THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 9—No. 8 "THERE IS NO SUBSTITUTE FOR WATER" *January 1963*

ON GROUND WATER

DEPLETION CASE WON

By ALLAN H. WHITE, Jr

What many consider to be the greatest single economic development to occur in the Southern High Plains of Texas since the general acceptance of irrigation has come to pass.

The High Plains Underground Water Conservation District has received notification that the Honorable Joseph B. Dooley, Judge of the U. S. District Court for the Northern District of Texas has ruled that ground water in the Southern High Plains of Texas is a depletable natural deposit and as such is eligible for a federal income-tax deduction under the cost-depletion portion of the tax laws.

His decision culminated long and continuous efforts by the Water District to obtain an income-tax deduction for water-users throughout the area.

Back in 1954, the Board of Directors of the High Plains Water District authorized the District's staff to commence work on such a program. That decision was the beginning of a long but fruitful struggle.

The Water District first attempted to obtain an administrative ruling directly from the U. S. Internal Revenue Service. Such a ruling would have immediately paved the way to a cost-depletion program for ground-water users in the Southern High Plains of Texas.

A brief containing basic facts pertaining to ground water in the area, and other pertinent information, was prepared largely by Lloyd Croslin, a Lubbock attorney now deceased, and Ray Lawrence, a Lubbock Certified Public Accountant. After about a year's work on the brief, it was presented to the Internal Revenue Service by Croslin, Lawrence, and Joe Greenhill, an Austin attorney who now is an Associate Justice on the Texas Supreme Court. Congressman George Mahon was most helpful, particularly in arranging hearings before the federal agency.

It was perhaps three years before the Internal Revenue Service rejected the District's request for the administrative ruling.

Again the Board of Directors of the Water District was confronted with an important decision. According to the best legal advise, litigation would now be necessary if the depletion allowance were ever to become a reality.

Even while remembering the multitudinous masses of red tape and other obstacles encountered with the Internal Revenue Service in seeking the administrative ruling, the Board, ever confident that the facts justified a depletion allowance, decided to play the hand to the bitter end.

Marvin Shurbet, Floyd County irrigation farmer and plaintiff in the widely-heralded ground-water depletion case, is shown above. U. S. District Court Judge Joseph B. Dooley recently ruled in favor of Shurbet who in 1961 filed the case, seeking an income tax deduction for the depletion of ground water, in behalf of the High Plains Underground Water Conservation District.

In substantiating the facts, there were untold problems that came upon the scene—those that had been anticipated and others that no one foresaw.

Marvin Shurbet volunteered and was selected as the individual around whom the case would be prepared. Shurbet, a Floyd County farmer, had formerly been a member of the District's Board of Directors. He served at the time the depletion program efforts were instigated. He had a personal interest in the outcome of the case and was typical of the many irrigators in the Southern High Plains.

Finally, after preparing the case as diligently and as methodically as was humanly possible, the suit was filed. In January 1962, the case, styled, *Marvin Shurbet, et ux. v. United States of America,* was tried in Judge Dooley's Court at Lubbock. Specifically, it asked for a tax refund of about $300.

After ten days of lengthy and detailed testimony by recognized leaders in the fields of land economics, hydrology, mineralogy, geology, irrigation, and banking, Judge Dooley ordered the testimony transcribed and briefs prepared. When this was completed in late August, he took the testimony under consideration.

One year after the trial, almost to the day, Judge Dooley's decision was announced in a letter addressed to George W. McCleskey, Lubbock attorney for Shurbet and the Water District, and Louis F. Oberdorfer, Assistant Attorney General in Washington, D. C.

Judge Dooley wrote, in part . . . "The record herein, as I see it, reflects by an impressive weight of evidence that ground water, such as that in the Ogallala formation of the Southern High Plains part of Texas, is a mineral and a natural deposit in the sense of the federal tax statutes governing the subject of depletion of minerals and natural deposits, particularly cost depletion thereof, as related to income tax liability."

Judge Dooley's decision, if upheld on appeal, will mean that all persons in the Southern High Plains of Texas who can show a cost in the water beneath their land, and who are using the water to produce income may take a deduction on their federal income tax returns for the cost of the water as it is depleted.

Shurbet had this comment on the outcome of the case, "I'm, of course, most happy that Judge Dooley has ruled in our favor. It's a real relief to have the long ordeal behind us, and believe me it has been lengthy. Do you realize that we've been working toward this day for almost nine years? There were many anxious moments during those years when we were confronted with rebuffs and various administrative obstacles. I never doubted the soundness of our facts, but there were times when all looked hopeless from other viewpoints; however, the outcome is worth the long hard struggle we've had."

The tax deduction will not be a tremendous amount for the average individual each year; however, during

(Continued on Page 4)

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ALLAN H. WHITE, JR.
Editor

MULTI-PURPOSE MODIFICATION OF PLAYA LAKES IN THE SOUTHERN HIGH PLAINS

By DONALD L. REDDELL

The High Plains of Texas, consisting of approximately 35,000 square miles, is widely known for its dry and windy weather. This vast area is affected not so much from lack of rain as by extreme variations in rainfall from year to year. The problem of extreme variations in rainfall is intensified by the tendency for most precipitation to occur in s u d d e n, heavy, thunder showers.

Unreliable rainfall coupled w i t h high rates of evaporation and transpiration have caused the High Plains' farmer to turn to irrigation. Water is being withdrawn from the Ogallala water-bearing s a n d s through thousands of wells at several hundred times the natural recharge rate. A serious ground-water depletion problem is being created by the mining of this vast ground-water supply.

Flat tableland, devoid of trees, with very few streams are features of the High Plains topography. However, the country is marked by numerous depressions in the land surface. Approximately 90 per cent of the rainfall-runoff in this area accumulates in these depressions and forms thousands of small, shallow, playa lakes.

The lake-bed soil in these depressions is a heavy, impermeable, black clay that retards the percolation of water downward into the water-bearing sands. Therefore, most of the water that collects in these playa lakes is lost through evaporation and transpiration.

The shallow depths of these lakes will normally allow certain grasses and weeds to grow in the lake bottoms. The shallow water in connection with the vegetative cover provides an ideal breeding place for mosquitoes.

In addition to being an ideal breeding place for mosquitoes, playa lakes represents an economic loss to the area by flooding thousands of acres of valuable land. This land if reclaimed could be used to grow crops, to build houses, and to establish parks or other recreational facilities.

By modifying the bottoms of the lakes, many persons on t h e H i g h Plains believe that playa lakes can be transformed from an economic liability to an economic asset and at the same time reduce the mosquito-breeding problem. With this in mind, a research grant was obtained from the National Institute of Health, U. S. Public Health Service, Department of Health, Education and Welfare. This grant named Dr. David Cowgill of the Lubbock City-County Health Unit and W. L. Broadhurst of the High Plains Underground Water Conservation District as Project Directors.

With this research grant, an experimental project was started to determine the feasibility of modifying playa lakes. Plans of the project called for a three-year study of playa lakes in Lubbock County, Texas. The first year of the project was to be spent in collecting biological and hydrological information on the lakes in their natural conditions. During the second and third years, several lakes were to be modified and data were to be collected on the lakes in their modified forms.

Work on the project was started in September of 1961. Ten lakes in Lubbock County were selected. Biological data pertaining to each lake were collected by personnel of the Lubbock City-County Health Unit a n d Texas Technological College.

Hydrological data for each l a k e were also collected. This work consisted of making maps of each lake and of installing rain gages, staff gages, and automatic water-level recorders. The volume of irrigation-runoff and rainfall-runoff was calculated at each lake. A progress report of the first year's work has been compiled and should be available about February 1, 1963.

With the data which were collected during the first year, modification designs were prepared for two lakes. Actual work on the modification of one of these lakes has been started and is nearing completion. This lake is on property o w n e d by Lubbock

Shown above is a scraper working in the bottom of a lake on the Lubbock Christian College campus. This is one of the Lubbock County study lakes in the multi-purpose modification research program. It presently is being modified to concentrate water which normally covered 17 acres of land in a 4-acre trench or pit. Bill Broadhurst, Chief Hydrologist for the High Plains Water District, center, explains details of the project to Marvin Shurbet, left, Lubbock Christian College advisory committee member and Dr. F. W. Mattox, President of LCC.

Three Directors And Thirteen Committeemen Elected

On January 8, voters of the High Plains Underground Water Conservation District elected three men to serve two-year terms on the District's Board of Directors. One County Committeeman in each of the District's thirteen counties was also elected to a three-year term of office.

Russell Bean, Lubbock, was elected to replace Elmer Blankenship on the Board. He will represent Lubbock and Lynn Counties.

John Gammon, Lazbuddy, was re-elected to the Board. He represents Bailey, Castro and Parmer Counties.

Earl Holt, Hereford, was elected to represent Armstrong, Potter, Deaf Smith and Randall Counties on the Board. He replaces T. L. Sparkman, Jr., also of Hereford.

Bean, Gammon and Holt join J. R. Belt, Jr. of Lockney and Henry "Chick" Schmidly of Levelland on the five-man District Board.

One County Committeeman was elected in each of the thirteen counties that make up the Water District. The County Committees also consist of five members. They approve well-drilling permits in their respective counties and make recommendations to the District Board. Committeemen are elected for three-year terms.

Committeemen elected are as follows:

Armstrong County, Dewitt McGehee, Wayside.

Bailey County, J. W. Witherspoon, Box 261, Muleshoe.

Castro County, Lester Dowell, Rt. 1, Dimmitt.

Cochran County, Willard Henry, Rt. 1, Morton.

Deaf Smith County, Labry Ballard, 120 Beach St., Hereford.

Floyd County, J. S. Hale, Jr., Rt. 1, Floydada.

Hockley County, S. H. Schoenrock, Rt. 2, Levelland.

Lamb County, W. B. Jones, Route 1, Anton.

Lubbock County, Edward C. Moseley, Rt. 1, Slaton.

Lynn County, Roy Lynn Kahlich, Wilson.

Parmer County, Wendol Christian, RFD, Farwell.

Randall County, Paul Dudenhoeffer, Route 2, Canyon.

Russell Bean of Lubbock, shown at left, John Gammon of Lazbuddie, center, and Earl Holt of Hereford are newly-elected members of the Board of Directors of the High Plains Water District. They take their places on the five-man governing body January 30th when each takes the oath of office. Bean represents Lubbock and Lynn Counties on the Board, Gammon is the representative of Bailey, Castro and Parmer Counties and Holt represents the people in Armstrong, Deaf Smith, Potter and Randall Counties.

"WEST TEXAS WATER CONFERENCE" TO BE HELD IN LUBBOCK FEBRUARY 1st

The first annual "West Texas Water Conference" will be held February 1, on the Texas Technological College campus in Lubbock.

Christian College in Lubbock, Texas.

The modification of the Lubbock Christian College lake consists of excavating about 36,000 cubic yards of dirt from the bottom of the lake to form a pit. Dirt excavated from the pit will be spread evenly onto the lake bottom adjoining the pit. The pit will be approximately 350 feet by 500 feet at the top, 100 feet by 300 feet at the bottom and 12 feet deep. Approximately 25 acre-feet of water can be stored in the finished pit.

Prior to modification, 25 acre-feet of water in this lake would cover about 17 acres. This same volume of water in the pit will cover only four acres. Because of the reduction in surface area, the total amount of water lost through evaporation and transpiration in a given length of time will be drastically reduced.

During an average year, enough rainfall-runoff will collect in the pit to serve as a source of irrigation water. By confining the water to the pit, former areas of shallow water in the lake, which were inducive to mosquito breeding, will be eliminated. Also, some 10 to 12 acres of lake bottom normally subject to flooding will be salvaged for beneficial uses.

The purpose of this project is to experiment and develop various designs for use in playa-lake modification. The results and data obtained from the modification on the Lubbock Christian College Lake will be used in designing modifications for other lakes.

The conference program, which will commence at 9:00 a. m. and continue until 4:30 p. m. in the grand ballroom of the Student Union building, will feature many outstanding authorities in the field of water. Among the noted speakers will be William L. Broadhurst, Chief Hydrologist for the High Plains Water District.

Tom McFarland, Manager of the Water District, will moderate a panel discussion.

The all-day conference promises to be a profitable period for the exchange of ideas as expressed by leaders throughout Texas.

Dr. Gerald W. Thomas, Dean of the School of Agriculture at Texas Tech and Chairman of the Conference's Program Committee, says, "The purpose of this first conference is to review research activities and certain action programs relating to water on the High Plains."

Anyone interested in attending the conference will be most welcome.

Please Close Those Abandoned Wells!!!

WHEN YOU MOVE—

Please notify the High Plains Underground Water Conservation District, Lubbock, Texas on Post Office Form 22S obtainable from your local postmaster, giving old as well as new address, to insure no interruption in the delivery of "The Cross Section."

Brochure On "Tailwater" And Lake Pumps Published By High Plains Water District

If you haven't seen a copy of a new brochure published recently by the High Plains Water District, and if you are interested in methods being used to re-circulate irrigation "tailwater," then write to the District for the booklet.

The brochure is actually a compilation of stories on recirculation systems and lake-pump installations that have been published in "The Cross Section."

If you are losing a relatively small amount of "tailwater" from your farm, or if your problem is quite large, this new brochure contains a story on an actual operating system of the size you are interested. It will give you some ideas that others have developed and used successfully.

If you would like a copy, address a card or letter to: High Plains Water District, 1628 - 15th Street, Lubbock, Texas, and ask for the brochure entitled, "Irrigation 'Tailwater' and Lake Pump Installations." It will be sent to you by return mail at no cost. Write today.

Annual Water-Level Measurements Being Made

Wayne Wyatt, left, and Don Reddell, members of the High Plains Water District staff, are shown above as they measure the depth to water in two observation wells. Through this program, the fluctuations in ground-water level from one year to the next are determined. At a later date, water level measurements will be published in "The Cross Section".

Depletion Case—

(Continued from Page 1)

the life span of the ground-water supply millions of dollars will be collectively retained in the area.

From a "water conservation" point of view, the depletion allowance will be of gigantic importance.

Some persons accept the fact that ground-water levels in the Southern High Plains are declining from the stand point that this is probably actually occuring, but not necessarily to me. Some still cling to the idea that they are pumping from an inexhaustible supply, and consequently have no urgent need for wise use of water.

In order to take a tax deduction for depletion, some determination of the decline in the water level beneath an individual's farm will be necessary. The decline will then become a real and a personal thing to the individual. He would know, first hand, that his supply is being used up year by year, and as a result would recognize that he must develop ways and means of using water more wisely in order to stay in business for a prolonged period of time.

W. O. Fortenberry of Lubbock, who was president of the Board of Directors of the Water District in 1954 when plans to pursue the depletion allowance were first formulated, made this comment when contacted following Judge Dooley's decision, "I was most gratified upon hearing of Judge Dooley's ruling, and quite frankly I feel confident that his decision will be upheld in the appellate courts. It is always good to see a project that we have had a part in commencing brought to a successful conclusion. This is my feeling about the depletion case ruling. The tax deduction will be a great thing for South Plains water users. I thought it was right when we started working on it, and I still feel the same way."

It is anticipated that the government will appeal Judge Dooley's decision to the U. S. Court of Civil Appeals in New Orleans. From there, the case may go to the U. S. Supreme Court.

T. L. Sparkman, Jr. of Hereford, present Chairman of the Water District's Board of Directors, had this to say concerning Judge Dooley's ruling, "I am of the opinion that winning the favorable decision in the depletion case is one of the most, if not the most, valuable services yet rendered the people by the Water District. Not only will water users throughout the area derive financial benefits through the years because of the program, but they will become more conscious of what the water actually means in their lives. As indirect benefits from the depletion program, the waste of water will undoubtedly diminish, and the monetary value now derived from ground water will surely increase. I trust that as a result of the vast press and radio coverage given Judge Dooley's decision, more people have gained an understanding and appreciation of the Water District, ground water and conservation in general."

The tremendous volumes of evidence gathered under the supervision of W. L. Broadhurst, Chief Hydrologist for the Water District, to substantiate the facts involved in the case will add immeasurably to the information and to the storehouse of knowledge available on the water supply and the reservoir underlying the vast Southern High Plains in Texas.

Reactions to the depletion case decision are being received from all parts of the nation. Perhaps the point that has been missed almost universally by most observers is the fact that this ruling has to do only with ground water that occurs under circumstances similiar to those found in the Southern High Plains of Texas. The vast majority of ground-water reservoirs throughout the nation are readily replenished naturally, whereas this is not the case in the Ogallala formation underlying the Southern High Plains of Texas. Another point of difference readily recognized is the fact that in Texas ground water is private property. In many other states, ground water is public property.

Some have attempted to parallel the cost-depletion allowance on ground water to the percentage depletion available to the oil and gas industry and others. The two methods are incomparable. Percentage depletion exempts from taxation a stipulated part of the revenue derived in the process of depleting the resource, whereas the cost-depletion method establishes a total acquisition figure for the depletable resource and that part of the cost which is used up annually is allowed as a tax deduction.

In answer to those who have expressed concern over ground water being considered a mineral for income tax purposes, and who have felt that such a consideration would jeopardize rights to use ground water in instances where a mineral lease exists, it is of importance to note that both the Texas and the Federal Courts have held that in Texas, even though water is technically a mineral, a mineral lease does not include water.

Water Is Your Future, Conserve It!

SHURBET AND POTTS APPOINTED TO STATE WATER DEVELOPMENT BOARD

Marvin Shurbet, an irrigation farmer in Floyd County, has recently been re-appointed as a member of the State Water Development Board.

Also, Milton Potts of Livingston was appointed to the Board. He replaces Bill Taylor of Longview.

Price Daniel made both six-year appointments prior to leaving the governor's office.

Shurbet is a former member of the Board of Directors of the High Plains Water District. He and his family reside on a farm located about five miles east of Petersburg. He is the farmer-rancher representative on the Water Development Board.

Potts is manager of the Sam Houston Electric Cooperative and represents public or private financing on the State Board.

Other members on the six-man Board are: Marvin Nichols, Ft. Worth; W. E. Tinsley, Austin; C. Y. Mills, Mission; and James D. Sartwelle of Houston.

The Water Development Board loans money to public groups in the State for construction of dams and water-supply systems. The Board administers a $200 million fund.

Lack of Water Can Cut Milk Production

Water, water everywhere but Bossy needs a drink. Water, the cheapest item in milk production, is all too often the limiting factor, says A. M. Meekma, extension dairy specialist, Texas A&M College.

Milk is about 87 percent water and the dairy cow needs about five gallons of water to produce a gallon of milk. Water also comprises 75 percent of the cow's total weight, adds Meekma.

The amount of water a cow will drink depends upon her body size, the amount of milk she gives, the air temperature and humidity and the amount of water in the feed she eats. An average consumption of water per day is 12 1/2 to 15 gallons but some very high producing cows may drink 35 gallons or more.

Therefore, make sure your herd has access to plenty of fresh, clean water of a desirable temperature and at a convenient location the year round, recommends Meekma.

Drilling Statistics For December 1962

During the month of December, 46 new wells were drilled within the High Plains Water District; 3 replacement wells were drilled; and 1 well was drilled that was either dry or non-productive for some other reason.

Permits issued and wells completed for December are listed below:

COUNTY	Permits Issued	New Wells Drilled	Replacement Wells	Dry Holes Drilled
Armstrong	0	0	0	0
Bailey	10	0	0	0
Castro	8	2	0	0
Cochran	8	3	0	0
Deaf Smith	15	7	2	0
Floyd	12	0	0	0
Hockley	16	6	0	1
Lamb	17	6	1	0
Lubbock	22	6	0	0
Lynn	3	2	0	0
Parmer	13	12	0	0
Potter	0	0	0	0
Randall	7	2	0	0
TOTALS	131	46	3	1

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GAMMON ELECTED PRESIDENT

New Directors Sworn In--Board Re-Organized

Three newly-elected area men are shown in the photograph at left above, as they receive the oath-of-office as members of the Board of Directors of the High Plains Water District. The oath was administered January 30th by the Honorable Howard C. Davidson, Judge of the 99th District Court of Lubbock. Left to right are shown, Judge Davidson, Russell Bean of Lubbock, Earl Holt of Hereford and John Gammon of Lazbuddie. Each man will serve a two-year term on the Board. Photograph at right shows the 1963 Board of Directors of the Water District. Standing, left to right, is Russell Bean of Lubbock, Secretary-Treasurer; John Gammon of Lazbuddie, President; and Earl Holt of Hereford. Seated, left to right is J. R. Belt, Jr. of Lockney; Henry J. Schmidly of Levelland, Vice Pres.

Water District officials are shown above as they speak during luncheon ceremonies in Lubbock following the swearing-in of new Board members. At left, Bill Broadhurst, Chief Hydrologist for the District, is shown as he discusses various field projects presently conducted by the Water District. T. L. Sparkman, Jr., outgoing Board President from Hereford, is shown in the center photograph as he explains efforts by the Water District during the past year to increase the number of observation wells measured annually in the District, and progress made toward completion of a cooperative topographic-mapping program with the Texas Water Commission and the U. S. Geological Survey. At right, Tom McFarland, Water District Manager, is shown as he explains efforts by the District in working with waste water problems that presently confront many irrigators within the Water District area. Brief comments were made concerning all major programs and projects of the District.

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The average individual thinks of ground water occurring and moving in occult and mysterious ways. Because of his dependance upon ground water and because of his mystical attitude toward it, ground water has become, in most western states, a resource so highly regulated and protected by governmental entities that to use it even for beneficial purposes, is most difficult. To preserve it in an unpolluted state for use at some future date is the secret thought harbored by many.

The fact of the matter, ground water in most areas of the nation is one of the most plentiful resources that we have. It is also probably the least exploited.

The ironical part of the entire picture is found in the practical application of this dilemma. Ground water is found almost everywhere, yet we spend millions of dollars for the construction of dams to salvage a little surface water which generally must be piped many miles before it can be used.

Now, before everyone commences to scream for our head, let us explain that we're not against building dams. We merely feel that we should re-evaluate our thinking. It's ridiculous not to utilize the ground-water reservoirs that already exist; they are furnished free by Nature for the using, they are generally situated so that water can be inexpensively extracted from them, they offer natural protection from pollutants, and they are vast in volume as compared to man-made surface reservoirs.

Most ground-water reservoirs are readily replenished naturally. As water levels are drawn down appreciably by pumping, we merely assist to increase the natural recharge rates by affording de-watered zones for accommodating recharge water. Much of the surface water which runs off to the rivers would not do so if the ground-water reservoirs were not filled to capacity which results in rejecting potential recharge. Natural ground-water reservoir discharge would also diminish if water levels were decreased by increased pumping and use. The normal stream flow of most rivers is merely water that has been discharged naturally from ground-water reservoirs along the course of the stream.

Increased use of ground water would alleviate many problems that we as a nation have in the broad field of "Water Utilization."

The High Plains area of Texas, and a few other areas, are exceptions to what has been discussed. In these isolated areas, water contained in the ground-water reservoirs accummulated over centuries of time, and now water that is removed by pumping, comes from the accummulated storage. Because natural recharge is meager, much time is required to replenish even minor quantities of water extracted from the reservoirs.

In an article entitled, "Economics of Ground Water Utilization' by Louis Koenig, Research Consultant of San Antonio, recently published in the American Water Works Journal, Koenig made many of the misconceptions about ground-water seem medieval.

He said, ". . . In the 103 years since the beginning of the exploitation of petroleum, that resource (recoverable discovered reserves) has been depleted by 66 percent, iron ore by 57 percent, natural gas by 40 percent, and saw timber by 43 percent. Bituminous coal has scarcely been touched at only 4 percent; but in the 300 years of underground water exploitation, the original reserve has been depleted by only 0.2 percent. There were 47,575,000,000 acre-feet when the Pilgrims landed, and in 1955, 47,500,000,000 remained.

". . . This depletion is almost entirely the result of the overdraft of ground water reservoirs in the Texas High Plains, in California, and in other smaller southwestern states."

Koenig concludes his discussion by stating that, "The current rate of depletion of the ground water reserve is so many times less than the rate of depletion of most other natural resources that the nation, at current rates of consumption, will run out of every other non-renewable resource thousands of years before it will exhaust its ground water. It is quite safe, therefore, within the framework of the total national life, to increase greatly the nation's utilization of ground-water, even to the extent of substantially increasing the rate of depletion of the reserve. The present attitude of extreme conservation toward ground water, in the face of quite the opposite for other natural resources must be based on emotion and tradition, for it certainly is not based on what is known of the arithmetic of the situation."

For the greater part of our nation it would appear that a second look should be taken at our ace-in-the-hole, ground water. This generally readily-replenished resource should not be viewed through eyes looking for spectacular and mystical phenomenons, but rather from a realistic and intelligent point of view. Ground water is not mysterious, but rather it adheres to the basic laws of Nature.

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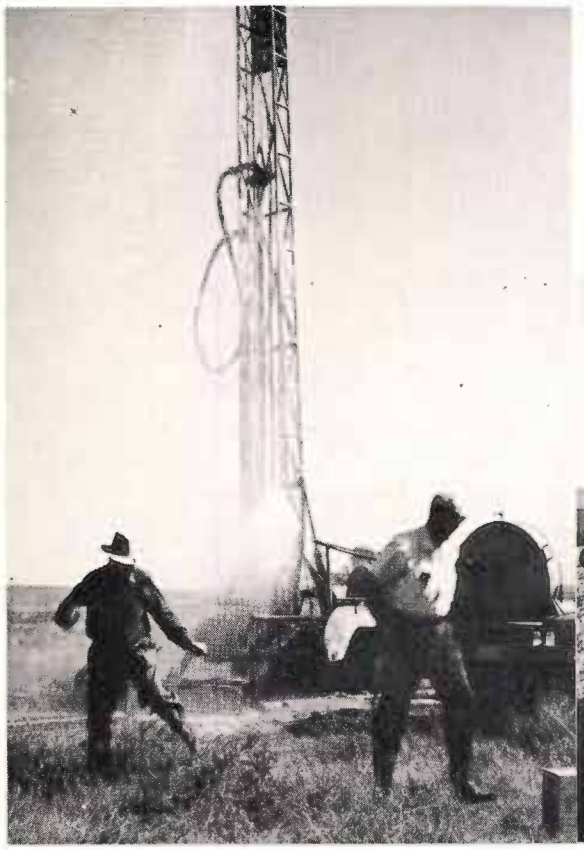
Water From The Cretaceous Sands In Cochran County, Texas

By F. A. RAYNER
Area Engineer, Texas Water Commission, Lubbock, Texas



T. B. Duggan, Cochran County farmer-rancher and F. G. Courtney with the Gulf Oil Corporation, are shown in the photograph at left as they hurry to escape the spray of water being blown by compressed air from a test well drilled into the Cretaceous sands on land owned by Duggan located south of Whiteface in Cochran County. At center, Duggan and a friend watch as water is pumped from the Cretaceous well during a development test. A flow-meter calculating the quantity of water pumped can be seen at the discharge end of the long pipe. Bill Broadhurst, Chief Hydrologist for the High Plains Water District is shown in the photograph at right as he observes the record of water-level fluctuations in a nearby observation well during the development test.

During recent years an ever-increasing number of oil operators in West Texas have been faced with the problem of securing relatively large amounts of water to stimulate additional oil production from the region's waning oil reservoirs. Such operations are termed secondary recovery, or in particular, water flooding, which consists of forcing and stripping oil from the voids of the oil reservoirs by the injection of water through retired oil wells. As previously mentioned, this process requires relatively large amounts of water of a quality compatible with the oilfield equipment and the oil reservoir.

From 1949 through 1959, in a 30-county West Texas area, secondary oil recovery operations have increased from 14 to 223 projects. As of January 1960, in the Southern High Plains from Hockley and Cochran Counties, southward through Midland and Ector Counties, there were 96 source wells producing about 12,000 acre-feet of water annually for water-flooding operations.

Cochran and Hockley Counties

In the giant 171,000-acre Levelland-Slaughter Oil Fields of Cochran and Hockley Counties, several pilot projects have proven the adaptability of these oil reservoirs to stimulation by water flooding.

During 1960, ten water-flood source wells produced about 900 acre-feet of water for repressuring operations in these two oil fields.

At present, within the Levelland-Slaughter Oil Fields, there are several large water-flood projects in the planning stages.

According to some oil operators, almost all of the Levelland-Slaughter Oil Fields are potentially floodable, and may require as little as five to ten acre-feet of water per acre throughout the estimated 20-year, or more life span of the secondary recovery operations.

Source of Water

There are only three primary sources of water for supplying all needs in the Levelland-Slaughter Oil Fields. All three are ground-water reservoirs. In ascending order, they are the Santa Rosa sands occurring from about 1700 to 2200 feet below land surface, the Cretaceous sands, occurring from about 340 to 430 feet below land surface, and the saturated sands of the Ogallala Formation overlying the yellow and blue Cretaceous shales and within 200 feet of the land surface.

Water flood source wells developed in the Santa Rosa sands cost as much as $60,000 to drill and equip. They produce water containing objectionable amounts of sulfate, chloride, and other dissolved solids. The capacities of the wells range upward to 250 gpm., but they generally are operated from 50 to 100 gpm.

In some areas of the Levelland-Slaughter Oil Fields, large capacity wells cannot be developed in the thinly saturated Ogallala sands. In other parts of the area where Ogallala wells can be developed, owners are sometimes reluctant to sell Ogallala water to be used for water-flood purposes.

Several such factors sometimes combine to force the oil operators into considering one of four alternatives:

1. Employ other secondary recovery measures that do not require additional water supplies.
2. Compete costly source wells in the Santa Rosa or deeper horizons.
3. Pipe water to project from distant points.
4. Search for near surface supplies.

First Cretaceous Water Flood Source Well

Early in 1960, Bert Murphy of Water Flood Associates, Incorporated, in search of a water supply for a small pilot water-flood project on the Reed-Wright lease, located about five miles west of Whiteface in Cochran County, was advised to test the Cretaceous sands beneath the subject lease. Murphy re-entered an abandoned windmill well and deepened it to the base of the Cretaceous sands (the top of the underlying Triassic "red beds"). This well, deriving most of its water from the Cretaceous sands and a nominal amount from the Ogallala reservoir, reportedly produces 120 gpm.

Large scale maps of the base of the Cretaceous sands, prepared by the Texas Water Commission in June1962, indicate these sands occur throughout the Levelland-Slaughter Oil Fields.

Pumping Test of Cretaceous Well

During October 1962, the Gulf Oil Corporation, in search of additional water to supply their water-flood operations, contacted T. B. Duggan, a Cochran County farmer-rancher. During negotiations with Duggan for the purchase of Ogallala water, it was agreed to first drill a Cretaceous test well to determine the potential of the deeper reservoir.

A slimhole test well was drilled on Labor 23, League 55, Oldham County School Land, Cochran County. This land is located about ten miles south of Whiteface, outside the High Plains Underground Water Conservation District. The drillers log indicated a 26-foot Cretaceous sand section.

On December 8, 1962, the static water level in the test well was about 158 feet below land surface.

Because of the favorable sand section shown in the test log, it was decided to drill and equip another Cretaceous well so that the formation could be tested. The 5-inch casing was left in the original test hole so

(Continued on Page 4)

DRILLER'S LOG—SLIMHOLE TEST
Labor 23, League 55
Oldham County School Land
Cochran County, Texas
DRILLED BY W. D. CLARK, ODESSA

Driller's Description	Depth (ft.)
Surface	3
Caliche	23
Red Pack Sand	36
Sandstone	39
Sandy	46
Rock, sandstone	57
Hard rock	76
Caliche clay with rock	127
Gray clay	130
Sandy sand with rock sand, pack sand	160
Sandy clay	164
Sand and gravel	178
Pack sand	180
Gravel	183
Pack gravel	185
***Base of Ogallala Formation**	
Clay	195
Blue (clay)*	205
Dark blue (clay)*	325
Lime and blue (clay)*	340
Lime	371
Pack sand and gravel	398
***Base of Cretaceous Deposits**	
Hard pack sand and shale	404
Sand	407
Light blue clay	416

*Interpretation by author

Sample of Cretaceous Water*
From Well Drilled on Labor23, League 55
Oldham County School Land
Cochran County, Texas

Constituent	Parts Per Million
Silica	12
Calcium	4
Magnesium	2
Sodium	421
Carbonate	4
Bicarbonate	366
Sulfate	280
Chloride	243
Fluoride	2.0
Nitrate	2.4
Total Dissolved Solids	1334
ph 8.4	

*Analysis by Texas State Department of Health, Austin, Texas

EXPERTS SPEAK AT FIRST "WEST TEXAS WATER CONFERENCE"

The first annual "West Texas Water Conference" was held February 1st on the Texas Technological College Campus in Lubbock. Experts in various aspects of the water problems which confront West Texas appeared on the day-long program. In photograph at left, Judge Otho Dent of Littlefield, member of the three-man Texas Water Commission, is shown as he discusses work being conducted in the High Plains area by the Commission. Photograph at upper center shows Bill Broadhurst, Chief Hydrologist for the High Plains Water District as he explains a study project being conducted on several playa lakes in Lubbock County. In lower center photograph, Tom McFarland, General Manager of the High Plains Water District, is shown as he moderates a discussion period by a panel of authorities on water problems in West Texas. E. R. Leggat, right, with the U. S. Geological Survey in Austin, explained work being conducted in West Texas by his organization. He said that ground water in the southern High Plains of Texas is being mined, and indicated that water problems in this area are of a more urgent nature than are those in most other areas in Texas.

Cretaceous Water—

(Continued from Page 3)

it could be used as an observation well.

Gulf Oil Corporation drilled the second Cretaceous water well 222 feet south of the original slimhole test. During the 24-hour pumping development of this well, pumping rates ranged up to 254 gpm for short intervals.

A 27-hour pumping test (pumping at 150 gpm) and a four-day recovery test, December 22 to December 27, 1962, was completed on the two subject wells.

Data collected during the 27-hour pumping period indicated a capacity for the pumped well of 1.63 gpm/foot of drawdown, and established that the reservoir possesses very low recoverable artesian storage characteristics and affords a comparatively restricted ability to transmit water.

At the end of the 27-hour pumping period, the water level in the pumped well was 294 feet below land surface while the water level in the observation well was 267 feet below land surface.

Further analysis of the pumping test data indicated that if the well were pumped continuously for 290 days at 200 gpm, the water level would be drawn down below the top of the contributing interval, which is 371 feet below land surface.

At the end of the 27-hour pumping period, calculations indicated the cone of influence theoretically extended several miles from the pumped well.

An analysis of a sample of water blown from the original slimhole test indicates a probable limited use for the irrigation of agricultural crops, because the high sodium percentage may tend to form black alkali.

In comparison with the generally prolific productive capacity of the Ogallala reservoir, the Cretaceous sands in the area of the Duggan well can be classified as only a minor source of water, but nevertheless, worthy of consideration for water-flooding and other limited uses.

PLEASE CLOSE THOSE ABANDONED WELLS ! ! !

Castro County Committee Office Re-located

The office of the Castro County Committee of the High Plains Underground Water Conservation District has been relocated in the City Hall at Dimmitt.

E. B. NOBLE

E. B. Noble, City Manager, has been appointed Secretary for the Committee and will receive applications for well-drilling permits and attend to other business for the Committee.

Noble has for ten years served as Manager for the City of Dimmitt. His father, Ester, is Vice President of the First State Bank in Dimmitt.

He attended high school in Dimmitt, and college at Texas A & M and North Texas State University where he received a B.B.A. Degree in Management.

Noble is married to the former Evelyn Kunetka of El Campo. They have three children, Rick, 12; Dave, 10; and Jan, 6.

The five-man Castro County Committee consists of C. W. Anthony, George Bradford, Lester Dowell, Lester Gladden, and H. E. Henley. They meet regularly on the last Saturday of each month at 10:00 a.m. in the City Hall at Dimmitt.

High Plains Underground Water Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas

Second Class Permit

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 9—No. 10 "THERE IS NO SUBSTITUTE FOR WATER" *March 1963*

WELL DRILLING IN HIGH PLAINS WATER DISTRICT INCREASES IN 1962

The number of wells drilled within the High Plains Underground Water Conservation District during 1962 increased over the number drilled during 1961.

In 1962, the total number of wells drilled in the 13-county area was 1388, which represents an increase of 479 wells over the 909 wells drilled in 1961. These figures include replacement wells and dry holes drilled.

Actually, with the passing of time, the number of acres of cropland irrigated in the High Plains Water District decreases slightly, whereas, the number of wells continues to increase. This is a result of individual well capacities decreasing as water levels decline, leaving a thinner zone from which the well obtains its water supply.

Many other factors influence the overall well-drilling picture, with moisture and crop price conditions taking the lead.

The table below compares drilling in the High Plains Water District for the years 1961 and 1962 by counties.

The ten-year total of permits issued and wells drilled are also shown in the table. The total number of wells drilled includes new wells, replacement wells and dry holes.

	Permits Issued			New Wells Drilled		Replacement Wells Drilled		Dry Holes Drilled		Total Wells Drilled		
County	1961	1962	10-yr. Total	1961	1962	1961	1962	1961	1962	1961	1962	10-yr. Total
Armstrong	7	1	52	9	0	0	0	0	0	9	0	50
Bailey	62	88	1440	31	47	13	13	4	5	48	65	1211
Castro	117	149	1796	70	101	29	12	1	4	100	117	1592
Cochran	49	91	1092	28	47	0	2	5	4	33	53	737
Deaf Smith	90	157	1701	48	73	23	28	1	8	72	109	1444
Floyd	66	203	2039	44	100	7	7	3	6	54	113	1585
Hockley	160	337	3283	115	224	4	11	12	17	131	252	2701
Lamb	116	153	2665	74	89	22	18	6	8	102	115	1986
Lubbock	192	344	4182	156	241	9	7	13	18	178	266	3459
Lynn	93	98	1689	73	93	2	0	7	11	82	104	1332
Parmer	77	184	2238	48	102	33	38	2	2	83	142	2065
Potter	0	2	22	1	0	1	1	0	0	2	1	18
Randall	20	68	649	12	43	1	1	2	7	15	51	561
TOTALS	1049	1875	22848	709	1160	144	138	56	90	909	1388	18741

A. A. MEREDITH

Area Man Receives Conservation Award

A. A. Meredith of Borger, Executive Secretary of the Canadian River Water Authority, has recently been presented the nation's highest conservation award.

The Department of Interior awarded its Conservation Service Award to Meredith for his "key role" in the $102 million Canadian River project.

In a personal message to Meredith, Interior Secretary Stewart Udall said in part, "Had it not been for your tireless and unselfish efforts, the project would never have become a reality."

Meredith played a leading role in formation of the Water Authority, an organization of 11 High Plains cities and towns.

At least two member cities have resolved to adopt "Lake Meredith" as the official name for the 28-mile long lake which will be formed behind the Sanford dam. Borger and Amarillo City Commissions have urged other water authority cities to take similar action.

Meredith is a member of the Texas Water Conservation Association and the National Reclamation Association. In 1957, he was named a delegate by then Governor Price Daniel to the National Rivers and Harbors Congress in Washington, D. C.

Lack of Research Funds Blamed on USDA

An interesting appraisal was recently made to the National Reclamation Association by the chairman of its Agricultural Research Committee.

George L. Henderson told the N. R. A. that, "the lack of progress in research concerning soil and water relationships is due entirely to a failure by the Department of Agriculture to request adequate funds. Such research was supported by about $10 million during the present fiscal year (1962) about the same as in past recent years. However, the escalation of costs has caused a steady degradation of the activity. Hence, for the present program to continue effectively, the support should be increased about 30 percent. Moreover, the program should be expanded. About $20 million should be provided for new or expanded research facilities, and another $20 million for personnel and operations at such facilities.

"During 1961 almost $11 billion was spent in industrial research, including about $6 1/2 billion of federal funds. When these facts are compared with the poor showing of agriculture research funds, it is clear that something should be done to correct the deplorable situation. Congress should be urged to earmark funds specifically for research in the Department of Agriculture's future appropriations."

MEETING AT HUB COMMUNITY OUTLINES EFFORTS IN WATER MANAGEMENT STUDIES

Shown above are photographs made during a recent meeting held at the Hub Community Center in east central Parmer County. Purpose of the meeting was to acquaint residents with water management studies which the High Plains Water District will conduct in the Hub area during this coming irrigation season. Tom McFarland, Manager of the Water District, led in the discussion of plans which will include demonstrations to calculate the amount of water lost at the end of irrigated fields when methods to salvage the water are not employed. Mr. and Mrs. T. I. Burleson of the Hub Community led in making arrangements for the meeting. A color sound movie about ground water in Arabia was also shown during the meeting.

PUBLISHED BY

HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT

MARCH 1963

DEAF SMITH

POTTER

RANDALL

PARMER

CASTRO

ARMSTRONG

SCALE

0 5 10 15 Miles

BAILEY

LAMB

FLOYD

COCHRAN

HOCKLEY

LUBBOCK

LYNN

EXPLANATION:
APPROXIMATE LOCATION OF
OBSERVATION WELLS
TEXAS WATER COMMISSION

THE Cross SECTION

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

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ALLAN H. WHITE, JR.
Editor

Drilling Statistics for January and February

During the month of January, 70 new wells were drilled within the High Plains Water District; 12 replacement wells were drilled; and eight wells were drilled that were either dry or non-productive for some other reason. The County Committees issued 328 new drilling permits.

In February, 140 new wells were drilled; two replacement wells were drilled; and eight dry holes were drilled. There were 246 new drilling permits issued.

Listed below by counties are permits issued and wells completed for January and February.

	Permits Issued		New Wells Drilled		Replacement Wells Drilled		Dry Holes Drilled	
County	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.
Armstrong	0	2	0	2	0	0	0	1
Bailey	25	1	2	15	1	0	2	0
Castro	31	12	9	9	0	0	0	1
Cochran	10	26	3	1	0	0	1	0
Deaf Smith	30	13	9	10	1	0	0	0
Floyd	11	7	12	2	2	0	0	0
Hockley	56	41	7	30	0	0	0	1
Lamb	35	33	14	16	3	0	4	0
Lubbock	95	62	8	38	1	0	1	5
Lynn	11	20	0	5	0	0	0	0
Parmer	17	16	4	6	4	2	0	0
Potter	1	3	0	0	0	0	0	0
Randall	6	10	2	6	0	0	0	0
TOTALS	328	246	70	140	12	2	8	8

Please Close Those Abandoned Wells!

Work Progresses on Topographic-Mapping Project in High Plains Water District

In February 1962, the High Plains Underground Water Conservation District entered into a cooperative topographic mapping agreement with the Texas Water Commission, who had previously arranged with the Topographic Division of the U. S. Geological Survey to prepare topographic maps for areas in Texas.

John J. Vandertulip, Chief Engineer for the Texas Water Commission, says that the average total cost to prepare one 7 1/2-minute topographic map (about 39,565 acres), is approximately $10,000. Under the cooperative program, the U. S. Geological Survey matches dollar for dollar any funds provided for mapping by state and local interests. Vandertulip states that the resulting cost to state and local interests is about 13 cents per acre, and he points out that this is a "remarkable bargain in these days of high service costs."

Fifty-six quadrangles located within the High Plains Water District are included in this program.

According to Vandertulip, aerial photography has been completed in all of the 56 quadrangles. After acceptance of the aerial photographs by the U. S. Geological Survey, field survey parties are sent to the areas to establish horizontal and vertical control using the most modern surveying equipment available. Field interpretation of the aerial photographs is made and all of this information is then sent to Denver, Colorado, office for compilation and preparation of the advance work sheets. The Geological Survey uses the latest precision instruments for completing the maps from the field data and aerial photographs.

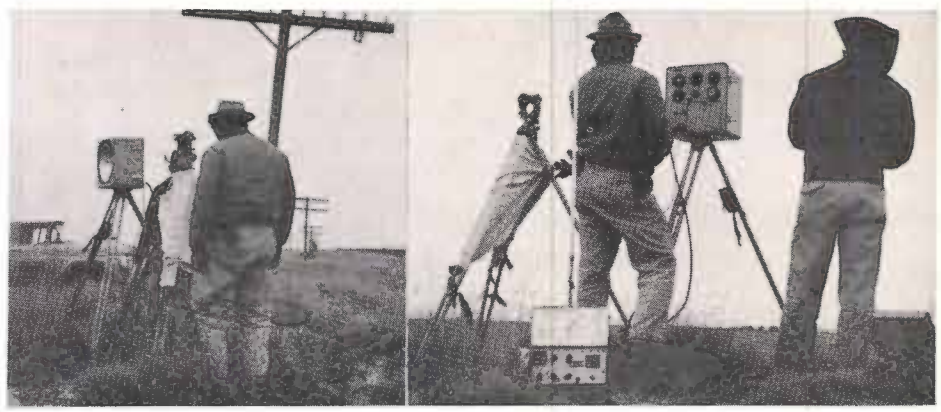
Vandertulip says that approximately one year will be required to complete the field work, and that during the next 18 to 24 months, the maps will progress through advanced compilation, assembly, and final editing. He states that usually an additional 6 to 9 months are required for printing of the published maps.

Where mapping is financed cooperatively by local interests, the Survey gives a high priority. Vandertulip suggests that perhaps time will be reduced by one year in completing the entire project which otherwise could be expected to consume about three to four years.

The topographic maps will show surface elevations and locations and elevations of most wells. They will be invaluable to agriculturists, industries, and municipalities for use in developing the area.

Advance work sheets are presently available for nine cooperative quadrangles located in the southern portion of Castro County and the northern portion of Lamb County. Eight quadrangles in the northwest part of Randall County, which are wholly financed by the U. S. Geological Survey are also in the advanced stages of work and available.

Vandertulip states that copies of these prints are available at 30 cents each from the Region Engineer, Rocky Mountain Region, U. S. Geological Survey, Topographic Division, Denver Federal Center, Denver 25, Colorado. Orders must be accompanied by cash, money order, or check made payable to the U. S. Geological Survey.



Pictured above are Yukio Yamamoto and Charlie Lough with the U. S. Geological Survey. They are shown using some of the modern surveying equipment, high-precision theodolite, electronic transit, high-frequency transceiver, and mobile elevation meter, employed to obtain field data for use in making topographic maps within the High Plains Water District. (Photo—Texas Water Commission)

High Plains Underground Water
Conservation District No. 1
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WATER LEVEL MEASUREMENTS IN OBSERVATION WELLS IN THE HIGH PLAINS WATER DISTRICT

EDITOR'S NOTE

Official water-level measurements for a majority of the observation wells within the High Plains Underground Water Conservation District are shown below. The measurements were made by the Texas Water Commission in cooperation with the High Plains Underground Water Conservation District.

The accompanying map shows the approximate location of the observation wells together with identifying well numbers. Use of a data processing system by the Texas Water Commission in tabulating and maintaining the state-wide observation well program necessitated a change in well numbers from those previously used.

You will note that in most instances measurements made in 1953, 1962 and 1963 are shown. However, in some counties, measurements for other years were used. A primary purpose of reporting these particular three years is to show the water level at about the time large-scale pumping commenced (1953), and to indicate present levels (1962 and 1963). By using these three years' measurements, a 10-year period and a one-year period of fluctuations may be studied and compared.

Measurements are shown in feet below land surface.

Water-level measurements are made each year during January prior to the beginning of extensive pumping for pre-plant irrigation.

ARMSTRONG COUNTY

Well No.	1962	1963
1112401	107.50	108.19
1112701	112.65	114.27
1112702	127.35	123.18
1112801	124.80	123.05
1112802	124.90	125.26
1112803	108.90	108.82
1112901	109.00	110.40
1113701	95.48	97.08

BAILEY COUNTY

Well No.	1953	1962	1963
0948901	96.06	113.66	115.16
0964601	.....	.....	.....
1041402	.....	120.40	122.78
1041601	.....	108.90	111.34
1041702	.....	70.89	73.81
1041903	35.74	60.30	62.22
1041905	.....	82.29	84.12
1042402	.....	100.36	102.91
1042503	.....	93.63	96.17
1042701	37.05	65.47	69.41
1042702	41.50	.....	.....
1042703	47.95	78.10	78.61
1042704	.....	.....	.....
1042805	32.54	56.75	58.56
1042901	35.03	58.70	59.83
1042902	38.37	63.85	69.58
1043401	56.60	88.00	91.91
1043601	60.37	98.95	87.95
1043704	50.32	68.12	75.32
1043706	49.74	67.80	71.46
1043707	49.70	68.97	70.49
1043805	37.30	63.66	66.21
1043903	.....	.....	78.69
1043905	.....	65.47	65.78
1043906	.....	64.75	.....
1043908	32.60	63.56	62.32
1043910	.....	60.31	62.43
1044708	33.64	63.79	65.29
1049101	.....	61.45	61.28

CASTRO COUNTY, Cont'd—

Well No.	1953	1962	1963
1039401	.....	134.00	.....
1039501	.....	129.59	134.14
1039701	.....	.....	117.90
1039801	.....	.....	129.08
1040401	.....	138.31	144.21
1040501	.....	170.20	176.31
1040702	101.91	130.61	.....
1040801	.....	146.92	154.12
1045101	.....	134.44	137.93
1045301	.....	140.91	145.25
1046301	.....	52.64	56.06
1046405	102.02	136.66	139.20
1047101	.....	.....	108.55
1047201	.....	.....	139.00
1047302	.....	121.76	125.64
1048501	.....	.....	116.03
1141402	81.32	112.77	119.38

COCHRAN COUNTY

Well No.	1956	1962	1963
2409602	.....	103.68	106.95
2409603	91.00	99.31	102.98
2409801	120.58	120.76	121.74
2409901	88.85	93.53	94.47
2410401	102.45	106.30	107.76
2410501	.....	92.96	93.97
2410502	.....	86.49	86.97
2410601	84.16	88.90	89.60
2410701	142.65	148.16	151.97
2410801	118.32	123.98	125.83
2410901	91.23	91.72	92.78
2411401	119.65	127.57	132.27
2411701	.....	122.22	123.28
2411801	106.05	103.43	104.41
2411802	93.72	98.24	101.06
2411901	103.50	115.09	117.14
2411902	97.97	117.23	123.24
2412702	103.05	120.11	125.61
2417301	123.50	127.16	128.92
2417601	126.20	136.43	138.80
2417901	146.28	159.78	161.55
2418101	134.33	143.30	144.68
2418201	147.37	157.34	159.91
2418301	120.73	125.82	127.56
2418302	139.50	142.73	145.32
2418401	128.50	138.06	142.00
2418501	174.65	.....	185.40
2418601	149.17	156.47	158.49
2418602	120.88	115.37	115.17
2418801	169.17	173.95	176.22
2418802	156.78	161.67	164.20
2419101	118.56	129.72	133.31
2419201	125.23	134.12	138.86
2419301	139.97	150.37	153.25
2419401	129.15	140.57	143.73
2419402	121.05	133.03	135.52
2419501	132.00	143.35	.....
2419502	140.90	152.18	155.46
2419601	132.41	144.57	146.53
2419701	142.00	144.07	147.37
2419801	140.02	144.35	146.70
2419901	125.54	124.93	125.62
2420102	106.75	120.04	124.26
2420402	125.30	134.61	137.26
2420702	138.55	143.28	145.38
2426701	.....	181.04	181.15
2427201	164.50	168.70	170.10
2427301	.....	176.66	178.04
2428101	148.80	.....	.....
2433701	.....	130.82	130.44
2434201	.....	159.37	159.63
2434301	.....	179.57	180.30
2434302	.....	157.76	158.62
2434501	.....	163.70	164.30
2435301	.....	170.15	171.53
2436101	.....	173.03	173.23
2436102	.....	167.38	168.25
2516601	.....	55.40	56.17
2540501	.....	136.84	135.93
2540601	.....	143.25	146.79

FLOYD COUNTY

Well No.	1953	1962	1963
1144901	66.09	102.28	105.07
1144902	63.72	.....	99.83
1145803	.....	140.27	133.53
1145802	.....	129.68	129.75
1145902	111.02	143.26	144.81
1146701	.....	158.40	164.17
1152301	77.68	109.13	112.94
1152302	79.54	115.80	119.36
1152303	97.40	135.33	145.90
1152304	83.80	127.07	128.27
1152601	90.41	136.84	140.53
1152602	93.77	142.30	.....
1152603	90.70	138.93	142.12
1152604	86.68	132.34	135.04
1152801	93.92	127.65	134.76
1152901	107.56	143.38	148.79
1152902	98.28	142.30	138.70
1152903	108.23	148.40	146.33
1152905	118.29	146.40	149.83
1153101	86.82	127.75	129.02
1153201	95.41	126.38	131.53
1153202	90.44	126.98	127.36
1153203	93.53	130.69	132.66
1153402	102.71	143.79	147.46
1153501	121.72	159.74	163.51
1153701	119.41	146.10	149.68
1153702	104.27	134.38	139.28
1153703	114.99	144.38	145.90
1153704	122.21	154.24	156.73
1153901	.....	.....	.....
1154301	196.46	209.24	.....
1154401	.....	165.32	166.29
1154901	.....	205.65	207.49
1155701	.....	214.70	216.54
1155901	.....	264.96	267.16
1160301	96.73	132.95	136.42
1160302	103.82	138.73	142.22
1160303	96.68	136.41	140.12
1160501	76.48	122.13	124.97
1160601	87.58	135.91	139.74
1160602	82.25	134.70	131.60
1160901	72.87	121.36	126.83
1161102	121.36	151.84	154.31
1161103	109.08	143.08	146.41
1161105	102.51	143.73	147.49
1161104	102.91	139.57	142.57
1161203	117.21	159.73	162.95
1161204	102.61	150.42	155.26
1161301	.....	37.29	38.60
1161401	96.05	145.89	153.92
1161402	87.68	135.90	143.28
1161404	94.52	143.79	153.56
1161601	36.50	44.64	44.14
1161801	100.60	153.40	159.56
1161802	.....	140.83	144.12
1161901	100.31	146.36	153.57
1162201	.....	102.86	133.63
1162401	.....	58.44	55.80
1162701	109.75	117.98	116.73
1162702	.....	93.08	94.31
1162801	.....	89.36	89.66
1162901	.....	171.04	.....
1163101	.....	154.90	155.66
1163801	.....	198.42	192.54
1164101	.....	210.18	210.32
1164401	235.60	237.66	235.86
1164502	.....	.....	.....
1262601	.....	.....	147.06
2304501	85.48	142.75	150.80
2304601	85.19	138.78	145.15
2304602	89.62	148.89	154.50
2304603	88.88	141.68	153.48
2304801	80.28	126.24	135.04
2305301	110.00	153.44	157.70
2305501	.....	171.78	176.86
2305801	.....	183.10	.....
2306101	.....	148.24	151.15
2306301	150.13	155.41	155.19
2306404	126.76	161.47	175.34
2306701	.....	179.82	184.64
2306802	152.35	183.42	188.58

HOCKLEY COUNTY, Cont'd—

Well No.	1953	1962	1963
2439101	.....	.....	146.34
2439301	.....	.....	142.30
2439501	.....	.....	129.79
2439701	.....	.....	107.07
2439901	.....	90.70	91.65
2440401	.....	131.52	134.65
2440403	.....	.....	139.77

LAMB COUNTY

Well No.	1953	1962	1963
1044401	73.74	103.42	98.26
1044701	35.13	64.68	67.92
1044702	35.42	63.62	64.00
1044703	.....	.....	79.10
1044902	.....	.....	84.11
1044903	.....	86.20	83.81
1045701	46.08	.....	72.00
1046404	100.33	131.55	135.30
1046703	.....	135.79	139.57
1046802	.....	134.45	138.72
1046804	.....	136.40	138.06
1046806	.....	126.95	137.46
1047401	92.52	119.08	122.06
1047801	108.86	147.05	148.05
1048401	90.55	125.90	129.33
1052101	27.20	57.64	58.40
1052102	26.25	55.66	57.09
1052601	.....	28.13	28.78
1052901	.....	59.02	59.49
1052902	.....	45.54	.....
1053302	42.55	63.51	67.00
1053303	.....	33.85	.....
1053304	.....	90.87	92.68
1053601	50.00	67.99	72.06
1053602	29.89	42.00	44.19
1054101	52.15	72.36	74.61
1054202	81.31	112.52	113.01
1054301	.....	132.28	135.02
1054801	.....	.....	.....
1055202	.....	130.65	.....
1055301	110.78	.....	150.65
1055302	93.14	144.88	.....
1055303	.....	147.62	.....
1055901	71.31	.....	98.96
1055902	.....	115.10	117.92
1055904	.....	110.66	113.94
1056102	.....	.....	153.12
1056402	.....	141.78	152.40
1056403	.....	137.49	140.77
1056404	.....	147.10	151.47
1060101	94.81	110.52	111.70
1060304	.....	.....	67.80
1060401	.....	122.57	126.16
1060601	.....	109.83	101.89
1060801	.....	115.26	.....
1061101	37.62	.....	61.69
1061201	.....	48.76	.....
1062401	.....	77.09	81.79
1062701	84.88	105.31	110.23
1063301	68.84	83.20	82.43
1063702	.....	120.11	124.66
2404401	.....	155.09	.....
2404601	.....	64.79	66.09
2404701	.....	74.47	71.24
2405302	.....	95.50	98.45
2406402	80.21	82.40	84.76
2406902	54.56	79.77	86.22
2407202	.....	131.51	133.26
2407301	92.10	113.61	116.34
2407601	113.85	130.56	133.39
2407701	.....	123.05	126.19
2407702	.....	127.15	130.00
2412101	.....	70.45	69.21
2415506	52.41	67.92	72.12
2415507	50.34	67.00	71.24
2415608	99.60	.....	.....
2415609	91.35	115.40	118.36

LUBBOCK COUNTY

Well No.	1953	1962	1963
2334602	102.90	.....	115.50
2334801	.....	128.92	131.38
2334802	.....	129.80	127.78
2334803	104.30	127.80	128.32
2334902	.....	121.93	121.50
2334904	94.50	117.62	124.08
2335703	.....	116.67	118.15
2335802	88.76	104.86	104.92
2336501	.....	194.70	202.75
2416501	90.32	108.19	110.18
2416601	.....	122.16	118.77
2416901	.....	162.33	162.67
2416902	.....	145.42	145.10
2424201	33.62	61.36	63.02
2424302	104.55	128.50	135.37
2424501	85.22	116.32	118.44
2424601	45.31	71.04	74.23
2424901	.....	130.28	134.90
2432301	101.61	128.52	132.61
2432501	103.60	114.20	118.22
2432601	93.47	120.61	119.48
2432602	.....	121.21	130.12
2440201	100.10	114.01	122.28
2440301	116.49	140.07	137.19
2440601	96.10	116.62	122.60
2440901	.....	66.03	67.63

LYNN COUNTY

Well No.	1957	1962	1963
2334901	117.66	119.61	125.47
2334903	137.25	133.73	136.89
2335801	79.44	81.34	.....
2335901	84.26	86.64	88.49
2341201	90.72	93.83	98.95
2341401	82.41	83.68	85.46
2341501	81.30	68.57	70.86
2341901	.....	122.97	125.28
2342201	.....	127.70	129.42
2342202	117.34	120.43	120.93
2342301	.....	102.68	99.49
2342401	104.15	108.63	111.11
2342501	90.15	90.79	93.25
2342601	.....	44.11	45.51
2342602	77.62	79.18	80.78
2342701	.....	.....	97.13
2342801	66.77	64.79	68.07
2343301	39.07	25.89	29.92
2343501	.....	69.95	70.44
2343502	74.53	74.20	75.72
2343503	.....	81.94	82.75
2343504	77.22	75.68	78.02
2343901	.....	64.74	66.28
2344101	.....	58.14	60.09
2344401	.....	56.19	58.57
2344701	.....	50.74	51.42
2344702	.....	37.58	39.69
2448201	.....	91.70	94.22
2448302	108.16	99.06	104.52
2448601	83.25	83.72	85.59

PARMER COUNTY

Well No.	1956	1962	1963
0924601	.....	286.05	.....
0932301	279.68	306.14	323.00
0940601	.....	239.59	242.18
0940901	209.26	226.64	229.28
0940902	184.28	198.53	202.78
0940903	194.76	206.38	221.16
0948301	170.70	.....	.....
1017401	229.09	241.84	.....
1017501	205.14	230.00	234.29
1018201	286.30	.....	.....
1018701	188.56	203.35	210.83
1018901	198.14	207.68	208.78
1019101	221.50	232.00	236.40
1019601	173.21	201.09	201.28
1020501	156.88	179.95	.....
1020502	131.85	151.34	151.11
1020801	127.98	144.60	150.49

Well No.	1953	1962	1963
1049301	17.48	25.88	26.29
1049501	71.47	73.96	74.25
1049602	31.64	41.26	39.37
1050201	.....	35.83	21.94
1050502	.....	53.27	55.08
1050601	.....	29.66	30.65
1050701	.....	55.37	.....
1050801	.....	69.34	70.37
1051101	34.78	59.59	60.61
1051105	.....	.....	44.58
1051301	22.67	48.46	.....
1051303	22.74	58.73	56.95
1051305	23.34	45.38	50.44
1051601	.....	25.11	24.47
1051602	.....	25.35	25.89
1051701	.....	60.30	60.50
1051703	55.66	82.00	82.25
1057401	.....	110.45	111.91
1057501	.....	37.09	32.66
1059101	69.91	.....	116.18
1059102	81.24	91.90	93.82
1059103	.....	92.85	94.52
1059401	84.21	103.59	110.73
2401101	.....	224.05	225.71
2401103	.....	222.78	223.92
2401201	.....	209.60	206.74
2401401	.....	169.19	169.24
2409201	.....	142.72	141.07
2508301	.....	80.54	81.98
2516301	.....	116.55	116.54

CASTRO COUNTY

Well No.	1953	1962	1963
1021401	.....	108.19	112.63
1021501	.....	111.83	115.73
1021601	82.25	122.60	.....
1021701	.....	163.65	168.40
1021801	.....	.....	150.04
1021901	.....	.....	126.22
1022101	.....	137.20	142.00
1022201	.....	128.65	.....
1022301	.....	.....	108.02
1022401	76.23	106.57	109.91
1022501	80.87	110.43	119.12
1022601	69.51	87.60	93.02
1022701	.....	135.63	.....
1022801	.....	.....	121.76
1022901	92.19	123.69	128.23
1023701	93.66	104.63	.....
1023801	.....	148.50	148.50
1024201	.....	.....	168.84
1024401	.....	176.50	180.76
1024601	.....	169.76	.....
1024701	.....	.....	176.23
1024801	.....	158.86	163.16
1028301	.....	224.41	234.50
1029302	.....	.....	216.29
1029601	.....	195.75	200.68
1029701	.....	200.89	213.27
1029901	.....	176.84	185.18
1030101	.....	.....	190.32
1030201	.....	185.52	191.68
1030401	.....	.....	216.90
1030505	.....	.....	202.88
1030601	.....	185.25	.....
1030801	.....	172.18	183.78
1030901	.....	.....	197.43
1031201	.....	139.18	142.70
1031301	.....	.....	163.54
1031501	.....	.....	189.98
1031601	.....	.....	135.24
1031701	160.60	202.59	205.00
1031801	.....	198.38	203.00
1032201	.....	.....	146.04
1032501	.....	125.64	126.81
1032701	151.42	180.03	183.72
1032801	.....	166.10	171.65
1037201	.....	155.45	163.51
1037401	.....	128.85	137.30
1037601	.....	113.03	115.37
1037901	.....	.....	118.24
1038401	101.36	126.26	128.69
1038403	.....	124.44	124.54
1038501	86.24	111.43	.....
1038601	.....	.....	118.80
1038701	98.84	123.24	126.39
1038801	99.19	125.10	128.40
1038901	.....	113.50	118.14
1039101	.....	153.30	157.22

DEAF SMITH COUNTY

Well No.	1953	1962	1963
0753701	.....	204.53	.....
0753901	.....	188.15	192.06
0755701	.....	179.07	181.89
0758801	.....	246.70	247.24
0759301	.....	.....	291.97
0759601	.....	289.52	.....
0759801	.....	249.31	253.97
0760201	.....	.....	260.73
0760301	.....	226.40	231.63
0760401	.....	.....	280.97
0760501	.....	210.72	213.64
0760901	.....	192.52	.....
0761101	.....	.....	198.37
0761201	166.75	.....	.....
0761301	.....	.....	187.31
0761501	.....	.....	163.91
0761601	.....	.....	160.32
0761801	.....	.....	163.98
0761901	123.68	139.06	142.55
0762101	.....	161.03	.....
0762301	.....	161.87	168.54
0762501	.....	134.40	135.64
0762601	.....	133.97	140.32
0763201	.....	149.15	.....
0763501	.....	109.98	110.90
0763701	.....	126.22	131.96
1003101	.....	286.40	287.68
1003701	.....	.....	226.73
1003901	.....	212.00	216.05
1004101	.....	275.05	277.97
1004201	.....	.....	235.32
1004301	.....	226.23	230.14
1004501	201.80	219.44	222.37
1004601	.....	.....	195.68
1004902	.....	148.95	.....
1005301	111.07	134.90	136.26
1005501	113.11	135.27	140.74
1005601	.....	.....	117.04
1005802	91.33	118.43	125.52
1005901	.....	132.62	.....
1006201	.....	117.89	.....
1006301	.....	129.80	132.38
1006401	.....	126.96	128.91
1006402	103.70	131.73	131.94
1006601	86.92	120.35	128.10
1006701	32.65	52.25	52.02
1006801	60.70	66.14	69.46
1006901	76.31	104.05	108.18
1007402	86.35	110.02	115.70
1007403	74.62	96.70	100.40
1007701	65.04	98.46	101.51
1007802	97.76	122.07	126.35
1009601	.....	64.98	57.23
1010801	.....	185.90	187.57
1011501	.....	171.99	175.85
1011601	132.64	151.10	155.53
1011802	.....	.....	166.60
1011901	.....	.....	178.48
1012102	.....	136.70	143.37
1012201	69.10	67.66	68.82
1012301	99.14	129.21	132.93
1012401	.....	.....	151.98
1012501	124.53	153.53	159.84
1012502	89.19	112.37	115.18
1012701	.....	120.23	124.12
1012901	89.52	112.21	115.34
1012902	120.74	148.25	152.18
1013101	.....	132.68	136.27
1013302	74.48	102.10	.....
1013304	85.96	115.03	117.14
1013401	.....	.....	120.69
1013501	73.30	94.53	96.67
1013502	102.11	134.72	141.09
1013801	.....	148.60	153.90
1013802	.....	105.84	110.01
1013901	93.17	122.07	124.74
1013902	95.71	125.06	.....
1013903	.....	126.62	130.95
1014101	58.20	.....	74.54
1014201	59.00	70.93	81.71
1014301	58.35	69.25	73.57
1014401	60.04	93.67	95.41
1014403	74.19	93.69	95.74
1014701	.....	139.55	141.67
1014702	110.78	139.05	143.34
1014801	96.52	122.26	125.34
1014901	89.77	101.86	102.89

Well No.	1953	1962	1963
2307101	.....	217.38	203.97
2307301	.....	.....	.....
2307401	.....	.....	233.45
2307501	209.38	231.16	241.18
2307601	212.19	234.48	243.13
2307701	.....	.....	213.24
2308201	.....	261.73	266.78
2308401	.....	.....	265.53
2308601	.....	251.58	254.72
2308701	.....	.....	261.18
2312301	96.32	138.97	144.89
2313101	.....	154.76	159.86
2313301	.....	188.22	174.23
2314101	.....	.....	194.25
2314301	.....	195.12	201.91
2315201	.....	240.33	243.93
2315301	.....	258.21	267.54
2315302	.....	254.32	255.86
2316101	.....	261.04	265.41

HOCKLEY COUNTY

Well No.	1953	1962	1963
2412701	.....	77.45	78.00
2412801	.....	124.75	125.93
2414501	.....	.....	105.64
2414801	.....	50.27	50.84
2414901	.....	.....	95.93
2415501	46.40	63.90	66.32
2415502	51.42	67.60	74.90
2415504	46.19	61.90	63.38
2415602	76.50	103.03	105.85
2415603	76.86	98.32	104.75
2415605	57.19	84.26	84.48
2415801	102.15	129.00	.....
2415802	136.96	173.30	174.60
2415901	30.79	41.20	41.96
2415902	30.81	34.64	43.29
2416402	91.02	124.29	123.26
2416403	68.31	93.55	98.77
2416701	42.02	58.38	60.23
2416702	64.01	85.47	88.15
2416704	83.55	85.60	104.20
2420101	.....	129.37	134.40
2420201	.....	115.21	118.99
2420401	.....	111.08	115.01
2420601	108.65	133.24	.....
2420701	.....	142.00	145.10
2420901	.....	120.72	124.85
2421201	.....	.....	38.55
2421301	.....	81.87	83.16
2421501	112.82	137.18	141.24
2421802	.....	.....	143.26
2421901	.....	141.77	144.42
2421902	121.10	150.52	149.80
2422201	.....	.....	74.53
2422401	.....	.....	84.41
2422601	.....	.....	98.34
2422802	.....	.....	114.94
2423101	.....	.....	105.45
2423301	149.55	178.60	179.45
2423501	.....	.....	100.96
2423701	.....	.....	99.36
2424402	106.40	.....	139.96
2424701	.....	.....	124.28
2428102	.....	.....	138.71
2428302	.....	.....	127.90
2428501	.....	.....	143.96
2428901	.....	.....	150.97
2429303	.....	.....	131.44
2429401	.....	.....	139.07
2429901	142.19	169.44	173.67
2430102	.....	.....	124.65
2430304	.....	.....	96.08
2430401	94.38	117.17	119.95
2430501	.....	.....	112.23
2430801	.....	.....	162.80
2430901	.....	.....	145.16
2431401	.....	.....	117.51
2431501	.....	.....	73.66
2431601	101.80	113.81	115.94
2431801	.....	.....	141.45
2432701	.....	.....	111.79
2436601	.....	.....	143.90
2437101	.....	.....	135.09
2437301	.....	.....	130.55
2437701	.....	151.00	150.76
2438201	.....	.....	154.46
2438403	.....	.....	151.79
2438601	100.60	119.80	124.27
2438801	.....	.....	155.91

Well No.	1953	1962	1963
2309501	.....	142.82	147.14
2309601	.....	123.09	128.94
2309701	.....	132.21	138.69
2309901	136.00	169.54	170.86
2309902	.....	144.46	.....
2310501	125.28	158.80	163.10
2310701	117.18	149.45	.....
2310801	110.02	144.55	148.48
2311401	104.17	156.93	161.65
2311601	106.40	145.88	149.81
2311701	.....	146.93	152.82
2311702	.....	142.94	146.40
2311901	88.72	127.09	131.78
2311902	100.39	141.92	145.91
2311903	89.91	128.61-	133.68
2312401	108.49	149.53	152.98
2312402	.....	150.33	153.28
2312803	.....	137.70	141.35
2317201	106.65	132.77	132.25
2317202	.....	129.49	129.06
2317601	93.29	112.13	113.73
2317701	.....	96.10	101.85
2317703	.....	86.86	88.79
2317704	60.60	70.14	71.71
2317705	63.11	.....	79.66
2317706	.....	83.22	88.88
2317801	57.70	75.13	.....
2317802	38.48	54.34	58.90
2317803	.....	73.47	74.91
2317804	33.90	52.53	.....
2318201	100.00	128.97	135.16
2318301	.....	145.56	157.92
2318401	.....	55.21	56.42
2318402	86.35	112.27	117.65
2318403	.....	113.12	115.43
2318404	88.50	118.57	121.43
2318501	82.65	113.13	.....
2318601	.....	118.81	123.81
2318701	55.55	.....	.....
2318702	54.19	.....	78.11
2318703	65.19	.....	89.56
2318704	59.26	.....	79.80
2319301	101.09	149.11	157.18
2319302	104.47	146.82	157.75
2319401	.....	109.49	117.01
2319402	83.55	126.80	130.67
2319403	84.30	127.28	131.60
2319501	93.38	138.53	141.12
2319701	50.80	76.68	80.62
2319802	.....	83.01	84.71
2319803	56.60	78.51	81.32
2319901	64.07	108.29	.....
2319902	73.77	.....	.....
2319903	81.34	125.12	135.40
2320101	97.27	139.18	147.08
2320505	110.80	158.32	.....
2320802	98.93	149.03	158.69
2325101	105.63	134.52	138.43
2325102	.....	131.77	133.70
2325302	67.59	.....	73.62
2325303	61.60	73.31	85.08
2325401	.....	131.00	133.33
2325701	84.16	110.42	114.59
2325702	80.22	.....	109.32
2325902	.....	103.77	109.76
2326101	.....	72.30	74.35
2326201	82.92	90.68	.....
2326301	74.58	89.48	92.56
2326901	51.47	49.73	50.45
2327101	69.93	89.26	91.71
2327201	62.19	84.31	83.61
2327202	55.12	73.80	77.61
2327203	.....	75.44	80.22
2327204	60.90	81.85	80.19
2327302	53.30	66.78	69.58
2327303	44.25	.....	.....
2327601	69.24	74.66	77.68
2327602	76.04	87.10	87.35
2328701	.....	59.62	61.02
2333201	106.39	125.11	128.31
2333401	92.20	100.13	102.05
2333601	94.80	101.40	104.05
2333501	.....	.....	106.22
2333801	.....	94.17	99.09
2334101	94.65	.....	113.24
2334102	.....	112.42	.....
2334501	101.80	125.00	128.35
2334502	.....	126.72	125.21
2334503	.....	115.32	112.17
2334601	93.80	113.84	112.16

Well No.	1953	1962	1963
1025701	188.90	212.68	.....
1026101	266.84	289.22	303.92
1026301	243.53	272.40	269.46
1026701	173.31	181.40	186.56
1027101	201.68	.....	230.52
1027301	225.18	252.15	256.22
1027401	217.13	245.37	248.01
1027901	185.45	208.00	213.31
1033101	225.13	238.25	253.41
1033301	.....	202.86	.....
1033401	.....	241.45	245.08
1033601	214.76	237.35	242.61
1033801	175.09	203.85	210.46
1033901	146.30	165.98	170.88
1033902	150.91	168.47	.....
1034301	162.01	186.80	200.65
1034401	212.27	234.85	240.75
1034801	157.70	175.46	.....
1034802	.....	201.04	202.91
1035401	184.60	204.15	207.98
1035501	173.64	194.50	199.31
1035601	157.52	169.60	173.55
1035701	163.10	182.78	192.60
1035901	.....	.....	206.05
1035902	179.84	196.41	205.83
1036101	153.70	165.80	170.10
1036801	139.12	156.82	160.65
1041201	.....	137.28	140.32
1041202	.....	123.35	126.98
1042101	123.17	138.20	141.50
1042201	150.63	164.18	.....
1042501	110.70	124.23	126.99
1042601	94.80	.....	.....
1043201	144.07	163.85	170.56
1044201	.....	159.70	168.26
1044201	.....	159.70	168.26

POTTER COUNTY

Well No.	1963
0649501	176.57
0756401	204.76
0756501	200.21
0756601	183.89

RANDALL COUNTY

Well No.	1953	1962	1963
0649701	.....	.....	200.32
0649902	.....	.....	196.37
0650901	.....	199.39	199.84
0657202	.....	.....	176.52
0657401	132.20	152.36	159.58
0657601	133.90	149.04	148.40
0657802	.....	.....	126.74
0658201	.....	197.29	197.85
0659101	.....	197.58	197.54
0755901	.....	.....	161.74
0756701	135.15	165.89	170.73
0756702	166.45	187.97	192.04
0756902	.....	.....	169.33
0763301	.....	.....	178.75
0763601	112.85	123.30	124.34
0763902	.....	.....	114.56
0764101	.....	.....	171.86
0764302	131.73	139.64	139.29
0764402	.....	.....	100.08
0764501	.....	.....	141.17
0764903	.....	132.64	140.58
1007301	.....	.....	115.07
1007601	.....	.....	90.37
1008102	.....	131.10	133.09
1016901	.....	.....	175.66
1101601	.....	3.94	4.92
1109301	.....	.....	156.63
1109501	.....	.....	172.81
1109601	169.55	187.11	190.04
1109801	.....	173.41	178.99
1109901	.....	166.44	170.52
1110201	.....	.....	151.32
1110402	151.80	169.48	168.25
1110802	.....	.....	160.73
1111101	.....	.....	130.03
1111502	.....	.....	157.66
1111701	.....	.....	150.51
1111801	.....	.....	97.08
1111901	.....	.....	101.99

WATER IS YOUR FUTURE—
CONSERVE IT!

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 9—No. 11 "THERE IS NO SUBSTITUTE FOR WATER" *April 1963*

AN EDITORIAL TRIBUTE TO PARMER COUNTY IRRIGATORS

WASTE WATER IN ROAD DITCH ---------- RE-CIRCULATED TO PRODUCE CROPS

Parmer County farmers encounter some rather knotty problems while irrigating agricultural crops — problems which are not found in all parts of the Water District.

First, their soils are tight and heavy, and do not readily allow water to penetrate. Water must either run through the fields, or be held in the furrows, for a period of time long enough to allow sufficient moisture to be taken into the soil to produce adequate crops and sustain yields. Particularly annoying to irrigators of tight soils, is how best to control irrigation water until it has remained on the cropland a sufficient period of time to wet the soil adequately and still keep it from escaping the land into the road bar-ditches and dry lakes.

Second, with rare exception, Parmer County farmers have become aware of the declining water table and the folly of allowing water to pour from their land.

Problems must be recognized as such before solutions will be sought. Tight soils plus a declining ground-water table have now been recognized by many as a threat to continued prosperity.

As a result of this recognition, in Parmer County, many farmers are doing what yesterday most had termed "impossible."

"Impossible," is becoming a moot word and "re-circulation" is taking its place in the minds of most. Pit pumps and lake pumps are being installed to salvage water that in the past has been wasted. "Tailwater," a term used to define water that has passed through the field, is now picked up and re-circulated to the cropland. "I'm getting more uniform penetration of moisture on my slopes than I've ever had before, and doing it with less water than I used to pump," one farmer who recently installed a re-circulation system advised a Water District field man, "and besides, my conscience isn't bothering me like it used to when water ran off my place."

There are still skeptics who are not convinced that the methods being used to retain irrigation water on the land will ever pay off — others feel that the installations will pay off over a long period of time — while many think that pits and lake pumps will pay off very rapidly.

Be this as it may — only time will answer many of the questions that have arisen in attempting to solve the problems of waste water that have long plagued hardlands farmers.

The important thing is that people are thinking, and they are talking with others, about methods that can be employed to make water management on their farms more efficient.

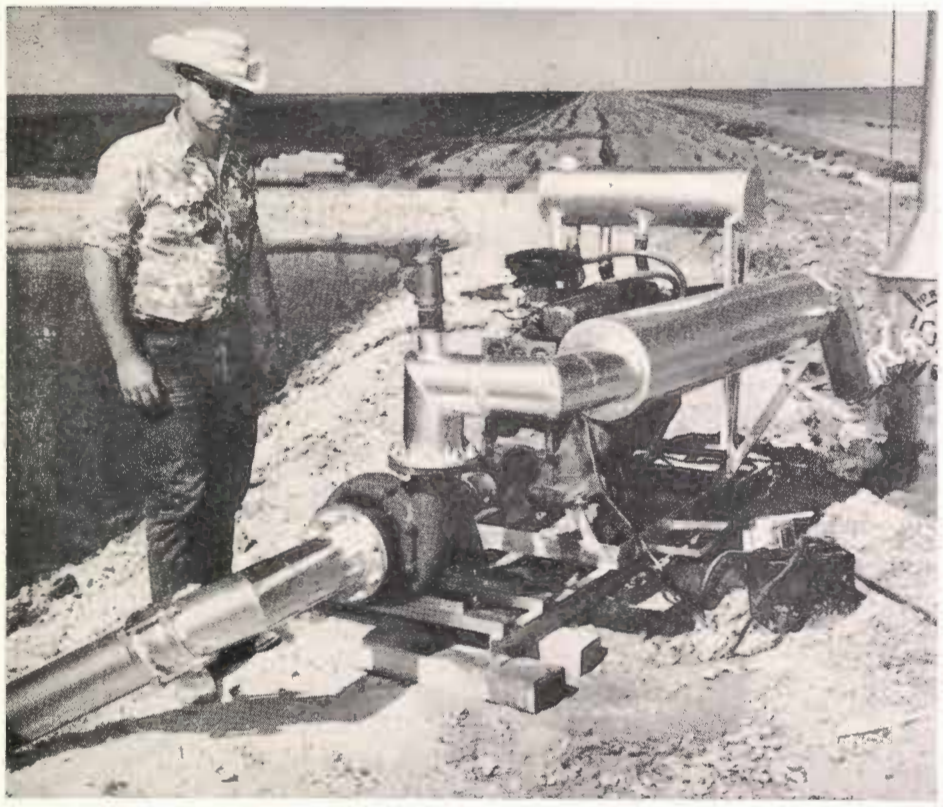
Suggestions and ideas are weighed, one against the other, and the most practical and economical method for the farm involved is then put into use.

Although much remains to be accomplished, residents of Parmer County who are meeting and finding solutions to these problems which threaten their economy are to be congratulated for the progress they have made toward the ultimate goal of complete water utility.

Most of the space in this edition of "The Cross Section" is devoted to showing what some farmers in Parmer County are doing to make certain that all their irrigation water is put to beneficial use.

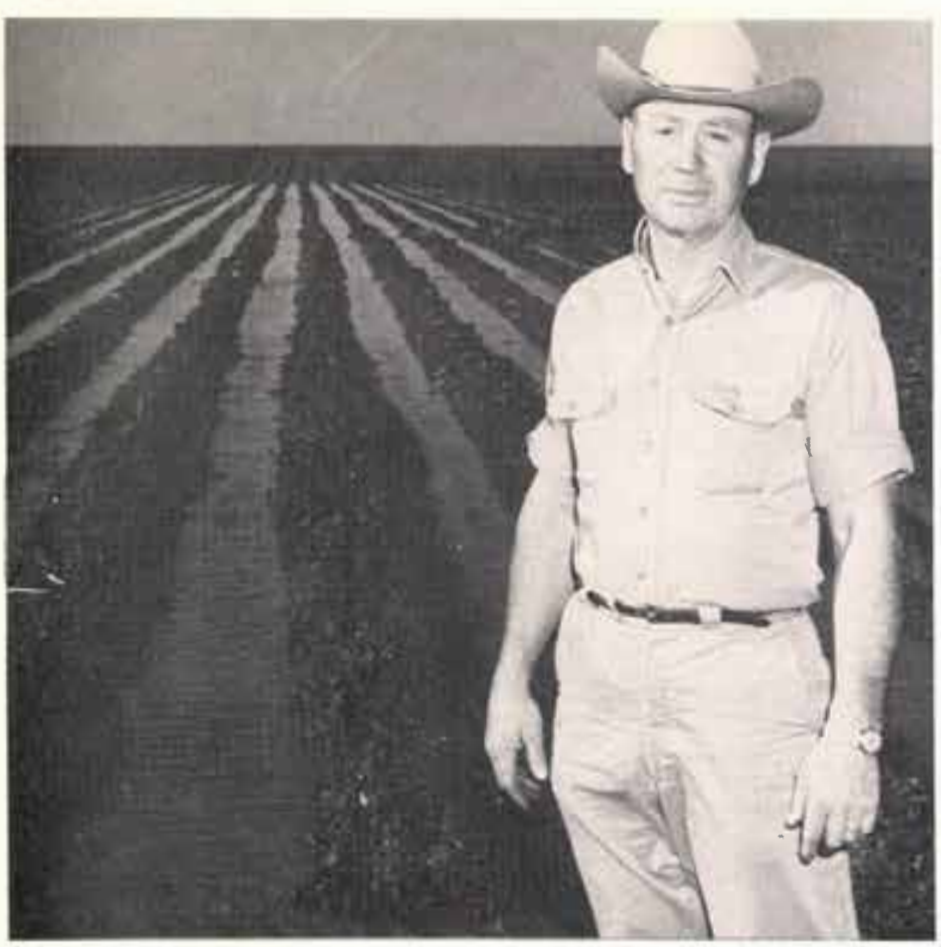
Clifton White

PARMER COUNTY FARMERS SALVAGE IRRIGATION "TAILWATER" THROUGH LA



Dwain Menefee, who farms 320 acres of land south of Friona, has constructed a re-circulation pit on his farm. He has installed a 5-inch centrifugal pump at the pit and 1/2 mile of 10-inch rubber gasket underground concrete pipe. He can use the "tailwater" that collects in the pit anywhere on the lower quarter. He hopes to water about 30 acres of land with "tailwater". He says that his engine is too large to run slowly enough to operate the pump at the proper speed and still oil itself adequately.
If there is a need, Menefee plans to install another re-circulation system on the upper quarter.

A. P. (Porter) McGee owns and operates a 320-acre farm located 2 miles north and 2 miles east of the Hub Community. He irrigates the farm with "tailwater" which comes to his place from about 1600 acres of adjoining land. He supplements the "tailwater" with water from one 8-inch well. The "tailwater" is pumped from a rather large reservoir created when a dam was built by McGee to hold the water on his farm and keep it from continuing into a large dry lake. An old-style 10-inch centrifugal pump is utilized at the reservoir, and water is pumped through a network of underground concrete pipe. Besides the pipelines, McGee estimates that he has spent about $600 for dirt work and about $500 for the used pump and butane-powered engine. Chief problems encountered by McGee during the 5-year period he has used "tailwater" - wild grass and weeds are bothersome, and silt collects in the reservoir that has to be removed. Chief advantage in utilizing "tailwater" says McGee, "I would have to drill and equip another well if I didn't use the "tailwater," and that would cost me around $6,000, plus my pumping expense would increase." One of McGee's employees is shown above with the pump and engine.



Kenneth Cass lives 4-1/2 miles south of Friona. He owns and operates a 320-acre farm which formerly sloped sharply along the mile-long south side. In the past, Cass ran water through the field and into the road ditch for a period of time long enough to allow sufficient water to penetrate the soil. The "tailwater" was not re-claimed by Cass. Now, however, he has uniformly levelled a 400-foot-long strip of land along the end of his rows. His rows still run down the slope, but when the water comes to the levelled strip, 400 feet from the row ends, it slows considerably, allowing sufficient time for proper penetration. No irrigation water leaves the farm. To level the strip he had 12,000 cubic yards of soil moved at a cost of $2400. Cass says," I believe that the added crop production I can obtain from the 24 or 25 acres which used to slope pretty sharply will repay my investment over about a 5-year period."

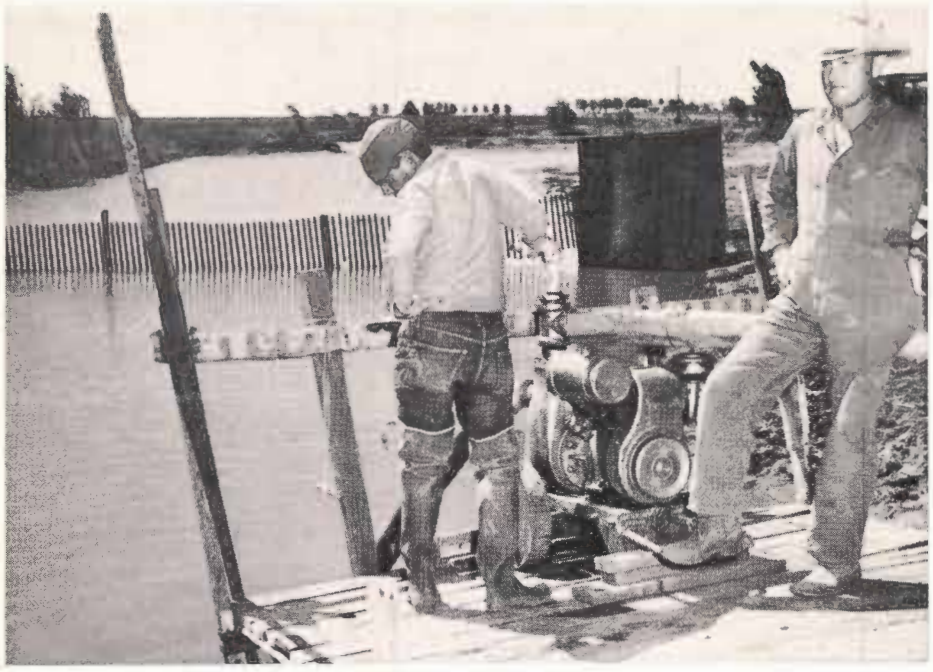
J. D. Kirkpatrick operates a 160-acre farm which is owned by Jack Dunn of Clovis. The place is located about 2 miles southwest of Bovina on Highway 60. Kirkpatrick also owns and operates a farm which is about one mile farther southwest. In years past, "tailwater" from Kirkpatrick's place, and "tailwater" from the land of a neighboring farm escaped and was lost into a draw. The water passed through Dunn's farm on its wasteful trek. Today, however, it is salvaged by using the new pit on Dunn's farm to intercept it. Kirkpatrick and the pit are shown in the photo. Water from 480 acres of land drains into the 15 feet deep by 150 feet long by 50 feet wide pit and is pumped to the cropland on Dunn's farm by using a 4-inch centrifugal pump and 7-1/2 H. P. electric motor. The system does not operate automatically. About one day is required to empty the pit. It fills in about three days. The pump has a capacity of approximately 700 G.P.M. Kirkpatrick states that the cost of digging the pit was about $500, pump and motor $1200, and that about 1800 feet of underground concrete pipe was installed by Dunn in order to use the "tailwater."

ND MANAGEMENT AND INSTALLING LAKE AND PIT RE-CIRCULATING SYSTEMS

Gilbert Wenner owns a 320-acre farm which is located about 5 miles south of Friona. He has one 8-inch well on the farm, with which 200 acres can be irrigated. Near the center of the farm is a rather large lake. About 1000 acres of surrounding farmland slopes toward the lake. He has recently installed a 6-inch centrifugal pump and engine at the lake to be used for pumping water from it. He purchased 1600 feet of 8-inch aluminum pipe and 1/2 mile of 12-inch underground pipe. The pumps, engine and their installation cost $1286 - the aluminum pipe cost $1630. Wenner pumps irrigation "tailwater" and rainwater from the lake - he can pump about 1200 gallons per minute and water all but about 48 acres of the farm by using the well and lake pump. When this picture was taken he had shut his well down and was irrigating with only "tailwater". About 5 gallons of butane per hour is used to operate the lake pump engine. Wenner purchased a 4-yard capacity scraper with which he plans to complete a pit in the bottom of the lake about 10 feet deep by 50 feet wide by 900 feet long. This will be done for three reasons: (1) to curb evaporation, (2) to make 100 percent of the lake water available to the pump, and (3) to reclaim some bottom land which can be farmed.

Walter Mabry operates a 320-acre farm located 1 mile south of the Hub Community. The farm is owned by James Mabry. Two 8-inch wells are located on the farm. During years gone by, "tailwater" from the cropland spilled out into the road bar-ditch and was not salvaged. Recently, however, a pit was constructed at the low end of the farm for collecting "tailwater" and a turbine-type pump with a 6-inch discharge and a 10 H. P. electric motor was installed in the pit. The pump operates automatically as the pit fills or empties. Mabry installed 1/2 mile of 6-inch underground plastic pipe from the pit to a previously installed pipeline so that the "tailwater" can be used anywhere on the 1/2-section. The pump will handle about 350 G. P. M. In the photo, a filter is shown around the pump.

Luther Hall operates the farm which is shown above, and which is located 2 miles east of the Hub Community. The farm is owned by Herman Heath of Lubbock. In an attempt to slow the movement of irrigation water as it meanders down the furrows, Hall contoured the ends of his rows. The contours are not on a perfect level—a slight grade was desired so that rainfall would be less apt to damage the beds.



W. S. Ingram shown above at right lives 5 miles south of Friona. He operates 320 acres of land which is owned by David Moseley of Friona. On the farm is a lake which covers about 80 acres if you include the land which slopes rather sharply to the center of the depression. Run-off water from a considerable area surrounding the farm drains into the lake. Ingram and Moseley built several earthen tanks to intercept irrigation "tailwater" before it gets to the lake bottom. They obtained a used 3-inch self-priming centrifugal pump and air-cooled engine. The pump is mounted on the bed of a trailer which is pulled by an old tractor from tank to tank. Eighteen acres of land that was formerly worked without benefit of irrigation is now watered with salvaged "tailwater." Dirt work cost $400, 320 feet of 4-inch plain aluminum pipe and 180 feet of 4-inch gated aluminum pipe cost $367, and the engine, tractor and pump together cost only about $200. About one hour is required to move the system from one tank to another. The pump uses about 3/4 of a gallon of gasoline per hour, and pumps approximately 300-400 gallons of water per minute.

Curtis Murphree is shown above with his newly-installed 3-inch recirculating pump and 10 H. P. electric motor. Si Darling of Pratt, Kansas owns the 320 acre farm on which the system is located. Murphree operates the farm which is about 4 miles north of Friona. He and Darling installed the re-circulating system in order to salvage irrigation "tailwater" which in the past was lost to the road ditches. There are two good 8-inch wells on the farm. Darling paid for digging the collection pit which measures approximately 40 feet wide by100 feet long by 14 feet deep, and installed 2640 feet of 6-inch underground plastic pipe. Murphree bought the pump and motor. When operating, the system will recirculate about 400 gallons of water per minute at a cost of approximately 18 cents per hour; or, enough water to irrigate 7or 8 one-half mile long rows per day. The system starts and stops automatically. Total cost of the installation, $3300. Murphree states, "I think that the best thing about the system is that now we can irrigate the bottom part of our farm and not lose any water. From these acres we should be able to increase production enough to pay for the installation."

THE Cross SECTION

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

Published monthly by the High Plains Underground Water Conservation District No. 1
1628 15th Street, Lubbock, Texas

Telephone PO2-8088

ALLAN H. WHITE, JR.
Editor

HIGH PLAINS WATER DISTRICT OPENS NEW FIELD OFFICE IN MULESHOE

A new field office of the High Plains Underground Water Conservation District has been established at Muleshoe. It will primarily serve the residents of Bailey, Cochran and Parmer Counties.

Two employees of the Water District will staff the office, David Cunningham, a new addition to the District staff and a new resident of the High Plains; and Mrs. Bertha Daniel who will handle the secretarial and clerical work at the new field office. She is the wife of James Daniel, who farms near Muleshoe in the YL community, and the mother of four boys, Ronnie 12, Ricky, 10; Randy, 7; and Roger, 4. The three older boys attend school in Muleshoe. Mrs. Daniel is the former Bertha Jones of the Roosevelt community east of Lubbock and graduated from Roosevelt High School in 1949. She played on the 1949 Roosevelt High girl's basketball team that won the state class "B" championship. In fact, she was selected as a member of the all-state team. The Daniel's attend the YL Methodist Church where she teaches in the Nursery Department and serves as secretary-treasurer for the congregation. Mr. Daniel is Superintendent for the Bible School of the Church.

Cunningham has just recently moved to Muleshoe from Del Rio. He and his wife, Cecile, and two children, Dorothy, 5, and Davie, 3, reside at 502 West 2nd Street in Muleshoe. Cunningham is 26 years old and graduated from high school at the San Marcos Academy. He formerly lived in Yoakum, Gaines, and Kent Counties and worked in the oil fields. He also has a ranching background. He and his wife are members of the Baptist Church.

The Water District field office will be located at 217 Avenue B in Muleshoe, where building space will be shared with the Ray Carter Insurance Agency.

Applications for well-drilling permits in Bailey County will be accepted at the new field office. Assistance will be provided to anyone who has a ground water problem.

We welcome Mr. Cunningham and Mrs. Daniel to our staff, and trust that the new field office in Muleshoe will be an asset to those who reside in the western part of the High Plains Water District.

DAVID CUNNINGHAM MRS. BERTHA DANIEL

NORTH PLAINS MAN TO RECEIVE TRIBUTE AS "WATER CONSERVATIONIST"

The General Manager of the North Plains Ground Water Conservation District has been notified that he is to receive one of the State's highest service awards for his efforts in the field of "water conservation."

J. W. "Buck" Buchanan of Dumas will be presented the Fort Worth Press Award plaque and citation at ceremonies May 4 in Fort Worth as the individual giving the most unselfish service to the cause of water conservation in the State of Texas.

He will also be presented a plaque on May 17 in Plainview for having won the Region I business or professional man award.

Buchanan will be cited for his tireless efforts in water conservation during the last session of the Texas Legislature when he served as chairman of the Reclamation and Conservation Committee in the House of Representatives.

J. W. BUCHANAN

Please Close Those Abandoned Wells!

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THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 9—No. 12 **"THERE IS NO SUBSTITUTE FOR WATER"** *May 1963*

Business Community Speaks on Subject —

NEAR RECORD NUMBER OF WELLS DRILLED IN AREA SERVED BY HIGH PLAINS WATER DIST.

The county offices of the High Plains Water District have reported for the first four months of 1963 that their well-drilling permit business has been rather rushing.

Mrs. Jean Lancaster, District Secretary for the Water District in Lubbock, states, "For the first four months of 1963 our County Committees have issued 1216 permits in our 13-county area. This was exceeded by a record number of permits issued for the same period in 1955. During that time, we issued 2298 permits. In 1957, another very busy year, the number of permits issued covering the first four months was 1703. Since 1953, the District has issued a total of 24,064 permits."

To obtain the reaction from those who supply equipment and services to irrigators throughout the Water District, "The Cross Section" asked representatives from the several facets of the industry to comment concerning increased activity during the winter of 1962 and the spring of 1963.

Bruce Spencer, Vice President of Gifford-Hill-Western, was contacted at his office in Lubbock. He was asked to comment concerning the installation of underground and surface pipelines. He had this to say: "It looks like 1963 may be a near-record or a record year in footage of all types of irrigation pipe purchased by Plains farmers.

"Searching for the reasons, the good crops in recent years is a major one, of course. But another big factor is the recognition and awareness by more farm operators of the vital necessity of water conservation; and, with the very slow linear travel of our water in the Ogallala formation, that the water they save by efficient irrigation is water that they will have to use on their own farm in the years ahead.

"Also, efficient irrigation pipe systems are now recognized as a sound and profitable farm investment rather than simply a luxury item, an 'easier way to do it'."

We contacted Pete Peeples, a water-well drilling contractor at Idalou for his comments. He told us, "Up until three or four weeks ago, I had as much business last year as I've had this time, but right now I'm farther behind than I've ever been. Probably the main reason for the sudden spurt of wells drilled this spring can be attributed to the generally good crops made last fall. It makes a big difference when folks have some money to spend. And, I think that there is no question but that the declining water level is making it mandatory for a man to have more wells to irrigate the same amount of land.

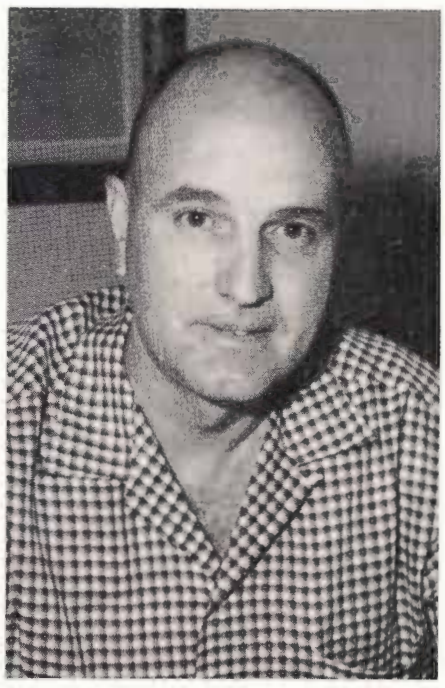
"Probably a third of all the wells we've drilled this year have been replacement wells. Many of the old wells that were drilled 15 or more years ago are now having to be abandoned and new wells put down deeper to take their place."

We visited briefly with Carl Gelin, Vice President of Layne Pumps, Inc., and he told us over a cup of coffee in his Lubbock office, that "The vertical turbine pump industry, as well as the drilling industry, has experienced a marked increase in business for the 1963 season. This has been primarily due to the prolonged winter and spring drought throughout the middle and southwest. It is secondarily due to the available supply of money for capital investment from loan agencies and from the end consumer because of the financially successful crop year of 1962.

"Although the number of pumps installed in 1963 may exceed the number of pumps manufactured during the peak year of 1955 by two to three times, the dollar volume of merchandise sold will not reach or surpass the dollar volume of the peak years of 1953, 1954, and 1955. This is due primarily, in this area, to the declining water table and the accompanying decrease in size of individual pumps. It takes almost as many man-hours to fabricate a 4-inch pump as a 10-inch pump, and since the largest cost in a deep well turbine pump is the material, the final total sales volume is much less. This is especially true in the submersible pump which has become predominate in the smaller sizes."

An accompanying table has been prepared which indicates, by Counties, the number of permits issued and wells drilled for the first four months of 1963.

Mrs. JEAN LANCASTER



BRUCE SPENCER

PETE PEEPLES

CARL GELIN

Turn To Page 4 For Statistical Table On Permits Issued And Wells Completed

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EXPERIMENT STATION APPROACHES W

"Water Stretch" tests will be conducted this summer at the Texas Agricultural Experiment Station located north of Lubbock.

No, they will not in these tests attempt to determine the elastic qualities of water. They will, however, commence studies which will in time give irrigators throughout the southern High Plains of Texas some insight as to just how efficiently water can be used in producing agricultural crops.

J. S. Newman and James Zetzsche, Irrigation Specialists at the Lubbock station, explain the program in this manner, "We know that we are using ground water at a much more rapid rate than the subterranean reservoir is being replenished, and we know from long-time records that we can generally expect to receive near 10-14 inches of rainfall during our growing season. Using present-day techniques, this is only about half enough moisture to sustain maximum crop yields; however, we suspect that in the near future, advances can be made that will enable us to produce adequate yields by supplementing rainfall with

Photograph above shows equipment used to install 1/2-inch plastic tubing for use in sub-irrigation tests. The tubing was installed 18-inches beneath the soil surface with some rows spaced 40-inches apart and others spaced 80-inches apart. The tubing was perforated at 13-inch intervals with holes 1/16-inch in diameter. These tests will deal primarily with solutions to problems encountered in the future when supplemental water supplies become extremely short. Evaporation losses of irrigation water can be drastically reduced using such a method of application.

AREA REPRESENTATIVE PROPOSES BILL TO MUFFLE PUMP ENGINES

State Representative Bill Clayton of Springlake in Lamb County has introduced a bill in the Legislature which, if passed, will require that all operators of irrigation wells, located within 300 yards of a dwelling and powered by internal combustion engines, equip them with mufflers.

The bill has been referred to the Committee on Criminal Jurisprudence.

Clayton's bill, H. B. 1074, reads as follows:

"BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

"Section 1. No person, firm, partnership, corporation or association shall operate any irrigation well pump powered by an internal combustion engine which is not equipped with an operable muffler, within three hundred (300) yards of any residence or any single or multiple unit dwelling house.

"Sec. 2. Any person, firm, partnership, corporation or association which violates any provision of this Act shall be fined not less than One Hundred Dollars ($100) nor more than Five Hundred Dollars ($500).

"Sec 3. The importance of this legislation and the crowded condition of the calendar in both houses create an emergency and an imperative public necessity that the Constitutional Rule requiring bills to be read on three several days in each house be suspended, and this Rule is hereby suspended."

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ATER RESEARCH FROM BOTH IMMEDIATE AND LONG-RANGE POINT OF VIEW

BY ALLAN H. WHITE Jr.

J. S. Newman, Irrigation Specialist at the Experiment Substation near Lubbock, is shown as he manipulates a neutron tube. The device has recently been added to the station's equipment inventory. Its function is to measure moisture in the soil by using a radioactive material. The neutron tube will be used in the station's irrigation and water research work.

only a very meager quantity of ground water."

Newman says, "I dislike referring to our research as experiments using *limited* quantities of water, because I believe that all irrigators, whether or not they have apparent limited supplies of ground water, should today be 'stretching' their water, for tomorrow their supplies will fall into the 'limited' category.

"The time will come when we can no longer employ present-day concepts of irrigation and stay in business. When that day arrives, we will need all the basic information that research can furnish. This is why we at Substation No. 8 at Lubbock have decided that it's more important to use our research funds and energies in striving to make water, both rainfall and irrigation, go as far as possible."

Charles Fisher, Superintendent of the Lubbock station says, "We are trying in our water-use research to do work in the applied field and also in the basic field. In other words, we are attempting to supply answers to irrigators concerning problems that are confronting them today. At the same time, we hope that our basic work will provide answers to problems that may not confront us on a large scale for ten or fifteen years from now. Research is generally a time-consuming process — so we sure don't want to sit around until the day when we need the answers before commencing to analyze the questions."

Research which will be conducted this year by Newman and Zetzsche will be divided into four major studies: (1) "Water-Stretch" tests, (2) Conservation and utilization of rainfall and irrigation water, (3) Root development of cotton grown under different moisture levels, and (4) Evaluation of sub-irrigation for crop production.

"Water-Stretch" Tests

These experiments will attempt to determine the effect that minimum amounts of irrigation water have upon the yield and quality of cotton.

Conservation of Rainfall and Irrigation Water

These tests will be made (1) to determine the influence of slope upon water -use efficiency when irrigating cotton, (2) to determine the influence that various land management practices have on runoff, and (3) to determine the influence fertilization and various soil-building crops have on restoring the high-yield capabilities in soils where cuts and fills have been made during leveling programs.

Metering devices will be installed to calculate the amount of runoff from areas having various slopes.

Financial assistance to commence and continue this work is being provided by the High Plains Underground Water Conservation District and the Plains Cotton Growers, Inc.

Root Development of Cotton

The chief aim of these tests is to develop information concerning the influence that varying quantities of moisture have on the root growth of cotton plants.

Development of the plant roots will be traced by placing radioactive phosphorus at various depths in the soil.

Three moisture levels will be used in the studies which are scheduled to continue for a three-year period.

The work is being partially financed by a grant from the National Science Foundation.

Sub-Irrigation of Crops

The evaluation of sub-irrigation for crop production tests are designed to ascertain the feasibility of irrigating a crop from below the soil surface. Perforated 1/2-inch plastic tubing has been installed at a depth of 18-inches below the soil surface on these test plots. The tubing is laid so that it will run in the same direction as the rows and is spaced either 40-inches or 80-inches apart. Well water is conveyed through the plastic tubing and distributed to the crops through 1/16 inch perforations spaced 13-inches apart.

This work is being conducted in an attempt to alleviate surface evaporation of irrigation water which may run as high as 30 percent or more. Also, this method of application should distribute water more uniformly than the staid down-the-furrow method.

The Southwestern Plastic Pipe Company has furnished the tubing and financial assistance for this experiment.

Research holds the key to many unanswered questions that will affect the future of agriculture on the Texas High Plains. Through the efforts of scientists such as Newman and Zetzsche, and with the support of people throughout the area, the High Plains should be in the irrigated agriculture business for many years to come.

Shown above are several flumes which have been installed at the end of plots leveled to varying grades for experimental purposes. Runoff water from rains and irrigation applications will be channeled through the flumes where quantities will be automatically recorded.

James Zetzsche, Agricultural Engineer conducting water-utilization research at the Experiment Station at Lubbock indicates how the flumes will appear when automatic recording equipment is attached. Note in photo at left how flumes are installed in the field. Each flume will be joined to a short length of 6-inch steel pipe so that when runoff occurs the water level in the pipe will be identical with that in the flume. An automatic recording device will be housed in the metal structure that appears in the form of a large kettle. A float is attached to the recorder and extends down into the pipe. Fluctuations of the level of water in the pipe are thus recorded.

A LITTLE LIFE IS WORTH MORE THAN A LITTLE TIME, CLOSE THOSE ABANDONED WELLS!

U. S. GEOLOGICAL SURVEY HYDROLOGIST DISCUSSES WATER AND THE SOUTHWEST

H. E. Thomas, a hydrologist with the U. S. Geological Survey, has done a masterful job in analyzing the multitude of problems that confront water-users in the southwestern states of this Nation. This has been accomplished in the New Circular No. 469 published by the U. S. G. S. The title of the 15-page circular is, "Water and the Southwest — What is the Future?"

Thomas commences by briefly reviewing the many reports on the Nation's water picture published by the Senate Select Committee. He then aims his writings in the direction of the arid southwest. He talks about the tremendous quantities of water available to us, but that most of it is not "usable" because it is either of "improper" quality or in unusable form sea water, chemically contaminated water, or atmospheric moisture. He discusses the idea that most people have concerning costs of obtaining usable water—he says that we're willing, generally to pay only the "warehousing" and "transportation" costs of making water available.

Thomas discusses at length the supply of water in the southwest and possibilities of making the supply more abundant by increasing total precipitation and desalting sea water, or brackish water and brines that lie deep beneath the surface of the earth.

He discusses the need for updating our attitude toward water rights in the several southwestern states, and concludes this phase of his discussion by saying that he would like to see water served to people in the same manner as electricity is distributed.

Thomas concludes his work by stating: "In conclusion as to the future, we can be sure that water supply in the West will continue to present many problems, undoubtedly of increasing complexity. We can be sure also that our water supplies will become increasingly expensive. If we do nothing constructive, we will pay heavily for controversies over division of the limited supplies that nature will provide. If we continue the present trend of modest development and improvement, we will still not have enough for our foreseeable requirements in 1980. And if we do meet those foreseeable requirements, we must have more knowledge, more effort, and more enlightened attitude of the public. Water, H2O, is sufficiently abundant that we may have several alternative means or combinations of means of providing a specified quantity at a desired standard of purity. Our choice then becomes one of the greatest benefit at least cost from the viewpoint of the public as well as the individual. Necessarily in effective economic planning for the future, planning of water use will be an inseparable component."

You will profit by obtaining Circular 469 from the U. S. G. S. in Washington, D. C. The bulletin can be obtained free of charge, and reading and studying it will enlighten you. You may not agree with Mr. Thomas in his ideas or with his remedies for solving the water problems of the southwest, but you will certainly appreciate the technique he uses in expressing his point of view.

Order the circular today.

U. S. DISTRICT COURT JUDGE ENTERS DECISION IN WATER DEPLETION CASE

A formal judgement was entered this month in the U. S. District Court at Lubbock in which Judge Joseph B. Dooley upheld the right of Marvin Shurbet and his wife, who live in southwestern Floyd County, to claim an income-tax deduction for the depletion of ground water used during 1959 in the production of agricultural crops.

The case is a test suit filed in behalf of the High Plains Underground Water Conservation District. The District's purpose in filing the suit is to establish in the minds of water users that ground water in this area is being depleted, and as a result the producing of ground water is similar to other mining operations and that conservation is a must for prolonging the subterranean supply.

The judgement comes as fulfillment of Judge Dooley's opinion as expressed earlier this year in a letter written by him to attorneys for both the Water District and the Justice Department. He said in the letter, " . . . 'The record herein, as I see it, reflects by an impressive weight of evidence that ground water, such as that in the Ogallala formation of the Southern High Plains part of Texas, is a mineral and a natural deposit in the sense of the federal tax statutes governing the subject of depletion of minerals and natural deposits, particularly cost depletion thereof, as related to income tax liability."

The Board of Directors of the Water District believes that conservation encouraged by the water depletion case will add many years to the economic life of the High Plains. To each citizen this means a prolonged and added value for his land, his home, his business, and his work.

DRILLING STATISTICS FOR FIRST FOUR MONTHS OF 1963

County	PERMITS ISSUED					NEW WELLS DRILLED				REPLACEMENT WELLS				DRY HOLES				TOTAL WELLS DRILLED				
	Jan	Feb	March	April	Total	Jan	Feb	March	April	Jan	Feb	March	April	Jan	Feb	March	April	Jan	Feb	March	April	Total
Armstrong	0	2	0	0	2	0	2	0	0	0	0	0	0	0	1	0	0	0	3	0	0	3
Bailey	25	1	0	23	49	2	15	0	15	1	0	0	0	2	0	0	0	5	15	0	15	35
Castro	31	12	13	19	75	9	9	8	12	0	0	0	1	0	1	0	0	9	10	8	13	40
Cochran	10	26	15	12	63	3	1	7	14	0	0	0	0	1	0	0	0	4	1	7	14	26
Deaf Smith	30	13	47	37	127	9	10	11	22	1	0	1	2	0	0	0	0	10	10	12	24	56
Floyd	11	7	36	29	83	12	2	6	11	2	0	0	0	0	0	1	0	14	2	7	11	34
Hockley	56	41	38	49	184	7	30	17	39	0	0	0	0	0	1	5	4	7	31	22	43	103
Lamb	35	33	31	40	139	14	16	8	20	3	0	2	0	4	0	1	0	21	16	11	20	68
Lubbock	95	62	74	51	282	8	38	41	32	1	0	2	0	1	5	5	0	10	43	48	32	133
Lynn	11	20	10	8	49	0	5	7	5	0	0	0	0	0	0	2	1	0	5	9	6	20
Parmer	17	16	31	45	109	4	6	1	13	4	2	2	3	0	0	1	0	8	8	4	16	36
Potter	1	3	2	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Randall	6	10	19	13	48	2	6	5	6	0	0	0	0	0	0	2	0	2	6	7	6	21
Totals	328	246	316	326	1216	70	140	111	189	12	2	7	6	8	8	17	5	90	150	135	200	575

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas

Second Class Permit

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 1 "THERE IS NO SUBSTITUTE FOR WATER" *June 1963*

LAKE WATER SHOULD BE USED IN LIEU OF GROUND WATER FROM WELLS

Right now it looks as though we will never again have need of water for growing crops in the southern High Plains. However, if conditions during the remainder of this growing season are anywhere near normal, at least one more irrigation will be needed, and in the case of grain sorghum and high moisture-requiring crops, perhaps more.

Knowing that there probably will be need for additional moisture during this summer, the Water District is urging all persons who have a lake on their land which has caught runoff during the recent rains (and which one hasn't?) to pump this water for irrigation in lieu of well water.

Many reasons can be presented for encouraging the use of surface runoff water, but perhaps chief among reasons would be that to do so effects a substantial saving of ground water.

In order to prolong the high level of irrigated agricultural production in this area we must make efficient use of ground water. Consequently, when a supply of supplemental water is available for use, such as a lake filled with runoff water, and still we pump ground water to irrigate our crops, we can hardly boast of efficient use.

Aside from the conservation advantages of using lake water in preference to ground water, there are also economic reasons which can be cited to justify our point of view.

Lake water can generally be pumped and used for irigation at less expense than can ground water. For one thing, the lift, or head, is much less. This results in a requirement for less power to pump a given quantity of water. For another, lake-pumping equipment costs only a fraction of the price paid for a deep-well pumping plant.

Other benefits derived from using lake water when it is available are:

(1) Water that remains in the normally dry lakes is largely wasted because probably 90 per cent of the total volume collected will evaporate into the atmosphere and be non - recoverable.

(2) When the lake water is used, a mosquito-breeding environment is largely alleviated.

(3) If the lake bottom is utilized as a pasture or in some other income-producing endeavor, water should be pumped from the lake as quickly as practical to prevent excessive damage.

(4) Because of its warmer temperature at this time of the year, lake water is probably more compatible to growing plants than ground water.

We urge the use of rainfall runoff as a supplement to ground-water requirements. Each farmer who has a lake on his land should consider putting to beneficial use the runoff water that it catches. It's good sound business to do so, and we further believe that benefits will be derived by not only the farmer, but by his entire community.

Water District Publishes Brochure Which Explains Depletion Case

A new brochure has been published by the High Plains Underground Water Conservation District. It is entitled, "High Plains Water Depletion Case — Its Effect on Me and My Community."

The new booklet has been prepared in an effort to explain, primarily to residents of the Water District, why an income tax deduction for the depletion of ground water in the southern High Plains of Texas was sought, and it points out the benefits that will be derived from such a tax program, especially those in the field of water conservation.

The booklet is attractively printed in two colors, green and black, and is illustrated by photographs, graphs, and maps.

Upon request, a copy of the new brochure will be mailed free of charge to anyone who desires it. For convenience, a clip-out coupon is provided.

HIGH PLAINS WATER DISTRICT
1628 — 15th Street
Lubbock, Texas
Gentlemen:

Will you please send me one of the District's new brochures entitled, "High Plains Water Depletion Case — Its Effect on Me and My Community." Send free of charge to the address shown below:

Name _____

Mailing Address _____

City and State _____

BURNING WHEAT STUBBLE CAN RESULT IN FINANCIAL LOSS TO FARMER

Wheat stubble has been burned from the field shown at left. You will note the large quantity of water standing in the field unable to rapidly penetrate the compacted soil. Big contrast, the photo at right, made the same day, shows J. S. Hale of Floyd County examining wheat stubble plowed into the soil on his farm. Hale received the same amount of rain on his land that fell on the tract shown at left. The farms are located about 2 miles part. It can readily be seen that on his farm all the rain water soaked into the soil where it can be used to produce another crop. Saving wheat stubble also aids in preventing wind erosion. Hale offers this one precautionary suggestion however — "When stubble is plowed into the soil, nitrogen is tied up in the process of decomposition; consequently, crop yields the first year are likely to be off unless additional nitrogen is supplied. There's just no doubt about it, a man's throwing away a valuable asset when he burns his wheat stubble." Hale is a County Committeeman for the High Plains Underground Water Conservation District.

THE Cross SECTION

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

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ALLAN H. WHITE, JR.
Editor

HIGH PLAINS IRR

The program of research, study, publication, and distribution of information relating to the development and use of ground water in the Southern High Plains of Texas is designed to aid in greater profit from the water resource and in turn provide a better way of life for the people of the region; it is not designed to more accurately predict the day of doom.

The chart entitled "Precipitation and Development of Irrigation", includes the territory within Subdivision No. 1, of the Underground Water Reservoir designation in the Ogallala Formation south of the Canadian River in Texas. (See insert map in upper left hand corner of the chart) The region includes all or parts of 21 counties and embraces about 10,650 square miles or 6,818,000 acres. Of this acreage about 60 percent or 4,000,000 acres are irrigated with water pumped from wells.

So far as records are available, the first large-scale, commercial irrigation well in the region was installed in the fall or winter of 1910. Because of numerous factors, some of which were low efficiency of the slow-speed pumps, high cost of oil engines and fuel, and introduction of the tractor which permitted large-scale dry farming, irrigation did not develop rapidly until during the severe drought of the late 1930's.

The left-hand column in the chart shows annual cumulative number of irrigation wells. A study of the column shows that about 45,200 wells were developed during the 52-year period of record; of that total, 27,700, or 61 percent, wells drilled during the 10-year period 1953-62. Few of the wells that were drilled in recent years are used to irrigate new lands; some of them are to supplement previously existing wells, chiefly to water the same acres but to do it quicker. Many, inevitably, were drilled to offset declining yields, especially where water-bearings sands are very thin.

The second column shows acres irrigated. Most of the irrigable land within the bounds of the subdivision where groundwater occurs is now irrigated; hence, it seems unlikely that appreciable new land will come under irrigation in the region. The decrease in 1961 and 1962 was in response to grain sorghum acreage reduction under Government regulations; it was not because irrigation supplies had failed As a matter of interest, an intensive study in 1961 failed to find a single farm throughout the entire 13 counties within the High Plains Underground Water Conservation District that had reverted entirely to dry-land farming because of a depleted water supply.

The third column shows annual withdrawls of ground water, in acre-feet. An acre-foot is the quantity required to cover 1 acre to a depth of 1 foot and equals 325,851 gallons. Pumpage was negligible until the 30's, and because of excessive rain in 1941 (the heaviest on record for the region) withdrawals during both 1941 and 1942 were nil. Calculations indicate that total pumpage since 1910 has been about 60,000,000 acre-feet, enough water to cover the subdivision to a depth of 8.8 feet. Again, it is interesting to note that more than 75 percent of all pumpage was during the 10-year period 1953-62.

Precipitation records compiled by the U. S. Weather Bureau are shown in the fourth column.

Below the precipitation column is a graph depicting the time and amount of ground-water depletion. The rate of depletion corresponds to the increased use of water; however, the total pumpage does not indicate the amount of depletion. Some of the water pumped returns to the groundwater reservoir by deep penetration below the root zone of plants. The U. S. Soil Conservation Service has indicated that in some areas at least 30 percent of the water pumped returns to the underground reservoir.

What does all this information mean if we are not going to run out of water in the next three or four decades? The question that has been asked time and time again is: At the present rate of pumping, how long will the supply last? That is merely a theoretical question and can have only a theoretical answer.

It is a foregone conclusion that pumpage cannot be continued at the present rate until the entire supply is exhausted. As the water table declines, the saturated section will become thinner and thinner, the yields of individual wells will decrease, and the quantity of water pumped per acre

WELL DRILLING STATISTICS FOR MAY

During the month of May, 223 new wells were drilled within the High Plains Water District; 30 replacement wells were drilled; and 19 wells were drilled that were either dry or nonproductive for some other reason. The County Committees issued 222 new drilling permits.

Listed below by counties are permits issued and wells completed for May.

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Dry Holes Drilled
Armstrong	0	0	0	1
Bailey	20	1	0	0
Castro	17	22	6	0
Cochran	18	16	0	4
Deaf Smith	35	12	2	1
Floyd	37	21	5	2
Hockley	25	21	1	3
Lamb	24	36	11	0
Lubbock	19	64	3	6
Lynn	0	9	0	0
Parmer	19	14	2	1
Potter	1	2	0	0
Randall	7	5	0	1
TOTAL	222	223	30	19

IGATION ------- PAST, PRESENT, FUTURE

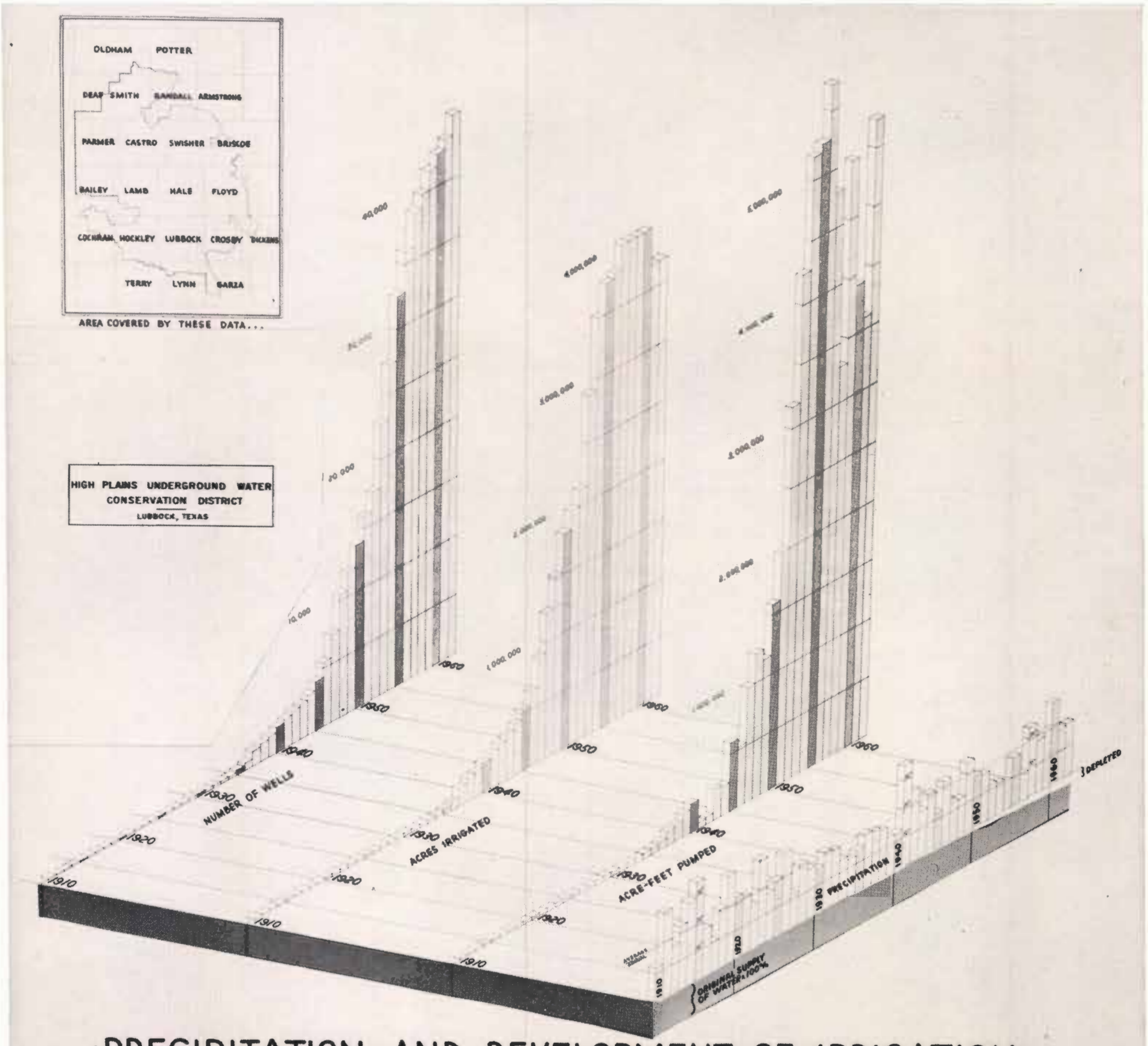
BY W. L. BROADHURST

will become less and less; as a result the water table will decline at a slower rate.

If we disregard economic factors and think only in terms of physical limitations, it seems logical that large-scale pumpage throughout much of the region, but somewhat less than at present, can be maintained for a half century or so, after which decreased rates of pumping may continue for generations.

Unquestionably, irrigation practices will change with time and a favorable economy can be sustained if we continue improving plant species and operational techniques. We should have no delusions about the fact that we are depleting our ground-water supply. However, the water creates wealth only when it is pumped to the surface and put to beneficial use.

The exceedingly heavy rainfall and hail that much of the Southern High Plains experienced during May and June of this year played havoc with thousands of acres, yes perhaps more than a million acres, of growing crops. It has dealt an economic blow to the region. Nevertheless, many playa lakes contain more water than at any time in recorded history. When the lakes are full recharge to the underground reservoir is substantial. In the long run, the addition to our ground-water supply will offset, to some degree this years loss. The full extent of the recharge will not be known until water-level measurements are made in the thousands of observation wells in January 1964.



PRECIPITATION AND DEVELOPMENT OF IRRIGATION

RUSSELL BEAN REPRESENTS LUBBOCK AND LYNN COUNTIES ON DISTRICT BOARD

Russell Bean is one of the two most recently elected members on the Board of Directors of the High Plains Underground Water Conservation District. He represents Lubbock and Lynn Counties on the Board.

Mr. Bean is a member of a well-known pioneer High Plains' family. His mother and father met during the early days of the region's development, after having moved here with their families. In 1881, Russell's mother, formerly Nora Hunt, moved to Estacado, a community in northeastern Lubbock County, from an Indian reservation in Oklahoma. Her father was a Quaker doctor. During 1893, George R. Bean, Russell's father, came to the High Plains. He was a rancher and school teacher. Later, in 1901, he set up a law practice in Lubbock. For many years, until his death in 1962, he was one of the city's most prominent business and civic leaders. Among other things, he served on the Lubbock School Board. One of the present day elementary schools in the sprawling system is named for him.

Mr. Russell Bean was born in Lubbock on August 19, 1912. He finished Lubbock High School in 1929 and graduated from Texas Technological College in 1933. Always interested in agriculture, he farmed during his college years, and majored in horticulture.

With the area, and the nation, in the grips of depression, he decided to see some of the rest of the world. He ended up in Haiti, an island in the West Indies. working for an American company that produced sisal. He liked it so well that he decided to stay on permanently, and remained until 1948. Sisal is used in making rope. When World War II commenced, the demand for sisal was so great that the company Mr. Bean worked for acquired additional land and expanded its operation. Mr. Bean became superintendent of a new plantation and was in charge of the operation. He was responsible for growing and processing as much as 26,000 acres of sisal.

During his years in Haiti, Mr. Bean acquired farm land in several counties in the Texas High Plains. In 1934, his brother Robert, who is at this time a District Judge in Lubbock, had an irrigation well drilled on one of the family farms. This was the Bean's earliest encounter with irrigation. Then in 1947, Russell drilled wells and commenced irrigating all his cropland.

Mr. Bean is married to the former Pauline Yeager Edwards. They have three children; David 25, is married and in his last year at the Southwestern Medical School in Dallas; Byron, 22, is a senior student at Texas Technological College; and Jane, 18, who last month completed the curriculum at Lubbock High School, plans to enter Texas Tech this fall. The Bean's reside at 2806 21st Street in Lubbock.

Even though Mr. Bean's farming interests keep him busy, he still finds time to serve on a multitude of committees and boards. He is on the board of directors of the Lubbock Community Planning Council and the United Fund; a member of the board of directors of the Farmer's Co-op Compress in Lubbock; Secretary of the Frenship Co-op Association; and President of the Lubbock County Historical Committee. He is also a member of the First Methodist Church in Lubbock.

Mr. Bean was elected last January by residents of Lubbock and Lynn Counties to serve on the five-man Board of Directors of the Water District for a two-year term of office. In re-organizing the Board for 1963, Mr. Bean was elected to serve as Secretary-Treasurer.

The people of Lubbock and Lynn Counties are fortunate indeed to be represented on the Board of Directors of the High Plains Underground Water Conservation District by a man with the education and experience possessed by Russell Bean.

RUSSELL BEAN

THE CROSS SECTION
1628 - 15th Street
Lubbock, Texas
Dear Sirs:

I do not now receive THE CROSS SECTION but would like to have it sent to me each month, free of charge, at the address given below.

Name _____

Street Address _____

City and State _____

(Please cut out and mail to our address)

CONSERVATION CONVERSATION

The "Water Newsletter" reports that, "Concentrating rainfall with plastic covers has enabled U. S. soil scientists to grow 50 bushels of corn per acre in a drought year, *without irrigation*, in south-central North Dakota. The technique involves covering ridges of soil between corn rows with plastic film, and although it is too *costly* now for farmers, it may lead to new moisture-conserving practices that can be put to general use. Rain falling on the plastic drained off and was concentrated on the 10 percent of the soil that was bare. As a consequence, a 1/4-inch rain actually became 2-1/2 inches of water along the line of growing plants."

* * * * *

In a paper prepared by W. L. "Bill" Broadhurst, Chief Hydrologist for the High Plains Water District, and delivered at the first annual meeting of the West Texas Water Conference, an interesting proposal to alleviate future water shortages was presented. Broadhurst suggested, ". . . When atomic energy, or any other form of energy can be developed at nominal cost, why not extract hydrogen from the sea, transport it inland through pipes to strategic points, extract oxygen from the air, combine the gases and form water? This will seem absurd to some today. I assume it would have been absurd 100 years ago to expect that Plant X in the sandhills in Lamb County would today be developing and delivering energy to heat our homes in winter, cool them in summer, light them at night, and do a thousand and one other things for our comfort and enjoyment. What would such a plant use for power? There was no coal or falling water within hundreds of miles. Yet today Plant X is a reality.

"Through research, man need not be stymied by a depleting groundwater supply."

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas

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THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 2 **"THERE IS NO SUBSTITUTE FOR WATER"** *July 1963*

Texas Water Commission Attorney Discusses Rights To Playa Lake Water

Editor's Note — The question has arisen from time to time concerning the ownership and rights of individuals in water from "playa lakes" which dot the Plains region.

The question has been briefed by the legal staff of the Texas Water Commission. Even though no court case was found dealing specifically with "playa lakes" there were those which applied to similar lakes and ponds and which indicate that the courts would probably hold that "playa lake" water is private property subject to neither riparian nor appropriative statutes.

For the edification of our readers we reproduce below a memorandum written by Charles Burton, a legal investigator with the Texas Water Commission to Otha F. Dent, member of the three-man Commission. Subject of the memorandum — Rights in the water of "playa lakes."

By "playa lakes" is meant those intermittent lakes found in the great Plains Region of the State, created by the interior drainage of diffused surface waters into natural depressions in the earth. The beds of these lakes are privately owned and the waters collected are dissipated rapidly through seepage and evaporation.

The issues determinative of the rights to "playa lakes" are: (1) Their characterization as either diffused surface waters or lake waters. (2) The nature of the right to diffused surface waters or lake waters. (3) The applicability of the appropriation statutes to diffused surface waters and lake waters.

Apparently, the waters of "playa lakes" have not been the subject of litigation in this state, as no Texas court decision involving these lakes has been found. The closest case in terms of the similarity of the waters involved is Turner v. Big Lake Oil Co., 128 Tex. 155, 96 S. W. 2d 221 (1936). The case involved the pollution of several livestock watering holes situated in Garrison Draw in Reagan County. The evidence was, that these watering holes, or at least one of them, were three or four hundred feet long and about fifty steps wide. The plaintiff's petition stated that the watering holes furnished a continuous supply of water for livestock. See the opinion of the El Paso Court of Civil Appeals, 62 S. W. 2d 491, 492. Garrison Draw appeared to the El Paso Court, "to be from one-fourth to one-half mile in width . . . just a wide valley; a typical West Texas Draw." Since Garrison Draw was not a watercourse within the meaning of the pollution statute (then Vernon's Ann. P. C. art. 698) the plaintiff could show a violation of article 698 only if the watering holes came within the provisions of the article. On this point the Court of Civil Appeals said:

Upon a reading of the entire act, including its caption, we think that, so far as concerns a "natural body of water of this State," it refers to waters owned by the state, and not to natural bodies of water privately owned, as are the watering holes in the draw upon Mrs. Turner's Land. We think the phrase "of this State" is used in the sense of ownership. Throughout the body of the act it refers to "Natural body of water of this State," and we think it refers to waters owned by the state in trust (see article 7467, R. S.), and not to waters privately owned.

Perhaps taking a course suggested by the Court of Civil Appeals in its reference to article 7467, the Plaintiffs urged on appeal to the Supreme Court that if the waters of Garrison Draw were not a stream, protected from pollution by article 698, they were nevertheless public waters under article 7467, to which the anti-pollution statutes would apply. After quoting with emphasis, the portion of article 7467 which provides, ". . .and the storm, flood or rain waters of every river or natural stream, canyon, ravine, depression or watershed, within the State of Texas, are hereby declared to be the property of the State . . .", the Supreme Court replied, that while article 7467 was capable of the construction contended for if it alone was looked to for its meaning,

(Continued On Page 4)

Government Appeals Water Depletion Case Decision To New Orleans Court

Attorneys for the High Plains Underground Water Conservation District have been advised that the water depletion case, styled Marvin Shurbet Et Ux vs. United States of America, was appealed by the government on July 22, 1963.

The appeal is from a judgment rendered in May 1963 by Judge Joseph B. Dooley of the U. S. District Court for the Northern District of Texas, sustaining Shurbet's claim for a federal income tax refund. The case will now go before the 5th Circuit Court of Appeals in New Orleans, Louisiana.

The claim for refund is based on a depletion deduction for ground water depleted while irrigating agricultural crops.

The suit is a test case, and is sponsored by the High Plains Water District in an effort to obtain a federal income-tax deduction for all owners of ground water in the southern High Plains of Texas who can show a cost in ground water that is depleted in the production of income.

There is no indication at this time when the case will be heard by the Court in New Orleans.

"High Plains Irrigation Survey" Published By Extension Service

The 1963 edition of the "High Plains Irrigation Survey" has been released by the Texas Agricultural Extension Service.

David W. Sherrill of Lubbock, Irrigation Specialist for the 42-county High Plains area, compiled the statistical data contained in the survey using estimates supplied by the Agricultural Agent in each county.

The 42-county area covered in the survey is roughly from the Oklahoma panhandle southward to the Midland-Odessa area and from the Texas-New Mexico line eastward to the caprock.

According to the survey, in June 1963, there were 51,807 irrigation wells being used in the area to water 5,140,406 acres of cropland. There were 9,923 miles of underground pipe used to convey water from wells to crops.

The number of wells increased by 1841 over the total number indicated one year ago. The number of acres irrigated is greater by 166,370 acres than those irrigated in 1962. Most of these additional acres are in counties outside the High Plains Water District.

According to the survey, 694 miles of underground pipe was installed in the area during the period from June 1962 to June 1963.

A table is shown below which reveals statistics from the survey for the 13 counties that comprise the High Plains Water District.

COUNTY	Irrigation Wells 1962	Irrigation Wells 1963	Total Acres Irrigated 1962	Total Acres Irrigated 1963	Miles Of Underground Pipe 1962	Miles Of Underground Pipe 1963	ACRES IRRIGATED: Cotton 1962	Cotton 1963	Grain Sorghum 1962	Grain Sorghum 1963	Wheat 1962	Wheat 1963	Vegetables 1962	Vegetables 1963	Others 1962	Others 1963
Armstrong	166	166	20,312	23,410	35	40	512	650	12,300	14,160	6,000	7,000			1,500	1,600
Bailey	1,710	1,800	165,000	165,000	300	330	70,000	69,000	70,000	55,000	9,000	6,000	1,870	520	11,410	16,200
Castro	2,800	2,950	408,000	410,000	530	550	59,283	55,000	150,000	175,200	60,000	80,289	7,050	5,600	38,100	41,077
Cochran	1,200	1,250	105,000	105,000	280	320	65,000	65,000	28,942	25,000	3,000	3,000	58	8	8,000	7,840
Deaf Smith	2,300	2,300	365,000	350,455	450	450	11,187	11,187	96,041	86,041	76,638	76,638	17,500	15,500	139,089	57,989
Floyd	2,819	3,000	305,500	305,500	466	516	87,184	77,411	76,613	111,980	42,000	45,067	825	1,025	17,535	20,235
Hockley	5,000	5,150	250,000	250,000	575	600	174,783	160,000	53.778	50,000	400	300	325	200	7,365	7,900
Lamb	5,390	5,470	360,000	360,000	1,140	1,190	155,000	149,000	108,000	106,000	4,000	4,000	375	425	25,300	30.320
Lubbock	5,570	5,811	330,000	330,000	1,445	1,535	200,000	200,000	106,000	106,385	1,500	1,000	1,100	1,015	21,350	20,700
Lynn	2,065	2,100	85,000	85,000	150	150	85,000	85,000	3,000	3,000			15		1,985	475
Parmer	2,475	2,625	417,500	422,500	780	844	51,686	49,790	170,000	230,425	92,500	82,000	1,890	1,940	35,000	31,821
Potter	34	36	13,250	13,250	15	18	40	20	6,500	6,500	5,500	6,500			580	580
Randall	780	795	85,000	85,200	95	98	1,600	2,100	51,000	55,000	25,000	22,000			6,500	7,100
TOTALS	32,309	33,453	2,909,562*	2,905,315*	6,261	6,641	961,275	924,158	932,174	1,024,691	325,538	333,794	31,008	26,233	313,714	243,837

*Difference in acres irrigated and total acres of various crops irrigated accounted for by soil bank and diverted acres

THE Cross SECTION

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ALLAN H. WHITE, JR.
Editor

TOW-MOVE OR NOT

A new wrinkle has been introduced into the sprinkler industry — at least, it's new in this area. The new wrinkle —a Tow-Move coupling which enables an irrigator to move an entire lateral line without uncoupling the lengths of pipe once they are put together.

The coupling is really quite simple —it merely serves to hold two lengths of sprinkler pipe together. The bottom of the coupling is built in the shape of a skid which enables the pipe to be pulled along the ground without damage. The coupling is built with a pin in the center of the skid to give a certain amount of lateral movement at each joint.

J. T. Shofner who lives in Muleshoe, in Bailey County, has a tow-move sprinkler system in use on an 80-acre tract of land which he owns five miles west of town.

J. T. Shofner, Bailey county farmer, is shown above beside a strong 6-inch well used to pump ground water for irrigating an 80-acre tract of land on which he has planted alfalfa and grass.

The tract has been entirely in native grass until recently when Shofner planted about 15 acres of alfalfa and 20 acres of Midland bermuda grass.

A strong 6-inch well was drilled in the center of the rectangular farm which is one-quarter mile wide and one-half mile long. A 6-inch cement asbestos main line was laid underground across the center of the place. It extended to within 75 feet of either side making a total length of 1150 feet of main line. A hydrant was placed every 150 feet along the length of the pipe line. With the use of a 50-foot swing line, 50-foot lateral line settings can be made across the farm.

Up to this point, Shofner's system is standard. However ,instead of ordinary hand-move lateral lines, he uses the new tow-move laterals. He employs two one-quarter mile long lines in his system.

When he commences to irrigate the farm, the laterals are laid out in the usual manner, one on either end of the main line. The well is started and water is applied to two strips of land, each being 50-feet wide and one-quarter mile long. When the strips are

When Shofner changes the setting of his lateral lines, first the water supply is cut off, the line disconnected from the main line and allowed to drain. Then the lateral is attached to the tow-bar of his tractor for movement to the next setting.

TOW-MOVE? --- THAT IS THE QUESTION

By ALLAN H. WHITE, Jr.

Shofner pointed out that one of the more important steps to remember in moving the tow-move lateral lines is to allow complete drainage of water from the line before movement is commenced.Damage to the couplings may result unless this basic rule is followed. Each 30-foot length of lateral pipe has its own automatic draining mechanism to facilitate this phase.

When the lateral line is in position for the next setting all that remains is attaching it to the main line and opening the valve which allows water to flow through to the sprinkler outlets. Shofner can change settings of his two one-quarter-mile long laterals in about 30-minutes.

watered sufficiently, Shofner drives his tractor to the hydrant end of one lateral and turns off the valve causing the well's entire output to flow through the remaining lateral line. After about five to ten minutes, when all the water drains from the lateral line which has been shut down, he attaches the end of the pipe line to the tow-bar on his tractor and pulls the pipeline's entire length across the main line to the other end of the field. Then he puts in an end-plug and drives back to the main line hydrant, hooks the other end of the lateral line to the main line and opens the valve. This procedure is then duplicated for the other lateral line. Shofner can shut down, drain and change the settings of both laterals in 30 minutes.

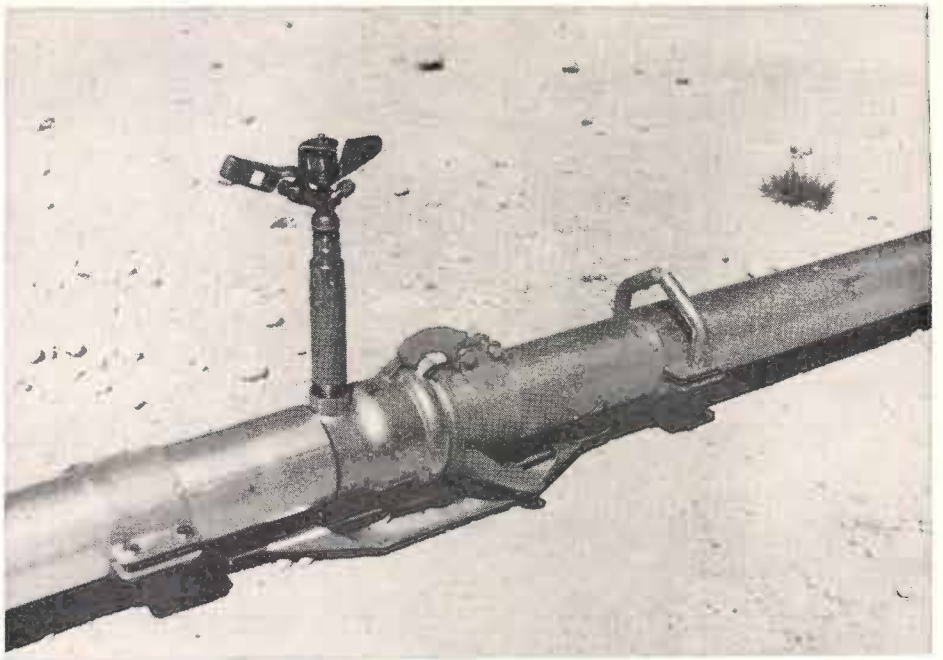
Each change in setting means moving the total length of lateral line across the main line to the opposite end of the tract to a new position 50 feet farther along the main line. The tractor is angled slightly away from the wetted area to accomplish each move. It naturally takes some practice, but in a short period of time the tractor operator learns the proper path to travel in order to position the line for the next setting.

Shofner's tow-move system cost a total of $5200. It is reported that the tow-move couplers can be added to any standard sprinkler system. The cost for installing couplers on 4-inch standard sprinkler line in 30-foot lengths is $585 for a quarter-mile long line.

Shofner stated that he was completely sold on the tow-move system and would especially recommend it to anyone who is irrigating pastureland. He has not had experience with the system on row crops.

According to Shofner, there are a few things that an individual should insist upon when going to the tow-move system. First, you should have your main line exactly in the center of the tract to be watered. The reason is obvious — to alleviate the necessity of adding or subtracting sprinkler pipe during each move. Shofner also recommends a minimum discharge pressure of 60 p. s. i. at the well to insure that the sprinkler pipe gaskets seat properly to maintain a leak-proof operation.

In the past, many irrigators have steered clear of sprinkler systems because of the additional labor involved in operating a system as compared to down-the-row surface method. With the tow-move coupler now on the scene, some of the fuel used in arguing against sprinklers may be eliminated.



The tow-move coupler is relatively simple and serves to hold two ordinary lengths of sprinkler pipe together. To facilitate its movement along the surface of the land, the bottom of the coupler is built in the form of a skid. The coupler has a pin in the center of the skid to allow slight lateral movement.

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Please Close Those Abandoned Wells!

Lake Water Rights—

(Continued from Page 1)

that it must be interpreted in the light of the Constitution and of the common law and Mexican Civil law under which lands have been granted in this State. The Court stating that:

Under both the common law and the Mexican civil law, the owners of the soil on which rains may fall *and surface waters gather* are the proprietors of the water so long as it remains on their land, and *prior to its passage into a natural water course to which riparian rights may attach.* (Emphasis added.)

The Court expressed no opinion as to the effect of article 7467 on lands patented after its enactment. However, it is believed that the courts will still hold that the owner of the land has the absolute right to capture and use all diffused surface waters which appear upon his land. See *Proceedings on Water Law Conference,* University of Texas, School of Law, 1955, "Rights in Diffused Surface Waters in Texas", by Victor Bouldin, page 9.

Several Texas cases have discussed the right of abutting landowners and the public in lake waters. None of these cases involved "playa lakes" or lakes with similar characteristics.

In Humphreys—Mexia Co., v. Arseneaux, 116 Tex. 603, 297 S. W. 225 (1927) the Court discussed rights attaching to small lakes or ponds of water remaining in the Navasota River following periods of high or flood flow. It appears that survey lines did not cross the river in this area. In upholding the right of a riparian to use such waters on either riparian or non-riparian land against a statutory appropriator, the court stated:

. . . All water when it comes, in the usual course of its migration, to rest permanently in a basin made by nature for that purpose, although it may have been flood water at one time, ceases to be flood water, and becomes a lake or pond. Water of this character comes within the usual physiographic definition of lakes and ponds, regardless of its origin.

It is an elementary rule that riparian rights attach to all natural lakes and ponds, regardless of origin. (Emphasis added.)

In Lakeside Irrigation Co. v. Kirby, 166 S. W. 715 (Texas. Civ. App. 1917, error ref'd.) the right to use the waters of Eagle Lake, a natural lake with a normal area of 1,250 acres or more, entirely owned by private citizens, was determined by application of the riparian doctrine. The Court stating:

Where it is shown, as in this case, that a person owns a part of the bed of a natural lake, which is very valuable with the water upon it and worthless without it, we think such person has the right to have the water of the same maintained at its natural level, unless that level is disturbed by another riparian owner for riparian uses recognized by our decisions, and that another owner of part of the bed of the lake cannot be permitted to divert the water to irrigate nonriparian lands, when it is shown that such diversion injuriously affects the rights of the owner of the other part of the lake. The contention that the water should be divided between the owners of the land covered by the lake in proportion to their ownership of such land cannot be sustained. To do so would be to permit the diversion of the water to non-riparian purposes to the injury of the other riparian owner. Appellee is entitled to the enjoyment and use of his land with the opportunities, advantages, and benefits thereto accruing by reason of a portion thereof being covered by a natural lake, subject only to riparian rights of others, and even if it was sought to irrigate riparian lands therefrom, which is not the above case, the use for such purpose would have to be a reasonable one.

The contention was made in Welder et al. v. State 196 S. W. 868 (Tex. Civ. App. 1917, error ref'd) that the bed of Green Lake in Calhoun County was owned by the abutting landowners and not by the State. This lake covered about 5,000 acres and was filled mainly by the overflow of the Guadalupe River. In holding for the State, the court approved two rules as being reasonable: (1) That the common law doctrine of extending the call for a non-navigable stream to the center thereof does not apply to calls for a lake as a boundry. (2) That lakes large enough to be useful to the public for boating and fishing should be held to be public and not private property.

City of Weslaco v. Turner, 237 S. W. 2d 635 (Tex. Civ. App. 1951, error ref'd. n.r.e.) was another case under the anti-pollution statutes. The waters involved were those of Llano Grande Lake, which the Court described as a part of a series of resacas or waterholes situated in an abandoned channel of the Rio Grande. A dam had been erected across the lower end of the channel to create the lake. The lake was filled by the overflow of the Rio Grande and by drainage waters from irrigation, municipal and industrial use. The Court recognized that the question as to whether the Lake was private or public was controlled by the laws of Mexico and Spain in force at the time the land grants were made, and found that:

Since the waters of Llano Grande Lake consisted of a series of water holes at the time of the grant made in 1790, they could not have had any public significance at that time for the purpose of navigation, and since they were situated wholly on the land granted (in an abandoned river bed) they were part of the land conveyed and as such passed from the Spanish Crown to the grantee.

Thus Article 698b Tex. Pen. Code. Anno. (Vernon, 1961) and Article 4444 Tex. Rev. Civ. Stat. Anno. (Vernon,1960) which prohibit the pollution of public bodies of water could not be relied upon to enjoin the pollution of Llano Grande Lake.

Once the waters of "playa lakes" have been characterized as either surface water owned by the proprietor of the land, which the Turner case, supra, indicates they are, or as lake waters, to which riparian rights attach, the next inquiry is whether these waters are subject to appropriation under the appropriation statutes.

As the Supreme Court points out in Turner et al. v. Big Lake Oil Co., supra, the Legislature could not, by the Irrigation Act of 1895, and subsequent legislation, make diffused surface waters on lands granted prior to such legislation subject to appropriation. And as mentioned prior, these waters will probably be held to be owned by the landowner even as to grants made subsequent to the appropriation statutes.

The Court in Lakeside Irrigation Co. v. Kirby, supra, expresses the opinion that the waters of natural lakes were not included in the waters made public and subject to appropriation by the Irrigation Act of 1895. If this view is correct then the waters of lakes were first designated as waters owned by the State in 1913. Following the reasoning of the Turner case above, only the waters of lakes upon lands granted after 1913 would be subject to appropriation without recognition of riparian rights. As to the waters of natural lakes upon lands granted prior to 1913, presumably the rule would be that these waters might only be appropriated subject to the rights of riparian owners to use the waters for riparian and non-riparian purposes, and subject to the right of the riparian owner to have the lake maintained at its normal level where this would be of value to the riparian owner. Humphreys—Mexia Co. v. Arseneaux, supra; Lakeside Irrigation Co. v. Kirby, supra. The case of Biggs et al. v. Lee, 147 S. W. 709 (Tex. Civ. App. 1912, error dism'd,) suggests that the riparian owner might be limited to the use of water for riparian purposes as against a statutory appropriator. However, stream waters were in issue in the case.

CONCLUSIONS

That the waters of "playa lakes" are surface waters, owned by the owners of the lands upon which they appear, to which no riparian rights attach, and to which the appropriation statutes are not applicable.

WHEN YOU MOVE—

Please notify the High Plains Underground Water Conservation District, Lubbock, Texas on Post Office Form 22S obtainable from your local postmaster, giving old as well as new address, to insure no interruption in the delivery of "The Cross Section."

WELL DRILLING STATISTICS FOR JUNE

During the month of June, 169 new wells were drilled within the High Plains Water District; 24 replacement wells were drilled; and 12 wells were drilled that were either dry or non-productive for some other reason. The County Committees issued 132 new drilling permits.

Listed below by counties are permits issued and wells completed for June.

COUNTY	PERMITS ISSUED	NEW WELLS DRILLED	REPLACEMENT WELLS DRILLED	DRY HOLES DRILLED
Armstrong	0	0	0	0
Bailey	23	13	1	2
Castro	21	5	1	0
Cochran	16	5	0	0
Deaf Smith	11	15	5	2
Floyd	14	6	1	1
Hockley	8	56	2	4
Lamb	13	13	8	0
Lubbock	6	22	0	0
Lynn	0	5	0	0
Parmer	13	19	6	0
Potter	0	0	0	0
Randall	7	10	0	3
TOTALS	132	169	24	12

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas

Second Class Permit

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 3 **"THERE IS NO SUBSTITUTE FOR WATER"** *August 1963*

"Tailwater" Retained When Parmer County Banker Installs Concrete Sump

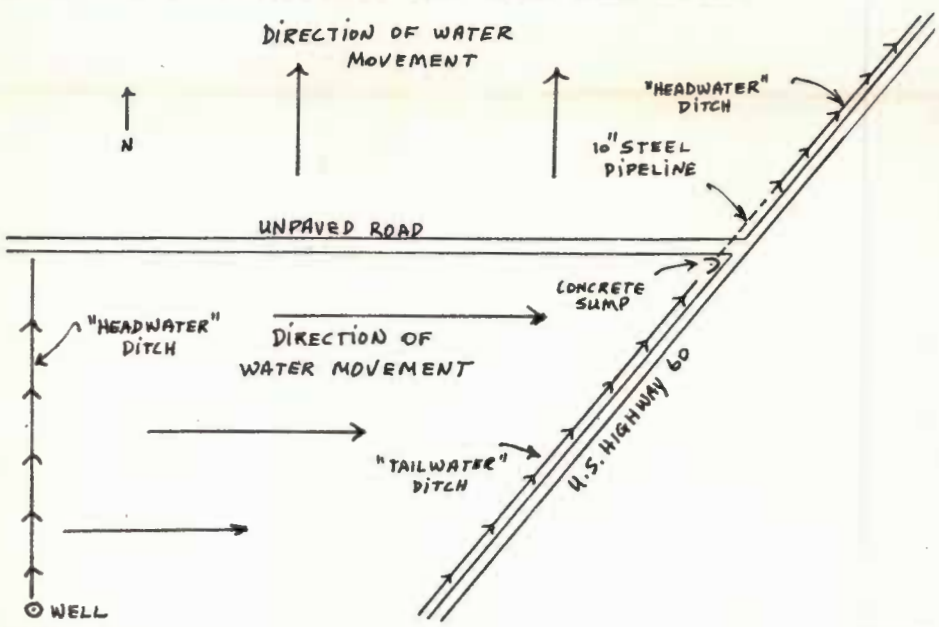
A water conservation innovation has recently been added to the G. D. Anderson farm located about four miles southwest of Friona in Parmer County.

At this location, Anderson, a Farwell banker, has approximately 200 acres of land which is separated by an unpaved county road from another tract of land which he owns. Irrigation "tailwater" from the 200-acre tract previously emptied into the road bar-ditch that parallels Highway 60. In the past, this "tailwater" was not beneficially used.

Now however, Anderson's innovation makes it possible to transport the "tailwater" through an open ditch cut along the row ends on the 200-acre tract to a small concrete sump at the low corner of the farm. The "tailwater" then flows by gravity beneath the unpaved road through a 10-inch steel pipeline to his other tract of land. It is now beneficially used on this land for irrigating crops.

Anderson can also divert water from the bar-ditch along the unpaved road into his concrete sump.

The Anderson farm is operated by Ralph Shelton of Friona, a Parmer County Committeeman for the High Plains Water District.



Above is shown a sketch of the G. D. Anderson farm near Friona. It indicates the relative location of the concrete sump installed on the farm to salvage irrigation "tailwater" that in the past was not beneficially used. Note in the picture at left the portable dam installed in the road bar-ditch to divert "tailwater" into the sump. Picture at right shows "tailwater" in the sump as it enters the pipeline that conveys it under the road and into an irrigation "headwater" ditch from where it is syphoned onto a milo field.

White Resigns District Staff Position

Allan White, Director of Education for the Water District, and long-time editor of "THE CROSS SECTION" has submitted his resignation to the Board of Directors.

White will leave the District's staff after having been employed for almost 10 years. His resignation will become effective on September 15th.

White resigns to accept a position with the Federal Land Bank of Texas. He and his family will continue to reside in Lubbock.

ALLAN WHITE

Chemical Used To Reduce Evaporation

Hexadecanol, a commercial alcohol product, has been used in limited experiments to reduce evaporation of moisture from soil by 43 percent.

This finding by scientists of the U. S. Department of Agriculture and the Colorado Agricultural Experiment Station may point the way toward the solution of one of agriculture's most challenging problems — how to reduce loss of soil moisture from evaporation.

In the Colorado tests, hexadecanol was applied to the soil at rates of 660, 3,320 and 16,600 pounds per acre. It was mixed with the surface quarter-inch of soil; mixed uniformly with all of the soil in the container; layered 1 inch below the soil surface and layered 3 inches below the soil surface.

Water was added to saturate the treated soil and the amount of water lost by evaporation was recorded for 10 days. This cycle was continued for 14 months. The greatest evaporation reduction, 43 percent, resulted from the heaviest rate of application in the surface quarter-inch of soil.

Hexadecanol mixed in the surface soil restricts evaporation by drying the top layer of soil, the scientists said. The dried surface then acts as a barrier to prevent the movement of moisture from soil to air.

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Committee meets on the first Monday of each month at 8:00 p.m., 1710 5th Ave., Canyon. Texas

R. D. NIX INSTALLS SELF-PRO

R. D. Nix of Sudan owns a 160-acre tract of land which is located about five miles southwest of Muleshoe. The tract is square in shape, the soil is sandy in texture, and the topography is unlevel and rolling. Beneath the farm, ground water is in abundance.

Nix bought this farm, with no basic crop allotments, for the purpose of producing alfalfa for a livestock program. His number one problem is how to make this less-than-perfect farm adequately produce with a minimum amount of overhead. He determined that from a long-range viewpoint, his major item of irrigation expense

The self-propelled sprinkler system moves in a straight line around a pivot point at the center of the square-shaped farm.

The lugs on each wheel play a two-fold role. First, they prevent slippage, and second, they are used in transmitting power from the water cylinder to the wheels. The wheels track in the same path each revolution of the system.

PELLED SPRINKLER SYSTEM ON FARM IN BAILEY COUNTY

By ALLAN H. WHITE, Jr.

would be labor, and in order to help reduce this item to an amount where a profit could be realized, he decided to water the land by using a self-propelled sprinkler system. According to Nix, this method of applying irrigation water should require less labor than any other he has investigated.

The self-propelled system travels continually, pivoting from a point located at the center of the tract. A wide range of water application rates can be selected by the operator.

The system consists of a 6-inch steel line extending from the pivot point at the center of the farm to the property lines which at the nearest points are 440 yards away. Standard sprinkler nozzles are spaced at appropriate intervals along the line. The pipeline is suspended about 7 1/2 feet above the land surface from steel towers located every ninety feet along the line. Each tower is mounted on two steel wheels which roll in a direction perpendicular to the pipeline.

Water flowing through the pipeline at a relatively high pressure, about 70 p.s.i., not only supplies the sprinkler nozzles with the supply needed for crop irrigation, but also furnishes the power necessary to turn the wheels on which the towers are mounted and the pipeline is suspended.

A cylinder, similar to an ordinary hydraulic cylinder, is located at each tower. Water entering the cylinders extends the pistons that in turn actuate horizontal bars which engage with lugs on the tower wheels and thus provides power for moving the system. The wheels move as the cylinder fills. The horizontal bar engages with the next set of wheels lugs as the cylinder empties. The cylinder empties onto the land surface through a relief valve.

In order that the pipeline move in a straight line around the center pivot, the towers farthest from the center of the farm must move at a faster rate of speed than those nearer the pivot point. To accomplish this straight line movement, each succeeding tower cylinder along the pipeline starting at the pivot, fills at a somewhat more rapid rate than does the one preceeding. The more rapidly the cylinder fills ,the more rapidly the tower moves. A manual adjustment on the last tower cylinder automatically sets all the other cylinders at the proper filling rate. Sprinkler nozzle sizes are also graduated from very small near the pivot point to large at the end in order to apply a uniform quantity of water over the farm.

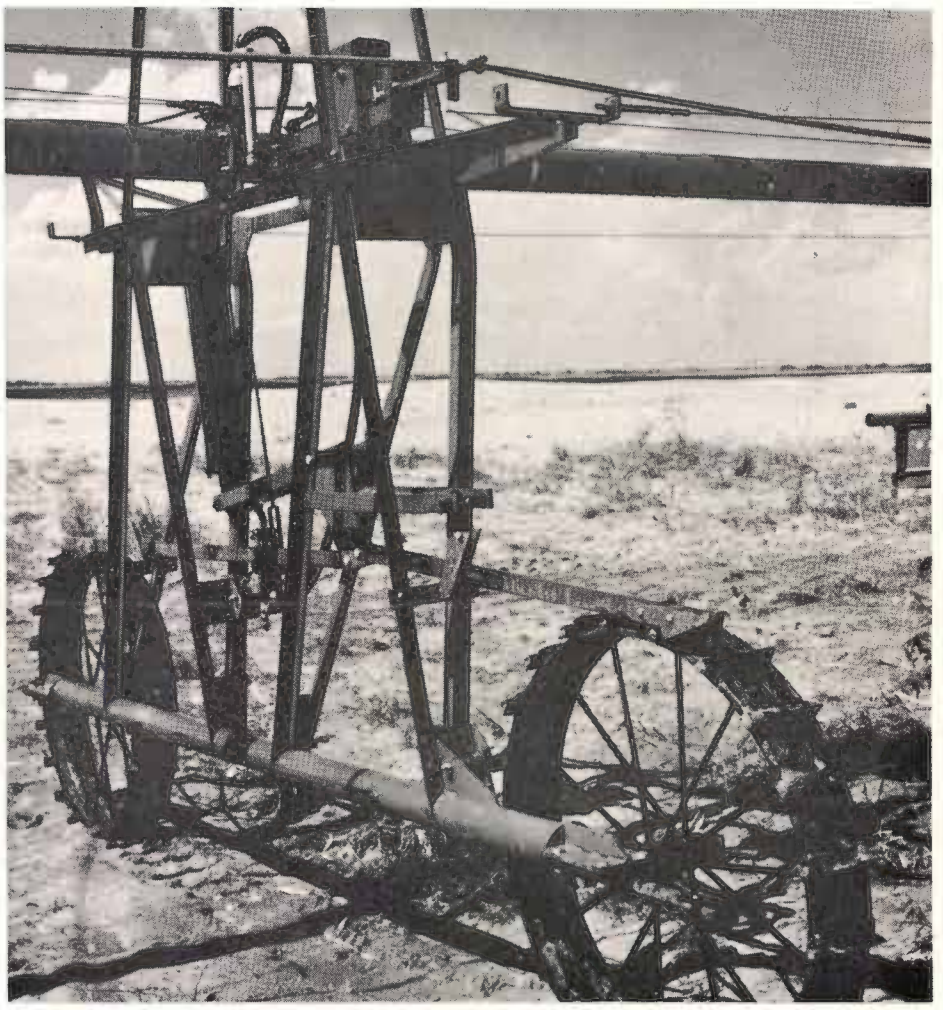
With each complete circle of the farm, Nix is presently applying .9 of an inch of water to his land. This quantity of water is applied in 72 hours. His well produces about 700 g.p.m.

He can irrigate 142 acres of the 1/4 section. The remaining 18 acres are in the four corners which cannot be watered with the self-propelled sprinkler system.

As a safeguard against major damage to the pipeline, should malfunction result from one or more of the towers either lagging behind or getting ahead of the others, an electrical system is provided which automatically cuts off the pump engine at the well.

Nix believes that his $17,500 investment in the system will pay for itself in 5 years of operation.

When the cylinder fills with water a relief valve is actuated that empties it onto the soil surface, and as this occurs, the horizontal bar engages with the next set of wheel lugs.



Note manner in which the horizontal bar engages with the wheel lugs when the cylinder is emptied. It is now prepared to slowly move the tower, and thus the pipeline, as the cylinder fills with water.

The pivot is guyed from a concrete base. Nix' well, shown left of center in the photograph, produces about 700 g. p. m. at 70 p. s. i. In length the system reaches from the center of the farm to the nearest property line 440 yards away.

A Little Life Is Worth More Than A Little Time, Please Close Those Abandoned Wells!

OBSERVATION WELL PROGRAM EXPANDED DURING 1963

By W. L. BROADHURST

In August 1962, a cooperative agreement to expand the observation well program throughout the 13 counties of the Water District was signed by the Texas Water Commission and the High Plains Underground Water Conservation District.

For a period of about 25 years, measurements of depths to water in several hundred wells throughout the plains region were made annually and published in United States Geological Survey Water Supply papers, and Texas Water Commission bulletins. In October 1962, the Texas Water Commission assumed responsibility for continuation of the formerly joint program. Annual measurements have also been published in "The Cross Section."

Most of the annual water-level observations were made in wells that were concentrated in the oldest areas of ground-water irrigation. Soon after World War II, the irrigation development spread throughout much of the High Plains, but the observation-well program did not keep pace with drilling of new wells. Consequently, there were numerous large areas of irrigation pumping in which there were no recorded observations of changeing water levels.

It is recognized generally that the most accurate method of calculating changes in ground-water storage, including addition and depletion, results from the comparison of annual depth-to-water measurements that are made under similar circumstances at representative sites.

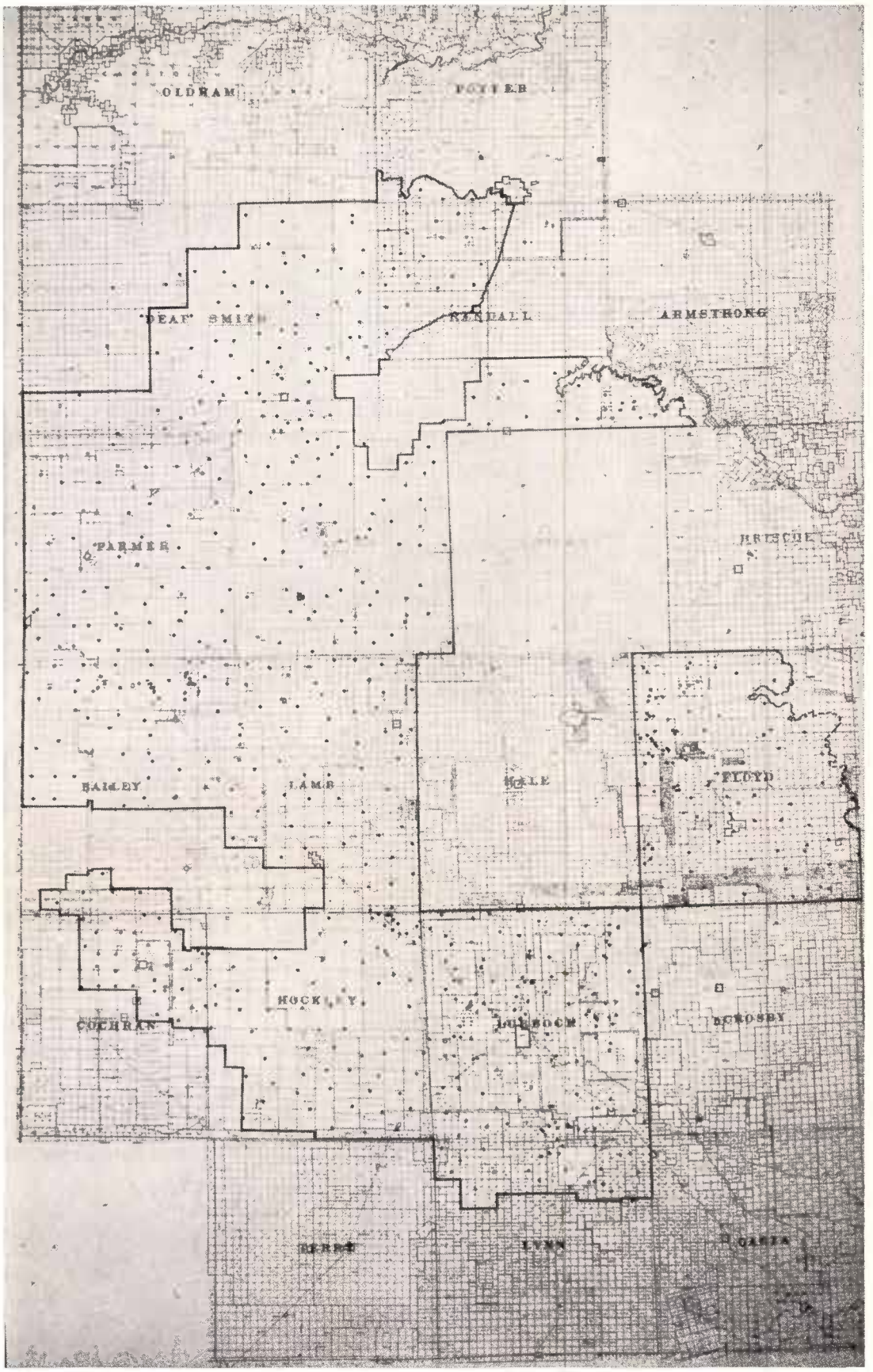
Recording of water-level measurements in wells has been compared to stubbing a checkbook. Neither record increases water in the reservoir or money in the bank; however, such information does reveal the vital balance remaining for future use.

The Water District is anxious to keep the people of the High plains posted on the annual changes in the ground-water levels, both the people who use the water directly and the people who indirectly depend on ground water to support the regional economy.

In order to more adequately cover the entire Water Conservation District, approximately 800 observation-well sites have been established. Of these wells, 210 have been added to the program during the spring and summer of 1963. Under the expanded program, there is now an average of one observation well to every 10 square miles within the District.

The field work, including accurate locations of the wells, permission of land owners and tenants to use the wells, and installation of identification numbers, has been done by Frank Rayner of the Texas Water Commission and Donald Reddell and Wayne Wyatt of the Water District.

In the future, efforts will be made to contact the owners of all wells that have been used in the past, to obtain permission to continue the annual water-level measurements and to affix identification numbers. Cooperation of the well owners is acknowledged and appreciated.



APPROXIMATE LOCATION OF OBSERVATION WELLS
Within
The High Plains Underground Water Conservation District

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas

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THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 4 "THERE IS NO SUBSTITUTE FOR WATER" *September 1963*

AT MIDLAND MEETING

GROUP DISCUSSES SALT-WATER POLLUTION

Salt-water pollution of fresh water has been a source of concern to water users of this area for some time. Recently a group of persons interested in preventing pollution met in Midland to discuss one phase of this problem.

Simply stated, the problem is this: Oil companies for some years have, in their production of oil and in their disposal of wastes, injected contaminated water into underground strata. In doing so, there is the possibility of contaminating our fresh water supply. If wells used for injection of this salt-water or "brine" are not constructed so as to protect the fresh water formations, pollution could very easily be the result.

Mr. Ed Reed, consulting hydrologist, of Midland aldressed the group of interested persons at the recent meeting in Midland on salt-water pollution of our underground water supply.

The High Plains Underground Water Conservation District is charged by the state with the responsibility of developing plans "for the control and prevention of waste of underground water, which plans shall specify in such detail as may be practicable the acts, procedure, performance and avoidance which are or may be necessary to effect such plans, including specifications therefor."

It is the feeling of the water districts of this area that wells, drilled and used by oil companies in the disposal of oil field waste and in secondary recovery operations, should be constructed by the companies in a manner insuring the protection of underground water.

In an effort to assure this protection of underground water, a set of minimum standards was drawn at the Midland meeting. These standards are concerned with the construction of wells used for subsurface injection of contaminating waters.

On September 26, this set of minimum standards was presented to the Texas Water Pollution Control Board in Austin. Members of the Board of Directors of the High Plains Water District, along with the Directors of the North Plains Water District presented testimony and data in support of the minimum standards.

If these standards are adopted as an enforceable criteria for construction of injection wells, we will have achieved another forward-step in the prevention of pollution of our water supply.

CLAUDETTE McINNIS NAMED CROSS SECTION EDITOR

Claudette McInnis, formerly of Brownwood, has been named editor of The Cross Section. she is a June graduate of Texas Technological College where she majored in journalism.

While at Tech, Miss McInnis served on the staff of the Toreador, the campus newspaper, and the La Ventana, the college year book. Also at Tech, she was a member of the Rodeo Club, Aggie Club and Block and Bridle Club. In 1959 Claudette was named "Aggie of the Month" at Tech. This was the first time for a freshman girl to receive the award for making a definite contribution to the School of Agriculture at Tech.

In 1961, Miss McInnis attended Kansas State University, where she was assistant editor of the Ag Student, an agricultural magazine for Kansas farms and agrarian type industries. Also at Kansas State, she was a member of the Plow and Pen Club, an organization to further interest in the field of agricultural journalism.

Having been a member of 4-H Club for 11 years, Miss McInnis engaged in such projects as livestock, public speaking, farmer cooperative demonstrations, food preparation and recreation. She fed and exhibited steers in such major livestock shows as Houston, Kansas City, Ft. Worth, San Antonio, and Denver.

Miss McInnis worked as news-editor of the Lamb County Leader and County-Wide News of Littlefield during her last semester at Tech. She was also a laboratory instructor in the Journalism Department at Tech.

The new editor has served on the board of directors for both the Texas and American Junior Hereford Associations. She was a member of the first board and the first secretary of the Texas Junior Hereford Association.

Problem Results From Fertilizer

By DON REDDELL

In many areas of the United States, contamination of rivers and streams by fertilizers, insecticides, and other chemicals has been the basis for much concern. Rachel Carson, in her book Silent Spring, has caused considerable controversy over the use of chemicals.

One of the interesting facts, as a result of this controversy, is that nitrogen fertilizer can pollute ground water supplies. The farmer, in his attempt to increase the yields from his farm is applying nitrogen fertilizer at an ever increasing rate. When fertilizer is added to the soil, nitrates are leached out by rain or irrigation water and are carried downward through the soil to the ground water supply. The extent of this process depends on many variables, one of which is the nitrate level of the ground water that could increase to a fairly high level.

Nitrate Limit Suggested

The U. S. Public Health Service recommends a nitrate limit of 45 parts per million in drinking water. Some authorities believe that a concentration of more than 10 parts per million can cause a harmful affect on the health of children under six months old.

If the nitrate level of ground water supply should increase to such a high level, then the use of the water for human consumption would create a health problem.

Agronomist Views Problem

Another interesting facet of this problem has been pointed out by Donald E. Longenecker, Associate Agronmist Substation 17, El Paso, in an article written for the Texas Agricultural Progress. Longenecker says that the presence of nitrates in the irrigation water means that savings in the amount of nitrogen applied to the soil could be made. More important than the savings on fertilizer cost is the possibility that some farmers may be lowering yields by too much nitrogen. Too much nitrogen can reduce yields by causing excessive vegetative growth

(Continued On Page 3)

THE Cross SECTION

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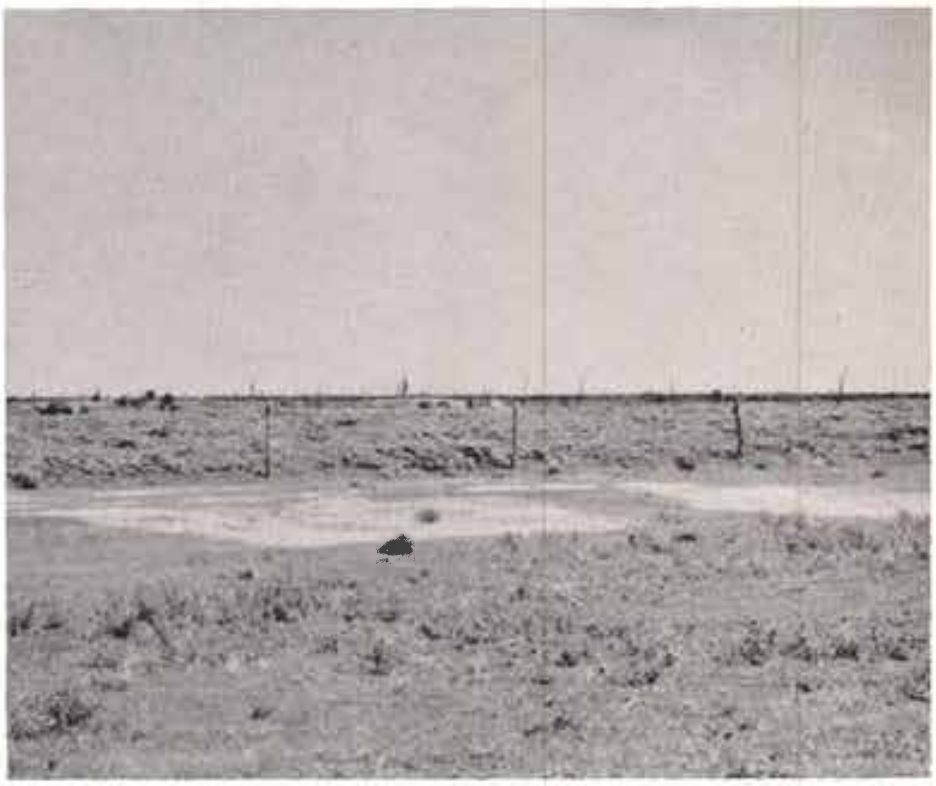
CLAUDETE MCINNIS
Editor

SPRINGLAKE FARMER



In the background, you can see the irrigated Bermuda pasture; In comparison with the barren spots in the foreground, which did not receive water. The scarcely turfed land is native pasture of Buffalo and Gramma grasses.

Texas Water Commission Publishes Circular On Hydrology—"The Science of Water"

"Increasing emphasis on water demands for our civilization has resulted in the development of the science of hydrology—the science of water," said Chief Engineer John Vandertulip in summarizing the Texas Water Commission's new publication. This report summarizes the historical development of hydrology and its recent recognition as a separate and unique field of scientific endeavor.

Published as Circular 63-03, "The Development of the Science of Hydrology" may be obtained without charge from the Commission's office, P. O. Box 2311-Capitol Station, Austin.

In Bibilical and earlier times the philosophers and scholars were uncertain of the origin of springs and rivers and their theories of rainfall were somewhat afar from today's science. Yet, despite their probable lack of knowledge of modern engineering refinements, they built water supplies for irrigation, domestic and municipal use, and even crude industrial innovations. Certainly they answered to the age-old saying "Necessity is the mother of invention."

In the pioneer United States, our development was near rivers and natural lakes for domestic use, for irrigation, and for transportation. As expansion spread westward, nature often betrayed man as floods or drought molded and changed our way of life. The control and conservation of water was necessary to cope with growth. The science of hydrology is the tool of man's mastering, to a great extent, the use of water—our most important natural resource. Billions of gallons of flood waters of today are stored in major reservoirs as a safeguard against tomorrow's water shortages through drought.

"Throughout the ages, the well-being of the civilization has been, and will forever be, dependent upon the available and useable water," the Circular states. "Without proper use of land and water, progress and even the survival of people is questionable."

Although the first roots of hydrologic knowledge date back to antiquity, most of the phenomena of ground water hydrology are so exceedingly complex that, to a casual observer, fundamental natural laws seem nonexistent. Notwithstanding this seeming confusion, however, the laws of ground water as well as those of water in lakes and streams is subject to careful observation by scientists and to predictions of future developments. "In cases where the field conditions are compatible with the theoretical mathematical relationships, quick answers can be given by hydrologists regarding the prediction of future water levels, the design of well fields, and the determination of optimum well yields and pump types," the report states. ". . .where complicated hydrologic conditions cannot be expressed by easily solvable mathematical relationships. . .tremendous advances have been made through use of modern computer methods, including analog models."

WHEN YOU MOVE—

Please notify the High Plains Underground Water Conservation District, Lubbock, Texas on Post Office Form 22S obtainable from your local postmaster, giving old as well as new address, to insure no interruption in the delivery of "The Cross Section."

INCREASES BERMUDA GRAZING WITH LAKE PUMP

By CLAUDETTE McINNIS

Anyone who has ever watched a crop burn up from lack of water, will agree with the importance of water and its conservation. This is what Ernest, Charles and W. C. White had in mind when they installed a lake pump on W. C. White's place six miles north of Springlake in Lamb County.

The pumping unit is a 50-50 endeavor with W. C., who owns the land, and the two brothers, who farm the property.

With the centrifugal pump the Whites were able to water 10 acres of Bermuda pasture that otherwise would not have received water, because the well was being used for watering field crops.

This 30 acre lake and the pumping unit manufactured by KMP Pump Co. of Earth, made possible twice as much pasturage as the White Brothers would have had without the additional water.

The lake filled in May, and the pumping system was installed in July. The water supply lasted until September.

According to the way the pump worked this summer it is profitable from an economic stand point, and easy to operate. Priming is not necessary for this pump which is motored by a six cylinder Chevrolet, number 292. Another extra-ordinary feature of this pump is that there is no screening necessary. The system has pumped tad-poles and water-dogs.

In the beginning the pump was set in the lake-bed, as the water was lowered the pump was gradually moved toward the receeding water. Finally, the Whites decided on a permanent placing of the pump. A dozer pulled out a dump for a stabilized place for the pump, this dump is above the high water level of the lake.

The pumping system, which costs approximately $1,425 will pump as much in a one week period as an eight-inch well, and in some cases considerably more. Broken down per item, the expenses for the unit are pump, $650; trailer, $150; engine and carburetor, $625.

"In five years, the pump should pay for itself, and based on this year's operation it will do it," said White.

This type operation is not saving the Whites' well, but utilizing what would be waste water, had they not used the lake pump to provide water for their Bermuda.

W. C., Ernest, and Charles White have improved the value of their land as well as utilizing lake water with this pump. The pump has made possible twice as much grazing as they would have otherwise had on their Bermuda pasture.

Charles White, Ernest White and Gus Parrish inspect the lake pump after it has been placed on the dump. This will be the permanent location for the pump, as it is above the high water level of the lake. Because the pump's bowls are submerged, it needs no priming.

The certrifugal pump that is manufactured by KMP Pump Co. of Earth will pump at almost any angle. This easy to operate unit which the Whites have is fueled by a 55 gallon gasoline drum and uses about one and one-half gallons of gasoline per hour of pumping time.

THE CROSS SECTION
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Lubbock, Texas
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Street Address _____

City and State _____

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Fertiliizer Problem —

(Continued From Page 3)

at the expense of fruiting.

Since September 1, 1962, a new water testing service has been offered by the soils laboratory at Texas A and M University. Farmers interested in having their irrigation waters tested may have a combined nitrate and total salt content test made for $5. per water sample. One pint samples of the water should be sent to the laboratory in plastic containers. The containers should be rinsed with the water to be analyzed at least three times before being filled to prevent contamination of the water sample. The samples should be well packaged and mailed to the Soil Testing Service, Texas Agricultural Extension Service, College Station, Texas.

A LITTLE LIFE IS WORTH MORE THAN A LITTLE TIME, CLOSE THOSE ABANDONED WELLS!

GROUND WATER CONSERVATION MANS ORDERLY DEVELOPMENT – PROVIDENT USE

Out of the awakening conscience of man was born the spirit of conservation. Throughout the ages, man gradually began to comprehend more and more the mysteries of nature and how they could be used. As he learned, he exploited the resources of his surroundings to the utmost extent. This exploitation came from one of two things, either greed or power.

Little did man realize, or possibly care, that in the process he was depleting nature and endangering his own livelihood. As a result of this attitude we read of the denudation in the Biblical Period; of the slaughter and extinction of the passenger pigeon, of polluted rivers, eroded fields, gutted timber areas and smog. All of these destructive acts are the result of man's careless nature.

From this scene, man in time became acutely conscious. What he had been doing to nature was not for his future benefit; he had a change of Heart. Man's conscience began to bother him. He saw that in the long run his welfare depended on all other living things and in the inorganic resources around him.

Man learned what Benjamin Franklin said, "Forever taking out and never putting anything in, soon exposes the bottom of the barrel."

It is now commonly accepted that resources should be used for the greatest good, for the largest number of people and for the longest period of time. However, in the case of water as a resource, the definition of conservation, more clearly stated, is that resources should be orderly developed and providently used for the greatest potential benefit. This definition is based on the knowledge and economic conditions of the times. As far as water conservation is concerned, neither the greatest number of people nor the longest period are the determining factors; but the main factor is the greatest potential benefit.

Conservation is a term that when applied to resources is often misconstructed. One generally accepted definition is that conservation is an effort to sustain our present supply of natural resources for generations to come. This is not a definition of conservation but one of preservation. To speak of conservation we must base our thoughts and conclusions on the present situations in economy and knowledge.

In most areas of the world, water is one of the renewable resources. But on the High Plains of Texas, we are confronted with a drastically different situation. Our water is not renewable, so we must engage in orderly development and provident use.

CONSERVATION—orderly development and provident use.

Deep Tillage Improves Water Intake

The water-intake rate of 12 million acres of slowly permeable Southern Great Plains Soils can be almost doubled by deep tillage with a disk plow, says U. S. Department of Agriculture.

Experiments conducted by the US DA and the Texas Agricultural Experiment Station found that plots disk-plowed 24 inches deep had a water-intake rate 1.9 times that of check plots not deep plowed.

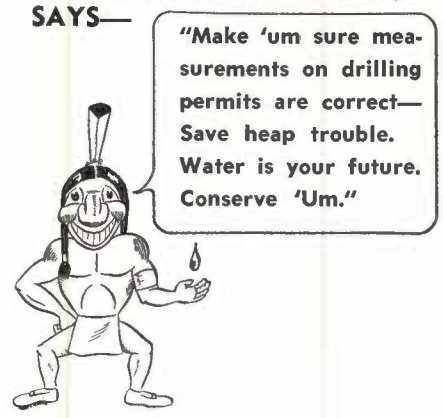
Pullman and associated soils which predominate on the Plains, are moderately permeable clay loam underlain by 16 to 20 inches of dense compact clay, says the Department. Immediately after irrigation or rainfall, water enters these soils at 0.5 to 1.0 inch per hour, but the water-intake rate declines to less than 0.1 inch per hour after four hours and to 0.05 inch per hour within 10 hours.

To determine the effectiveness of deep tillage, moisture measurements were taken 20 minutes following an irrigation. Moisture was distributed to a depth of six feet in the disk-plowed soils but entered the check plot to a depth of only one foot.

Deep tillage appeared to have a permanent effect on the soil permeability, say the scientists. Three years after the disk-plowing the water-intake was undiminished, they report.

This improvement of the soil was attributed to the mixing of more permeable layers with less permeable ones. The USDA says that the mixing of the less fertile soil with the fertile top soil will probably not reduce the productive capacity of the land if moisture and soil fertility remain adequate.

"CHIEF RUNNING WATER," SAYS—



DRILLING STATISTICS FOR JULY AND AUGUST

During the month of August 91 new wells were drilled within the High Plains Water District; 19 replacement wells were drilled; and 11 wells were drilled that were either dry or non-productive for some other reason. The County Committees issued 115 new drilling permits.

Listed below by counties are permits issued and wells completed for August.

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Dry Holes Drilled
Armstrong	0	0	0	0
Bailey	1	0	0	0
Castro	12	1	0	0
Cochran	7	6	0	0
Deaf Smith	20	18	4	1
Floyd	19	3	0	0
Hockley	6	12	1	2
Lamb	12	19	4	4
Lubbock	9	20	1	3
Lynn	0	2	0	0
Parmer	25	6	9	1
Potter	1	0	0	0
Randall	3	4	0	0
TOTALS	115	91	19	11

During the month of July, 145 new wells were drilled within the High Plains Water District; 27 replacement wells were drilled; and 8 wells were drilled that were either dry or non-productive for some other reason. The County Committees issued 84 new drilling permits.

Listed below by counties are permits issued and wells completed for July.

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Dry Holes Drilled
Armstrong	0	0	0	0
Bailey	2	14	9	1
Castro	16	14	1	0
Cochran	4	5	0	0
Deaf Smith	22	23	0	0
Floyd	1	20	1	3
Hockley	5	5	1	0
Lamb	8	20	6	1
Lubbock	11	23	2	2
Lynn	0	3	0	1
Parmer	11	11	5	0
Potter	1	1	0	0
Randall	3	6	2	0
TOTALS	84	145	27	8

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Conservation District No. 1
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THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 5 **"THERE IS NO SUBSTITUTE FOR WATER"** *October 1963*

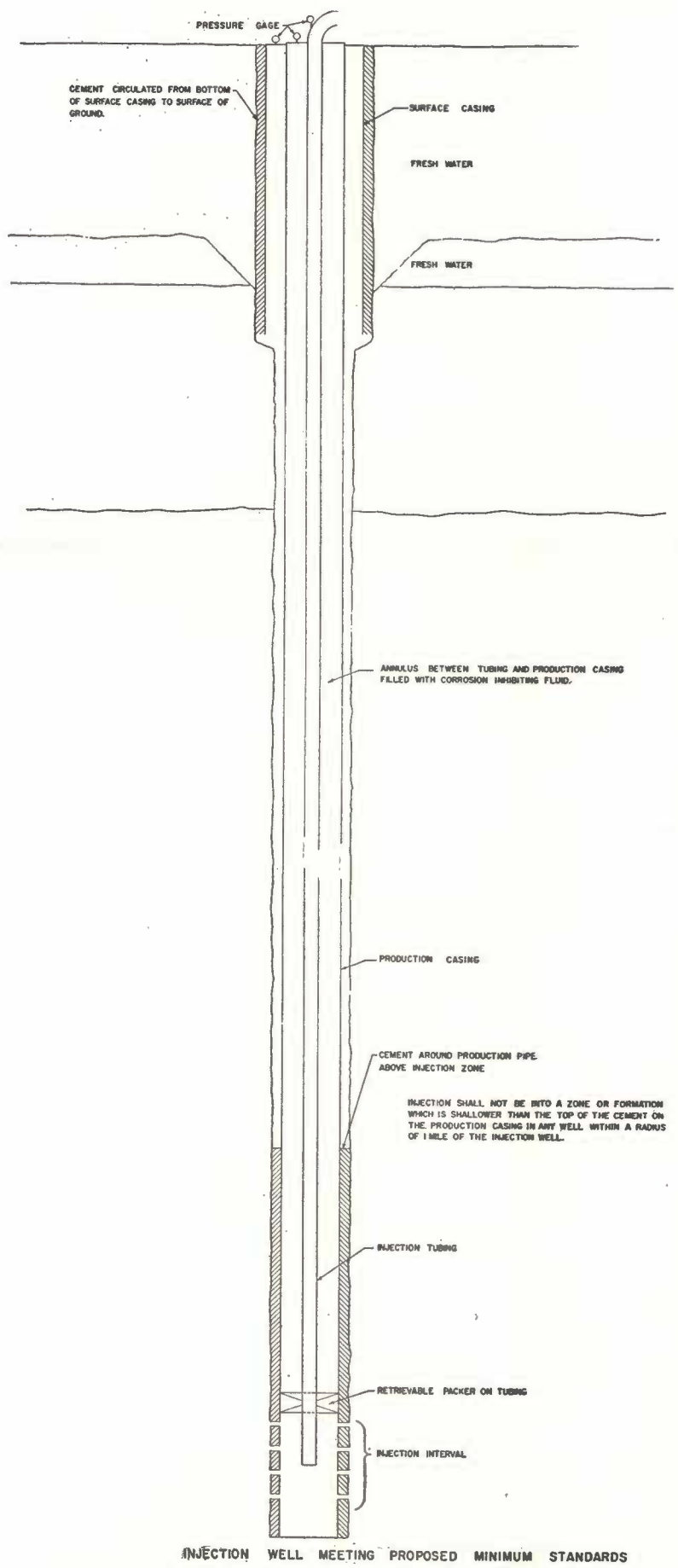
Salt-Water Disposal Methods Scheduled For Second Hearing Nov. 20 In Austin

Pollution of fresh water, the lifeblood of the South Plains was brought before the Texas Water Pollution Control Board in Austin when the Board asked for proposals on the best way to dispose of oilfield brine. The problem brought before the Board was: What to do with the salt-water that comes to the surface with oil.

Immediately preceeding the hearing on salt-water injection wells, the Pollution Board heard evidence on the surface disposal of brine into unlined earthen pits. The Texas Water Commission stated that this disposal practice should be halted in the Ogallala formation area. On this topic the oil companies challenged the Pollution Board's authority. Elmer Patman, attorney for Superior Oil Company, stated that the Pollution Board has no jurisdiction on the discharge of oilfield brine into unlined earthen pits.

The Texas Water Pollution Control Board, the Railroad Commisssion, the High Plains Underground Water Conservation District, the North Plains Underground Water Conservation District, the Panhandle Underground Water Conservation District and the Red River Authority rules already in effect in 33 of the 48 Ogallala counties, outlawing the use of salt-water pits.

(Continued on Page 4)



INJECTION WELL MEETING PROPOSED MINIMUM STANDARDS

District Appoints Legal Consultant

H. G. WELLS

H. G. Wells, State Representative, has been appointed Attorney for the High Plains Underground Water Conservation District. Wells, a resident of Tulia, completed his high school education there. He is a graduate of North Texas State University with a Bachelor of Arts Degree.

The Representative did graduate work at West Texas State University and studied law at the University of Texas Law School. He ran for the State Legislature in 1957 and is presently serving his third term of office. He has had himself taken off the state payroll as a Representative to accept the job with the Water District.

The Representative will retain his seat in the House of Representatives and will take a leave of absence from the District during legislative sessions. Legality of Wells' acceptance of the job with the authority was based on early attorney generals' opinions, upheld by Attorney General Waggoner Carr's recent opinion that membership in the Legislature is not incompatable with employment with districts of this type.

Precedent was set for Wells' action by Sam Collins of Newton who this summer took similar steps in order to go to work for the Sabine River Authority. Other Representatives are teaching school, in public schools or colleges, which receive direct state funds. The High Plains Water District has no state appropriations. It is a district supported by local tax funds.

The Texas Constitution prohibits a person from holding two state jobs from which income is received at the same time.

Wells taught school in Tulia High School for one year, and has served in the Army two years. He was admitted to the State Bar of Texas in 1961 and has practiced law in Tulia since his admittance. He is a member of the State Bar Association, Kiwanis, and the Methodist Church.

As a State Representative, Wells has been on the Committee for Conservation and Reclamation for his three terms of office.

Wells, who is a partner in a Swisher County Farm, will retain his residence in Tulia.

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CLAUDETTE McINNIS
Editor

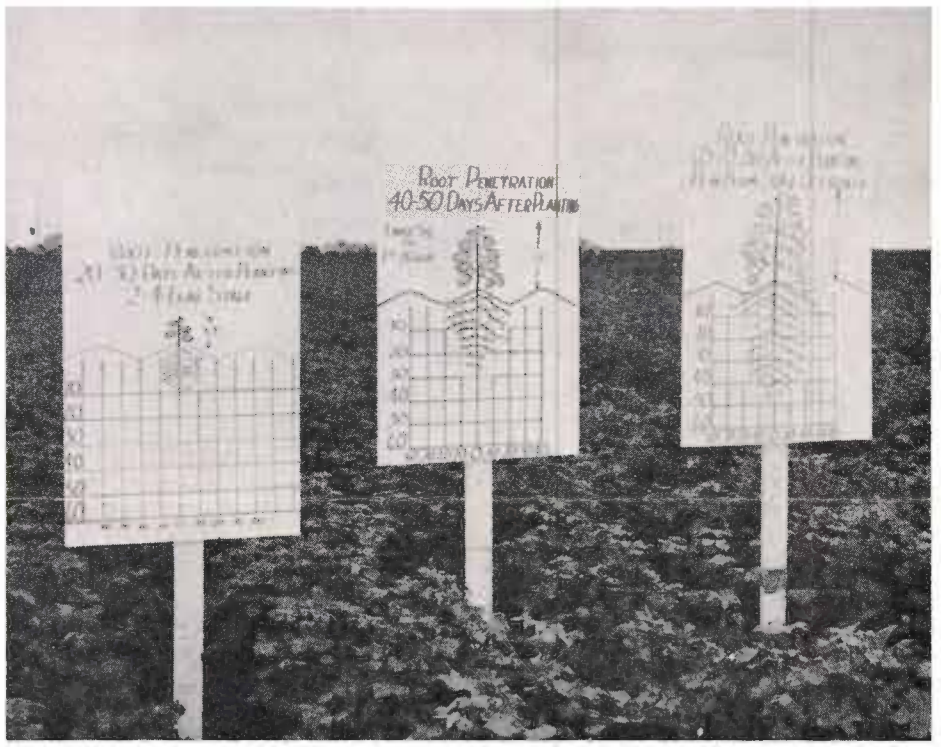
Moisture Influenc

A healthy, well developed root system is necessary for maximum utilization of soil moisture and nutrients, yet very little research has been done to study the influence of cultural practices on root growth and development. One of the primary reasons for the lack of information in this field, was the absence of an efficient and accurate technique to study root development of plants throughout the growing season.

In recent years, an acceptable technique using soil placement of radioactive phosphorus has been developed and used successfully to study root growth. This technique has been used recently by many scientists to collect accurate data not possible before on growth and function of plant roots.

One area of interest on the High Plains is the effect of moisture levels on cotton root growth and development. Research in this area could provide information useful in water management, fertility placement and other cultural areas.

A test was initiated at the Lubbock Experiment Station in 1963 using the radioactive phosphorus technique to study cotton root growth under different moisture levels. Preliminary results indicated that root development in cotton grown under a high



The charts in the field show the average root growth of cotton at three selected stages of growth.

DRILLING STATISTICS FOR SEPTEMBER

During the month of September 89 new wells were drilled within the High Plains Water District; 25 replacement wells were drilled; and 3 wells were drilled that were either dry or nonproductive for some other reason. The County Committees issued 102 new drilling permits.

Listed below by counties are permits issued and wells completed for September.

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Dry Holes Drilled
Armstrong	0	0	0	0
Bailey	10	14	3	0
Castro	2	11	7	0
Cochran	1	4	0	0
Deaf Smith	19	15	5	0
Floyd	19	14	1	0
Hockley	13	9	0	0
Lamb	11	4	1	0
Lubbock	8	5	5	0
Lynn	4	0	0	2
Parmer	10	9	3	1
Potter	0	1	0	0
Randall	4	3	0	0
Total	102	89	25	3

e On Roots Measured With Phosphorus

By JAMES S. NEWMAN
Ass't Agronomist, Texas Agricultural Experiment Station,
Substation No. 8 Lubbock, Texas

moisture level was less extensive than cotton grown under less favorable soil moisture conditions.

Root development of cotton grown under three moisture levels was similar from emergence to the mid-bloom stage. Thereafter, cotton growth in the low and medium moisture levels produced additional root growth but cotton grown in the high moisture level did not. Apparently frequent irrigation of cotton grown under the high moisture level replenished soil moisture in the root zone; therefore, additional root growth was not necessary to satisfy the plants water requirements.

Plants grown in the low and medium moisture levels produce additional lateral root growth at the 10-inch depth and additional vertical growth beneath and 10 inches either side of the row at the 50 inch depth. It was believed that soil moisture had been exhausted in the root zone and additional root growth was produced at these depths to obtain moisture.

Root Growth

No root growth was detected later than 78 days after planting which was approximately 1 week after peak bloom. The average extent of root penetration at this stage of growth was as follows:

1. 10 inch depth - 30 inches either side of plants (low and medium moisture level) and 20 inches either side of plants (high moisture level).

2. 20 inch depth - 20 inches either side of plants (low, medium and high moisture levels).

3. 30 inch depth - 20 inches either side of plants (low, medium, and high moisture levels).

4. 40 inch depth - 20 inches either side of plants (low, medium, and high moisture levels).

5. 50 inch depth - 10 inches either side of plants (low and medium moisture levels only).

6. 60 inch depth - no roots were detected at this or lower depths.

Early Season Root Growth

The first useful observation made in the root study occurred the first 20 days after seedling emergence. Roots were observed to grow at the rate of 1 inch per day during this period. Root growth was somewhat slower as the plants grew larger and older.

Plant-Root Ratio

Plant height and root penetration was made throughout the test. Summary averages indicated that a 2 to 1 root-to-plant ratio existed from seed emergence thru the first bloom stage of growth. For example, 15 inch plants had roots that penetrated 30 inches in the soil. This ratio changed after plants grew older and different moisture levels were established.

Skip-Row Planting

Root penetration was detected 30 inches either side of the drill at the 10 inch depth in the low and medium moisture levels. This information would indicate that cotton planted in a skip-row manner which leaves more than 1 unplanted 40-inch row between planted rows is a wasteful practice. Cotton planted in a 2-in-2-out arrangement would not utilize moisture stored in the equivalent of 1 40-inch row, where cotton planted in a 2-in-1-out arrangement would utilize efficiently moisture stored in the unplanted row.

Moisture stored in the unplanted row of a 2-in-1-out planting arrangement would not become available to plants in adjacent rows until the mid-bloom stage of growth since it took 60 days for root growth to be detected 30 inches either side of the plant at the 10-inch depth.

Side-Dress Fertilizer Aplications

Side-dress fertilizer applications could have been made with chisels set on 20-inch centers from seedling through the 12 leaf stage of growth which was 27 days after planting since root growth was not detected 10 inches either side of the row until this date.

Chisels set on 40 inch centers could have been used from seedling through the heavy square stage of growth without root damage because roots were not detected 20 inches either side of the row until 45 days after planting.

Test Outline

Radioactive phosphorus was used as a tool to study the root growth of cotton grown under low, medium and high moisture levels. Small amounts of the material was placed in the soil from 10 to 40 inches either side of the row and in 10-inch increments to a depth of 60 inches beneath the soil surface. Plants became radioactive when roots grew into and absorbed radioactive phosphorus placed in the soil. A geiger counter was used to monitor plants at each location which contained a single known radioactive phosphorus placement.

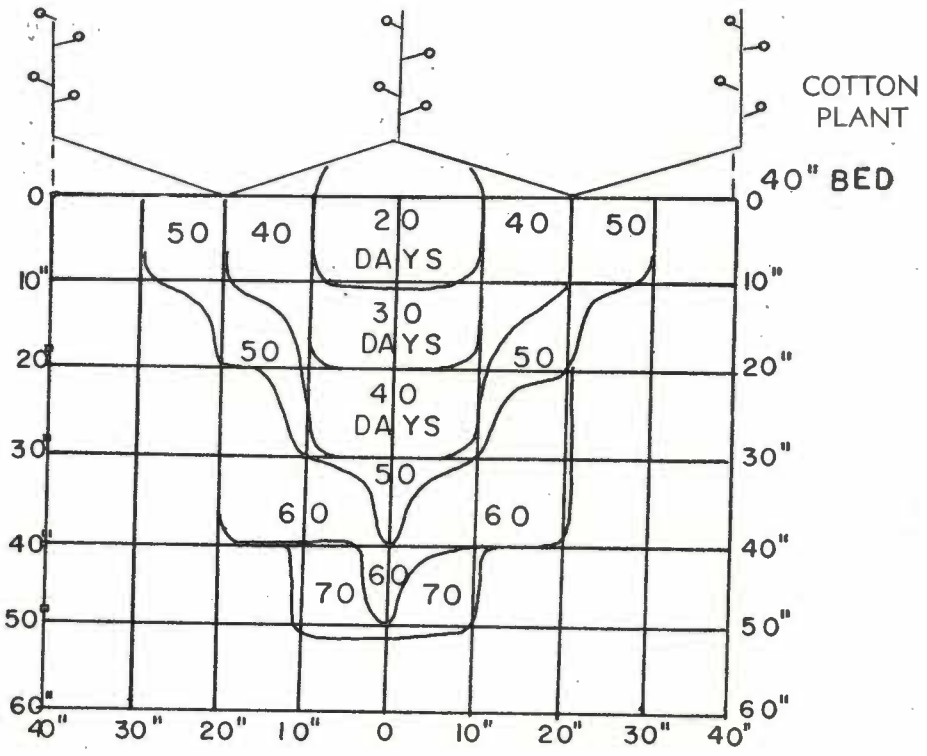
The radioactive material was buried in the soil on June 9 and Paymaster 101-A cotton was planted in four-row irrigation borders at the rate of 30 pounds of acid delinted seed per acre with a conventional 4 row planter on June 12.

The three moisture levels used in the test received the following irrigation plus rainfall: low moisture level - a preplant irrigation only; medium moisture level - a preplant plus one summer irrigation at peak bloom; and high moisture level - a preplant plus a light summer irrigation each 7-10 days starting at the heavy square stage of growth and continuing thru August 25.

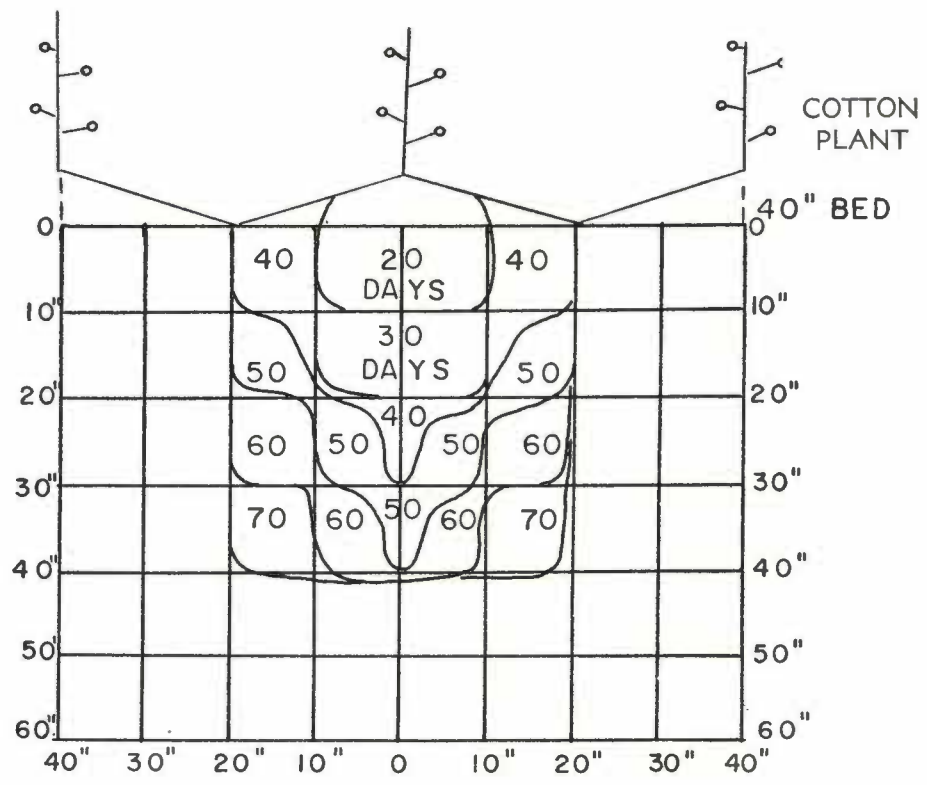
Plants at each radioactive phosphorus location were monitored with a geiger counter every other day starting at seedling emergence and continuing through October 1. Plant height and number of leaves were taken each week within each moisture level from seedling emergence until the first square was noted in plant terminals. Thereafter, plant height and weight was taken within each moisture level until October 1.

Data presented in this report represents the influence of moisture on root growth and development of cotton grown under one set of conditions. Additional test will be conducted to determine the response of cotton roots to moisture levels under different environmental and climatical conditions.

This test was made possible through a National Science Foundation Grant administered through the Department of Soils and Crops, College of Agriculture, Texas A&M University.



This graph for the low and medium moisture levels illustrates the average root development by 10-day periods after planting. The first useful observation made in the root study occurred the first 20 days after seedling emergence.



This graph shows the average root development of the cotton by 10-day periods after planting. This measurement was taken on the high moisture level. No root growth was detected later than 78 days after planting, which was one week after peak bloom.

Kirkland Elected National Secretary Of Water Well Drillers Association

J. D. Kirkland, Hereford, who has been in the water well drilling business for 19 years, has been elected secretary of the National Water Well Drillers Association. The election took place at the recent National Water Well Exposition in San Francisco, California.

On October 5, 1908, Kirkland was born in Gatesville, Texas. He and his family moved to Sudan in 1921, where he attended high school.

The Secretary was in the automobile business in Sudan from 1934 to 1944. He married Della Mae Calloway in Sudan in 1928. They made their home on a farm south of town.

In 1944, Kirkland moved to Littlefield where he went into the drilling business. He later moved to Hereford, where he is now with West Texas Drilling, Inc.

Kirkland has served on school boards and city councils. He is currently on the State of Texas Board of Water Well Drillers. He was appointed for this position in 1961 and will serve on the Board until 1965. He was secretary and treasurer of the Texas Association, and is also a past president of the same organization.

The Kirklands make their home in Hereford and have seven children, three of whom are in the drilling business.

J. D. KIRKLAND

Conservation Conversation

The Texas Water Commission has released information on the abundance of ground water in the Trinity River Basin. The information states that the greatly increased ground-water withdrawals can be supported by major aquifers in the Trinity-River Basin, except in the heavily-pumped areas such as Dallas and Fort Worth. The occurence, quality, utilization, and availability of ground-water supplies in various parts of the Trinity River Basin are evaluated in the report, which may be obtained without charge from the Commission's office, P. O. Box 2311, Austin, Texas 78711.

* * * * *

Gifford-Hill Western is in the process of expanding its Parmer County plant. The company has been in business in Parmer County since July 1955. The new facilities will house some of the most modern offices, shops and manufacturing plants in the entire Gifford-Hill Western Co.

* * * * *

Creation of a New Hudspeth County underground water conservation district was refused by the Water Commission after the hearing held in Hudspeth County July 23. Commission refusal was based on a conclusion that there was no definable reservoir in the Fort Hancock area, and that ground water may really be surface water from the Rio Grande alluvium.

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Salt Water Hearing—

(Continued from Page 1)

According to the San Antonio, SUNDAY LIGHT, "There seems to be little doubt that the Board will eventually issue one applying to the remaining 15 counties."

The High Plains and other Water Districts have learned that the problem of what to do with this salt-water was not solved when the use of salt-water pits was outlawed. The salt-water has to be put somewhere. The obvious answer is to have injection wells through which the brine is returned to a formation from which it cannot percolate upward and pollute the fresh water. Also this injection must be administered in a manner in which the brine is not allowed to escape into the fresh water strata before reaching the intended deposit area, below the fresh water levels.

A municipal water district in the Abilene vacinity found that if the injection wells are poorly cased, the salt-water gets right back into the fresh water formation. As a result of this type pollution, water interests prepared and proposed minimum standards for injection wells which would require adequate casing and cementing to a point below the fresh water levels.

Patman, attacked the Pollution Board by directly challenging the Board's authority to consider such matters. He said that if the Board should issue orders setting up standards for casing and cementing salt-water injection wells, there would be a court attack.

Oilmen contended that they would take care of the salt-water but they would like to do it voluntarily. If the action is to be taken by a governmental agency, the oilmen ask that the rules be passed by the Railroad Commission.

October 14, seven petroleum executives were named to head-up an industry-wide conservation program in Texas. This is the first step toward a policy adopted by the Mid-Continent Oil and Gas Association at a Houston meeting, September 23. The basis for setting up this committee is to study problems involving fresh water protection and to provide the oil and gas industry with information on developments in this field.

At an October 15 meeting, the Water Resources Committee of the West Texas Chamber of Commerce passed a resolution to set-up a committee to work with the oil and gas industry on the problem of salt-water pollution.

The Pollution hearing will reconvene November 20. At the September meeting there were no rules adopted for brine disposal by the Pollution Board. However, a set of minimum standards was presented by representatives of the water districts. These standards, for the 48-county Ogallala Area, were recorded and will be reviewed at the November hearing.

Swisher County Asks For Annexation

The Board of Directors of the Water District held a hearing at Tulia, October 21, as a result of a petition by Swisher County Citizens for annexation into the High Plains Water District.

At the hearing questions and remarks were made, these will be the basis for the Board's opinion for whether or not to call an election for the annexation. At an October meeting of the Board, a decision will be made on calling the election and a date will be set.

Water For Texas Meet Slated For Nov. 19-20

The 1963 Water for Texas Conference is scheduled for November 18 and 20 at the Memorial Student Center on the Texas A&M University Campus

The theme of the conference is 'Education and Research Programs Needed for Water in Texas." Governor John Connally has been invited to speak for the annual banquet.

WHEN YOU MOVE—

Please notify the High Plains Underground Water Conservation District, Lubbock, Texas on Post Office Form 22S obtainable from your local postmaster, giving old as well as new address, to insure no interruption in the delivery of "The Cross Section."

A LITTLE LIFE IS WORTH MORE THAN A LITTLE TIME, CLOSE THOSE ABANDONED WELLS!

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
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THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 6 **"THERE IS NO SUBSTITUTE FOR WATER"** *November 1963*

Money And Resources Pledged To Insure Fresh Water

The Mid-Continent Oil and Gas Association, representing 90 percent of Texas oil and gas producers, has pledged "money and resources to help insure the state adequate fresh water supplies in the 48-County Ogallala Area."

The construction of injection wells was brought before the Pollution Control Board on September 26 at which time no action was taken. In a continuance of the Hearing, November 20, the oil industry told the Pollution Board that the petroleum industry has made great strides in protection of fresh water and issued an invitation to form an alliance between the association and others interested in protection of fresh water.

The pollution of fresh water by oil field brines has been a long-standing issue with the High Plains Underground Water Conservation District. The salt water pollution comes from two sources connected with the production of oil. The first source recognized was open-pits. These pits were disposal locations for the salt-water which comes to the surface with oil.

The reason for the presence of salt-water is that in geologic time water has been trapped in the formation. This water is in contact with rocks in the formation. Thru many years of contact, the water will dissolve some of the rocks, just as sugar dissolves in a glass of tea. During geologic time this water becomes brine and may contain up to 25 percent dissolved solids. A large part of these dissolved solids is sodium chloride or table salt.

During more than 30 years from the time oil was discovered in West Texas until 1957, nothing officially was done to prevent the use of surface pits for the disposal of oil-field brine. The accepted practice of all operators, after an oil well came in, was to set up a tank battery and separator, separate the oil from the salt-water, pump the oil into tanks, and drain the salt-water into open earthen pits from which it was supposed to "evaporate".

The salt-water did not evaporate but instead was driven downward as additional water was added by both gravity and hydrostatic head.

On September 6, 1957, the Board of Directors of the Water District promulgated a rule which states, "No person shall pollute or harmfully alter the character of the underground water reservoir of the District by means of salt-water or other deterious matter admitted from some other stratum or strata or from the surface of the ground." This brought about the no-pit order and closed earthen pits within the bounds of the High Plains Water District.

The second source of salt-water pollution of fresh water came up as a result of the no-pit order. The brine must be disposed of, therefore oil producers began using injection wells. From these injection wells, the salt-water should be returned to the stratum or strata from which it is produced. However, if the well is poorly cased or cemented, the brine will escape and enter the fresh water formation.

At this time, representatives from both water districts and oil producers are in agreement that measures must be taken to insure the fresh water that is necessary for existence in the High Plains Area. Technical skill and know-how are being combined to combat this problem.

Progress reports of the Hearings on the disposal of oil-field brines are in the September and October issues of the CROSS SECTION.

The plowing under of shredded stalks is a method of land conditioning which prepares the soil for a greater "in-soak". See story on conservation practices, page 2 and 3.

Kansans' Water Rights Reviewed

Anyone, who has ever watched his crop burn up because it didn't get that inch of rain it needed, will agree with Kansans on the importance of water rights. Neither will a fellow disagree who has had to haul water for family use, or to his cattle because his well went dry.

Since the supply of water in Kansas, like the High Plains of Texas, is not increasing, the competition for existing water is keen and will continue to increase as the need for water becomes greater.

In Kansas or any other state, a farmer does not want to make expensive investments in pumps, pipe, ditches, wells, and land leveling only to find his water supply exhausted in a few years or to be told that he has no right to the water he is using. The Kansas law states that unless you were using water prior to June 28, 1945, you can get an irrigation water right only by applying to the Chief Engineer, Division of Water Resources, Kansas State Board Of Agriculture.

The law does not state that you have to have a permit to drill a well for irrigation purposes but you have no legally enforceable water right, except for domestic and stock uses, unless you follow this procedure. Your neighbor may drill a well across the fence from you, apply to the Chief Engineer, get his water right and force you to stop pumping because you are interferring with his water right.

After a Kansan has applied to the Chief Engineer and has his application approved, he must go ahead and set up his operation within reasonable length of time. When his system is operational, he notifies the Chief Engineer. The operation is then checked to see how much water he is using. He is issued a certificate for this amount of water and it is recorded in the county courthouse.

In Kansas, a water user has a legal water right after following the approval procedure, but just what does this do for the user? Under the appropriation doctrine of Kansas, it gives the user the right to use water for beneficial purposes. The right is acquired by use and can be lost by failure to use within a reasonable length of time .

Th priority of rights is based on time order. Vested rights take priority over all appropriation rights. For instance, if a person was putting water to beneficial use before the appropriation was put into effect on June 28, 1945, he would have a vested right for that amount of water. He would have had priority over all appropriation right, but this right, like other rights, might have been lost due to non-use or failure to continue use for a beneficial purpose.

The Kansas water laws are specific as to quantity, place and purpose of use. Any change in use or location of use must be authorized by the Chief Engineer. If a user wants to expand and pump more water from the same source, he must obtain an additional water right to make it legal.

The appropriation doctrine is applied to all water of all sources in Kansas. It recognizes the relationship between ground waters and surface waters and provides a system for coordinating rights between them. If pumping from a well can be shown to be detrimental to a stream flow or vice versa, the earlier rights will be honored.

Under the Kansas water rights statute, certain water uses have been rated more important than others. They are in order of importance: domestic, municipal, irrigation, industrial, recreation, and water power. But if an inferior use has a prior water right, this right can be taken only by condemnation for public use and the holder of the right must be fully compensated. However, water rights may be bought and sold by mutual agreement.

In comparison to the water laws governing the High Plains Underground Water Conservation District, the Kansas Water Rights show state control of water, whereas, the High Plains District is controlled by the people who use the water.

THE Cross SECTION

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

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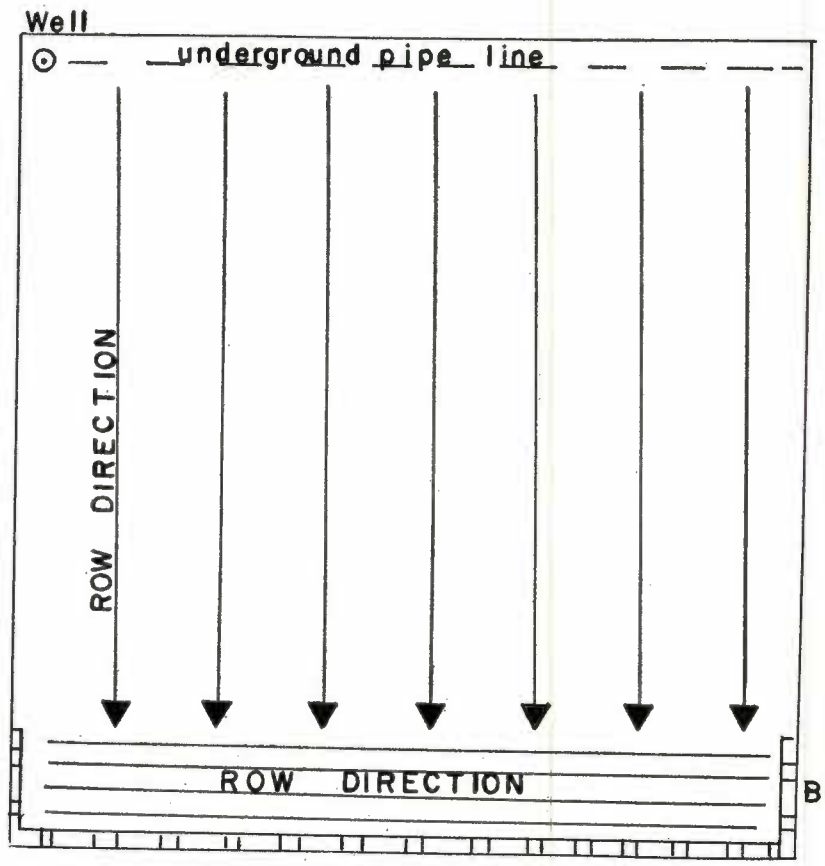
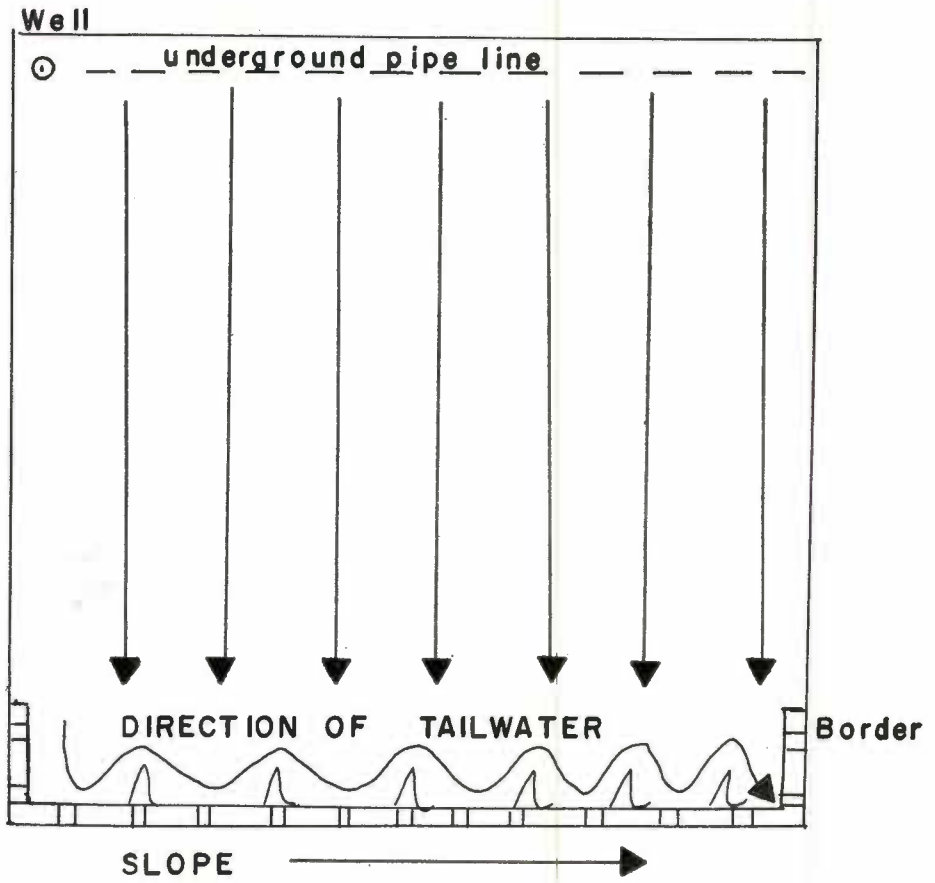
CLAUDETTE McINNIS
Editor

In-Soak



One water conservation practice is to drill or plant a crop parallel to the ends of the normal row direction. This practice is especially efficient for land with a general slope in one direction.



On a farm where land has a two direction slope a border can be constructed around the lower end of the farm. At approximately two foot intervals a diverter can be run toward the rows. this will slow down and back-up tailwater in a manner as to soak the land before the water moves to the next section.

WATER IS YOUR FUTURE, CONSERVE IT!

--- What Does This Mean?

Soil management is a key to water conservation. Preparation of the soil in such manner as to facilitate the "in-soak"from not only irrigation water, but also the rain that falls on the land, is the condition for which each individual farmer should strive.

There are many varied and diversified methods of soil management and preparation in practice in the High Plains Water District. One of these is the plowing under of shredded stalks or cotton burrs. This provides the organic matter necessary to prepare the soil for good "in-soak" texture. This method of soil preparation provides a useful tool in combating waste of water. Well conditioned soil has the ability to hold more water as well as higher infiltration rates, and also gives water up to evaporation more slowly.

It takes good productive soil to grow high yielding crops, and in turn, good soil without water is unproductive. Irrigation farmers who farm sloping lands down slope should carefully consider their practices because they are possibly wasting water and removing topsoil by erosion. Land forming can be practiced by man to improve the soil, which nature has taken thousands of years to build, or man can neglect the soil until the land is unproductive.

Many farmers in the Southern High Plains farm lands that have steep slopes. Even though these lands are well conditioned, they still present the problem of how to soak the soil and not run water off the land. This problem is being solved by many of our enterprising farmers. Various methods are being employed and many are working excellently.

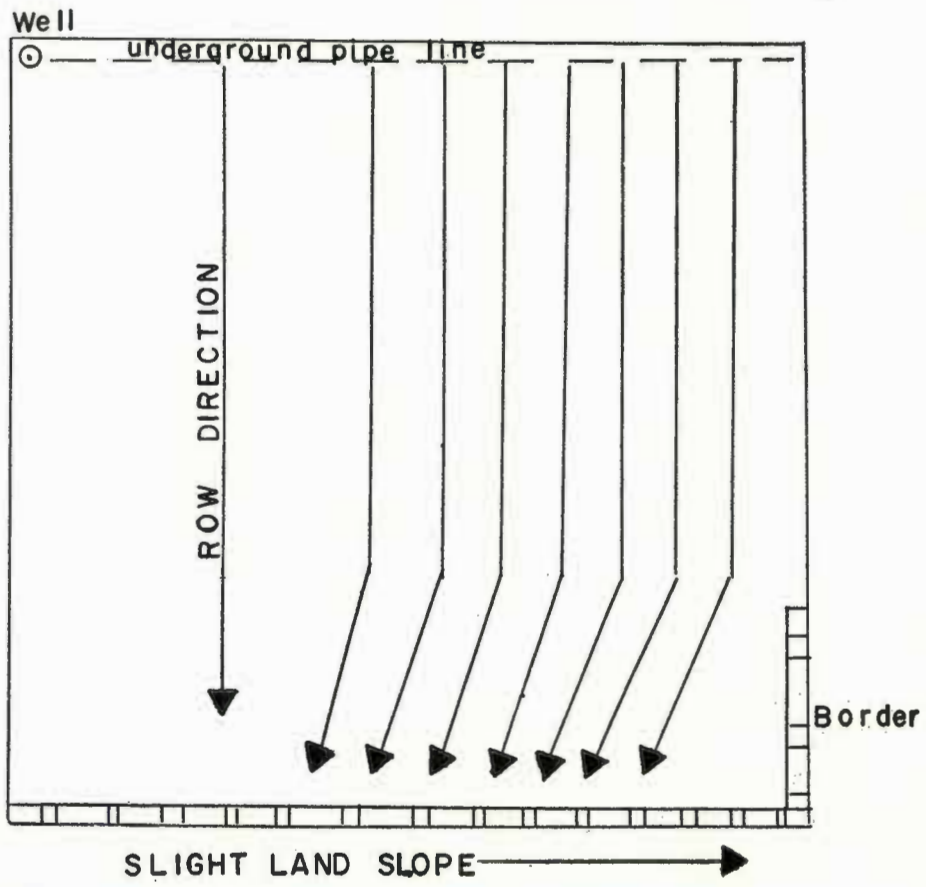
Contour irrigation farming is one method, of soil and water conservation.

Bench levelling of sloping land is probably the best method of keeping water under control. Heavy rains can be handled with practically no runoff and irrigation water can be distributed evenly.

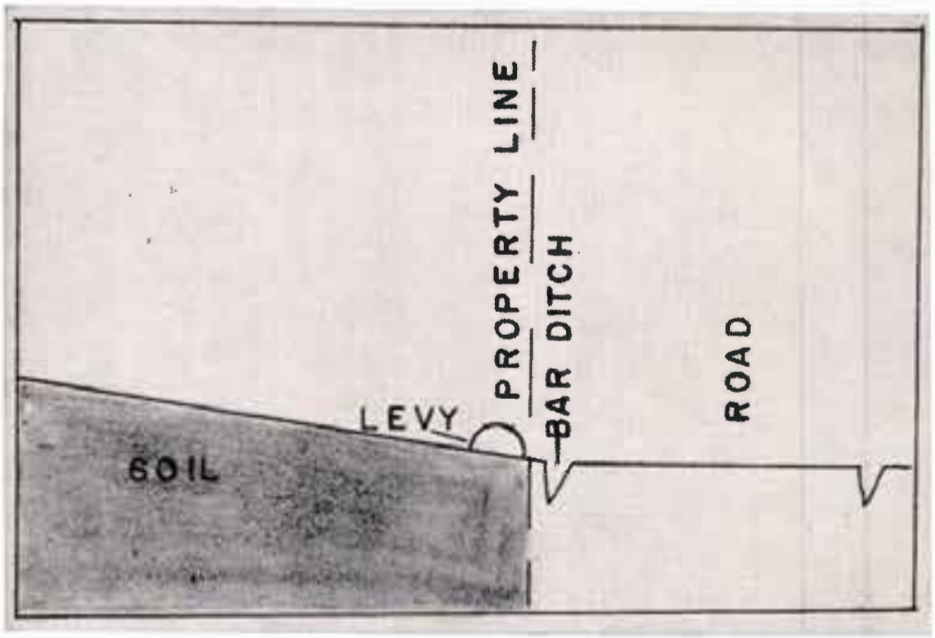
High borders at the end of rows are being used with satisfaction by many farmers who have slight sloping land. This method of controlling water is inexpensive and normally is satisfactory, particularly on land where the sharp slope is not immediately at the end of the rows.

On land where the majority of the slope comes at the immediate end of the rows, many farmers have found that by planting grain sorghum, alfalfa, or corn in perpendicular rows to the main crop, that these rows will take up any excessive runoff of irrigation water.

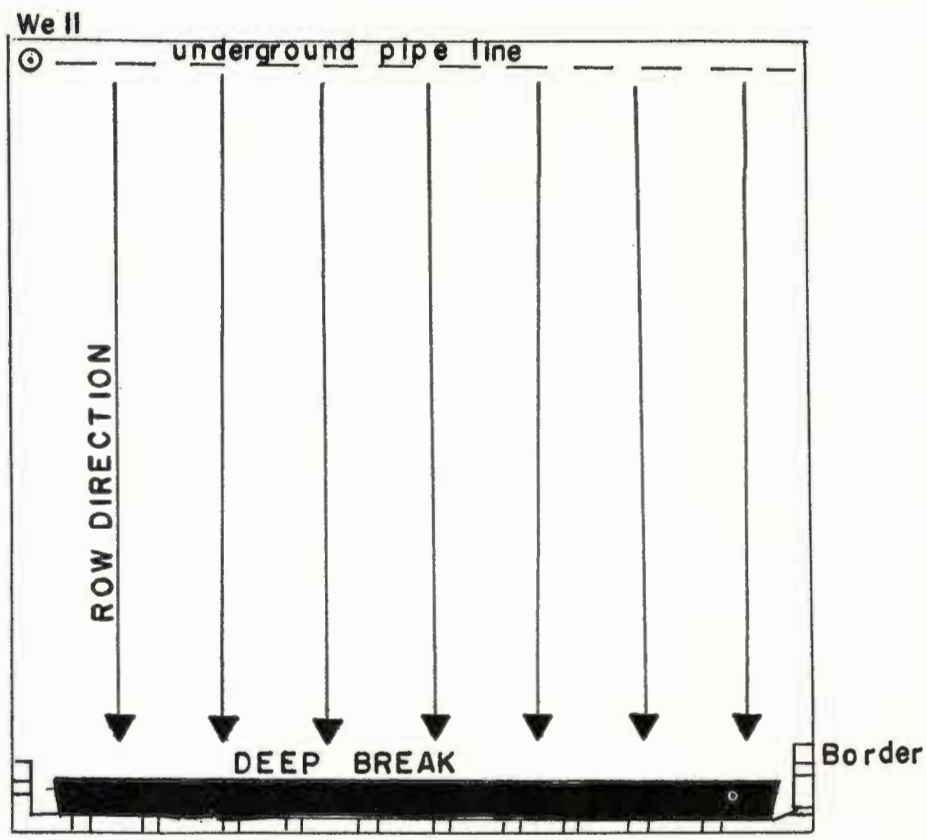
More efficient irrigation and land formation are closely related. However, there are several steps that can be taken for more efficient irrigation which we have not mentioned. The practices discussed can be modified or combined to fit the individual need of a farm. If you have the problem of what to do about "tail-water" on your farm, give it careful consideration. You will find that good land and water management will pay dividends.



If you have land that slopes in two directions, contoured rows can save water. Tailwater can be conserved by watering from north to south with rows angling across from northeast to southwest. The angled rows at the end of the field should be almost level from one end to the other.



Sometimes building border and then plowing it down can present a problem. An answer to this problem is to get a maintainer to roll a broad border that you can plow over but will hold the tailwater in the field. This illustration shows the levy in an extremity, it should be more sloping to facilitate plowing over.



Deep breaking across the lower end of a field with a general slope in one direction can stop the flow of tailwater. In using this practice it is necessary to construct a border beyond the deep breaking to prevent the tailwater from channeling.

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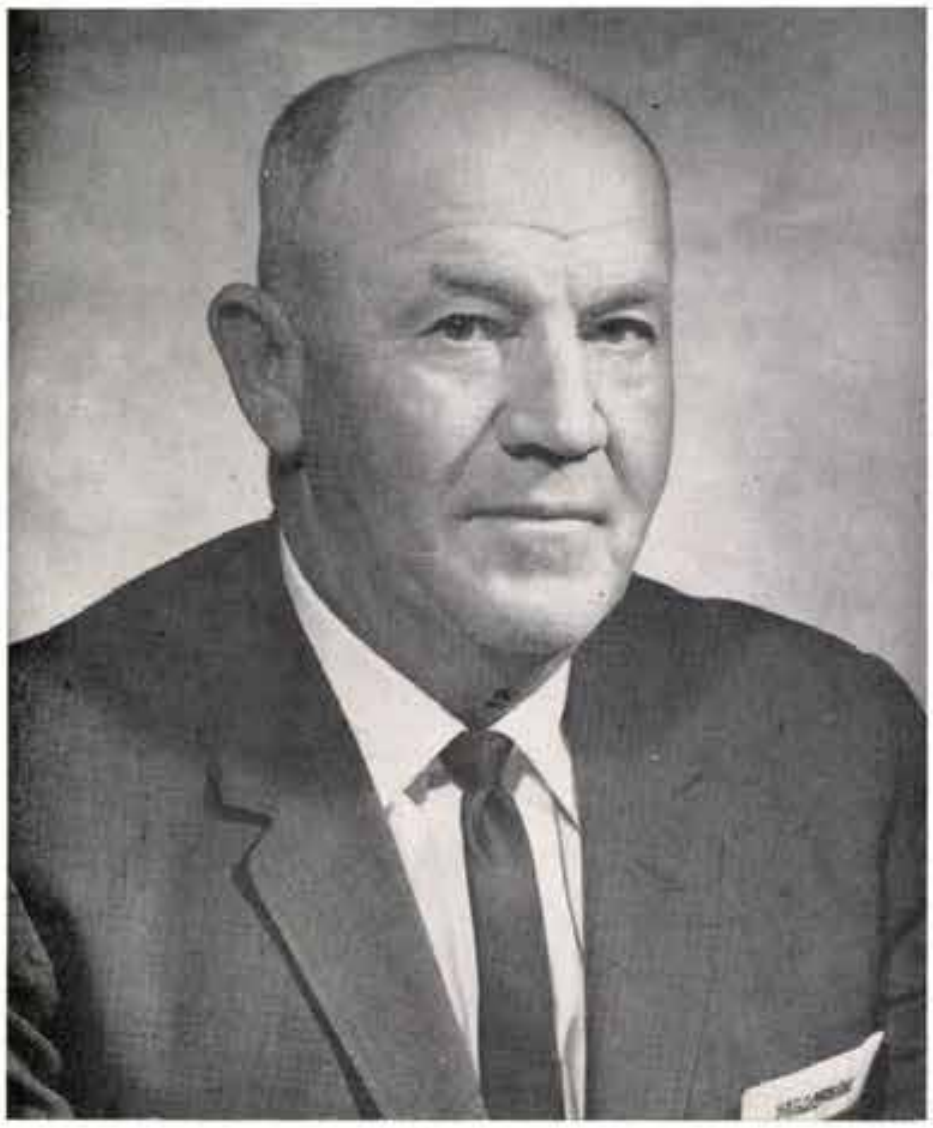

EARL HOLT

"The Cross Section" takes this opportunity to introduce to its readers one of the newest members on the Board of Directors of the High Plains Underground Water Conservation District. Earl Holt of Hereford took office in January 1963, He is the Director from District Precinct No. 4 which consists of Deaf Smith, Armstrong, Potter and Randall Counties.

Holt Represents Deaf Smith, Armstrong, Potter, And Randall Counties On District Board

Earl Holt of Hereford represents District Precinct Four which consists of Armstrong, Deaf Smith, Potter and Randall Counties, on the Board of Directors of the High Plains Underground Water Conservation District.

The newly elected Director was born in Cloud Chief, Oklahoma, January 4, 1909. He attended Southwestern State Teacher's College in Weatherford, Oklahoma, where he received both Bachelor of Arts and Bachelor of Science Degrees. Holt has majors in biological science, industrial arts and History. While at Southwest State Teachers' College, Holt was named All-State Forward in basketball and holds the State Record in the 440-yard dash. He participated in both basketball and track for the full four-year college term.

After college days, the ex-athlete taught school and coached in the Oklahoma School system for 14 years. The three Oklahoma towns in which Holt taught are Dill City, Roger Mills and Canute.

Holt moved to Deaf Smith County in 1963, where he now farms 950 acres and runs approximately 50 head of cattle.

Holt's wife, Faye, teaches in the Hereford Schools. He has three daughters, Clarabeth, Cherry Anne, and Jenny Sue. Clarabeth is a technician at the Deaf Smith County Research Center, while Jenny Sue and Cherry Anne attend Oklahoma State University.

The veteran educator, is very active in community development projects, he presently serves on the Board of Supervision of the Upper Washita Watershed in Oklahoma, and is a director of both the Hereford Lions Club and the West Texas Rural Telephone Cooperative. He is a member of the Masonic Lodge and the Odd Fellows.

The Holts live at Route 3, Hereford and are members of the Hereford First Methodist Church.

Holt was elected last January by residents of Armstrong, Deaf Smith, Potter and Randall Counties to represent them on the five-man Board of Directors of the Water District for a two-year term of office.

Water Listed, Problem

Lt. Governor, Preston Smith, has asked 8,000 Texans to comment on the State problems. A test of 50 of the 1,200 replies found six people listing water and pollution as their town's major problem; nine listing supply as the major State problem.

On the question: Do people in your area favor local control of water resources as strongly as ever? (an obviously leading question), 40 said "yes", eight said "no" and two understood a bit better.

A McKinney man said that you can't have local control, unless you consider State control local. An El Paso man said they would favor local control, but there is a growing realization "that some projects are too big to be handled on a local basis."

The 50 replies were merely taken at random from the 1,200 recieved in the Lt. Governor's office.

Government Publishes Yearbook of Agriculture

"Water is Always A Critical Factor" is one of the chapters included in the 1963 Yearbook of Agriculture. The book, entitled "A Place to Live", focuses attention to the many changes occurring in rural areas throughout the country as a result of urbanization.

Gerald F. Vaughn, Extension resource development specialist at Texas A&M, says the book has many applications to Texas and Texas conditions and should prove a valuable aid to leaders in keeping abreast of changes.

For example, other chapters are "The Family Farm in Transition", "Farming on the Urban Fringe", "The Small Rural Town", "Encouraging Industry in the Country," and many others that are of concern to South Plains residents.

"This is one of the most valuable references on Rural-Urban affairs published to date, "Vaughn said.

Copies of the Yearbook may be obtained from your Congressman, free of charge, or from the U. S. Government Printing Office for $3.00.

WELL DRILLING STATISTICS FOR OCTOBER

During the month of October 84 new wells were drilled within the High Plains Water District; 12 replacement wells were drilled; and 3 wells were drilled that were either dry or non-productive for some other reason. The County Committees issued 81 new drilling permits.

Listed below by counties are permits issued and wells completed.

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Dry Holes Drilled
Armstrong	0	0	0	0
Bailey	0	8	2	0
Castro	3	14	1	0
Cochran	10	5	2	0
Deaf Smith	10	21	3	2
Floyd	0	2	0	0
Hockley	17	6	0	0
Lamb	15	6	0	0
Lubbock	11	11	1	0
Lynn	3	0	0	0
Parmer	9	1	3	0
Potter	0	0	0	0
Randall	3	10	0	1
TOTALS	81	84	12	3

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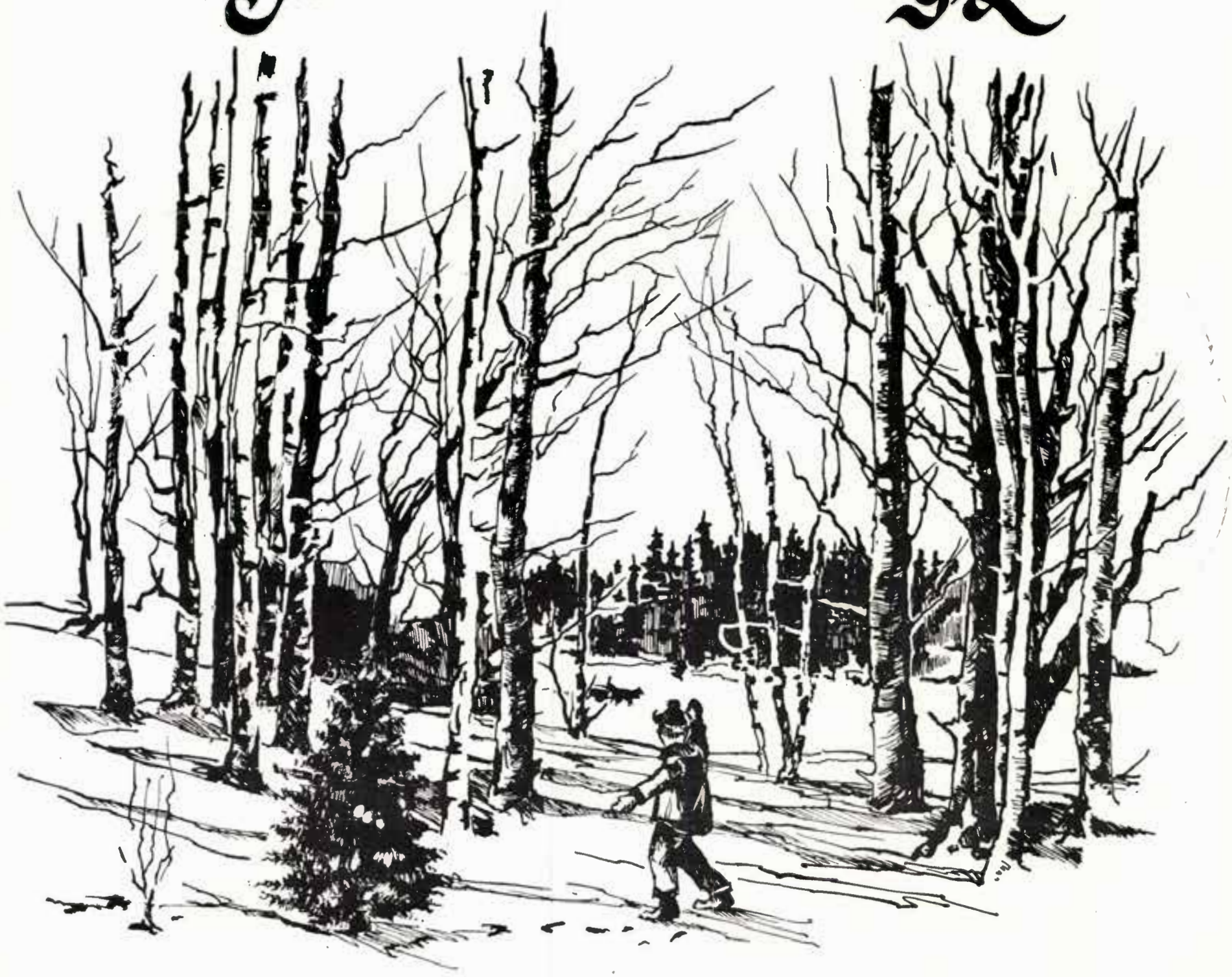
THE Cross SECTION

INDUSTRIAL AGRICULTURAL MUNICIPAL

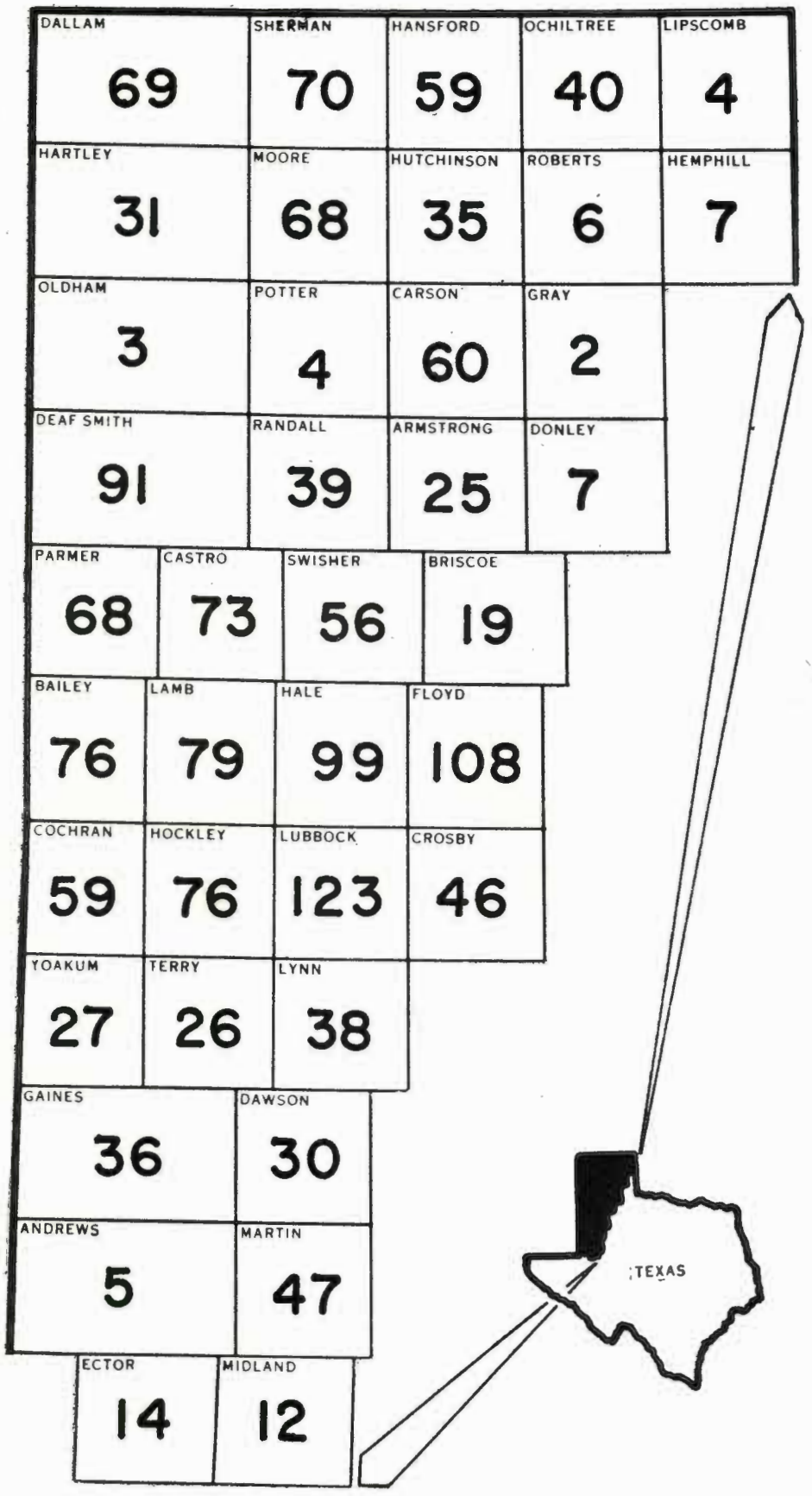
A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 10—No. 7 **"THERE IS NO SUBSTITUTE FOR WATER"** *December 1963*

Season's Greetings



Water Level Measurements



This map represents the 39-county area in which observation wells are located. All or parts of 13 counties are within the bounds of the Water District. Wells within the District total more than 800. The numbers on the map signify the number of observation wells with each county.

The annual water-level measurements of more than 800 observation wells in the High Plains Water District will begin in early January. The wells in the High Plains District are a portion of the over 1700 wells to be measured in a 39-county area by personnel of the Water Comission, North Plains District, and High Plains District.

In September of 1963, the Water District entered into an agreement with the Texas Water Commission, whereby the observation well network within the District was to be updated and expanded. Under the terms of this expansion, 211 wells were added to the program. These, new wells were precisely mapped and identified by a metal plate attached to the concrete pump base. The existing observation wells were remapped by field survey and all current information, regarding the individual wells was recorded. Idenfification plates were attached to several of the older wells.

FIRST MEASUREMENTS

Through the years, the observation well network has continued to expand as wells have been added to the program. The 1964, annual measurements will continue a program part of which originated in the early nineteen hundreds. The water level measurements provide an annual record of changes in ground water storage.

In the beginning, the detailed obser vation wells were primarily confined to those areas experiencing irrigation well development near Hereford, Lockney, Lubbock, Plainview, and Muleshoe. At about this same time, personnel of the U. S. Geological Survey established numerous observation wells, primarily windmill wells, along the highways connecting the major cities and towns through the High Plains of Texas.

The first water level measurements that were to continue on an annual basis were made by personnel of the U. S. Geological Survey in cooperation with the Texas Water Commission (then the Board of Water Engineers) and other governmental agencies.

During the war years (1942-1945)

Frank Rayner, Texas Water Commission, is placing an identification tag on the concrete base of a pump. The tag, and the number stamped on it are used for identification. (Photo by Friona Star Staff)

MERRY CHRISTMAS
AND HAPPY NEW YEAR
From The High Plains Water District

Slated For Early January

the lack of personnel necessitated a major curtailment of the annual water level measurements. After this period, irrigation well development accellerated, and numerous observation wells were added by persons concerned with underground water developments and studies in localized areas, thereby establishing observation well concentrations and leaving large irrigated areas without the benefit of observation well coverage. This necessitating the expanding and updating program between the Water District and the Water Commission.

WATER LEVEL MEASUREMENTS

The water levels are measured with a thin steel tape. These tapes, which are spooled in 300 and 500 foot lengths, are graduated in feet, with about 30 feet of the free-end being graduated to the hundreths of a foot. The operator, after noting the previous year's measurement, enters enough tape into the well annulus to insure wetting a portion of the free-end of the tape.

After extraction from the well, the footage of the wetted portion of the tape is then subtracted from the total length of tape entered into the well, the difference being the depth of water. This measurement is then recorded in reference to some datum, usually the general land surface in the vicinity of the well measured.

ANNUAL MEASURING PERIOD

In the High Plains Area, observation wells are measured during December and January of each year. The primary factors determining the selection of the midwinter season are:

* Reasonable rest (recovery) period after the end of the summer irrigation season, and the early fall "wheat" irrigation
* Before the early spring preplant irrigation season
* The time and personnel to measure several hundred wells
* The necessity of making water level masurements near the same date every year

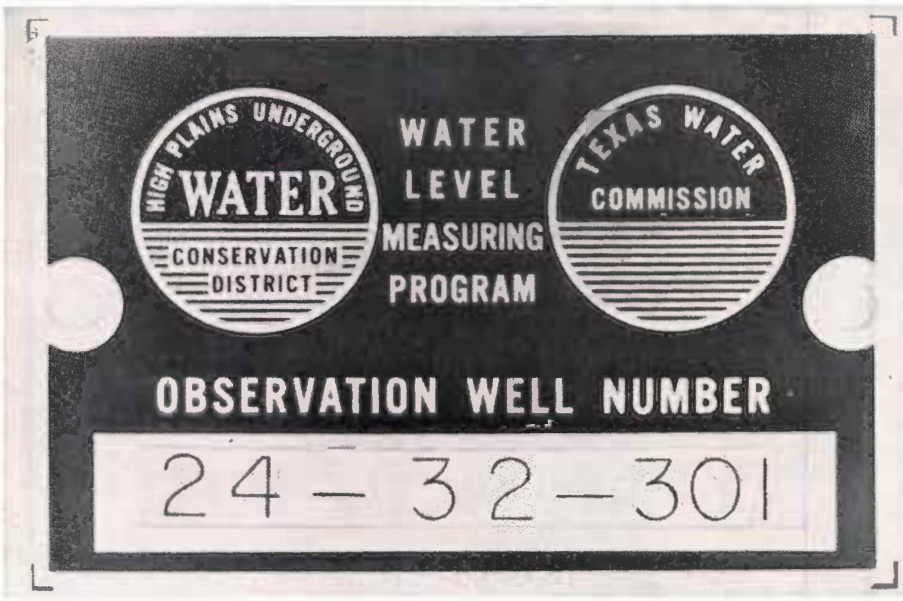
AVAILABILITY OF RECORDS

Any owner of a "tagged" observation well can quickly identify the records pertaining to his well by comparing the number on the identification plate with the well number as published by the Texas Water Commission or the District.

The numbering system, developed by the Texas Water Commission in 1960, is based n the longitudinal and latitudinal grid pattern. This system employing seven digits, provides for the location and identification of each well so numbered with no two wells possessing the same seven number series.

Water level records are available in the Lubbock Office of the District and through the Texas Water Commission at P. O. Box 2311, Capitol Station, Austin 11, Texas.

Wayne Wyatt, field representative for the Water District, is measuring an observation well. In this picture the graduated, steel tape is being inserted into the well annulus. After the well has been measured, a loose tag will be attached, which will have the 1963 and 1964 measurements on it.



The indentification plate affords the owner of the observation well a method of identifying the records pertaining to his well by comparing the number on the identification plate with the well number as published by the Water Commission or District.

HIGH PLAINS WATER DISTRICT
1628 — 15th Street
Lubbock, Texas
Gentlemen:

Will you please send me one of the District's new brochures entitled, "High Plains Water Depletion Case — Its Effect on Me and My Community." Send free of charge to the address shown below:

Name _____

Mailing Address _____

City and State _____

THE Cross SECTION

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CLAUDETTE McINNIS
Editor

WATER IS YOUR FUTURE CONSERVE IT

Board Calls Annual Election, January 14

The ballot for the High Plains Underground Water Conservation District's Annual Election will have an added question for the voter's consideration on January 14.

The (unusual) question on the ballot will be for and against the anexation of more than 800 square miles of Swisher County to the District. At the same time that people living within the bounds of the district are deciding this question, the people of Swisher County will also be voting for and against the annexation question.

On the 1964 ballot the resident voters will be voting for two District Directors, who will serve on the District Board for two-year terms, and two committeemen, from each county who will hold three-year terms of office.

FOR DISTRICT DIRECTOR

(One to be elected for each precinct)

PRECINCT TWO (Cochran, Hockley and Lamb Counties)
1. V. E. Diersing, Pep
2. Weldon Newsom, Morton
3. Henry J. Schmidly, Levelland
4. H. G. Walker, Olton
5. _____

PRECINCT FIVE (Floyd County)
1. Chester Mitchell, Lockney
2. _____

FOR COUNTY COMMITTEEMEN

(Two to be elected for each county)

ARMSTRONG COUNTY
(Two to be elected—Commissioner's Precinct No. 3)
1. Foster Parker, Happy
2. Clifford Stevens, Happy
3. Wayne McNeil, Happy
4. Jack McGehee, Wayside
5. _____

BAILEY COUNTY
(One to be elected—Commissioner's Precinct No. 2)
1. D. O. Burelsmith, Muleshoe
2. James P. (Jimmy) Wedel, Muleshoe.
3. _____

(One to be elected—Commissioner's Precinct No. 4)
1. Lester Howard, Muleshoe
2. W. L. (Willie) Welch, Mapel
3. _____

CASTRO COUNTY
(One to be elected—Commissioner's Precinct No. 2)
1. Earl Lust, Dimmitt
2. Frank Wise, Dimmitt
3. _____

(One to be elected—Committeeman at Large)
1. Ray Riley, Dimmitt
2. Tommy Stanton, Dimmitt
3. _____

COCHRAN COUNTY
(One to be elected—Commissioner's Precinct No. 1)
1. H. B. Barker, Morton
2. Ray Griffith, Morton
3. _____

(One to be elected—Committeeman at Large)
1. D. A. Ramsey, Morton
2. E. J. French, Sr., Levelland
3. E. E. (Bud) Thomas, Morton
4. _____

DEAF SMITH COUNTY
(One to be elected—Commissioner's Precinct No. 1)
1. Charles Packard, Hereford
2. G. W. Duncan, Hereford
3. _____

(One to be elected—Committeeman at Large)
1. J. E. McCathern, Jr., Hereford
2. Virgil Marsh, Hereford
3. _____

FLOYD COUNTY
(One to be elected—Commissioner's Precinct No. 4)
1. Kenneth Willis, Floydada
2. Tate Jones, Floydada
3. _____

(One to be elected—Commissioner's Precinct No. 2)
1. Forrest Mickey, Lockney
2. Bill Sherman, Lockney
3. _____

HOCKLEY COUNTY
(One to be elected—Commissioner's Precinct No. 3)
1. Leon Lawson, Levelland
2. T. C. Ivey, Levelland
3. _____

(One to be elected—Committeeman at Large)
1. Bryan Daniel, Levelland
2. Horace Abston, Ropesville
3. _____

LAMB COUNTY
(One to be elected—Comissioner's Precinct No. 4)
1. Richard West, Sudan
2. Halbert Harvey, Sudan
3. _____

(One to be elected—Comissioner's Precinct No. 1)
1. Willie Green, Olton
2. J. L. Snider, Olton
3. _____

LUBBOCK COUNTY
(One to be elected—Commissioner's Precinct No. 3)
1. Weldon M. Boyd, Idalou
2. F. I. Johnson, Idalou
3. _____

(One to be elected—Committeeman at Large)
1. Bill Dorman, Lubbock
2. _____

LYNN COUNTY
(One to be elected—Commissioner's Precinct No. 4)
1. Harold Gene Franklin, Tahoka
2. Oscar H. Lowery, Tahoka
3. _____

(One to be elected—Comissioner's Precinct No. 1)
1. Hubert C. Teinert, Wilson
2. George Williamson, Wilson
3. _____

PARMER COUNTY
(One to be elected—Commissioner's Precinct No. 4)
1. J. B. Jennings, Muleshoe
2. Henry Ivy, Friona
3. _____

(One to be elected—Committeeman at Large)
1. Walter Kaltwasser, Farwell
2. Melvin Jones, Farwell
3. _____

POTTER COUNTY
(Two to be elected—Commissioner's Precinct No. 4)
1. E. L. Milhon, Amarillo
2. Eldon Plunk, Amarillo
3. _____

RANDALL COUNTY
(One to be elected—Commissioner's Precinct No. 4)
1. Lewis Tucek, Canyon
2. E. A. Stocker, Canyon
3. _____

(One to be elected—Commissioner's Precinct No. 2)
1. Ed Wieck, Canyon
2. Bernard Hartman, Canyon
3. _____

POLLING PLACES

ARMSTRONG COUNTY
1. School House in Wayside

BAILEY COUNTY
1. Enochs' Gin, Enochs
2. Community House, Muleshoe

CASTRO COUNTY
1. Hardware Company, Nazareth
2. County Courthouse, Dimmitt
3. Easter Community Center, Easter
4. American Legion Hall, Hart

COCHRAN COUNTY
1. County Activities Bldg., Morton
2. Star Route Co-Op Gin, 5 miles west of Morton

DEAF SMITH COUNTY
1. County Courthouse, Hereford

FLOYD COUNTY
1. County Courthouse, Floydada
2. City Hall, Lockney

HOCKLEY COUNTY
1. City Hall, Anton
2. Farm Center Gin, Ropesville
3. County Courthouse, Levelland
4. Whitharral Lions Club Bldg., Whitharral
5. City Hall, Sundown

LAMB COUNTY
1. City Hall, Olton
2. City Hall, Sudan
3. Community Bldg., Earth
4. County Courthouse, Littlefield
5. Farmer's Co-Op Gin, Spade

LUBBOCK COUNTY
1. Community Clubhouse, Shallowater
2. City Hall, Wolfforth
3. Old County Courthouse, Lubbock
4. City Hall, Idalou
5. Community Clubhouse, Slaton

LYNN COUNTY
1. Community Center, New Home
2. City Judge's Office, Wilson State Bank Wilson

PARMER COUNTY
1. City Hall, Friona
2. Wilson & Brock Insurance Agency, Bovina
3. County Courthouse, Farwell
4. Schoolhouse, Lazbuddie

POTTER COUNTY
1. Schoolhouse, Bushland

RANDALL COUNTY
1. Consumer's Fuel Ass'n. Elevator, Ralph Switch
2. VFW Hall, 1 mile North of Canyon
3. Columbus Club Hall, Umbarger

High Plains Underground Water Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas

Second Class Permit