B. Gist, III, 1983 ..... Happy

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

KATHY ANN MILLER

Introducing Our Newest:

She's a former junior high math teacher and high school track coach, currently a part time beauty counselor and a full time crackerjack secretary, and she's the newest asset to the water district staff.

Kathy Ann Miller is our bright eyed, eager learner and receptionist. She also provides clerical secretarial support for all divisions. Kathy's enthusiasm is contagious, as is her smile. Her motto, which she says she learned from her daddy, is reflected in her work: "If you're going to take the time to do it, do the best you can."

Kathy is making Lubbock her first home away from home. She moved from Amarillo in August with her husband, Dave, who recently set a major new career course and began earning credits toward a degree in civil engineering at Texas Tech University.

Still a sports enthusiast, Kathy plays softball, basketball, racketball, tennis and golf. She's already found herself a city women's basketball team and is on her way to a winning season. We think we've found a winner, too.

TALLOW . . . continued from page 1

The antitranspirant treated plants tended to use water over a longer period of time and tended to stress less than the untreated plants, while the tallow and Folicote treated potatoes in two percent concentrations were most effective in increasing the value of the yield of the potato crops. The sprayed crops yielded an increase of more than $500 per acre, primarily as the result of an increase in the quality of the potatoes.

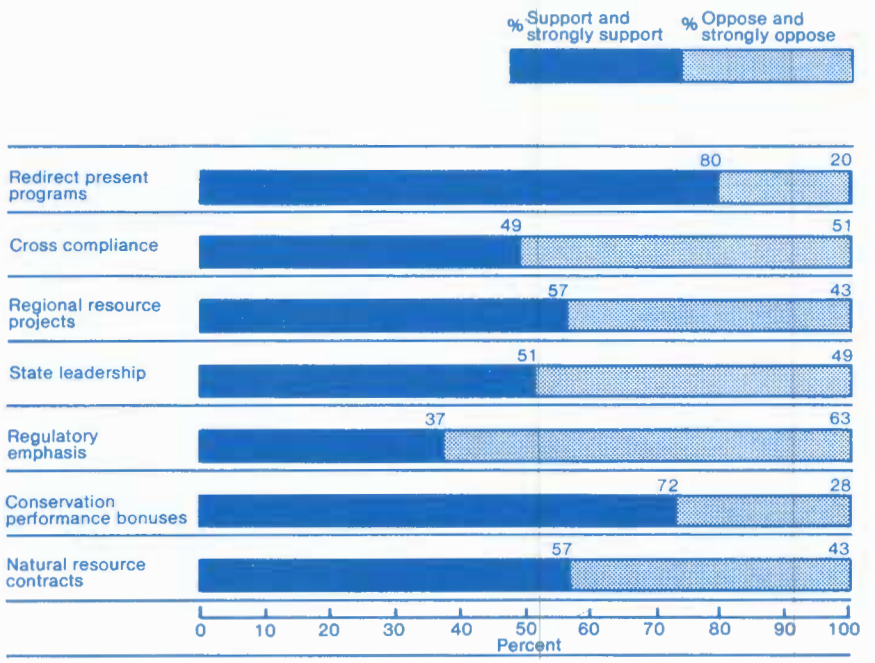
The study suggests a tremendous potential for more beneficial water use applying tallow as an antitranspirant, particularly when its cost of $5.20 per acre is compared with the cost of Folicote at $40.58 per acre.

Dr. Wendt is hopeful of research funds to continue the studies with tallow. He is working to get even higher concentrations of tallow into solution so the farmer won't have to carry around so much water. He has plans to further examine tallow under field conditions to study its influence on soil properties and its affect on water movement into the soil.

If tallow does prove effective as an evaporation suppressant, its potential wide use could increase the water use efficiency of area crops, and strengthen the beef industry on the High Plains.

EMULSIFIED tallow mists into a thin film to temporarily seal in plant moisture and retard evapotranspiration.

Summary of Comments Expressing Support for or Opposition to the Alternative Strategies



Public Comments On Resource Conservation Act

Reprint edited from *Tuesday Letter*, Sept. 30, 1980, National Association of Conservation Districts

The USDA has finished analyzing the comments received on the RCA proposals last winter. Almost 65,000 responses were received in the Athens, Georgia response center between January and March of 1980. The responses, signed by over 118,000 people, contained over 1.5 million separate comments about the RCA draft documents and their contents. They came from every state in the nation and the Caribbean area. A summary of the responses that were received are as follows:

Analysis of these responses shows that:

responses from the South are proportionately greater than the non-metropolitan population of the region; responses from the Northeast are proportionately smaller;

at least 37 percent of the respondents came from the farm community, including those who identified themselves as farmers and those affiliated with conservation districts, ASCS county committees and farm organizations;

one-fourth of the respondents identified themselves as employees of federal, state, or local government;

about half of all comments address the alternative strategies for conserving soil and water resources; and,

more than one-third of all comments address the conservation objectives.

Respondents commenting on soil, water, and related resources:

demonstrated a good understanding of resource status and trends;

gave the greatest attention to water resources followed by soil resources and fish and wildlife habitat; and,

are concerned about the capacity of the nation's resources to meet future needs.

Respondents commenting on the conservation objectives:

express strong support for USDA's traditional objectives relating to the conservation and preservation of agricultural land;

support the objective of reducing soil erosion as the cornerstone of USDA conservation programs, with retention of prime farmland for agricultural use receiving the second highest level of support;

want the Department to take an active role in helping to protect and preserve farmland without attempting direct federal control;

support objectives directed at non-cropland, such as wetlands preservation and wildlife habitat improvement, but not nearly as much as they support the traditional objectives;

say that conservation of natural resources is important, that conservation is in the public interest, and that accomplishing the objectives would conserve resources for the future; and,

think that many conservation problems originate in urban areas and that USDA should deal with these if doing so helps to solve resource problems.

Those commenting on the activities proposed to reach the objectives:

say, by a 3 to 2 margin, that proposed activities, taken as a group, for achieving conservation objectives are adequate rather than inadequate;

most favor conservation tillage, drainage, erosion control measures, and structural flood control as effective conservation measures;

express least support for wetland retention policies and data collection methods; and,

support government providing research, technical assistance and cost-sharing for practices that benefit society but yield little or no short-term economic return to farmers.

Respondents commenting on the alternative strategies, including farmers and ranchers:

most favor redirecting present conservation programs and conservation performance bonuses such as higher target prices and loan rates or lower interest rates on loans for those who practice good conservation;

least favor the regulatory emphasis and cross compliance; and,

generally say that they would support a national conservation program that is well funded, voluntary, and responsive to local conditions and needs.

REVIEW TEAM, Gary Westmoreland (l), SCS Resource Conservationist; George Marks, Texas State Conservationist; and Dan Holmes, SCS Assistant Chief for the South West Region, surveyed the progress of West Texas area SCS programs including the cooperative work with in-field irrigation efficiency evaluation tests.

Persons commenting on USDA agencies and their conservation programs:

generally believe that the programs are effective but say that the agencies could do a better job if they had more funding, if they could provide more technical assistance, and if they were more efficient.

Those commenting on related agricultural issues:

favor a strong export policy, and relate this to energy needs;

endorse the traditional American concept of small family farms; and,

say that education and research—but not regulation—are appropriate areas for federal involvement in conservation activities.

Respondents commenting on the RCA process:

endorse the RCA public participation effort, but;

express some doubts about the accuracy of data in the RCA draft documents; and,

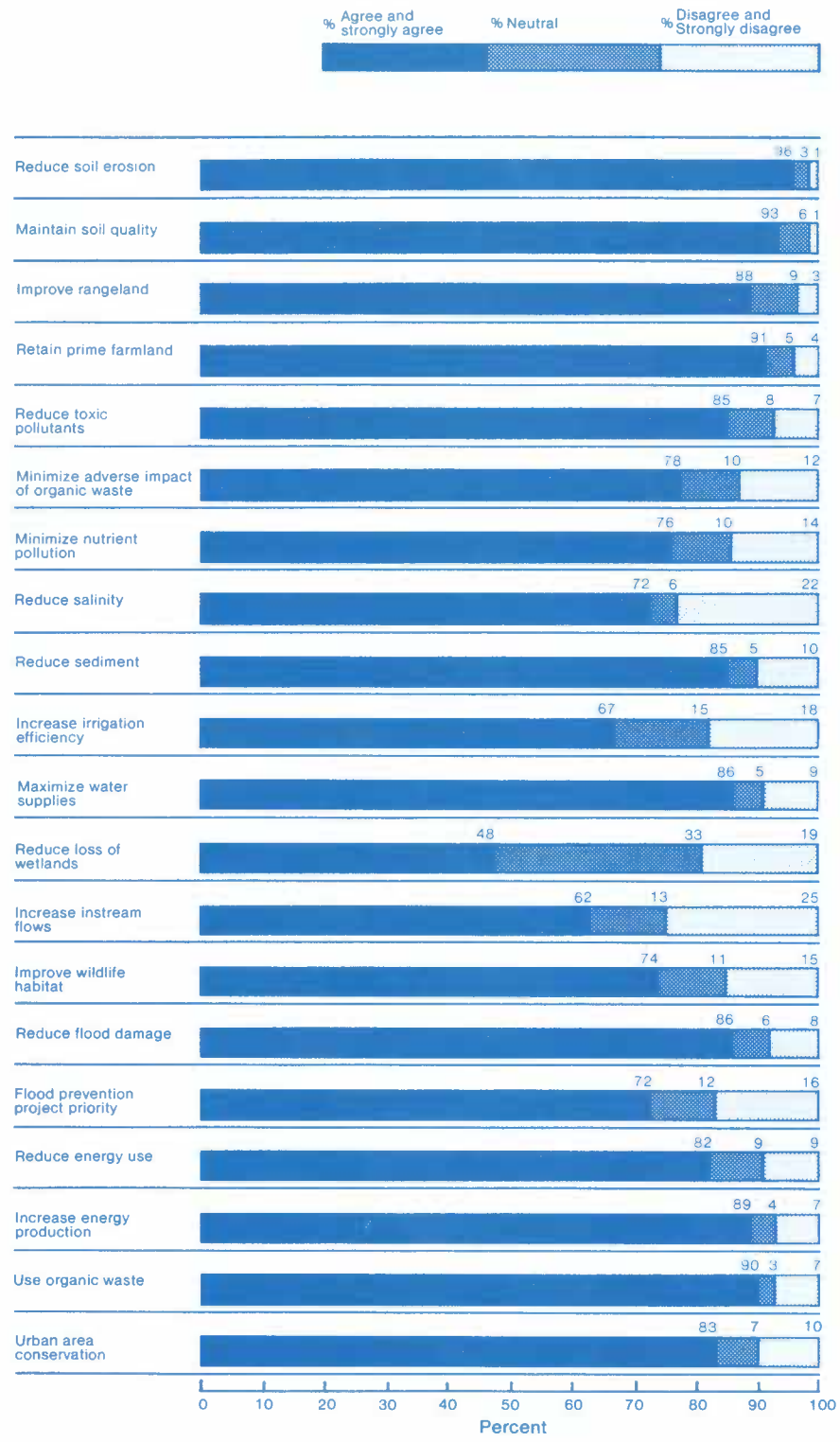
say that the review period was too short, that too few copies of the documents were available, and that the documents should have had more exposure.

Conclusion:

People do not think there is a need to reorganize agencies, shuffle programs from one agency to another, or carry out a major re-structuring of current USDA conservation programs. One of the reasons behind the RCA study was to test the notion that the "old" programs were not working, and therefore some drastic overhaul of federal efforts was needed. That simply did not prove to be the case. Neither the technical study done under the RCA nor the public comment supported that idea.

continued on page 4 . . . RCA

Summary of Comments Expressing Agreement or Disagreement with the Conservation Objectives



A FAIR DAY'S WORK for Ken Carver (l) at the water district's South Plains Fair booth, meant demonstrating how a pump plant efficiency test can help the irrigator detect wasted fuel/energy.

RCA . . . continued from page 3

But that is not to say that significant improvements could not be made in the USDA efforts. The most important improvement identified was the lack of adequate funding in virtually every USDA conservation program. The public was clear on this point, both in the RCA review and in the Louis Harris poll: soil and water conservation is worth doing, it is a responsibility of the public to support private landusers in their conservation efforts, and the current effort is inadequate. The public thinks more money should be spent on these programs, and they say they are willing to pay the bill.

WATER . . . continued from page 1

Other experts scheduled for the three day in-depth investigation of West Texas water needs include Dr. Herb Grubb, Director, Planning and Development Division of the Texas Department of Water Resources in Austin. Dr. Grubb will give the overview and West Texas perspective.

Addressing the mechanics of a water project's financing will be Dr. Frank Baird, Associate Professor with the Center for Public Service, Texas Tech University, Lubbock; engineering concerns will be summarized by Dr. Robert Sweazy, Director of the Water Resources Center and Professor of Civil Engineering, Texas Tech University; legal aspects will be examined by Felix McDonald, Chairman of the Texas Water Commission; and Danny Burger, Executive Director of the Texas Municipal League will discuss the concept of a Water Development Fund Proposal.

The program will also provide an opportunity for community discussion by cities and water groups who may want to present oral or written testimony to the West Texas Chamber on their local problems and needs related to water development.

Area state and national legislators will be present for discussion and to participate in a panel on water issues, answering questions from a firing line of water experts representing the press and private sector.

Conference planners hope to persuade these legislators of the need for their help in solving our long term water supply problems.

The WTCC Water Committee further plans to seek the counsel of top water experts in the state to review the data collected from the survey inventory and to obtain as many possible solutions as they can develop for our towns and cities' consideration in solving their future water supply problems.

Survey questionnaire data will be compiled into a report with recommendations and submitted to Governor Clements, the Lieutenant Governor, the Speaker of the House and appropriate legislative committees.

Credit goes to Jack Pilon, West Texas Chamber of Commerce President, for committing the Chamber's resources and setting a priority on the development of long term dependable municipal water supplies as vital to the future growth and development of West Texas communities.

AGRICULTURE . . . continued from page 1

that broad industry today are as follows:

1. *Agriculture is a major industry in Texas and is based on the use of renewable resources. It generates a high proportion of the total (25 percent) income in the State.*
2. *The capacity for agriculture to grow exists but is threatened by critical problems related to productivity.*
3. *Much of the technology developed for agriculture is based on increasing productivity by substituting cheap energy for manpower. Energy is no longer cheap, and much of today's agricultural technology will become obsolete.*
4. *The ability to increase production by increasing the use of natural resources (such as land and water) allowed for major growth in agriculture; an excess of these resources no longer exists. Through research and extension, natural resources use can be substantially reduced while maintaining existing or even increased yields.*
5. *Production costs have increased radically in the last 3 years; while farm and ranch prices have increased, they have not kept pace with production costs.*
6. *Many farmers and ranchers are operating very near the breakeven point, at best, in most commodities. This creates a major increase in capital risk, a risk which will be manifested in continuing increase in cost of capital and ultimately an increase in consumer food prices.*
7. *The complex interplay of the cost-price squeeze along with governmental policy and regulations also threatens agricultural production in Texas. The basic-sized Texas family farm unit is most severely affected by this situation. Many of these operations will continue to be forced out of business.*
8. *The crisis in agriculture in the 80's has its basic roots in lower productivity relative to input resource costs. Solutions require increasing productivity. There is a strong and compelling logic and experience to argue that solid programs of research and new lower cost technology development with effective transfer and adoption by farmers are the major factors in increasing productivity. This has been particularly well documented in Texas agriculture.*
9. *Texas agriculture is not only large, it is uniquely diversified in comparison to that in other states. Research and extension programs should logically reflect both the size and complexity of the industry. If one looks at the ratio of dollars spent on research versus the level of farm and ranch receipts, Texas ranks 33 out of 35 major agricultural states; it ranks last in the 13 Southern agricultural states. Yet Texas ranks second in the Nation in the level of farm and ranch receipts. Research programs have experienced a 23-percent erosion of scientific purchasing power since 1978.*
10. *Research and extension have a validated return on investment to the taxpayer of between 30 and 50 percent per year.*
11. *Increasing productivity is a key component in reducing inflation. Increased investment in research and extension is inherently anti-inflationary because research and extension increase productivity. Ultimately the consumer is the beneficiary.*

The crisis is now. The time for action is now. The issues are complex, but one thing is very clear: major revitalization of Texas' research and extension programs is an urgent necessity if we are to meet the challenges of the 80's, maintain a competitive advantage in agriculture, and continue to provide consumers wholesome safe food at a reasonable price.

THE GOVERNOR SPOKE to Texas Tech officials and media recently after a briefing on West Texas water problems: "I am committed to water importation as viable."

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 11 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | November, 1980

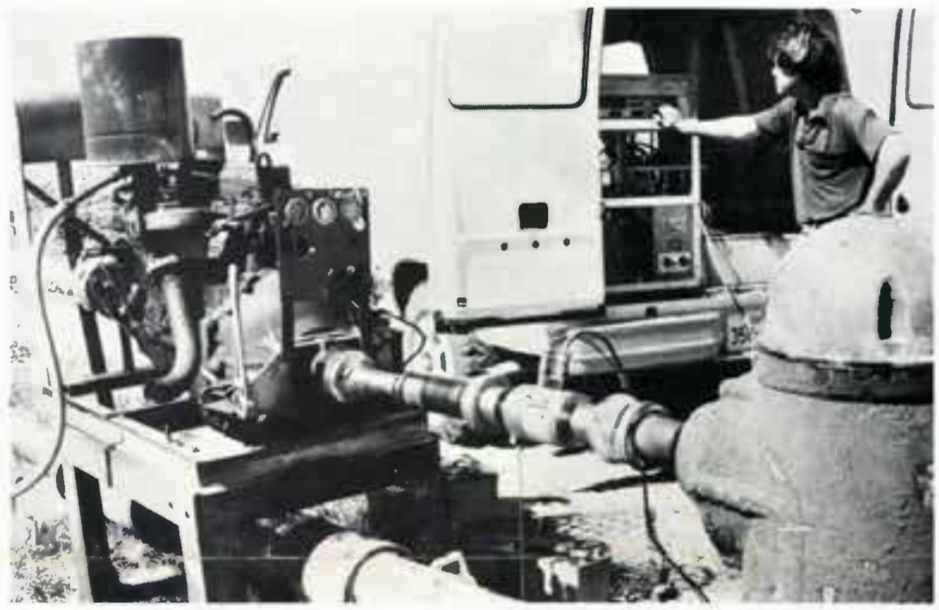
TESTS SHOW 60% EFFICIENCY ATTAINABLE

By DWIGHT ADAMS and KENNETH CARVER

Pump plant efficiency tests conducted on 249 irrigation wells by the District with funds from a grant from the Texas Energy and Natural Resources Advisory Council during the spring and summer of 1980, reveal that it is possible to obtain a bowl efficiency on your pump of more than 60 percent. The efficiency the irrigator should expect from his pumps has come under considerable discussion during the past few years, brought about mostly by the increase in the cost of the fuel to power the pump.

Pump efficiencies measured by the 249 tests showed that 39 pumps or 15.7 percent had efficiencies of more than 60 percent while seven exceeded 70 percent. Forty-two percent or 105 of the pumps tested ranged between 40 and 60 percent, indicating that slightly more than one-half of the pumps tested, or 57.8 percent, were operating a little below the desired efficiency range of 60 percent or better. An additional forty-two percent or 105 of the pumps tested fell below the 40 percent efficiency level. Below 40 percent is considered to be unacceptable by most irrigators with today's fuel costs which are expected to continue to increase.

While pump efficiency is considered to be the largest area of improvement in reducing pumping costs, the efficiency of the power units should also be considered; especially those plants run by natural gas powered (internal combustion) engines. While most electric motors are considered to have a fairly constant efficiency rating according to the size of the motor, internal combustion engines may need some minor improvements to keep the engine from using more fuel than is necessary.



REVVING UP the motor on a natural gas powered pumping plant, Dwight Adams looks for a brake horsepower reading with a torquemeter.

Of the 91 natural gas powered pump plants which were tested in 1980, 47 natural gas engines or 51.65 percent fell in the desirable efficiency range of 20 to 30 percent, while two engines were found to be above the expected normal efficiency range. The tests also revealed that 34 natural gas engines or 37.36 percent were found to have engine efficiencies of 15 to 20 percent which is a little less than desired, but acceptable; while eight natural gas engines or 8.69 percent fell below the acceptable range.

continued on page 2... SUMMARIES

Municipal Water Surveys Reported

The first report of the 1980 West Texas Chamber of Commerce Municipal Water Survey drew an attentive audience to the opening program of the Chamber's Fall pre-session Legislative Conference. The three day mid-year meeting, November 19-21 at Lubbock's South Park Inn, placed special emphasis on municipal water resource development.

The West Texas Chamber's Water Development Committee, chaired by Arthur Duggan, presented preliminary results of its municipal water survey based on 51 initial respondents representing about 33% of the communities of the West Texas area. The purpose of the survey is to identify short, intermediate and long-range local water needs, as well as possible solutions to these needs, and to obtain a base of water data for future planning of WTCC policy.

Cities responding represent the entire range in size, with 12% of the response coming from cities over 85,000 population; 20% coming from cities between 12 and 85 thousand, and the remaining 68% coming from cities under 12 thousand in population. WTCC feels that a larger response is needed to complete the data bank on West Texas, and to obtain as accurate an overall picture as possible. Communities who have not yet returned their surveys are encouraged to com-

continued on page 3... SURVEYS

START NOW---

Wet Root Zone Key To Better Yields

As area farmers begin to wind down harvest for the year, coffee table talk has already shifted to next year and individual evaluations of the various practices which were good as well as some things that did not work.

Conversations normally include a discussion of the past year's successes and failures and how they could have been done differently. Most producers seem to be of the opinion that the lands which had the soil root zone wet to near field capacity prior to spring planting were turning out better yields in spite of the long dry and hot summer. This seems to be most apparent on those lands which had furrow dikes in place during the spring rains. Some lands also received a pre-plant irrigation in order to bring the soil moisture up to field capacity. The amount of water which can be stored in the top six feet of High Plains soils ranges from eight to twelve inches. (For a detailed discussion of soil moisture, intake rates and field capacity, the reader is referred to the April and May, 1980 issues of *The Cross Section.)*

FURROW DIKES will hold moisture and take advantage of winter precipitation.

Furrow dikes were again installed after the crop was established; but this summer very little precipitation over the area occurred during the growing season. Hopefully, we will not be faced with such an episode during the coming season.

continued on page 4... FURROW DIKES

THE Cross SECTION

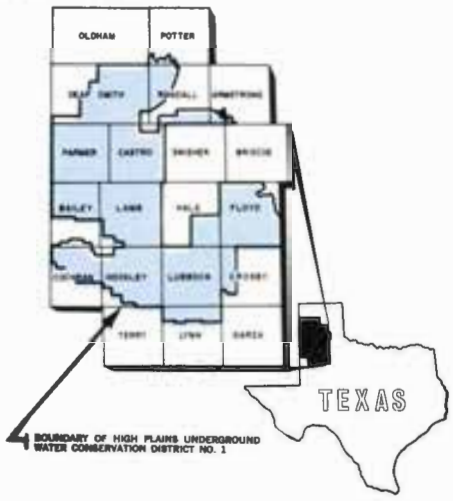
THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

2930 Avenue Q, Lubbock, Texas 79405
Telephone 762-0181

PATRICIA BRUNO, Editor

Second Class Postage Paid at Lubbock, Texas
District Office at Lubbock



NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

SUMMARY OF ENGINE EFFICIENCIES ON 91 NATURAL GAS POWERED PUMP PLANTS

Number of Internal Combustion Engines		Performance Level Rating
8	or	8.69% ranged from 10 to 15 percent
34	or	37.36% ranged from 15 to 20 percent
36	or	39.56% ranged from 20 to 25 percent
11	or	12.09% ranged from 25 to 30 percent
2	or	2.20% tested over 30 percent

SUMMARY OF PUMP EFFICIENCIES ON 91 PUMPS POWERED BY INTERNAL COMBUSTION ENGINES (Natural Gas)

Pumps		Performance Level Rating
1		tested less than 10 percent efficient
3	or	3.30% ranged between 10 and 20 percent
14	or	15.38% ranged between 20 and 30 percent
9	or	9.89% ranged between 30 and 40 percent
23	or	25.27% ranged between 40 and 50 percent
22	or	24.18% ranged between 50 and 60 percent
14	or	15.38% ranged between 60 and 70 percent
5	or	5.49% ranged between 70 and 80 percent

The average pump efficiency was 46.41% with an average yield of 475 gallons per minute with an average lift of 225 feet. The average cost to pump an acre foot of water was $24.65, based on a cost of $2.50 per mcf of natural gas.

SUMMARY OF PUMP EFFICIENCIES ON 158 PUMPS POWERED BY ELECTRIC MOTORS

Pumps		Performance Level Rating
1		tested less than 10 percent efficient
11	or	6.9 % ranged between 10 and 20 percent
21	or	13.29% ranged between 20 and 30 percent
45	or	28.48% ranged between 30 and 40 percent
34	or	21.51% ranged between 40 and 50 percent
26	or	16.45% ranged between 50 and 60 percent
18	or	11.39% ranged between 60 and 70 percent
2	or	1.26% ranged between 70 and 80 percent

The average pump efficiency was 41.35 percent with an average pumping lift of 188 feet, and an average yield of 215 gallons per minute. The average cost to pump an acre foot of water was $24.01 based on an average cost of four cents per kwh.

SUMMARIES . . . continued from page 1

If your pump is operating at 35 percent efficiency when it could be operating at 70 percent efficiency, the fact is you are paying TWICE the fuel bill you should be paying to pump water.

The Water District has recently published three brochures which are designed to aid the irrigator in determining his well's efficiency. These brochures, titled, Overall Pump Plant Efficiency—The Pinch; How To Calculate The Cost Of Pumping Water With A Natural Gas Power Unit; and How To Calculate The Cost Of Pumping Water With An Electric Power Unit; are available free of charge from the District office.

LOTS OF FOLKS turned out to meet the water district Board of Directors invited by Dir. Mack Hicks to hold their October meeting in Levelland. Selmer Schoenrock, recent past director (2nd left) visits with Bd. Secty. Jim Conkwright while County Secty. Jim Montgomery talks with Bd. Pres. James Mitchell. Levelland County Committeemen, area producers, and Extension Agent Bill Taylor were also present.

WATER AND OUR FUTURE

DR. GERALD W. THOMAS

By GERALD W. THOMAS
President
New Mexico State University

Presented to joint meeting of the Lubbock Chamber of Commerce Water Committee and Water Inc., at Lubbock, Texas, November 10, 1980.

Where does water stand in importance as a basic resource in food and fiber production and in economic development? *Secondly,* what about water and food production? *Third,* what about the competition for water? *Fourth,* what about water rights and litigation? *Fifth,* what are our needs for water research? *Sixth,* how can we encourage water conservation? *Seventh,* what about the future for West Texas agriculture? These are only a few of the important questions that your board has dealt with through the years. May I comment briefly on each of these points.

Let's look first at water as a resource. It is my belief that *for the next two, perhaps three, decades, energy (both cost and availability) will be the most critical factor in food production both at home and abroad.* But energy is different from the other resources in that there is an adequate supply of energy in our system if we can capture it and make it available to people in a usable and economical form. Some of the new research on energy alternatives looks promising—particularly the developments in solar energy, in geothermal, and in bio-conversion. If we can gear up our research effort, which should be multiplied by a factor of 10, we *can* find solutions to the energy problem and design systems for food and fiber production based upon renewable rather than depletable energy supplies.

The second important resource, then, is land. While I am concerned about land, and particularly about the rapid transfer of good crop land to other purposes such as buildings, asphalt, and concrete, I believe that *land will not become limiting in the United States for many years into the future.* At the present time, we're losing well over a million acres of good crop land each year to other purposes, and we need to be concerned about this. Nevertheless, as new technology develops and crop yields increase, the amount of land required to sustain each person decreases. We still have some flexibility in this resource.

That means, then, that *water is more critical in the long term than either land or energy.* We can, and must, find solutions to the energy problem; we can, and will, determine ways to operate with a smaller relative land base, but the amount of water in our system is fixed and there is no substitute for water. Water is a renewable resource. Man uses it as it moves through the hydrologic cycle, usually pollutes it to a certain extent and feeds it back into the system. While we can reduce the dependence upon water by increasing the efficiency of water use, there is a very limited supply which must be husbanded with great care as the world population increases.

Let us first look at the value of water to world food and fiber production. A few years ago scientists were talking about the great potential in the higher rainfall zones of the tropics. Much of this optimism has disappeared as we learned more and more about the sensitivity of the tropics and the difficulty in producing food under these kinds of situations. This means, of course, that the arid and semi-arid lands, the vast moderate to low rainfall areas will still be the major areas for world food production. At the present time there are only about eight countries in the world with surplus food production potential, and the United States and Canada stand out as the primary countries in this group.

Irrigated agriculture is becoming much more important with time. The amount of irrigated acreage has doubled in the last twenty years or so. This growth in irrigated land has not only been in the traditional irrigated areas but in the moderate to high rainfall zones as a risk reducing factor. For example, in the United States, Nebraska has become the fifth most irrigated state in the nation. Also, irrigation is becoming more important in the less-developed areas of the world—perhaps the major hope for many of these poor countries. McNamara, retiring president of the World Bank, recently stated that on a global basis, the major increase in total food output in recent years has been associated with expanding the area under cultivation—particularly the irrigated sector. He states that *in the last ten years, roughly 40% of all increases in developing country food production has come from expanded irrigation.* In the past 50 years the areas of land under irrigation has increased threefold and the costs have escalated far more rapidly than the general inflation rate. He also states that despite this development, *water has been traditionally treated as a free good* and this encourages waste. As you know, the irrigated acreage in the United States comprises about 15% of the total harvested crop land but provides in excess of 25% of all crop production. The statistics coming out of the High Plains Study emphasize even more the importance of irrigated agriculture in the U.S. food situation.

The competition for water will increase. We see this particularly in the western states. One of our agricultural economists at New Mexico recently stated that if the present trends continue we will have little agricultural land with water associated with it in the state in 25 to 30 years. The transfer of water from productive land and the transfer of productive land to other than agriculture uses is a situation which must be of more concern as we look to the future.

To an increasing extent *water is becoming the subject of litigation.* There are now over 160 Supreme Court decisions relating to water issues, and Steve Reynolds, who many of you know, the State Engineer for New Mexico, stated that a Supreme Court judge told him recently that because of his association with water he was the most litigious S.O.B. in the history of the state. The judge's clerk had made a count and found Steve Reynolds' name in the files of more Supreme Court cases than the name of any other individual in the state. There have been about 60 Supreme Court opinions involving the New Mexico State Engineer alone in the last 25 years. Personally, I am very leery about the decisions involving water that have been relegated to the courts but this trend seems to be increasing. It is interesting that in Steve Reynolds' opinion, and I quote, "These cases seem to demonstrate the wisdom and sound common sense that the court has applied to our water law. I submit that we have reason to be profoundly grateful for the contribution that our judicial system has made to water management in New Mexico." Steve may be optimistic because he has often been on the right side. Generally, I do not favor developing water regulations or any other regulations in the courts.

What then are our urgent needs in water research? The answer to this question seems obvious, but unfortunately too much of our agricultural research is not designed with water as a constraint. How can we increase the efficiency of water use in food production, processing and distribution systems? We must learn to measure everything that we do in units of water and become more conscious of water in all aspects of research. My experience in the sub-Sahara region of Africa recently led me to believe that if we could

continued on page 4 . . . "SOME . . ."

Surveys Reveal Water Overview

continued from page 1

plete and mail them to Arthur Duggan, WTCC Water Development Committee, P.O. Box 1561, Abilene, Texas 79604.

Population Summary Of Cities Responding

Under 1,500	14% (7)
1,501 - 5,000	33% (17)
5,001 - 12,000	21% (11)
12,001 - 25,000	14% (7)
25,001 - 85,000	6% (3)
Over 85,000	12% (6)

Water Supply Sources

Over half of the towns responding to the survey (52%) rely on well water for their municipal needs at the present time. Sixteen percent of the cities use surface water sources, and the remaining 32% rely on a combination of wells and surface water.

Future Water Supplies

Most of the cities responding to the survey classified themselves in "good shape" for the next 50 years. Generally, the larger cities appear to be in the best position to meet future demands for water at projected growth rates, while a few small towns and several rural areas indicate immediate supply problems or shortages within the coming 20 years. Of the cities estimating their ground water supplies in years, the average expectancy is forty-four years.

However, cities planning to construct a reservoir number only 12% of those responding. Seventy-eight percent indicated that none are under consideration in their areas, with at least half of those towns indicating no need for one. Reservoir construction was not feasible for many of the other cities.

Emergency Contingencies

Thirty-eight percent of the cities answering the survey have an emergency rationing plan for their residents which could be put into effect should the municipal supplies reach a dangerous level. However, only 16% of the cities indicate the existence of an emergency plan by which they can secure water from an additional outside source.

In answer to the question, *"Do you think your city would be willing to join a regional water supply project to obtain a long-term source of water?"* 68%, over two-thirds of the respondents, indicated they would be willing. Twenty-six percent replied no, and six percent did not answer.

Industrial Water Use

Over 50% of those responding have identified industrial water users of some kind in their cities, while the remaining cities indicate that they do not have any heavy water user industrial customers.

Eighty-nine industries are named by responding cities with water use requirements ranging from one million gallons to 785 million gallons of water annually. City officials and chamber officials completing the surveys were asked to estimate what these industries would do if confronted with water shortages, and the responses are eye-opening.

Fully one-fourth of the industries, it is estimated, would move to another city with an adequate water supply. Another 9% would close and abandon their operations. Thirty-seven percent would try to obtain their own water supply from a private source, and twenty-two percent could not or would not estimate what the industries might do if confronted with such a dilemma.

Common Problems And Needs

The most common local problem listed by West Texas cities dealt with water treatment and sewage systems. Special water problems identified were salt pollution, hazardous waste dump sites, illegal irrigation, and overloaded purification and sewer systems.

The survey has also shown an awareness among West Texas cities of a need to pursue programs that will result in developing additional long-term water supplies; a goal which the West Texas Chamber of Commerce has been working toward since 1918.

FURROW DIKES CHEAP MOISTURE TRAP

continued from page 1

Most of the farmers we have heard discussing their plans for next year are thinking about shredding their stalks, listing, and installing furrow dikes to take maximum advantage of winter precipitation. Dr. John Abernathy of the Texas Agricultural Experiment Station at Lubbock, suggests that if you consider listing early and installing furrow dikes that you should also give thought to applying pre-emergence herbicides now, prior to listing, at a slightly higher rate in accordance with label directions for early application.

If there is a concensus, it seems to be that we sure need to know what our soil moisture profile is in time to take action before planting. Many who went into the past crop season with a low soil moisture profile found it impossible to catch up as the plant water needs began to exceed their ability to supply irrigation water and a lot of fields suffered stress as the need for deeper moisture in the root zone was not met.

Most irrigators seem to be of the opinion that water stored in the soil profile from precipitation will sure go a long way in helping to make a crop. It is pretty cheap to come by when you use furrow dikes and are fortunate enough to receive a little rain.

CHECKING OUT the field water lab equipment, Charles Nemir, asst. exec. dir. and Harvey Davis, exec. dir. of the Texas Dept. of Water Resources, were in Lubbock for a first hand look at local water conservation techniques.

"Some of our research already indicates that by selecting plants for various water regimes we can increase production potential in excess of 200% . . ."

continued from page 3

all value water *"with the concern of the desert nomad,"* we could move much faster into water conservation and more effective use of this valuable resource.

The High Plains Study is one example of a major research effort which was long overdue. This multi-state study is just beginning to yield valuable information for those of us concerned about the resource and involved in the decision-making process. The study, as you know, has concluded that by the year 2000 the Ogallala will supply only enough water to irrigate 56% of the needed acreage in the six-state area. The aquifer, of course, is the primary source of irrigation, municipal and industrial water in the states of Texas, New Mexico, Oklahoma, Colorado, Kansas and Nebraska. I serve on the advisory committee for Governor King on this council, and the research to date looks impressive and will be essential to our decision-making process as we plan for the future.

We must step up our research on photosynthesis, not only to capture more energy from the sun by this process, but also to determine more effective ways to increase the efficiency of water. We must put more emphasis on plant breeding with water as the prime measurement unit. Some of our research already indicates that by selecting plants for various water regimes we can increase the production potential in excess of 200% over the non-selected plant varieties.

But the research will not be effective unless we design better educational programs to emphasize the value and the conservation aspects of water. How can we encourage better water conservation? I know that your group has been primarily concerned with water importation, but the West Texas areas is also providing good leadership in various aspects of water conservation. Conservation offers a good opportunity for extending the water supply while we are exploring economic and engineering alternatives to supplement the water resource.

The final question, then, is, what about the future of West Texas irrigated agriculture? I know you spend most of each session discussing this point and you can predict much better than I can what this future presents to us. Much will depend upon the cost and availability of energy and how soon we can find alternative energy resources. The move toward center-pivot irrigation is a risk-reducing, labor-saving alternative, but it is energy expensive. The future of irrigated agriculture will depend upon cheap and adequate energy supplies. On the other hand, this costly energy is working for us on the conservation side. The cost of pumping is forcing some individuals into dry-land farming and will force more to choose this route in the future. The irrigated agricultural economy of West Texas will not decline suddenly but there will be a gradual change depending on the economic situation and the availability of water. We will reach the economic limits of the Ogallala long before we reach the engineering and technological limits.

In the meantime, the possibilities for importation do not look good. The High Plains Study is examining a number of these alternatives. We had a lot of interest a few years ago, as you know, in NAWAPA and several other water cross-country transport schemes. The High Plains Study is probably focusing in on more reasonable alternatives, but the eventual supplementation of the Ogallala will be a tough political issue, a tough legal issue, and a questionable economic one. Also, water importation schemes take time to complete. Studies of the water projects by the Corps of Engineers by the General Accounting Office showed that it takes an average of 26 years from the time the study is authorized until construction begins.

This does not mean that we should not continue the thrust of Water, Inc.; continue to examine all alternatives; continue to emphasize water conservation and our dependence upon this valuable resource. Indeed, the challenge ahead and the magnitude of the task should not discourage us from making a reasonable beginning.

Talking Water Depletion

The annual meeting of the Groundwater Management Districts Association (GMDA) will be held December 8-9, 1980 at the North Platte Holiday Inn in North Platte, Nebraska. GMDA is an affiliation of management districts and their governing boards, including interested individuals and organizations throughout the U.S. with responsibilities for administration of water policy.

Highlights of the program will include an update by Kansas Governor John Carlin of the High Plains Ogallala Aquifer Study; a report by the Army Corps of Engineers on aspects of the interstate water transfer study; and a report from the U.S. Environmental Protection Agency on groundwater policy, assessment studies of the hydrology of the Missouri River Basin and Minnesota groundwater.

In addition, current developments for implementation of a landowners tax depletion allowance to cover groundwater pumpage in South Dakota, Colorado, Nebraska, Kansas, Oklahoma, New Mexico and the Panhandle of Texas will be reviewed and discussed. Please contact D. D. Smith of this water district for a copy of the program and room registration information if you are interested in attending the meeting.

THE CROSS SECTION (USPS 564-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

THE Cross SECTION

Published monthly by High Plains Underground Water Conservation District No. 1, 2930 Avenue Q, Lubbock, Texas 79405

Volume 26—No. 12 | Publication number USPS 564-920, Second Class Postage paid at Lubbock, Texas | December, 1980

Bill Clayton Reveals Water Plan

Texas House Speaker Bill Clayton says he has a plan for funding water development in Texas that is unique and perpetual, will not involve taxes or bonds, and is a "pay-as-you-go" approach to financing long term state water projects. Clayton has still not unmasked the details of his innovative plan, except to say that it involves creating a trust fund from the interest from surplus state revenues with the trust fund's interest to be used for water development. Interest repaid by cities or groups who secure loans from the trust fund would make the fund self-sustaining and perpetual.

Clayton's disclosure was an encouraging word to West Texans and area legislators brought together in November by the West Texas Chamber of Commerce and by a common concern for municipal water issues. In particular the conference addressed concern for how to locate, finance and construct the water supplies to match growing demand, depleting reserves and increasingly inadequate existing systems.

Participants in the WT Chamber's recent pre-legislative conference and water program heard Dr. Herb Grubb, Director of Planning and Development for the Texas Department of Water Resources, estimate statewide water supply deficits of six million acre feet by the year 2000 and three times that—18.6 million acre feet—by the year 2030. "Most of that will be in West Texas," said Grubb. He believes the state will eventually be forced to rely on imported water from other states to meet growing population and industrial demand.

"No part of Texas is free from water problems," said Grubb. "In the Ogallala area municipal and industrial water supplies are becoming more difficult to obtain, and more expensive as the water tables decline and in many areas the groundwater is higher in flouride contents than allowed under the Federal Safe Drinking Water Act." The Ogallala is also expected to supply only enough water to irrigate 56 percent of Texas' current irrigated acreage by the year 2000.

In surface water supplies, West Texas has 42 percent of the state reservoirs. It has only 33 percent of the conservation storage capacity and captures only 16 percent of the state's annual surface supply.

But the High Plains area has developed a complex economy that contributes significantly to the nation's energy, food, fiber and manufactured goods, Grubb said. If that economy is interfered with by limited water supplies, all areas will suffer.

A key solution is seen as water importation, in spite of the crippling energy crunch. Senator E. L. Short of Tahoka said, "Texan's water needs for the next fifty years could be imported for less (cost) than state residents will be charged under the windfall profits tax for three years!"

Short cited the Ogallala Water Import Authority of Texas which was approved by the Legislature in 1979 as the first legal step necessary. An import authority can be created only with the approval of area voters when a source of water is "contractually available."

Surplus waters are being identified in other states such as Arkansas, but extensive discussions and assurances are needed before any agreements to transport water could be reached. The uphill treck of imported water pumped from areas of surplus will likely impose a tremendous cost on the user.

continued on page 4 . . . HANCE

THOUGHT PROVOKING, District Board members and staff hear Speaker Clayton talk water funds.

Water District Election Set

Voters in the High Plains Underground Water Conservation District 15 county service area will go to the polls on January 17, 1981 for the annual election of a slate of District Directors and County Committeemen. The election will be held only in those counties (or portions thereof) comprising District Director Precincts Three and Four. The counties affected are Bailey, Castro, Parmer, Armstrong, Deaf Smith, Potter and Randall.

Two directors and twenty-one committeemen will be elected in January. Directors serve the Board for two year terms with no restrictions on the number of terms they may serve, while committeemen are elected for four year terms and may not serve more than two consecutive terms under the by-laws of the district.

To vote in the election, a valid voter registration certificate, residence within the boundaries of the District, and within the county where the balloting is conducted are required.

Voters should cast a ballot only for the candidate eligible to serve in the specific precinct boundaries within the water district's service area where the voter lives. Maps are being provided to each election judge to further define the overall District Directors precincts and county committeemen or county commissioners boundaries for the election.

Nominees for the positions to be elected are:

continued on page 3 . . . ELECTIONS

Low Pump Efficiencies Costly--

Irrigators Pay For Waste

By DWIGHT ADAMS

Recent pump plant efficiency tests performed by the District show that area farmers may be paying twice as much, in some cases three times as much, for irrigation fuel as necessary, depending on the efficiency of their irrigation pumps. The tests also revealed that while the condition of the power units, particularly natural gas internal combustion engines, can be improved occasionally to maintain operation at a reasonably high efficiency level, the main areas where pumping costs can be lowered are with proper sizing staging, and improving the condition of the irrigation pump.

A large portion of the pumps found inefficient by the tests performed by the District were the result of "too much pump in the hole." These pumps were designed years ago to pump larger quantities of water than the aquifer is now capable of yielding. Other pumps were improperly staged to meet the changed water level conditions of the aquifer, while a few pumps were not properly staged to meet the additional lift requirements of newly installed sprinkler systems. Still other pumps were concluded to be just worn out.

The following chart provides some guidelines for annual attainable pumping costs according to gallons per minute and total lift, based on the amount of horsepower required to pump at the various efficiency levels. The chart assumes a 2000 hour pumping season, with a price of $2.50/mcf for natural gas and $.04/kwh for electricity. Efficiencies for the power units were assumed to be ninety percent for electric motors and 19.2 percent for natural gas engines. If your annual fuel cost is exceeding those listed in the 70 percent and 50 percent cost lines on the chart, your pump may need to undergo some changes or repairs. *(See chart page 2.)*

The Water District recently published three brochures which are designed to aid the irrigator in determining his well's efficiency. These how-to pamphlets are titled Overall Pump Plant Efficiency—The Pinch; How to Calculate the Cost of Pumping Water With a Natural Gas Power Unit; and How to Calculate the Cost of Pumping Water With an Electric Power Unit. Write or telephone the District's office for free copies of these pamphlets.

THE Cross SECTION

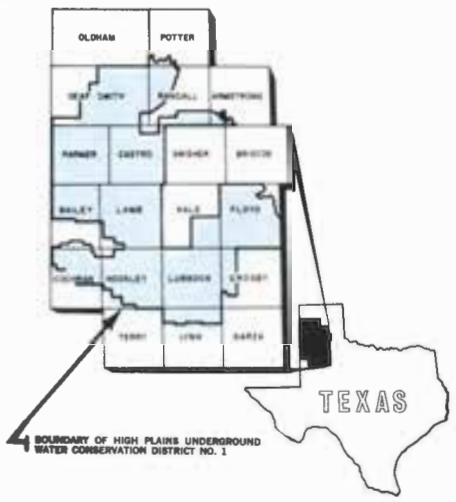
THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

2930 Avenue Q, Lubbock, Texas 79405
Telephone 762-0181

PATRICIA BRUNO, Editor

Second Class Postage Paid at Lubbock, Texas
District Office at Lubbock



BOARD OF DIRECTORS

Precinct 1
(CROSBY, LUBBOCK and LYNN COUNTIES)
James P. Mitchell, President ..... Wolfforth

Precinct 2
(COCHRAN, HOCKLEY and LAMB COUNTIES)
Mack Hicks ..... Levelland

Precinct 3
(BAILEY, CASTRO and PARMER COUNTIES)
A. W. Gober ..... Farwell

Precinct 4
(ARMSTRONG, DEAF SMITH, POTTER and RANDALL COUNTIES)
Jim Conkwright, Secy.-Treas. ..... Hereford

Precinct 5
(FLOYD and HALE COUNTIES)
Malvin A. Jarboe, Vice President ..... Floydada

COUNTY COMMITTEEMEN

Armstrong County
Carroll Rogers, Secretary
Wayside, Texas

Guy Watson, 1981 ..... Wayside
Bill Heisler, 1981 ..... Wayside
M. L. McGehee, 1981 ..... Wayside
James Bible, 1983 ..... Wayside
James Stockett, 1983 ..... Wayside

Bailey County
Doris Wedel, Secretary
H&R Block, 224 W. 2nd, Muleshoe

Eugene Shaw, 1981 ..... Rt. 2, Muleshoe
David Stovall, 1981 ..... Rt. 2, Muleshoe
Ernest Ramm, 1981 ..... Rt. 2, Muleshoe
D. J. Cox, 1983 ..... Enochs
Marshall Head, 1983 ..... Muleshoe

Castro County
Garnett Holland, Secretary
City Hall, 120 Jones St., Dimmitt

Jackie Clark, 1981 ..... Rt. 1, Box 33, Dimmitt
W. A. Baldridge, 1981 ..... 608 W. Grant, Dimmitt
Frank Wise, 1981 ..... Rt. 4, Box 10, Dimmitt
George Elder, 1983 ..... Dimmitt
Floyd Schulte, 1983 ..... Dimmitt

Cochran County
W. M. Butler, Jr., Secretary
Western Abstract Co., 108 N. Main Ave., Morton

Keith Kennedy, 1982 ..... Star Route 2, Morton
Robert Yeary, 1982 ..... Route 2, Box 66, Morton
Hershel M. Tanner, 1984, Route 2, Box 36, Morton
Richard Greer, 1984 .... Star Rt. 1, Box 4, Morton
Donnie B. Simpson, 1984, 292 SW 3rd St., Morton

Crosby County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Mike Carlisle, 1982 ..... Route 1, Box 274, Lorenzo
Alvin C. Morrison, 1982 ..... Box 6, Lorenzo
Tommy McCallister, 1984 ..... 209 N. Van Buren, Lorenzo
Edward S. Smith, 1984 ..... 102 N. Van Buren Lorenzo
Pat Yoakum, 1984 ..... Box 146, Lorenzo

Deaf Smith County
B. F. Cain, Secretary
County Courthouse, 2nd Floor, Hereford

James E. Higgins, 1981 ..... 200 Star St., Hereford
Garland Solomon, 1981 .... 303 Sunset Dr., Hereford
Tom Robinson, 1981 .... 211 Cherokee Dr., Hereford
Bill Cleavinger, 1983 ..... Wildorado
W. L. Davis, Jr., 1983 ..... Hereford

Floyd County
Verna Lynne Stewart, Secretary
Floyd Co. Abstract, 215 W. California, Floydada

Charles Huffman, 1982 ..... Route 1, Lockney
Gilbert L. Fawver, 1982 ..... Route 4, Floydada
C. O. Lyles, 1984 ..... Route 4, Floydada
Cecil Jackson, 1984 ..... Route 3, Floydada
D. R. Sanders, 1984 ..... Star Route, Floydada

Hale County
J. B. Mayo, Secretary
Mayo Ins., 1617 Main, Petersburg

Gaylord Groce, 1982 ..... Box 314, Petersburg
Bill John Hegi, 1982 ..... Route 2, Petersburg
Harold W. Newton, 1984 ..... Box 191, Petersburg
Jim Byrd, 1984 ..... Route 1, Petersburg
Ray Porter, 1984 ..... Box 193, Petersburg

Hockley County
Jim Montgomery, Secretary
609 Austin Street, Levelland

J. E. Wade, 1982 ..... Route 2, Littlefield
Jack Earl French, 1982, Rt. 3, Box 125, Levelland
W. C. McKee, 1984 ..... Box 514, Sundown
Leon Young, 1984 ..... Route 1, Ropesville
Robert Phillips, 1984 ..... 218 Redwood, Levelland

Lamb County
Robert Richards, Secretary
402 Phelps Avenue, Littlefield

Billy J. Langford, 1982 ..... Box 381, Olton
Edward Fisher, 1982 ..... Box 67, Sudan
P. A. Washington, 1984 ..... Box 124, Springlake
Jack Stubblefield, 1984 ..... Box 397, Spade
Larry Lockwood, 1984 ..... Star Rt. 2, Littlefield

Lubbock County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Owen Gilbreath, 1982 ..... 3302 23rd St., Lubbock
Clifford Hilbers, 1982 ..... Route 1, Box 14, Idalou
Don Bell, 1984 ..... Box 114, Wolfforth
Ronald Schilling, 1984 ..... Route 1, Slaton
Granville Igo, 1984 ..... 1304 8th St., Shallowater

Lynn County
Clifford Thompson, Secretary
2930 Avenue Q, Lubbock

Gary Houchin, 1982 ..... Box 54, Wilson
Freddie Kieth, 1982 ..... Box 283, New Home
Leland Zant, 1984 ..... Route 1, Wilson
David R. Wied, 1984 ..... Box 68, Wilson
Wendell Morrow, 1984 ..... Route 1, Wilson

Parmer County
Pat Kunselman, Secretary
City Hall, 323 North Street, Bovina

Troy Christian, 1981 ..... Rt. 1, Farwell
Dalton Caffey, 1981 ..... P.O. Box 488, Friona
Ronald Elliott, 1981 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Friona
Ralph Roming, 1983 ..... Bovina

Potter County
Jim Line, 1981 ..... Box 87, Bushland
Albert Nichols, 1981 ..... Rt. 1, Box 491, Amarillo
Weldon Rea, 1981 ..... Bushland
Sam Line, 1983 ..... Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

Randall County
Mrs. Louise Tompkins, Secretary
Farm Bureau, 1714 Fifth Ave., Canyon

Harry LeGrand, 1981 ..... 4700 S. Bowie, Amarillo
Jack Brandt, 1981 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1981 ..... Box 56, Bushland
Bill Dugan, 1983 ..... Happy
Roger B. Gist, III, 1983 ..... Happy

NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

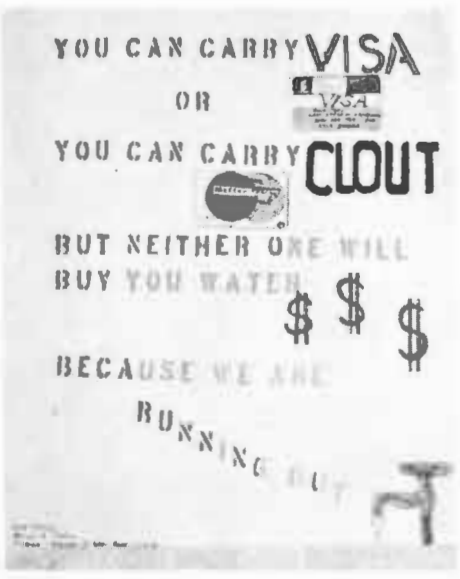
ESTIMATED EFFECTS OF PUMP EFFICIENCY ON ANNUAL FUEL COSTS

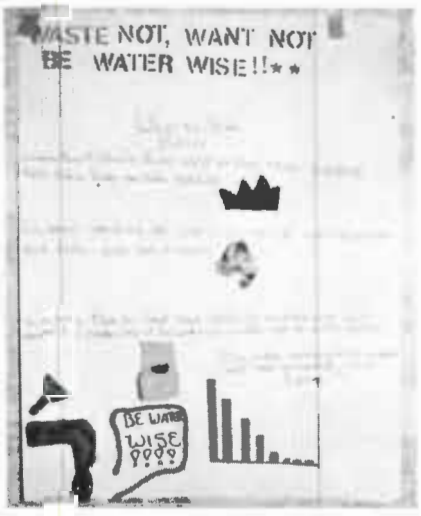
Assume 2000 Hour Pumping Season, Fuel Prices of $2.50/mcf, $.04/kwh and Motor Efficiencies of 19.25%* for Natural Gas, 90% for Electricity.

Annual Cost of pump efficiency at:	GPM LIFT 100 gals. at 100 ft.	GPM LIFT 100 gals. at 200 ft.	GPM LIFT 100 gals. at 300 ft.
70%	$ 238.00	$ 476.00	$ 715.00
50%	$ 338.00	$ 660.00	$ 1,000.00
30%	$ 557.00	$ 1,109.00	$ 1,665.00
Annual Cost of pump efficiency at:	**GPM LIFT 200 gals. at 100 ft.**	**GPM LIFT 200 gals. at 200 ft.**	**GPM LIFT 200 gals. at 300 ft.**
70%	$ 476.00	$ 954.00	$ 1,431.00
50%	$ 666.00	$ 1,336.00	$ 2,005.00
30%	$1,109.00	$ 2,222.00	$ 3,336.00
Annual Cost of pump efficiency at:	**GPM LIFT 300 gals. at 100 ft.**	**GPM LIFT 300 gals. at 200 ft.**	**GPM LIFT 300 gals. at 300 ft.**
70%	$ 715.00	$ 1,431.00	$ 2,147.00
50%	$1,000.00	$ 2,005.00	$ 3,007.00
30%	$1,665.00	$ 3,336.00	$ 5,004.00
Annual Cost of pump efficiency at:	**GPM LIFT 400 gals. at 100 ft.**	**GPM LIFT 400 gals. at 200 ft.**	**GPM LIFT 400 gals. at 300 ft.**
70%	$ 954.00	$ 1,909.00	$ 2,863.00
50%	$1,336.00	$ 2,673.00	$ 4,008.00
30%	$2,222.00	$ 4,450.00	$ 6,672.00
Annual Cost of pump efficiency at:	**GPM LIFT 600 gals. at 150 ft.**	**GPM LIFT 600 gals. at 250 ft.**	**GPM LIFT 600 gals. at 350 ft.**
70%	$2,147.00	$ 3,579.00	$ 5,011.00
50%	$3,007.00	$ 5,010.00	$ 7,015.00
30%	$5,004.00	$ 8,340.00	$11,676.00
Annual Cost of pump efficiency at:	**GPM LIFT 800 gals. at 150 ft.**	**GPM LIFT 800 gals. at 250 ft.**	**GPM LIFT 800 gals. at 350 ft.**
70%	$2,863.00	$ 4,772.00	$ 6,681.00
50%	$4,008.00	$ 6,680.00	$ 9,353.00
30%	$6,672.00	$11,120.00	$15,570.00
Annual Cost of pump efficiency at:	**GPM LIFT 1000 gals. at 150 ft.**	**GPM LIFT 1000 gals. at 250 ft.**	**GPM LIFT 1000 gals. at 350 ft.**
70%	$3,579.00	$ 5,965.00	$ 8,351.00
50%	$5,010.00	$ 8,351.00	$11,691.00
30%	$8,340.00	$13,900.00	$19,457.00

*An attainable engine efficiency of 25% should be expected. Using the desired engine efficiency of 25% the natural gas costs should be about 23% less than the table values.

First Place—above, Second Place—right, Third Place tie—below.





Water Depletion Information Ready January 6

By D. D. SMITH

In making announcement of the availability of water depletion information for 1980, the District enters its 18th year of administration of this program. From the humble beginning with an announcement of the district's intent to seek an IRS ruling to allow a water depletion allowance *(Cross Section* — June 1954), through lengthy preparation and a protracted confrontation in the courts, the issue culminated with publication of IRS Revenue Ruling 65-296 on November 19, 1965: "The Internal Revenue Service will follow the decision of the United States Court of Appeals for the Fifth Circuit in *United States* v. *Marvin Shurbet et ux,* 347 Fed. (2d) 103 in the disposition of cases involving taxpayers in the Southern High Plains of Texas and New Mexico who extract groundwater from the Ogallala Formation beneath their land for irrigation purposes."

With success of the endeavor came the recognition that administration of a tax allowance for water depletion which was fair to the landowner and the IRS could only be simplified to a certain level. Beyond that point, substantial involvement in data gathering, processing and analysis would be required on a continuous basis in order to amass and refine the information in such a way as to be capable of assigning depletion data to every farm each year.

Recognizing the risk that over simplification can be misleading, basic water depletion program administration can be broken into three areas:

1. *Determining the quantity of groundwater in storage beneath any given tract of land at any time.* A series of maps were developed and kept up to date to make this determination for any landowner in the Water District, for any year he might have acquired his land.
2. *Determining the landowner's cost basis in the water.* This is the difference paid for improved irrigated land as compared to the average cost of comparable dryland with little or no water in storage beneath it. The difference is the value attributed to the groundwater in storage beneath the irrigated tract. These values are obtained from actual sales records for each year the water depletion has been allowed.
3. *Assigning of decline values for each land tract on an annual basis.* These decline values are determined from actual measurements made in a network of 900 observation wells in the Water District. These values are plotted on a hydrograph along with a moving ten year average decline for each well. The ten year moving average is used to detect abnormal one year changes.

Brief explanation of these three phases will provide more insight into the complexity of such program administration. Also, bear in mind that each activity is closely supervised by knowledgeable IRS Engineers.

In making determinations of the quantity of ground water in storage, a decision was made to handle this factor in terms of aquifer thickness (saturated thickness of the Ogallala Formation). Since the most commonly understood measurement was 'feet' these data are given as aquifer thickness-in-feet for a given year.

To make a determination of the owner's cost in water, records are compiled each year on land sales transactions throughout the area. While very few, if any, transfers set out a separate price for the land, water or improvements, such comparisons are normally available by relating the sales price per acre for land without any ground water reserves to equivalent land sold with recognized reserves. In an elemental sense, the per acre value difference indicates the cost in water to be recognized for that particular year. Since substantial differences can occur over the total area and from year-to-year, a qualified consulting appraiser is employed to gather, interpret and analyze the values. In this manner values for the minimum dollar worth of the land and the maximum dollars per acre paid for water can be ascertained. Since all transactions must fit within these guidelines, and they were arrived at by consideration of the transfers that year, the true cost of water for any land acquired that year is recognized. The cost for ground water reserves acquired in 1979 ranged from $150 to $875 per acre within the District's 15-county area.

For assignment of annual decline, the water-level observation well network (currently 950 wells) is measured each winter. The one year change, the average annual change for the current five year and ten year period and the bookkeeping excess or deficit are considered in making each determination.

To put it all together now, the landowner's cost-in-water on a per acre basis is divided by the aquifer thickness to arrive at a cost per-foot per-acre. In subsequent years, with receipt of an assignment of 'feet of decline,' the landowner then calculates his cost of depletion by multiplying feet of decline times cost per-foot times total acres to arrive at a dollar value.

Poster Contest Winners Named

"Water, Our Liquid Gold, is Our Most Valuable Resource," was the wisdom passed on by eighth grade Earth Science student Kerrie Farror. It is also the overall first prize winning theme of an areawide water conservation poster contest recently sponsored by the High Plains, North Plains and Panhandle Underground Water Conservation Districts in West Texas.

Kerrie's water conservation poster earned a cash prize of $50 for her Levelland Junior High science department. Bowie Junior High in Amarillo won a $25 cash prize for Second Place overall, thanks to the poster entry from Barry Cochran, a seventh grade earth science student. Barry's poster characterized "Aqua Bear," a conservation water hero saving our resource from a rogue's gallery of water wasters and polluters.

The race for third place resulted in a tie. Prizes of $10 each were awarded to the science departments of Lazbuddie School for the entry by Wendy Jarmon, and Crockett Junior High of Amarillo for Lyle Strong's poster. Wendy reminded us to "Waste Not, Want Not, Be Water Wise." Lyle's poster warns that "You can carry Visa, and You can carry Clout, but neither one will buy you water because we are running out!"

Each of these winners is also the first place poster contest winner among earth science classes and classmates in their own schools. Sixteen schools in the water districts' service areas competed in the poster event. Each school's top winner went on to compete for top places overall and to be displayed at the West Texas Chamber of Commerce Fall Pre-Legislative Conference held in Lubbock in late November. The conference focused on water issues and drew area and state water leaders, business leaders, and over 30 West Texas Legislators to the three day event.

The West Texas Chamber staff announced poster winners and their schools at the opening of the conference and later awarded each student a certificate of recognition.

ELECTIONS . . . continued from page 1

In District Directors Precinct Three: Bailey, Castro and Parmer Counties voters will elect one (1) Director and nine (9) committeemen:

District Director: A. W. "Webb" Gober

County Committeemen:

in Bailey County	Precinct 2 at-large	Lloyd Haire David Stovall Ernest Ramm	elect one in the precinct and two at-large
in Castro County	Precinct 1 Precinct 2 at-large	Dan Petty W. A. Baldridge Garnett Holland	elect one in each precinct and one at-large
in Parmer County	Precinct 3 Precinct 4 at-large	Wendal Christian Ronald Elliott John R. Cook	elect one in each precinct and one at-large

In District Directors Precinct Four: Armstrong, Deaf Smith, Potter and Randall Counties voters will elect one (1) Director and twelve (12) committeemen:

District Director: James Conkwright

County Committeemen:

in Armstrong County	at-large	Kent Scroggins M. L. McGehee Tom Ferris Larry Stevens	elect ONLY three at-large
in Deaf Smith County	Precinct 1 Precinct 2 at-large	J. F. Martin Troy Sublett Tom Robinson	elect one in each precinct and one at-large
in Potter County	at-large	Frank T. Beznar Ronnie Johnson Weldon Rea	elect three at-large
in Randall County	at-large	Jack Brandt Johnny Sluder	elect three at-large

The polling places and officers for the election are:

ARMSTRONG COUNTY

Polling Place No. 1
Wayside Community Center, Wayside, Texas
Presiding Judge: Estelle Rogers

BAILEY COUNTY

Polling Place o. 1
Enochs Gin Office, Enochs, Texas
Presiding Judge: Mrs. W. R. Adams

Polling Place No. 2
Bailey County Courthouse, Muleshoe, Texas
Presiding Judge: B. H. Black

CASTRO COUNTY

Polling Place No. 1
American Legion Hall, Nazareth, Texas
Presiding Judge: Mrs. Leo Ehly

Polling Place No. 2
City Hall Community Room, Dimmit, Texas
Presiding Judge: Noel Gollehon

Polling Place No. 3
City Hall, Hart, Texas
Presiding Judge: Percy Hart

DEAF SMITH COUNTY

Polling Place No. 1
Schroeter Building, 242 E. Third, Hereford, Texas
Presiding Judge: Mrs. Clinton Jackson

PARMER COUNTY

Polling Place No. 1
County Courthouse, Farwell, Texas
Presiding Judge: Mrs. Albert H. Smith

Polling Place No. 2
City Hall, Bovina, Texas
Presiding Judge: Aubrey Brock

Polling Place No. 3
Fire Station, Friona, Texas
Presiding Judge: J. L. Wittin

POTTER COUNTY

Polling Place No. 1
Schoolhouse in Bushland, Texas
Presiding Judge: Mrs. Robert Lolley

RANDALL COUNTY

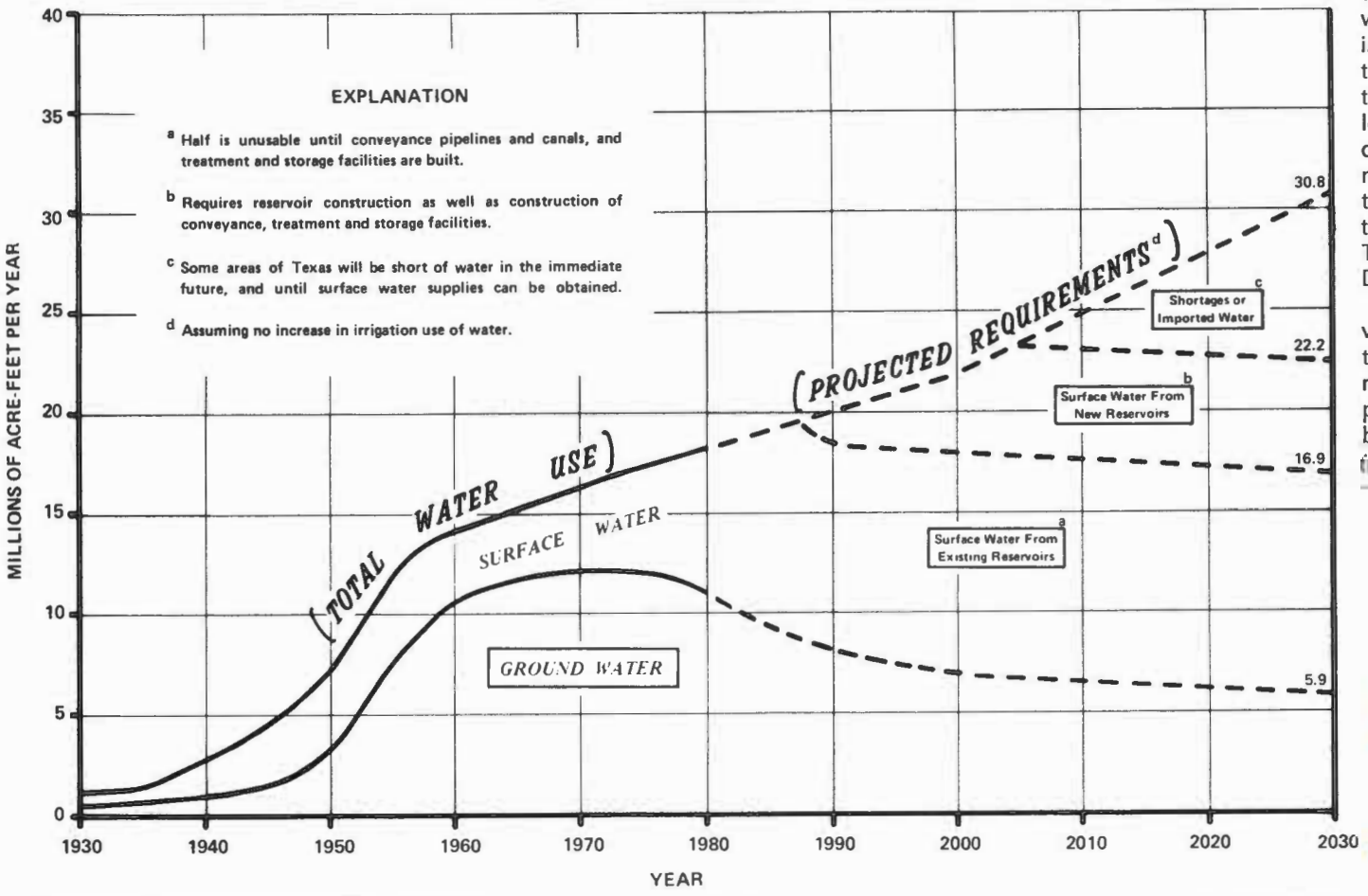
Polling Place No. 1
Acco Feed Store, Hereford Highway, Canyon, Texas
Presiding Judge: R. B. Richardson

HANCE . . . continued from page 1

U.S. Representative Kent Hance, addressing the conference of business and water leaders and over 30 West Texas Legislators, said he doubted that the Congress will fund outright a water importation plan for this area, but he does believe lawmakers would create a loan or bond program for such a project. Hance predicted the issue could come before Congress sometime after the Six State High Plains Study of water importation to the Ogallala region is complete and recommendations are made to Congress in July, 1981.

WEST TEXAS Legislators lined up before Speaker Bill Clayton at the WT Chamber pre-legislative session. Felix McDonald (lower left), Texas Water Commission, and a panel of water experts addressed the conference.

STATE OF TEXAS
PROJECTION OF WATER DEMAND AND SOURCE OF SUPPLY



OBSERVATION WELLS TO BE MEASURED

By BUTCH BATES

On January 5, 1981 the staff of the High Plains Underground Water District will begin making depth-to-water measurements in a select group of wells in the District's service area to determine the annual change in the underground water supply which occurred during the past year. The District will measure water levels in approximately 900 wells to make this determination.

These wells, referred to as water level observation wells, are carefully chosen to reflect the variation in the thickness of the aquifer throughout the area. While new wells are continually being added to the network to upgrade and maintain good coverage of the District, most of the wells have been measured annually for many years. Annual measurements in the same group of wells allows for a comparison of current water levels with levels of past years.

The actual measurements are obtained by lowering steel tapes coated with blue carpenter's chalk into the wells to a predetermined depth, usually about five feet below last year's water level. When the tape contacts water, that portion of the chalked tape in water turns a darker blue. By subtracting the amount of wet area on the tape from the total length of tape lowered into the well, the current depth to water is determined. This measurement is then written on vinyl tags which are attached to the well for the landowner-operator's information. The reading is also recorded by the District's technical staff.

Should you notice a blue and white vehicle with the District's seal affixed to its doors in your area during the months of January and February, it will probably be a Water District staff member making his appointed rounds of the wells he is to measure.

From All Of Us
To All Of You
A Very
Merry Christmas
and a
Happy New Year

THE CROSS SECTION (USPS 364-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT