THE Cross SECTION

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

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Irrigators Bracing For Leap In Electric Prices

The price of electric power for irrigation is going up 50 to 100 percent as of October 1982. James Hull, manager of Deaf Smith County Electric Cooperative, is predicting a large number of farmers will abandon irrigating by 1983 as a result. Hull based his remarks on the expected increase in the cost of electricity to the coop once its current contract with the supplier expires in October 1982.

The cost of electric irrigation power has already doubled over the past several years, and the price of the fuel adjustment charge by the suppliers to generate that power now reflects half the irrigator's electric bill.

October's big jump will be only the beginning of continuing price hikes foreseen by the electric coop. Hull believes energy prices won't stabilize but continue to escalate every year. These dismal figures are still lower than projections of a year ago, Hull said. "The impending increase is inevitable."

Hull also predicted a change in the variety of crops to be grown on the High Plains. Away from corn and back to milo, wheat, and even to sugar beets.

The fuel price bombshell set off discussion at this year's High Plains Irrigation Conference, sponsored by the Amarillo Texas Agricultural Extension Service. The rest of the day was spent examining what a farmer can do to head off the shock wave and hold down his power costs.

Fuel Cost Comparisons

The next conference speaker compared the costs of electric, natural gas and diesel fuel. Dr. Ray Sammons, an Amarillo TAES economist, offered irrigators a formula for estimating their actual fuel or electric costs based on such variables as equipment purchase price, expected life, depreciation, repairs, maintenance, overall efficiency, and even the farmer's tax bracket. The result was a figure that could help him decide whether he can justify switching

DR. RAY SAMMONS

from one fuel source to another. Many area irrigators have been switching

continued page 3, col. 3 . . . PRICES

Photo courtesy Bureau of Reclamation.

AND THAT'S THE TRUTH

". . . While God was in the process of creating the Earth, He was working on Texas when darkness fell forcing an end to His labors for that day. He gave a last smoothing stroke to the Great Plains area, and vowed to Himself that the next morning He would begin where He had left off and make the region a pretty place like the rest of the world, with hills and mountains, lakes and rivers, and trees and plenty of rainfall as well. But when He returned to His work the next morning, He found the area had hardened like concrete. As He thought about tearing it out and starting all over again, He was struck with a happy thought. Rather than changing what He had done, He decided to create some people who would like that kind of land and fit in with it. And that is how it came to be that there are Plainsmen who feel truly at home only here."

George Autry
Panhandle-Plains Historical Review, 1960.

New Director Elected

The votes are in. High Plains Underground Water District residents have elected James Mitchell, Mack Hicks and Gilbert Fawver as their Board Directors in Precincts 1, 2, and 5 for 1982. Also elected were sixteen county committeemen to serve in the eight counties represented in this election.

In District Directors Precinct One, which includes all or parts of Crosby, Lubbock and Lynn Counties, James Mitchell of Wolfforth will serve his fourth term on the Board of Directors. Committeemen serving with him will be Tom McGee and Bobby Brown in Crosby County, J. O. Gilbreath and Pierce Truett in Lubbock County, and Gary Houchin and Danny Nettles in Lynn County.

Precinct Two District Director Mack Hicks of Levelland will serve his second term on the Board. Committeemen serving with him include Keith Kennedy and L. T. Lemons in Cochran County, Jack Earl French and Marion Polk in Hockley County and Jim Brown and Haldon Messamore in Lamb County.

Precinct Five voters elected Gilbert Fawver of Floydada to his first term as a Board Director. Fawver is replacing Malvin Jarboe who is stepping down from his Board position after serving three terms from 1976 through 1981. County Committeemen who will serve with Fawver include Charles W. Huffman and Kenneth Willis in Floyd County and Larry B. Martin and W. T. Leon in Hale County.

Votes will be canvassed and the results made official on February 1 during the next regular board meeting. Directors will be sworn in during ceremonies at that time.

Tough, Resourceful Descendents Still Making Home on the Range

It's been 30 years in coming! A celebration of our Spirit and our People, our programs and our services. We are pausing to honor the contributions, the memory and, most importantly, the men who are and have been the leadership and backbone of the High Plains Underground Water Conservation District. Our celebration is dedicated to those men of vision who served for 30 years as its Board of Directors and County Committeemen.

To capture their vision, the District has published a very special anniversary publication, *30 Years—A Tradition of Service, 1951-1981*. It's a first. It highlights and reflects the best of the District's history, the people it serves, their beliefs and 30 years of District accomplishments. It is the first publication to offer a comprehensive, up-to-date overview of the District's active role in water conservation programs and services for the folks in West Texas.

The anniversary publication features a complete record listing all 30 years of Board Directors and County Committeemen. It includes a photograph of each year's Board, photos of many of our committeemen, and of many of the staff over the years. The book is designed to be a keepsake of memories, accomplishments and photographs.

continued pages 2, 3 . . . 30 YEARS

OLD FRIENDS and former directors, Marvin Shurbet and Ross Goodwin, reviewed highlights of **30 Years** during our anniversary open house.

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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 (806) 762-0181

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District Office at Lubbock

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BOARD OF DIRECTORS

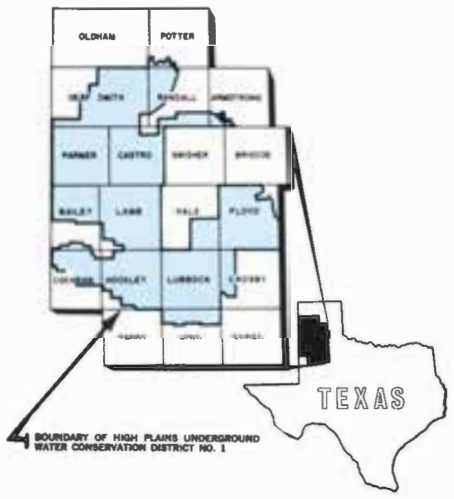
Precinct 1
(CROSBY, LUBBOCK and LYNN COUNTIES)
James P. Mitchell, President ..... Wolfforth

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

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

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

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



COUNTY COMMITTEEMEN

Armstrong County
Carroll Rogers, Secretary
Wayside, Texas
Tom Ferris, 1985 ..... Wayside
Larry Stevens, 1985 ..... Happy
Kent Scroggins, 1985 ..... Wayside
James Bible, 1983 ..... Wayside
James Stockett, 1983 ..... Wayside

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David Stovall, 1985 ..... Rt. 2, Muleshoe
Ernest Ramm, 1985 ..... Rt. 2, Muleshoe
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Marshall Head, 1983 ..... Muleshoe

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Garnett Holland, 1985 .... 1007 Maple St., Dimmitt
W. A. Baldridge, 1985 ..... 608 W. Grant, Dimmitt
Dan C. Petty, 1985 ..... Box 846, Dimmitt
George Elder, 1983 ..... Dimmitt
Floyd Schulte, 1983 ..... Dimmitt

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Western Abstract Co., 108 N. Main Ave., Morton
Keith Kennedy, 1982 ..... Star Route 2, Morton
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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

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B. F. Cain, Secretary
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Troy Sublett, 1985 ..... Route 1, Hereford
Virgil P. Walker, 1985 ..... Star Route, Hereford
Bill Cleavinger, 1983 ..... Star Route, Wildorado
W. L. Davis, Jr., 1983 ..... Hereford

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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

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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

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Leon Young, 1984 ..... Route 1, Ropesville
Robert Phillips, 1984 ..... 218 Redwood, Levelland

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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

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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

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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
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City Hall, 323 North Street, Bovina
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John Cook, 1985 ..... Box 506, Friona
Ronald Elliott, 1985 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Friona
Ralph Roming, 1983 ..... Bovina

Potter County
Frank T. Beznar, 1985 ..... Box 41, Bushland
Ronnie Johnson, 1985 ..... Box 127, Amarillo
Weldon Rea, 1985 ..... Bushland
Sam Line, 1983 ..... Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

Randall County
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Farm Bureau, 1714 Fifth Ave., Canyon
Gary Wagner, 1985 ..... Box 219, Bushland
Jack Brandt, 1985 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1985 ..... 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.

GOD AND EPA

Courtesy of
HON. ANDREW J. HINSHAW
of California
In The House of Representatives

Mr. HINSHAW. Mr. Speaker, under the leave to extend my remarks in the Record, I include the following:

GOD and EPA

In the beginning God created heaven and earth.

He was then faced with a class action lawsuit for failing to file an environmental impact statement with HEPA (Heavenly Environmental Protection Agency), an angelically staffed agency dedicated to keeping the Universe pollution free.

God was granted a temporary permit for the heavenly portion of the project, but was issued a cease and desist order on the earthly part, pending further investigation by HEPA.

Upon completion of his construction permit application and environmental impact statement, God appeared before the HEPA Council to answer questions.

When asked why he began these projects in the first place, he simply replied that he liked to be creative.

This was not considered adequate reasoning and he would be required to substantiate this further.

HEPA was unable to see any practical use for earth since "the earth was void and empty and darkness was upon the face of the deep."

Then God said: "Let there be light."

He should never have brought up this point since one member of the Council was active in the Sierrangel Club and immediately protested, asking "how was the light to be made? Would there be strip mining? What about thermal pollution? Air pollution?" God explained the light would come from a huge ball of fire.

Nobody on the council really understood this, but it was provisionally accepted assuming (1) there would be no smog or smoke resulting from the ball of fire, (2) a separate burning permit would be required, and (3) since continuous light would be a waste of energy it should be dark at least one-half of the time.

So God agreed to divide light and darkness and he would call the light Day, and this darkness Night. (The Council expressed no interest with in-house semantics.)

When asked how the earth would be covered, God said, "let there be firmament made amidst the waters; and let it divide the waters from the waters."

One ecologically radical Council member accused him of double talk, but the Council tabled action since God would be required first to file for a permit from the ABLM (Angelic Bureau of Land Management) and further would be required to obtain water permits from appropriate agencies involved.

The Council asked if there would be only water and firmament and God said "Let the earth bring forth the green herb, and such as may seed," and the fruit tree yielding fruit after its kind, which may have seen itself upon the earth.

The Council agreed, as long as native seed would be used.

About future development God also said: "Let the waters bring forth the creeping creature having life, and the fowl that may fly over the earth."

Here again, the Council took no formal action since this would require approval of the Game and Fish Commission coordinated with the Heavenly Wildlife Federation and Audobongelic Society.

It appeared everything was in order until God stated he wanted to complete the project in six days.

At this time he was advised by the Council that his timing was completely out of the question . . . HEPA would require a minimum of 180 days to review the application and environmental impact statement, then there would be the public hearings.

It would take 10 to 12 months before a permit could be granted.

God said, "To Hell with it!"

30 Years—A Tradition of Service . . .

(continued from page 1)

The printer delivered just enough of the limited edition copies in time for our 30th Anniversary Open House in December. District friends, Directors, Committeemen and staff—present and past—were invited to share in the Sunday afternoon celebration and buffet. They remembered many good old times and faces, made new acquaintances, and talked about plans for the future. It marked the beginning of our next 30 years of making progress.

"As we move into the decade of the 80's, the Water District has redoubled its work to find new and better ways to conserve water. While the doomsdayers are spouting water crisis predictions of coming agricultural and economic decline on the High Plains, West Texans are proving them wrong with record yields and improved production techniques.

"The High Plains District is still an innovator in supporting water conservation research and introducing new programs to help save water. But we're not doing it alone. The cooperative efforts of many organizations working toward the same goal, have produced some major advances.

"We have learned to improve our irrigation efficiencies and capture and hold more rainfall on our lands. We are studying ways to slow down evaporation losses and improve plant water use.

We are developing new varieties of drought tolerant plants. We are examining the water use patterns of our lawn grasses and yard sprinklers to find the best methods and times of watering. And we're investigating ways to coax even more ground water from the formational sands using secondary recovery technology. All of this is

A PREDICTION FOR WORLD FOOD PRODUCTION, EXPORT

The Department of Agriculture expects global demand for agricultural products to expand at or near record rates in the years ahead as growth in global production slows to about three-fourths of the average postwar rate. If this forecast is correct, the world supply-demand balance will become increasingly tenuous, and the rest of the world could be importing 15 percent of its agricultural supplies from the United States by 1985. That compares with 2 percent in the early 1950's and 11 percent in the late 1970's.

The projection of a noticeably tighter world food balance as the decade progresses is based largely on the assumption that income-related shifts in diets will be rapid in a group of middle-income developing countries. The group includes the oil-exporting nations and a few high-growth oil-importing countries, such as Ghana, Korea, Malaysia, and Taiwan. Rising incomes in this group of countries, which have a combined population of about 600 million, are expected to increase both the quantity of food demanded and the proportion of livestock products in the mix of foods consumed.

Another important factor is that, according to the USDA, many countries will be nearing what some consider absolute production constraints within the next five years. Reserves of readily available fertile land have almost been depleted in developed and centrally planned countries. The same is true for some developing countries, especially in Asia, North Africa, and the Middle East. Expansion in the resources committed to agriculture by developing countries is expected to be slower than in the 1960's and 1970's as it becomes more difficult and costly to increase the cropland base. In addition, because of poor management and conservation practices, some developing countries will have difficulty maintaining productivity on lands already in use.

Accelerated adoption of existing technologies could possibly increase world agricultural productivity growth substantially in the 1980's, but adoption of technology tends to be a relatively slow process and accelerated adoption would likely require substantial economic incentives. Aggravating the situation is the fact that such key inputs as fertilizers, pesticides, and fuels are energy-based and will make productivity gains expensive to attain. Major new technological breakthroughs are possible but do not appear imminent and would also likely have substantial lead times from discovery to widespread adoption.

It is anticipated that more land, whether well suited or not, will have to be brought into cultivation around the world in the 1980's. As more land of marginal productive capacity is added to the world's cropland base, the overall vulnerability of crops to weather will increase. By 1985, it is expected that 30 percent of the land under cultivation in the world will be semiarid and rainfall-dependent, compared with less than 20 percent in the 1960's.

Wider swings in world production could have an increasingly destabilizing effect in the United States as exports gradually become a larger component of total agricultural sales. Currently, the production from about 1 out of every 3½ acres in this country is sold abroad, compared with about 1 out of every 5 acres a decade ago.

The tight global supply-demand scenario suggested here is not the only plausible one and must be viewed with caution. However, if world demand does tend to grow significantly faster than world output, the impact of erratic, weather-related swings in output will be magnified as world grain stocks are drawn down. The resulting surges in export demand for U.S. farm products could have a sizable impact on domestic food and farm product prices.

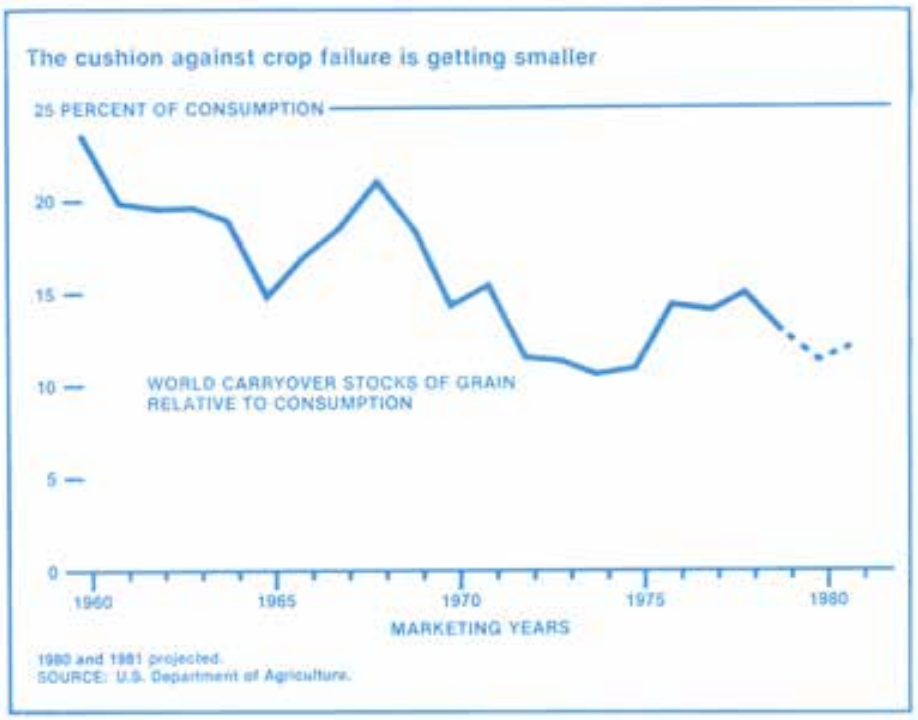
CONCLUSION

After being surprised by a strong surge in export demand for farm products in the early 1970's, the U.S. Government experimented with price and export controls on food and agricultural products. The controls were of an *ad hoc* nature, were largely ineffective in curbing inflation, and had some undesirable side effects. That is not to say that some form of controls could not have worked more effectively, but the experience of the early 1970's illustrates the potential for political conflict over food prices and the difficulty of formulating and implementing policies during such a conflict.

Although cur m and food policies have been desi vith the experience of the early 1970' ninid, there is great uncertainty about the United States would deal with a dramatic rise in domestic food prices that was induced by conditions in other parts of the world. Increased use of bilateral trade agreements and reliance on a farmer-owned reserve may not be enough to insulate domestic consumers from the price effects of large swings in world output.

In the event of another major burst of food price inflation, there would undoubtedly be public pressure to "do something," and as Paarlberg has pointed out, the passage of time will dim the memory of difficulties experienced with controls in the early 1970's. While such a large surge in demand might never occur again, the risk appears sufficiently great to make it worthwhile for farmers and consumers to debate and enact policies for dealing with a more volatile world food balance in advance of a potentially destabilizing surge in export demand.

(Excerpted from "Farmers and Consumers: Conflict Ahead?" By Don A. Riffe in Voice of the Federal Reserve Bank of Dallas, Sept. 1981.)



EXCHANGING VIEWS, former director Russell Bean and former field staff member Y. F. Snodgrass joined us to celebrate 30 years. So did former staff geologist Ann Bell, and "Buck" Buchanan, now a Texas Representative, and his successor as Manager of the North Plains Water District, Orval Allen.

designed to stretch our existing ground water reserves.

"Frankly, our success depends on the farmer. We are paying a great deal of attention to science and to figuring out ways to help him apply this knowledge to managing his business to assure the survival and prosperity of this area—with or without an abundance of water."

PRICES . . .

(continued from page 1)

wells from gas to electric to buffer gas price increases. Sammons suggested there are no rules for determining when an operation should convert, particularly since all farm operations are different. He stressed the irrigation system efficiency is more critical than what powers the system, and he urged all irrigators to learn their pump plant efficiencies.

Efficiency Tests

Later, Leon New, Lubbock TAES irrigation specialist, told irrigators that many times repairs can increase pump efficiency and reduce pumping costs. His pump plant efficiency tests before and after pump and engine repairs documented their benefit. He stressed that a farmer needs to know the energy use efficiency of his pump to determine if repairs are needed. Also he needs this data to calculate the fuel savings that must be achieved to offset the cost of those repairs.

Video Inspections

Another help in the decision to repair a poorly performing pump was offered by Steve Coneway with the Well Survey Company of Hereford. He advocates using closed circuit television to inspect wells and pinpoint possible causes of low efficiency. When lowered into the well, the camera can detect if a casing is broken or if the perforations are plugged by encrustations. Going back into an old hole, the camera can inspect for obstructions that would prevent a pump from being installed and determine whether there are enough open perforations for water to enter the well from the formation.

Using the camera for well analysis can help a farmer decide whether to renovate an old well or drill a new one. Renovation may save him a substantial investment, especially at today's drilling costs.

Leon New

Don McElroy

Well Monitoring

Don McElroy with Irrigation Pumps and Power at Muleshoe, offered irrigators advice on how they could help their pump man design an efficient well. Don suggested that to eliminate guess work, every farmer needs a drawdown gauge to measure his pumping depths, and every farmer should have a meter on each of his wells. This would not only give him a record of total gallons of water pumped in a season, it would allow him to check his wells to figure current production. This could alert him early to lowering efficiencies and to potential problems.

Furrow Dikes

The benefits of furrow dikes were presented by Reggie Jones, research soil scientist with the USDA Research Center at Bushland. He explained that the mini-dams significantly diminished rainfall runoff and offered real potential for crop yield increases. He estimated over two million acres currently in furrow dikes on the High Plains, and anticipated that figure would continue to rise.

The day's program concluded with a panel discussion by area growers. The one practice all four irrigators endorsed was a minimum tillage operation.

High Plains Area Cited For Water Conservation

The High Plains area of Texas—centered in Lubbock—has overcome dire predictions that it could and would run out of underground water for irrigation in the early 1980s. The predictions were made in the early 1960s, when it was said that ground water resources would be gone by the beginning of this decade.

But the area was held up as a shining example of what good water management could accomplish during a recent Chicago conference on "Ground Water in the '80s."

Dr. Jay H. Lehr, a noted hydrologist and executive director of the National Water Well Association, pointed out that in the early '60s, predictions were made that the High Plains area had only 20 years of underground water left.

"But," he said, "farmers and other Texans involved in resource management developed conservation methods that have led to a recent prediction of another 30 years' supply. My guess is that 30 years from now, they'll have another 20." Lehr suggested that similar conservation techniques could be applied in the High Plains regions of Kansas and Nebraska, where some predictions for the future have included fears of a new Dust Bowl era in the making.

He believes Texas-style reforms could help reverse a situation where the water table has been falling at the rate of a foot or two a year.

"You cannot irrigate indiscriminately," Lehr said. "Wasting water is a luxury farmers can no longer afford. Today, it is a matter of using methods and equipment that assure crops get the necessary moisture while runoff is controlled and evaporation is reduced.

"The reforms instituted in Texas have made a major difference. Others can learn an important lesson from what has been done there," he said.

(Reprinted from Lubbock Avalanche-Journal, Jan. 2, 1982)

A PRIME ATTRACTION of our anniversary open house was the photo gallery of 30 years of District Boards. HPWD Manager Wayne Wyatt enjoyed reminiscing with former director H. J. Schmidly and current Board Secretary Mack Hicks. Current Board directors' wives, Sylvia Mitchell and Irene Gober shared Webb Gober's enthusiasm in the celebration.

JUDY PERRY

WATER, INC. MEETING SET

Water, Inc. is planning its 15th annual membership meeting for Saturday, February 13th at the Quality Inn in Amarillo. New Board Directors will be elected on Friday and recognized at an early evening reception at 7 p.m.

The formal membership informational meeting will open Saturday morning and include a breakfast program. The meeting will adjourn after the noon luncheon. Congressman Jack Hightower will be the featured luncheon speaker.

Water, Inc. members will receive pre-registration information in the mail, and the general public is also invited to register at the door.

A Good Hand...

Judy Perry is a natural for her position as receptionist with the Water District. She has lots of office skills and plenty of experience with farm folks.

Judy went from three years as a Texas Tech University business major to her first work experience in agribusiness with Borg-Warner in Dallas. She spent three years financing wholesale floor plans of farm equipment to implement dealers.

"I got tired of the big city," Judy admits. She came home to her native Lubbock and to an administrative job with the State Comptroller's tax enforcement office.

After a brief pause in her career to become a bride and mother, Judy was back working with farmers in the Small Business Administration farm disaster office. Her legal department responsibilities involved closing disaster loans.

"We met many good, warm people," Judy remembers. "Sometimes we didn't know if the loans really helped or hurt them in the long run."

Last summer Judy brought her experience and skills to her current responsibilities as District receptionist. She has taken over the daily administration of the water depletion tax information program, and provides clerical support to all staff divisions.

One of Judy's most unexpected and delightful qualities is that she's a part time cowgirl . . . from her genuine, well-seasoned boots to her occasional weekend at a family ranch where she helps work the cattle roundup. Naturally, she loves horses and western dancing. But Judy won't tell you she's a cowgirl.

"My grandfather had a ranch and farm, and my parents met while working on a ranch, so maybe it's just in me," she smiles. One thing is sure, she makes a good hand around the district office.

WE'VE MOVED . . .

Our district field offices in Floydada are now in a new location at 108 W. Missouri Street. Our post office address and phone number remain the same. Come in and see us.

Verna Lynne
County Secretary

THE CROSS SECTION (USPS 561-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

SECOND CLASS PERMIT

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Changes In Aquifer Mapped In Color

WATER LEVEL CHANGES

The High Plains aquifer in Texas covers approximately 35,450 square miles. In this area, since irrigation began in the 1930's, approximately seven percent has had water level declines of 100 to 150 feet; 18 percent has had declines of 50 to 100 feet; 17 percent has had declines of 25 to 50 feet; 34 percent has had declines of 10 to 25 feet; 23 percent has had changes ranging from rises of ten feet to ten feet of decline, and about one percent has had rises of 10 to 25 feet.

The water-level-change map on page two illustrates the areal extent of water level changes that occurred from predevelopment to 1980 in the Southern part of the High Plains aquifer. This map was constructed by superimposing maps of predevelopment and 1980 water levels and connecting points of equal water-level change. Each water level change interval on the map shows the range of change that predominates in that area. Because of map scale, it is not possible to show small areas within each interval where water-level change may be more or less than that indicated.

Predevelopment water-level data were collected prior to significant development of irrigation wells in the High Plains. Development generally progressed northward from New Mexico and Texas during the 1930's, and to Oklahoma and Kansas during the 1940's.

Before irrigation development, the High Plains ground-water system was in a state of dynamic equilibrium, with long-term recharge equal to long-term discharge. In many parts of the High Plains, natural equilibrium was significantly modified by one or more of the following activities: (1) Development of irrigation wells that increased discharge and removed large quantities of water from the aquifer; (2) changes in land management that affected the amount of recharge the aquifer received from precipitation. These activities cause water levels to either rise or decline as the system seeks to reestablish equilibrium between recharge and discharge.

In most areas irrigated in the High Plains, ground water is being mined; that is, more water is removed annually from storage in the ground-water reservoir than is replaced by recharge. As a result, water levels in these areas are declining.

The largest area of water level declines exceeding 100 feet occurs south of the Canadian River extending from Curry County, New Mexico, to Crosby County, Texas. In Dawson and Lynn Counties, Texas, water-level rises are attributed to clearing sandy soils of native vegetation for cultivation, which increases the rate of recharge from precipitation on dryland crop areas.

Maps and texts are excerpted from Hydrologic Atlas HA-652, U.S. Geological Survey, by Luckey, Gutentag and Weeks. Copies of the complete atlas may be obtained from USGS, 1200 South Eads Street, Arlington, VA 22202.

SATURATED-THICKNESS CHANGES

The High Plains aquifer in Texas originally had approximately 484,500,000 acre feet of water in storage prior to irrigation development in the late 1930's. In 1980, the quantity estimated to be left in storage was about 375 million acre feet. The change in storage of 109,500,000 acre feet or 23 percent equals an average reduction of 2.7 million acre feet annually during the past 40 years.

The map on page three illustrates the areal extent of saturated-thickness changes (in percent) that occurred from predevelopment to 1980 in the Southern part of the High Plains aquifer. The map was constructed by superimposing the 1980 saturated-thickness map and the predevelopment to 1980 water-level-change map and calculating the percent change in saturated thickness. Each saturated-thickness-change interval on the map shows the range of change that predominates in that area. Because of the map scale, it is not possible to show small areas within each interval where saturated-thickness change may be more or less than that indicated.

The saturated-thickness-change map depicts areas of change in available water supply caused by pumpage. This map appears similar in some areas to the water-level-change map shown on page two.

Areas with small water-level changes may have a large percentage change in saturated thickness because of small predevelopment saturated thickness. For example, a water-level decline of ten feet in an area where predevelopment saturated thickness was 200 feet represents a change in saturated thickness of only five percent. However, a decline of ten feet in an area where the original saturated thickness was 30 feet represents a change of 33 percent. Changes in saturated thickness may be directly related to changes in well yield.

Increases in saturated thickness of more than ten percent have occurred in Dallam, Dawson, and Lynn Counties, Texas. These increases are the result of small water-level rises in areas with little saturated thickness. Small rises in water levels in areas with thin saturated thickness result in significant percentage increases in saturated thickness.

continued on page 4, col. 1 . . . AQUIFER

HPWD Directors Re-elected

Mack Hicks and James Mitchell took the oath of office as Directors of the Board of the High Plains Underground Water Conservation District on February first. They were sworn in by the Honorable J. Q. Warnick, Judge of Lubbock's County Court at Law #2. Judge Warnick administered the oath in a very dignified ceremony before congratulating Mack and James with a touch of humor. He remarked, "It is especially a pleasure for me, as a taxpayer now, to swear-in a public official who doesn't get paid for his office."

MACK HICKS takes the oath of office as a Director to represent Cochran, Hockley and Lamb Counties in Precinct Two.

Mack Hicks begins his second term representing Cochran, Hockley and Lamb Counties on the Board. Mack recently celebrated his 24th anniversary as manager of the White Face Farms near Levelland.

James Mitchell is a fourth term Board veteran representing Lubbock, Lynn and Crosby Counties. James' innovative and comprehensive water conservation practices and his commitment to supporting research in his own fields near Wolfforth, have brought him local, state and national recognition.

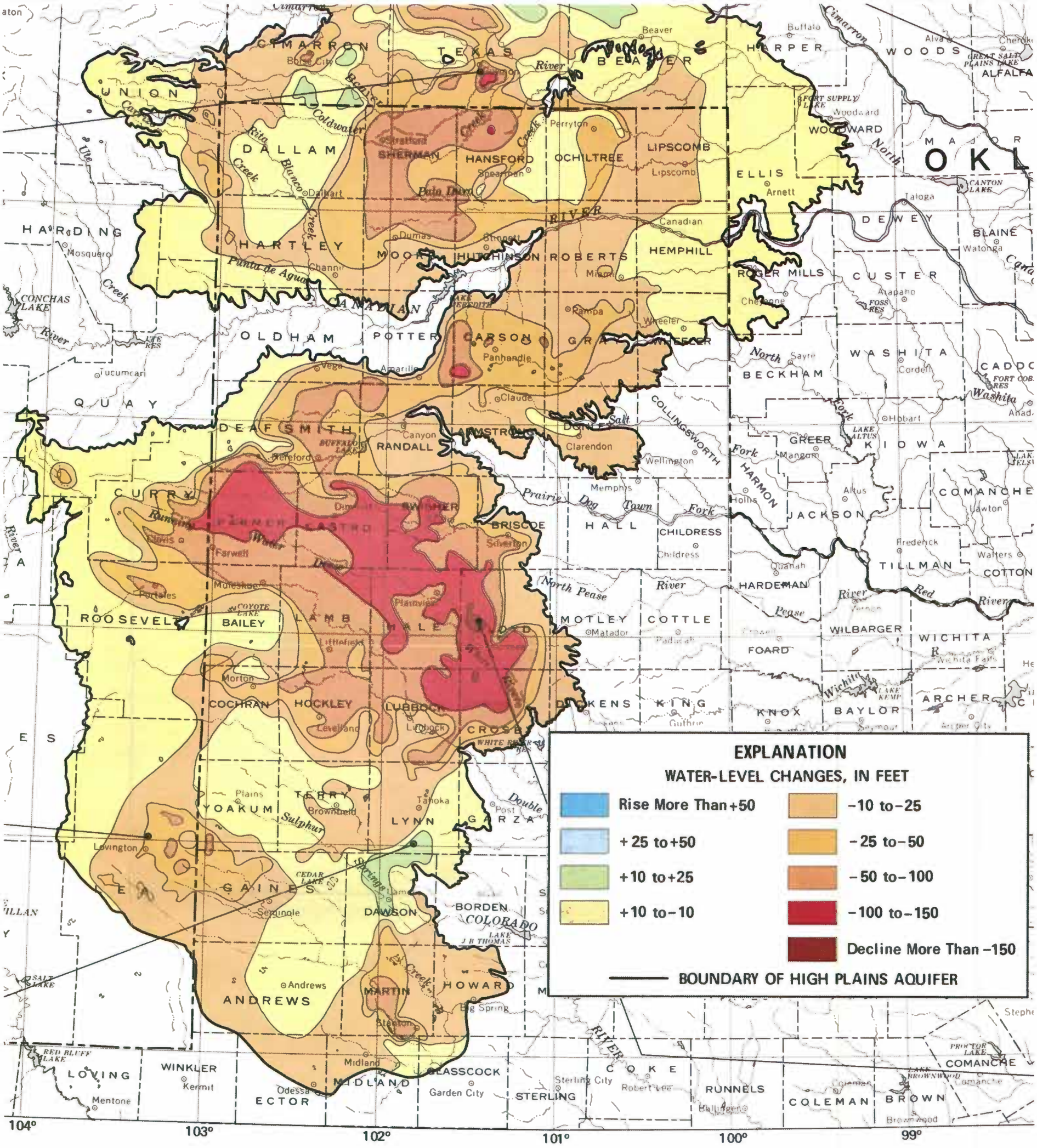
JAMES MITCHELL, accompanied by his wife Sylvia, repeats the oath after Judge J. Q. Warnick, County Court at Law #2. James is representing Crosby, Lubbock and Lynn Counties in Precinct One.

FAWVER TO BE SWORN-IN

Gilbert Fawver of Floydada will be stepping into his new position as a District Board Director in a few weeks —as soon as he's up to stepping at all. Gilbert was elected to his first board term by folks in Floyd and Hale Counties at about the same time as he checked into a Lubbock hospital for knee surgery. The doctors recently

continued on page 4, col 1 . . . 30 YEARS

GILBERT FAWVER



SCALE 1:2 500 000

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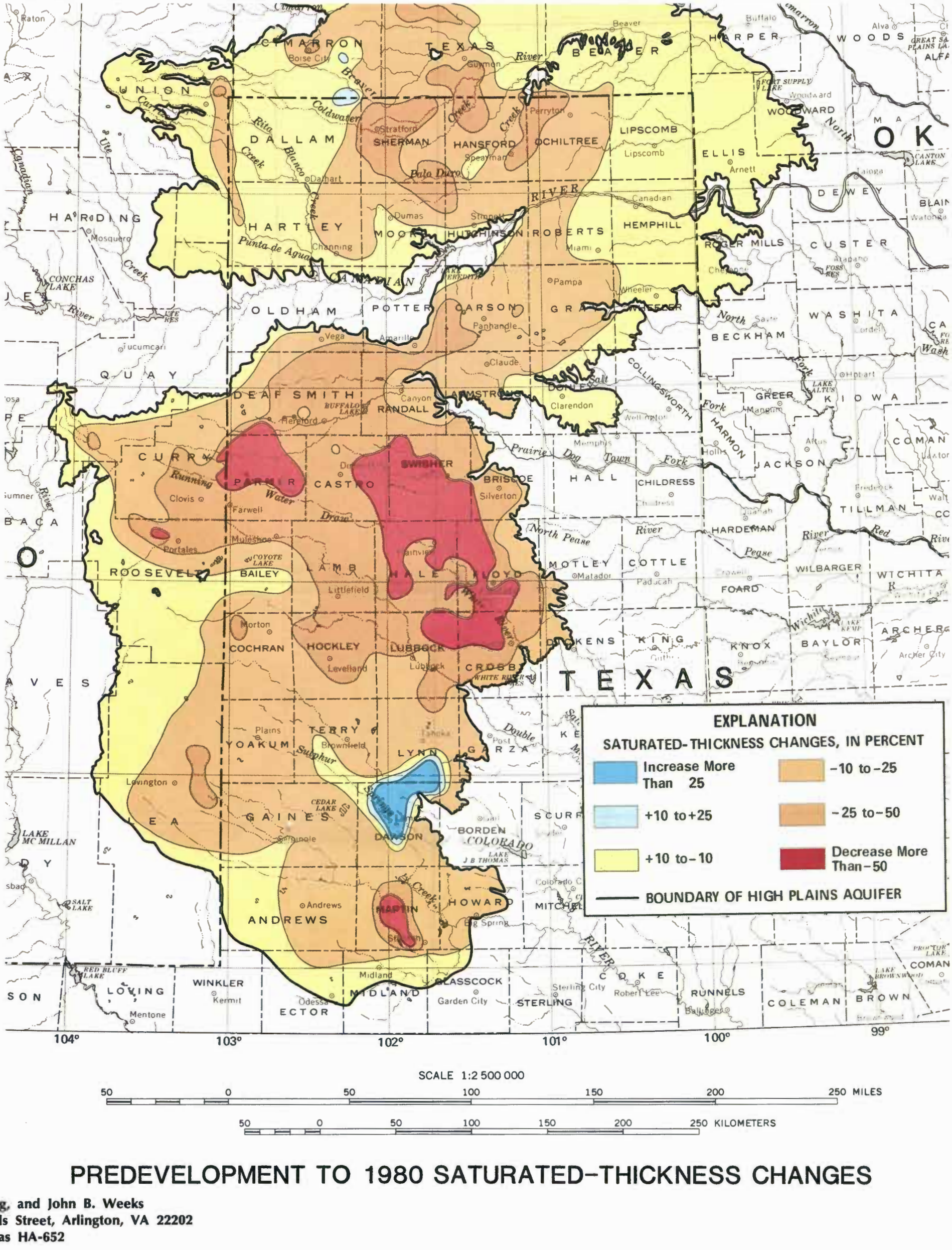
50 0 50 100 150 200 250 KILOMETERS

PREDEVELOPMENT TO 1980 WATER-LEVEL CHANGES

By Richard R. Luckey, Edwin D.
United States Geological Survey, 1200 Sc
Hydrologic Investigat



PREDEVELOPMENT TO 1980 SATURATED-THICKNESS CHANGES

Gutentag, and John B. Weeks
uth Eads Street, Arlington, VA 22202
ons Atlas HA-652

Aquifer Changes Mapped By USGS

(continued from page 1)

Areas of significant decreases in saturated thickness generally are found where the aquifer has been pumped for irrigation for a long period of time. Large scale irrigation development began south of the Canadian River in the Southern High Plains of Texas and New Mexico during the 1930's. Areas of more than 25 percent decrease in saturated thickness have occurred since the 1930's in nearly one-half of the southern High Plains.

In Texas, more than ten percent decrease in saturated thickness has occurred in 74 percent, or 26 thousand square miles (17 million acres), of the High Plains aquifer. Also, more than 25 percent decrease in saturated thickness has occurred in 29 percent of the aquifer, and more than 50 percent decrease in saturated thickness since predevelopment has occurred in only eight percent of the aquifer.

Saturated thickness has decreased more than 50 percent in large parts of Castro, Crosby, Floyd, Hale, Lubbock, Parmer and Swisher Counties, Texas. The average number of acres irrigated per well in these seven counties has decreased from 118 in 1958 to 62 in 1980. This decrease in acres irrigated per well is the result of decreasing well yields caused by declining water levels and decreasing saturated thickness in the aquifer.

In 30 Years He Missed 3 Meetings

(continued from page 1)

sent him home with a new knee, and the patient is predicting he'll be up and out for the Water district's March Board meeting. Swearing - in ceremonies are being planned for Gilbert at his first Board meeting, at which time members will elect officers for the year.

Gilbert serves as the Floyd Coun- has served on the Floyd County Soil and Water Conservation District Board for thirty years. He has chaired that body for the last twelve years, and held every other board office. In 30 years, Gilbert has missed only three meetings. He was also elected to the SWCD's 100 Man Committee which works in Austin to promote sound soil and water conservation policies by the legislature.

Gilbert also serves as the Floyd County representative to the South Plains Association of Governments. He has been a board member of the FmHA, a coop gin, and has served as a rural school board trustee. The local FFA has honored him as its Chapter Farmer for his strong support of the area stock show, for furnishing the trophy for the grand champion steer class and for furnishing lambs to the FFA youngsters.

Gilbert's dad homesteaded their land in Floyd County in 1891. Gilbert was born and raised on that land, and until he retired three years ago and rented it out, he and his wife Thelma farmed 230 acres of cotton and wheat and kept 630 acres in grass. He row irrigated using underground pipeline and says he has always been concerned with preventing runoff and washes from irrigation fields.

Gilbert served four terms as a Floyd County Committeeman for the High Plains Water District. His current term expired with this election. Gilbert says he's eager to continue working to promote water conservation. And we're eager to welcome him aboard.

Retiring Board Veteran Given Recognition

The Water District Board of Directors and staff honored Malvin Jarboe, a three term veteran of the Board who retired from his position as Board Vice President early this month. Malvin served Floyd and Hale Counties for six years as District Director Precinct Five representative from 1976 through 1981. He has served as a District county committeeman. The Board presented him with a memorial plaque citing his dedicated service, contributions and wealth of leadership.

Mal has been a community leader in many capacities over the years, including service on the Federal Land Bank Association Board in Floydada, the Consumers Fuel Association Board, the Floyd County Tax Board of Equalization, and the Floydada Independent School District Board of Trustees.

He plans to continue to farm cotton and wheat near Floydada.

Decline Rate Decreases

The Water District has completed its annual program of measuring the depth to water levels in more than 900 observation wells scattered throughout the fifteen county District area. A total of 904 wells were measured this year.

Those measurements of water levels showed an average of 0.37 of a foot lowering from January 1981 to January 1982. The −0.37 foot change compares favorably with the ten year average annual change of −1.42 feet (1970-1980). 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 amounts of precipitation in the late summer of 1981. The abnormal rise in water levels in some wells probably reflects filling of the cones of depression around these wells rather than substantial recharge to the aquifer.

Because most of the wells measured are operational irrigation wells, the month of January was chosen for the observations in order to allow for a dormant period and for well recovery from the cone of depression developed during the pumping season. Wells were measured to find the depth to "static" water level. After measuring, each well received a red District identification tag for the owner's information.

Data gained from this program is used for decline rate projections, determining the amount of water left in storage in the Ogallala, and very importantly, as a basis for the income-tax depletion allowance claims on landowner's tax returns.

Data on individual wells were available within a few days of completed readings, but a formal tabulation of the data on the entire network is not expected until mid-year.

Average Annual 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	1979-1980	1980-1981**	1981-1982
Armstrong	9	—1.05	—1.49	—1.13	+ 0.45
Bailey	73	—1.24	—0.78	—2.57	—0.79
Castro	89	—2.82	—2.82	—3.06	—2.23
Cochran	53	—0.22	+ 0.87	—1.09	+ 0.56
Crosby	23	—1.98	—0.01	—3.28	—0.65
Deaf Smith	89	—2.42	—2.10	—1.42	—0.76
Floyd	97	—1.98	+ 0.51	—3.54	+ 0.19
Hale	26	—1.22	+ 1.40	—3.29	—1.53
Hockley	90	—0.18	+ 1.21	—1.32	—0.17
Lamb	93	—2.12	—1.33	—3.50	—1.92
Lubbock	119	—0.62	+ 1.49	—1.86	+ 0.03
Lynn	38	+0.02	+ 1.25	—1.60	+ 0.14
Parmer	97	—2.87	—2.55	—3.49	—1.63
Potter	6	—1.19	—1.86	—1.46	+ 1.47
Randall	50	—1.36	—1.01	—0.73	+ 1.23
District Average		—1.42	—0.48	—2.41	—0.37

**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.*

***Severe drought in summer of 1980.*

SPEAKING FOR ALL of us, James Mitchell recognizes Malvin Jarboe for his 6 years of dedicated service to the district and to promoting water conservation.

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

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Capillary Water Yields New Hope

by Don Rauschuber, P.E.

The Ogallala aquifer underlying the Texas High Plains may prove to be a dependable water supply source for domestic, industrial and irrigation water three to four times longer than recent projections indicate. That is, if the objectives of the High Plains Water District's Secondary Recovery study prove to be technologically and economically feasible.

Preliminary results of this study have shown that as the Ogallala has been developed only about 40 percent of the water in the formation is recovered by conventional pumping means. An estimated 60 percent of water is held in storage by "capillary" forces. Equating this to the Ogallala aquifer of Texas, there may be as much as 920 million acre-feet of capillary water remaining in storage when the gravity water is depleted.

One of the main objectives of the District's secondary recovery study is to research and develop techniques for recovering capillary water. The District, in association with Texas Tech University and the Texas Department of Water Resources, are studying the possibility of using air pressure, soaps (surfactants), thermal, electrical, and vibration processes. Air pressure and soaps appear to hold the most promise based on current research.

In a recent pilot program, the District field tested the air injection process. An air injection well along with numerous types of monitoring wells were drilled on the Ronald Schilling farm southwest of Slaton. Compressed air was injected into the unsaturated zone of the Ogallala formation at a rate of a thousand cubic feet per minute for nine days. During the test, air pressure in the formation and water level changes were monitored. Results of the pilot test are being currently analyzed by numerous engineers and scientists throughout the country. The most promising result is that the moisture content of the unsaturated zone within the immediate testing area decreased by an estimated 59 percent from pre-test moisture conditions. Much work has to be done before a complete assessment of the amount of capillary water actually removed can be made. The District is planning another larger scale air injection test to be conducted in April, 1982.

ON SITE at the Schilling Farm in Slaton, Wayne Wyatt, Herb Grubb, Bobby Whitefield (standing) and Charles Nemir inspect the air injection well and recording instruments at the Secondary Recovery study test area.

Moisture Deficit Surveyed

The annual pre-plant soil moisture survey over the Southern High Plains area is now complete. The soil moisture deficit, a measure of how much water is still needed to wet the soil in the crop root zone to field capacity, ranges from less than two inches of moisture needed in some areas to more than eight inches needed in other areas.

The wide range of moisture deficits over the 18 county area surveyed is generally due to differences in each soil's capacity to store moisture and to local rainfall patterns.

Other factors also affect the amounts of deficit recorded. In addition to precipitation and soil types, moisture deficits may be different due to individual farm management practices, the type of crops grown in an area, and the amount of water a particular farmer applied late last growing season.

The soil moisture deficit was determined at 135 observation points, including over 50 new sites installed last fall, with the cooperation of the local landowners. Site selection was based on soil type and variation in the saturated thickness of the Ogallala aquifer.

Crews used a soil auger mounted on a small trailer to core the seven foot holes at the new sites. At each site a neutron soil moisture probe was lowered down a two inch diameter, thin-walled aluminum tube set to a depth of seven feet below land surface. Readings were taken at one foot intervals at each site. Soil core samples were also taken at one foot intervals at each of the newly installed sites and tested at the soil physics laboratory at Texas Tech University, to determine their soil moisture content and bulk density. This information was correlated with data from the neutron probe readings at each site.

Public Opinion Needed

Texans made it clear at the polls last November that they wanted something else in the way of a plan for developing, updating and financing our water resources for the future. But what exactly do they want?

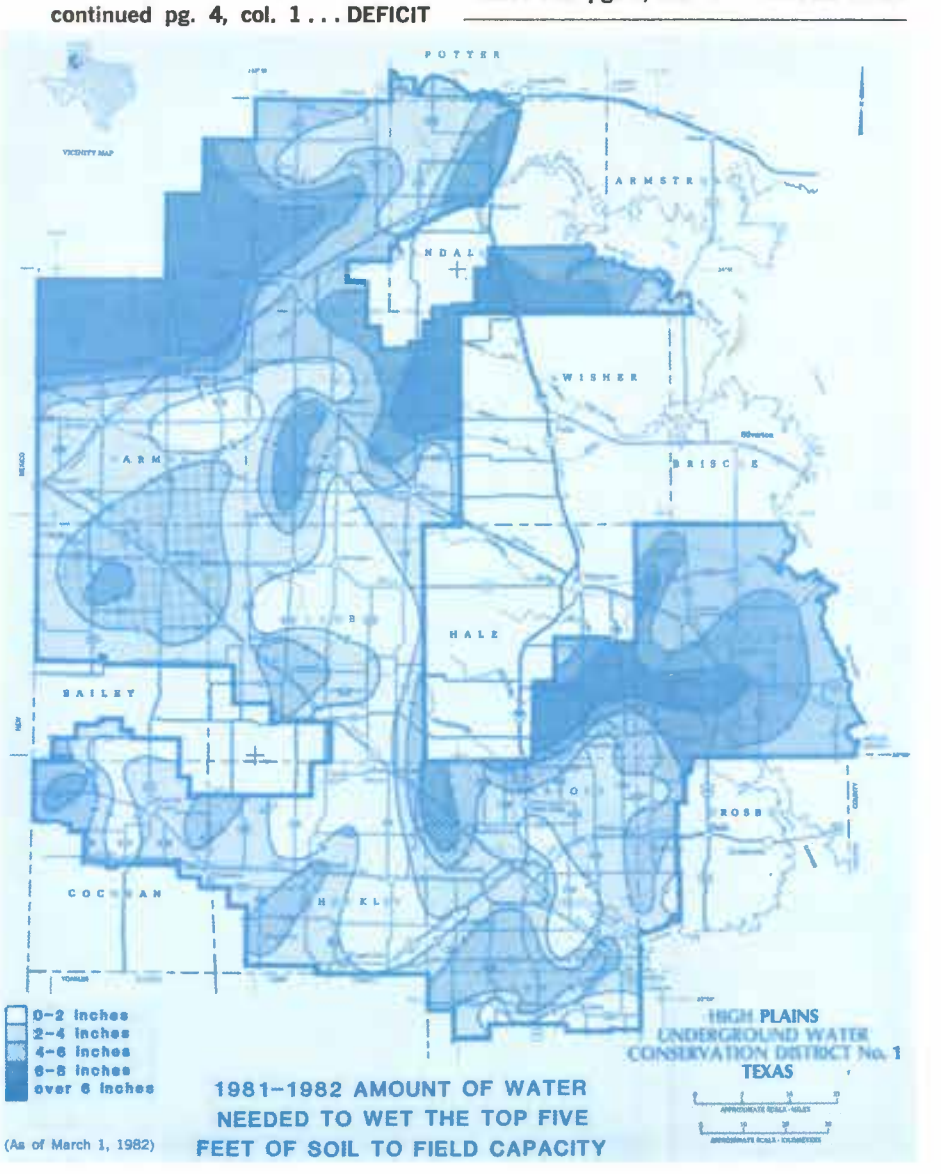
In order to find out, the Governor's Water Task Force and the Texas Department of Water Resources are actively inviting public participation in a major revision of the 1968 Texas Water Plan. The revised plan of recommendations and long-range water planning for Texas will be presented to the Governor and the Legislature convening in 1983.

Meanwhile TDWR is seeking comment and response to a summary statement of eleven critical issues facing the state, each of which poses questions about choices and priorities that must be decided by Texas citizens. Copies of the issues statement are available all over the state. The High Plains Water District has additionally requested and mailed out over 250 copies to folks just on the High Plains. Included in the mailout were copies for the County SCS and Extension Agent's offices. The local district offices of the TDWR have copies on reserve, as do over 50 state libraries. There are still some additional issue statements available on request from the Water District's Lubbock headquarters.

continued pg. 4, col. 1 . . . WATER PLAN

The survey is a cooperative effort by the Soil Conservation Service and the High Plains Underground Water Conservation District with support from the

continued pg. 4, col. 1 . . . DEFICIT



THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

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2930 Avenue Q, Lubbock, Texas 79405
Telephone (806) 762-0181

PATRICIA BRUNO, Editor

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District Office at Lubbock

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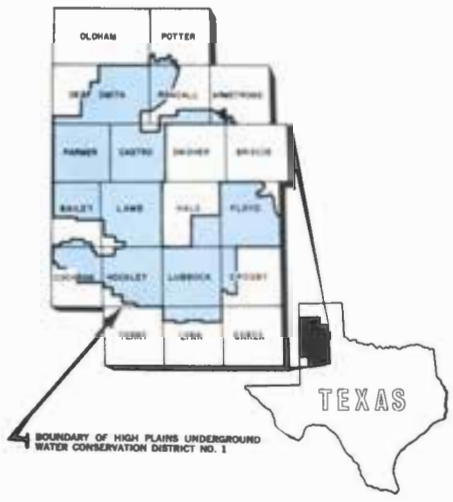

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Roger B. Gist, III, 1983	Happy

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.

Recent Water Appointments:

TWCA GENERAL MANAGER

Leroy Goodson is the new general manager of the Texas Water Conservation Association. He took his position at their headquarters in February just in time for the 38th Annual meeting of the membership. Leroy succeeds the late Bill Waddle who died in November.

At 41, Goodson brings over ten years of water business experience to his job. He left a post at the Guadalupe-Blanco River Authority in Seguin, Texas where he was serving as director of planning and development. He had joined GBRA in 1971 as an assistant to the general manager.

Some of Leroy's other water-related affiliations include an active membership in the National Water Resources Association, the Water Resources Congress, Water Inc., and the Soil Conservation Society of America.

He graduated from Southwest Texas State University with a BS degree in Education and has been an elementary and secondary school teacher in Uvalde, Harlandale, and New Braunfels where he and his wife Judene and their two children, Colby 11, and Kyla 8, now live.

Leroy currently serves as chairman of the Comal County Appraisal District, as a director of the New Braunfels Savings and Loan Association, and as a member of the Alamo Area Council of Government's Regional Development Review Committee.

As a concerned community leader, Leroy is immediate past president of the Hill Country School Boards Association and of the Comal Independent School District Board of Trustees. He has served the State Young Farmers of Texas, the area VII Vocational Agricultural Teachers Association of Texas, and the Comal County Fair Association.

TWCA PRESIDENT

The Texas Water Conservation Association membership elected A. Wayne Wyatt their new president during the 38th annual meeting in February. Wyatt is the general manager of the High Plains Underground Water Conservation District No. 1.

His career in the water business spans 23 years, beginning in 1957 with his first job as field representative for the High Plains Water District. He served the District for ten years in various assignments including manager of field operations and office manager, before joining the Ground Water Division of the Texas Water Development Board in Austin in 1968. There he directed the establishment of a statewide water level and ground water quality monitoring program. He directed many other groundwater studies throughout the state and was appointed assistant director of the Ground Water Division. He later became the Director of the Water Importation Division of the agency.

In 1977 Wyatt established his own groundwater consulting firm and in 1978 he was hired away by the High Plains Water District as its general manager.

Wayne is currently helping to guide the study of the feasibility of recovering 'capillary' water from the dewatered portions of the Ogallala aquifer using secondary recovery technology.

Wyatt now serves as the Chairman of the Water Committee of the West Texas Chamber of Commerce. He is a member of the Conservation and Operations Committee of the Governor's Water Task Force, and a member of the Groundwater Management Districts Association, the Soil Conservation Society of America and the High Plains Chapter of the West Texas Drillers Association. He has also served as Chairman of the National and State Groundwater Officers Association.

George McCleskey was recently appointed by the Governor to his second six year term on the Texas Water Development Board, and Board members have also elected him to a two year term as the Vice Chairman of the Board. George practices law in Lubbock where he has lived since 1940.

George is a graduate of the University of Texas Law School at Austin. He

TWDB VICE CHAIR

is a member of the High Plains Research Coordinating Board, the West Texas Water Institute Advisory Board, and the Lieutenant Governor's Water Resources Advisory Committee. He is a past president of Water Inc. and former co-chair of the underground water law committee of the environmental law section of the State Bar of Texas.

Lawn Sprinkler Evaporation Losses High

EDITOR'S NOTE: *Nearly 40% of the water used around the home in West Texas goes to our lawns and shrubs. We are finding that more than half of that water is often lost to evaporation, poor watering habits and inefficient home sprinklers through an urban water conservation research project conducted last summer and fall by the Texas Agricultural Experiment Station in Lubbock. This work was jointly supported by the Water District, the Texas Department of Water Resources and the City of Muleshoe.*

Dr. Charles Wendt, project director, was surprised by some of the discoveries. The three pronged study evaluated the distribution and efficiency of locally available sprinklers, of irrigation water regimes on the water use efficiency of common Bermuda grass grown on the High Plains, and of the potential for using growth regulators.

In the following months we will present a summary of research findings for each aspect of the study, beginning with the results of efficiency evaluations on locally available lawn sprinklers.

It has been estimated that there are 3.2 million acres of turf in Texas. All that grass is diverting 30 percent of the state's municipal water supplies through a variety of distribution systems into residential lawns, city parks, school and industrial landscapes. But not all that water is making it into the ground. We are discovering that a substantial percentage of that water being squirted, sprayed and jetted through lawn sprinklers never does its job of watering the grass, in fact, much of it never reaches the surface of the lawn.

Poor sprinkler application efficiency has been cited as the primary cause of high water use for lawns. It is also responsible for a high percentage of water wasted on the High Plains.

Dr. Charles Wendt, soil-plant-water specialist, and a team of researchers

at the Texas Agricultural Experiment Station at Lubbock conducted an urban water conservation study last summer which confirms and emphasizes the importance of evaluating lawn sprinklers in the climatic conditions where they are expected to be used. His team tested six models of commercially available lawn sprinklers including an impact, oscillating, traveling, stationary ring, rotating and buried head model. Each unit was evaluated on a scale from 0(worst) to 9(best) for its flow rate, evenness of water distribution, evaporation loss and wind susceptibility.

All six sprinklers performed with poor efficiencies, but two models stood out as sorely inefficient. The buried head sprinkler rated only two points on the study's performance criteria point scale, and the impact sprinkler rated a zero. The two models with high ratings in the study were the stationary ring sprinkler with a 7, and the traveling sprinkler, the overall top performer, with a 9 rating. These ratings reflect the weighing of tests for all four variables measured in the study.

The one factor which appeared to have the most effect on efficiencies was flow rate, or the rate at which the sprinkler applied water. The flow rate appeared to be the key variable influencing evaporation, distribution and wind susceptibility. The lower the flow rate, the higher the evaporation, wind susceptibility and time required to apply the same amount of water, and the poorer the distribution and application efficiency of the sprinkler. This is emphasized in Table 1 which shows the rate of flow in gallons per minute for each sprinkler, along with the amount of water applied through the sprinkler in 24 hours, how much water was caught in cans in the test area, and the amount of water evaporating in a 24 hour period. The sprinkler with the lowest flow rate had the highest percentage of the water lost to evaporation.

A big surprise was the discovery that every sprinkler lost much more water to evaporation than could be expected by the evaporative demand of the atmosphere. The losses were so high they could not be closely related to the evaporative demand of the atmosphere (Table 1). They were better related to sprinkler design. The smaller the water droplets or spray vapor being applied, the more quickly water could be lost from the area of application. And in general, the lower the flow rate the finer the spray, the greater the loss.

It is also important to note that the atmospheric evaporation demand during the testing period was lower than usual, and much lower than in June and July when the demand was greater than a half inch per day. Although evaporation losses for the sprinklers were quite high under the low evaporative demand conditions of the study, even higher losses can be expected in the average summer. This underscores the inefficiency of commercial lawn sprinkling designs now available on the High Plains.

The percentages of water lost by the different sprinklers during a 24 hour period are shown in Figure 1. The impact and buried head sprinklers lost as much at 70 percent of the water they applied during day watering and over 45 percent of the total water applied during that 24 hours. These two worst performers also lost twice the water and required more application time than did the ring and oscillating models to put on an inch application. This is related to the amount of watering area covered by each sprinkler.

Another factor in these glaring inefficiencies was the effect of wind. Wind speeds measured during the study did not exceed 11 mph. The average area wind speed is 15 to 18 mph. The low flow rate sprinkler models were very susceptible to wind. Wind speeds were found to be a primary cause of uneven pattern distribution, in particular for the buried head sprinkler. Wind also affected the oscillating sprinkler. As wind speed increased, the watering pattern was distorted and moved downwind. The lower the flow rate, the greater the shift in watering pattern. As the water pattern shifted, distribution got poorer. Dry patches, where NO water was caught in some cans under the watering area, were discovered in the impact sprinkler test. The uniformity of the spray pattern decreased with increased windspeed for all sprinklers tested. Any pattern variation affects how evenly the lawn will green, and brown patches may well be the result of poor distribution patterns.

The information obtained during the study suggests that sprinkler models with higher flow rates will be better performers. In general all models had lower evaporation losses during night watering. But if you have a buried head or an impact sprinkler system, water only at night in low wind conditions to avoid high evaporation losses and severe distortion in the pattern distribution.

The oscillating sprinkler covers a large area and requires less frequent hand moving. It will also perform best, with less evaporation or pattern warp if used for night watering.

For a small area, the ring sprinkler is very efficient. It had the highest flow rate and consistently low evaporation losses. But it must be moved often.

continued pg. 4, col. 1 . . . FLOW RATE

TABLE 1. AVERAGE CLIMATOLOGICAL AND SPRINKLER OPERATING DATA OBTAINED DURING THE EVAPORATION TEST

TYPE	FLOW RATE IN GPM	IRRIGATION (INCHES) APPLIED	CAUGHT	EVAPORATION MEASURED	% WATER EVAPORATED	EVAPORATION DEMAND MEASURED		CALCULATED	PAN	POINT SCALE TOTAL
IMPACT	3.8	1.48	.82	.66	45	.66	VS	.17	.17	0
OSCILLATING	5.6	3.55	3.06	.49	14	.49	VS	.21	.14	4
TRAVELING	5.1	21.88	17.37	4.51	21	4.51	VS	.20	.14	9
RING	8.6	17.81	15.48	2.33	13	2.33	VS	.23	.18	7
ROTATING	5.6	12.92	10.35	2.57	20	2.57	VS	.26	.26	4
BURIED	6.4	9.33	4.96	4.37	47	4.37	VS	.11	.18	2

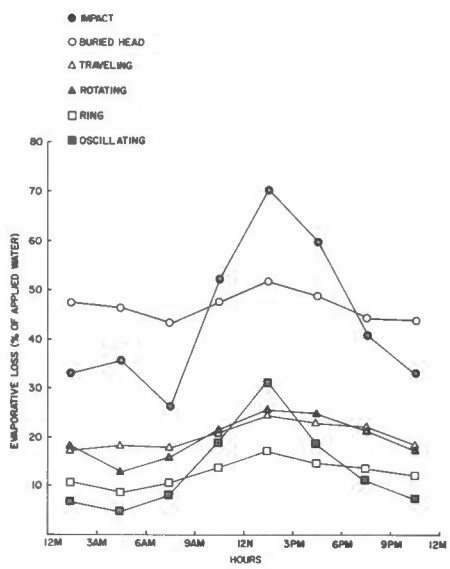
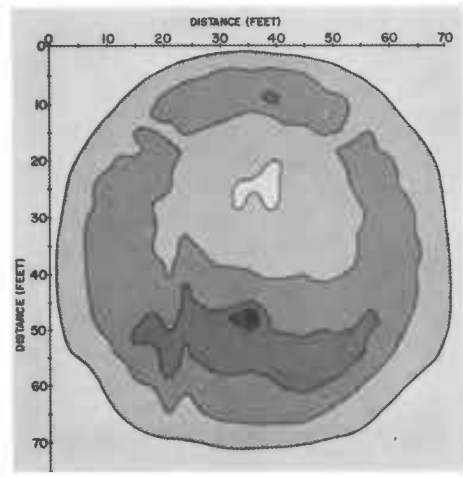
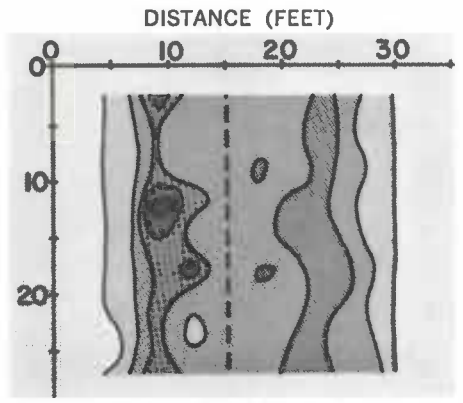


Figure 1: Percent evaporation of water applied by different sprinkler systems during a 24 hour period at Lubbock, TX, 1981.



Pattern for an impact sprinkler based on percent of largest catch with 7 mph wind.



Pattern of traveling sprinkler based on percent of largest catch with 10 mph wind.

WATER PLAN REVISED

(continued from page 1)

The purpose of getting these statements out is to allow people time to study and prepare responses, and to appear at one of the 13 public forums which are being conducted across the state. Lubbock's public forum is scheduled for April 1st, at the Texas Tech University campus Home Economics Auditorium on West Broadway in Lubbock, beginning at 7 p.m. It is very important for area residents to be there and to express their views.

But comment will not end there. The Department is also inviting people to submit written statements, or to call (512) 475-0223 with telephone statements. They are conducting one-on-one interviews around the state and are polling Texas citizens with a questionnaire survey to further learn their views.

Neither the issues nor the questions are simple. They include concerns impacting future statewide policies for water resource management, population and economic growth in the state, water laws, water quality, wastewater treatment projects, flood protection, water conservation, importation, research and development of new technology, and the state's role in financing future water development.

The big question is "where is an estimated $50 billion dollars going to come from over the next 25 years to finance Texas' future water needs?" Public comment is needed to help determine where that money will come from and how it will be spent.

Additional Copies of
TEXAS WATER PLAN REVISION
ISSUES STATEMENT
available from
BOBBY WHITEFIELD
Texas Dept. of Water Resources
P.O. Box 13087, Capitol Station
Austin, TX 78711
(512) 475-0223

SHOULD STATE CONTROL UNDERGROUND WATER USE

Among the eleven key issues being addressed in the Texas Water Plan revision, Issue II: Water Laws, is of keen interest to the Texas High Plains. The kernel of this issue is whether state ground water controls are needed.

The Background statement clarifies that Texas groundwater is subject to the right of capture by landowners as long as the water is put to beneficial use and not wasted. It states that in many parts of Texas the value of land depends upon the quantity and quality of the water which occurs beneath it. A distinction is made between rechargeable and nonrechargeable aquifers, and the background statement reads," At the present time, aquifers provide approximately 69 percent of the water used in Texas, and the water supplies of several major aquifers are being depleted.

"Aquifers which receive appreciable recharge could perhaps be managed by limiting the quantities of water pumped to some specified quantity, i.e., restricting pumpage to the long-term average recharge. However, those aquifers which receive very little natural recharge do not lend themselves to such a management approach. For such aquifers, the question is "Over what period of time should the water stored in the aquifer be withdrawn and used?"

The Issue statement focuses on whether and how the state should intervene to offset ground water declines in the face of growing water demands. The options mentioned are water conservation, increased efficiency, supplemental surface supply development, ground water transfers, or a combination of these. The report also states:

"In Texas, underground water resources can be managed and controlled by local units of government either by the creation of Underground Water Conservation Districts or by special districts created directly by the Legislature (the Harris-Galveston Coastal Subsidence District is an example). Several conservation districts have been formed; however a significant part of the ground water resources in the State are not within the jurisdiction of the six currently active underground water districts, only the Harris-Galveston Subsidence District directly regulates the quantity of water that can be pumped. Existing ground water conservation districts have promulgated and are enforcing rules to prohibit water waste and control spacing of wells to reduce competition among wells. In addition, these districts carry out water conservation information and education programs, some sponsor and implement aquifer recharge projects, and some are participating in various types of water conservation research and development projects within their respective areas.

"It has been suggested that essentially all of the State lying outside the boundaries of an existing conservation district be placed in one or more conservation districts that would be subject to State regulations as to the withdrawal of water. Under this suggested plan, the citizens of an area could decide to locally organize and operate a conservation district. This plan would afford local control over the ground water resource in that area, but would provide State regulation should the citizens choose not to organize such a district."

The Question posed is "Is State regulation and control needed? Should the State pursue a policy of regulations and control in those regions of Texas where conservation districts are not formed and operated? Should some other course of action be chosen? What are your views and reasons regarding this issue?"

Please direct your response to Bobby Whitefield, Texas Department of Water Resources, P.O. Box 13087, Capitol Station, Austin, TX 78711.

FLOW RATE AND WIND SPEED AFFECT LOSSES

(continued from page 3)

The rotating sprinkler measured only 15 to 30 percent evaporation losses, and its application rate was fair, but its pattern uniformity was not good.

The traveling sprinkler also had a high flow rate and lost only 20 to 25 percent of its water; but it applies only an inch of water per pass and probably would need to be moved often. It's not for lazy irrigators.

Most traveling sprinklers have adjustable arms that can be used to fit the watering pattern to the configuration of the irrigation area. The area covered by the other five models can also be adjusted simply by changing the water pressure. Even though the sprinklers that have higher flow rates are more efficient, care should be taken to be sure the soil will absorb the water at the rate at which you apply it to avoid runoff.

Finally, Dr. Wendt and others see these study results as clearly pointing to the need to redesign our lawn sprinkler systems in West Texas. Their ideal would be an underground catchment system for both irrigating and runoff that could hold water in the soil until it was absorbed. Clogging problems, however, make it an ideal that has so far been easier to imagine than to design.

DEFICIT RANGE: 2"-8" . . . from page 1

Texas Department of Water Resources. The SCS and Water District assumed responsibility for the program last year and developed a cooperative agreement to expand its data base. Oliver Newton, an agricultural meteorologist with the National Weather Service at Lubbock, developed the original survey and maintained it for 15 years with technical assistance from the Texas Agricultural Experiment Station at Lubbock, and financial support from Plains Cotton Growers. Oliver recently retired.

The survey is an important tool for giving us a better picture of our soil moisture reserves over the entire area. It can help the farmer make more informed pre-plant irrigation decisions and help him avoid both over and under irrigating in the spring. It can also give an indication of potential dryland production.

The sample indicates general trends over the area, but does not predict exact soil moisture conditions on any given farm. Each landowner needs to check his individual farm soil moisture to determine his pre-plant moisture needs.

FROM THE HIP — Secty. of Agriculture John Block sympathized, but offered little hope to 5,000 High Plains area farmers who packed the Lubbock Municipal Auditorium to capacity and then some for a town-hall meeting on Feb. 25.

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

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THE Cross SECTION

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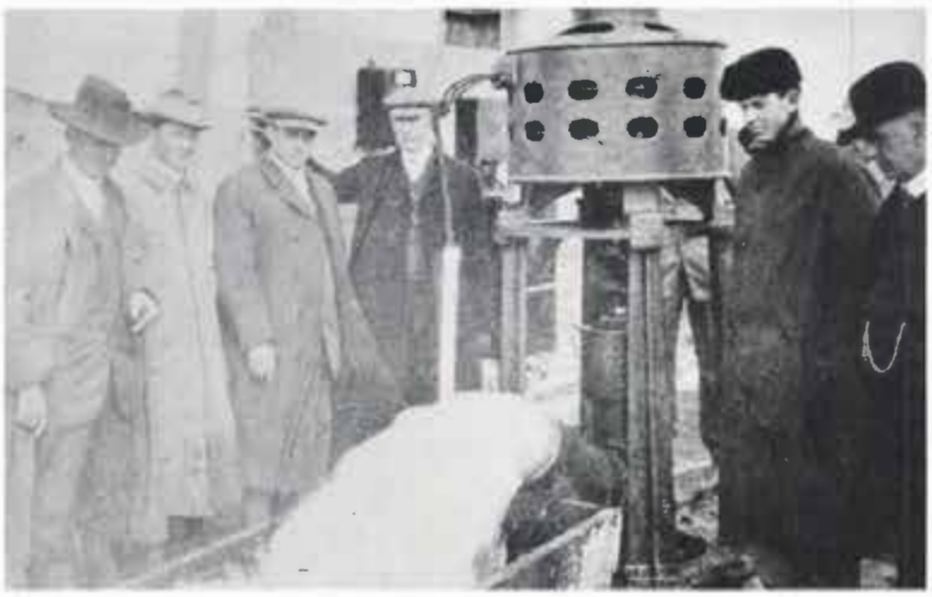

ONE OF FIRST pumped irrigation wells on Texas High Plains, exact location unknown.

IRRIGATION CONTRIBUTES TO TEXAS PROSPERITY

EDITOR'S NOTE: More than half of the total dollar value of harvested crops in Texas in 1979 came from irrigated cropland. But irrigated crops represent only about a third of the state's total cropland. Most of this irrigated acreage is supported by groundwater resources in the High Plains of Texas.

The importance of the contribution of irrigated cropland in Texas cannot be overlooked, particularly as Texans grapple with establishing priorities and guidelines for a statewide water plan revision, including the question of state groundwater controls. (See story on state groundwater control in Cross Section, *March, 1982, p. 4.)*

The Texas Department of Water Resources has published an Inventories of Irrigation in Texas using data compiled by them in 1958, 1964, 1969, 1974 and 1979. Because of the above normal rainfall in 1979 and the below normal rainfall in 1980, a 1980 irrigation survey was also conducted for selected Texas areas and is included in the report. The report, No. 263, identifies the major irrigation areas in Texas and makes comparisons over several years for such data as acres irrigated, cropping patterns, water applied, rainfall received, and the percentage of total water use for irrigation as supplied by both ground water and surface water.

The report includes a map identifying the ground water and surface irrigated acres in Texas. The map shows that the lion's share of irrigated production (75 percent in 1979) occurs in groundwater use areas, primarily the High Plains. These areas would be the target of any state regulation of ground water for irrigation.

The report also details a brief history of irrigation farming in Texas showing the trend in irrigation development from 1889 through 1979. Copies of report No. 263 are available without charge from TDWR Publications Distribution Unit, P.O. Box 13087, Austin, Texas 78711.

Irrigation farming in Texas antedates any historical records available. Some believe that irrigation has been practiced for a longer period in Texas than in other parts of the United States (Nagle and Fortier, 1910). The earliest record of irrigation in Texas is that reported by Coronado, an early Spanish explorer, who found Indians irrigating crops in the vicinity of the present city of El Paso when his expedition reached there in 1541 (Hutson, 1898). However, this was not the first irrigation practiced in the State. Evidence of ancient irrigation systems in some of the valleys of the Trans-Pecos area indicate that irrigation had helped support a prehistoric population (Hutson, 1898).

A revolt by the Pueblo Indians in 1680 drove the Spaniards and many Christian Indians out of New Mexico. They fled down the Rio Grande to the Mission of Guadalupe, where the City of Juarez, Mexico, now stands. The towns of Ysleta and Socorro were founded by these Christian Pueblo Indians (Harrington, 1952), who used irrigation as a means of producing their crops in that area of scanty rainfall.

The Spanish Mission of San Antonio de Valero, the Alamo, was established on the San Antonio River in 1718. The San Jose, Concepcion, San Juan de Capistrano, and La Espada Missions were established later. San Antonio, the center of Spanish power in the territory, had the largest area of early irrigation in Texas (Harrington, 1952).

The United States Senate passed a resolution on August 4, 1886 inquiring into the status of irrigation in that portion of the United States largely west

continued pg. 2, col. 1 . . . HISTORY

WATER "CHIEF CONCERN"

EDITOR'S NOTE: The Texas 2000 Commission Report and Recommendations are out. After a year of study and debate on seven major economic development issues, including water, energy, agriculture, transportation, research and development, government finance and relations with Mexico, the commission has presented its recommendations to Governor Clements. They include a series of innovative state actions which may bring the state to "revise existing legislation and break with some time-honored traditions." Particularly in the area of water. The commission has stated that chief among their concerns is water. "Water scarcity holds the greatest potential for disrupting the Texas economy and is the single most important issue addressed by the Texas 2000 Commission." They also recognized that basic issues in each issue area are interwoven.

For this reason, as time and space allow, the Cross Section *will reprint the entire text of each of the seven issue statements for a broader understanding of their interrelationships. The Texas 2000 Commission Report and Recommendations will undoubtedly contribute to the Texas Water Plan revision now in progress.*

WATER

Ensuring an adequate supply of usable water in the next 20 years is one of the most important challenges facing Texas. The State's healthy economic condition and recent rapid growth have been possible because there usually has been enough water for all sectors. If immediate action is not taken, that will not be the case in the future. Forecasted increases in demand for water and lead times of 15 to 30 years to complete major water projects make immediate action necessary.

Texas has a wide assortment of water and water-related problems: 1) frequent flooding; 3) man-made pollution; 4) natural pollution and contamination from salt and mineral deposits; 5) excessive groundwater use causing land subsidence, salt water encroachment and aquifer depletion; 6) need for water purification, transportation, storage and distribution; 7) potentially insufficient water supplies for our growing industrial economy; 8) inadequate management of freshwater inflows; and 9) potentially insufficient water supplies for food and fiber production, and for energy production.

Extensive use of groundwater and increasing demand for surface water, along with the probabilities for major

continued pg. 4, col. 1 . . . TEXAS

Furrow Dikes Work, Here's Proof . . .

Research at Bushland and Lubbock evaluating furrow dikes installed during the growing season, increased yields in dryland grain sorghum from 10 to 12 percent over undiked furrows. Cotton yields increased from 15 to 25 percent.

Dikes are also being used with irrigation, especially under pivots. With the row dammers, runoff can be contained up to about a 1.5 percent slope.

Dikes maximize rainfall retention, save pumping costs, stop erosion and control runoff.

THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

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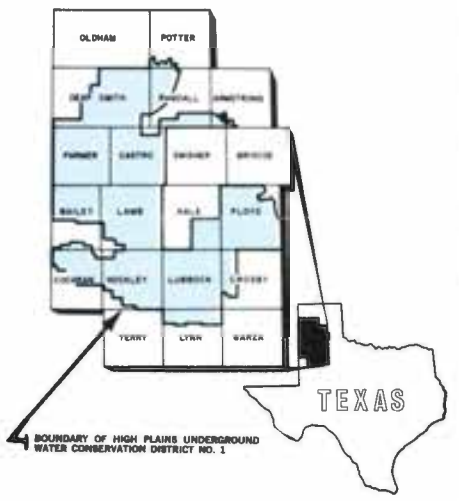

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NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.

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.

History Of Texas Irrigation

(continued from page 1)

of the one-hundredth meridian and from the Rio Grande to the border of the British Territory on the north. Responding to this resolution, a report of the U.S. Department of Agriculture (Hinton, 1886, p. 118) includes a quotation from James B. Newcomb of San Antonio that stated there were 50,000 acres (20,233 ha) of irrigated land in Bexar County valued at $50.00 to $300.00 per acre ($123.50 to $741.50 per ha). Irrigation water, sold by hours of use and at nominal price, was used only on gardens as the rainfall was considered adequate for small grains and fruits.

Other early references to the use of irrigation in Texas include its application by Indians in the vicinity of the present city of Wichita Falls and by the Spanish who founded the city of Laredo (Harrington, 1952). Irrigation was also used by the Franciscan fathers who established the San Saba Mission and built canals at the presidio on the San Saba River in 1756 (Hughes and Motheral, 1950).

One of the first irrigation developments by Anglo-Americans occurred in 1853 near the present town of Balmorhea in the Trans-Pecos area of the State (Hughes and Motheral, 1950). Other developments in the Trans-Pecos utilized water of the Rio Grande and the perennial springs of the area. Large-scale development of water supplies in the Rio Grande and the Pecos River came after 1880 when railroads were extended into the area. Development along the Pecos River soon exceeded the dependable supply of water, and some of the irrigation projects were actually abandoned before completion (Hughes and Motheral, 1950). Irrigation along the Rio Grande developed rather slowly until completion of the Elephant Butte project in 1916. Development in the Upper Rio Grande Valley has remained nearly constant since 1925. More recent developments in the Trans-Pecos have utilized ground water available in some of the valleys and basins of the area.

Irrigation was being practiced to some extent in most parts of the Rio Grande Plain by 1897 (Hutson, 1898). Irrigation farming had begun in the Lower Rio Grande Valley in 1876. However, little progress was made in this area until a railroad for the area was built in 1904. Water from artesian wells was used for irrigation in Zavala County and Bexar County in the late 1890's. The first flowing well was completed in Atascosa County in 1904 (Lonsdale, 1935). Completion of a similar well in Frio County in 1905 marked the beginning of irrigation in that area. Irrigation development in the Rio Grande Plain, centered primarily in the Lower Rio Grande Valley and the Winter Garden area, has expanded. Some irrigation has developed in the Coastal Bend, using the limited quantities of surface water and relatively poor quality ground water that are available.

Irrigated rice production began in the Coast Prairie before 1900. However, production of this crop was not significant until about 1910. Rice has continued to be the principal irrigated crop in the area.

Irrigation began on the High Plains with the completion of the first successful irrigation well on the J. H. Slaton farm, four miles west of Plainview, in 1911 (White, Broadhurst, and Lang, 1946). Development of the vast groundwater resource of the High Plains progressed very slowly until 1935. Drought and improved efficiency of pumps and power units stimulated increased interest in irrigation by 1936 (Jones and Gaines, 1941). Irrigation farming soon expanded from the early centers around Plainview, Hereford, and Muleshoe into every county of the High Plains. After World War II, irrigated acreage increased at a phenomenal rate. In some areas of the North High Plains it is still growing at the present time, but at a somewhat reduced rate.

Irrigation in other parts of the State has been developed primarily on isolated tracts by individuals who desired to eliminate the crop production hazards of droughts. The extent of development has depended primarily upon the ease with which ground-water supplies can be developed. Although many of the individual developments have utilized surface waters, most of the irrigated acreage in these isolated areas is supported with ground water. Significant acreages have been developed in the alluvial valleys of some of the major streams, particularly the Brazos River.

Until 1979, the statewide trend in irrigated acreage had been upward since the first historical developments, but the increase has not occurred at a constant rate. Some periods have shown rapid increases in irrigation development, while others have shown only slight increases (Figure 1). General economic conditions, technological improvements in irrigation equipment, climatic conditions, and other factors have influenced interest in irrigation and the development of irrigated agriculture in the State.

The agricultural census for the crop year of 1889 reported over 18,000 acres (about 7,300 ha) irrigated on 623 farms. By 1899, the area irrigated approached 50,000 acres (20,000 ha) on 1,325 farms. Comparatively rapid development occurred during the period 1900-09. The area irrigated in 1909 was about 451,000 acres (183,000 ha).

Development was much slower from 1910 to 1929 when about 594,000 acres (240,000 ha) were irrigated. Irrigated acreage increased by about 301,000 acres (122,000 ha) during the next 10 years. The census for 1939 reported nearly 895,000 acres (362,000 ha) irrigated. Particularly rapid irrigation development followed the end of World War II. The 1949 census of agriculture reported 3.1 million acres (1.3 million ha) irrigated, and the 1958 irrigation inventory showed 6.7 million acres (2.7 million ha) irrigated. Subsequent inventories reported 7.7 million acres (3.1 million ha) in 1964, 8.2 million acres (3.3 million ha) in 1969, and 8.6 million acres (3.5 million ha) in 1974. By 1979, the area irrigated in the State was 7.8 million acres (3.2 million ha) as was found in the 1979 irrigation inventory (Figure 1).

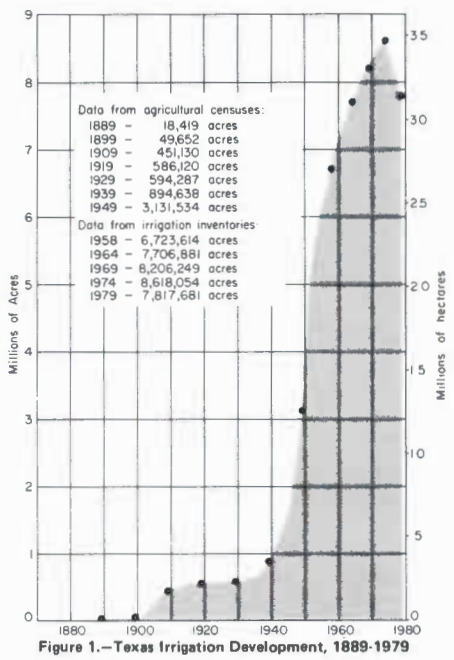

Figure 1.—Texas Irrigation Development, 1889-1979

The history of irrigation in Texas has recorded some failures because of inadequate water supply, poor water quality, poor soil conditions, inadequate irrigation systems, or inefficient water management. On the other hand, successful irrigation enterprises have been developed in every area of the State including the eastern humid areas.

Irrigated agriculture was vital to the existence of the early historical settlements, especially those in the arid sections of the State. Today, irrigation plays a significant role in the agricultural economy of the State. The irrigated cropland harvested in 1948 amounted to about 10 percent of the State's total harvested cropland and accounted for about 30 percent of the value of crops produced (Hughes and Motheral, 1950).

In 1957, a year of above average rainfall, approximately 42 percent of the total value of all the principal crops grown in Texas was produced on the 18 percent of the harvested cropland which was irrigated. Data for 1979 indicate that cash receipts from crop production statewide was approximately $3.9 billion. Of this amount, receipts from irrigated crops was estimated at over 50 percent of total crop production from an estimated one-third of the total cropland in the State.

Maintaining water conditions in the soil favorable to plant growth continues to be an especially important requirement in the arid and semiarid parts of the State where the rainfall is variable as to amounts and seasons of occurrences, and where most crops cannot be grown without irrigation water. In other cases, the risk without irrigation water is too great for viable, long-term farm enterprises.

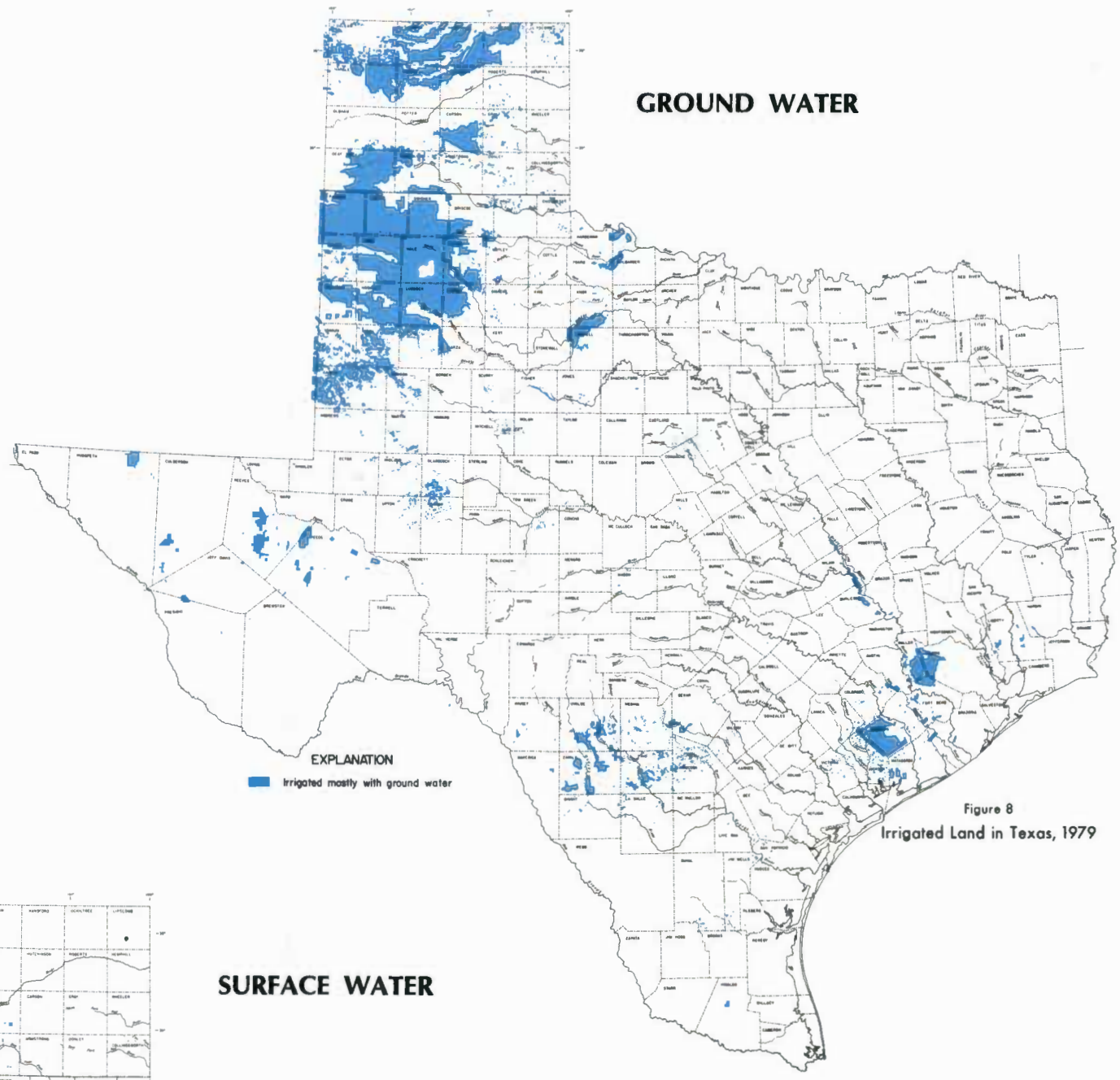

Figure 8
Irrigated Land in Texas, 1979

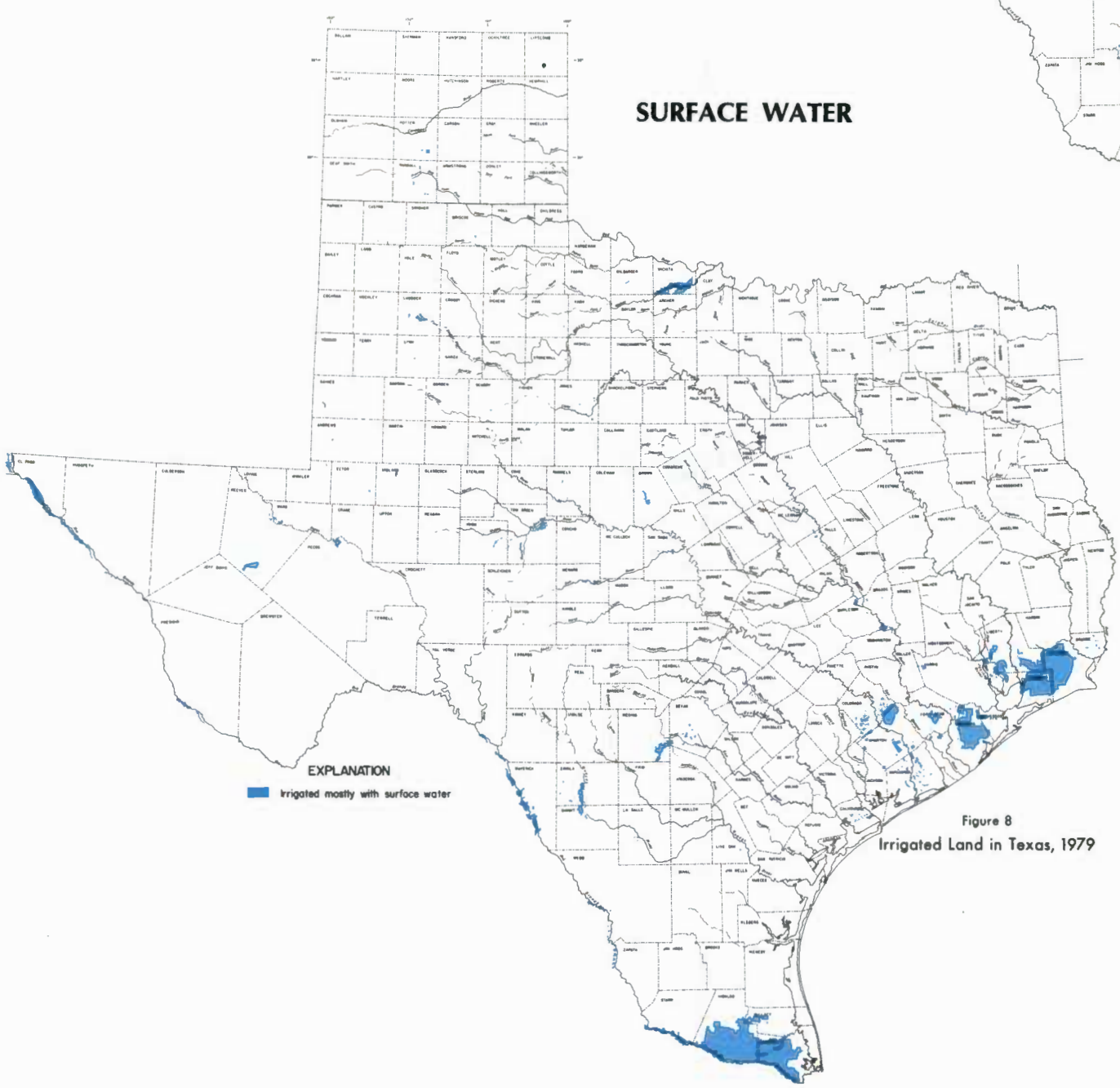

Figure 8
Irrigated Land in Texas, 1979

This section is extraced largely from a Texas A&M University publication, Agricultural Resources Related to Water Development in Texas, *March 1968.*

Texas 2000 Commission Reports

(continued from page 1)

droughts and devastating floods, demonstrate that we must pay more attention to the development and protection of our water resource supplies as our population and economy grow.

Over the next two decades Texas cities and water authorities will need to invest in a wide range of facilities to supplement existing water supplies and meet the growing water needs of cities, business, and industry. According to the Texas Department of Water Resources estimates, the sewage treatment, flood protection, and water supply projects will cost approximately $30.2 billion through the year 2000.

In addition, the future of Texas' important agricultural sector is dependent upon the availability of adequate water supplies for irrigation.

Thus, water conservation, quality protection and development financing activities need to be accelerated to avert a water crisis in Texas. An aggressive planning effort, backed by implementation authority, is a major first step.

WATER RECOMMENDATIONS

The Commission recommends that:

1. A statewide water plan be developed, adopted, and implemented as soon as possible. A plan should include a priority list of surface water development and transfer projects, with options for interjurisdictional (including interstate and international) transfers; water-sharing mechanisms witnin use categories for times of short- and long-term shortages; a mechanism for allocating water under the preference list in Section 11.024 of the Texas Water Code; conservation strategies; water quality protection strategies; and financing strategies for water development, conservation, treatment, and quality control.

   Rationale
   - The State needs a revised water plan developed with input from all regions and sectors of the State, so that water needs are met in an orderly and just manner.
   - Given the projected growth of Texas over the next 20 years, competition for water resources will increase greatly.
   - Major water projects require lead times of 15 to 30 years.
   - Meeting Texas' long-term requirements is likely to necessitate importing water. Importation is feasible only if a willing seller exists and if it receives the support of industrial and agricultural users.
2. The State design and implement a financing strategy for the plan called for in the preceding recommendation.

   Rationale
   - Very large investments in a wide range of water projects will be needed over the next two decades.
   - Local bonding arrangements and federal funding, currently the two main sources of funding, are inadequate.
3. Authority be granted to the Texas Department of Water Resources to initiate, sponsor, or undertake water development projects that involve interbasin transfers of floodwater, floodwater in storage, water in conservation storage and joint use of conveyance facilities and reservoirs in accordance with a State water plan.

   Rationale
   - If a local government is unable to undertake a needed major water project, there is currently no authority for the State to do so.
   - Population growth patterns and political jurisdictions do not always coincide with the location of water resources. New legal and institutional arrangements to overcome these differences are needed to meet the State's future water needs.
4. The Texas Department of Water Resources be authorized to develop and implement a statewide system for groundwater management. This should be done as part of the revised water plan in cooperation with the special districts in Texas that currently have management responsibility for underground water.

   Rationale
   - Management of groundwater is necessary to prevent subsidence, saltwater intrusion, other mineral and pollutant intrusion, aquifer damage, and total aquifer depletion — all factors which affect more than each individual landholder.
   - Using aquifers to store floodwater and recharging aquifers with wastewater are actions which are needed, but are now outside the scope of traditional water law and thus require new management strategies.
   - Groundwater quality varies considerably, and proper groundwater management would ensure that the lowest quality ground water be substituted where feasible. This would encourage the most appropriate use of potable groundwater.
5. The State increase financial support for research and assist in technology transfer in the areas of desalinization, weather modification, aquifer geology and mechanics, water quality enhancement, conservation methods, water reuse and recycling, economies in agricultural water use, and water treatment process improvements.

   Rationale
   - Water-related R&D can lead to increased water availability and new methods to protect and efficiently use current supplies.
   - Long lead times needed to find solutions to many water problems require that investment in R&D be stepped up immediately.

ARTHUR DUGGAN, JR.

WATER RIGHTS PIONEER DIES

Texas lost a great friend and advocate for individual water rights with the death of Arthur P. Duggan, Jr., in Austin on March 25th. Arthur, 71, an attorney, a civic leader, and a man of much wit and wisdom, leaves a legacy of monumental contributions to the state's water history. He helped shape its destiny.

Duggan, the son of the founder of Littlefield, was born in Denton, Texas. His family moved to Littlefield when he was two years old. He attended Littlefield schools until his junior year when he transferred to the New Mexico Military Institute before graduating in 1928. Arthur received his BBA degree from the University of Texas at Austin in 1932 and his Law degree in 1935. He practiced law in the capitol city for eight years, it was then that he met and married Josephine.

During World War II, Arthur was associated with the Federal Bureau of Investigation from June 1941 to March 1946. For a year and a half during that time he was assistant Legal Attache and Legal Attache in the Dominican Republic.

After the war, Duggan returned to Littlefield, where he opened his law practice and became involved in his community. It wasn't long before his community concern led him into the fight for individual water rights.

He drafted the legislation that declared a landowner's right to the water under his property for beneficial use, and it was his work that resulted in the bill passed by the 1949 Texas Legislature declaring groundwater as private property. Arthur was also responsible for much of the research and the draft proposal which resulted in the state legislation providing for the creation of ground water conservation districts.

In 1976 Governor Dolph Briscoe appointed Arthur Duggan as Compact Commissioner to represent Texas on the Canadian River Compact Commission where he served for over five years. In 1980 the West Texas Chamber of Commerce named Arthur as chairman of its water and natural resources committee.

He has been a past president of the Littlefield Rotary Club, a member of the West Texas Chamber of Commerce, the American Bar Association, the State Bar Association and the Texas Water Conservation Association. Arthur served on TWCA's water laws committee.

In recent years, Arthur P. Duggan, Jr., dedicated a plot of land from the original family home site in Littlefield to construction of a new Lamb County Library. A Lamb County Memorial Library Fund has been established, and the Duggan family requests that memorials be made in the form of contributions to the fund in care of Mrs. Tena Wicker.

Arthur is survived by his widow, Josephine; two sons, Alex Duggan of Fort Worth and George Duggan of Santa Monica, California, a daughter, Sallie Strickland of Austin, five grandchildren and a sister, Mrs. David C. Gracy of Austin.

THE CROSS SECTION (USPS 561-920)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

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THE Cross SECTION

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Water District Board Funds Urban Studies

The High Plains Water District Board of Directors has committed a total of $55 thousand dollars to water related research at the Texas Agricultural Experiment Station at Lubbock in 1982. The Texas Department of Water Resources is also providing funds in partial support of urban water conservation research. The Experiment Station has received approval for funding grants to four proposals, including continuing research with plant growth regulators, beef tallow, and lawn water application and irrigation scheduling.

During 1980 and 1981, the High Plains Water Conservation District No. 1 partially funded studies to determine the effect of the growth regulator PIX on the water relations and yield of cotton on Producers Farms. Although the two years were different in climate, there were trends concerning the use of PIX during both years. It is very important to have good moisture conditions from the time PIX is applied until peak bloom. Conditions which adversely affect positive effects from PIX include high plant populations (greater than 50,000 plants/A), irregular stands, stress during PIX application, and irrigation water distribution. Since the climate of the Texas High Plains is so variable such studies should be continued for a minimum of three years to determine the climate and soil moisture conditions under which results from PIX can be expected. One study proposes to continue the studies initiated in 1980 with the objective to determine the influence of PIX on the water relations and yield of cotton grown on Producers Farms.

There were several promising findings from the plant growth regulator studies conducted during the 1981 growing season. One of these was the enhancement of PIX absorption in cotton leaves. It was found that under certain conditions a substantial (20-80%) increase in uptake can be demonstrated when PIX is applied with surfactant. This may represent a significant enhancement of PIX effectiveness or a capability to reduce chemical application costs. Some effect was obtained in experiments conducted with sorghum leaves but the surfactant treatments were considerably less effective (20%).

The continuation of the influence of water availability studies confirmed results obtained in studies from previous years. The data show the dependence of PIX effectiveness on adequate water supply during the period from first square appearance to full bloom. If PIX is applied to a crop with an extended period of water stress, then yield reductions are probable.

Additionally, a third development was realized from the 1981 studies. That is the possible improvement of crop yield when PIX is applied prior to or following severe hail damage. It appears that PIX, when applied before and following severe hail damage, may significantly improve lint yield.

The results from 1981 are enlightening and encouraging the prospects for utilization of plant growth regulators in this area. Objectives in the plant growth regulator research program for the 1982 season will be:

1) To continue the evaluation of PIX absorption as influenced by surfactants.

2) To further test the possibility of PIX utilization in monocots (e.g. grain sorghum, corn, etc.)

3) To gain information on the influence of the time of day of application upon plant growth regulator activity.

4) To evaluate additional plant growth regulators that are released for experimental work and that have potential for improvement of crop production in this area.

In the past, tallow alcohol has been shown to suppress soil water evaporation, but the material was not water soluble. During 1980, water soluble tallow emulsions were developed for use as antitranspirants on potatoes. In 1981 a study was initiated to determine the effect of tallow on soil water evaporation and infiltration. From the studies, it was found that 2,800 lbs/A of tallow saved 1-2 inches of water following major rains but decreased infiltration. The objectives of a third research study are:

1. To determine the effect of tallow emulsions on seedling emergence of small seeded vegetables.

2. To determine the minimum application rate of tallow that will suppress soil water evaporation.

continued pg. 2, col. 3 . . . URBAN

DIKING DECISIONS—As more producers take to the field with different row damming devices, studies continue to find the best techniques. Variables, such as tractor speed, spacing, height, erosion, and irrigation, are being considered.

Scientist Gives Lawn Water Use Advice

EDITOR'S NOTE: *This is the second of a three part report on continuing research in urban water conservation to evaluate lawn sprinklers, watering habits, and growth regulators on common Bermudagrass in West Texas. The studies are conducted at Lubbock's Texas Agricultural Experiment Station by Dr. Charles Wendt and associates. (See story, March 1982* Cross Section, *part one.)*

Recent studies of lawn water application have shown that lawns are irrigated with amounts ranging from 80 to 156 percent of their actual water requirements. Little has been reported on the water balance of lawns and how the balance is affected by watering patterns and soil types. Most studies are concerned with lawn water application rates compared to evaporative demand of the atmosphere and measurement of evaporation losses. The water balance of a lawn is: the water-in ratio is equal to the water-out. Water-in includes rainfall and irrigation water. The water-out is: the water lost to turf through runoff, deep percolation, evaporation from the soil or turf surface, or through transpiration or

continued pg. 4, col. 1 . . . LAWN

Rainfall Probabilities Noted

In evaluating your present soil moisture condition and estimating how much water your crops will need during the growing season, the probability of rain becomes very important. The following are monthly precipitation probabilities for the cities of Lubbock, Amarillo, Plainview and Muleshoe, Texas. These derived figures are provided by the Texas Department of Water Resources and are based on 51 years of National Weather Service precipitation data (1930-1980).

The specific data in the Table indicates the percent of the time when the corresponding precipitation quantity or larger quantities can be expected to occur during the month indicated. However, these figures were derived without the benefit of information about precipitation during the month prior to that for which the estimate is made. These probabilities may be improved if prior month data were included in the calculations. For example, if Lubbock recorded a three inch rainfall for July then it is likely that the probability of August recording two inches or more of rainfall may be better than the indicated 47 percent due to persistance of weather regimes.

The Rainfall Probability Table will give you an indication of your chances of getting all or a portion of the moisture needed to fill your soil profile from seasonal rains.

(See TABLES Page 3)

'Shorty' Fits Job

Eldon "Shorty" Lancaster is an ex-farmer who is combining his wealth of knowledge about the farm with a growing body of technical data and using it to assist irrigators with water conservation management.

He was born and raised on a farm in Lynn County, started out farming on his own at 20, and says he's farmed most all his life in and around Hale Center and Lubbock with irrigated cotton, grain sorghum and some wheat. He raised four sons to be good farmers and started them off on their own. And when he wasn't farming or fishing, he says he was teaching himself to be a mechanic.

"You couldn't afford to pay someone to come in, so I taught myself by working on those old irrigation motors," says Shorty. Now he can fix just about anything, and does.

In 1978 Shorty quit farming and turned to his skills as a maintenance mechanic. He worked for a Lubbock investment firm until last year when the Water District needed an engineer field technician with a strong farming background. Shorty fit the job like a glove. He spends most of his time out in the field, working on the pre-plant soil moisture monitoring program, the district's furrow diking survey project, and in putting down soil moisture monitoring devices and helping farmers benefit from the knowledge to be gained by their use.

THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

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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.

URBAN PROGRAM PROPOSED

(continued from page 1)

3. To determine the potential of antitranspirants for cotton.

In 1981 an Urban Water Conservation program was initiated at Lubbock. The initial studies were to evaluate the influence of growth regulators and irrigation scheduling on water use efficiency and sprinkler application efficiency. Some of the growth regulators showed promise to modify growth and enhance water use efficiency. However, above average rainfall beginning in late July prevented a thorough evaluation of the influence of growth regulators on water use efficiency. At the end of the season, plots treated with growth regulators had 1-3 inches less water than the untreated plots. The same is true for irrigation scheduling. Although different amounts were applied at different times, the rainfall prevented any conclusions concerning irrigation scheduling. All of the sprinkler systems evaluated had high losses up to 70% of water applied to evaporation even though neither the calculated potential evapotranspiration nor pan evaporation exceed 0.3 inches per day, compared to 0.5 inches per day in the early summer. Windspeeds did not exceed 7 mph. Further evaluations are needed at high evaporative demands and windspeeds. To obtain further information on growth regulators, sprinklers, irrigation scheduling, and other approaches to increase the water use efficiency of turf grass, a program with the following objectives is proposed.

1. Determine the residual effects of growth regulators on growth and water use efficiency of turf grass.
2. Evaluate the effects of different rates of the more promising growth regulators on growth and water use efficiency of turf grass.
3. Determine sprinkler losses under high evaporative demand and windspeed conditions.
4. Determine the water budget of the various sprinkler systems.
5. Determine the influence of irrigation scheduling on the water use efficiency of turf grass.
6. Determine the application efficiency of a new irrigation system for applying water to turf grass.
7. Determine the water use efficiency of different species of turf grass.

RAIN-OUT SHELTER—Covers turf grasses in continuing research.

2000 Report Revealed

EDITOR'S NOTE: *This is the second of seven statements to be presented for our readers taken from the Texas 2000 Commission Report and Recommendations on major economic development issues. This report was received by Governor Clements in March. (See* Water "Chief Concern" *in April, 1982* Cross Section.)

AGRICULTURE

Despite its 80% urban population, Texas is among the nation's leading agricultural states. Its $9.9 billion cash receipts for 1980 ranked third in the country. The Texas Agricultural Experiment Station estimates that the total impact of these receipts on the Texas economy was $33.7 billion. Export value of Texas agricultural products is approaching $2.2 billion—an amount that emphasizes the importance of the State's agricultural production to the national economy as well as locally.

These impressive agricultural statistics should not disguise the fact that Texas farmers and ranchers are enduring difficult times. Some of the hardships are cyclical, some are the result of government policies, and some have been induced by resource constraints such as the escalating costs of energy and transportation and declining water supplies. In addition, trends indicate that the rate of increase of agricultural productivity is declining. This decline in the rate of growth is a sign that the limits of widely employed agricultural technologies are being reached. Recognizing these hardships, the Texas 2000 Commission examined the long-term threats to the State's agricultural industry, separating those that arise from national policy from those that can be mitigated by action within the State.

The Commission carefully examined the State's role in agriculture, seeking information and direction from a variety of State agencies, producer organizations and individuals. Sources contacted by the Commission responded with near unanimity on the need for the State to ensure an adequate water supply for agriculture, to revise or remove onerous transportation regulations; to support research and extension; and to promote Texas food and fiber outside the state. Respondents also indicated that inflation and high interest rates have created major problems for farmers and ranchers, but obviously these rates can be altered only at the national level.

Although long-range prospects for the agricultural sector depend on many factors beyond the State's control, the State does have responsibility in many areas crucial to the agricultural industry. The following recommendations reflect the Commission's consideration of how the State can best support, protect and meet its obligation to the Texas agricultural industry.

Agriculture Recommendations

The Commission recommends that:

1. The Texas Legislature support increased agricultural research and development with the express purpose of increasing productivity and developing and introducing new agricultural technologies.

continued pg. 4, col. 2 . . . 2000 REPORT

Farmers Check Likelihood Of Rain

LUBBOCK WB.A.P. INDEX NO. 5411

Probability (in percent) of receiving rainfall during various months that is equal to or more than the amount stated.

Rainfall (inches)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.25	61	55	59	82	98	96	88	90	84	88	57	61
0.50	41	43	53	65	92	88	86	78	80	78	45	43
0.75	24	31	41	57	90	82	78	75	65	71	35	27
1.00	14	24	29	47	90	78	75	73	57	55	24	22
1.25	10	18	25	33	84	76	67	67	55	47	18	18
1.50	4	10	25	27	73	71	57	63	53	37	10	8
1.75	4	6	20	27	67	65	53	55	53	33	8	6
2.00	4	2	12	14	61	53	47	47	49	29	8	4
2.25	4	2	8	10	55	49	39	35	45	29	6	4
2.50	2	2	8	8	49	35	37	27	43	27	2	2
2.75	2		8	8	43	29	35	22	41	25		2
3.00	2		4	6	35	29	31	18	35	24		
3.25	2		2	4	29	27	20	16	33	22		
3.50	2		2		24	25	18	16	29	18		
3.75	2				24	24	16	14	20	18		
4.00	2				20	24	16	12	18	14		
4.25					16	18	10	10	16	10		
4.50					12	18	4	8	14	10		
4.75					12	16	4	8	14	6		
5.00					12	14	2	6	10	6		
5.25					12	12	2	4	8	6		
5.50					12	10	2	2	8	6		
5.75					12	6	2	2	6	6		
6.00					10	4	2	2	6	2		
6.25					10	4	2	2	6	2		
6.50					6	4	2	2	6	2		
6.75					6	4	2	2	4	2		
7.00					4	4	2	2	4	2		
7.25					4	4		2	4	2		
7.50					4	2		2	4	2		
7.75					4	2		2	2	2		
8.00					2			2	2			
8.25					2			2	2			
8.50					2			2	2			
8.75					2			2	2			
9.00					2				2			
9.25					2				2			
9.50					2				2			
9.75					2				2			
10.00					2				2			

PLAINVIEW WB.A.P. INDEX NO. 5411

Probability (in percent) of receiving rainfall during various months that is equal to or more than the amount stated.

Rainfall (inches)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.25	67	65	67	90	98	96	90	92	86	84	57	71
0.50	47	53	53	76	98	90	82	90	84	80	43	37
0.75	33	39	42	65	92	82	76	84	80	61	37	29
1.00	22	29	36	49	88	80	64	75	75	53	29	24
1.25	16	14	26	39	76	80	64	69	59	49	20	20
1.50	12	6	18	33	69	74	58	59	57	39	18	18
1.75	8	4	16	25	67	64	58	51	49	35	10	12
2.00	6	2	10	24	59	64	50	43	45	25	4	10
2.25	4	2	8	20	59	54	38	39	41	24	2	8
2.50	2		2	16	53	50	38	35	33	20	2	6
2.75	2		2	10	51	48	34	29	31	20	2	2
3.00	2		2	8	47	46	30	22	31	18	2	
3.25	2			6	35	40	30	14	31	14		
3.50	2			6	33	34	26	14	22	14		
3.75	2			4	29	34	20	10	16	14		
4.00				4	27	34	20	10	14	14		
4.25				2	25	32	16	8	14	12		
4.50				2	22	28	14	6	14	12		
4.75				2	20	20	14	6	12	10		
5.00				2	20	14	12	6	6	8		
5.25				2	16	10	10	6	6	8		
5.50					16	10	6	6	4	6		
5.75					14	6	6	6	2	6		
6.00					12	6	6	6	2	2		
6.25					10	4	6	4	2	2		
6.50					10	2	6	2	2			
6.75					10	2	2	2	2			
7.00					8	2	2	2	2			
7.25					4		2	2				
7.50					4		2	2				
7.75					4		2	2				
8.00					4		2	2				
8.25					4		2					
8.50					4		2					
8.75					2		2					
9.00					2		2					
9.25					2		2					
9.50					2		2					
9.75					2		2					
10.00					2		2					

AMARILLO WB.A.P. INDEX NO. 5411

Probability (in percent) of receiving rainfall during various months that is equal to or more than the amount stated.

Rainfall (inches)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.25	67	67	73	86	96	96	94	98	94	86	67	69
0.50	45	47	53	75	94	94	94	96	80	73	41	37
0.75	25	25	35	63	92	90	84	90	71	65	33	27
1.00	18	18	31	53	84	86	76	86	59	49	20	14
1.25	12	12	24	43	80	84	75	86	57	37	16	6
1.50	10	8	18	35	75	80	63	78	53	33	12	4
1.75	6	6	14	25	75	73	55	67	43	27	10	4
2.00	6	2	14	18	61	65	45	61	41	27	10	4
2.25	4	2	12	12	57	55	39	51	35	27	8	4
2.50	2	2	10	6	53	53	37	49	27	24	4	4
2.75		2	6	2	49	51	37	49	24	14	4	4
3.00			2	2	39	45	27	47	20	14	2	4
3.25			2	2	33	41	25	41	18	12	2	4
3.50			2	2	31	35	22	33	16	10	2	4
3.75			2		27	33	20	33	16	10	2	4
4.00					25	31	18	22	14	10		2
4.25					20	22	14	22	10	10		2
4.50					16	16	14	22	6	10		2
4.75					14	14	14	18	2	8		
5.00					12	12	14	14	2	6		
5.25					12	10	10	8		6		
5.50					12	10	10	6		6		
5.75					12	10	10	4		4		
6.00					10	10	10	4		4		
6.25					10	10	8	2		2		
6.50					8	10	8	2		2		
6.75					8	8	6	2		2		
7.00					6	8	6	2		2		
7.25					6	8	6	2		2		
7.50					6	8	4	2		2		
7.75					4	6						
8.00					4	6						
8.25					4	6						
8.50					4	6						
8.75					4	6						
9.00					4	6						
9.25					2	4						
9.50					2	4						
9.75					2	4						
10.00						4						

MULESHOE WB.A.P. INDEX NO. 5411

Probability (in percent) of receiving rainfall during various months that is equal to or more than the amount stated.

Rainfall (inches)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.25	61	65	56	74	96	94	96	94	88	74	62	56
0.50	49	45	37	58	82	86	90	88	80	70	45	35
0.75	25	21	23	50	76	80	86	80	74	58	35	21
1.00	16	14	18	43	69	78	75	76	67	49	24	18
1.25	10	8	14	33	61	69	69	73	61	37	18	14
1.50	10	4	10	25	55	67	65	71	59	31	14	6
1.75	8	2	6	22	43	63	61	55	51	25	8	4
2.00	2		4	12	37	49	51	43	39	24	8	2
2.25	2		4	10	33	47	41	37	39	20	2	2
2.50			4	6	29	41	33	37	33	16	2	2
2.75			2	6	27	35	29	33	29	16	2	2
3.00			2	4	24	29	24	27	25	14		2
3.25				4	18	27	20	25	20	12		2
3.50				2	16	24	14	22	10	12		
3.75					14	24	12	18	10	12		
4.00					10	22	12	16	8	12		
4.25					10	18	10	16	6	12		
4.50					8	12	10	16	6	12		
4.75					8	10	10	10	4	10		
5.00					8	10	10	10		4		
5.25					8	10	10	8		4		
5.50					8	6	10	8		2		
5.75					6	6	10	8		2		
6.00					6	4	8	8		2		
6.25					6	4	6	6				
6.50					6	4	4	6				
6.75					6	4	4	4				
7.00					4	4	2	4				
7.25					4	2	2	2				
7.50					2	2	2	2				
7.75					2		2	2				
8.00					2		2					
8.25					2		2					
8.50					2		2					
8.75					2							
9.00					2							
9.25					2							
9.50					2							
9.75					2							
10.00					2							

LAWN WATERING . . .

(continued from page 2)

evaporation of water from the plant leaves after being added to the soil, and the change in stored soil water.

Dr. Charles Wendt and his research team at Lubbock's Texas Agricultural Experiment Station compared three different irrigation regimes on water use efficiency in turf, and examined the water balance of the traveling home lawn sprinkler, in order to further determine the water use efficiency of urban water sprinkler systems.

Previous research has shown that turf uses water at a rate greater than 80 percent of pan evaporation if adequate water is available. Dr. Wendt's studies for this area of West Texas measured evaporation losses from lawn sprinklers at over 300 percent of pan evaporation. While the application efficiency of urban lawn sprinklers in West Texas was commonly found to be less than 30 percent. Much of the loss and inefficiency is caused by poor distribution, high evaporation and climatic conditions. However, tests were also conducted to measure runoff and the frequency of irrigation as it affected soil moisture storage and sprinkler application rates. The data suggests the desirability of matching sprinkler systems to soil types, and emphasized the need for certain irrigation practices for optimum water use by the turf and best use of any rainfall.

Runoff from lawn sprinklers is avoidable if the water infiltration properties and moisture holding capacity of local soil types are considered. For example, sandy soils such as those south and west of Lubbock will absorb water at a rate of 7 to 10 inches per hour for the first 30 minutes and then from one to one and a half inches per hour after that. The research data suggests any of the urban sprinklers tested could be used on these soils without any runoff problems.

Loam and fine sandy loam soils in the Lubbock area have an infiltration rate of 4 to 5 inches per hour for the first 30 minutes, but decrease to a rate of .3 to .7 inches per hour after 30 minutes. For short irrigation periods up to three hours, there would be no runoff with any of the tested sprinklers. However, for longer irrigations there could be runoff with the rotating, buried head and ring type sprinklers. This could explain some of the runoff in Lubbock from lawns irrigated with permanently installed solid set sprinkler systems that commonly use buried head nozzles. It is doubtful if there would be any runoff from the traveling sprinkler since it applies approximately a half inch of water as it travels through the area of application.

The clay loam to silty clay loams have an infiltration rate of 2 to 4 inches per hour for the first 30 minutes after which the rate decreases to .1 to .4 inches per hour. For short periods of one to two hours, any of the sprinklers could be used without runoff. As with the loam and fine sandy loam soils, there could be runoff problems with rotating, buried head and ring sprinklers when irrigating for longer periods of time. There would probably be no runoff with the traveling sprinkler, however it must be reset to apply sufficient water. For instance, to apply three inches of water with the traveling sprinkler would require irrigating the same area six times.

Studies to determine the influence of irrigation water regimes on water use efficiency in common Bermudagrass compared patterns of wet or heavy, infrequent watering to medium and to dry or light, frequent watering patterns. Soil water storage readings showed that the wet water regime was much more effective in storing rainfall than the medium and dry regimes.

The data emphasizes the need to use infrequent heavy irrigations to make best use of rainfall. If rain is received on a profile that had adequate moisture storage so that unsaturated water flow can occur, the water from the rain moves deeper into the soil profile and less water is lost to evaporation. Irrigations that wet the soil to a considerable depth also encourage deep rooting and result in more vigorous high quality turf.

CONSERVATION CHIEF—Newly appointed Soil Conservation Service Chief Peter Myers visited the High Plains in late April to view water conservation methods. Among other things Myers, center, saw James Mitchell's low pressure center pivot system near Wolfforth and a mobile irrigation evaluation trailer.

2000 REPORT . . .

(continued from page 1)

Rationale

- Remarkable gains in productivity of U.S. and Texas agriculture can be attributed in large part to past R&D efforts.
- Research provides more efficient ways to use water and energy resources for agricultural purposes.
- Research and development in promising fields such as genetic engineering and tissue culture will lead to new plant strains and improved livestock which will increase productivity.
- Continued R&D investments will be required to sustain productivity growth.
- A time span of two to ten years is normal for research efforts to produce operational results.
- R&D on the many uses for biomass is yielding economic benefits to the agricultural sector.

2. The State's promotional efforts be evaluated to determine if a more aggressive approach would improve export sales of Texas food and fiber.

Rationale

- The value of Texas agricultural exports has tripled since 1973, with agriculture continuing as a major contributor to the Gross State Product.
- The Texas Department of Agriculture (TDA) is helpful particularly to small producers and processors who do not have the assistance of commodity organizations.
- Producers and processors will continue to rely on TDA to support their foreign and domestic marketing efforts.

3. Regulations governing transportation of agricultural products within the State be evaluated for their economic impact on producers, processors, and transporters.

Rationale

- Transportation regulations may hurt Texas independent truckers.
- Controlled intrastate rates are alleged to put Texas products at a competitive disadvantage in the marketplace.
- Controlled transport rates may be higher than market-determined rates.
- Adjustments in weight allowances could assist farmers particularly during harvest.

4. The Texas Legislature and the Texas A&M Board of Regents direct the Agricultural Extension Service to prepare and implement a targeted educational campaign to provide up-to-date water conservation information to all farmers and ranchers.

Rationale

- Conservation of water will extend existing water resources and will lower energy consumption.
- Effective water conservation techniques have been developed but are not widely in use.
- The Texas Agricultural Extension Service has the network and resources to undertake this campaign.

5. The State legislature and Texas A&M Board of Regents direct the Texas Agricultural Extension Service to concentrate more of its resources on meeting critical needs of the agricultural sector. These needs include technical assistance on efficient agricultural production, efficient use of limited water and energy resources, and introduction of new technologies.

Rationale

- Much of the information and many of the services provided by the Agricultural Extension Service are available from other public agencies or the private sector.
- General consumer information is widely available to rural populations through the media.
- The Texas Agricultural Extension Service receives 70% of its funding from the State.
- After fulfilling basic obligations to mandated programs, the Agricultural Extension Service should use the remainder of its appropriation for meeting these critical needs.

6. The agricultural sector participate in the development of a statewide water plan.

SECOND CLASS PERMIT

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

THE Cross SECTION

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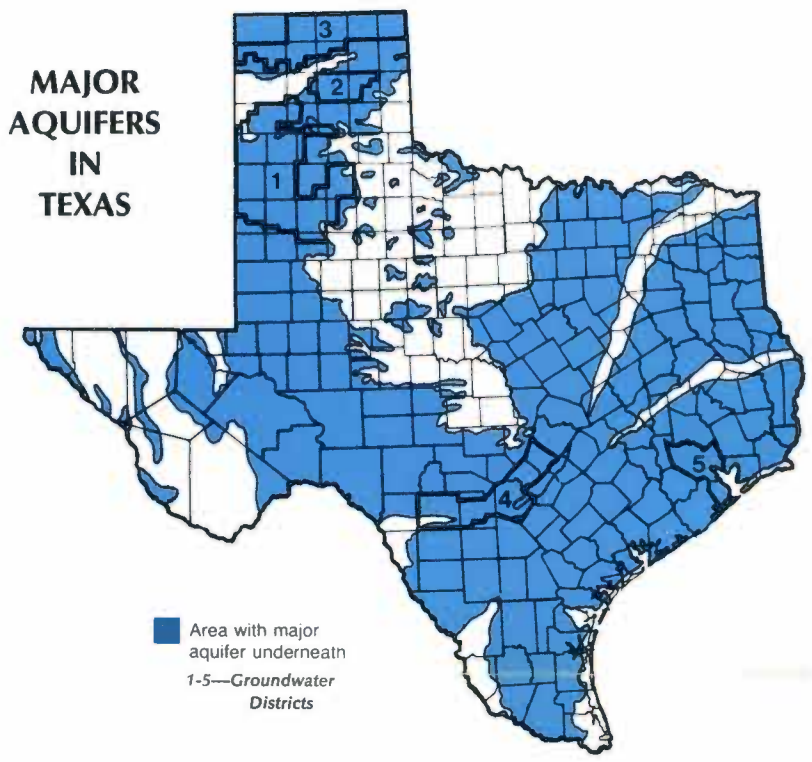


Precipitation Enhancement Increases Crop Yields

by Kathleen Davis

Though a weather modification project started 11 years ago by the Colorado River Municipal Water District in Big Spring was intended to increase runoff in area lakes for urban uses, cumulative data more clearly shows agricultural benefits.

O. H. Ivie, CRMWD general manager, said the district first started a "cloud seeding" project in April 1971 because "we needed to assure that there would be ample supply of water" for several surrounding municipalities.

CRMWD supplies municipal water to Odessa, Midland, Big Spring and Snyder with some contracted to San Angelo and Robert Lee. The supply reservoirs, Lakes J. B. Thomas and E. V. Spence, were "nearly empty" in 1970 when the district decided to begin the project, Ivie noted.

But after 10 years of injecting silver iodide into potential rain - making clouds, the district's meteorologist Ray Pat Jones compiled figures that "further support the suggestion that cloud-seeding is reflecting greater cotton yields in the target areas.

In fact, Jones reported, increased yields of 52 percent in 1971-80 over the 1940-70 base period were noted in the target area, including Borden, Scurry, Howard and Mitchell counties.

Ivie believes cloud seeding to enhance rainfall, not suppress hail, results in 10-15 percent more water out of a cloud. But, he said, more funds and research are necessary to prove that statement.

"I believe we are already there. But we have worked for years to scientifically prove that rainfall increases and to what extent," Ivie said. "We are in the process of proving it now."

The district's weather modification department, consisting of a pilot, meteorologist and rain gauge technician, stands ready from April through October to seed clouds.

Scattered across the target area and upwind and downwind sections, are a "mass distribution" of recording gauges as well as "fence post-type" gauges, Ivie said.

When CRMWD's meteorologist predicts seedable clouds may develop during the day, Ivie said, the team readies the district's twin engine plane with 12 silver iodide flares on each wing. Ivie said a smaller amount of the chemical is used than when trying to suppress hail.

When the right clouds are present, the flares burn within the updraft of the cloud, carrying inside "trillions of nuclei" similar to nuclei that would naturally form rain drops, Ivie explained.

As the nuclei gather moisture-laden air into the cloud, causing it to grow, the pilot continues to seed, the cloud grows more and hopefully it will rain more, Ivie said.

continued on page 4 . . . PRECIPITATION

IS GROUND-WATER LEGISLATION NEEDED?

Much has been said during the past year in meetings throughout the state about the need for state control of ground water. Most of those pushing for state control of ground water have only a vague idea of where ground water is being used and what changes in ground-water levels have actually occurred during the past decade period. The maps on pages two and three illustrate the appreciable changes in water levels from 1970 to 1980 in water table aquifers and in artesian aquifers in the state.

The reader will notice that only small portions of the water table aquifers in the state have had water-level declines in excess of 20 feet. However, in the artesian aquifers, principally the Trinity Group which extends from Austin north through Waco and Dallas to the Oklahoma-Texas border, water-level declines have been in excess of 100 feet. An artesian aquifer and a water table aquifer respond quite differently to similar withdrawals. An artesian aquifer will yield a much greater decline than a water table aquifer with the same withdrawal. It is not the intent of this article to explain the difference between water table and artesian aquifers, but to point out that there are many differences. It is also intended to point out that the greatest declines in water levels during the past ten year period have occurred in artesian aquifers.

The principal users of the Trinity aquifer are industry and municipal users. Irrigation development in the Trinity aquifer generally is located in the outcrop area. These maps should illustrate that the ground-water depletion problem is not occurring all over the state as some would lead you to believe, but only in certain areas of the state.

The rate of water-level declines in the Ogallala aquifer in the High Plains is decreasing due to the high cost of energy to pump water, the low prices currently being received for the commodities grown in the area and increased conservation techniques. From January 1980 to January 1981, the average decline in water levels in more than 900 wells measured annually by this District was 0.37 foot.

It is anticipated that recommendations will be made to the Texas legislature this session that the ground-water laws of the state be changed to allow for local control districts such as this district and provide that if these districts are not created by the local people, then the state should develop and enforce rules regulating the withdrawal of ground water. We hope that this article and the use of these maps will illustrate to our lawmakers as well as our readers that the problem is not as severe and critical as many would lead you to believe. Only small areas of the state have any appreciable decline of ground water. We would also hope that our lawmakers will consider the high agricultural productivity of the High Plains and its value to the state and our nation. In addition they should consider the high population and industrial development in the Trinity aquifer area and its contribution to the state before deciding to regulate pumpage of ground water to restrict water useage in these areas. Hopefully our lawmakers will additionally consider the fact that surface waters are available in the Trinity aquifer region to offset ground-water useage. The federal government has passed many laws regulating our people with little or no supportive data to justify the new laws which later prove to be unwarranted and unneeded. These mistakes have cost the American taxpayers billions of dollars. We would hope that our legislature would learn from federal mistakes and move carefully in their deliberations and not pass unnecessary laws until they know the problem and develop sensible solutions.

DISTRICT'S LAMB COUNTY OFFICE MOVED

Mr. George Harlan has assumed responsibility as Lamb County Secretary for the High Plains Underground Water Conservation District as of June first.

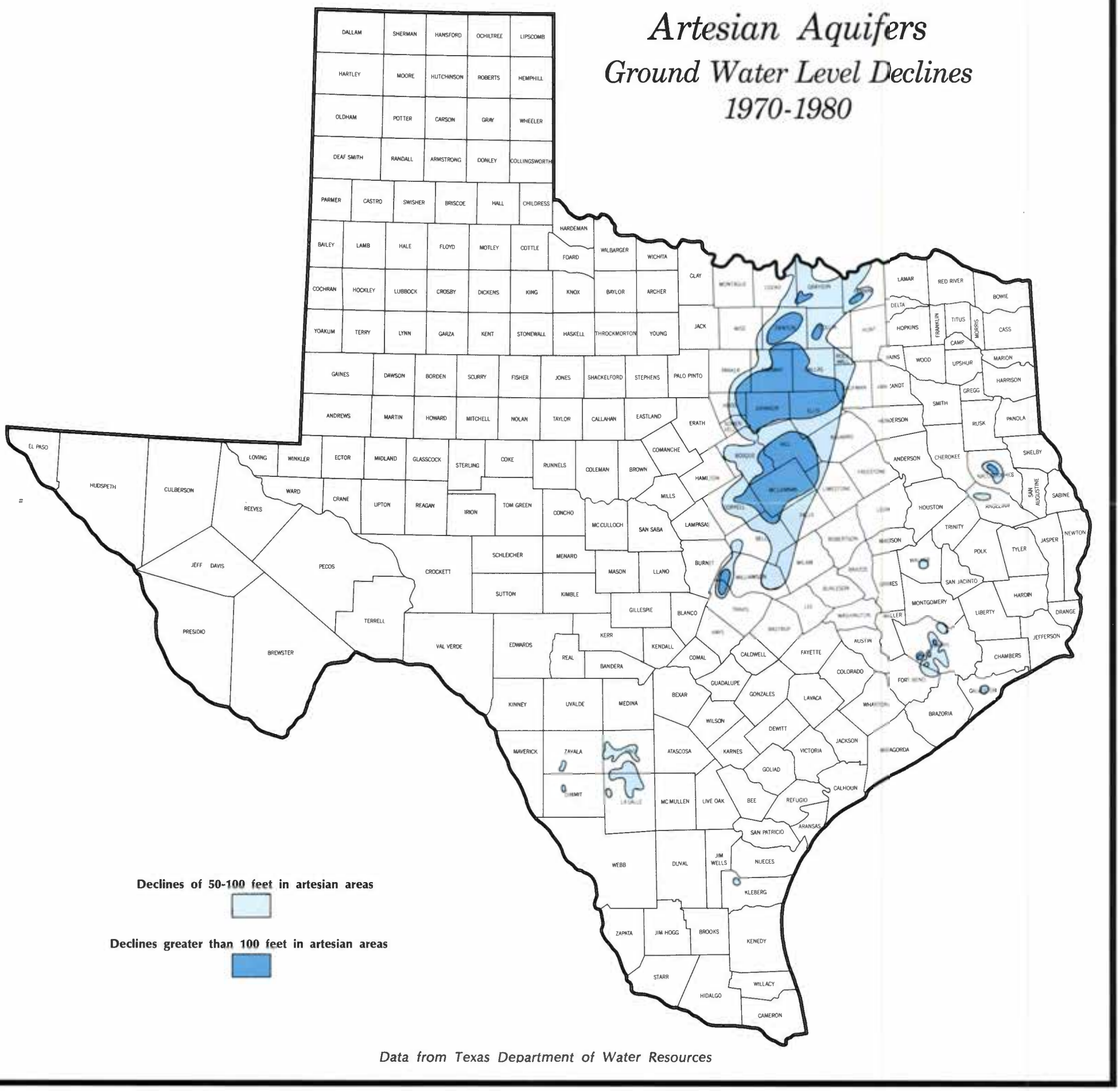
Mr. Harlan, a Littlefield real estate broker who also handles insurance and appraisals, is succeeding Robert and Sandra Richards who have handled the Water District's water well permitting and extension applications in Lamb County since 1976. The Richards are leaving Littlefield to continue work in Midland on a real estate venture.

The District Directors and Lamb County Committeemen extend their sincere appreciation to the Richards for nearly six years of service and association with the District, and wish them every success in their expanded business.

The new Lamb County Secretary's office for the Water District will be located at 103 East Fourth Street in Littlefield, at George Harlan's real

continued on page 4 . . . LAMB OFFICE

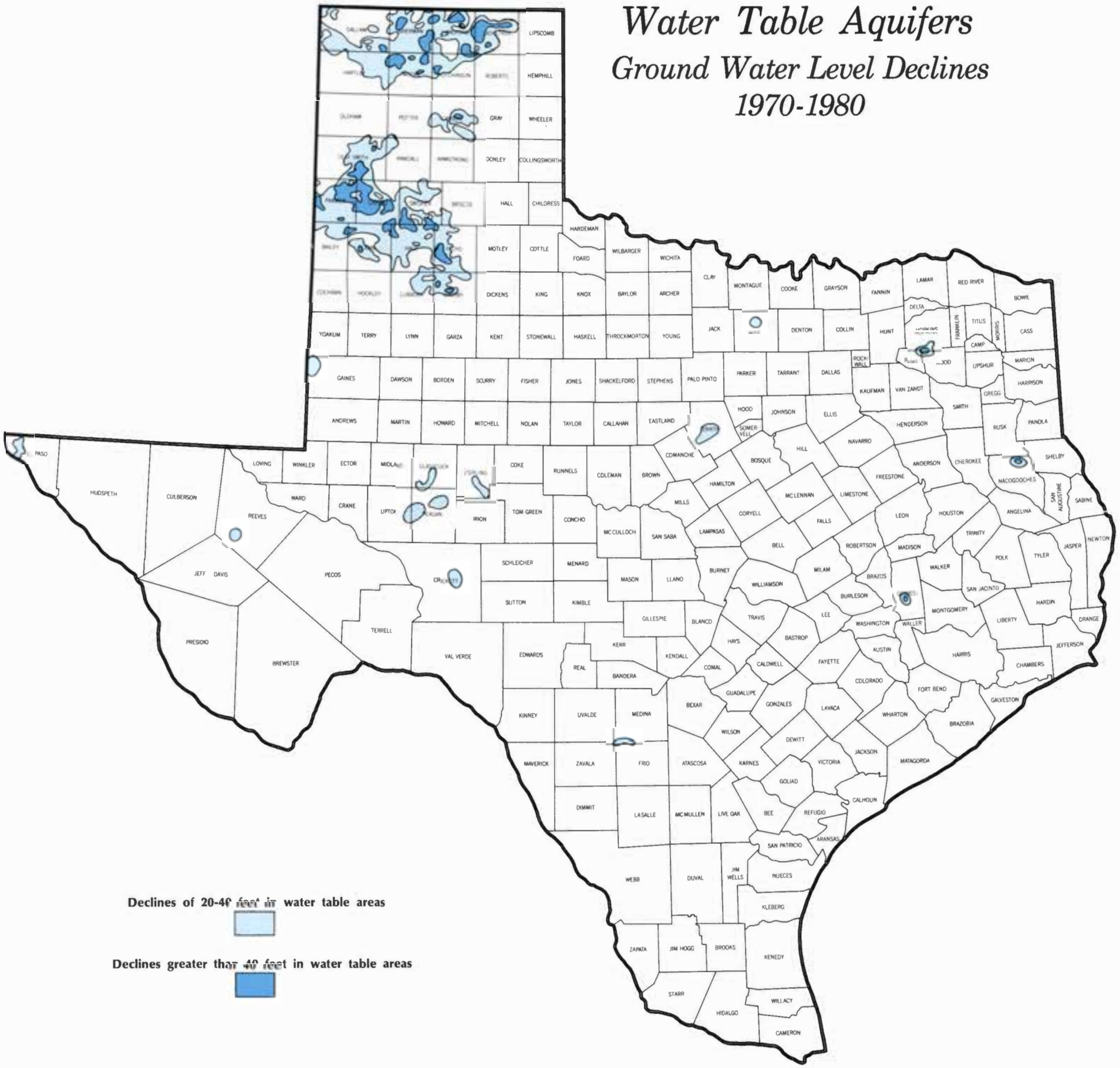
Artesian Aquifers
Ground Water Level Declines
1970-1980



Data from Texas Department of Water Resources

Water Table Aquifers

Ground Water Level Declines 1970-1980



Data from Texas Department of Water Resources

Hickory Water District Created

About one hundred local people from the counties underlain by the Hickory Aquifer gathered in Austin on Tuesday, June 8 at the Texas Water Commission offices to petition the Commission to create an underground water conservation district. During the public hearing the Commission heard local citizens' comments on the benefits and desirability for creation of the district. As a result of this public testimony, the Commission did grant the petition and formally create the Hickory Underground Water Conservation District.

The Hickory Water District was created in accordance with Section 59 of Article 16 of the Texas Constitution and Chapter 52 of the Texas Water Code for the purposes of: 1) formulating, promulgating and enforcing rules and regulations for the purpose of conserving, preserving, protecting and recharging the underground water of the underground water reservoir or subdivision thereof; and, 2) formulating, promulgating and enforcing rules and regulations to control subsidence and prevent waste of the underground water of the underground water reservoir or subdivision thereof.

The Commission, upon granting of the petition for creation of the water district, also appointed a temporary Board of Directors. The Board Members are: C. P. Rockwell of Brady, Russell Callan of Menard, Larry Lehmberg of Mason, W. Owen Parks of San Saba and Jay Mark Martin of San Saba. The Directors are now responsible for calling a general election for confirmation of the District by popular vote of the people in the counties involved, election of directors, and funding for the district. Upon ratification by popular vote of the people confirming creation of the district, it will serve all or portions of Kimble, Menard, Mason, San Saba, Concho, McCulloch and Llano Counties of Texas.

Airplanes used in cloud seeding project.

Need For Targeted Funds Discussed

Joseph Haas, Soil Conservation Service deputy chief for natural resources, and associate chief Gerald Seinwill, visited several key areas across the state in early June with hopes of gaining more understanding of the critical problems after their Texas trip.

"Many think the next crisis in this country will be the water supply," Haas said at a briefing at the High Plains Underground Water Conservation District.

"Water conservation is something that pays," he added. "If we can teach farmers how to conserve water and increase yields, it will be better for everyone."

Although Congress has not yet appropriated funds that will be targeted to key areas of conservation concern, area officials have asked for at least $400 million to be funneled to the Texas High Plains.

The proposed $400 million over a 10-year period would provide the cost-share programs and technical assistance necessary for continued achievements.

After viewing several innovations and experiments aimed at stretching the availability and use of agricultural water, Haas said the Texas High Plains appears to be an area with significant water needs.

The Illinois engineer, who has been with the SCS in Washington for 12 years, said most of the targeted funds probably will be used for soil erosion problems, flood prevention and water conservation.

"Because the area has a special need for water conservation, it should be important to concentrate some of the targeted funds here," he said.

In Lubbock, Haas viewed irrigation efficiency tests and equipment, furrow diking, modified pivot sprinklers and an experiment with beef tallow sprayed in the fields to reduce water evaporation.

PRECIPITATION . . . cont'd. from page 1

The increased crop yields in the targeted area are significant, the district believes, because that particular area had never surpassed cotton production for either the upwind or downwind area. But in seven of the 10 experimental years, Jones revealed, cotton in the cloud seeding counties did yield more than the other two areas.

The district manager predicted that precipitation enhancement will become increasingly important to area agriculture.

"It is inexpensive. It may cost 5 cents per acre," he estimated. "A group of farmers or a water district with the support of area producers could seed clouds in a particular area."

"We will continue to work in weather modification because we feel like it is important and someone in the state should be doing it," Ivie concluded.

LAMB OFFICE . . . continued from page 1

estate offices. George will accept applications for water well permits and extensions and provide well log forms. The new phone number in Littlefield is (806) 385-4265. Lamb County residents are invited to stop in and get acquainted with George and become familiar with some of the High Plains Water District's water conservation programs and services.

Mack Hicks of Levelland is the District Director for Precinct 2 representing Lamb County, and the five County Committeemen elected to serve in Lamb County include: P. A. Washington of Springlake, Jack Stubblefield of Spade, Larry Lockwood of Littlefield, Jim Brown of Olton, and Haldon Messamore of Sudan.

SCS Chief Myers Calls For Conservation Volunteers

Thousands of volunteers are needed to help battle soil erosion and other natural resource problems, Peter C. Myers, Chief of the U. S. Department of Agriculture's Soil Conservation Service said.

"Soil erosion is one of the most serious problems facing America today," Myers said. "People who will volunteer their time and talents to help the Soil Conservation Service and local soil and water conservation districts can put more conservation on the land while keeping federal costs down."

In the new volunteer program, authorized by the Agriculture and Food Act of 1981, people could perform a wide range of services on a part-time or full-time basis, such as aiding with:

— field surveys and layout of conservation practices;
— conservation education programs in schools, churches and clubs;
— training of high school, vocational and agricultural students for soil and land judging contests; and
— building or making use of outdoor learning areas with schools, scouts and other groups.

"Volunteers won't be paid, but they will find it is satisfying and interesting work," Myers said. "They would not be considered federal employees, but they will receive legal protection as well as insurance for any work-related injuries. Lack of such protection discouraged volunteer service in the past. The Soil Conservation Service had only a small student volunteer program under the Civil Service Reform Act.

Volunteers won't be used to displace current employees of USDA; we need all the trained conservationists we have," Myers said. "But volunteers can help us be more responsive to local needs without adding staff, and they can help free up more time for field employees to work directly with landowners on solving conservation problems."

Anyone interested in volunteering, said Myers, should contact the local office of the Soil Conservation Service or the local conservation district, usually in the county or parish seat.

Other information on how to become a conservation volunteer is available by writing: Soil Conservation Volunteer, c/o Deputy Chief for Administration, P. O. Box 2890, Washington, D.C. 20013.

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

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30 Inches Of Rain, Floods, Hail Destroy Millions Of Crop Acres

By KATHLEEN DAVIS
Avalanche-Journal Farm Writer

Within a few weeks, farmers in 76 counties of Texas, New Mexico and Oklahoma should begin receiving their portion of a $400 million disaster relief package implemented by Agriculture Secretary John Block.

Through a telephone hook-up, Block announced to about 100 farmers and agribusinessmen at the Lubbock Memorial Civic Center Thursday afternoon, July 15, that "because of the severity of the problem, we are taking this unusual action" in implementing a disaster provision in the 1981 farm bill.

Block told the audience and meeting moderators Gov. Bill Clements, Deputy Assistant Secretary John Ford and Undersecretary Frank Naylor that the plan contains four parts:

- Disaster assistance through grants.
- Inclusion of federal crop insurance policy owners in both the disaster program and the FCIC claims.
- Emergency disaster loans through the Farmers Home Administration.
- Emergency conservation funds to meet erosion problems.

But Block said the disaster payments are "the center portion" of the plan. The special disaster payments will include:

- Cotton, 20.5 cents per pound for crop losses in excess of 25 percent of the crop.
- Wheat, $1.75 per bushel for wheat losses in excess of 40 percent of the crop.
- Feedgrains, 15 cents per bushel for corn, 18 cents per bushel for grain sorghum and 15 cents per bushel for barley for any losses that exceed 40 percent of each of those three crops.

As Block completed his announcement, the audience stood to applaud the action.

Just as the losses sustained on the High Plains were unparalleled in area history, so was the major decision that came only nine working days after a special task force returned to Washington with a report.

Ford said the unprecedented decision came as it did because of the "serious damage and because John Block is a dedicated fighter for people in agriculture."

"Of course we all wish more money were available, but it is a generous response and a timely response," Clements said following the announcement. He said the money will become available as soon as farmers report to county Agricultural Stabilization and Conservation Service offices.

continued on page 3, col. 1 . . . DISASTER

A 60 day siege of heavy rain, hail and wind, cool temperatures and seedling diseases has wrought some of the most devastating crop damage to this area in twenty years. Parts of the Texas Plains area were under some kind of severe weather alert leading to massive agricultural crop destruction for 36 days during the months of May and June, according to Lubbock's National Weather Service office records. Texas Agriculture Commissioner Reagan Brown estimates growers' losses from weather in June at more than $686 million. This year's crop disaster comes on the heels of two bad years in a row: a drought in 1980 and low prices in 1981. Many growers were counting on 1982 crops for survival. Their futures seem even more precarious now.

BLOCK'S TASK FORCE toured the devastation with Lubbock County ASCS Executive Director Alan Mackey, State ASCS Rep. Wayne Mayfield, and Deputy Secretary of Agriculture John Ford.

Ag. Secretary JOHN BLOCK

The following counties are included in the contiguous area designated by the secretary of agriculture for disaster relief:

Texas: Andrews, Archer, Armstrong, Bailey, Baylor, Borden, Briscoe, Carson, Castro, Childress, Cochran, Collingsworth, Cottle, Crosby, Dallam, Dawson, Deaf Smith, Dickens, Donley, Fisher, Floyd, Foard, Gaines, Garza, Gray, Hale, Hall, Hansford, Hardeman, Hartley, Haskell, Hemphill, Hockley, Howard, Hutchinson, Jones, Kent, King, Knox, Lamb, Lipscomb, Lubbock, Lynn, Martin, Mitchell, Moore, Motley, Nolan, Ochiltree, Oldham, Parmer, Potter, Randall, Roberts, Scurry, Schackelford, Sherman, Stephens, Stonewall, Swisher, Taylor, Terry, Throckmorton,, Wheeler, Wichita, Wilbarger, Yoakum and Young.

New Mexico: Curry, Lea, Quay and Roosevelt.

Oklahoma: Beaver, Cimarron, Harper and Texas.

Ag Unity Key To Relief

Word that an obscure disaster program provision was written into the 1981 farm bill recharged High Plains producers with some hope in late June, after a month of severe weather had demolished more than 2.3 million acres.

As the clause was made known, Texas congressmen Kent Hance of Lubbock, Charles Stenholm of Stamford and Jack Hightower of Vernon and Sens. John Tower and Lloyd Bentsen along with the National Cotton Council immediately contacted Agriculture Secretary John Block, urging him to implement the program.

Under the law, the agriculture secretary has the authority to make payments if:

—A natural disaster creates an economic emergency for producers.

—Federal crop insurance does not cover the crop because of "transitional problems" attendant to the insurance program, and

—Additional assistance must be made available to such producers to alleviate the economic emergency.

The criteria was easily met in more than 20 counties of the High Plains, and parts of Eastern New Mexico and Oklahoma, but the legislators, every farm group and the local and state governments banded together in a three-week plea with federal officials.

As nightly hail storms continued and more crops shrivelled to death with weather-related seedling disease and blight, Block sent a special task force to the area June 29 to gather extensive figures on which to base his decision.

It was unanimous with every member of several tour groups that the

continued on page 3, col. 1 . . . TEAM

THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

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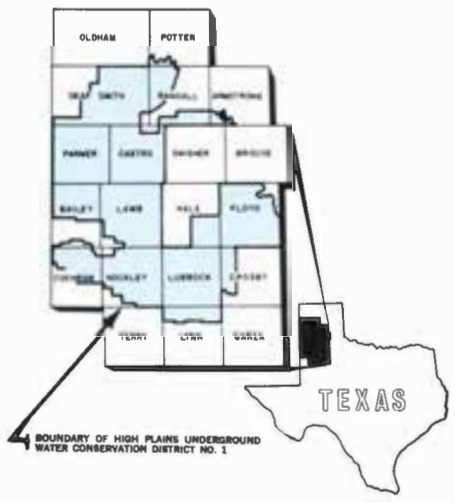

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NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.
Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

HINDS APPOINTED

Eugene Hinds, a veteran manager with the Bureau of Reclamation, has been appointed Regional Director of the agency's Southwest Region headquartered in Amarillo, Texas. The appointment became effective July 11, Commissioner of Reclamation Robert N. Broadbent announced. Hinds most recent assignment was Assistant Commissioner—Planning and Operations in Washington, D.C.

Reclamation is responsible for the development and conservation of water resources in the West. The Southwest Region encompasses the States of Texas and Oklahoma, most of New Mexico, and portions of Colorado and Kansas. In addition to the Regional Office in Amarillo, ten field offices are located throughout the region.

Hinds was born in Beaver County, Oklahoma, but spent most of his early years in New Mexico. He is a graduate of New Mexico State University with a degree in agronomy. He worked several years in private industry before beginning his Federal career with the Bureau of Indian Affairs in 1956 in Tuba City, Arizona. The Southwest Region's present Regional Director, Darrell W. Webber, has been named Assistant Commissioner — Engineering and Research in Denver, Colorado.

Field Day

The Annual Field Day at the Texas A&M Research Field at Etter, Texas, will be at 1:30 on August 18. Anyone interested in latest research on water conservation, limited tillage, center pivot irrigation, and crop varieties is invited to attend by Dr. G. B. Thompson, Director of Research at the Texas A&M Center in Amarillo.

Field day activities will be directed by Cecil Regier, Manager of the Research Field. "We are on our third year of research on efficiency of high and low pressure center pivot sprinklers and have information on the efficiency of each system." A set up for injecting insecticides through the sprinklers will be explained.

Other items of interest will be irrigated variety trials with corn, cotton, sorghum, and silage sorghum.

Results with the limited irrigation, dryland (LID) systems will be available for sorghum and wheat.

Bond Vote

The second called session of the 67th Legislature passed several constitutional amendments which the voters of Texas will approve or reject at the general election on November 2, 1982. SJR 6, the Senate Joint Resolution if approved by the voters will allow state governmental entities to sell bonds at a competitive rate by raising from 6 to 12 percent the allowable weighted average interest rate on most constitutionally authorized bonds.

The Texas Water Development Board has voter approval to sell $118 million of water development bonds and $100 million of water quality enhancement bonds at a 6 percent interest rate. These bonds are not salable at current interest rates. The State water agency's loan fund is at such a low level the Board will consider only emergency loan applications. Numerous High Plains towns have obtained low interest loans from the Texas Water Development Board for water supply and treatment projects. Others may need financial assistance in the future; therefore, High Plains voters are urged to consider this amendment favorably at the November election.

DRAFTSMAN MAPS FUTURE IN WATER

Richard is a rookie on the Water District's drafting team, but he tackles his job with talent, a drive for improving his skills, and some experience.

He got his first on-the-job training as a mechanical draftsman working for several major pump companies in Lubbock. Over four years he sharpened his pencils and his drafting abilities producing assembly, casting pattern and machine drawings. Advancing to engineer technician, he later handled both drafting responsibilities and test analysis and calculations for pump efficiency curves. As a pump company tool designer he both drafted and designed tools to meet precision specifications for lathe and drill work.

RICHARD HOWARD

Richard's drafting skill is matched by his drive for self-improvement. He has taken commercial college courses in sketching and has accumulated over 60 credit hours at Texas Tech University toward a major in Range and Wildlife Management. He says that reflects his appreciation for nature and his growing up in Panhandle country. Richard loves to hunt and fish and claims he learned it from his ten brothers and sisters. "When one of us got lost, the rest would all go hunt 'em up," he quips."

Since coming to work for the District Richard has gone back to school part-time and is redirecting his studies toward a degree program in agricultural engineering. Besides drafting, Richard is getting field experience at the District's secondary water recovery test sites helping to install and take data from the well monitoring equipment, learning to survey, and working on the District's soil moisture monitoring program.

"I enjoy the job," he says, "and I think I'd like to make a future in water engineering."

REP. KENT HANCE toured cotton field in Hockley County where Albert Kahlick's crop was hailed out twice.

TEAM . . . .

(continued from page 1)

fertile, highly-concentrated agriculture area was disaster-struck and that the dependent economics of every community would suffer.

But there was some dissension among federal authorities: Should the federal government implement disaster grants to the stricken farmers? Should the program be denied on the basis of low federal crop insurance participation? How would such a disaster program be administered? Where would the money come from?

Touring the area June 28, Hance said he was optimistic after seeing the devastation that a disaster program would be implemented.

"Not very many farmers, in fact, maybe only a little more than one-half can make it if they (the U.S. Department of Agriculture) don't reinstate the disaster program," Hance said at a barren farm in Hockley County.

"Until a person has seen a Texas hail storm, he can't comprehend," Hance said. "This will have an effect on related businesses from the gins to the service industries and even on the long shoremen in Galveston who won't have a lot of cotton to load for export."

Although he said the disaster relief should be granted "on its own merits," Hance said this could "give the Reagan administration the unique opportunity to show they are for the farmers. They should seize that opportunity."

When task force members arrived in Lubbock June 29, however, the devastation was obvious, but the outlook for funds was bleak.

"This is going to be a tough one. These are rough, rough times in Washington for money," said the team's leader John Ford, deputy assistant secretary.

The team spent about two days on the High and Rolling Plains and Eastern New Mexico, gathering figures from the Agricultural Stabilization and Conservation Service offices in each county and talking individually with farmers.

In a letter to Reagan asking for a cabinet-level task force on agriculture, Bentsen said June 30 that the disaster "situation would be an emergency in the best of times, but given the depressed state of American agriculture, it could become a full-blown disaster, not only for these farmers, but for all Americans who depend on them for their food and clothing."

DISASTER AID PLAN FUNDED . . .

(continued from page 1)

The Texas governor said the positive decision was the result of a team effort and that "not any one person is due the credit."

From Washington, U.S. Rep. Kent Hance said, "The reason this was successful is that everyone who was affected worked together. That could be a lesson to be learned, so we can get a better farm bill."

Hance praised the disaster program but said only the short-term problem has been addressed.

"This takes care of a temporary problem," he said, "We need to write a new farm bill to do something about inadequate commodity prices."

In a press release, U.S. Sen. John Tower said he is "extremely pleased that the Reagan administration has responded so promptly to the natural disaster that has hit our West Texas farmers."

Ford noted that the unity of all people and groups involved made it somewhat easier to decide.

"Reps. Hance, Stenholm and Hightower did a lot of hard work on this, too," the deputy assistant secretary said. "They made it much easier."

Comments from most of the High Plains residents at the meeting expressed relief, both for financial and emotional conditions.

Grain Sorghum Producers Association executive vice president Elbert Harp of Abernathy said, "The disaster program is certainly what we were hoping for."

Tommy Fondren of Lorenzo, president of Plains Cotton Growers Inc., said, "It will help, and we appreciate it. The dollar amount may sound like a great deal to them, but it will be a catalyst to work from."

Wolfforth farmer James Mitchell was appreciative of all the "hard work everyone put into this effort.

"This is the fairest, best help that could have come," Mitchell said, adding, "While we are cranked up and have the attention of the nation, we need to work on a new farm bill—something we can live with to get commodity prices up.

"This is a temporary thing," he said. "If we don't do something about the prices, we'll be back in the same shape the next time an extensive hail storm hits."

"We are making disaster assistance available in this region because our revised and expanded FCIC insurance program is still in a transitional phase," Block pointed out. "We continue to support the principle and the mandate from Congress that the expanded crop insurance program will replace disaster payments.

"The heavy losses created by the storm damage in this three-state region dramatically demonstrate the necessity for farmers here, and nationwide, to take advantage of the protection offered by FCIC," Block said.

SEN. LLOYD BENTSEN

Bentsen noted that weather had compounded the financial problems in Texas agriculture where "half or more of the farmers could go under if nothing is done."

About midway through Block's decision process, the farm chief sent an additional 20 Federal Crop Insurance Corp. adjusters to hasten payments on claims.

When the original disaster program expired with the 1981 crop, the U.S. government was hopeful that all farmers would purchase federal crop insurance. But figures compiled by the county USDA advisory committees revealed that only 4 to 25 percent of the producers in each county were covered by the all-risk policies.

Producers have said the insurance program is inadequate and that a transitional period should be allowed as problems with the policy are worked out.

SEN. JOHN TOWER

Tower called the additional adjusters an important "first step" and added that "hopefully it won't be the last step (taken to relieve the disaster)."

Some said scant participation on the government's purported all-risk insurance program would weigh on Block's decision on whether to implement disaster payments, but that rumor was denied by Ford July 7.

Following a four-hour meeting with Block and his assistant and undersecretaries, Ford said the farm chief is "fully aware and understands that federal crop insurance was not a viable program this year for High Plains farmers."

Funding should not be a decisive factor, either, Hance announced July 2, after investigating possibilities with House Agriculture Committee appropriations panel members Stenholm and Hightower.

"Stenholm and I worked through this and there are ways to do it," Hance said. "It is the American way to address those problems (of natural disaster)."

Hance returned to Washington after viewing the devastation "to cover all bases" by meeting with Block, Office of Management and Budget director David Stockman, and a top White House aide Ken Duberstein.

Tower made a tour of the area July 10, accompanied by Sen. Pete Domenici of New Mexico, chairman of the prestigious Senate Budget Committee.

The two were later joined by U.S. Rep. Joe Skeen of New Mexico for a meeting with the newly-formed Agriculture Emergency Coordinating Council.

During that meeting, the legislators called Block to report on the crop situation and ask for a meeting with the agriculture secretary.

Both Tower and Domenici said the decision will be rough, but they asked Block to respond "in a timely way."

"These people need help and they need it now," Tower told Block.

"We need your honest evaluations, but I don't think we can wait too long," Domenici added.

GOV. BILL CLEMENTS

Clements presented a proposal when he visited with High Plains producers in Lubbock July 12 saying, "God doesn't run His calendar on the basis of the U.S. government's budget."

The governor said his plan called for the use of existing monies, formerly designated for use in the government cotton loan program.

"There is a sum of money that we feel is available—money that is available to farmers when they put cotton under the loan," Clements explained. "I have my eye on it. I'm making a case for those monies, now that there's (virtually) no cotton to go in the loan."

Clements said those funds total about $300 million.

"We are hopeful that we can evolve something that will make sense to the High Plains farmer to provide some assistance," he said. "I can't say they will get everything they want. But we want to provide significant relief."

With the Clements tour July 12, it seemed that every dignitary capable of persuading the federal government had seen the unprecedented destruction. Farmers began to watch the clock for a decision from Washington.

The historic verdict on what could be the year's single most unified agricultural effort, however, was made public July 15.

UPDATE:

Texas Water Plan Draft

Texas Department of Water Resources Deputy Director Charles Nemir reported to the Governor's Water Task Force on Water Resources Use and Conservation that a draft copy of the updated water plan should be ready for public review in November..

The Department has published a report of findings on "Public Input to Amend the Texas Water Plan." This report contains a summary of 13 public hearings, 182 personal interviews and more than 100 written responses.

Nemir reported that there had been a wide range of opinions and sentiments expressed to water related issues which the Department must consider in updating the water plan. He further stated that on some issues there has been a consensus of opinion.

Water Conservation is one issue on which most agree. The participants feel that water conservation goals and practices should be an integral part of the State water plan. They feel that conservation could be accomplished in several ways: First, encourage the use of pricing policies that reflect the true costs of water projects and that discourage increasing water use. Second, develop and implement a State level program of education and information for public schools and the general public to describe water resource issues and encourage water conservation. Third, encourage the use of either tax incentives or tax credits to businesses and industries to practice water conservation. Finally, encourage the adoption of metering water for agricultural use and the application of water pricing policies to discourage waste."

Water Resources Management and Population/Economic Growth: "Of the three major views concerning the role of water resources to population and economic growth, it was largely agreed that water resource policy should be neutral with respect to growth and accommodate projected increases in State growth and water needs."

Water Laws: "In respect to regulation of ground water, the majority felt some regulation was needed to prevent waste and ensure supplies. It was largely agreed the State should assist in creation of underground water conservation districts where none exist for the purpose of regulating ground water and that the State should regulate ground water in those areas where ground water conservation districts are not formed by the local people."

Water Quality Management: "Because there was widespread support for a continued program of water quality management, it was largely felt the State should provide financial assistance in the form of loans and loan guarantees. Any grants were felt to be appropriate only for feasibility studies or for communities that could not otherwise secure financing. In addition, many thought the protection of ground water from contamination and pollution should be considered in a water plan."

State Role in Water Resources Financing: "Given the anticipated costs of future water projects and the reduction of federal funds, state financial assistance is essential. Most recommendations for State assistance were either one or a combination of low-interest loans, loan guarantees, or loans at state bond rates. Legislative appropriations were also suggested for programs other than wastewater facilities, flood control, and water supply and distribution systems."

Bays and Estuaries, Instream Flows, Etc.: "Although it was widely acknowledged that provisions for the maintenance of bays and estuaries should be incorporated into a state water plan, there was no concensus concerning the payment of costs for requisite freshwater inflows. Furthermore, while the provision for instream flows and fish and wildlife habitats was generally recommended, there was similarly no concensus concerning the provision for their costs."

Research and Technology: "There was widespread support for a greater State role in the coordination and funding of research and development efforts in order to increase or extend water supplies in all parts of the State."

Water Importation: "Although there was substantial criticism of any State importation plan, a large number of those who spoke to this issue felt importation should be considered as an alternative in a State water plan."

Flood Protection: "While it was largely agreed that local governments have the principal responsibility for flood protection, it was also suggested the State provide some assistance and encourage the use of primarily non-structural measures in flood control. Most felt governments at all levels should discourage development in floodplains and flood prone areas. Because some felt structural projects should also be continued, State assistance was recommended in the form of loans and loan guarantees."

Regional Water/Sewerage Systems and Reservoir Operation Procedures: "It was generally acknowledged that the State should encourage but not mandate regional facilities, while local governments reserve the prerogative to initiate and develop such systems."

Project Prioritization: "The majority of participants endorsed the State's devising a prioritization system based on priorities for the beneficial use of State water contained in the Texas Water Code."

WIND STRIPCROPPING

By DENNIS NEFFENDORF
SCS Area Agronomist

Wind is the most visual and detrimental climatic force that works against farmers on the High Plains. Farmers spend tremendous amounts of time, labor, and fuel combating this critical problem. When they have young cotton planted in their field, wind reduces cotton production, cotton grade, removes needed moisture in the soil, carries away expensive herbicides and costs farmers by removing their most valuable asset, soil.

Soil Conservation Service Agronomists have developed a wind erosion system utilizing perennial grasses in a calculated spacing across a field. One of the grasses that appears to fit in with a farming operation is Weeping Lovegrass. This particular grass does not spread into the cotton area and any normal tillage operation will destroy it. Lovegrass does extremely well on our sandy soils, needs little moisture and during the winter months its structure is well maintained and provides a very effective wind barrier.

In April of 1980, SCS personnel designed and helped plant 3 acres of Lovegrass strips on Mr. Robert Melcher's 200 acre cotton field near Roaring Springs. This was done under the Great Plains Conservation Cost-Share Program. The grass strips were planted with a broadcast seeder. Fortunately, in 1981 there was adequate moisture and the strips were established quickly. When Mr. Melcher planted his 1981 cotton crop, the grass strips were established. At this planting he then began to realize the significance of his efforts to establish these strips. In 1981, Mr. Melcher did not use a sandfighter on this field where in the past this had been done every year to the tune of three trips or more.

Mr. Melcher's benefits did not stop there. At harvest time he began to realize how good a crop he actually had. From his other field, his neighbor and the gin people, he estimated he had a 25-30% better quality of cotton crop and a cleaner cotton at ginning time.

Mr. Melcher also increased his overall yield performance significantly against his neighboring non-stripped field. The 3 acres of grass strips taken out of the 200 acre field were offset by the increased overall production of cotton.

Because of the visual and financial benefits that Mr. Melcher received from these wind strips, he planted the remaining 200 acre cotton field to grass strips in April of 1982.

This year Mr. Melcher states that these strips have saved him from replanting his young cotton crop at least once. By having these strips he has saved a tremendous amount of labor and time. Mr. Melcher has also begun to see the advantages of keeping his soil from blowing, increasing the effectiveness of his herbicide programs. Other benefits noted have been the increased moisture saved in the soils. The best crop rows are growing next to the protective wind strips.

Mr. Melcher began his stripcropping practice on a terraced field which has reduced maintenance and wear and tear on his terrace system, but it is now extended on non-terraced fields.

Mr. Melcher is one of several farmers that realizes wind erosion has to be stopped or halted *before* the sand fighter is mounted to the tractor and that there are direct economic paybacks for using this one of many Soil Conservation Service designed systems to control wind erosion.

LOVEGRASS strips in this wind erosion prevention system are saving soil.

THE CROSS SECTION (USPS 554320)
HIGH PLAINS UNDERGROUND WATER
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Growth Regulators: New AG Chemicals

Reprinted with permission from FURROW July-Aug. 1982.

The acronym PGR, short for plant growth regulator, is worth remembering. Many scentists believe that PGRs are about to lead agriculture into whole new ways of tailoring crops for better production and efficiency.

Some of the effects of plant growth regulators have been known for years. In fact, many herbicides are PGRs; 2,4-D was developed as a spinoff of PGR research in the 1940s. But PGRs that directly improve crop quality and quantity are just now being put to work on a sizable commercial scale.

Last year about 5 percent of farmers' ag-chemical dollars went for growth regulators, and the future looks extremely bright. Louis Nickell, a PGR scientist with Velsicol Chemical Corporation, says one reason for the great potential of these organic compounds is the many different ways they can impact plants. "They can alter life processes or structures to enhance yields, improve quality or facilitate harvesting," he explains. "These chemicals can affect the plant's own hormones so efficiently that they change the normal timing of growth and development. As a result, the plant can be made to grow taller, remain dwarfed, drop its fruit early, regrow a missing part, or die."

PGRs were first used commercially to prevent preharvest droppage of apples and later to control the blooming date of carnations and poinsettias produced for holiday markets. They're now used on hundreds of crops, ranging from sugarcane to evergreens.

Less Lodging

Applied to cereal grains, these subtle chemicals produce a shorter plant with thicker stems, greener leaves, more tillers, and better-filled grain heads. Cycocel, an American Cyanamid product, and Ethrel, from Union Carbide, are registered for use on small grains in Europe. Union Carbide spokesman Don Page says experimental-use permits are expected for Ethrel on wheat and barley in the U.S. and Canada this year.

Terpal, a product that combines Ethrel and Pix (a BASF Wyandotte Corporation growth regulator), is registered in Europe for use in reducing lodging of winter rye and barley. "Just reducing lodging can means as much as a 25-percent yield increase in small grains grown in humid or irrigated environments," says Denny O'Neal, a PGR specialist for BASF.

Row-Crop Regulators

Earlier maturity and better fruiting have also been noted when Ethrel or Pix are applied to cotton. Jim Mitchell, who grows 1,500 acres of cotton near Wolfforth, Texas, says his Pix-treated fields have yielded nearly 100 pounds more lint per acre than untreated cotton. "The treated cotton was shorter, whiter, and more open," he adds, "and it was ready to pick sooner."

A. J. Ohlrogge, a Purdue University agronomist and pioneer in growth-regulator research, reports corn-yield increases of 5 to 10 percent from PGR treatment. Upright-leaf hybrids respond best. He and co-worker Sherry Fulk-Bringman have found that Premerge-3, marketed by Dow Chemical, causes earlier pollination and a longer grain-filling period, resulting in more kernels and better tip fill.

"At a cost of $2 per acre—and most of that is for application—we can increase corn yields up to 10 percent," Ohlrogge says. "With that kind of cost-payback ratio, growth-regulator applications are certainly worth trying on a portion of the corn acreage."

continued page 3, col. 1 . . . PGR's

IMPROVEMENTS VISIBLE to Ed Oplinger who treated the shorter sunflowers with a growth regulator for less lodging and more yield.

Field Day

Weed control, cotton insect research, irrigation water application efficiency, and cotton breeding and hybridization will be the topics highlighted during the 73rd Annual Field Day at the Texas Agricultural Experiment Station at Halfway. TAES is hosting the field day on Tuesday, September 14, 1982, beginning at 1:00 p.m. Other agencies located at the Lubbock-Halfway Center and cooperating in the event are the USDA-ARS, Texas Forest Service, Texas Agricultural Extension Service and the High Plains Research Foundation.

Specialists will be centrally located and available for discussion of specific problems. Displays and exhibits will also be featured for public viewing.

Texans' Attitudes Toward Water Resource Polled

A representative sample of 760 Texans statewide were asked their opinion in recent months on a range of issues affecting state policy and long range planning for the state's water resources. Telephone interviews were conducted in eight urban and rural geographic areas of Texas for the Governor's Task Force on Water Resource Use and Conservation and the Texas Department of Water Resources. The results are being weighed into a revised plan of recommendations for long range water planning for Texas. This will be presented to the Governor and the 1983 Legislature.

A measure of public attitudes on some 18 different questions and topics raised in the survey are summarized in a report entitled "A Statewide Public Opinion Study Regarding the Texas Water Plan—Computer Printout." Its findings reflect what are the public's major concerns and priorities for future water resource development in Texas.

Attitudes Toward Supply And Quality

Four out of every ten adults in Texas recognize that the supply and the quality of water are problems to the people of Texas, but these water related problems rank behind other issues measured—crime, drug abuse, cost of living and inflation, unemployment, and energy. Among those who say water quality is a problem, six out of every ten also consider the

continued page 4, col. 1 . . . TEXANS

THE Cross SECTION

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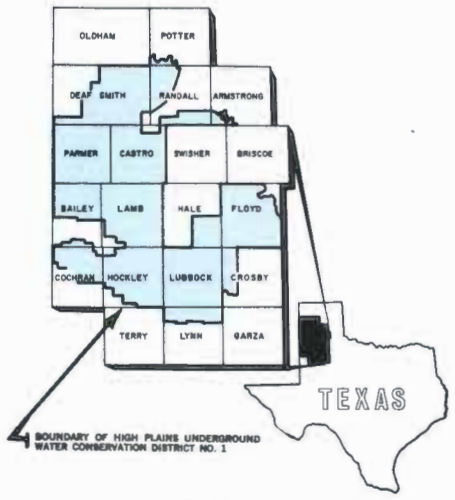

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Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

Comments:
From the SCS Chief

Water—Keeping It Clean And Conserving It

Any farmer can figure out that muddy ditches and muddy water have to be causing problems for somebody downstream as well as on the farm. I know that the chemicals we put on the cropland must be washing off with the soil, too. Where they belong, they are a tremendous resource—out of place, they become a nuisance, a hazard, and a costly cleanup problem for some community.

Farmers aren't the only cause of dirty water, not by any means. But I think we can do our part to keep the problems from being unnecessarily serious. If we can keep the soil in place, we can hold the pesticides and fertilizer on the land also.

Water quantity hasn't been much of a problem on my Mississippi River bottomland except when there's just too much of it.. But dry weather has appeared in many more States than usual the past few years, and water conservation has become a good idea for all of us. We can look to those who are doing an excellent job of attacking the water stewardship problem, like the High Plains Underground Water Conservation District in Lubbock, Texas.

Americans do waste a lot of water on the farm and in the house, and we ought to work together to be more efficient—better stewards of water as well as soil.

Peter Myers

Reprinted from Soil & Water Conservation News July 1982.

Looking Toward 2000

EDITOR'S NOTE: *This is the third of seven statements to be presented for our readers taken from the Texas 2000 Commission Report and Recommendations on major economic development issues. This report was received by Governor Clements in March. (See "2000 Report Revealed" in May, 1982 Cross Section.)*

ENERGY

Historically, Texas energy resources have played a major role in the State as well as in the nation. A full quarter of all the energy ever produced in the United States, including 40 percent of the nation's historic production of oil, gas, and gas liquids, has been produced in Texas. The State's current contribution to the nation's energy output has declined somewhat from historic levels, but still stands at an impressive 21 percent. Through 1980 some 542 quads of energy (equivalent to 97.6 billion barrels of oil) have been produced in Texas.

There are four key facts which summarize Texas' energy situation:

1) conventional production of oil and gas is declining at a time when energy consumption in Texas continues to rise;

2) the important Texas refining and petrochemical industry has become dependent on imported oil;

3) thus far, State finances and Gross State Product have been shielded from the decline in energy production by the rapid rise of oil and gas prices since 1973. We simply do not know, however, what path oil and gas prices will follow over the next 20 years, and it would be unwise to count on continued price increases compensating fully and indefinitely for a continuing decline in Texas energy production; and

4) Texas' economic future will be dictated largely by how successful efforts are to stem the decline in conventional oil and gas production, to increase the production of surface lignite, uranium and synthetics, and to develop the State's submarginal energy resources — such as deep lignite and oil and gas produced by nonconventional recovery techniques, e.g. infill drilling.

Energy Recommendations

The Commission recommends that:

1. The State pursue policies that promote exploration, development, and production of nonrenewable conventional energy sources, including lignite, and that encourage development of renewable energy sources.

   Rationale

   - Future levels of oil and gas production will affect State finances, as well as the overall level of economic activity.
   - The character of Texas' energy reserves and resources makes production increasingly expensive.
   - Expansion of lignite and uranium production and development of alternate energy sources will help to offset the effect of declining oil and gas production and the need for additional importation of oil and gas.
   - A large portion of the Gross State Product is derived from refinery, chemical, and petrochemical and metal processing industries—all high-energy consumption industries.

2. The State work with the federal government to develop measures which produce appropriate incentives to maximize efficient energy

MITCHELL shows a tour group he's satisfied by PIX performance on demonstration plots of cotton on his Wolfforth farm.

PGRs Show Promise

(continued from page 1)

Irvin Anderson, an Iowa State University agronomist, says the most promising corn PGR he has worked with is ACA, a chemical marketed by Amoco. He tank-mixes it with a preplant application of anhydrous ammonia.

Yield Boosts

"ACA appears to act on the hormones in the plant, causing it to build a bigger, more vigorous root system plus a larger leaf area and heavier kernels," Anderson says. "In some of our tests, it has increased yields of Pioneer 3780 as much as 20 bushels per acre."

Anderson is also working with several promising experimental growth stimulants for soybeans, some of which raise yields impressively. Certain varieties respond more than others, he says. In one three-year test, Wayne variety yielded 12 to 14 more bushels per acre when treated with a regulator from Fisons-Boots Chemical, an English firm. Treated Harcors yielded 4 to 8 more bushels per acre than untreated Harcors, while Corsoys didn't respond at all.

"Applying plant growth regulators looks especially promising for some varieties," Anderson concludes. "However, the yield increases come largely from bigger branches and lower podding, and that could result in greater harvest losses."

Anderson's tests were conducted in soybeans planted in 30-inch rows. The same growth regulator boosted yields in drilled soybeans by 20 percent (from 37.6 bushels per acre to 45.3 bushels) in Southern Illinois University tests. Agronomist George Kapusta applied a pound of the product per acre at very early bloom on a plant population of 150,000 plants per acre. Kapusta has also been testing ACA on corn. He reports a 9-bushel-per-acre yield advantage—154 versus 145 bushels per acre—during five years of tests.

Shorter Sunflower

Ed Oplinger, a University of Wisconsin agronomist, says PGRs increased soybean yields 5 to 30 percent in his tests. Sunflower yield potential also increased, he adds. PGR treatment reduced plant height by a foot or more, making them less top-heavy and less prone to lodging. In most of his tests, Oplinger has found that PGRs allow plants to make better use of such inputs as fertilizer, sunlight and water.

DuPont researchers report promising results from using a PGR to inhibit photorespiration, a wasteful plant process. In experiments, they've nearly doubled soybean yields. They've also produced major yield increases in wheat and other crops.

In addition to developing new chemicals PGRs, many of the 600 or so PGR researchers around the world continue to work with naturally occurring plant-altering compounds. One is triacontanol (TRIA), which occurs in nature in everything from alfalfa to soybean residue.

Applications of TRIA have boosted yields of many food crops. Examples are increases of as much as 18 percent in potato yields and 7 to 15 percent in corn yields, according to Stanley Ries, the Michigan State University horticulturist who first identified the substance. He says researchers haven't been able to pin down the conditions required for consistent yield increases. However, he adds that results show it's possible to get substantial yield hikes from extremely small amounts of a chemical that's environmentally as clean as a hound's tooth.

In Use Soon?

"Within two or three years, we could see brassinosteroids used quite extensively in vegetable and field crops," Bhushan Mandava predicts.

Another avenue for plant-growth regulation is allelopathy. In this natural process, plants release chemicals that may inhibit or increase growth of other plants. Scientists say any commercial application of these chemicals is down the road a ways, but farmers may be able to enjoy some allelopathic advantages through inter-cropping or even crop rotations. Iowa State's Irvin Anderson says soybean residue, for example, contains compounds that are beneficial to corn seedlings. He hopes to isolate these chemicals (one is triacontanol) and produce them synthetically.

Naturally occurring growth regulators have some big advantages, according to Horace Cutler, a USDA plant physiologist at the Richard Russell Agricultural Research Center, Athens, Ga. "Not only are they environmentally acceptable," he says, "but many also work with doses as small as a half ounce per acre. Some, such as those derived from fungi, can be applied for very specific reasons, such as to control a particular plant disease."

Bright Future

Wisconsin's Ed Oplinger is similarly enthusiastic about the outlook for the entire plant growth regulator complex. "There are literally thousands of compounds available to modify the growth of plants," he says. "During the years ahead, we'll be able to match these compounds with plants and their environments to get really consistent yield increases."

BASF's Denny O'Neal agrees that the potential is enormous. He says most major chemical companies and many smaller firms are investing heavily in money and research time on PGRs for a wide range of crops.

Also ahead are improvements to PGR application systems, ranging from seed treatment to bulb dipping.

Experts like Velsicol's Louis Nickell emphasize that PGRs should not be considered miracle compounds or substitutes for optimum amounts of fertilizers, herbicides or insecticides. But he does predict that PGRs will form the next major wave of agricultural chemicals, and that they'll foster a gradual increase in crop quality and yield.

"If adding plant growth regulators increases your crop yields consistently —even by a small percentage—that extra yield hasn't cost much in dollars or energy," Nickell says. "That's a positive beginning for a system that's bound to get better."

production and ensure that the State has equal geographic and price access to natural gas.

Rationale

- A number of current federal laws and regulations are disincentives or impediments to energy production and need to be amended or repealed.
- Measures such as selective subsidies, free-market energy pricing, and permit-processing reform are needed to help expedite energy development.
- Federal laws and regulations have created major gas price distortions and have led to a system of gas dedication that put Texas intrastate consumers at a disadvantage.

3. Public and private energy research and development efforts be concentrated on development of subeconomic, marginal resources, chiefly nonconventional oil and gas and deep basin lignite, and renewable resources such as biomass, solar and wind energy.

Rationale

- Texas has the energy equivalent of about 250 billion barrels of oil of known energy resources which are not producible under existing economic and technological conditions. Bringing significant increments of this vast resource base to producible reserves is a challenge to both public and private research and development.
- Research and development will be an important factor in the State's ability to develop its potential energy resources.

4. The State in concert with the federal government pursue both the continued use of nuclear technology and the technical resolution of waste disposal issues, while devoting the highest priority to protection of public health and safety.

Rationale

- Nuclear power can provide energy from Texas uranium and supplement natural gas or lignite use as a boiler fuel.
- Texas has a major fusion research effort underway that should be supported, as should other research and development efforts to improve the efficiency, cost effectiveness, and safety of nuclear energy.
- Nuclear power offers a potential for meeting Texas' long - term electricity needs until renewable sources become economically available.

5. The State seek to ensure an adequate supply of trained personnel and teachers to meet the demands of local energy industries for skilled and professional employees.

Rationale

- There is a national shortage of engineers, scientists, and engineering and science faculties.
- An adequate supply of trained personnel will facilitate the continued operation and expansion of energy industries in Texas.

6. The State, in collaboration with the private sector and universities, develop and maintain a more accurate body of information and projections on energy production, consumption, and prices.

Rationale

- A systematically organized and accurate body of data is needed as a base from which accurate forecasts of the future may be made.
- New or improved projection methods will be needed to interpret changing prices, technologies, tax policies, regulations, and other factors.
- Accurate and timely forecasts are needed by the State in order for it to develop and act on well-founded policies.

7. Educational, financial, and technical programs that augment energy conservation be supported by the State.

Rationale

- Federal funds have constituted the principal financial support for conservation programs to date, but these funds are being reduced significantly.
- Even though market pricing of energy is the fundamental way to prompt efficient energy use, programs are needed to publicize methods of conserving energy.

Texans Favor Water Conservation, Price Increases, Education, Research

(continued from page 1)

future supply of water to be a problem. And six out of ten who rate the supply of water a problem say water quality is also a problem.

Four out of every ten adults in Texas say there is no problem with respect to water in their part of the State, or they are unable to name any particular problem.

Overall, Texans are not critical of the quality of water in the State. A majority (seven out of every ten) have something positive to say about the quality of their water. Taste is the most frequently mentioned reason for poor water quality, followed closely by references to impure or unclean water, too many chemicals, hard water, and too many minerals. People in the Southeast/Gulf Coast area think they have greater problems with water quality.

Getting Texans To Use Less Water

Texans think water conservation efforts can make a significant contribution toward solving the long-term water supply needs of the state. About eight out of every ten adults say water conservation efforts will make a very or a somewhat significant contribution toward saving water. Opinions are quite diverse as to what is the best approach to encourage reduced use of water among the public. Education is volunteered by two out of every ten adults, and at least one in ten says government regulation, voluntary conservation, and increasing prices would be most effective in decreasing the use of water. The fact that very few *suggest* increasing the price of water would indicate that people are unwilling to volunteer that raising their water rates would decrease their water consumption.

Four to five out of ten among all segments of the public analyzed consider increasing water rates would be a successful way of reducing water usage. Seven to nine out of every ten say education would be successful in reducing water consumption.

Water Storage And Sewage Treatment Facilities

A majority considers existing facilities at least adequate to meet present needs for water storage and for sewage treatment. Looking at the future, however, a majority says existing facilities will not be adequate to needs twenty years from now. Seven out of ten say the State should pay all or part of the costs for these additional sewage treatment facilities, and the same number want local governments involved in the funding. Four out of ten Texans favor help from the Federal government to pay for new sewage facilities projects. Only a few would put the entire burden on any one level of government.

Regulation Of Ground Water

Expressing traditionally held views that it is the right of the property owner to control his property, a majority of Texans oppose government regulation of the amount of ground water that can be pumped on private property. If the pumping of ground water must be regulated, however, a majority would delegate the responsibility to local government.

Among those who do favor government regulation of ground water, opinions are fairly evenly divided between local and State regulation. However, among those who oppose government regulation of ground water, six out of ten say the local government should be responsible if there must be government regulation.

The overall pattern of results is found among all groups of the population, with from six to seven out of every ten in each group opposed to government regulating the amount of ground water which can be pumped on private property. All basic groups except those with less than a high school education prefer local government control if ground water must be regulated; majorities range from five to more than six out of ten.

Meeting Future Water Needs

The suggestion most frequently volunteered to ensure "our area does have enough water," by three out of every ten Texas adults, is to construct more reservoirs, dams, or lakes. Other ideas shared by one to two out of ten include conservation, rationing or government regulation, education, and planning for the future through committees and studies.

Water Importation

Six out of ten Texans favor importation in response to this question: "Even with all conservation efforts, some areas of Texas will not have enough water for all of their future needs. Do you think the State should or should not try to move water into Texas from outside the State even though it might be expensive to do so?" The question does say importation of water would be expensive, it does not connote how expensive. When actual costs are known, it is possible that the public may change its mind. On the other hand, by the time the issue is actually put before the public, the need for water may be so great that an even larger majority would favor importation. If water is to be brought into Texas, a majority (eight to nine out of every ten) thinks that the State should pay all or part of the costs.

Researching Water Conservation And Development

The overwhelming majority of the public believes the State should spend time and money on research to find new ways to save water and to get more water. More than seven out of every ten Texans are willing to pay an additional one dollar per month on their water bill to be used to pay for this research. Among those who favor research, eight out of ten would help pay for it. Even two of ten among those who oppose research are willing to have the additional dollar added to their water bills.

In 1896 William Jennings Bryan said it best, "Burn down your cities and leave our farm, and your cities will spring up again as if by magic, but destroy our farms and the grass will grow in the streets of every city in the country." As long as the North American farmer can supply our food at a price that allows us to spend the greatest part of our income for our cars and TVs and recreational items, our high standard of living can continue. But, when our farmers can no longer produce our low-cost food, or when they have no economic incentive or ability to produce this food—truly, again, "the grass will grow in the streets of every city in the country."

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Future Level Of High Plains Economy Will Be In Direct Proportion To Water Conservation Effort

EDITOR'S NOTE: *This month's issue of the* Cross Section *is dedicated to a topic of vital concern to the residents of this area: the future economic health and agricultural productivity of the High Plains of Texas overlying the Ogallala Aquifer. The High Plains Study Council will soon present its summary of results of the Ogallala Aquifer Regional Study and Recommendations to the Secretary of Commerce and Congress. Its conclusions strongly suggest that conservation is our only option.*

Preliminary results from the federally funded High Plains Economic Study for that part of Texas covered by the Ogallala Formation indicates that from a financial perspective, irrigated agriculture can be maintained on a profitable level through the year 2020, showing a positive return to land, water, and management. Doing so, however, will require very skillful management. A successful irrigator will need to be informed about, and take advantage of, all applicable water-conserving practices and technologies. He must maintain his equipment at a high level of efficiency, closely monitor soil moisture available to his crop and must not over-water, cut to the barest minimum the amount of irrigation water and precipitation lost to runoff, evaporation, and deep percolation, and have the necessary supplies of reasonably priced capital. In short, the successful irrigator must manage his water resource such that practically none of it—precipitation and irrigation water—is lost from a particular plant's use.

Case Study Projections

Four cases—a baseline case, a voluntary water conservation case, a mandatory water conservation case, and an interstate water importation combined with voluntary conservation case—were analyzed in Texas.

Baseline And Alternative Baseline Case

The Baseline Case is probably the most relevant to the current situation in Texas. The Baseline Case in Texas represents a projection of the agricultural economy of the Texas High Plains under the assumption that there will be no changes in laws which would affect water use. However, data which represent new management practices and improved technologies are included if their adoption follows from ordinary economic incentives.

The specific data for Texas about water conservation technologies, crop yield trends, and expected improvements in plant breeding were obtained from agricultural scientists and leading farmers in the area. However, the rate of adoption of technology to achieve increased water use efficiency will depend upon prices for farm commodities, costs of production, and capital availability to finance the investments. In the Baseline Case, it was estimated that technology and management would reduce the average quantity of water use per acre from 1.38 acre-feet in 1977 to 0.68 acre-feet in 1990, and 0.65 acre-feet in 2020. To test the sensitivity of these results to improvements in water use efficiency, an Alternative Baseline was analyzed based on the assumption that the adoption rate of technology and management to improve water use efficiency would be only one-half as effective, in terms of average reductions in the quantity of water used per acre, as that of the Baseline Case described above; i.e., the average quantity of water used per acre would be reduced from 1.38 acre-feet in 1977 to 1.03 acre-feet in 2000, and 1.01 acre-feet in 2020. These data, along with information about pumping lifts and costs, other production costs, crop yields and crop prices, and estimates of the quantity of water in storage beneath each subarea of the High Plains were used to estimate long-term irrigated acreage, value of farm production, farm income, effects of changes in farm production upon the general economy, and the quantity of water remaining in storage through time for the different water conservation cases. The major results are summarized below.

TENSIOMETERS installed in a cotton field measure soil moisture and help signal when to irrigate.

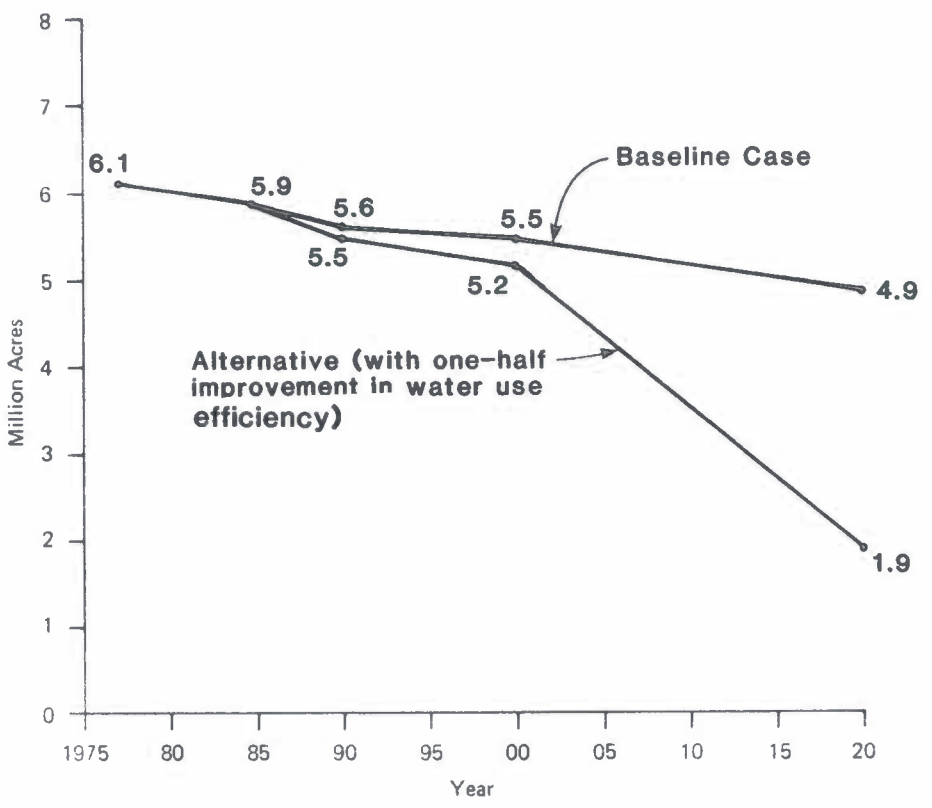

Figure 3.—Projected Irrigated Acreage—Texas High Plains; 1977 to 2020

Under the more efficient water use technology of the Baseline Case, other things equal, irrigated acreage would decline from its annual level of 6.1 million acres in 1977 to 5.5 million in 2000 and 4.9 million in 2020 (see Figure 3). Under the alternative assumption about a less efficient technology of water use, annual irrigated acreage in the Texas High Plains would decline from 6.1 million acres in 1977 to 5.2 million in 2000 and 1.9 million in 2020.

Value of crop production (measured in 1977 dollars) increases steadily over the study period, from $1.7 billion in 1977 to $2.8 billion in 2020 (Figure 4). Approximately 76 percent of the 1977 value is attributable to irrigated production, decreasing slightly to 72 percent in 2020. This increase is the combined long-term effects of slightly higher crop prices and increases in yield per acre, overcoming a net decrease of over one million irrigated acres for the Baseline Case.

In the Alternative Baseline Case, value of production is actually slightly higher than for the Baseline Case in 1985, but then drops below Baseline

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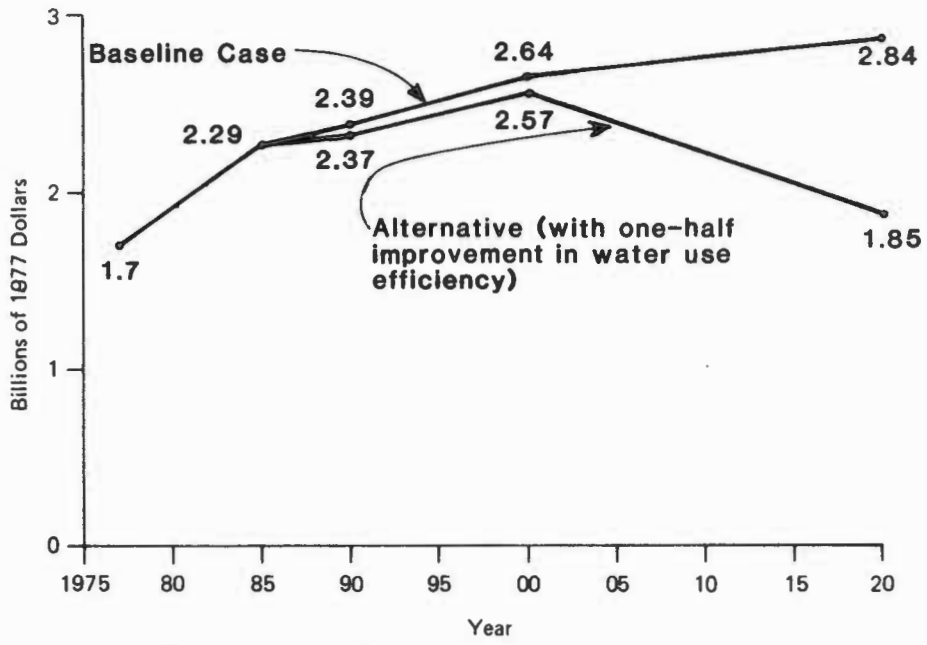

Figure 4.—Texas High Plains, Projected Value of Production: Baseline Case and Alternative Baseline Case

Case levels in following years; by $20 million in 1990, $70 million in 2000 and $99 million in 2020. Only 42 percent of the value of production of the High Plains area comes from irrigated acreage in 2020, compared to 72 percent in the Baseline Case.

In the Baseline Case, returns to land and management are projected to increase from $143.5 million in 1977 to $733.4 million in 2020. In the Alternative Baseline Case, returns are projected to increase from 1977 to 2000, although at a level consistently below the Baseline Case returns, and then decrease sharply between 2000 and 2020, from $493.5 million to $382.8 million (Figure 5).

Voluntary Conservation Case

In the Voluntary Water Conservation Case, Texas data indicated that most of the conservation possible could and most likely would occur from farm management response to economic incentives and adoption of available technology. Thus, the results of the analyses are not significantly different from those of the Baseline Case, and are not discussed in detail here.

Mandatory Conservation Case

A "Mandatory Conservation" case was defined by the study team for the purpose of evaluating the economic and water resource effects of arbitrarily limiting the quantity of water that could be pumped and used annually by High Plains irrigation farmers. Therefore, for this case, the Texas researchers calculated a separate set of projections assuming that the quantity of water that would be pumped annually would be limited to a percentage of the water projected to be used in the Voluntary Conservation case—90 percent in 1985, 80 percent in 1990, and 70 percent in 2000 and beyond.

Under this analysis, irrigated acreage would decline from its annual level of 6.1 million acres in 1977 to 4.5 million in 2000 and 4.1 million in 2020 (see Figure 6). Value of production (measured in 1977 dollars) is consistently lower than in the Baseline Case, though it increases slightly over the study period (Figure 7). From $1.7 billion in 1977, value of production increases to $2.3 billion in 2000, $31 million less than for the Baseline Case analysis, and to $2.5 billion in 2020, a decrease of $33 million from the Baseline Case.

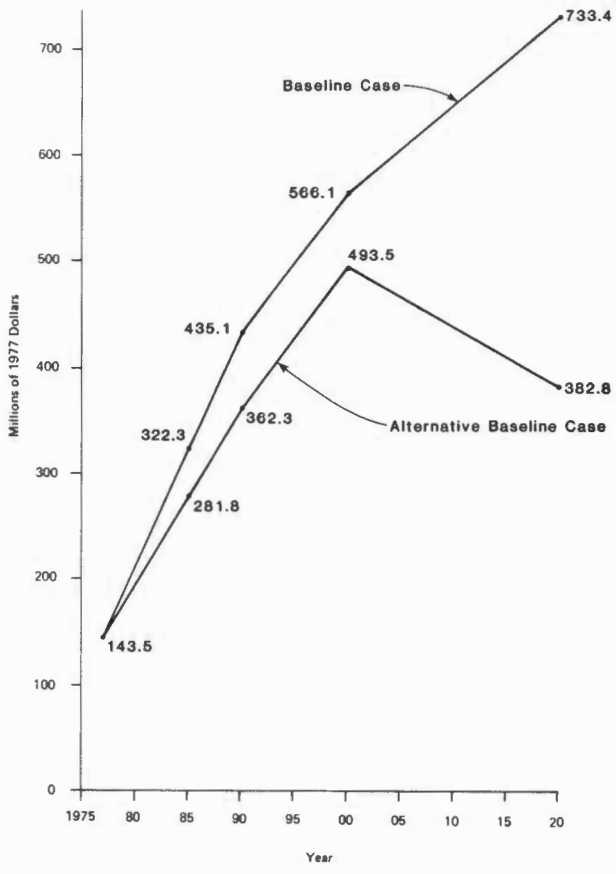

Figure 5.—Texas High Plains, Projected Returns to Land and Management: Baseline Case and Alternative Baseline Case

Returns to land and management, in the Mandatory Conservation Case, are generally lower than in the Baseline Case (Figure 8). Returns projected under this analysis are $41 million lower than for the Baseline Case in 2000, and $37 million lower in 2020.

TEN THOUSAND miles of underground irrigation pipeline deliver water to High Plains crops and stop evaporation or deep percolation losses from open ditches.

Water Importation—Voluntary Conservation Case

A case in which Water Importation would be combined with Voluntary Water Conservation was analyzed. In this case, the Ogallala aquifer would be supplemented with imported water in sufficient quantities to maintain irrigated acreage at the levels observed in 1977. In these calculations, no charge has been included for the cost of imported water, thus the resulting income estimates are an estimate of the returns to imported water.

In this case, 643,233 acres would be kept in irrigated production in the year 2000, with an import water requirement of 524,677 acre-feet of water. These water requirements are based upon the water use rates of the Voluntary Conservation Case analysis. If these required quantities of imported water were made available to the High Plains area, the analyses indicated that Value of Production, in 1977 dollars, would be $2.77 billion in 2000, an increase of $130 million from the Baseline Case, and $3.1 billion in 2020, an increase of $260 million from the Baseline Case (Figure 9).

TAILWATER RECOVERY ponds and lake pumps capture irrigation runoff for reuse.

Returns to land, management, and, in this case, water, are projected to be $45.7 million more than for the Baseline Case projection in 2000, and $107.8 million more than the Baseline Case projection in 2020 (Figure 10).

Projections Of The Texas High Plains Economy

The results of the petroleum and agricultural sectors were combined with projections of the non-farm sectors of the Texas High Plains economy for the purpose of making projections of the effects of changing supplies of petroleum and water upon regional value of production, employment, and income. The total value added of all economic sectors of the Texas High Plains is projected to grow from about $15.3 billion in 1977 to $31.6 billion in 2020 (1977 prices). The predominant sector of the area's economy through the year 2000 is projected to be oil and gas production, accounting for most of the growth in output until 2000. Value added in the mining sector (oil and gas) in the Texas High Plains is projected to rise from $5.5 billion in 1977 to a high of $12.8 billion in 1990, falling thereafter to $1.6 billion in 2020 (1977 prices). For the Baseline Case, agriculture is not projected to decline in terms of total dollar value of output, but the annual growth rate of output steadily declines over the period. Value added from the agriculture sector is projected to rise steadily from $1.1 billion in 1977 to about $1.9 billion in 2020 (1977 prices). Manufacturing is projected to become the leading economic activity by 2020, following trends already beginning in the state

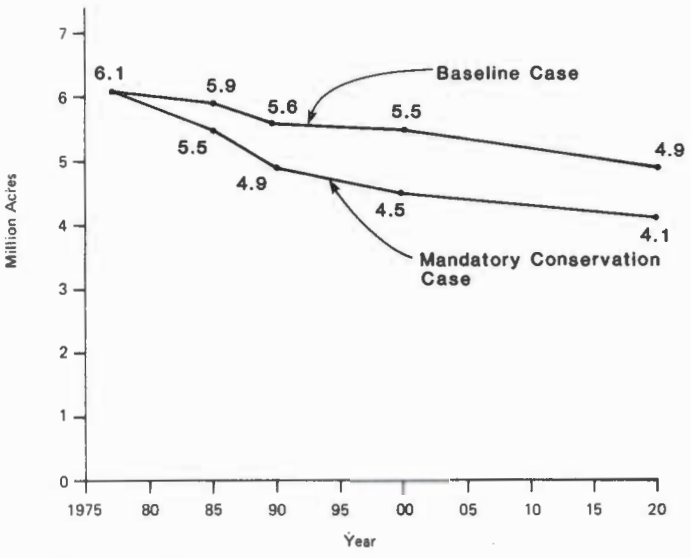

Figure 6.—Texas High Plains, Projected Irrigated Acreage: Mandatory Water Conservation Case and Baseline Case

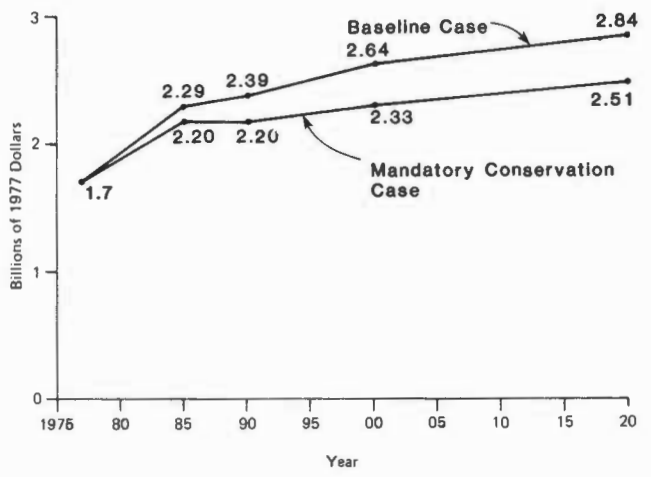

Figure 7.—Texas High Plains, Projected Value of Production: Mandatory Water Conservation Case and Baseline Case

and in the region itself. Value added from manufacturing is projected to rise from $1.7 billion in 1977 to $7.8 billion in 2020 (1977 prices). However, the growth rate of manufacturing output is projected to decline significantly between 2000 and 2020 when it is projected that mining-related industries such as oil field machinery will no longer have a significant regional market due to depletion of oil and gas reserves.

The effects of declining crude oil and natural gas resources between 2000 and 2020, as projected in the energy parts of this study, are projected to adversely affect growth of many consumer oriented sectors. For example, retail trade and services slows considerably in response to anticipated losses in total subregional employment.

The projections for employment in the Texas High Plains Study area show that total private sector employment could increase by over fifty percent from 1977 to 2000. By then, an estimated additional 223 thousand new employees will be located in the region with most of the growth resulting from an approximate 89 percent increase in manufacturing employment. The baseline projections show a decline in total employment in the twenty year period 2000 to 2020. This projected decline will not be so severe is it would be if manufacturing sectors' output showed either no growth or declines. The total decrease of about four percent for this twenty year period results from a large drop in petroleum production (mining) and oil field services employment of over 27,000 jobs.

The projections until 2000 for the Texas High Plains is one of rapidly increasing production for almost every sector except the agriculture sectors, the outputs of which remain relatively constant. The regional economic level of the area is projected to decline between 2000 and 2020, although the period from 1977 to 2000 is projected to be an era of relatively high economic activity. During the 1977 to 2000 period, the economic base of the area is projected to be broadened considerably through the expansion of the manufacturing and services sectors. Supplies of petroleum and water resources of the region will be extremely limited in the later periods of the study. Thus, unless human and capital resources continue to contribute significantly to the economy it will not be possible to maintain its production during the twenty year period, 2000-2020. The influences of rapidly declining oil and gas production after about 2010 is strong, resulting in net negative changes in outputs for some sectors and overall lower employment in the region.

Conclusions

The water resources of the Ogallala are the lowest cost, most valuable water resources the region will ever have available to it. The U.S. Corps of Army Engineers' cost estimates for importing water to the area can be viewed as replacement cost of water at the terminal storage points. This, of course, is not the total replacement cost of water at farms, since cost of distribution from terminal storage was not included in their study. When viewed from the replacement cost vantage point, each farmer of the High Plains must consider whether or not his present water marketing, irrigation operation is paying him enough returns for his water.

There may not be a way to convert the present Ogallala water into dollar values as high as those estimated dollar costs to import replacement water to the area. The reasons for this include the fact that land and water are the claimants of residual income from irrigation farming, after all other farm expenses have been paid. The price of farm commodities, of course, determines the gross income from which expenses can be paid. Thus, the fact is that the short run market for water is through agricultural commodities. The value of the present water supply depends upon farm commodity prices as determined in national and world markets, costs of purchased production inputs (labor, seed, fertilizer, insecticides, herbicides, fuel, machinery, insurance, interest, transportation, and supplies), the weather and the efficiency of water and other inputs used in irrigation. The High Plains farmer has very little influence on any of these factors except the management of his operation to achieve the most efficient use of his production inputs, including water. That is to say, the High Plains farmer must take every action possible to get the most dollar yield from each acre inch of water he uses. (Remember, the replacement cost of water [imported water] will be more than $500 per acre foot.) To these ends, both public and private sector research has been directed toward means to increase productivity of water on the one hand, to reduce the quantity of water needed per acre irrigated, and to increase the efficiency of irrigation systems. The High Plains Study Team has assembled information about potential water conservation and water efficiency improving techniques. They are recommending that all possible public [illegible] support, encouragement, incentive and public distribution of this knowledge be given high priority immediately. This course of action will not produce more water, but it will work to save farm businesses from financial ruin, it will make the present water supply last longer, it will increase the value of the existing water supply, and in the end it could work to reduce the quantity of water that would need to be imported. Also, more efficient irrigation methods would raise the value of net returns per unit of water that could be used to pay importation costs. The major water conservation practices are:

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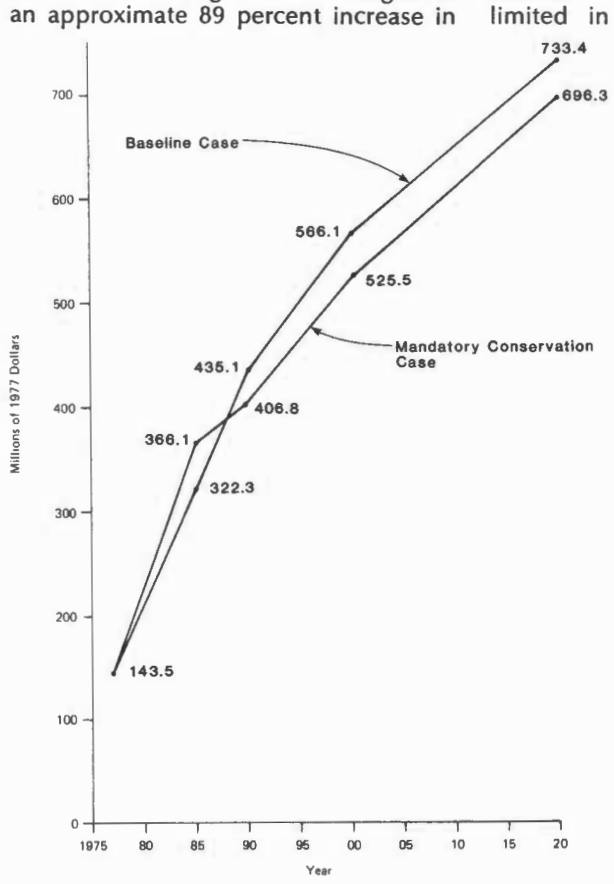

Figure 8.—Texas High Plains, Projected Returns to Land and Management: Mandatory Water Conservation Case and Baseline Case

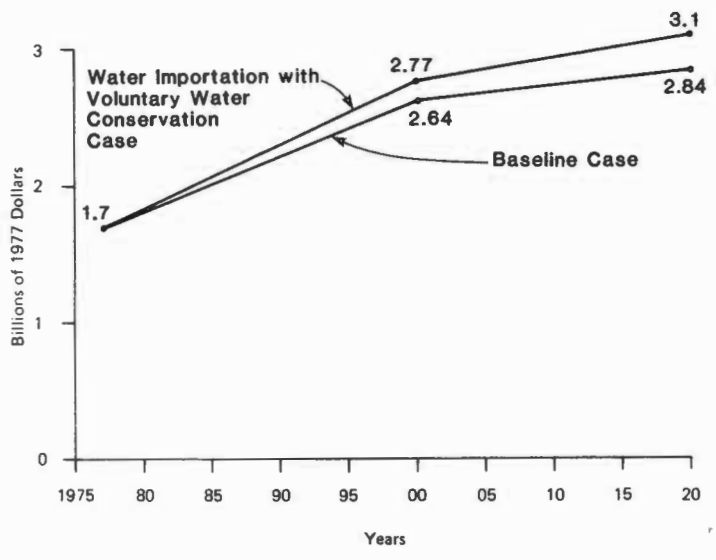

Figure 9.—Texas High Plains, Projected Value of Production: Water Importation With Voluntary Water Conservation Case and Baseline Case

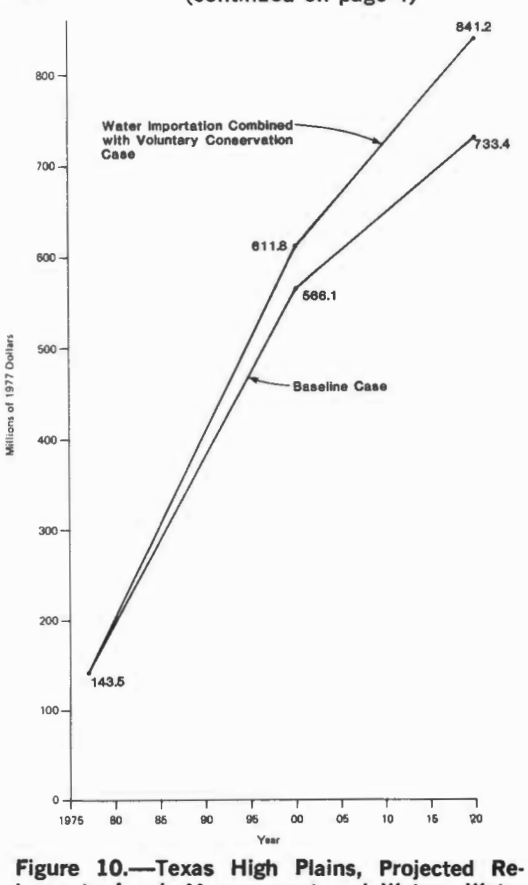

Figure 10.—Texas High Plains, Projected Returns to Land, Management and Water: Water Importation Combined with Voluntary Water Conservation Case and Baseline Case

1. Irrigation management: to meet plant water needs in light of soil moisture conditions;
2. Irrigation system improvements: to increase efficiencies of wells, pumps, motors, and distribution systems, to reduce surface water runoff, and to capture and reuse tailwater;
3. Evapotranspiration, evaporation, and runoff reduction: to select the most drought tolerant strains and varieties of crops, use of reduced tillage methods of cultivation, residue management, basin tillage, terracing, and in some cases deep plowing to store and hold moisture;
4. Farm Management—Select economically efficient level of irrigation: to irrigate at a level at which returns to water are maximum as opposed to irrigation for maximum crop yields.

The priority agricultural research and development topics for both public and private sector research efforts, that have been identified are:

1. Genetic improvements to increase drought tolerance;
2. Evaporation suppressants and anti-transpirant methods and materials;
3. Engineering improvements in irrigation wells, pump and motor efficiencies, irrigation application systems, and cultivation and harvesting systems for use in water conservation farming systems.

Finally, the public sector needs to increase its efforts at demonstration of water conservation farming methods and distribution of information to farmers. All units of government should adopt tax incentives to encourage investment in water saving equipment, and consideration should be given to low interest loans for such investments. It is in the interest of the entire economy to achieve the maximum economic efficiency from the use of exhaustible resources, such as water from the Ogallala aquifer.

Prepared by the Division of Planning and Development, Texas Department of Water Resources, July 1982, Dr. Herbert W. Grubb, Director.

HIGHLY EFFICIENT, very low pressure sprinkler systems circle the crop and lay water right down into the furrow where mini-dams prevent the water from running.

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.

DAMMED WATER stays put between furrow dikes until the soil can absorb all rainfall or irrigation applications.

PARALLEL TERRACES catch and hold rainfall in the field to prevent runoff and soil erosion.

IRRIGATION EFFICIENCY evaluations of water distribution and application systems are a highly profitable management tool available to farmers.

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Plow Pans Increase Runoff On High Plains

An unusually high incidence of plow pans, apparently widespread over the High Plains, is slowing water absorption and costing farmers by causing excessive runoff, soil erosion, extra irrigations and possibly even lower yields.

"It's not obvious, but it's there, a sneak-thief," says Mike Risinger, SCS soil scientist. "The top of the field usually looks pretty: soft, fluffy, no weeds, and the trash plowed under. But hard packed just below the surface, about three to six inches down, is the top of a hardpan layer two to four inches thick that defies penetration by water, plant roots, and in some cases even the shovel."

That is what Mike and Shorty Lancaster, High Plains Water District field technician, found all too often this year as they randomly cut the dirt across 15 counties to bury tubes and establish neutron moisture monitoring sites for the SCS/HPWD cooperative annual soil moisture survey and moisture deficit mapping program. They expected to find some pretty wet soil profiles after the long, strong spring rains of March through June. Instead they found plow or tillage pans. The data they collected showed that 60 to 80 percent of the heavy rainfall received between March and July was lost to runoff. This was partially due to plowpans which severely decreased infiltration.

Comparing soil moisture measurements at 39 sites installed in March and remeasured in July, Mike found only five had picked up more than two and a half inches of moisture. The rest showed less than one and a half inches of new moisture. This increase was surprisingly low after the eight to twenty inches of rain received during the monitoring period this Spring. Twenty-three of the 39 sites had serious hardpans. The pans were so compact in some of the plots that the staff says it was difficult to dig holes to bury the tubes.

The problem is not isolated. SCS soil experts in Lubbock and Amarillo think it is much worse than expected. Fred Pringle, SCS soil scientist in Amarillo believes the plow pans are widespread. He says, "they exist to some degree over 25 to 30 percent of most fields at some time during the year; but in some fields they are present all the time, especially under disc-type operations."

Fred has measured infiltration rates and found some of the lowest intake on Acuff soils growing continuous cotton. Another study of infiltration rates on Acuff soil in cotton at Big Spring's Agricultural Experiment Station found that where traffic was confined and maintained to the same rows for three years, the result was a three-fold increase in infiltration rates in the untrafficked rows.

An average measure of infiltration rates in four High Plains soils with and without hardpans showed dramatic decreases in water intake as a result of compaction. Soils with a pan took in one-fourth as much water in 12 hours.

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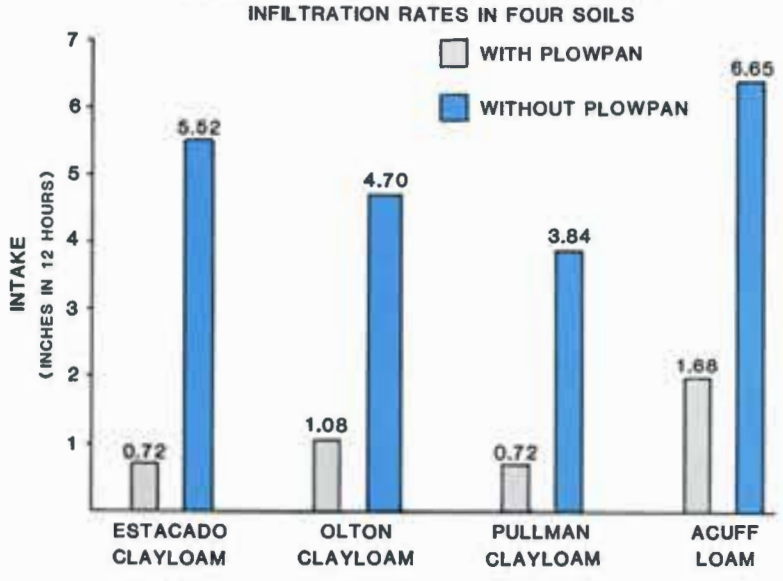
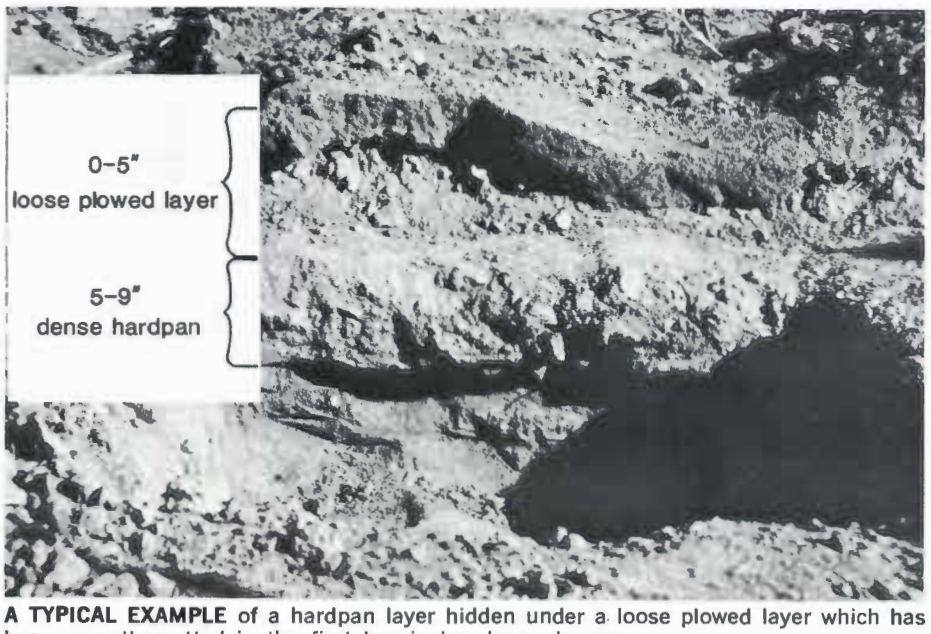
THE EFFECT OF PLOWPANS ON SOIL MOISTURE
INFILTRATION RATES IN FOUR SOILS





A TYPICAL EXAMPLE of a hardpan layer hidden under a loose plowed layer which has been recently wetted in the first two inches by a shower.

Court Rules On Water Rights

In a decision of great importance to those interested in the transfer of water across state boundaries, the U.S. Supreme Court, by a 7 to 2 vote, ruled that "ground water is an article of commerce and therefore subject to congressional regulation." The ruling was announced on July 2 in the case of Sporhase vs. the State of Nebraska.

The appellants, Sporhase et al, own contiguous tracts of land in Nebraska and Colorado and were using water from a well located in Nebraska to irrigate land located in Colorado. Nebraska had brought an action in state court to enjoin Sporhase from transferring water across the state line without a Nebraska permit.

A Nebraska law authorizes export of water, when otherwise reasonable, if the other state granted reciprocal rights to transfer water from that state into Nebraska. Colorado had not granted reciprocal rights and in fact had a law which prohibited transfer of Colorado ground water for use in another state. The Supreme Court ruled that the Nebraska law violates the commerce clause of the constitution as imposing an impermissible burden on interstate commerce.

The Sporhase vs. Nebraska case is likely to impact the dispute between the City of El Paso and New Mexico. As reported in the February 1982 TIA UPDATE, El Paso sued New Mexico when the latter blocked El Paso's plans to drill wells on land in New Mexico, just across the border, and pipe the water into the city water system. New Mexico enacted a "water embargo" statute prohibiting export of that state's ground water. El Paso's suit challenging the law was filed in September 1980. The case was heard by federal Judge Howard Bratton in New Mexico beginning in January 1982. Testimony had been completed and briefs filed when the Sporhase ruling was announced. Judge Bratton, who had not

cont'd. pg. 4, col. 3 . . . COURT RULING

Urban Water Study Coming

A preview of a study on urban water conservation which will be published later this year was presented at College Station on September 15 to a group of Texans who have interest and experience in urban water use. The report is being prepared by an eighteen member task force from the Texas Water Resources Institute and the Texas Agricultural Experiment Station.

The report will be in five sections. The first section deals with ornamental trees, shrubs and turfs which are efficient users of water and are suitable for Texas soils and climate. It will feature a list of approximately 200 plants that are drought tolerant, giving the common and scientific names, growth habits such as height, color, type of fruit or flower, and where in Texas it will grow best. Most of the plants listed will be native to Texas. Because of climate, latitude and soil characteristics, many plants which do well in other relatively dry areas such as Ari-

cont'd. pg. 3, col. 4 . . . URBAN WATER

PLOW PANS . . . continued from page 1

That means in a 12 hour set, an irrigator could only get one inch instead of four inches of water into a soil profile. In a tailwater irrigation operation hardpans increase runoff and erosion and require three or four times more pumping to get the same amount of water into the ground.

Hardpan or plowpan is caused by compaction. Compaction destroys the natural soil structure and closes off the small pores and channels which normally carry soil water. The most frequent cause is tire traffic from cultivation equipment or by the downward pressure from the cutting edge of a plow or disc. Tillage pans and plowsoles have developed on many of the fine sandy loams and silt loam soils in our area as the result of management systems that destroy the organic matter in the soil. Running tillage equipment over wet ground causes severe compaction.

"This was a particularly bad year for pans," says Mike Risinger. "We had unusually heavy rains, wet fields, and lots of trips to fight sand."

Tandum and one-way disc plowed fields are the most susceptible to pan because these operations only plow up the top six inches of the soil. A deep chiseling operation will break up the pan and allow water to enter at a much faster rate.

"We are not suggesting everyone go out and deep chisel," says Mike. "The first thing they need to do is go dig some holes and find out how bad a problem they've got. It may not be cost effective or even necessary for an operator to chisel an entire field. Possibly only the traffic rows need to be chiseled."

Mike suggests pushing a thin metal rod or electric fence post at least 18 inches into the soil at random sites over the field. If the rod cannot penetrate this deep, either a hardpan or extremely dry conditions exist. Where more than half of the rows in a field are affected, the problem is severe.

A deep chisel operation may only be necessary once every few years over most of the field. It may be needed more often in rows traveled by equipment. But a deep chisel operation can pay for itself in increased stored moisture which reduces runoff and erosion and has the potential to increase yields and profits.

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Western Water Reform May Affect West Texas

The Reclamation Reform Act of 1982 is on its way to President Reagan for signature. The bill was approved by the Senate on Friday, September 24, and by the House on Wednesday, September 29.

The bill is expected to be signed into law without delay.

[*The High Plains Water District has watched the progress of this piece of legislation with vested interest. If water is ever imported to the High Plains with the help of federal funds, then the rules and guidelines under this law might be applicable to this area.*]

In its final form, the bill provides for a number of changes in reclamation law which would be applicable to all districts, and a number which would be applicable only to those districts which amend their contracts. However, the bill also provides an "individual option" which will enable farmers in districts which do not amend their contracts to take advantage of the provisions of the bill.

Bill's Provisions Outlined

Provisions of the bill which apply to all districts would:

- Make clear that residency is not required in any districts.
- Limit the length of new recordable contracts to five years. The present limit is 10 years.
- Eliminate the possibility of "windfall" profits on the purchase and sale of excess land by requiring the land to be sold for no more than its purchase price if it is sold within 10 years.
- Require the Secretary of the Interior to encourage districts to engage in water conservation programs.
- Make clear that reclamation law does not apply to lands in Corps of Engineers projects.

Payout Eliminates Acreage Limitations

- Acreage limitations are eliminated on repayment of construction obligations. Prepayment—either by district or by individual—is permitted where provided in existing contracts.
- Certificates and letters of exemption due to payout, which had been issued by previous Secretaries of the Interior, are validated.
- "Contracting entities" can get the U.S. government into court without the Government being able to escape the suit by claiming sovereign immunity.
- The provisions of contracts which define project and non-project water are validated.
- Leases must be written, and for a term not to exceed 10 years except that leases on lands to be planted to crops having a life of more than 10 years can be as long as 25 years. (In districts which amend their contracts, providing for full-cost pricing on operations of more than 960 acres, the landowner and lessee would have to certify that the rents provided reflect the true value of the land with project water and not just the "dry-land" value.)

Amendments Can Bring Benefits

Some of the provisions of the bill will be available only to districts which amend their contracts, but the bill also contains a provision that would permit an individual to obtain the benefits of the bill's provisions by agreeing to pay higher costs and other restrictions.

The new ownership limitation would be 960 acres per farming unit ("a qualified recipient"). Corporations would be treated in a more restrictive fashion.

Water applied to landholdings up to 960 acres would be at the regular contract rate, but water applied to land in excess of 960 would be paid for at "full cost." The interest rate to be used in determining full cost would depend on when the funds were expended, with funds expended prior to the date of enactment going at a lower rate than funds spent after the date of enactment.

Corporations with more than 25 shareholders would be considered "limited recipients" and would be limited to ownership of 640 acres. If they are "in place" on October 1, 1981, they would have to pay full cost for all water going on land in excess of 320 acres. If they began farming after October 1, 1981, they would have to pay full cost for all water.

Acreage limitations, both as to ownership and leasing, would be applied on a westwide basis rather than on a district-by-district basis. The bill would require every landowner and every lessee to file certain certificates with the irrigation districts. This is defended as being necessary to enforce the westwide limitations.

Equivalency would be available to districts which amend their contracts, but the "individual option" appears to be available in regard to equivalency as well as to increased acreage.

Small Projects Would Benefit

The bill would permit similar increases in acreage for Small Reclamation Projects. The language of the conference report indicates that these would apply only to future projects, but the language of the bill appears to suggest that it could apply to existing projects as well.

Provisions which would have been of special benefit to the Central Arizona Project were eliminated, except that new recordable contracts in the CAP may continue to run for 10 years although the length for other projects was cut to five years.

Constitutional Flaw Hits Californians

In the San Joaquin Valley of California an area of about a million acres, there are 20 to 30 irrigation districts.

These districts all receive their water supplies under the terms of contracts written under Section 9(e) of the Reclamation Project Act of 1939. The 9(e) contract is a "utility" type contract under which the water district never stops paying. When the term of the contract expires, the district doesn't

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"own" anything and it has not completed its "repayment" for the dams and conveyance features of the project.

The 9(e) contract has no reference to operation and maintenance charges and no separate payment for O&M is made. The 1939 act requires the Secretary of the Interior to set the rates under the 9(e) contract high enough to "produce revenues at least sufficient to cover an appropriate share of the annual operation and maintenance cost." Due to escalating costs for O&M, the rates in the existing contracts do not in all cases cover O&M, let alone provide anything left over to be credited to the cost of the project on the department's books.

A provision in the new bill, first suggested in writing by Senator James McClure, would permit these districts to continue to operate under their existing contracts for only 4½ years, after which they would be required to pay full cost for all water going on LEASED lands in excess of the 160 acres permitted under the ownership limitations of existing law.

The bill is written in such a way that the net effect of this provision is to require a separate charge for O&M in these situations. Some of these contracts have 20 to 30 years to run. It is the contention of farmers in the affected districts that this is an unconstitutional denial of their rights under their contracts. It is one of the ironies of the legislation that despite all the self-serving statements made about defending the family size farm, it was the small to middle size farmer that took it on the chin in the bill.

Other States Not Affected

As has so frequently happened in the course of this legislation, the negative effects of the 9(e) contract provision do not significantly affect districts outside the State of California. Districts in most other states have contracts written under Section 9(e) of the Reclamation Project Act of 1939 and they pay a separate charge for O&M already. However, once they complete payment under their repayment contracts, they are freed of acreage limitations and need not pay anything except O&M from then on. This option is not open to the Californians.

California farmers objected to the use of the 9(e) contracts when the Central Valley Project first came on line, claiming it was intended to keep California's Central Valley under the perpetual domination of the Bureau. Their complaints fell on deaf ears, however, and the Government insisted on the 9(e) contract.

Reprinted from Farm Water, newsletter of the Farm/Water Alliance, Washington, D.C., Sept. 29, 1982.

West Texans Opinion On Water Issues Revealed

How do West Texans' convictions about major water issues like state control of ground water pumpage or water importation stack up against folks in other areas of the State? Returns from a public opinion survey distributed statewide by the Texas Department of Water Resources and in West Texas by the West Texas Chamber of Commerce and High Plains Water District let you see for yourself.

The survey was created to obtain public opinion and participation in formulating policies and priorities for amending the Texas Water Plan. Many of the 32 statements presented in the survey are included here with the percentage totals for each response choice.

STATEMENT 1 A goal of the TEXAS WATER PLAN should be to satisfy the projected water requirements of communities, and not deliberately use water as a means to influence the direction of population or economic growth.

West Texans	49%	43%	3%	5%		
Statewide	56%	26%	1%	10%	6%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 2 Economic and population growth in Texas will be influenced by the availability of future water supplies.

West Texans	80%	20%				
Statewide	76%	22%	3%			
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 3 Texas needs stronger laws to protect underground water resources from overpumping in those areas where overpumping creates a problem.

West Texans	30%	37%	2%	10%	21%	
Statewide	43%	35%	5%	13%	2%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 4 Presently, underground water belongs to the landowner, but it should be managed by a public agency in the public interest.

West Texans	5%	29%	3%	20%	43%	
Statewide	27%	37%	5%	15%	13%	2%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 5 The most desirable way to manage underground water is on a local or regional basis as opposed to uniform statewide control.

West Texans	59%	37%		4%		
Statewide	35%	35%	3%	18%	8%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 6 Efforts to maintain clean water should be continued at the present level even if federal funding is reduced.

West Texans	45%	49%	2%	4%		
Statewide	61%	27%	2%	7%	3%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 7 In the face of reduced federal assistance, local and/or regional authorities must assume the cost of sustained high water quality.

West Texans	36%	45%	7%	12%		
Statewide	36%	38%	3%	19%	3%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 8 Local and/or regional authorities will need state assistance in order to be able to finance the costs of sustaining high water quality.

West Texans	35%	44%	5%	11%	5%	
Statewide	42%	43%	3%	7%	5%	4%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 9 If people locate in a known flood prone area, they should be given flood protection assistance by public agencies.

West Texans	4%	10%	7%	27%	52%	
Statewide	2%	10%	3%	25%	59%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 12 The TEXAS WATER PLAN should fully recognize water conservation (meaning to increase efficiency and reduce per capita consumption) as well as supply development.

West Texans	57%	41%			2%	
Statewide	83%	15%		1%		
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 13 The primary responsibility for municipal, industrial and agricultural water conservation programs should rest with the local or regional authorities.

West Texans	60%	35%		5%		
Statewide	26%	44%	3%	18%	8%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

continued on page 4 . . . OPINIONS REVEALED

URBAN WATER . . . continued from page 1

zona, southern California and the southeastern United States do not grow well in Texas. Our special conditions include a temperature range, from 0°F to 120°F, calcareous or limey soils having pH's from 7.0 to 8.5 and less than 40 inches of moisture per year. Acceptability to homeowners is another important characteristic; e.g. the creosote bush and the cactus are drought tolerant but many people would not want them in their yards.

A section of the report will address the problem of the urban physical environment and its impact on water consumption, particularly in regard to climate and soils. In the urban area, climate reflects not only the climate of the surrounding region but the changes imposed by the size of the city and the nature of its buildings and the ratio between building space and greenspace. The nature of soils is affected by disturbance to natural conditions in the process of constructing homes and building. Sealing off the soil area by pavements and roof areas affect runoff and absorption. In the long range, a whole new technology for urban planning may be desirable. There appears to be a favorable trade off between providing water to create urban greenery and increased costs of air conditioning where the soil is bare or paved over.

The alternatives in water usage are covered in a section which examines water supply and distribution planning, usage internal and external to the house, possible ways to reduce per capita consumption, and supplementary supplies such as use of "gray water" (effluent from showers and laundries). Some of these applications involve retrofitting, such as replacement of existing commodes with water efficient models, or changes in life styles. Use of "gray water" to irrigate lawns would be prohibited under many existing building codes and would require extensive modifications to existing house plumbing.

A section of the report deals with the landscape ecosystems. Alternative cultural approaches to dwellings are described. The Mediterranean/near East solution was an inward looking residence with a small garden area internal to the living area with no landscaping outside the walls. This style was developed to fit a water-short climate. The north European model featured gardens and green areas surrounding the house which were built to cope with cold winters and ample water supplies. When we try to adapt northern climate living styles to the sunbelt, including northern ornamental plants, the results are sometimes not very successful.

The last section of the study addresses legal and economic restraints to water conservation measures and to their public acceptability.

The task force will complete its draft, including changes and additions suggested at the September 15 meeting, by the end of October. It is hoping to have the study printed and distributed by the end of the year. Questions concerning the study may be addressed to Dr. A. J. Turgeon, Texas A&M Research and Extension Center, 17360 Coit Road, Dallas, TX 75252.

Reprinted from TIA UPDATE, Trinity Improvement Association, Irving, Texas, September 1982.

OPINIONS REVEALED . . . continued from page 3

STATEMENT 14 Market forces, including increased water price, not government regulations, is the best way to encourage efficient water use.

West Texas	26%	47%	7%	16%	4%	
Statewide	37%	39%	3%	17%	3%	
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 15 Many Texas cities will face major water shortages by the year 2000 if present facilities and water use patterns remain unchanged.

West Texas	53%	45%	2%			
Statewide	68%	24%	3%	2%	1%	2%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 16 The State should have a strong program and adequate funding for public education and public awareness relating to water resources, water quality protection, and water conservation.

West Texas	62%	34%	2%	2%		
Statewide	71%	22%	3%	3%	2%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 22 Additional interbasin transfers of water from basins having water surplus to their long-term needs should be done in order to meet shortages in other basins, provided the beneficiaries pay the costs.

West Texas	31%	60%	7%		2%	
Statewide	48%	36%	3%	5%	3%	5%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 23 Irrigation farming and food processing business in Texas is so important that the State should plan for the development of future agricultural water supplies.

West Texas	70%	23%		5%	2%	
Statewide	50%	37%	3%	8%	3%	
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 24 The TEXAS WATER PLAN should continue to consider the importation of surplus water from outside the state in order to meet the long-term needs of agriculture and other uses in semi-arid regions such as the Texas High Plains and the Rio Grande Valley. (Surplus means water in excess of the needs of the areas from which it would be obtained.

West Texas	68%	21%	2%	5%	4%	
Statewide	38%	37%	3%	8%	14%	
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 25 The State (either the Governor, Legislature, Texas Water Development Board, or a combination thereof) should develop a priority system to establish the merits of water development projects competing for the same water resources and for future state and/or federal funds.

West Texas	43%	52%	2%	3%		
Statewide	47%	38%	4%	7%	3%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 26 The State should take a more active role, including increased financing, of water resources and related research.

West Texas	49%	37%	5%	9%		
Statewide	59%	30%	3%	5%	1%	2%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 27 The State should assist local and regional governments in the financing of water supply, and wastewater and flood control systems.

West Texas	32%	53%	3%	7%	5%	
Statewide	40%	47%	2%	7%	3%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

STATEMENT 28 The State should provide loans to local and regional governments for the construction of water supply, and wastewater and flood control systems.

West Texas	32%	49%	5%	12%	2%	
Statewide	32%	47%	5%	10%	5%	1%
	strongly agree	*tend to agree*	*indifferent no opinion*	*tend to disagree*	*strongly disagree*	*declined to answer*

COURT RULING . . . continued from pg. 1

made his ruling, allowed New Mexico to submit any additional evidence it desired in light of the ruling on the Sporhase case. The trial will be resumed on September 13 to receive additional evidence from both El Paso and New Mexico.

The Sporhase ruling differentiates between economic protectionism, on the one hand, and safeguarding the public health, on the other. A state's power to regulate water for the purpose of protecting the health of its citizens, but not simply for the health of its economy, was recognized.

The Supreme Court also affirmed the ruling in the case of the City of Altus vs. Carr. Altus, Oklahoma, sought to buy well water in Texas and import it for domestic use. Texas enacted a "water embargo" law to block the sale. The court found that since well water could be sold freely in Texas, its export could not be prohibited.

Reprinted from TIA UPDATE, Trinity Improvement Association, Irving, Texas, September 1982.

Annual Wind Stripcropping Improves Soil, Buffers Crop

By DENNIS W. NEFFENDORF
Area Agronomist, SCS Lubbock

One answer to wind erosion on the High Plains on row crops is annual stripcropping. The most popular form is wheat strips across a field, normally at right angles to the prevailing wind direction. The spacing required between the wheat strips is calculated to hold down soil movement. Correctly spaced wheat strips serve as a wind buffer. A farmer benefits from this reduced soil movement by reducing sandfighting trips and by providing protection for young growing crops of cotton in a healthier environment.

With a rotation of these wheat strips and by moving them every year, the operator improves his soil's organic matter, its moisture holding capacity, and he maintains the soil for future production. Many times these strips can be used by farmers as set aside acres.

Several farmers in the Lubbock area have worked with the Soil Conservation Service in applying, designing and managing a wind stripcropping system. Some of these farmers include Billy Thetford, Joe Hoelscher of Levelland, Fred Albus, Jr., of Littlefield, Jerry and Ronald Thuett of Post, Mickey Givens, W. W. Robertson, R. H. Farris of Crosbyton, and Leona Cox, Bob Burns and Dan Brandon of Matador.

SCS technicians are available to assist landusers in planning, designing and laying out an effective annual wind stripcropping system. For more information contact your local SCS field office.

TERRACED FIELD with terrace ridges and odd areas planted to wheat for effective windstrip cropping system.

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

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FROM ONE PIPE to another, water is automatically redirected through the diaphram control valve and a Y shaped connector to gated pipe to furrow irrigate half the rows at set intervals.

New Method Of Row Watering Studied

For the furrow irrigator whose soil takes in massive quantities of water at the top end of the field and loses it to deep percolation while the stream moves toward the bottom of the row, there is a new row water management technique.

The equipment investment is minimal. It uses much less water to furrow irrigate the same number and length of rows. It can do the job in much less time or can water twice as many rows in about the same time. It eliminates or cuts tailwater runoff to a minimum. It dramatically reduces deep percolation water losses, and to top it all off, the system is automated and is already commercially available. Sound too good to be true?

The technique is a new concept in row watering called surge irrigation. It involves turning the irrigation flow on and off for set lengths of time rather than allowing it to continuously flood from one end of the field to the other. The idea appears to be relatively simple, but the results of recent field tests by the Amarillo Soil Conservation Service were dramatic. SCS engineer Jerry Walker and USDA Bushland Research Center Engineer Dr. Arland Schneider worked with a Hereford irrigator to measure the effect of the automated surge irrigation system on his grain sorghum.

Melvin Betzen normally pre-waters eighteen 30-inch rows 24 hundred feet long with 840 gallons per minute on a 12 hour set. To get the water out at the lower end of the field he normally applied about nine inches per acre. According to the SCS for his soil type, a Ulysses soil with a 0.5 inch per hour intake rate, Betzen only needed a 3.5 inch application of water to fill his soil profile on the day of the test. If he applied nine inches, all the water in excess of 3.5 inches would be lost to deep percolation in the super saturated upper end of the furrow as the water slowly advanced to the lower end of the field.

On May 27th Walker, Schneider and other SCS personnel set up a surge irrigation test system on the Betzen farm. They connected an alfalfa valve to a "Y" shaped pipe followed by a pair of diaphram control valves and an automated switching control unit. Water flowed past the control valve and through gated pipe to irrigate 20 rows. At 24 minute intervals the diaphram on the valve gradually filled on one side of the "Y", shut it off, tripped the timer and diverted water through the other control valve to the second set of gated pipe.

continued on page 3 . . . SURGE

Public Agrees On Need For Strong Water Ed Program

A whopping 93% of all Texans and 96% of West Texans polled recently by the Texas Department of Water Resources agree the State should have a strong program and adequate funding for public education and awareness related to water resources, water quality protection and water conservation. In an independent marketing and communications research survey statewide measuring public opinion on a range of water issues, Texans ranked education first as the best way to get people to use less water. Clearly, water education has become a prirority for Texans. But there is precious little water education material available in the State to match that demand.

TDWR has stated there is insufficient availability of educational information on the subject of water and water related issues for use by Texas educators. Last fall they sponsored an educational pilot project to evaluate, test and distribuute a newly created, interdisciplinary water education series for grades K-12 produced by Water & Man, Inc. in Salt Lake City, Utah. Over 90 West Texas educators in the High Plains Water District service area participated in the pilot evaluation project. (See *Cross Section*, Nov. 1981.)

Participants were introduced to the water education series at specially called workshops. They took the material back to their classrooms, examined it, and used some of the lessons with their students. Each teacher completed an extensive evaluation instrument to rate the pilot project overall and the water education materials. Their responses were analyzed by Jim Barufaldi, Director of the Science Education Center at the University of Texas, Austin.

Project findings are complete. Based on a composite of responses, it was concluded that the introductory workshops were well received, and the materials were highly rated. Teachers evaluated workshop administration, adequacy of materials, relevance to local interest and to school curriculum, and adequacy of teacher training all excellent. The success of the pilot project is apparent from these randomly selected samples of educators' impressions about the program, and their comments on the strengths and weaknesses of the materials.

continued on page 4 . . . WATER

MULESHOE TEACHERS participating in the Water & Man introductory workshop enjoyed dramatizing a trip through the hydrologic cycle.

THE Cross SECTION

THE CROSS SECTION (USPS 564-920)

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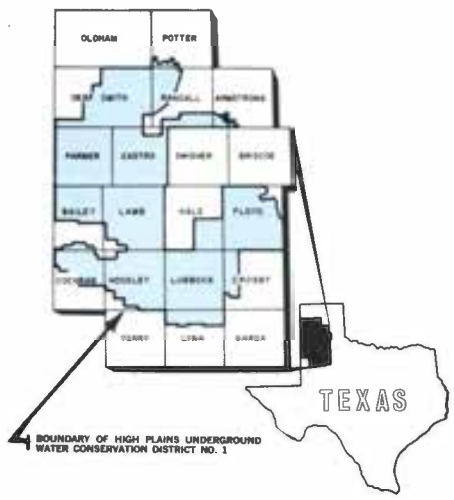

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NOTICE: Information regarding times and places of the monthly County Committee meeting can be secured from the respective County Secretaries.
Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Potter County; in this county contact Jim Line.

Davis Retires

SUCCESSOR NAMED TO LEAD WATER RESOURCES

Charles E. Nemir was appointed executive director of the Texas Department of Water Resources by the Texas Water Development Board on Wednesday. He succeeds Harvey Davis who is retiring.

The appointment is effective Dec. 1, said Louis A. Beecherl Jr. of Dallas, chairman of the six-member Board.

Nemir, 50, is a native of Austin and has been with the Department of Water Resources and its predecessor agency since 1967. He was named assistant executive director of the Texas Water Development Board in June of 1972 and served in that capacity until September of 1977 when the three water agencies were merged and he was appointed acting executive director of the Department of Water Resources. He served in that capacity until Davis was appointed executive director in November of 1977. In September of 1981, Nemir was named deputy director.

A registered professional engineer in Texas, Nemir holds bachelors and masters degrees in petroleum engineering from the University of Texas at Austin. He served in the U.S. Navy from 1955 to 1958 and was employed by Texaco Inc. from 1958 to 1967.

The new executive director has been an appointed member from Texas to the Western States Water Council since

CHARLES NEMIR

Texas became a member state in 1978. He served as chairman of the 12-state council during the 1981-82 year.

Nemir and his wife, Judy, are the parents of three daughters.

Davis, 55, has served Texas' state government for 28 years. A native of Williamson County, he was with the Texas State Soil and Water Conservation Board headquartered in Temple for 23 years, 16 of which he served as its executive director.

Future Farmers Learn Water Management

Area farmers are not the only ones learning the lessons of efficient water management. Future farmers and vocational agriculture students on the High Plains are getting in on the information. The District began four years ago talking to vo-ag teachers, providing maps of our water resource, pamphlets, bulletins, technical reports and films as teaching resources for introducing agricultural water management and conservation.

Awareness of the latest water and energy saving techniques for profitable farm management are essential to tomorrows farmers and agribusiness leaders. This fall the District has launched a new campaign to get information to vo-ag teachers and students on the latest technology and practices for efficient farm water management.

JAY EUDY
Area I - Vocational Agriculture Consultant

We're again talking to the teachers in the District, letting them know what programs and materials the district can provide. We are still taking requests for classroom copies of the *Cross Section*, for hydrologic atlases, speakers, brochures on the field water laboratory on-farm irrigation efficiency evaluation program and on how to calculate the cost of pumping water with an electric or natural gas power unit. We still offer classroom demonstrations of irrigation efficiency and evaluation equipment or field tours of how this equipment is used to evaluate an entire water management system. And this year we are looking for more suggestions from teachers. We are asking them to tell us what teaching aids they could best use if additional educational materials were available to the students.

We are finding their curriculum is limited because few conservation farming educational materials are up to date or relevant to conditions on the High Plains. Perhaps as a result many area vocational agriculture teachers are requesting classroom sets of the District's junior high mini-text, *An Introduction to Water and Water Conservation with Emphasis on the High Plains of Texas.*

As the interviews with teachers continue and the suggestions grow, the District will be looking for new ways to help educators emphasize the necessity of a total water management efficiency and conservation awareness among our future farm leaders and producers.

Regulating Groundwater Pumpage

During the past year there has been a great deal of discussion about the need for statewide control and management of ground water (Governor's Water Task Force, Texas 2000 Commission and others). There have been many ideas suggested as to how the legislature should address this issue. There are always extreme viewpoints on any issue. In this instance, one extreme believes that laws should be passed and implemented which would limit ground-water pumpage from each aquifer in the state to an amount which would not exceed the average annual recharge to the aquifer. The other end of the spectrum believes that there is no need for any regulation on ground-water pumpage. Those between these two extremes seem to believe that the statewide management of ground water can be achieved without making drastic changes in state law or disrupting the lives of very many Texans with these changes. Additionally, the Texas Department of Water Resources, as a part of their effort to update the Texas Water Plan, conducted a public opinion survey which included the ground-water control and management issue. The results of this survey are as follows as it addressed the ground-water issues:

Statement:
1) *Texas needs stronger laws to protect underground water resources from overpumping in those areas where overpumping creates a problem."*

Response:
Statewide the responses were as follows: 43 percent strongly agreed, 35 percent tended to agree, five percent were indifferent, 13 percent tended to disagree, two percent strongly disagreed and one percent declined to answer.

Statement:
2) *"Presently, underground water belongs to the landowner, but it should be managed by a public agency in the public interest."*

Response:
Statewide the responses were: 27 percent strongly agreed, 37 percent tended to agree, five percent were indifferent, 15 percent tended to disagree, 13 percent strongly disagreed and two percent declined to answer.

Statement:
3) *"The most desirable way to manage underground water is on a local or regional basis as opposed to uniform statewide control."*

Response:
Statewide responses were: 35 percent strongly agreed, 35 percent tended to agree, three percent were indifferent, 18 percent tended to disagree, eight percent strongly disagreed and one percent declined to answer.

The results of the public opinion survey and position papers issued by the various study committees seem to agree that a majority of Texans want stronger ground-water laws and that the most desirable way to manage ground water is on a local or regional basis. The committees and opinion polls indicate that most Texans prefer local controlled management districts over any other form of statewide ground-water management to this date suggested. Regional ground-water management has been practiced on a local option basis for more than 30 years in Texas.

**Presented at the "Water for Texas" conference, November 18-19, 1982, by A. Wayne Wyatt, Manager, High Plains Underground Water Conservation District No. 1.*

HOBBY ANNOUNCES 5-POINT POLICY

By BILL KIDD
Avalanche-Journal Austin Bureau

AUSTIN — Lt. Gov. Bill Hobby has announced a five-point proposal for a state water policy, including state assistance for water projects and consideration of a low-interest loan program to assist farmers in financing water-saving equipment.

Hobby said he is in "broad general support" of the recommendations which have been made by the Governor's Water Task Force and Texas Energy and Natural Resources Advisory Council on water development and conservation.

After studying those proposals, he said, he was recommending the following:

- That the state insure the water-related debt of local political subdivisions.
- That the Water Development Fund be continued and expanded, "especially in the water quality area."
- Restructuring the state's storage acquisition program and role in reservoir financing.
- Addressing the "very real needs of agricultural water users."
- Giving increased attention "to conservation and better management of state water."

Hobby said a bond insurance program "would get the best possible bond rating for the water boards of Texas cities and special districts, thus lowering interest rates and directly saving money for taxpayers."

But even with such a program, Hobby said, there would be "hardship cases" in need of assistance, which could be provided by the Water Development Fund (in existence since 1957).

Hobby said that "perhaps the most important long-range water problem faced by this state is major reservoir construction," which historically has been handled in large part by the Corps of Engineers.

"Unfortunately," he noted, "as in so many other areas, the federal government's willingness to play this role of banker is diminishing."

"One way of partially filling this void is to restructure the state's storage acquisition program," Hobby said.

Under this existing program, the state issues bonds and uses the proceeds to purchase water storage space in a reservoir.

But, Hobby said, the problem with the current program is that "it co-exists with the state's direct loan program within the Water Development Fund," and because the fund is low, "no money is available for storage acquisition since hardship loans are of a higher priority."

The storage acquisition program would work better if set apart with a separate debt authorization, Hobby argued, "with legislative approval required before an investment is made in a given project."

The program "would have to be carefully constructed to insure that the state responds only to reasonably foreseeable growth and does not act as a speculative developer," he said.

For many years, Hobby said, "agricultural users have planned on the possibility of water imported from other states. But it is becoming apparent that such an event, if it ever occurs, is a long way off."

Therefore, he said, "it is important to proceed with other more immediately practical plans," including the possibility of a state bond financed, low-interest loan program to aid farmers in purchasing "the capital equipment necessary to use water more efficiently."

"In some cases, the technology currently exists to cut agricultural water applications by 40 to 50 percent," Hobby said.

"And since over three-quarters of the water used in Texas is used in agriculture, the potential for saving is enormous."

Hobby said he has instructed his staff to begin preparing recommendations on how to implement such a program.

"If such a program — implemented through underground water conservation districts and tied to existing irrigated acreage — proves workable and can prolong the life of our underground water supplies by several decades, all Texas will be winners," he said.

Hobby also urged increased research and development efforts aimed at agricultural water use.

The final part of the program, Hobby said, should be increased attention to conservation and better management of state water.

He said the study groups have recommended a strong conservation program, encouraging locally managed underground water conservation districts, and continued study of freshwater inflows to bays and estuaries.

"The Legislature," Hobby said, "must give serious consideration to these goals."

SURGE IRRIGATION . . . (continued from page 1)

The gated pipe was set to water twenty 30-inch rows on each side of the "Y." One side was watered for 24 minutes, then the valve automatically closed and redirected the water to the other 20 rows for another 24 minutes. After 14½ hours the field was fully irrigated with only 4.9 inches of water applied. Twice as many rows as Betzen normally irrigated had been wetted. The rate of the water's advance down the furrow was about two minutes per hundred feet. Each 20 row set received water for only seven and a quarter hours. The rate of advance down the row was much faster than for Betzen's normal 12 hour set and he was able to water twice the number of rows in only two and a half more hours. Losses to deep percolation were greatly reduced because the "opportunity time" for water to continue soaking in at the top of the field was shortened.

Investigators are not sure exactly why it works, but explained Jerry Walker, "the water moves farther faster over the slick wetted areas at the top of the field to get to the end of the furrow sooner."

One explanation is that as the water surged down the furrow it picked up silts and dirt from the dry bed and carries them along. When the surge is diverted and the water recedes, the suspended particles settle out and form a silt slick on the furrow bed. With the next surge water rushes down the furrow with greater energy meeting little resistance until it again hits dry ground.

"We don't know very much yet about how surge irrigation will affect intake rates and compaction on different soils. We are still figuring out ways to manage surge irrigation," says Jerry. He suspects there may be a more dramatic affect with the first surge irrigation application as the operator changes from normal furrow watering. "But we just don't know yet," Jerry says. He suggests interested irrigators try surging on their own by manually switching row water back and forth to see if there is an increase in the rate of advance for the amount of time water is in the furrow.

The equipment investment necessary would amount to about a thousand dollars for one complete set of a "Y," two control valves and a timing box. The timing device can be set on 15 minute to eight hour intervals per side to control which valve is open. A minimum two foot of head of upstream pressure is needed to control the valves. The timing units are being produced locally in Amarillo. For more information contact the Amarillo Soil Conservation Service.

Water & Man Guides Rated

(continued from page 1)

The science and chemistry experiments are not practical for our school. We didn't have the facilities to do these.

I think the materials are good. However, I think the lesson plans for 4th grade are too hard for them to understand.

These materials are necessary and should be available in every school building. Each teacher, in all the schools should be aware of the materials that are geared to his/her grade level.

I believe students could benefit from this presentation better than the general presentation of our current science book . . . having spent two years helping develop a BES-pilot program—I can fully appreciate the program developed here.

Many of these lessons fit right into the units taught throughout the year.

I would like to see more lessons on methods of conserving water.

Seemed to be few, if any, 1st grade material.

Everything was very well put together and explained. The only thing on the lesson plans was that some were not too practical, especially some of the materials. Some would be hard to obtain and find. Otherwise a lot of hard work and research was evident.

I plan to use it again next year!

Great program! Booklets easy to use —handy! Great illustrations! Great activities! Fun to teach –students really enjoyed activities and discussions!

I found the activity guides extremely useful. We wanted to teach a basic unit on water and so we combined and deleted from the lesson plans as needed. Since it was new information the students did well when we used the lower level (K-4) guides and the "sharp" kids weren't bored, so I think it would be profitable to have both guides. Most all of the resource students understood when we used experiments (I believe all students love experiments and they listen so well when you use them.) Most of the materials were precise, easy to understand and typed properly. I feel this material will be useful to me in my teaching.

With more inservice training this will be an excellent program. Lesson ideas and plans are very practical and useful.

The program set forth by Water and Man, Inc. seems to be scientifically sound. I especially like the multidiscipline approach to the program. My students were amazed that there were so many ways to conserve water at home. I do believe that an introduction for the educator is necessary. The program that we attended was very informative and helpful in demonstrating the proper way to use the materials given to each of us. I have enjoyed this program and will use it again in the future.

I like the materials being printed in small easy to use and handle books rather than one large, heavy, bulky volume. This allows for greater flexibility.

There were flaws in the project materials as identified in the final report provided by Water & Man, Inc. to TDWR. It indicates teachers found deficiencies in the 9-12 grade materials. The report quotes Dr. Barufaldi who states participants believe the activities and ideas are "too simplistic" for "our sophisticated students." He recommends further evaluation of the 9-12 material.

Dr. Barufaldi also suggests that program objectives should be stated behaviorally. He believes the objective that "the learner *understand*" is difficult to evaluate and should be revised to reflect measurable outcomes.

It was recommended that science background information for the teacher dealing with water education be included. And an apparent lack of continuity was seen in the flow of ideas presented in the model lesson plans. Dr. Barufaldi notes a lack of suggested classroom questions, information for the teacher, and suggestions for discussion.

The pilot teacher evaluation of Water & Man's water education materials demonstrated the high calibre of these materials, the receptivity of classroom teacher to using them, and the potential for expanding a comprehensive water education program to other regions of Texas.

The Texas Department of Water Resources is searching for sources of funding to continue the program. The Texas Education Agency is currently reviewing the materials. And many Texas professional and water or water related organizations and associations are considering a role in furthering a statewide program of water education in our schools.

AMARILLO TEACHERS invited to the special dinner workshop were introduced to Water & Man materials by consultant Don Daugs. Teachers volunteered to review and evaluate lessons.

More Proof They Work . . .

FURROW DIKE field research at the Etter Experiment Station for 1980 and 1981 show dramatic grain sorghum yield increases.

ETTER (dryland)

	SORGHUM YIELD (lb/ac)		INCHES RUNOFF CONSERVED	
	1980	1981	1980	1981
Diked Furrows	2080	2350	2.71	3.47
Open Furrows	570	1250	0	0
YIELD INCREASE	1510	1100		

THE CROSS SECTION (USPS 564-520)
HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
2930 AVENUE Q
LUBBOCK, TEXAS 79405

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THE Cross SECTION

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The Case For Local Regulation

EDITOR'S NOTE: This issue of the Cross Section anticipates discussions by the 1983 Texas Legislature on Texas water law, and offers some insights into the development of our present groundwater law and management practices under these laws. Don Graf, water law attorney with McCleskey, Harriger, Brazill and Graf in Lubbock, presented these remarks on "Legal Trends in Groundwater Management" before the State Bar of Texas during a symposium on Environmental Law: Texas Water Resources—1982.

Texas Groundwater Law Takes Shape

More than seventy-five years ago the Supreme Court decided the case of *Houston & T. C. Railway Co. v. East,* 81 S.W. 279 (Tex. Sup. Ct. 1904). As Texas students of groundwater law know, the Court, after considering various theories of groundwater law, unequivocally adopted the rule originally stated in *Acton v. Blundell,* 12 M. & W. 324, 152 E.R. 122E (Ex. 1843):

> *"That the person who owns the surface may dig therein and apply all that is there found to his own purposes, at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from the underground springs in his neighbor's well, this inconvenience to his neighbor falls within the description of damnum adsque injuria, which cannot become the ground of an action."*

The Court rejected the correlative rights or reasonable use theories, denying Mr. East any recovery for damages even though the railroad had drilled a well on land adjacent to Mr. East's land and by pumping large amounts of water had dried up Mr. East's well.

Fifty years later, in 1955, the Honorable Joe Greenhill, now Chief Justice of the Texas Supreme Court, and the Honorable Tom Gee, now sitting on the United States Court of Appeals for the Fifth Circuit, re-examined legal opinions that had come after the *East* case, *supra.* These authors concluded that as of 1955, the *East* rule remained firmly in place. The Texas Supreme Court had refused to change or disavow the *East* rule in the Comanche Springs case or the Corpus Christi case.

The last quarter century has seen little significant change in the area of Court made law. The Supreme Court, with Judge Greenhill presiding, had the opportunity to again examine the *East* rule as to ownership in the case of *Friendswood Development Company v. Smith-Southwest Industries, Inc.,* 576 S.W.2d 21 (Tex. Sup. Ct. 1978). Judge Daniel recognized that the *East* rule had become an established rule of property law in Texas under which many citizens, industries and municipalities owned and utilized water rights. He further pointed out, however, that legislative action had taken place with the enactment of Chapter 52 of the Texas Water Code. Judge Daniel stated:

> *"Providing policy and regulatory procedures in this field is a legislative function. It is well that the Legislature has assumed its proper role, because our courts are not equipped to regulate ground water uses and subsidence on a suit-by-suit basis.*
>
> *This case, however, gives the Court its first opportunity to recognize, and to encourage compliance with, the policy set forth by the Legislature and its regulatory agencies in an effort to curb excessive underground water withdrawals and resulting land subsidence. It also affords us the opportunity to discard an objectionable aspect of the court-made English rule as it relates to subsidence by stating a rule for the future which is more in harmony with expressed legislative policy."*

The court then fashioned a rule that is to be applicable in the future in cases of land subsidence caused by the removal of groundwater that was stated as follows:

> *"Therefore, if the landowner's manner of withdrawing groundwater from his land is negligent, willfully wasteful, or for the purpose of malicious injury, and such conduct is a proximate cause of the subsidence of the land of others, he will be liable for the consequences of his conduct. The addition of negligence as a ground of recovery shall apply only to future subsidence proximately caused by future withdrawals of groundwater from wells which are either produced or drilled in a negligent manner after the date this opinion becomes final."*

The court took great care to limit the rule of the *Friendswood* case to cases involving subsidence. However, the court did indicate a willingness to at least re-examine aspects of the *East* rule which cause unusually harsh results.

The Court's decision in *Friendswood* re-confirms the conclusion of Greenhill and Gee that:

> *"Regulation of groundwater, under the (Corpus Christi) decision, is primarily a legislative, not a judicial problem. The Court apparently believes that frontline regulation of groundwater production should not be on a suit-by-suit basis in the Courts."*

Greenhill and Gee further pointed out that in 1949 the legislature had enacted legislation that would authorize the creation of underground water conservation districts for the purpose of promulgating "rules and regulations for the purpose of conserving, preserving, protecting and re-charging the underground water reservoir or subdivision thereof." They suggested that the development of good management practices for the future rested in the hands of these districts.

Thus, it is pertinent to review the substantial progress that has been made by the underground water districts that have been created and to discuss shortcomings in existing legislation that may have slowed the progress of underground water districts. Several commentators have argued that the regional system of underground water districts has not worked and that statewide control of groundwater production is needed. These writers have assumed that the presently existing underground water districts are not performing an adequate job of preventing the waste of underground water and/or of controlling the usage of underground water. Secondly, these writers assume that the current Texas legal framework for the regulation of groundwater usage is inadequate. To speak to these assumptions, three questions seem appropriate:

1. Have existing underground water districts made satisfactory progress in controlling waste and managing production of groundwater?
2. Is the existing legislation adequate to allow proper control of waste and management of groundwater production?
3. If existing legislation is not adequate, how should it be changed?

Have existing underground water districts made satisfactory progress in managing the usage of groundwater?

Since 1949 nine underground water districts have been created. They cover 45 counties (or parts of counties). The earliest underground water districts was created in 1951. It is the High Plains Underground Water Conservation District No. 1 and covers all or parts of fifteen counties (parts of two counties have been annexed since the District was originally created). One of the most recently created underground water districts is the Glasscock County Underground Water Conservation District created by the legislature in 1981. It should be noted, however, that this district was not created by following the procedures set out in Chapter 52, Texas Water Code, but by legislative fiat (the reasons for this will be discussed in more detail later). The most recent district created is the Hickory Underground Water Conservation District, which was ratified by the voters in September, 1982. As provided for by Chapter 52 of the Texas Water Code the Texas Water Commission has designated underground water reservoirs or subdivisions thereof in other areas in which no underground water district has been created. There are sizable portions of the State that do not have an underground water district in existence, even though there is an underground aquifer in place.

In many of those areas where a district has been created, a significant degree of success has been attained in managing the usage of underground water. A number of examples from the history of the High Plains Underground Water Conservation District No. 1 will illustrate the methods and manner of "control" that have been placed upon usage.

A number of obvious problems of waste and inefficient use of groundwater have been eliminated.

Open Ditches Thing Of The Past

Open irrigation ditches from the well to the head of the row where watering takes place are almost a thing of the past. There are over 10,000 miles of closed underground irrigation pipe in the area of the High Plains Underground Water Conservation District and probably again that many miles of portable surface pipe. The District was instrumental in promoting and publishing research that explained to the farmers the amount of water loss that occurred by the use of an open ditch to transport water.

Tailwater Being Recaptured

The waste of tailwater has been largely eliminated. (Tailwater is defined as underground water which is allowed to escape from the contiguous boundaries of the land from beneath which it was pumped.) Not only do District rules prohibit the escape of tailwater from any farm, but in addition, extensive research has been done by the District in order to prove to the farmer that construction of tailwater pits will capture significant amounts of water that can then be utilized economically for irrigation. The tailwater captured in these pits is then pumped by means of a surface pump back to the upgrade area of the farmers land for reutilization. In this area, control has been achieved by a combination of rules and education. The District, in addition, will furnish to the farmer a free service that will help him engineer his tailwater pit and will help him determine whether or not such a pit would be a feasible installation.

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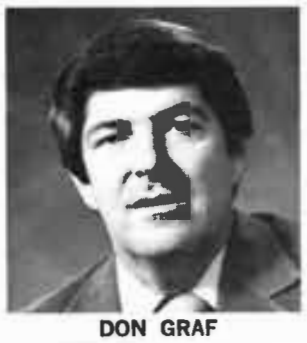

DON GRAF

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Dan C. Petty, 1985 ..... Box 846, Dimmitt
George Elder, 1983 ..... Rt. 5, Box 19, Dimmitt
Floyd Schulte, 1983 ..... Route 2, Dimmitt

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

Keith Kennedy, 1986 ..... Star Route 2, Morton
L. T. Lemons, 1986 ..... Route 2, 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

Tom McGee, 1986 ..... Box 117, Lorenzo
Bobby Brown, 1986 .... Route 1, Box 267C, 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

J. F. Martin, 1985 ..... Box 1306, Hereford
Troy Sublett, 1985 ..... Route 1, Hereford
Virgil P. Walker, 1985 ..... Star Route, Hereford
Bill Cleavinger, 1983 ..... Star Route, Wildorado
W. L. Davis, Jr., 1983 ..... Box 312, Hereford

Floyd County
Verna Lynne Stewart, Secretary
108 W. Missouri, Floydada

Charles Huffman, 1986 ..... Route 1, Lockney
Kenneth Willis, 1986 .. Route 4, Box 103, 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

Larry Martin, 1986 ..... Box 189, Petersburg
W. T. Leon, 1986 ..... Box 249, 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

Marion Polk, 1986 ..... Box 185, Whitharral
Jack Earl French, 1986, 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
George Harlan, Secretary
103 E. 4th Street, Littlefield

Haldon Messamore, 1986 .... Rt. 2, Box 272A, Sudan
Jim Brown, 1986 ..... Route 1, Box 152, Olton
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, 1986 ..... 3302 23rd St., Lubbock
Pierce Truett, 1986 ..... Route 1, Box 44, 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, 1986 ..... Box 54, Wilson
Danny Nettles, 1986 ..... Route 4, Tahoka
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

Wendal Christian, 1985 ..... Rt. 1, Farwell
John Cook, 1985 ..... Box 506, Friona
Ronald Elliott, 1985 ..... Rt. 3, Muleshoe
Floyd Reeve, 1983 ..... Box 876, Friona
Ralph Roming, 1983 ..... 809 Ridglea Dr., Bovina

Potter County
Frank T. Beznar, 1985 ..... Box 41, Bushland
Ronnie Johnson, 1985 ..... Box 127, Amarillo
Weldon Rea, 1985 ..... Box 41, Bushland
Sam Line, 1983 ..... Box 143, Bushland
Mark Menke, 1983 ..... Rt. 1, Box 476, Amarillo

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

Gary Wagner, 1985 ..... Box 219, Bushland
Jack Brandt, 1985 ..... Rt. 1, Box 280, Canyon
Johnny Sluder, 1985 ..... Box 56, Bushland
Roger B. Gist, III, 1983 ..... Route 1, 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.

Modified Playas Provide Surface Water

The District has sponsored playa basin modification research. As a result within a decade most of the farmers in the area have totally changed their views of the values of a playa. Whereas ten years ago a farm would be downgraded and devalued because a playa existed on the property, today that farm will be considered more valuable than the neighboring farm without a playa because it can be modified and surface water and tailwater can be captured for utilization by the farmer. Although no "controls" have been enacted by rules, the District's research and educational activities have been instrumental in establishing a method for the utilization of tremendous amounts of surface and groundwater that otherwise would have been lost to evaporation.

Improved Sprinklers Increase Savings

Currently research is going on in the area of more efficient use of sprinkler irrigation systems and sprinkler heads. The last three to five years have seen a change in the design of sprinkler systems that is dramatic in its effect on the conservation of water. Today sprinkler manufacturers are converting their systems to those that utilize dropped sprinkler heads and trailing lines that trail in the rows on the farm. The net results in savings of water is substantial. Again, while no rules for "control" exist in the area of the use of sprinkler systems, new systems that do not have these water saving attributes are simply not being purchased. This change in attitude is primarily the result of research and education in this area by the District.

"No Pit" Rule Reduces Pollution

One of the early efforts by the Water District to reduce the pollution of the underground water aquifer in the West Texas area involved the establishment of a District wide "no pit" rule. This prohibited the disposal of salt water from oil and gas activities into open unlined pits. Unfortunately, the procedure frequently caused pollution of the underlying aquifer. While this practice had been utilized by oil companies throughout the state for decades the activity of the water district in establishing an initial no pit order gave the impetus to the eventual establishment of a statewide no pit order by the Texas Railroad Commission. In this case "control" was brought about by the actual enactment of a rule prohibiting a particular practice. Following the enactment of the rule it was necessary for a number of lawsuits to be filed in order to establish the validity of the rule and the seriousness of the District in enforcing that rule. None of these suits reached the Appellate level. It has not been necessary to file a suit of this kind for over a decade inside the High Plains Water District area. This does not mean that the problem has gone away because as recently as a year ago a major oil company was found disposing of drilling mud and other oil and gas waters in open pits in Hockley County. The improper disposal method was discovered by a county committeeman for the High Plains Water District who is an unpaid volunteer. The District Manager contacted the oil company. The practice was immediately stopped and the oil company began engaging in appropriate disposal of its wastes. It is significant that this recent problem was not brought to the attention of the Texas Railroad Commission even though it has a Lubbock office and is charged with the responsibility of preventing pollution. This may be a specific illustration of the general principle that an individual will relate to and communicate with a local or regional agency much more readily than with a statewide agency.

Water Well Spacing Controlled

In addition, control of groundwater usage has been established by means that are not so obvious to the average individual. Examples include the following:

All underground water districts in the Panhandle have been requiring the spacing of water wells since their inception. What is not so obvious to the average individual is that these spacing requirements do result in the control of pumpage. A farmer who can have only one 6 inch well on his 80 acre tract is thereby limited in the amount of groundwater that he is able to produce just as effectively as if he were authorized to have two 6 inch wells on that 80 acre tract, but was prevented from pumping them more than 50% of the time. To be more specific the farmer who farms that 80 acre tract in cotton may well use 80 acre feet of water per year from his one 6 inch well. If he were authorized to have two 6 inch wells, but could only produce them 50% of the time he would then still produce the same amount of water for his crop, namely 80 acre feet per year. Thus while the spacing regulations of these districts are normally thought of as being for the purpose of minimizing interference between wells they also serve the very vital function of controlling the amount of water which is actually produced by a given farmer or industry.

Subsurface Moisture Identified

The district regularly furnishes to all water users within the District information as to the amount of subsurface moisture already in the soil on the farm land which is to be irrigated. As a result the farmer has accurate knowledge as to the amount of water required to fill his soil to full capacity for production of a crop. A plant requires a known quantity of water to grow the stalk and produce the fruit. Water is stored in the soil for the plant to use when it needs it. If the soil root zone has twelve inches of water in storage when filled and the plant

requires twenty-four inches for the growth cycle, the additional twelve inches will be provided by rainfall or irrigation. This amount will differ significantly from year to year depending upon rainfall. No specific rule has been enacted to encourage conservation by the expedient of turning off the wells when no water is needed, but the District has effectively conserved large amounts of groundwater by publishing their research regularly in this area. Farmers regularly use the District information to determine when to shut off their wells so that overwatering does not occur.

Irrigation Efficiency Tested

The District will furnish to any individual or entity requesting it a free mobile laboratory efficiency test of the water user's pumping equipment as well as his irrigation application system. More than 500 such tests have been performed in the last three years. These tests are designed to show to the farmer whether he is inefficiently utilizing his irrigation water. Amazingly the results of these tests have been to show that the average farmer has been quite efficient and has not produced more water than has been necessary for him to produce his crop.

Artificial Recharge Researched

Extensive research has been done by the District in the area of artificial recharge. Unfortunately, to date, such research has not found satisfactory methods to economically clean up the turbid playa water which is the only available surface water for recharging the Ogallala aquifer in the area of the District.

Research In Secondary Recovery

The District is just now beginning substantial research in the area of secondary recovery of water. Large volumes of water exist in the vadose zone (the area of land surface down to the water table) and are held there by capillary attraction. Secondary recovery research envisions development of a methodology to force this water to migrate on down to the water table so that it will be available to the pumps. Current tests are using air injected under pressure to cause the water to migrate to a level where the water can be utilized. While this is not a means of "control" of groundwater it is a means of conservation of natural resources which could be extremely important to the groundwater users in the State of Texas. Initial research has been encouraging.

Water Education Introduced In Schools

The District, for many years, has maintained an extensive educational program for school children. A textbook with teacher's guide and films has been developed. These educational aids are utilized throughout the District area to give one to two weeks instruction in water education to 7th or 8th grade students as part of the life science course. Additional courses have been designed for high school agriculture courses, with the course directed toward the specific county in which the material is used. Future generations of West Texans will have an understanding of the necessity for conservation and the methods available in our area. Other districts have also found the educational aspects of their activities to be an important function. The Edwards Underground Water District, for example, recently held a series of Regional Forums throughout the District to discuss water issues in the area of the Edwards Aquifer.

Cost-In-Water Depletion Allowed

The case of *U.S. v. Shurbet*, 347 F.2d 103 (5th Cir. 1965) was a district financed case. This case established that water users in the District were entitled to a cost depletion allowance for Federal income tax purposes for the amount of water which was "mined" or used by the farmer or industry each year. Nothing has done more to vividly bring home to each user the necessity of conserving his water than the availability of this allowance. Each year he must calculate (using District furnished information) the amount of water decline that has occurred under his land, the amount he paid for that water when he purchased his property, and the amount of water remaining under his property. Thus, while the amount of income tax which has been saved by users in the District has been measured in millions of dollars, the real value of the *Shurbet* case has been its effect upon attitude that each water user has developed towards the true economic value of his water. Conservation methods can easily be sold if the user is convinced that the failure to use them will cost him money.

Yard Water Conservation Studied

The District has embarked upon an urban conservation program, also. Significant amounts of municipal water can be saved if attention is given to proper watering of lawns, use of water efficient plumbing, etc.

While the above listing of some of the District's activities can only touch upon the numerous conservation methods that have been developed and encouraged by the District, the examples given do indicate that the District has been active in groundwater management programs.

The District, however, has not only been active, but substantial progress in groundwater management has taken place. One measure of the District's success can be seen in the fact that a significant decrease in the amount of water needed for irrigation purposes has taken place in the District. In 1951 an average farmer used ten gpm of well water to water an acre of farm land. Today an average farmer uses five to six gpm to water the same acre because of the more efficient utilization of his water. Translated into acre feet that means that in 1951 the average farmer would use 160 acre feet of water to water 80 acres of crop. To grow the same crop today the same farmer would use 80-100 acre feet. However, at least one farmer, currently Chairman of the Board of the High Plains Water District, who uses the latest state of the art sprinkler system and irrigation practices uses only 1.5 gpm of water per acre. The next decade should see even more improvement in management of water usage.

Could a statewide system of controls have achieved better results? Obviously no one can answer with certainty, but the widespread voluntary acceptance of District sponsored improvements within the District is an indication of the willingness of West Texas District Courts to promptly enforce District rules in those few cases where the District has felt it necessary to resort to suits to require compliance with conservation efforts. Only one High Plains Water District case has been appealed and the District was upheld in that case. The vastness of the District area requires that compliance efforts must be largely voluntary. Over 70,000 wells exist in the District. No program that required enforcement without the support of the vast majority of the users could be workable. It is submitted that the District has done excellent work and has moved towards management of the groundwater in its area with relative speed and as quickly as the necessary public opinion could be mobilized.

Not all groundwater districts have done as well. For example, a groundwater district covering only one commissioner's precinct in Dallam County is basically defunct. One reason for the lack of activity would appear to be the lack of an adequate tax base to support an active district. In some areas, efforts have been made to establish a district without success.

Thus, while the history of groundwater conservation by means of underground water districts does not show even or perfect results, properly managed districts can make a difference and have exhibited a willingness and ability to exercise "control" over the usage of groundwater.

Is the existing legislation for the creation of underground water districts adequate to allow proper control of waste and management of groundwater production? If not, how should existing legislation be changed?

A. Powers of a District.

Section 52.021, Texas Water Code provides:

> *"In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of the underground water of underground water reservoirs or their subdivisions, consistent with the objectives of Article XVI, Section 59, of the Texas Constitution, underground water conservation districts may be created as provided by this chapter."*

Section 52.010, Texas Water Code further outlines the District's authority by establishing rule-making power for the Districts:

> *"A district may make and enforce rules to provide for conserving, preserving, protecting, recharging, controlling subsidence, and preventing waste of the underground water of an underground water reservoir or its subdivisions."*

Other sections provide specifically that the Districts can require well permits (Section 52.114) and regulate production by spacing requirements or otherwise. (Section 52.117). These extremely broad powers to deal with vested underground water rights are grounded upon Art. 16 Section 59 of the Texas Constitution which provides:

> *"(a) The conservation and development of all of the natural resources of this State, including the control, storing, preservation and distribution of its storm and flood waters, the waters of its rivers and streams, for irrigation, power and all other useful purposes, the reclamation and irrigation of its arid, semi-arid and other lands needing irrigation, the reclamation and drainage of its overflowed lands, and other lands needing drainage, the conservation and development of its forests, water and hydro-electric power, the navigation of its inland and coastal waters, and the preservation and conservation of all such natural resources of the State are each and all hereby declared public rights and duties; and the Legislature shall pass all such laws as may be appropriate thereto.*
>
> *(b) There may be created within the State of Texas, or the State may be divided into, such number of conservation and reclamation districts as may be determined to be essential to the accomplishment of the purpose of this amendment to the constitution, which districts shall be governmental agencies and bodies politic and corporate with such powers of government and with the authority to exercise such rights, privileges and functions concerning the subject matter of this amendment as may be conferred by law."*

While no case law exists which interprets the statutes granting these widespread powers to districts, similar legislation granting power to control the production of oil and gas has been found constitutional in *Corzelius v. Harrell*, 186 S.W.2d 961 (Tex. Sup. Ct. 1945) and *Brown, et al v. Humble Oil and Refining Co.*, 83 S.W.2d 935 (Tex. Sup. Ct. 1935). The Supreme Court in reviewing the legislative power granted to the Railroad Commission pointed out that Art. 16 Section 59 was adopted after the case of *Board of Water Engineers v. McKnight*, 229 S.W.

301 (Tex. Sup. Ct. 1921) was decided. In the *McKnight* case, the Supreme Court had held that the legislature could not grant the Board of Water Engineers the power to determine and adjudicate water rights in Texas. The *Corzelius* Court further stated:

> *". . . In view of the broad provisions of Article XVI, Section 59a, authorizing the Legislature to pass all laws that may be appropriate for the conservation and development of all natural resources, and in view of the fact that the statutes provide for a full review in the course of all orders entered by the Railroad Commission, we are of the opinion that the statutes which authorize the Railroad Commission to adjust correlative rights of owners in a common gas reservoir do not violate the provisions of Article II, Section 1, of the Constitution . . . .*
>
> *"The rule in this State recognizes the ownership of oil and gas in place, and gives to the lessee a determinable fee therein. It is also held that such rule should be considered in connection with the law of capture, which is recognized as a property right, and both rules are subject to regulation under the police power of this State." . . .*

A previous writer has commented:

> *"Section 59 of Article XVI of the Constitution does not mention oil or gas but specifically refers to water, and the three paragraphs of the lengthy amendment relate in terms to water conservation, the creation of water conservation and reclamation districts, and the issuance of bonds by such districts. It would therefore seem certain that the Supreme Court would sustain legislation relating to the reasonable regulation of production of underground water for the prevention of waste and pollution, and to prevent one landowner from destroying the rights of another by excessive and unreasonable use."*

Thus, it appears that existing districts have the authority to take whatever steps are necessary to manage the production of groundwater. In fact, several districts have rules which have strict spacing requirements and which limit production of water.

However, the legislature has placed some limits upon District power. For example, Section 52.118 prevents a District from exercising jurisdiction over wells that produce less than 100,000 gallons of water per day. Such a limitation was not important in the past, since irrigators typically did not use wells with a capacity of less than 100,000 gpd. However, such a limitation is becoming more significant as irrigators become more efficient. Today, a limitation of 25,000 gpd would be more realistic.

The Districts created under Chapter 52 do not have authority to regulate surface water. This is not of major importance in West Texas where little surface water is available except for playa water. However, some question could be raised, for example; if a water district attempted to regulate water use in the City of Lubbock, which receives a portion of its supply from the Canadian River (Lake Meredith) and a portion of its water from a well field in Bailey County. Currently, the District is emphasizing voluntary urban conservation techniques. Ideally, a water district should have authority to prevent waste of both surface and underground water within its area. Apparently no agency is specifically charged with the responsibility of preventing the waste of surface water.

The Districts have no power to levy fines for the violation of its rules. Section 52.103 provides that rules may be enforced, but only by injunction. Injunction powers, followed by a show cause order with a request that a violator be held in contempt, have, so far, been adequate to obtain compliance from individual rule breakers. In fact, within the High Plains Underground Water District only in one case has a request for a contempt finding been necessary. The High Plains Underground Water District has no artesian wells. Waste from an artesian well is a misdemeanor. Other types of water waste are also subject to fines or misdemeanor penalties. The potential for such a financial penalty would be a more effective deterrant than injunction powers alone.

Chapter 52 districts can not sell or distribute water, (Section 52.105) although they can acquire land to construct dams and engage in re-charge activities. Section 52.104. Section 52.202 also provides that a district may issue bonds—in a left-handed fashion. The failure to expressly spell out specific powers for a bond issue may make it difficult to actually issue bonds. Further, the lack of a viable revenue source, such as the sale of water, has made it impractical for any district to issue bonds. The Glasscock County Water District created by the legislature in 1981, H.B. 2381, Leg. 1981, chose to have a special act passed by the legislature rather than follow the procedures set out in Chapter 52 for the creation of underground districts. One of the reasons was the lack of power in a Chapter 52 district to buy and sell water. The legislature has given the Glasscock County District powers of a district created under Chapter 51 as well as under Chapter 52, so that District can buy and sell water.

B. Procedures for Creating a District.

The procedure for creating a Chapter 52 District is unbelievably complicated. It requires a hearing before the Texas Water Commission to delineate the boundaries of a reservoir or a subdivision thereof (if more than one county is involved). Section 52.024. A second hearing must be held on the question of whether to create a district within the designated area. Although these hearings can be held the same day, this is a time consuming process. If the petition is granted for the creation of the district, a confirmation election must be held. If a majority of the voters vote for the district it will be created, but even then certain areas such as cities or counties may vote to exclude themselves from the district. The case of *Shaddix* v. *Kendrick*, 430 S.W.2d 461 (Tex. Sup. Ct. 1968) illustrates the frustrations of trying to create a district when there is not overwhelming support throughout the region for a district. A second election was held in the South Plains Water District area following the decision in *Shaddix* v. *Kendrick, supra,* but also failed because of opposition from oil and gas interests. There is the further complication provided by Section 52.026 which states that no "segregated irrigated area" can be included in a district without a vote in favor of inclusion. No cases tell us what a "segregated irrigated area" consists of. Additionally, a maintenance tax election must be held at the same time or the district has no means of financing. Theoretically the voters could vote in favor of the district, but against the tax. Primarily because of these complicated provisions, the writer advised the Glasscock County Water District to seek special legislative approval rather than follow the statutory procedures. As a result, the District became a viable entity within a six month period of time, whereas the statutory procedure would take two to three times as long. Legislation is needed to enable districts to more easily come into existence and to ensure that when they are created they cover the complete area that is delineated by the Water Commission.

Current legislation does not sufficiently take into account the very practical fact that a district should not be created that does not have an adequate tax base to support it. Uneven conservation efforts result from the creation of a district that is too small to engage in adequate management techniques. Hopefully, such areas as the Dallam County District mentioned previously will not be delineated as subdivisions of reservoirs in the future.

On the other hand a district should not be so large that adequate personal relationships with the regulatory agency are difficult. In addition, a district that is too large will have difficulty in recognizing the need for different rules and efforts in different areas of the aquifer. The Ogallala aquifer North of the Canadian River, for example, has different problems than the Ogallala aquifer South of the Canadian. Farming practices and other uses differ widely in those areas. These considerations support the idea of regional districts that are subject to regional control rather than state-wide control.

CONCLUSION

The last thirty years have seen a considerable expansion of the regulation and management of groundwater by groundwater districts. While the system of regional districts is not perfect, there is good reason to believe that such districts can continue to progress towards even better management practices. It is not proper to say that the use of regional districts has failed. It is proper to say that areas of the State that do not have such districts need to act, either under Chapter 52 or legislatively, to create some system of wise water management for their groundwater. The final paragraph of the Article written by Judge Greenhill in 1955 appears just as timely today as it did then:

> *"Since conditions in various parts of the state are dissimilar, the average rainfall differing as much as 47 inches, and since the reservoirs, the land use, and the water use vary so widely, a large measure of relatively local control is indicated rather than authority vested in one central agency to regulate reservoirs separately. This local regulation approach is the one presently adopted by the Texas Legislature, though its statutes on the subject invite considerable strengthening and improvement."*

THE CROSS SECTION (USPS 564-920)
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SECOND CLASS PERMIT