THE Cross SECTION

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

Volume 12—No. 8 "THERE IS NO SUBSTITUTE FOR WATER" *January 1966*

District Residents Elect Directors and Committeemen

RUSSELL BEAN

WELDON NEWSOM

CHESTER MITCHELL

The annual election of the High Plains Underground Water Conservation District No. 1 was held January 11. This year's election was different from many of the past, in that the annexation of new lands to the district was involved .

Three of the present five district directors were returned to their board posts.

Russell Bean was re-elected to the board representing Precinct 1, which is composed of Lubbock and Lynn Counties. Bean is presently serving as Board Chairman.

Precinct 2, Cochran, Hockley and Lamb Counties re-elected Weldon Newsom of Morton to represent the three above mentioned counties. Newsom is presently serving as secretary of the board.

Chester Mitchell of Lockney, was re-elected to the Precinct 5 position. This precinct is composed of Floyd County.

All three of the Directors will serve a two year term, with the remaining two directors positions due for election in 1967.

Thirteen county committeemen were elected to serve for two years. these individuals will serve their county on the local board, approving drilling permits and recommending policies to the district board. These county groups are the "backbone" of the High Plains Water Conservation District and their service is invaluable to the progress of the district.

Individuals elected to the county committees are: John Patterson of Armstrong County, J. W. Witherspoon of Bailey County, Calvin Petty of Castro County, Willard Henry representing Cochran County, W. H. Gentry representing Deaf Smith County, Edward C. Moseley of Lubbock County, Don Smith of Lynn County, Webb Gober of Parmer County, W. J. Hill, Jr. representing Potter County and Ralph Ruthart of Randall County.

This years' ballot also included the proposal to annex some new lands in Cochran County. These new lands are located South of Whiteface and North and West of Morton. These lands became eligible to enter the Water District after intensive studies of the Texas Water Development Board revealed that the Ogallala formation lay beneath them and sufficient quantities of water could be produced from the formation. A vote of the residents of the areas indicated their desire to become a part of the District.

Advantages that the residents of the newly added areas will benefit from are: Assistance in the conservation, preservation, protection, recharging and prevention of waste of ground water; well spacing protection; log information of irrigation well development; tax depletion information for irrigation water depletion, and local representation in local state and federal legislation that would affect the Water District.

Residents of the existing District were happy to receive the new areas into the High Plains Water District.

IRRIGATION WATER QUALITY

The rapid expansion of irrigation in the Southern High Plains and other parts of Texas has resulted in many inquiries as to the limitations water quality may place on continued irrigation. Since discussions of water quality generally appear in technical publications, information on the subject is not readily available to the average farmer. The following discussion has been prepared at the suggestion of the Editor so that readers of the Cross Section may be better informed on how quality of water may affect irrigation farming.

Continued successful operation of irrigated farms involves not only sup-

(Continued on Page 4)

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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
Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

Water Depletion News

Numerous inquiries have been pouring into the High Plains Water District office from Texas taxpayers and accountants across the High Plains as to how and when they can begin figuring tax deductions for 1965 income tax returns for water used in the business of irrigation farming. Also, the question of refunds for the taxable years 1962, 1963, and 1964 has arisen.

Russell Bean, Chairman of the Board of Directors of the Water District stated that the District office recently received a published technical information release from the United States Treasury Department which states that the Internal Revenue Service would follow the decision of the United States Court of Appeals in United States v. Shurbet. The Shurbet case held that landowners in the Southern High Plains are entitled to a cost depletion deduction for ground water from the Ogallala formation used by them in their business of irrigation farming. The release emphasized the deduction would be allowed to any taxpayer who could prove, first, a decline of his ground water during the taxable year; second, the thickness of the water formation under his farm at the time of purchase; and third the actual cost basis in his water.

The first two factors can be easily determined by the taxpayer if his land lies within the bounds of the Water District. Contour maps showing the saturated thickness for various years, together with maps showing the annual decline of the water table, have been prepared by the Water District from a vast amount of data collected in the field by county and district offices over a period of 14 years. The second factor requires the taxpayer to prove the purchase price of his land and allocate part of that purchase price to the ground water.

The Water District has caused a study to be made so that guidelines can be published indicating the amount of the purchase price that can be allocated to water under ordinary conditions.

Current discussions have been held with the Internal Revenue Service so that the contour maps and the cost guidelines will probably be accepted when completed.

The factors described above can be set out by the following formula:

Decline of water table in taxable year
Thickness of water formation when purchased X Cost of Water

For example if a farmer paid $300 an acre for irrigated land and similar dry land was selling for $100 per acre, then $200 per acre is the cost of the water: if there was 100 feet of water formation under the land at the time of purchase, and if the water table declined three (3) feet during the taxable year, then the cost depletion deduction is $6 per acre.

(3/100 X $200 - $6.00)

The information necessary for taking the water depletion deduction on 1965 income tax returns will not be completed by February 15, 1966, (the date some farmers ordinarily file their income tax returns), but will be completed before April 15, 1966. Accordingly, a taxpayer has two alternatives. First, he can file an estimated tax return on January 15, 1966 and file his income tax return on April 15, 1966 with the water depletion deduction taken thereon. Also, on or before April 15, 1966, he can file refund claims for 1962, 1963 and 1964. The second alternative is for the taxpayer to file his return as usual on February 15, 1966 without taking the deduction, and at some later date he can file refund claims for 1962, 1963, 1964, and 1965. Of course, the refund claim for 1962 must be filed by April 15, 1966.

Mr Bean also announced that a tax institute under the auspices of Texas Technological College will be held on March 11, 1966. At this tax institute final details for the calculation of the water depletion deduction will be published and discussed. Under present plans, representatives of Texas Technological College, the Internal Revenue Service, and the High Plains Water District will participate in the tax institute. In addition, a representative of the Texas Water Development Board will present the position of taxpayers whose irrigated land lies outside of the High Plains Water District.

The tax institute will be open to the public. Reservations can be obtained by writing Haskell Taylor, Box 4129, Tech Station, Lubbock, Texas, and enclosing a check in the amount of $5.00 to cover the cost of the luncheon and a copy of the proceedings.

DRILLING STATISTICS FOR DECEMBER

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Dry Holes
Armstrong	9	7	0	0
Bailey	4	3	0	0
Castro	9	8	1	0
Cochran	0	0	0	0
Deaf Smith	13	11	2	1
Floyd	7	8	0	0
Hockley	15	4	0	1
Lamb	6	2	1	0
Lubbock	17	8	1	1
Lynn	8	4	0	0
Parmer	11	15	1	0
Potter	0	1	0	0
Randall	7	8	0	0
Total	106	79	6	3

NOW IS THE TIME TO ACT—

Guards On Pumps

One of the most dangerous omissions that an irrigation farmer can be guilty of is that of leaving the drive shaft between his irrigation pump and engine exposed.

We all remember the story that appeared in our nations' newspapers that told of a 12-year old girl whose pony-tail became entangled in the moving parts of a potato-digging machine. As a result of this tragic accident, she lost her ears, eyebrows and scalp. Death ultimately claimed this 12-year old.

This was a terrible thing, and we found ourselves saying that it is difficult to understand how such an accident could happen and why the moving parts on the digger were not covered to prevent such an occurrence.

Well, the answer as to "why" may never be evident; however, one thing is certain—the potentially dangerous gears, etc. of that particular potato digger are no doubt adequately guarded today. The regretable thing about it is that the safeguards came too late. The cost of this lesson was too expensive.

Parallel this incident with the picture here in our own backyard, so to speak. We literally have thousands of irrigation wells in the southern High Plains of Texas that do not have any form of cover or guard that would offer protection from contact with high speed drive shaft that transmits power to the pump from the engine.

If any model, of the many guards that are manufactured to cover exposed drive shafts, was expensive, an irrigator would perhaps have an excuse for not having one on each well that he operates, but all are probably under $10 in price. Therefore, the expense is not much of a factor.

What is the reason then for these many drive shafts remaining exposed?

Probably the principal reason can be traced back to our old friend "complacency." He can be a bitter foe. Most of us simply cannot feature tragic things happening to us. Oh, sure, these things occur every day, but always to someone else.

That's probably what a lady who lives in Lubbock today thought, until her hair became accidentally entangled in an irrigation drive shaft back in 1948. This particular woman was observing a pumping well on her husband's farm near Anton in Hockley County at the time of the accident. She leaned in to get a better view of the water being pumped from the well. The next thing she remembered was regaining consciousness in a Lubbock hospital. The agonizing pain that she felt was caused by the fact that one of her eyebrows and her entire scalp had been ripped from her head by the irrigation well's treacherous drive shaft. For weeks she lay at the brink of death. When finally the ordeal of facing death itself had passed, the months of expensive and painful surgery began.

This is not a fictitious story. It actually happened, and it happened here at home.

Don't shrug your shoulders and say to yourself that this is a one chance in a million occurrence. You have children who are looking to you for the proper decision in this matter. Consider them—their very lives may depend on your decision. Consider also the adult friends who come by your well to watch and visit. Their safety too may well depend upon your decision.

Today place a protecting guard on every irrigation well drive shaft that is exposed on your farm. It might well be one of the wisest things that you will ever have an opportunity to do.

Think about it ——— then act!!

Water Committee Met January 13 In El Paso

The Water Resources Committee of West Texas Chamber of Commerce met January 13 in El Paso.

The committee was addressed by K. D. McFarland of the Ralph M. Parsons Company, and Joe Moore, Executive Director of the Texas Water Development Board.

McFarland's address dealt with the North American Water and Power Alliance conception of imparting water to the western states of the United States. He explained the concept and revealed that the plan called for the annual delivery of twelve million acre feet of water to Texas. The estimated cost of this water, depending on its use, would be from four to fifteen dollars at ditch side. McFarland further stated that it was very difficult to give an exact cost figure for the water since their studies of water costs were not complete.

Moore commented on the progress of the State Wide Water Plan. He stated that the Texas Water Rights Commission was going to start immediately determining water rights and try to do away with some of the back log of old permits that are now in effect, but are not in use.

He brought the group up-to-date on the status of the plan and said it would be presented to the governor in the early part of this year.

Water Institute Conference Scheduled

The West Texas Water Institute will conduct its fourth annual West Texas Water Conference Feb. 4 in the Student Union Building on the Texas Tech campus, according to Dr. Gerald Thomas, chairman of the institute and Dean of Tech's School of Agriculture.

Registration will begin at 8 a.m., and the conference will convene at 9 a.m.

The conference will be highlighted by release of a summary by the institute's research committee of all research projects pertaining to West Texas water resources.

Dr. Thomas said the Texas Water Development Board also will distribute several publications relating to the state wide water plan. They will contain a survey of sewage effluent use, an economic study of underground water and the multi-purpose modification of playa lakes for conservation, irrigation and public health.

Conference topics include the Texas Statewide Water plan, Importance of irrigation to the West Texas Economy, Weather Forecasting in West Texas, Groundwater in Texas and Water Use Efficiency.

"This conference should be of great interest to farmers, businessmen and others of West Texas," Thomas said.

JUST WONDERING

Expressing some wonder as to "why someone has not written more about things than the water problem" on the Plains, Claude B. Hurlbut, area farm and ranch loan agent and long time Plains resident, suggests that "before someone sells this country short, we ought to stop and think and realize the whole situation."

He referred to the Ogallala water formation underlying the lower part of the Texas Plains, where the static level has been dropping some each year in most of the area.

But, he observes, first "all irrigation areas have a water problem of one kind or another and in most areas—but not in ours—if they are out of water their land is worth a little less than nothing," then added:

Good Dryland Production

"This country was, and is, one of the most productive areas in the state in dryland farming. Our average production of cotton per acre on dryland over a ten year period is greater than the best blackland in Texas. That is with no irrigation, we should not forget. We do have water and with careful using should have it a long time.

"The reason is our rich natural soil, but besides that we have a clay subsoil beneath our top soil of rich land that takes and holds our rainfall until it is needed by our growing crops. I have seen several crops of cotton, etc. grow here after a wet winter with very little rainfall during the growing season.

"Second, did you know that a lot of irrigation areas in New Mexico, Arizona and California have to have feet of irrigation water to our inches and instead of having rich soil to commence with, they just have a place to make soil with fertilizer, etc. Our soil cannot be beat anywhere.

Heavy Cotton Producer

"Third, we are now producing around 40 percent of the Texas cotton in 20 or so counties surrounding Lubbock and nearly 20 percent of the cotton of the nation, even under restricted acreage, and we are still using more water than is good for our crops. I know of farmers who, I am sure, are using twice the water the crops need. As we improve our knowledge of irrigation, that would not be done.

"I have some interests in Colorado in irrigated land, and the government recently by experiments found that more hay with three times the amount of protein can be grown with a third of the water which they had been using.

"Fourth skip row farming brings up dryland production of the planted portion to very near irrigation production and also allows for building the soil.

Learned How To Keep Land Good

"Fortunately we did not damage our rich soil out here by bad methods before we learned how to keep it good, like almost the east half of the nation did, and I doubt we ever will be that foolish. Go back in the eastern states and see how much of their one-time rich land has had to be put back in grass.

"I doubt very seriously if anything is likely to happen that will retard the growth and development of this great country. I never saw as little good land for sale in this area. They evidently like it.

Irrigation Water —

(Continued from Page 1)

plying of irrigation water to the land but also control of the salinity and alkalinity of the soil. The quality of irrigation water, irrigation practices, and drainage conditions are involved in salinity and alkali control. Soil that was originally nonsaline and nonalkali may become unproductive if excessive soluble salts or exchangeable sodium are allowed to accumulate because of improper irrigation and soil management practices or inadequate drainage.

In areas of sufficient rainfall and ideal soil conditions, the soluble salts originally present in the soil or added to the soil with water are carried downward by the water and ultimately reach the water table. The process of removal of soluble material by the passage of water through the soil is called leaching. If the amount of water applied to the soil is not in excess of the amount needed by plants, there will be no downward percolation of water below the root zone and an accumulation of mineral matter will form in that zone. Likewise, impermeable soil zones near the surface can retard the downward movement of water, resulting in waterlogging of the soil and deposition of salts. Unless drainage is adequate, attempts at leaching may not be successful, because leaching requires the free passage of water through and away from the root zone.

Irrigation waters, whether diverted from surface streams or pumped from wells, carry certain chemical substances in solution, dissolved from the rocks or soils over which the waters have passed. The concentration and nature of these dissolved constituents determine the quality of the water for irrigation use.

Accurate chemical analyses of irrigation waters identify the more important substances that are present and show their concentration. From such analyses, it is possible to classify waters in terms of their suitability for irrigation and to anticipate with some assurance the effect of the water on crops and on soils.

The characteristics of an irrigation water that seem to be most iimportant in determining its quality are: (1) total concentration of soluble salts; (2) relative pro-portion of sodium to other principal cations (magnesium, calcium ,and potassium); (3) concentration of boron or other elements that may be toxic ;and (4) under some conditions ,the bicarbonate concentration as related to the concentration of calcium plus magnesium. These have been termed the salinity hazard, the sodium (alkali) hazard, the boron hazard, and the bicarbonate hazard.

For purposes of diagnosis and classification, the total concentration of soluble salts (salinity hazard) in irrigation water can be adequately expressed in terms of specific conductance. Specific conductance is the measure of the ability of the ionized inorganic salts in solution to conduct an electrical current, and usually expressed in terms of micromhos per centimeter at 25 degrees C. Where a conductance determination is not a part of the analysis, a rough approximation of the specific conductance values can be obtained by multiplying the sum of the equivalent per million of the principal cations (calcium, sodium, magnesium, and potassium) by 100, or by dividing the dissolved solids in parts per million by a factor of 0.6 to 0.7. In general, water having a conductance below 750 micromhos per centimeter is satisfactory for irrigation insofar as salt content is concerned, although salt-sensitive crops such as strawberries, green beans ,and red clover may be adversely affected by irrigation water having a conductance in the range of 250 to 750 micromhos per centimeter. Water in the range of 750 to 2,250 micromhos per centimeter is widely used ,and satisfactory crop growth is obtained under good management and favorable drainage conditions, but saline conditions will develop if leaching and drainage are inadequate. Use of water for irrigation having a conductance of more than 2,250 micromhos per centimeter is not common, although such water has been used for many years in the Pecos Valley in Texas with considerable success.

In the past, the relative proportion of sodium to other cations (sodium hazard) in irrigation water usually has been expressed simply as the percentage of sodium among the principal cations (expressed in equivalents), or simply the percent sodium. Irrigation waters were divided into three classes, based on the percent sodium. Water with a percent sodium less than 60 was considered excellent to good; water with a percent sodium between 60 and 75 was considered good to injurious; while water with a percent sodium greater than 75 was considered injurious to unsatisfactory. According to the U. S. Department of Agriculture, the sodium-adsorption ratio, used to express the relative activity of sodium ions in exchange reactions with soil, is a better measure of the suitability of water for irrigation with respect to the sodium hazard. The sodium-adsorption ratio is easily computed from the data determined in the usual water analysis, and is now frequently included with the analytical data.

When the sodium-adsorption ratio and the specific conductance of a water are known, the classification of the water for irrigation can be determined by graphically plotting these values on the diagram shown in Figure 1. Low-sodium water (S 1) can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. Medium-sodium water (S 2) will present an appreciable sodium hazard in certain fine-textured or organic soils having good permeability. High sodium water (S 3) may produce harmful levels of exchangeable sodium in most soils and will require special soil management such as good drainage and leaching and additional organic matter. Very high sodium water (S 4) is generally unsatisfactory for irrigation unless special action is taken ,such as addition of gypsum to the soil.

Low salinity water (C 1) can be used for irrigation of most crops on most soils with little liklehood that soil salinity will develop. Medium-salinity water (C 2) can be used if a moderate salt tolerance, such as potatoes, corn, wheat, oats, and alfalfa, can be irrigated with C2 water without special practices. High-salinity water (C 3) cannot be used on soils of restricted drainage. Very high-salinity water (C 4) is not suitable for irrigation under ordinary conditions. It can be used only on very salt-tolerant crops and then only if special practices are followed, including a high degree of leaching.

Boron is essential to the normal growth of all plants, but the quantity required is very small. A deficiency of boron produces striking symptoms in many plant species. Boron is very toxic to certain plant species and the concentration that will injure these sensitive plants is often approximately that required for normal growth of very tolerant plants. For instance, lemons show definite and, at times, economically important injury when irrigated with water containing 1 ppm of boron, while alfalfa will make maximum growth with 1 to 2 ppm of boron.

In water having high concentrations of bicarbonate, there is a tendency for calcium and magnesium to precipitate as the water in the soil becomes more concentrated. This reaction ordinarily does not go to completion, but insofar as it does proceed, there is a reduction in the concentration of calcium and magnesium and therfore a relative increase in sodium, resulting in an increase in the alkalinity of the soil water. The calcium and magnesium are precipitated as the carbonates, and any carbonate or bicarbonate left in solution is termed "residual sodium carbonate."

On the basis of limited data and using the "residual sodium carbonate" concept described above, it is concluded by the Department of Agriculture that water having more than 2.5 equivalents per million (epm) residual sodium carbonate is not suitable for irrigation purposes because of the posible effect on soil structure such as puddling and solution of organic materials. Water containing 1.25 to 2.50 epm of residual sodium carbonate is marginal ,and water containing less than 1.25 epm is safe. Where not given with the analysis, the residual sodium carbonate can be computed from the usual complete water analysis.

In appraising the quality of an irrigation water, first consideration must be given to salinity and sodium hazards by reference to Figure 1. Then consideration should be given to independent characteristics such as boron and bicarbonate, either of which may change the quality rating. The use of water of any quality must first take into account such factors as drainage and management practices.

The foregoining discussion of the affects of water quality were developed from experience in arid areas where rainfall is low and most of the water used by crops is applied by irrigation. In portions of East Texas, supplemental irrigation is being recommended to insure crop production during low rainfall years.

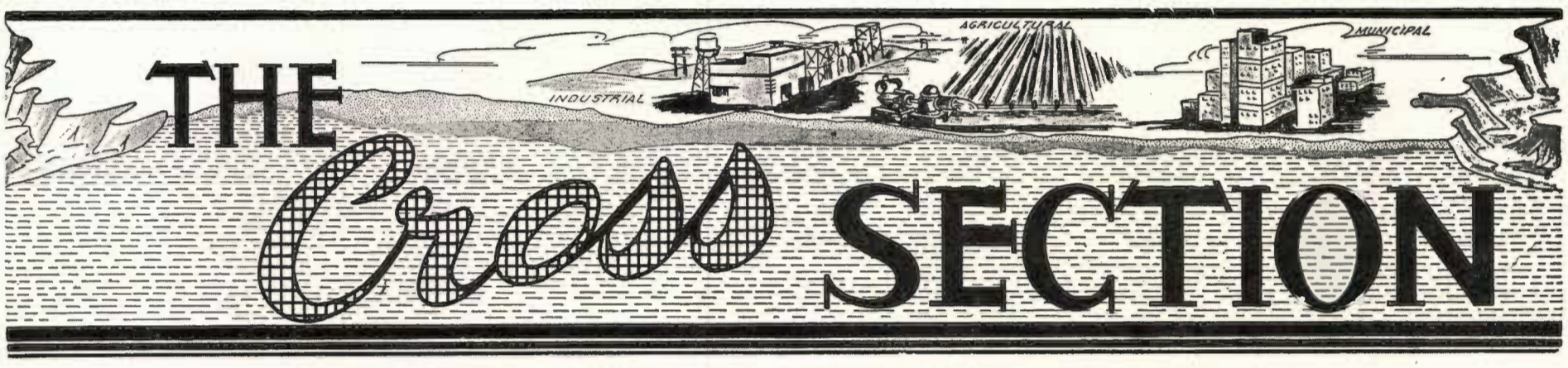
Supplemental irrigation is probably less affected by water quality, but information and experience are not sufficient to classify irrigation waters for high rainfall areas. However, it is known that serious leaf burn has occurred in areas where saline irrigation waters have been applied by sprinklers. Boron poisoning of sensitive plants may also occur. Hence, even in East Texas farmers should make certain that water quality is satisfactory when developing new irrigation supplies.

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."

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas 79401

Second Class Permit



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Ground Water Depletion

The annual water level measurements of more than 800 observation wells in the High Plains Water District were recently completed. These measurements are made each year during January. The Water District, in cooperation with the Texas Water Commission, is attempting to provide the people of the High Plains area with the best water level information available anywhere. Numerous observation wells were established several years ago in what were then areas of heavy pumpage. During recent years, the areas of heavy pumpage have grown until today there is one vast area. Consequently, the observation well network has continued to expand to keep pace with the well development. Today there are more than 1700 observation wells in a 39-county High Plains area. Over 800 of these observation wells are in the 13-county area of the High Plains Water District.

The records of water levels in wells and their interpretation have long formed an important part of ground water work. Time is required to obtain reliable results in ground-water investigations. Ground water work does not deal with definite events that occurred in the past and can be studied at any time. Ground water work deals with events that are always changing. Therefore, past records that were not recorded are gone forever, and future records can be obtained only with the passing of time. For this reason, periodic observations should be made and records of ground water changes should be kept so that reliable data will accumulate for use in the future.

The value of a continuous record of water-level measurements increases greatly with the length of the record. Many of the present observation wells have records of water level measurements since the late 1930's. Numerous wells around Lockney, in Floyd County, and Plainview, in Hale County, have water records as far back as 1914 and 1915. A stark realization of the magnitude of the depletion occurs when one measures a well in which it was 40 feet to water in 1914 and 160 feet to water in 1965

Even though the Ogallala formation extends throughout the entire Water District, the hydrologic conditions within this aquifer are varied and sometimes complex. Therefore, a large number of observation wells is needed to pick up the various changes in the aquifer. On the other hand, to make these water level measurements and have them properly filed and analyzed is expensive and time-consuming. Good judgment is required in order to keep the number of observation wells within feasible limits while providing the maximum of useful information. It is impossible to have an observation well on every farm. Therefore, the distribution of observation wells is a compromise between what is feasible and what will yield the maximum information.

The observation well program allows a better analysis of the effects which heavy pumping has upon the water table. In this issue of The Cross Section we are supplying the people of the Water District with their annual "Water Statement". By studying the water level measurements on the adjoining pages, the effects of pumpage during the year of 1965 can be determined.

The effects of the hot dry summer of 1964 were reflected in the decline of the water table of the entire district to the tune of 3.99 feet. The 1965 decline for the entire district was 2.08 feet. This decline is 1.91 feet less than the previous year. The decline for the district for 1963 was 2.49 feet.

Probable causes for the decrease in the average decline of the water table for the district are the scattered rains received during the summer, use of playa lakes for irrigation and the "water stretching" programs being used by farmers to cut down on the amount of water required to produce a crop.

If we continue to use ground water in the High Plains we eventually will reach a point of economic exhaustion. This has already happened in some areas. Other areas of the High Plains have enough ground water to last for many years to come. A practical method for meeting the water depletion problem is the improvement of water conservation practices. However, this will at best only serve to extend the life of the area's water supply. Therefore, some long range thinking and planning are needed if the High Plains is to have adequate water to maintain its economy in the future.

In a democracy, adequate public understanding is essential to the support of any desirable public program. The development of informed public opinion about water resources would do more toward getting what the High Plains needs in water resource policy, and implementing that policy in the long run, than any other specific item. But public understanding involves something more than widespread interest and anxiety. It must be based on a recognition of (1) the dimensions of the problems and how they vary from area to area, and (2) the range of possible solutions that the people can adopt.

If the urgent requirements for additional water supplies are to be met, vigorous and enlightened leadership must be provided by the leaders of each and every community. The people of the High Plains should take to heart the words engraved on the speaker's stand in the House of Representatives. These words by Daniel Webster are, "Let us develop the resources of our land, call forth its power and build its institutions, promote all its great interests and see whether we also, in our day and generation, may not perform something worthy to be remembered."

Tax Institute On Water Depletion Deduction

Clarence P. Brazill, Jr., president of the Texas Tech Tax Institute, has announced plans for a special meeting to be held March the 11th in the Student Union Building on the Tech campus.

Highlight of the event will be the discussion and explanation of the calculation of the water depletion deduction for Federal tax purposes.

Representatives of the Internal Revenue Service, Texas Water Development Board, High Plains Underground Water District, and Texas Technological College will deliver the program.

Individuals attending the conference will be shown the materials and taught the method that can be used and will be accepted by the Internal Revenue Service in calculating water depletion allowances on the Southern High Plains of Texas.

Brazill emphasized that *all* interested landowners, farmers, tax accountants, attorneys, businessmen and even housewives are welcome.

Registration for the conference is $5.00 which includes the cost of the noon luncheon.

Reservations for the conference which starts at 12:00 noon, may be made by writing Haskell Taylor, Texas Tech Tax Institute, Box 4129, Tech Station, Lubbock, Texas 79409. Advance registrations are requested.

West Texas Water Institute Held February 4

The West Texas Water Institute was held February 4 at Texas Technological College. A record attendance was present. More than 300 individuals registered for the event.

Speakers for the conference included Joe Moore, Jr., Director, Texas Water Development Board, Austin; Harvey O. Banks, San Francisco, California; Otha Dent, Commissioner, Texas Water Rights Commission, Austin; Bill J. Parsley, Vice President for Development, Texas Technological College and many others.

Banks ignited a fuse among the West Texans when he delivered his address. He made them aware of pending federal legislation known as H. R. 4671 or the Lower Colorado River Basin Act. The bill in its present form does not include Texas. The bill would authorize federal studies on means of augmenting the supply of water available for use in the Colorado River Basin, including the alternative of importing water from sources outside the Colorado River system's natural drainage area. The Columbia River below Bonneville Dam is reported to be one of the principle sources of surplus for importation that would be studied.

Banks made it very clear to the group that if West Texas was not included in the initial planning done by the bill that all the water would probably be appropriated to other areas and West Texas would never be able to obtain any water in future years from the basin.

The Water For The Future Committee of the West Texas Water Institute immediately set out to do whatever possible to have West Texas included in all future water plans for the Western States.

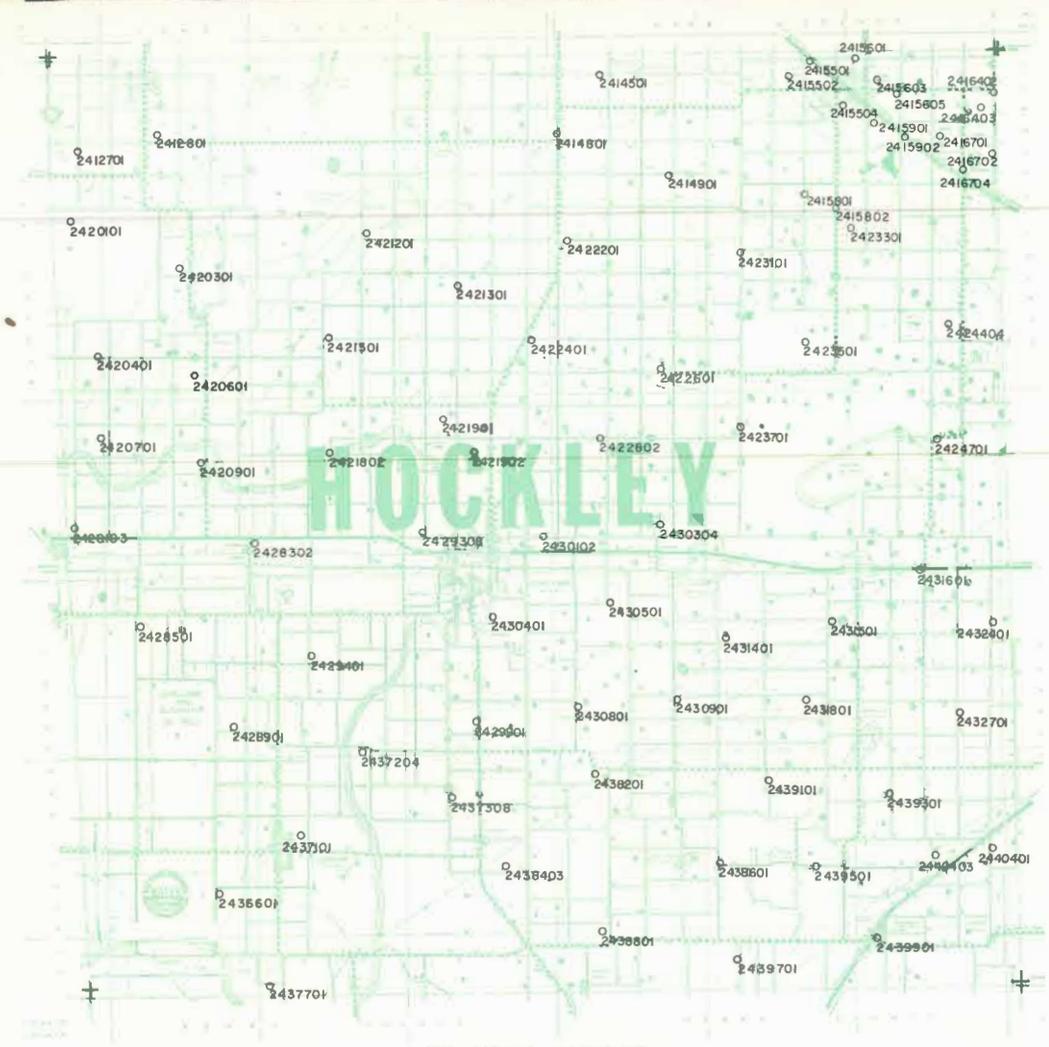
On February 19, G H. Nelson, Marvin Shurbet and A. C. Verner attended a meeting of the Western States Water Council in Phoenix Arizona. Their purpose was to sound out the possibilities of getting West Texas included in an interstate regional water plan now under active consideration by the council.

New Directors Named

Four new directors were elected to the West Texas Water Institute Board at a meeting of the Directors February 3 in Lubbock.

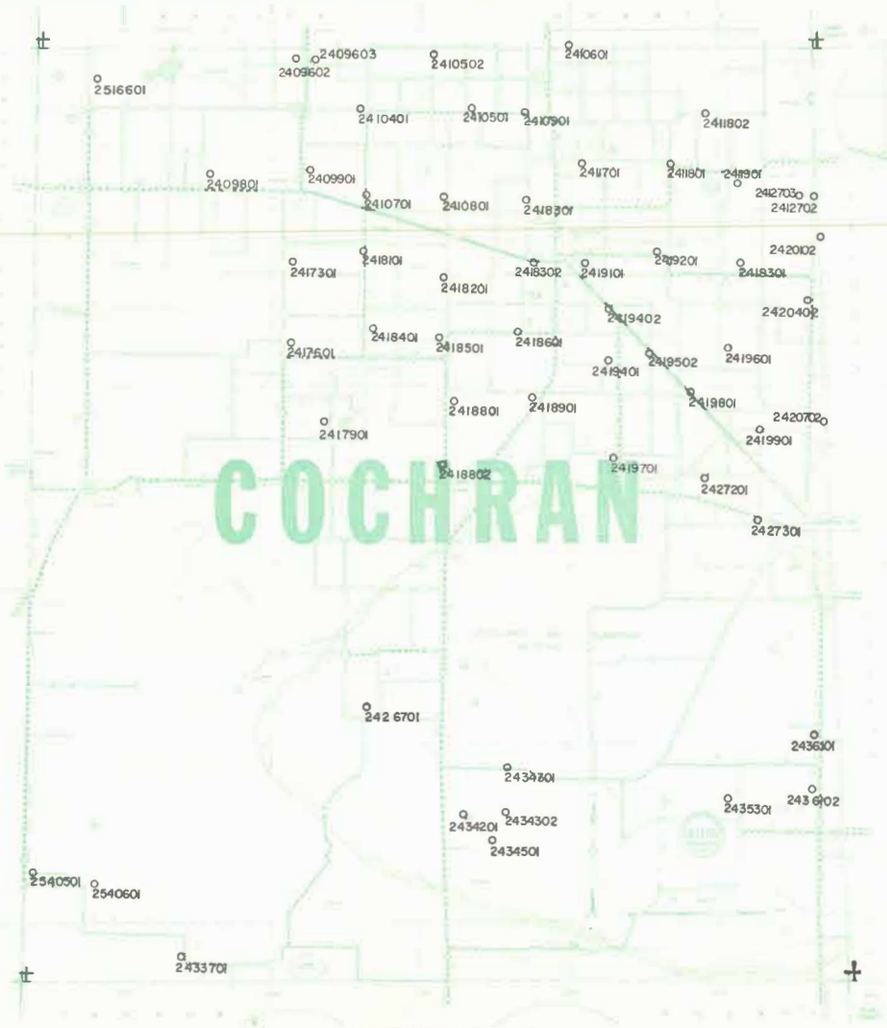
The new members are: A. L. Black, a farmer who lives at Friona, Texas· Loyan Walker of the West Texas Chamber of Commerce in Abilene; Don Anderson, a farmer from Crosbyton; and George McCleskey, an attorney who resides in Lubbock.

The present board members feel that the addition of these members will be of great benefit to the institute.



HOCKLEY COUNTY

Well No.	1962	1963	1964	1965	1966
24 12 701	077.45	078.00	078.57	079.48	080.30
24 12 801	124.75	125.93	125.99	139.40	136.90
24 14 501	106.00	105.44	105.65	107.72	109.40
24 14 801	050.27	050.34	050.10	055.82	053.30
24 14 901	096.06	095.93	096.37	102.68	104.80
24 15 501	063.90	066.32	066.06	068.44	072.43
24 15 502	074.90	.....	073.13	085.80	087.47
24 15 504	061.90	063.38	064.10	065.70	069.30
24 15 601	090.02	092.34	094.26	101.44	100.08
24 15 602	103.03	105.85	.....	.....	114.12
24 15 603	098.32	104.23	105.17	108.74	111.67
24 15 605	089.26	084.48	.....	089.50	092.20
24 15 801	129.00	134.00	133.00	135.88	132.70
24 15 802	173.30	174.60	171.29	172.68	178.86
24 15 901	041.20	041.96	042.00	046.00	051.48
24 15 902	034.64	043.29	043.09	048.60	048.84
24 16 402	124.29	123.26	124.22	127.00	129.18
24 16 403	093.55	098.77	098.17	106.14	104.30
24 16 701	058.38	060.23	060.70	062.74	065.30
24 16 702	085.47	088.15	088.65	093.08	100.98
24 16 704	085.60	104.20	105.50	.....	.....
24 20 101	129.37	134.40	138.30	156.82	159.60
24 20 301	115.21	118.99	121.60	137.41	140.14
24 20 401	111.08	115.01	114.30	118.98	123.32
24 20 601	133.24	137.50	.....	143.82	147.80
24 20 701	142.00	145.10	144.30	.....	145.66
24 20 901	120.72	124.85	.....	132.14	134.60
24 21 201	040.39	038.55	039.66	043.50	043.90
24 21 301	081.87	083.16	084.94	088.60	090.56
24 21 501	137.18	141.24	143.20	155.22	152.38
24 21 802	143.95	143.26	144.72	.....	151.92
24 21 901	141.77	142.42	146.52	149.64	152.72
24 21 902	150.52	149.80	152.78	153.64	159.02
24 22 201	075.38	074.53	075.08	080.62	078.24
24 22 401	084.41	083.41	082.80	084.48	.....
24 22 601	106.24	098.25	096.80	096.78	097.75
24 22 802	116.16	114.94	116.55	121.74	125.34
24 23 101	105.53	104.95	105.78	107.44	108.60
24 23 301	178.60	182.25	182.97	187.32	190.82
24 23 501	101.43	100.87	102.99	105.60	109.94
24 23 701	100.88	098.36	098.67	101.46	102.30
24 24 404	136.78	140.96	142.18	.....	.....
24 24 701	124.45	124.23	124.75	126.64	126.84
24 28 103	139.05	138.71	138.87	143.66	149.06
24 28 302	128.20	127.90	126.14	129.20	130.13
24 28 501	144.15	143.96	143.40	159.54	155.46
24 28 901	151.16	150.92	150.55	156.96	161.20
24 29 308	132.18	131.44	133.80	138.99	142.04
24 29 401	139.10	139.07	138.82	148.92	142.70
24 29 901	169.44	173.63	175.30	181.82	.....
24 30 102	125.39	124.65	125.96	130.00	135.64
24 30 304	096.40	096.08	097.11	100.86	101.07
24 30 401	117.17	119.95	121.14	124.76	128.30
24 30 501	116.73	112.23	114.27	117.42	121.99
24 30 801	159.59	162.71	161.61	165.33	167.36
24 30 901	146.63	145.07	146.87	151.02	158.40
24 31 401	118.35	117.51	119.45	123.40	126.70
24 31 501	073.78	073.66	075.51	077.76	078.96
24 31 601	113.81	115.14	116.78	118.94	120.10
24 31 801	142.09	141.39	142.31	143.47	145.03
24 32 401	099.50	101.45	101.15	105.56	106.74
24 32 701	113.12	111.74	111.78	116.44	116.04
24 36 601	142.21	143.30	143.24	149.05	153.38
24 37 101	135.14	135.11	135.29	140.34	144.24
24 37 204	.....	.....	137.36	137.71	140.82	143.48
24 37 308	131.63	130.55	131.75	138.24	149.10
24 37 701	151.00	150.76	150.25	151.66	152.30
24 38 201	154.64	154.46	156.67	159.70	164.46
24 38 403	154.00	151.74	153.35	156.54	158.74
24 38 601	119.80	124.27	124.09	125.10	132.80
24 38 801	155.97	154.91	157.15	162.82	165.30
24 39 101	147.50	146.34	148.30	150.84	155.20
24 39 301	142.72	142.30	142.79	144.64	147.76
24 39 501	130.19	129.79	130.81	133.50	140.98
24 39 701	108.85	107.05	107.84	112.80	118.10
24 39 901	090.70	091.65	091.89	.....	094.02
24 40 401	131.52	134.65	135.00	137.02	139.63
24 40 403	.....	139.77	141.30	141.77	146.78
10 55 902	115.10	117.92	120.96	126.32	130.14
10 55 904	110.66	113.94	115.87	123.17	125.87
10 56 102	.....	153.12	158.68	165.64	171.82
10 56 403	137.49	140.77	145.28	151.75	155.92
10 56 404	147.10	151.47	157.79	165.54	.....
10 60 101	110.52	111.70	111.83	117.38	119.59
24 08 401	.....	.....	137.53	145.02	143.37
24 08 701	.....	.....	114.98	120.18	121.71
24 12 101	070.45	069.21	069.92	071.69	073.48
24 15 201	.....	.....	105.16	110.44	119.48
24 15 506	067.92	072.12	072.77	078.16	078.85
24 15 609	115.40	118.36	118.94	.....	126.88



COCHRAN COUNTY

Well No.	1962	1963	1964	1965	1966
24 09 602	103.68	106.95	.....	112.70	115.98
24 09 603	099.31	102.98	.....	108.65	112.02
24 09 801	120.76	121.74	122.40	123.75	124.17
24 09 901	093.53	094.47	096.50	100.32	102.58
24 10 401	106.30	107.76	108.45	110.16	111.14
24 10 501	092.96	093.97	094.35	094.69	094.77
24 10 502	086.49	086.97	087.23	087.78	088.32
24 10 601	088.90	089.60	090.17	091.45	091.59
24 10 701	148.16	151.97	153.14	.....	161.34
24 10 801	123.98	125.83	126.76	130.06	131.66
24 10 901	091.72	092.78	093.48	094.04	093.74
24 11 701	122.22	123.28	124.05	126.20	125.49
24 11 801	102.43	104.41	105.38	107.14	107.85
24 11 802	098.24	101.06	101.81	105.51	107.90
24 11 901	115.09	117.14	118.17	120.37	122.94
24 12 702	120.11	125.61	130.26	135.30	140.53
24 12 703	117.23	123.24	126.00	128.89	131.20
24 17 301	127.16	128.92	131.00	134.85	.....
24 17 601	136.43	138.80	140.60	146.45	147.19
24 17 901	159.78	161.55	162.26	164.30	165.34
24 18 101	143.30	144.68	145.31	147.10	148.04
24 18 201	157.34	159.91	161.78	166.80	169.85
24 18 301	125.82	127.56	128.40	130.92	131.18
24 18 302	142.73	145.32	147.30	153.27	157.52
24 18 401	138.06	142.00	141.65	147.28	146.50
24 18 601	156.47	158.49	160.00	168.07	165.92
24 18 801	173.95	176.22	180.80	193.50	184.82
24 18 802	161.67	164.20	165.05	167.66	169.12
24 18 901	115.37	115.17	117.03	117.60	117.86
24 19 101	129.72	133.31	134.75	139.80	.....
24 19 201	134.12	138.86	139.10	142.39	144.10
24 19 301	150.37	153.25	153.52	157.75	162.12
24 19 401	140.57	143.73	145.57	148.44	150.49
24 19 402	133.03	135.52	137.48	141.26	144.59
24 19 502	152.18	155.46	156.55	162.20	165.48
24 19 601	144.57	146.53	146.90	150.26	152.87
24 19 701	144.07	147.37	158.30	161.75	162.04
24 19 801	144.55	146.70	147.83	151.89	156.08
24 19 901	124.93	125.62	125.19	125.85	126.20
24 20 102	120.04	124.26	128.80	134.74	139.69
24 20 402	134.61	136.86	138.36	143.20	145.14
24 20 702	143.28	145.38	146.13	150.10	150.42
24 26 701	181.04	181.15	181.20	181.41	181.55
24 27 201	168.70	170.10	170.50	175.44	175.70
24 27 301	176.66	178.04	178.45	179.70	179.99
24 33 701	130.82	130.44	150.72	138.98	139.41
24 34 201	159.37	159.63	160.12	161.23	162.55
24 34 301	179.57	180.30	180.87	181.42	182.13
24 34 302	157.76	158.62	160.05	161.40	162.31
24 34 501	163.70	164.30	165.38	.....	168.63
24 35 301	170.15	171.53	171.03	175.76	172.57
24 36 101	173.03	173.23	174.27	175.29	176.75
24 36 102	167.38	168.25	171.06	174.31	176.36
25 16 601	055.40	056.17	057.15	058.20	060.59
25 40 501	136.84	135.93	134.75	136.00	140.45
25 40 601	143.25	146.79	146.55	149.64	149.84

PARMER COUNTY

Well No.	1962	1963	1964	1965	1966
09 24 601	286.05	.....	.....	302.01	315.42
09 32 301	306.14	323.00	.....	.....	.....
09 32 901	.....	.....	246.54	249.35	.....
09 40 901	226.64	229.28	234.74	234.36	240.11
09 40 902	198.53	202.78	205.97	209.72	216.83
09 40 903	206.38	221.16	213.25	223.29	220.66
09 48 301	191.54	163.88	204.95	206.08	205.48
10 17 301	.....	191.74	191.00	188.64	189.41
10 17 401	241.84	.....	256.90	255.74	261.02
10 17 501	230.00	234.29	240.70	244.23	247.75
10 18 501	.....	.....	.....	271.20	277.88
10 18 701	203.35	210.83	216.32	220.86	224.36
10 18 901	207.68	208.78	220.16	215.65	222.11
10 19 101	232.00	236.40	241.05	245.89	249.65
10 19 301	.....	.....	239.90	248.56	242.98
10 19 601	201.09	201.28	207.12	205.56	208.66
10 20 401	.....	.....	196.36	202.15	205.03
10 20 502	151.34	151.11	153.11	159.42	155.67
10 20 801	144.62	150.49	157.10	167.75	167.45
10 25 101	.....	.....	.....	304.22	300.46
10 25 301	274.05	278.62	279.87	283.61	.....
10 25 501	.....	163.60	.....	164.22	165.15
10 25 701	212.68	.....	223.56	231.93	236.17
10 26 101	289.22	303.92	299.99	.....	306.68
10 26 301	272.40	269.46	275.32	280.01	.....
10 26 701	181.40	186.56	186.30	187.66	192.89
10 26 801	.....	.....	198.05	206.80	.....
10 27 101	.....	230.52	236.59	244.46	.....
10 27 301	252.15	256.22	263.55	267.30	271.25
10 27 401	245.37	248.01	251.83	257.44	.....
10 27 501	.....	296.85	295.37	301.55	305.17

Well No.	1962	1963	1964	1965	1966
10 27 901	208.00	213.31	218.80	223.13	224.82
10 28 201	.....	228.55	245.82	239.52	.....
10 33 101	238.25	253.41	253.48	260.22	266.71
10 33 301	202.86	.....	211.85	215.21	219.85
10 33 401	241.45	245.08	249.00	244.49	.....
10 33 601	237.35	242.61	248.82	253.69	257.43
10 33 802	168.47	.....	177.66	182.13	184.17
10 33 901	165.98	170.88	175.02	179.08	182.58
10 34 101	.....	.....	.....	.....	224.42
10 34 301	186.80	200.65	186.20	189.48	196.17
10 34 401	234.85	240.75	244.83	248.73	259.97
10 34 801	175.46	.....	183.77	188.49	.....
10 34 802	201.04	202.91	206.46	211.81	222.41
10 35 304	.....	.....	181.75	186.55	188.72
10 35 401	204.15	207.98	.....	.....	222.47
10 35 501	194.50	199.31	.....	.....	210.03
10 35 601	169.60	173.55	177.05	182.32	185.08
10 35 701	182.78	192.60	194.51	195.13	198.21
10 35 901	.....	206.05	214.18	215.92	.....
10 35 902	196.41	205.83	.....	.....	216.93
10 36 101	165.80	170.10	177.06	178.02	181.40
10 36 601	.....	.....	164.25	169.26	176.87
10 36 801	156.82	160.65	165.51	167.54	178.96
10 41 201	137.28	140.32	.....	143.21	154.42
10 41 202	123.35	126.98	130.44	133.95	138.08
10 42 101	138.20	141.50	146.43	148.24	.....
10 42 202	163.80	165.90	174.23	177.05	180.64
10 42 501	124.23	126.99	130.20	.....	135.65
10 43 201	163.85	170.56	180.30	178.98	184.40
10 44 101	.....	.....	152.60	157.14	159.39
10 44 201	159.70	168.26	175.20	.....	176.86

LYNN COUNTY

Well No.	1962	1963	1964	1965	1966
23 34 901	119.61	124.47	123.93	128.28	130.49
23 34 903	133.73	.....	137.57	140.38	146.45
23 35 801	081.34	.....	082.64	091.88	095.37
23 35 901	086.64	088.49	089.95	097.40	094.38
23 41 201	093.83	098.95	096.79	102.88	104.26
23 41 401	083.68	085.46	088.17	088.94	089.86
23 41 501	068.57	070.86	066.76	070.20	071.92
23 41 901	122.97	125.28	123.08	125.67	127.65
23 42 201	127.70	129.42	127.64	.....	128.99
23 42 202	120.43	120.93	120.43	122.01	124.39
23 42 301	102.68	099.49	098.08	101.32	105.97
23 42 401	108.63	111.11	111.01	112.50	115.01
23 42 501	090.79	093.25	092.06	.....	099.15
23 42 601	041.11	045.51	043.11	049.38	048.73
23 42 602	079.18	080.78	080.71	083.69	085.23
23 42 701	.....	097.13	089.11	.....	103.43
23 42 801	064.79	068.07	073.08	065.11	068.96
23 43 301	025.89	029.92	025.24	028.32	034.92
23 43 501	069.95	070.44	070.41	076.77	077.76

Well No.	1962	1963	1964	1965	1966
23 43 502	074.20	075.72	074.92	076.74	077.76
23 43 503	081.94	082.75	084.65	084.40	085.14
23 43 504	075.68	078.02	077.54	078.26	078.91
23 43 901	064.74	066.28	065.21	065.14	069.70
23 44 101	058.14	060.09	058.38	069.79	065.83
23 44 401	056.19	058.57	054.38	061.35	.....
23 44 701	050.74	051.42	066.89	.....	075.19
23 44 702	037.58	039.69	040.83	039.19	039.23
23 58 201	011.49	018.06	010.84	014.03	014.79
23 58 202	007.17	009.22	006.32	017.51	012.64
23 58 203	004.21	007.04	007.26	015.72	009.97
23 58 801	063.19	062.36	061.75	.....	068.45
23 58 802	060.65	060.36	059.63	060.30	060.20
23 58 803	065.47	069.57	065.88	065.16	064.66
24 48 201	091.70	094.22	094.25	098.24	101.35
24 48 302	099.06	104.52	102.51	108.55	110.88
24 48 601	083.72	085.59	086.55	089.84	091.89
24 02 101	032.49	034.79	.....	037.22	.....

CASTRO COUNTY

Well No.	1962	1963	1964	1965	1966
10 21 401	108.19	112.63	119.42	121.00	123.59
10 21 501	111.83	115.73	118.68	122.62	124.01
10 21 601	122.60	149.24	146.06	137.80	.....
10 21 701	163.65	168.40	178.79	184.26	182.22
10 21 801	152.98	150.04	155.22	159.49	164.84
10 21 901	130.22	126.22	131.73	136.44	141.15
10 22 101	137.20	142.00	144.12	151.64	154.05
10 22 201	126.65	144.98	146.73	.....	141.51
10 22 301	110.60	108.02	109.74	112.42	113.76
10 22 401	106.57	109.91	111.58	117.76	119.97
10 22 801	134.02	121.76	127.24	133.68	138.96
10 22 901	123.69	128.23	.....	136.30	133.09
10 23 701	104.63	.....	144.24	122.79	.....
10 23 801	148.50	148.50	148.44	148.55	148.52
10 24 201	169.57	168.84	170.04	173.68	176.00
10 24 401	176.50	180.76	180.16	181.17	186.59
10 24 601	169.76	.....	172.80	169.50	171.94
10 24 701	182.40	176.23	.....	175.24	178.51
10 28 301	224.41	234.50	246.85	252.26	253.22
10 29 302	.....	216.29	221.58	226.78	.....
10 29 601	195.75	200.68	201.25	211.75	216.59
10 29 701	200.89	213.27	220.80	227.64	221.00
10 29 901	176.84	185.18	.....	199.60	199.94
10 30 101	190.52	190.32	191.34	202.05	204.33
10 30 201	185.52	191.68	198.24	204.08	209.72
10 30 401	212.65	216.90	.....	220.82	225.82
10 30 505	194.98	202.88	199.37	203.68	207.18
10 30 601	185.25	.....	191.00	197.38	202.78
10 30 801	172.18	183.78	180.92	184.39	188.95
10 30 901	199.78	194.43	198.70	.....	212.13
10 31 201	139.18	142.70	148.89	153.31	155.05
10 31 301	163.92	163.54	166.79	172.70	172.58
10 31 501	193.05	189.98	191.93	190.42	189.69

Well No.	1962	1963	1964	1965	1966
10 31 601	135.22	135.24	139.14	142.61	145.22
10 31 801	198.38	203.00	.....	.....	219.06
10 32 201	148.62	146.04	149.97	152.32	156.55
10 32 501	125.64	126.81	129.20	129.52	.....
10 32 701	180.03	183.72	185.90	192.00	.....
10 32 801	166.10	171.65	176.42	.....	184.44
10 37 201	155.45	163.51	.....	.....	174.56
10 37 401	128.85	137.30	135.55	139.63	143.43
10 37 601	113.03	115.37	124.13	120.72	125.13
10 37 901	120.51	118.24	122.96	130.94	127.79
10 38 401	126.26	128.69	128.76	.....	.....
10 38 601	120.40	118.80	128.90	130.80	126.41
10 38 701	123.24	126.39	130.75	133.99	139.87
10 38 801	125.10	128.40	133.20	135.79	140.30
10 38 901	113.50	118.14	123.95	123.51	126.93
10 39 101	153.30	157.22	161.12	167.22	172.02
10 39 401	134.00	.....	146.42	147.05	.....
10 39 501	129.54	134.14	141.90	145.78	148.93
10 39 701	120.89	117.90	123.83	128.42	.....
10 39 801	137.65	129.08	138.42	136.13	139.11
10 40 401	138.31	144.21	152.75	157.93	157.44
10 40 501	170.20	176.31	189.31	194.45	194.35
10 40 702	130.61	.....	148.92	152.98	.....
10 40 801	146.92	154.12	163.14	160.61	164.72
10 45 101	134.44	137.93	141.98	.....	146.39
10 45 301	140.91	145.25	147.12	151.49	154.19
10 46 301	052.64	056.06	060.50	063.61	067.50
10 46 405	136.66	139.20	147.02	147.27	153.85
10 47 101	108.83	108.55	112.24	116.05	118.33
10 47 201	143.25	139.00	145.45	152.77	155.14
10 47 302	121.76	125.64	131.26	.....	.....
10 48 301	112.77	119.38	129.20	134.39	.....
-0 48 501	.....	116.03	120.64	127.89	.....

ARMSTRONG COUNTY

Well No.	1962	1963	1964	1965	1966
11 12 401	107.50	108.19	109.72	110.64	111.25
11 12 701	112.65	114.27	118.66	124.74	121.20
11 12 702	127.35	123.18	128.76	130.12	133.89
11 12 801	124.80	123.05	124.14	128.10	131.75
11 12 802	124.90	125.26	.....	135.04	132.13
11 12 803	108.90	108.82	112.50	114.83	117.60
11 12 901	109.00	110.40	111.33	114.84	118.02
11 12 904	100.80	099.75	101.58	102.90	106.18
11 13 701	095.48	097.08	100.90	104.53	107.68

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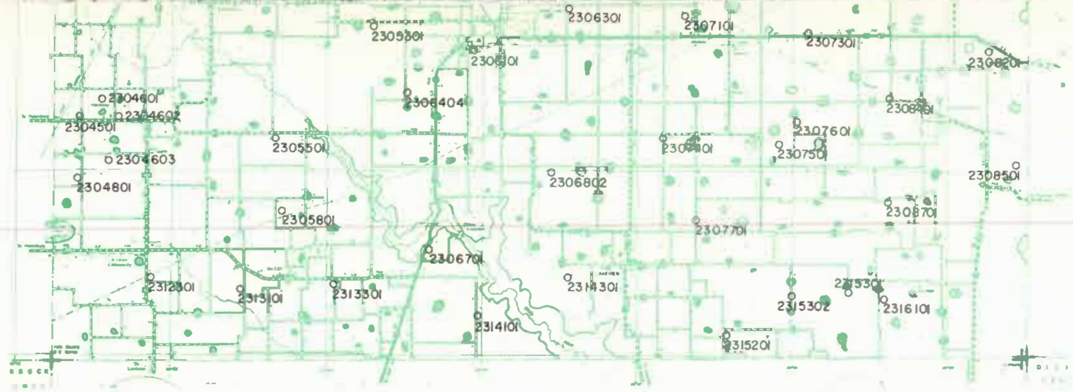
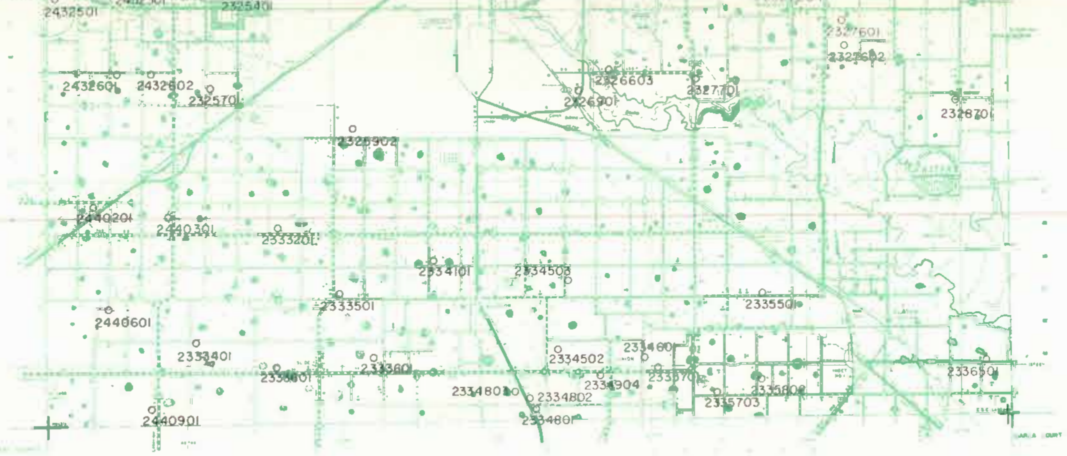
FEBRUARY 1966





FLOYD COUNTY

Well No.	1962	1963	1964	1965	1966
11 44 901	102.28	105.07	109.44	115.12	117.58
11 44 902	--------	099.83	106.73	109.63	--------
11 45 802	129.68	129.75	133.19	147.08	142.42
11 45 803	140.27	133.53	137.42	143.08	148.45
11 45 902	143.26	144.81	158.09	152.98	151.71
11 46 701	158.40	164.17	161.87	172.19	177.55
11 46 801	--------	207.58	212.84	215.19	221.77
11 47 701	--------	214.80	220.52	214.89	--------
11 52 301	109.13	112.94	118.48	118.48	138.08
11 52 302	115.80	119.36	125.11	--------	139.00
11 52 303	135.33	145.90	151.97	157.18	164.75
11 52 304	127.07	128.27	138.17	145.38	--------
11 52 601	136.84	140.53	143.52	147.21	--------
11 52 603	138.93	142.12	144.89	149.15	--------
11 52 604	132.34	135.04	--------	142.05	--------
11 52 801	127.65	134.76	137.52	140.41	146.23
11 52 901	143.38	148.79	154.53	156.00	--------
11 52 902	142.30	138.70	149.43	150.48	--------
11 52 903	148.40	146.33	149.22	152.15	--------
11 52 905	146.40	148.83	151.83	154.80	--------
11 52 906	145.20	148.34	151.46	158.12	157.90
11 53 101	127.75	129.02	148.41	149.85	159.99
11 53 201	126.38	131.53	134.33	138.97	140.61
11 53 202	126.98	127.36	136.27	136.67	143.43
11 53 203	130.69	132.66	139.36	138.98	139.60
11 53 402	143.79	147.46	149.51	--------	158.68
11 53 501	159.74	163.51	167.43	174.26	176.38
11 53 701	146.10	149.68	152.60	155.23	158.36
11 53 702	134.38	138.28	141.85	147.40	152.49
11 53 703	144.38	145.90	148.82	150.33	152.64
11 54 301	208.24	--------	223.87	233.58	230.48
11 54 401	165.32	166.29	168.26	169.88	171.98
11 54 901	205.65	207.49	210.88	213.92	215.80
11 55 701	214.70	216.54	220.57	224.83	227.76
11 55 901	264.96	267.16	267.15	269.09	271.29
11 60 301	132.95	136.42	138.22	142.02	--------
11 60 302	138.73	142.22	144.46	147.87	153.10
11 60 303	136.41	140.12	142.04	146.51	152.57
11 60 501	122.13	124.97	128.31	134.08	140.95
11 60 601	135.91	139.74	143.33	149.02	157.90
11 60 602	134.70	131.60	133.87	141.23	146.06
11 60 901	121.36	126.83	127.70	135.74	140.77
11 61 101	147.91	151.50	157.36	158.02	162.12
11 61 102	151.84	154.31	160.17	163.72	167.49
11 61 103	143.08	146.41	--------	152.61	--------
11 61 104	139.57	142.57	145.36	150.34	--------
11 61 105	143.73	147.49	151.90	156.49	163.03
11 61 203	159.73	162.95	167.73	172.99	181.24
11 61 204	150.42	155.26	160.03	166.42	173.89
11 61 301	037.29	038.60	039.31	041.33	042.10
11 61 401	145.89	153.92	159.63	166.34	168.12
11 61 403	138.14	148.60	153.61	160.91	171.61
11 61 404	143.79	153.56	159.39	166.55	170.75
11 61 801	153.40	159.56	170.96	181.49	187.63
11 61 802	140.83	144.12	160.57	161.76	162.38
11 61 901	146.36	153.57	161.93	173.82	177.47
11 62 201	102.86	133.63	135.73	138.07	143.00
11 62 401	058.44	055.80	--------	061.11	058.71
11 62 601	--------	147.06	147.89	148.27	151.01
11 62 701	117.98	116.73	117.44	118.39	--------
11 62 702	093.08	094.31	095.39	097.09	098.59
11 62 801	089.36	089.66	092.08	094.34	100.39
11 63 101	154.90	155.66	157.06	158.28	157.94
11 63 801	198.42	192.54	194.96	198.64	202.07
11 64 101	210.18	210.32	217.49	221.36	222.98
11 64 401	237.66	235.86	236.16	236.51	--------
11 64 502	--------	--------	263.78	263.96	264.31
23 04 501	142.75	150.80	158.61	165.23	172.98
23 04 601	138.78	145.15	150.74	156.68	162.84
23 04 602	148.89	154.50	158.61	163.69	171.03
23 04 603	141.68	153.48	161.69	168.85	174.88
23 04 801	126.24	135.04	143.45	150.90	155.56
23 05 301	153.44	157.70	164.86	175.12	177.04
23 05 501	171.78	176.86	185.03	193.68	--------
23 05 801	183.10	--------	--------	202.93	--------
23 06 101	148.24	151.15	152.96	155.41	158.48
23 06 301	155.41	155.19	159.02	157.62	162.17
23 06 404	161.47	175.34	181.91	193.21	196.03
23 06 701	179.82	184.64	--------	199.40	196.66
23 06 802	183.42	188.58	196.40	205.16	--------
23 07 101	217.38	203.97	208.99	--------	209.89
23 07 301	--------	--------	222.58	224.53	220.27
23 07 401	--------	233.45	231.71	248.43	258.03
23 07 501	231.16	241.18	267.88	278.00	280.45
23 07 601	234.48	243.13	259.16	266.38	--------
23 07 701	--------	213.24	195.64	196.53	203.18
23 08 201	261.73	264.86	263.61	264.01	262.04
23 08 401	--------	265.53	263.64	270.67	269.91
23 08 501	252.58	252.50	252.57	254.42	261.55
23 08 701	--------	261.18	264.80	270.51	271.60
23 12 301	138.97	144.89	154.36	183.63	--------
23 13 101	154.76	159.86	163.39	171.31	--------
23 13 301	188.22	174.23	179.02	192.27	204.36
23 14 101	--------	194.25	198.96	222.25	230.75
23 14 301	195.12	201.91	194.73	208.89	206.26
23 15 201	240.33	243.93	246.17	--------	253.42
23 15 301	258.21	267.54	266.13	270.54	276.35
23 15 302	254.32	255.86	262.87	277.22	272.65
23 16 101	261.04	265.41	271.98	278.94	283.03

LUBBOCK COUNTY

Well No.	1962	1963	1964	1965	1966
23 09 501	142.82	147.14	147.31	151.62	156.03
23 09 601	123.09	128.94	131.81	137.85	140.61
23 09 701	132.21	138.69	140.77	144.28	148.01
23 09 901	169.54	170.86	172.17	180.43	187.72
23 10 501	158.80	163.10	167.03	173.19	--------
23 10 801	144.55	148.48	152.74	154.74	160.31
23 11 401	156.93	161.65	159.94	168.71	177.35
23 11 601	145.88	149.81	152.51	158.35	158.90
23 11 701	146.93	152.82	157.17	162.73	167.61
23 11 702	142.94	146.40	150.98	158.03	161.53
23 11 901	127.09	131.78	136.21	--------	148.90
23 11 902	141.92	145.91	147.98	151.35	155.95
23 11 903	128.61	133.68	137.72	146.73	151.45
23 12 401	149.53	152.98	156.23	166.15	--------
23 12 402	150.33	153.28	157.57	161.29	167.11
23 12 803	137.70	141.35	146.80	153.00	158.61
23 17 201	132.77	132.25	133.07	141.24	139.14
23 17 202	129.49	129.06	132.25	--------	137.38
23 17 501	112.13	113.73	118.11	118.61	120.59
23 17 701	096.10	101.85	099.87	106.17	107.78
23 17 703	086.86	088.79	089.07	--------	091.11
23 17 704	070.14	071.71	071.70	073.26	--------
23 17 705	--------	079.66	082.83	086.40	088.50
23 17 706	083.22	088.88	088.02	091.34	101.43
23 17 801	075.13	--------	077.94	--------	084.78
23 17 802	054.34	058.90	057.32	054.08	066.56
23 17 901	073.47	074.91	079.81	085.24	078.58
23 18 201	128.97	135.16	138.27	142.42	147.73
23 18 301	145.56	157.92	155.50	164.88	168.98
23 18 402	112.27	117.65	121.52	126.27	131.28
23 18 403	113.12	115.43	117.05	121.88	--------
23 18 404	118.57	121.43	125.27	130.12	134.68
23 18 502	--------	--------	110.83	114.93	119.37
23 18 601	118.81	123.81	129.47	--------	--------
23 18 702	--------	078.11	080.58	--------	084.27
23 18 704	--------	079.80	081.00	082.62	083.21
23 19 301	149.11	157.18	161.27	172.28	178.15
23 19 302	146.82	157.25	164.74	--------	155.61
23 19 402	126.80	130.67	140.28	140.38	145.92
23 19 403	127.28	131.60	--------	145.14	149.77
23 19 501	138.53	141.12	144.88	--------	--------
23 19 502	109.49	117.01	121.63	--------	130.19
23 19 701	076.68	080.62	082.74	081.08	093.10
23 19 802	083.01	084.71	085.26	089.60	091.22
23 19 804	--------	080.82	081.84	087.18	089.91
23 19 901	108.29	123.26	125.74	136.33	146.00
23 20 401	139.18	147.08	152.11	159.75	169.99
23 20 701	125.12	135.40	142.42	--------	137.07
23 20 802	--------	158.69	160.22	164.69	165.04
23 25 101	134.52	138.43	142.41	138.88	140.82
23 25 102	131.77	133.70	138.26	137.79	141.44
23 25 303	073.31	085.08	081.55	082.79	084.84
23 25 304	065.23	065.63	064.19	065.79	--------
23 25 401	131.00	133.33	134.90	--------	141.05
23 25 701	110.42	114.59	116.47	122.12	125.33
23 25 902	103.77	107.76	108.33	--------	--------
23 26 301	089.48	091.56	092.20	--------	094.26
23 26 603	012.82	010.21	008.00	016.30	011.61
23 26 901	049.73	050.45	050.56	--------	046.11
23 27 101	089.26	091.71	093.52	094.64	--------
23 27 201	084.31	083.61	085.03	092.52	088.68
23 27 202	073.80	077.61	078.30	083.52	083.37
23 27 203	075.44	080.22	080.02	083.10	--------
23 27 204	081.85	080.19	081.42	080.64	088.02
23 27 302	066.78	069.58	073.14	076.52	078.78
23 27 601	074.66	077.68	081.48	081.83	082.62
23 27 602	087.10	087.35	093.82	098.41	099.55
23 27 701	--------	--------	096.93	096.38	088.69
23 28 701	059.62	061.02	063.14	066.27	068.21
23 33 201	125.11	128.31	--------	130.74	130.78
23 33 401	100.13	102.05	102.32	104.00	105.04
23 33 501	--------	106.22	108.82	109.73	108.17
23 33 601	101.40	104.05	106.08	106.68	107.42
23 33 801	094.17	099.09	096.21	098.15	098.19
23 34 101	106.83	113.24	113.58	114.59	114.74
23 34 502	126.72	125.21	126.55	138.32	--------
23 34 503	115.32	112.17	114.59	116.61	118.41
23 34 601	113.84	112.16	114.68	118.05	120.13
23 34 801	128.92	131.38	135.41	137.90	140.08
23 34 802	129.80	127.78	131.40	131.41	134.72
23 34 803	127.80	128.32	131.16	129.71	130.37
23 34 804	125.00	128.35	--------	--------	--------
23 34 902	121.93	121.50	123.39	125.32	129.65
23 34 904	117.62	124.08	126.31	122.77	126.28
23 35 501	--------	--------	088.01	090.66	--------
23 35 701	114.86	117.12	123.22	133.54	--------
23 35 703	116.67	118.15	117.80	121.77	126.67
23 35 802	104.86	104.92	106.97	108.48	--------
23 36 501	194.70	202.75	197.82	183.06	179.42
24 16 501	108.19	110.18	112.47	113.75	115.43
24 16 601	122.16	118.77	122.82	128.07	123.89
24 16 901	162.33	162.67	163.92	166.03	168.08
24 16 902	144.46	144.20	150.01	150.45	151.61
24 24 201	061.36	063.02	063.11	071.09	066.46
24 24 302	128.50	135.37	133.79	143.50	145.05
24 24 501	116.32	118.44	122.33	131.66	133.55
24 24 601	071.04	074.23	074.28	078.51	081.03
24 24 901	130.28	134.90	134.58	151.64	157.40
24 32 301	128.52	132.61	135.07	139.22	141.82
24 32 501	114.20	118.22	119.05	127.14	124.21
24 32 601	120.61	119.48	120.28	121.77	123.71
24 32 602	121.21	130.12	133.82	135.18	137.36
24 40 201	114.01	122.28	119.76	125.92	128.81
24 40 301	140.07	137.19	143.16	138.16	144.67
24 40 601	116.62	122.60	118.08	120.93	117.62
24 40 901	066.03	067.63	066.62	--------	069.89

POTTER COUNTY

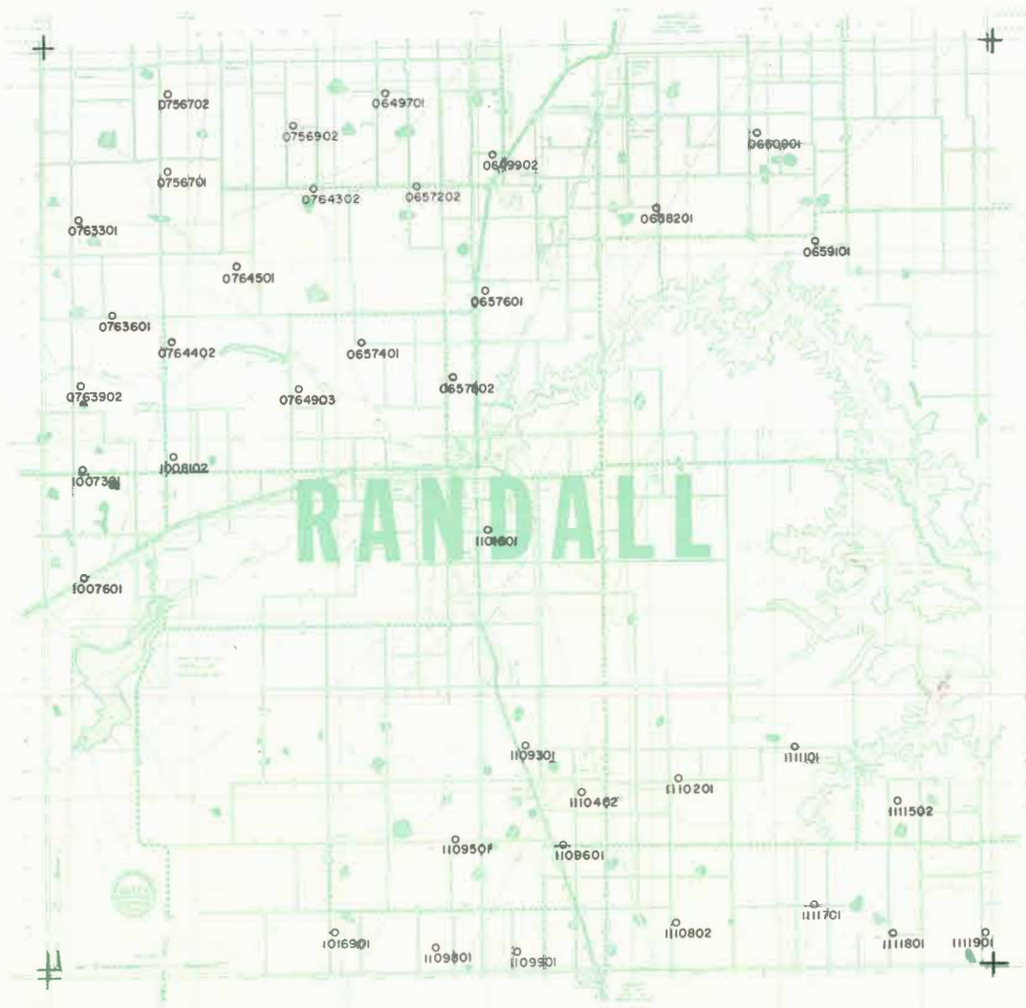
Well No.	1962	1963	1964	1965	1966
06 49 501	178.77	176.57	178.96	183.55	188.23
07 56 401	206.71	204.76	210.88	216.82	--------
07 56 501	201.20	200.21	204.18	213.42	208.18
07 56 601	184.53	183.89	192.31	196.47	198.54

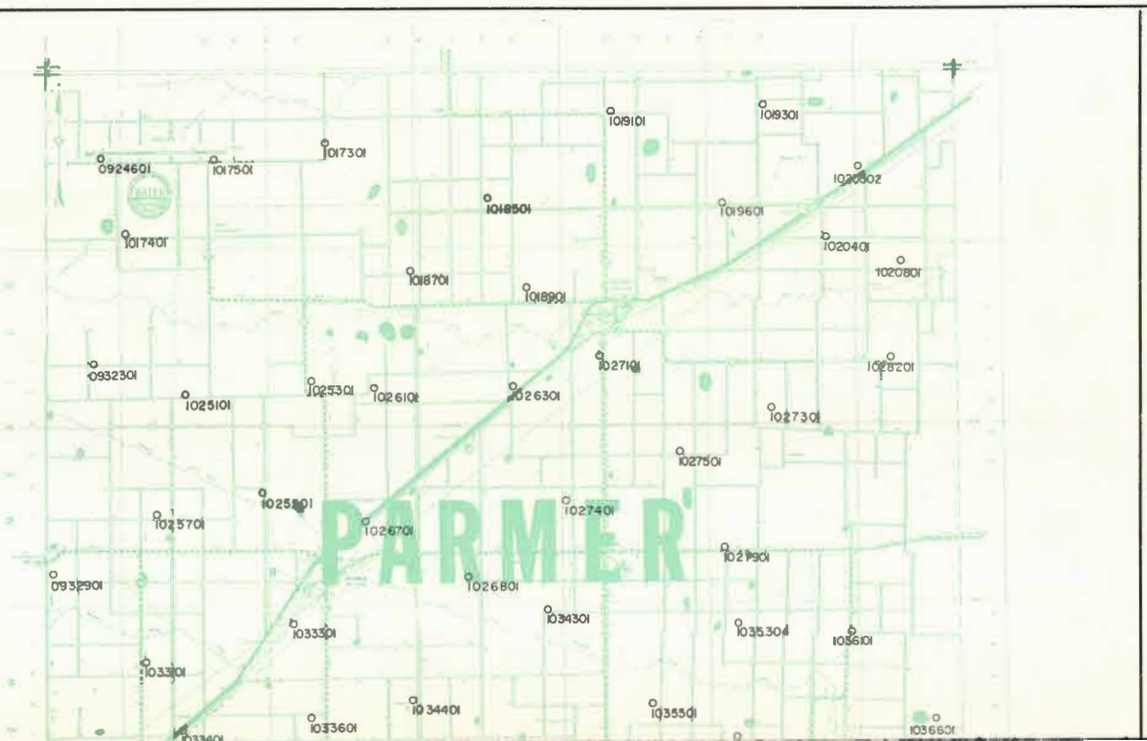
Water Level Measurements In Observation Wells In High Plains Water District

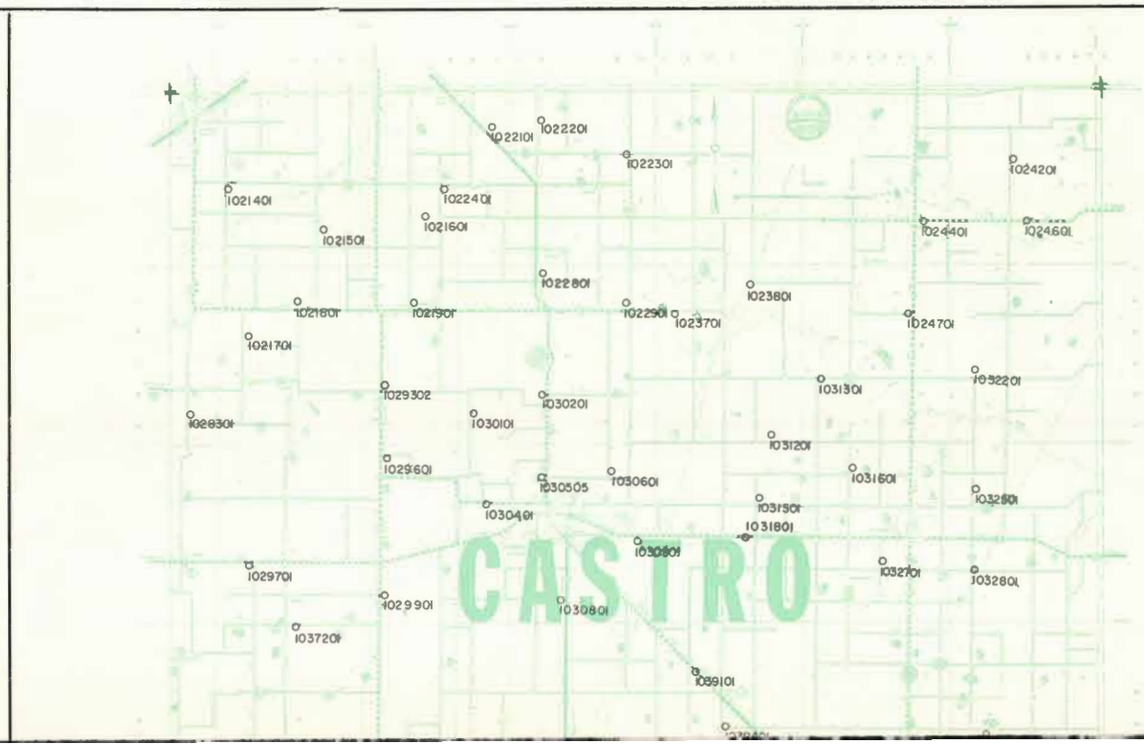
EDITOR'S NOTE: Official Water-level measurements for a majority of the observation wells within the High Plains Underground Water Conservation District are shown below. The measurements were made by the High Plains Water District in coopeartion with the Texas Water Commission.

The accompanying maps show 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 necessitates the use of a seven-digit number. All measurements shown in feet below land surface.

Measurements are made each year during January, prior to the beginning of extensive pumping for preplant irrigation. All measurements were made by personnel of the Texas Water Commission and the High Plains Underground Water Conservation District.





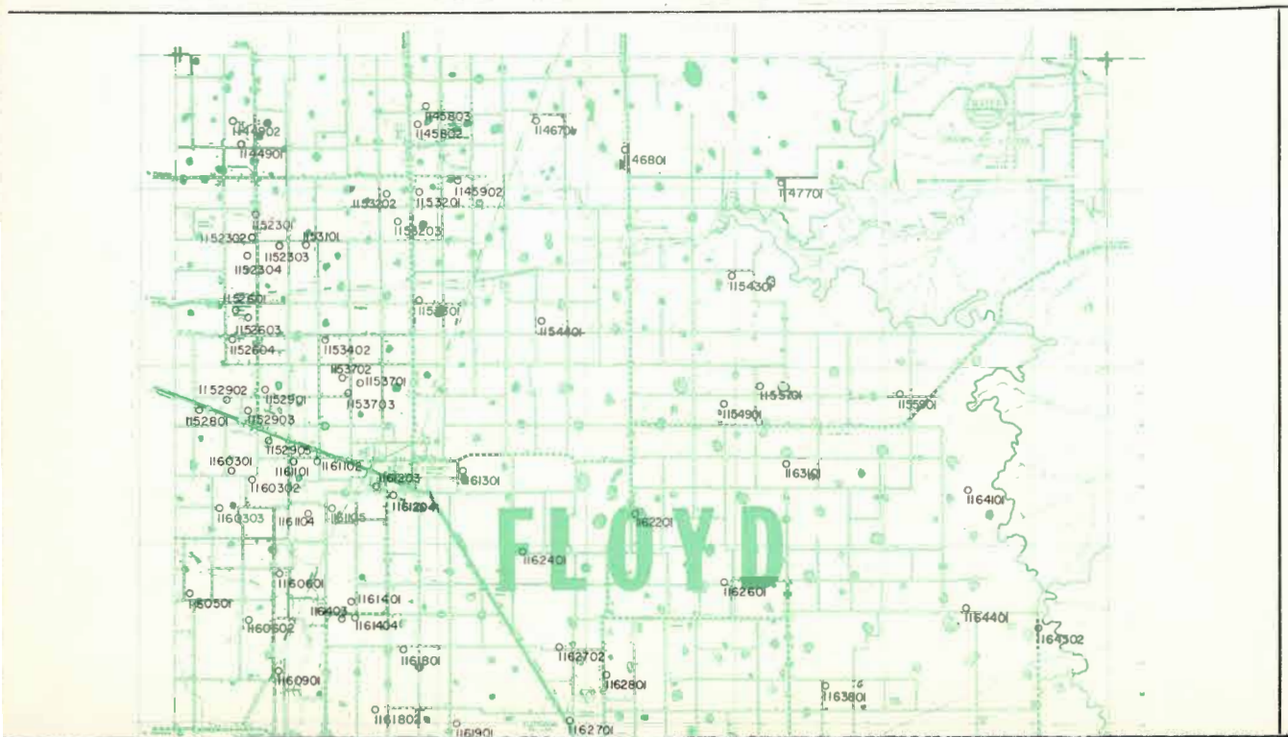


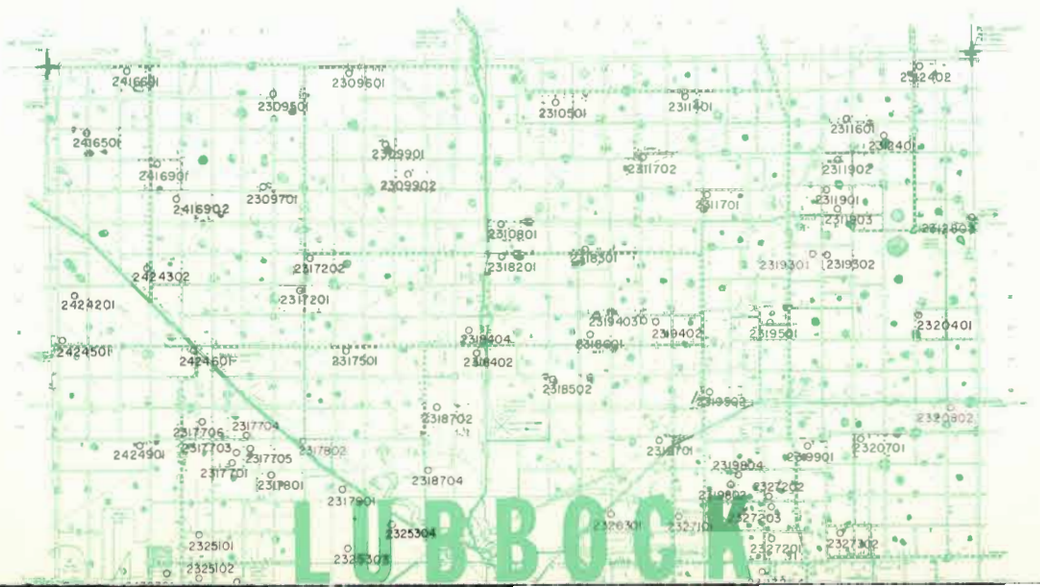
RANDALL COUNTY

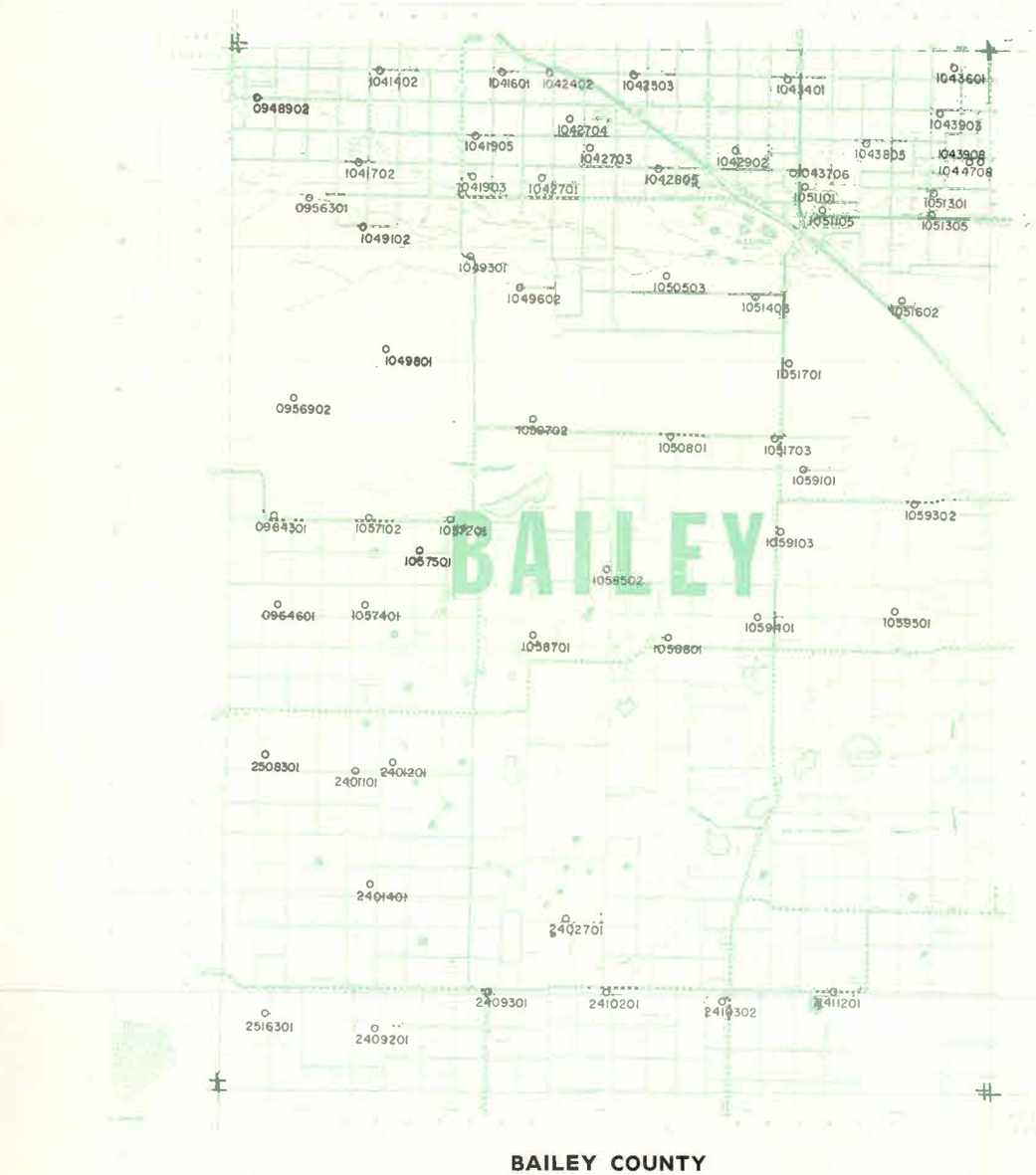
Well No.	1962	1963	1964	1965	1966
06 49 701	.....	200.32	207.02	211.88	219.68
06 49 902	199.20	196.37	197.62	198.55	198.52
06 50 901	199.39	199.84	200.78	.....	203.31
06 57 202	117.34	173.52	178.83	180.57	183.92
06 57 401	152.36	159.58	160.53	.....	157.01
06 57 601	149.04	148.40	149.20	154.41	156.58
06 57 802	127.54	126.74	129.73	132.27	136.34
06 58 201	197.29	197.85	201.52	203.49	205.44
06 59 101	197.58	197.54	197.41	196.94	197.44
07 56 701	165.89	170.73	177.78	181.29	185.98
07 56 702	187.97	192.04	196.51	192.61	.....
07 56 902	169.94	169.33	172.26	175.09	177.90
07 63 301	.....	178.75	.....	178.82	179.15
07 63 601	123.30	124.34	126.37	129.16	132.25
07 63 902	115.79	114.56	115.82	121.19	.....
07 64 101	165.80	171.86	.....	.....	181.49
07 64 302	139.64	139.29	141.12	153.00	.....
07 64 402	100.81	100.08	101.87	102.94	101.92
07 64 501	.....	141.17	132.87	131.40	133.72
07 64 903	132.64	140.58	137.41	145.25	.....
10 07 301	.....	115.07	118.42	114.89	117.15
10 07 601	090.90	090.37	095.29	091.77	094.23
10 08 102	131.10	133.09	134.69	.....	136.03
10 16 901	.....	175.66	178.46	178.45	.....
11 01 601	003.94	004.92	004.94	004.54	003.49
11 09 301	157.30	156.63	161.64	158.01	158.34
11 09 501	175.31	172.81	178.64	175.69	176.58
11 09 601	187.11	190.04	195.23	194.17	191.83
11 09 801	173.41	178.99	.....	179.36	184.31
11 09 901	166.44	170.52	173.31	176.31	.....
11 10 201	151.36	151.32	151.73	151.74	152.11
11 10 402	169.48	168.25	175.85	172.90	169.69
11 10 802	163.27	160.73	158.09	167.55	169.96
11 11 101	129.94	130.03	130.99	131.03	140.91
11 11 502	158.41	157.66	158.21	158.67	148.37
11 11 701	151.18	150.51	152.55	155.22	157.45
11 11 801	097.26	097.08	100.69	101.81	103.95
11 11 901	102.29	101.99	104.49	106.91	110.57

DEAF SMITH COUNTY

Well No.	1962	1963	1964	1965	1966
07 53 901	188.15	192.06	201.12	202.75	202.42
07 55 701	179.07	181.89	183.14	181.89	193.00
07 58 801	246.70	247.24	246.77	246.49	246.81
07 59 301	293.36	291.97	295.55	297.59	300.00+
07 59 601	289.52	.....	297.24	300.00+	300.00+
07 59 801	249.31	253.97	254.45	260.42	258.83
07 60 201	.....	260.73	262.00	266.37	268.53
07 60 301	226.40	231.63	233.53	240.17	242.33
07 60 401	271.50	280.97	293.86	.....	300.00+
07 60 501	210.72	213.64	218.22	228.11	.....
07 60 901	192.52	.....	196.36	197.25	197.58
07 61 201	.....	.....	205.48	202.99	208.93
07 61 301	164.00	188.31	.....	191.79	196.22
07 61 501	161.13	163.91	168.93	178.49	172.55
07 61 601	159.55	160.32	163.61	167.04	169.82
07 61 801	189.92	163.98	163.87	167.45	168.43
07 62 101	161.03	.....	178.67	187.15	181.76
07 62 301	161.87	168.54	164.63	171.70	176.72
07 62 501	134.40	135.64	138.76	147.80	.....
07 62 601	133.97	140.32	142.36	148.03	155.94
07 63 201	149.15	.....	155.33	164.59	.....
07 63 701	126.22	131.96	135.18	148.89	151.99
10 03 101	286.40	287.68	289.04	.....	293.13
10 03 701	224.52	226.23	226.81	220.31	220.11
10 03 901	212.00	216.05	218.37	223.28	227.39
10 04 101	275.05	277.97	283.27	285.15	287.11
10 04 301	226.23	230.14	235.52	239.81	245.11
10 04 501	219.44	222.37	.....	230.89	240.67
10 04 601	211.42	195.68	199.78	207.63	211.34
10 04 902	158.95	.....	159.81	165.02	160.46
10 05 301	134.90	136.26	138.91	148.16	143.49
10 05 501	135.27	140.74	145.96	157.56	162.11
10 05 601	121.13	117.04	120.76	127.69	129.12
10 05 802	118.43	125.52	130.53	135.62	139.75
10 05 903	132.62	.....	132.52	140.45	142.54
10 06 201	117.87	.....	126.32	138.71	132.68
10 06 401	126.96	128.91	132.41	141.38	140.80
10 06 601	120.35	128.10	125.78	131.18	133.60
10 06 701	052.25	052.02	057.64	.....	062.83
10 06 901	104.05	108.18	109.60	114.18	115.56
10 07 402	110.02	115.70	119.07	124.89	124.98
10 07 403	096.70	100.40	103.80	111.65	114.29
10 07 701	098.46	101.51	100.84	.....	120.85
10 07 802	122.07	126.35	129.40	159.58	169.44
10 09 601	064.98	057.23	061.19	058.83	062.01
10 10 801	185.90	187.57	189.81	192.88	193.15
10 11 501	171.99	175.85	175.78	179.57	179.44
10 11 601	151.10	155.53	.....	161.19	163.40
10 11 802	168.36	166.60	170.58	175.61	179.10
10 11 901	178.11	178.48	180.87	.....	186.02
10 12 102	138.70	143.37	143.96	154.78	.....
10 12 201	067.66	068.82	068.68	071.08	072.14
10 12 301	129.21	132.93	139.75	133.48	135.07
10 12 401	134.00	157.98	153.15	163.55	162.28
10 12 501	153.53	159.84	164.44	164.89	.....
19 12 502	112.37	115.18	118.74	124.41	127.49
10 12 701	120.23	124.12	125.89	130.15	.....
10 12 901	112.21	115.34	.....	121.95	124.75
10 12 902	148.25	152.18	154.30	158.15	162.98
10 13 101	132.68	136.27	140.61	148.12	152.80
10 13 302	102.10	.....	108.06	121.82	123.31
10 13 304	115.03	117.14	125.15	130.79	.....
10 13 305	.....	102.47	.....	117.31	113.35
10 13 401	117.12	120.63	124.30	.....	133.58
10 13 502	134.72	141.09	138.36	143.73	145.96
10 13 802	105.84	114.51	.....	.....	126.77
10 13 901	122.07	124.74	126.25	128.36	129.88
10 13 902	125.06	.....	.....	138.38	139.86
10 13 903	126.62	130.95	130.82	140.55	143.22
10 14 301	069.25	073.57	074.89	.....	079.80
10 14 403	093.69	095.74	099.50	103.20	106.40
10 14 701	139.55	141.67	148.08	160.20	156.88
10 14 702	139.05	143.34	149.43	166.08	154.05
10 14 801	122.26	125.34	130.46	133.40	134.68

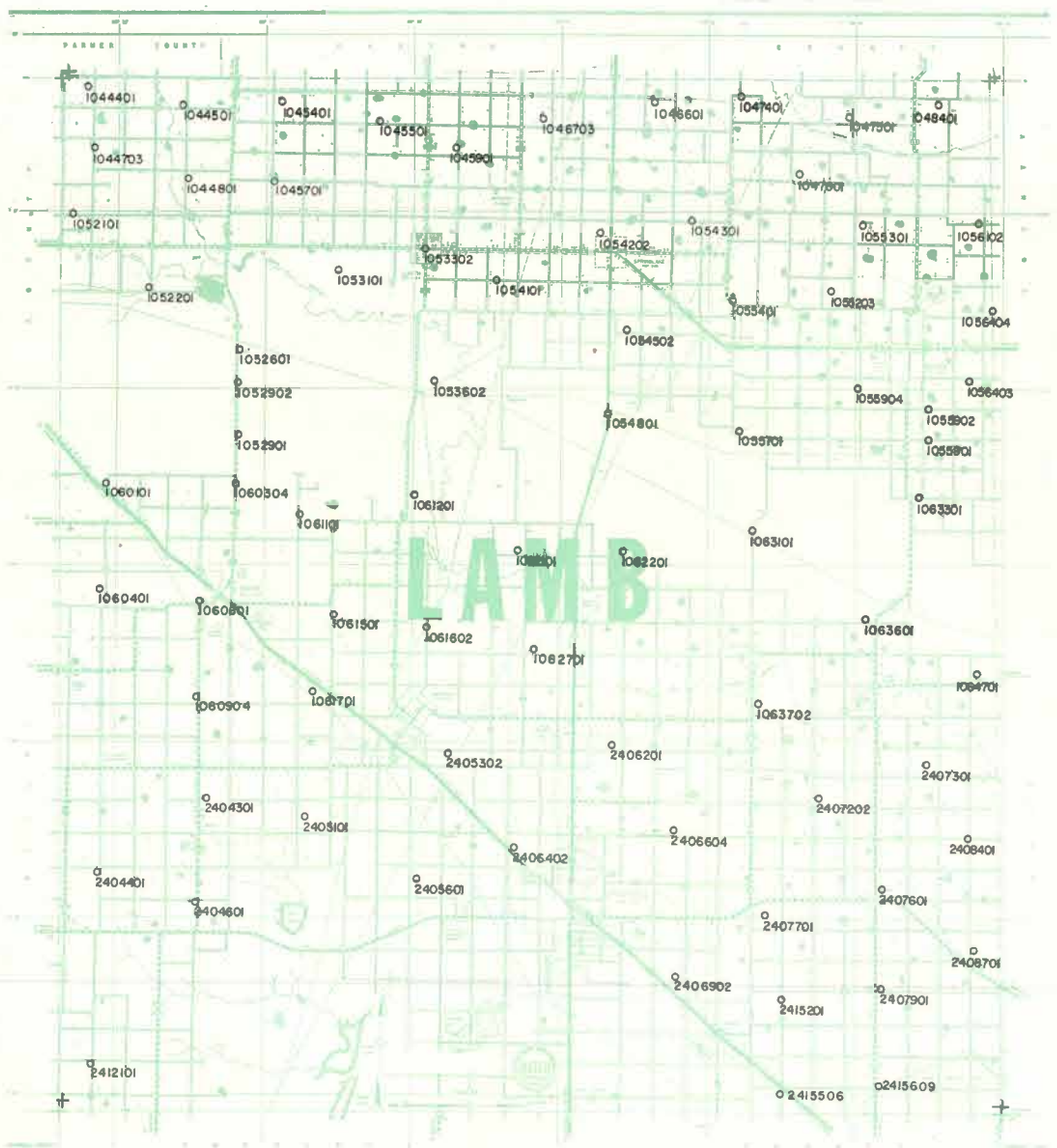






BAILEY COUNTY

Well No.	1962	1963	1964	1965	1966
09 48 902	.....	.....	117.15	121.90	124.31
09 56 301	061.45	061.28	062.06	064.39	068.98
09 56 902	038.20	038.40	039.64	038.97	039.25
09 64 301	.....	061.94	051.41	056.37	055.64
09 64 601	.....	126.07	132.25	135.24	135.08
10 41 401	120.40	122.78	125.83	129.65	132.46
10 41 601	108.90	111.34	115.67	118.31	120.31
10 41 702	070.89	073.81	076.51	079.27	081.17
10 41 903	060.30	062.22	063.28	067.59	068.15
10 41 905	082.29	084.12	086.09	089.79	092.17
10 42 402	100.36	102.91	106.05	109.90	110.94
10 42 503	093.63	096.17	098.25	101.65	106.89
10 42 701	065.47	069.49	071.79	074.28	076.18
10 42 703	078.10	078.61	081.42	084.78	085.64
10 42 704	.....	.....	092.64	095.59	098.81
10 42 805	056.75	058.56	062.19	063.87	066.48
10 42 902	063.85	069.58	069.44	071.60	070.23
10 43 401	088.00	091.91	093.71	094.35	096.55
10 43 601	.....	.....	100.98	106.47	108.62
10 43 706	067.80	071.46	071.61	075.08	079.07
10 43 707	068.97	070.49	.....	076.96	077.56
10 43 805	063.66	066.21	067.31	071.59	074.34
10 43 903	.....	078.69	081.56	085.12	088.61
10 43 908	063.56	062.32	.....	070.43	074.28
10 43 910	060.31	062.43	.....	069.95	071.19
10 44 708	063.79	065.29	068.04	071.93	074.89
10 49 101	.....	.....	.....	.....	045.56
10 49 102	040.30	.....	.....	045.79	045.56
10 49 301	025.88	026.48	026.98	028.09	024.83
10 49 602	041.26	039.37	040.37	045.84	048.89
10 49 801	073.96	074.25	074.47	074.79	075.02
10 50 503	035.83	.....	037.68	042.87	044.72
10 50 702	.....	082.69	082.94	084.52	084.42
10 50 801	069.34	070.37	073.52	072.74	072.87
10 51 101	059.59	060.61	061.86	063.92	064.01
10 51 105	.....	044.58	044.88	048.56	048.35
10 51 301	048.46	.....	047.25	051.19	050.31
10 51 305	045.38	050.44	050.68	049.75	047.05
10 51 403	029.66	030.65	028.67	028.66	031.12
10 51 501	025.11	024.47	.....	030.96	030.11
10 51 602	025.35	025.89	026.74	032.28	033.25
10 51 701	060.31	060.50	.....	060.75	069.25
10 51 703	082.00	081.25	078.36	083.48	082.97
10 57 102	.....	.....	077.87	077.32	077.39
10 57 201	.....	027.58	026.29	029.10	027.11
10 57 401	110.45	111.91	117.17	115.28	114.72
10 57 501	037.09	032.66	.....	035.73	036.47
10 58 502	.....	074.89	073.68	076.01	075.38
10 58 701	.....	047.69	046.49	047.59	046.44
10 58 801	.....	016.36	019.21	019.97	017.19
10 59 101	.....	116.18	105.76	106.25	107.21
10 59 103	092.85	094.52	.....	099.51	101.75
10 59 302	.....	109.66	106.31	106.66	107.21
10 59 401	103.59	110.73	106.99	109.48	111.13
10 59 501	.....	102.78	102.39	101.74	101.33
24 01 101	224.05	225.71	225.61	228.35	226.02
24 01 201	.....	206.74	206.24	209.06	208.48
24 01 401	169.19	169.24	172.63	.....	177.15
24 02 701	.....	059.32	059.34	059.82	062.34
24 09 201	142.72	141.07	144.04	149.66	.....
24 09 301	.....	089.75	089.23	089.86	090.42
24 10 201	.....	102.66	103.19	107.40	112.35
24 10 302	.....	087.62	090.52	087.93	091.65
24 11 201	.....	107.05	107.15	106.07	105.98
25 08 301	080.54	081.98	.....	.....	081.07
25 16 301	116.55	116.54	119.32	122.33	123.75



LAMB COUNTY

Well No.	1962	1963	1964	1965	1966
10 44 401	103.42	098.26	115.14	118.95	121.94
10 44 501	.....	.....	109.54	115.15	121.17
10 44 703	.....	079.90	085.56	087.95	.....
10 44 801	064.00	068.58	067.46	071.08	.....
10 45 401	.....	110.50	111.83	117.48	119.32
10 45 501	.....	.....	132.03	130.58	136.45
10 45 701	.....	071.40	075.79	078.15	080.24
10 45 901	.....	.....	132.22	137.77	135.14
10 46 601	.....	111.40	149.29	154.24	162.89
10 46 703	135.79	139.57	143.45	148.45	151.87
10 47 401	119.08	122.06	125.33	129.52	135.71
10 47 501	.....	.....	119.68	124.78	129.98
10 47 801	147.05	148.05	150.61	154.72	159.81
10 48 401	125.90	129.33	130.15	135.72	140.28
10 52 101	057.64	058.40	060.92	065.62	069.07
10 52 201	.....	.....	037.03	037.69	.....
10 52 601	028.13	028.78	029.31	030.01	030.62
10 52 901	059.02	059.69	062.06	062.62	063.21
10 52 902	046.45	047.20	048.62	048.78	049.12
10 53 101	.....	058.90	050.04	053.42	053.72
10 53 302	063.51	067.00	068.94	071.42	072.91
10 53 602	042.02	044.36	046.50	047.35	048.00
10 54 101	072.36	074.61	075.18	078.81	.....
10 54 202	112.52	113.01	114.19	118.35	124.81
10 54 301	132.28	135.02	138.41	144.07	148.02
10 54 502	.....	.....	087.61	090.72	093.78
10 54 801	059.93	060.94	061.82	062.99	064.51
10 55 203	.....	137.39	140.57	146.53	150.89
10 55 301	.....	153.34	157.87	164.61	170.05
10 55 401	.....	.....	147.06	153.12	158.98
10 55 701	.....	.....	072.63	075.21	076.68
10 60 304	.....	067.80	068.66	070.24	069.24
10 60 401	122.57	126.20	123.47	130.25	125.90
10 60 601	109.83	101.89	101.66	101.32	107.27
10 60 904	.....	137.50	138.05	139.93	143.51
10 61 101	.....	061.69	064.93	.....	070.41
10 61 201	048.76	049.80	050.89	053.89	059.03
10 61 501	.....	.....	106.14	112.92	109.89
10 61 602	.....	.....	090.18	091.19	089.96
10 61 701	.....	.....	106.23	110.51	113.12
10 62 101	.....	046.33	047.75	050.02	051.03
10 62 201	.....	.....	092.79	096.22	098.48
10 62 701	105.31	110.23	112.98	119.38	123.35
10 63 101	.....	064.20	064.62	078.18	066.28
10 63 301	083.20	082.43	086.61	089.78	093.12
10 63 601	.....	.....	101.39	103.52	099.72
10 63 702	120.11	124.66	124.28	127.96	131.38
10 64 701	.....	.....	105.79	110.52	111.67
24 04 301	.....	063.40	053.94	057.48	059.41
24 04 401	155.09	.....	164.86	179.18	181.52
24 04 601	064.79	066.09	065.16	067.86	074.51
24 05 101	.....	037.60	037.49	039.01	039.98
24 05 302	095.50	098.45	098.64	099.87	104.63
24 05 601	.....	.....	089.81	094.31	098.02
24 06 201	.....	.....	117.79	125.15	131.33
24 06 402	082.40	084.86	084.36	085.91	087.72
24 06 604	.....	107.70	110.01	112.98	117.76
24 06 902	079.77	086.22	085.18	092.29	082.76
24 07 202	131.51	133.26	140.98	144.18	148.59
24 07 301	113.61	117.24	118.39	122.34	125.42
24 07 601	130.56	133.39	138.04	139.12	141.31
24 07 701	123.05	126.19	127.87	130.68	135.80

Preplant Irrigation Should Just Fill Soil's Root Zone

As preplant irrigation begins on the High Plains, an Extension irrigation specialist suggests that farmers plan their first watering so they apply only the amount which can be effectively stored in the soil's root zone.

The specialist, Bill Lyle, of Lubbock, says in general too much water is applied during preplant irrigation in this region.

There are instances where as much as 12 inches are applied when four inches will bring the soil to its field capacity throughout the root zone, the specialist said.

Field capacity is the maximum amount of water a soil can retain for crop use.

"Watering deeper than four feet is usually inefficient and results in considerable losses to deep percolation," Lyle said.

Water necessary to saturate the root zone varies with the soil type. Lyle describes the water holding ability of the common soil types on the South Plains as follows:

Hardlands — such as Pullman clay loams — hold an average of 2 to 2½ inches of water per foot of soil. At this rate, it takes eight to 10 inches to fill the four foot root zone. But the intake rate of these soils is extremely low so it is difficult to apply much more than four inches per irrigation.

Mixedlands — such as Amarillo fine sandy loams — hold about 1½ inches per foot of soil. A six-inch preplant irrigation should bring the root zone to field capacity.

Sandylands — such as Brownfield loamy sand — hold an average of one inch of water per foot of soil. An application in excess of four inches is probably wasteful.

To estimate the amount of water applied per irrigation, farmers first learn the pumping rate of the well. This gallons-per-minute figure can be converted to acre-inches per hour by dividing it by 450, Lyle said.

The acre-inches per hour can then be multiplied by the time per set and divided by the area irrigated to give the number of inches applied per acre.

For example, Lyle says this is how you can figure a 600 GPM well pumping on 1.5 acres for a six hour set. (1) The 600 GPM well puts out about 1.3 acre-inches per hour (600/450= 1.33). (2) Multiplying the acre-inches per hour of 1.3 times the 6 hours of the set gives 7.8 total acre-inches. (3) This 7.8 is then divided by the area irrigated or 1.5 acres to give 5.3 inches of water per acre.

Irrigation is not 100 percent efficient because of such things as ditch losses and evaporation. Average efficiency is estimated at about 70 percent, Lyle says, so the average amount of water applied per acre in this example is 5.3 inches times .7, which is 3.7 inches.

"Notice that we use the word 'average'," Lyle said. "The water penetration will be greater at the upper end of the furrow and less at the lower end."

Those with limited irrigation water may want to consider an application that will not bring the entire root zone to field capacity, he said.

Studies at the South Plains Research and Extension Center, near Lubbock, indicate that average summer rains with light preplant irrigation will produce yields comparable to those experienced with heavier preplant irrigations.

Lyle said in years of less than average rainfall, the center has, of course, gotten significant yield decreases with the lighter preplant irrigations.

New Water District Created At Lamesa

The South Plains Underground Water District was created February 2.

A hearing was held in Lamesa by the Texas Water Rights Commission at which time the commission issued the order for the creation of the District.

The district will cover parts of seven counties. Dawson, Lynn, Terry, Gaines, Yoakum, Cochran, and Andrews counties are included in the delineation.

The district has appointed temporary directors who will call an election in the near future. Residents of the above mentioned counties will be given the opportunity to vote on participation in the District.

PLEASE CLOSE THOSE ABANDONED WELLS ! ! !

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
Second-class Postage Paid at Lubbock, Texas.
BILL J WADDLE
Editor

High Plains Underground Water Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas 79401

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THE Cross SECTION

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

Volume 12—No. 10 **"THERE IS NO SUBSTITUTE FOR WATER"** *March 1966*

SATURATED THICKNESS OF THE OGALLALA FORMATION

1963

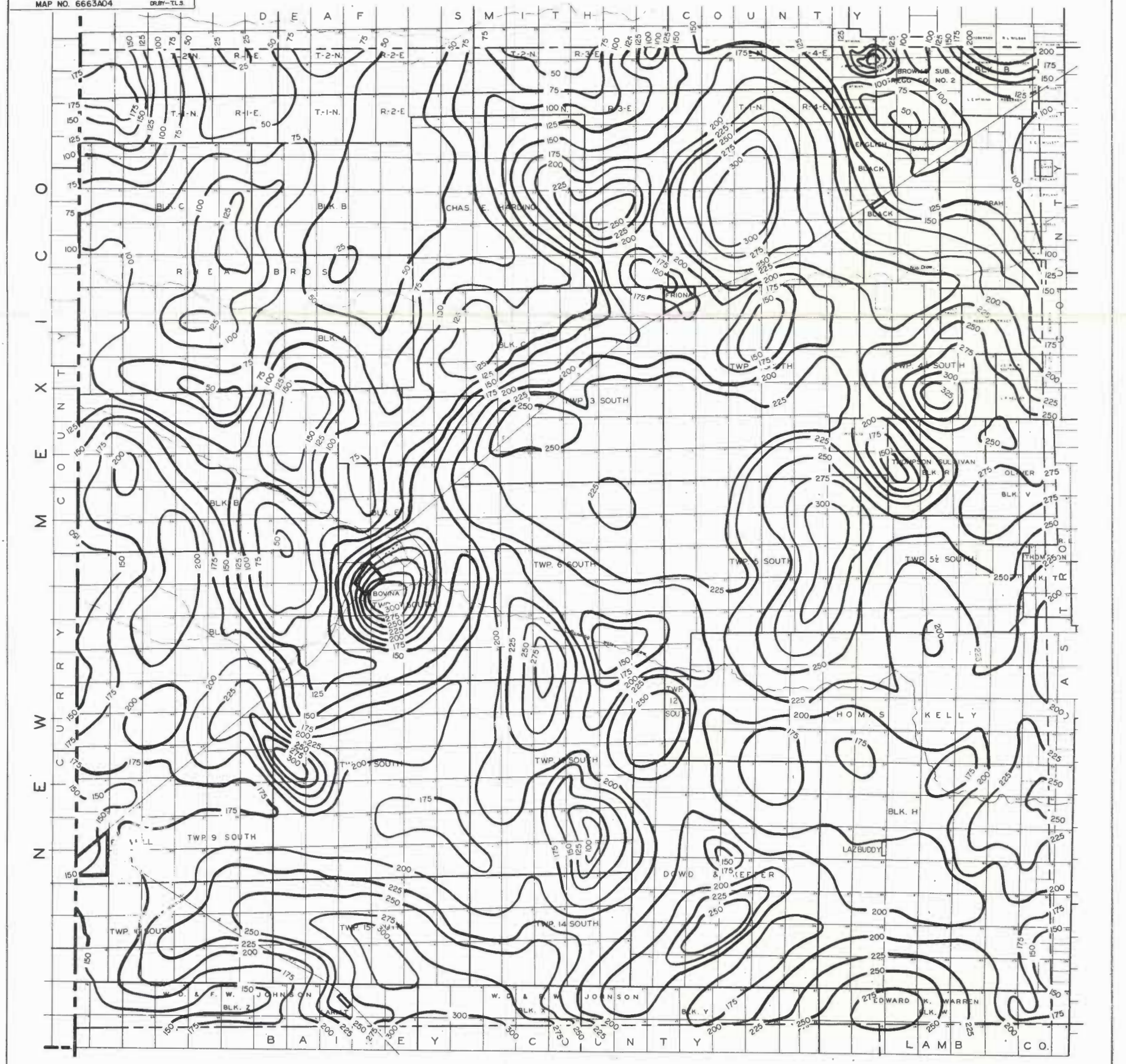
HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO.1
1628 - 13th. STREET
LUBBOCK, TEXAS

T. J. McFARLAND—MANAGER
ED L. REED—ENGINEER—A. WAYNE WYATT
MAP NO. 6663A04 DR.BY—T.L.S.

PARMER COUNTY TEXAS

GEO. F. KELLY
TULSA, OKLAHOMA
P O BOX 1 13 PHONE TU 4 5288

THIS MAP IS A GUIDELINE FOR TAX DEPLETION CALCULATION ONLY



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RELATION OF WATER DEPLETION TO WATER CONSERVATION

BY RUSSELL BEAN

The High Plains Underground Water Conservation District was formed as a conservation and regulatory agency aimed at making the best possible use of water stored in the great Ogallala sands underlying the South Plains of Texas. It covers all or parts of 13 counties. It is operated by elected county committeemen and an overall board of five members, plus the necessary technical and administrative staff headed by Mr. Tom McFarland as manager. The headquarters are in Lubbock.

Over the years the directors of the HPUWCD have been a rather remarkably astute group of men ,and the question of the long-range effects of depletion of the Ogallala water in this area was discussed soon after the formation of the Water District. There was no question in the minds of the directors that as pumping increased over the area, the water table would fall proportionately. It was obvious to them that the loss was far faster than the recharge, and that the recharge was for all practical purposes, insignificant. Also, it was obvious that land buyers had begun to pay a premium for land with proven water for irrigation. Therefore it was obvious that water was a capital asset which was being depleted.

As a conservation agency, the Water District wanted the means to show landowners in the Southern High Plains that Ogallala water was a valuable asset to be used with the greatest of care. And thus the question came up, "How is the best way to educate the water users of the South Plains in the careful use of this resource?" Oftentimes the water has been, and is being, wasted with little thought of its being a non-renewable asset.

One of the basic ideas initiated within the concept of water depletion was to get the water user to see, directly, the cost of water in the course of his doing business. The nerve that runs to the pocketbook is considered to be very tender. And the person primarily concerned here is the irrigation farmer or landowner who, at this point in history, has been neglecting to take into account the cost of water in growing his crops. Now, he does take into account the cost of pumping and the cost of the distribution of water over the land, but he doesn't take or at least he hasn't been taking, into account the real value of the water as stored beneath his land.

To use an over-simplified example, suppose a man pays $600 per acre for irrigable land at a time and place where dry land of equivalent quality sells for $200 per acre. It is obvious that the man is paying $400 per acre for the water. Let's suppose further that there is a 20 year supply of water under the land. In a case, the man would have a direct cost of $20 per acre per year to add to his farming costs. At least he should have this cost in his accounting both for tax purposes and for his own information, but up to now there has been no way to account for this cost for tax purposes except to use up the water, sell the land, and take a capital loss of $1,000. To carry this theoretical case a little farther, if the land involved were a half section with a capital loss of $400 per acre, the capital loss would be $128,000 out of which the landowner would be expected to get no tax relief on $127,000 of the loss.

I am sure that all of you agree that there has been a very considerable cost factor in South Plains agriculture which has been neglected over the years. At the same time I am sure that all of you agree that if the landowner of this area took into account each year the cost of water used in agriculture, through capital depletion, there would certainly be a strong tendency to be most careful of the use of water. Add to this the necessity of keeping records on remaining thickness of the saturated section of water sands, plus the yearly recording of the decline of the water table, and then it is all too obvious that with the most primitive of arithmetic the landowner will become aware of what is happening to his investment. Even a glance at such a set of figures should do more for water conservation than years of more conventional educational campaigning.

By 1954, such ideas as I have outlined had been crystallized, and the first move was to collect enough data to ask the Internal Revenue Service for a ruling. Several conditions had to be met, of course. First, the wells from which the pertinent data was to be taken needed to be in the Water District. Second, the wells needed to be accurately gauged as to water level over a long period of time at regular intervals. Third, the well logs needed to show the location of the bottom of the water-producing section, and this usually would mean the point where the Triassic formation starts, the Red Beds as they are usually called in this area. Four, there needed to be an obvious record of a premium having been paid for the water under the land. Five, there needed to be an owner of the water and the land who was willing to be the quinea pig. Many owners with many pieces of land and many wells were checked over, and that is a long, long story; but suffice it to say that Mr. Marvin Shurbet, a former director of the Water District and presently a member of the Texas Water Development Board, a Floyd County farmer who lives a few miles east of Petersburg, was chosen to be that guinea pig.

The first step was to ask for a ruling in late 1954. The first two attorneys to work on this matter were Lloyd Croslin of Lubbock and Joe Greenhill of Austin. They, with Mr. Ray Lawrence, the Lubbock accountant who worked out the first figures on water depletion on Mr. Shurbet's land, went to Washington in January 1955 to argue the logic of the case, but the IRS turned them down.

Further efforts were made to get IRS approval of water depletion in 1956, 1957, 1958, and 1959, all to no avail. In 1960 a test was initiated in which Mr. Shurbet took a carefully calculated depletion on his income tax. It was denied and the case went to the Federal Court in Lubbock in January 1962.

By this time a number of refinements had been worked out in an effort to make the case air-tight. Meanwhile, Lloyd Croslin had died and the local attorney who carried the load

(Continued on Page 4)

The Necessary Materials To Calculate Ground Water Depletion Are Now Available

Featured in this month's edition are some of the "tools" prepared by the District for use by tax payers in calculating their water depletion allowance. On the front page is one of the many maps prepared and accepted by Internal Revenue Service. The map shown is a "saturated thickness" map which reveals the thickness of the water bearing sands in a certain area. Maps of this type are used to determine the amount of water beneath a piece of land at date of acquisition.

On page three we have placed a copy of the Guideline for Calculating Cost Depletion Deduction for Ground Water Used for Irrigation in the High Plains Underground Water Conservation District No. 1. This guide is used to establish the amount of cost that a landowner will have in the water beneath his land. Landowners may use this guideline to establish their water cost. or they can use

(Continued on Page 4)

Guidelines For Calculating Cost Of Depletion

County	Year	Percent Of Cost Attributable To Irrig. Water:	Cost Per Acre Of Irrig. Water Cannot Exceed:	Cost Per Acre Attrib. To Dryland Cannot Be Less Than
Bailey	1948	69	115	25
	1953	73	250	50
	1958	72	300	70
	1963	70	350	100
	1965	70	350	100
Potter	1948	0	0	50
	1953	39	80	80
	1958	52	130	85
	1963	62	245	100
	1965	62	245	100
Castro	1948	53	80	40
	1953	60	150	50
	1958	64	250	70
	1963	66	360	100
	1965	66	360	100
Cochran	1948	9	5	35
	1953	39	80	60
	1958	56	210	75
	1963	67	330	100
	1965	67	330	100
Deaf Smith	1948	60	100	30
	1953	72	190	50
	1958	71	225	60
	1963	71	410	100
	1965	71	410	100
Lubbock	1948	40	65	60
	1953	55	200	90
	1958	52	225	100
	1963	56	340	155
	1965	57	340	155
Parmer	1948	18	20	50
	1953	51	110	65
	1958	60	200	95
	1963	65	360	125
	1965	65	360	125
Armstrong	1948	28	35	50
	1953	52	140	60
	1958	51	130	80
	1963	34	85	100
	1965	28	85	100
Randall SE	1948	32	40	50
	1953	33	50	80
	1958	37	85	90
	1963	29	50	100
	1965	29	50	100
Randall NW	1948	32	40	50
	1953	33	50	80
	1958	54	135	90
	1963	62	250	100
	1965	62	250	100
Hockley	1948	50	100	30
	1953	51	145	60
	1958	59	220	75
	1963	64	325	100
	1965	63	300	100
Floyd	1948	40	70	50
	1953	50	135	70
	1958	56	185	90
	1963	66	340	110
	1965	66	340	110
Lamb	1948	30	50	50
	1953	53	160	65
	1958	57	220	90
	1963	57	325	130
	1965	57	325	130
Lynn	1948	36	45	50
	1953	41	85	65
	1958	43	150	100
	1963	58	325	125
	1965	58	325	125

SWR AUD - 665 (3-66)

U. S. TREASURY DEPARTMENT - INTERNAL REVENUE SERVICE

SCHEDULE TO SUPPORT DEDUCTION FOR DEPLETION ON GROUND WATER USED FOR IRRIGATION

TAXPAYER: JOHN and MARY DOKES — YEAR: 1963

ADDRESS: 5428 Main Avenue (County) Lubbock, Texas (State) 79401 (Zip Code)

NAME OF THE COUNTY IN WHICH YOUR FARM IS LOCATED: Lamb

IMPORTANT: If your farm was acquired in more than one acquisition, prepare a separate depletion schedule for each acquisition *(tract)* making up your farm.

1. (a) Number of acres 320 : **Show only the number of acres in this acquisition *(tract)***
   (b) Give complete legal description of this tract and locate this tract in spaces provided on the back of this form.
2. Is this farm within and part of a Water Conservation District? [X] YES [ ] NO If yes, please give your Water Conservation District No. 1.
3. (a) Date of acquisition 1960
   (b) How did you acquire this tract? [X] PURCHASE [ ] INHERITANCE [ ] GIFT. [ ] EXCHANGE
4. Basis at time of acquisition: ..... $ 138,000.00
   (a) If by purchase, your purchase price.
   (b) If by inheritance, the fair market value on that date *(as shown by Federal Estate Tax Return if filed or inheritance tax return)*
   (c) If by gift, donors basis plus gift tax paid but total not to exceed fair market value at time of gift.
   (d) If by exchange, give details on back.
5. Value of improvements, including residence, at time of acquisition ..... $ 19,200.00
6. Basis attributable to land and water *(Line 4 less Line 5)* ..... $ 116,800.00
7. Basis attributable to land and water per acre ..... $ 365.00
   (To determine this, divide amount on line 6 by number of acres on this tract from line 1(a))
8. Portion of basis attributable to ground water per acre ..... $ 208.00
   (a) If your farm is part of High Plains Underground Water Conservation District No. 1, you may use the percent of value attributable to ground water as shown in the guideline table for that area. Such value should not exceed the upper limit for water nor should the balance attributable to land be less than the lower limit for land as shown in the guideline table *(Show percentage used 57 %; Upper limit for water $ 262.00 ; Lower limit for land $ 106.00)*
   (b) If you computed the amount on line 8 by some other method check here [ ] and explain the basis of your computation on back.
9. Decline in water table under this tract for this year: 4 ft. Show source of information: Map No. 666 3706
10. Saturated thickness of water formation under this tract in year of acquisition 159 ft. Show how this was determined Map No. 6658703 & 666 3704 Straight Line Interpolation *(If additional space is needed, show on back)*
11. Water depletion allowance per acre in this year:
    To determine this, divide decline in water table (line 9) by saturated thickness (line 10) and multiply result by basis of ground water per acre (line 8)
    (Line 9) 4 ft X $ 208.00 (Line 8) = depletion per acre ..... $ 5.23
    (Line 10) 159
12. Your water depletion allowance for this year. ..... $ 1,674.00
    To determine this, multiply acres of this tract 320 (line 1(a)) by water depletion per acre $ 5.23 (line 11)
13. Water depletion claimed and allowed in prior years.
    (a) Prior to 1962 837 (b) 1962 _____ (c) 1963 _____ (d) 1964 _____

(Over)

This form is for computing cost depletion deductions by taxpayers in the Southern High Plains of Texas and New Mexico who extract ground water from the Ogallala formation for irrigation purposes. (See Revenue Procedure 66-11, Internal Revenue Bulletin 1966-12 dated March 21, 1966)

FORM 843 (Rev. July 1965)

U.S. TREASURY DEPARTMENT - INTERNAL REVENUE SERVICE

CLAIM

TO BE FILED WITH THE DISTRICT DIRECTOR WHERE ASSESSMENT WAS MADE OR TAX PAID

District Director's Stamp (Date Received)

The District Director will indicate in the block below the kind of claim filed, and fill in, where required.

[X] Refund of Taxes Illegally, Erroneously, or Excessively Collected.
[ ] Refund of Amount Paid for Stamps Unused, or Used in Error or Excess.
[ ] Abatement of Tax Assessed (not applicable to estate, gift, or income taxes).

PLEASE TYPE OR PRINT PLAINLY

Name of taxpayer or purchaser of stamps: JOHN and MARY DOKES

Number and street: 5428 Main Avenue — City, town, State, Postal ZIP Code: Lubbock, Texas 79401

Fill in applicable items—Attach letter size sheets if space is not sufficient

a. Your social security number: 159 12 3122 — Wife's number, if joint return: — b. If an employer, enter employer identification number:

c. District in which return (if any) was filed: Dallas, Texas

d. Name and address shown on return, if different from above:

e. Period—if for tax reported on an annual basis, prepare separate form for each taxable year: From Jan. 1, 1963, To Dec. 31, 1963

f. Kind of tax: Income

g. Amount of assessment: $ 3,222.00 — Dates of payment: Feb. 15, 1964

h. Date stamps were purchased from Government:

i. Amount to be refunded (If income tax, complete computation below): $ 502.00

j. Amount to be abated (not applicable to income, estate, or gift taxes): $

k. The claimant believes that this claim should be allowed for the following reasons:

The refund results solely from a recalculation of tax due to the allowable cost depletion deduction for ground water used in our business of irrigation farming in accordance with Rev. Rul. 1965 - 296 and Rev. Proc. 1966 - 11.

Taxable income per return	$13,674.00
Less: Cost depletion deduction	1,674.00
Corrected taxable income	12,000.00
Corrected tax	2,720.00
Tax paid	3,222.00
Refund requested	502.00

(See attached schedule to support deductions for depletion on ground water used for irrigation).

COMPUTATION OF INCOME TAX REFUND	Income Tax
1. Tax withheld	
2. Estimated tax paid	
3. Tax paid with original return	
4. Any additional income tax paid	
5. Total tax paid (Add lines 1–4)	
6. Less: Your computation of correct tax	
7. Amount of overpayment	
8. Amount previously refunded	
9. Net overpayment (Enter in item i above)	

Under penalties of perjury, I declare that this claim, including any accompanying schedules and statements, has been examined by me and to the best of my knowledge and belief it is true and correct.

Signed JOHN DOKES

Dated April 15, 1966 MARY DOKES

SEE INSTRUCTIONS ON REVERSE

FORM 843 (Rev. 7-65)

TEXAS TECH TAX INSTITUTE ON . . .

WATER DEPLETION

Details of how High Plains landowners could claim an income tax depletion allowance on underground water was explained to over five hundred persons March 11th. The meeting was a special meeting of the Texas Tech Tax Institute and the High Plains Underground Water District.

Howard C. Longley of the Internal Revenue Service explained the recent tax ruling by the Treasury Department which allows a depletion allowance for ground water depleted in the business of farming.

Joe G. Moore, Jr., executive director of the Texas Water Development Board explained what information was available from his organization. He commented on the cost of preparing this information and distributing it to landowners not in organized water districts. Moore stated that a very small number of landowners had requested information and due to the cost, it was doubtful that the board would prepare information to be distributed. He did however, state that any information the board now has would be available to the taxpayers.

Land value cost guidelines developed by Dr. Vernon T. Clover of Texas Tech were presented and discussed. The guidelines show the amounts of the purchase price that can be attributed to the cost of water and land.

Ed Reed, hydrologist for the Water District, explained the saturated thickness and decline maps prepared by the District. He gave a definite example on determing the saturated thickness of the water bearing sands and the decline of the water table on a tract of land in Lamb County, Texas.

Questions were taken from the audience and answered by Jack Sexton, Vernon Clover, J. Chrys Dougherty, Clarence P. Brazill, Jr., Edwin L. Kahn, Joe G. Moore, Jr., Howard Longley, George McCleskey and Ed Reed.

Maps. cost guidelines, and refund claim forms were distributed.

Participants and guests at the recent Texas Tech Tax Institute on water depletion included left—right, Clarence P. Brazill, Jr. President of the Institute; Ellis Campbell, District Director, Dallas District of Internal Revenue Service Joe G. Moore, Jr. Ex. Director Texas Water Development Board,; Russell Bean, Chairman of The Board H.P.U.W.D. Marvin Shurbet farmer and member Texas Water Development Board; Howard C. Longley Internal Revenue Service.

Interested landowners in the High Plains Water District have recently been studying maps prepared by the District for use in calculating water depletion allowances. Above left—right, B. V. Padon of Springlake, Tom McFarland of the H.P.W.D., State Representative Bill Clayton and Donnie Clayton of Springlake discuss a water decline map for Lamb County.

Relation Of Depletion

(Continued From Page 2)

from then on was George McCleskey, aided by Clancy Brazill. In Austin, Joe Greenhill had become a justice of the Texas Supreme Court, and his former partner, Chrys Dougherty, took over. And in Washington, Edwin L. Kahn had become a part of the team. Among the refinements decided on were, for one, that the score of the case would be limited to the Southern High Plains with its unique isolation, thus precluding any possible argument of recharge from the Rocky Mountains. Another thing, decided early, was the point of sticking to cost depletion only.

In January 1963, a year after the case was presented, Judge Dooley handed down the decision in favor of Mr. Shurbet. The government appealed and oral arguments took place before the 5th Circuit Court of Appeals in Houston in June 1964. A year later that decision was handed down, again in favor of Mr. Shurbet. Some five motnhs later, on November 2, 1965, the government announced that the decision would not be appealed to the U. S. Supreme Court, and in December the Treasury Department agreed to acquiesce in the decision.

Now it took 11 years and a lot of work to get to this point, in December 1965 just three months ago, and I am sure that all of you realize what a monumental task awaited the Water District and the Internal Revenue Service in preparing guidelines and maps to make possible the proper accounting of water depletion for income tax purposes. The amount of work which went into the preparation of these maps and tables is almost impossible to conceive, and I won't try to give credit to all the people involved as the list is lond, but the culmination of their efforts will mean many dollars will be saved annually by landowners using ground water for irrigation.

Materials Available

(Continued From Page 3)

other means to establish this fact if they so desire.

The Schedule to Support Deduction for Depletion on Ground Water Used for Irrigation has been filled out to give our readers an idea of how to complete the form. This "tool" is designed to give the exact location of the land where depletion is claimed.

Form 843 is the standard claim form used by the Internal Revenue Service. It has also been completed to give the reader an idea of how to complete such a form.

These "tools" will become very familiar on the Southern High Plains during the coming years. In addition to the "saturated thickness" maps. decline maps have also been prepared by the Water District. If one should desire to secure a set of maps for his particular county they are available at the District office. The maps are being made available at the cost of printing which is 50c per map.

To many this is not new material, but we felt we had many readers who live in other areas that might be interested in how we were establishing the facts for tax payers in the High Plains Water District.

High Plains Underground Water
Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas 79401

Second Class Permit

THE Grass SECTION

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

Volume 12—No. 11 "THERE IS NO SUBSTITUTE FOR WATER" *April 1966*

Mineral Leases

During the past ten years much has been said about mineral leases, both good and bad.

Years ago when oil and gas was first discovered in West Texas, mineral leases were welcomed by all and these leases put a lot of money in a lot of pockets and really gave some areas in West Texas a "shot in the arm", as far as economy is concerned. In many areas this is still true. These leases provided income from which fine schools were constructed and many jobs for local people were created.

The industry moved along and times were good for everyone in the petroleum business, lessees, lessors, producers ,and everyone. Then the oil became hard to produce and make money due to allowables and the price of raw crude. The producers began looking for an inexpensive method of producing marginal wells and here we are today.

Lengthy discussions have been conducted on oil leases that are now in effect and what they mean to the owner of the surface rights to a piece of property.

The pracitce of "water flooding" oil leases has proved to be very successful in recovering crude oil which would otherwise be unrecoverable. Many differences of opinions have arisen over water flood projects in some West Texas areas using fresh water.

Many of our readers are unaware of the specifications of mineral leases negotiated in past years as well as those drawn today. In an attempt to inform our readers we would like to expand on a few problems that have arisen from mineral leases during the past few years.

One problem incurred has been the clause in almost every mineral lease negotiated in West Texas that gives the "free use of wood, water, and coal for the production of oil." Petroleum people interpret this clause to give them the use of fresh water in the production of oil, specifically in "water flood" projects. Farmers, who in many instances never owned the mineral rights to a piece of land, interpret the clause to mean that the free use of fresh water was for the drilling and construction of the well and nothing thereafter.

The interpretation of this clause has been presented to the courts in Hockley County ,Texas. In a case filed in

(Continued On Page 3)

In the area on the High Plains of West Texas where this picture was taken there is no water to waste. The windmill has stopped pumping. Net returns from crops is low. Conservation is your responsibility. Do your part to make sure this will not be the picture of the entire West Texas area in future years. Water conserved is insurance against this becoming a reality for West Texas.

COUNTY WATER TABLE DECLINES

The average decline of the water table in the thirteen counties of the High Plains Underground Water District for 1965 was 2.06 feet. Listed below are the counties and the average decline of each.

Armstrong	1.84 feet
Bailey	1.10
Castro	2.37
Cochran	1.27
Deaf Smith	1.39
Floyd	3.77
Hockley	2.44
Lamb	2.51
Lubbock	2.74
Lynn	1.22
Parmer	3.98
Potter	.50
Randall	1.66

Parmer County had the greatest decline and Potter County had the least decline.

When one's bank account declines sharply, one takes steps to control the decline. Water is money to the High Plains and everyone needs to take steps to conserve water. Start today to do your part.

SEWAGE EFFLUENT

Value of sewage effluent for agricultural use is a topic from a recently published report by Dr. Clark Harvey and Ronald Cantrell of the Agronomy Department of Texas Technological College .

The report was prepared for the Texas Water Development Board and entitled *Use of Sewage Effluent For Production of Agricultural Crops.*

The following is an excerpt from the report.

The economic contribution that could be made to the State through efficient use of 1,317,375 acre-feet of effluent would be difficult to estimate. An estimate that has had wide distribution in the literature and often quoted by speakers is that agriculture returns $44 to $51 per acre-foot of water used. The value would vary greatly with crops and the influence that increased acreages of some crops might have on prices. The estimated value of an acre-foot of water varies from a net of $16.50 for an average of several crops to $78.50 for cotton. In any case the value is sufficiently high to justify expenditures necessary to properly distribute it over productive soils.

In Israel sewage effluent is considered of sufficient value to justify transporting it 60 miles from the point of origin.

A ranch operator using San Antonio sewage effluent states that his ranch will support two cows per acre compared with one cow per 30 acres on local non-irrigated land.

Crops And Acreage

Data available on crops being irrigated and the specific acreage of each is scant. Information available is summarized in the table below.

Major Crops Irrigated With Sewage Effluent

Crop	Acreage
Wheat	1,610
Cotton	1,580
Grain Sorghum	1,609
Alfalfa	365
Rye	20
Corn	60
Oats	100
Pasture grasses	5,801
Not Specified	1,011
Total	12,157

Included in "Pasture grasses" in the table are Johnson grass, Coastal Bermuda grass, and native or related

(Continued On Page 2)

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

Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

Sewage Effluent —

(Continued From Page 1)

species. This type of vegetation is normally adjacent to sewage disposal plants and represents minimum cost to the user in seedbed preparation, seeding, tillage, harvesting, etc. Also this cover is present the year-round and provides erosion control superior to most row crops. Johnson grass is a low-value crop and would generally represent less than maximum or optimum utilization of the resource.

Irrigation with water or effluent may be questionable in areas with annual rainfall in excess of about 25 inches. This amount of rainfall if evenly distributed throughout the growing season would nullify many benefits of supplemental irrigation. There are very few areas in Texas that receive rainfall in this manner, and moisture deficiencies are commonplace throughout most of the State.

Cost To Users

Information about the cost of effluent to the user is scant. The most common arrangement appears to be one in which the effluent is donated to the user if he will defray costs involved in removing it from the disposal plant or some area of deposit. In other cases the user pays a stipulated sum for the use of the effluent. Others are charged on a quantity basis such as so much per 1,000 gallons. Figures made available are summarized in this table.

Cost Of Effluent To User

Amarillo	$ 0.01 per 1,000 gal.
New Braunfels	300.00 per year
Hale Center	.25 per 1,000 gal.
Edinburg	.50 per acre irri.
Coahoma	150.00 per year
Snyder	.05 per 1,000 gal.
Muleshoe	500.00 per year
Midland	.10 per 1,000 gal.
Burnet	.10 per 1,000 gal.

As water resources become more acute it is probable that higher charges will be demanded of users. Engineers at San Antonio calculate the cost of producing a million gallons of effluent at $35—including chlorination. A million gallons equals 3.07 acre-feet.

It was surprising to the authors of this report to find a general lack of understanding or appreciation for the value of effluent. Its use was discontinued at San Marcos and Burnet after having been used 15 years or more. The vocational agriculture teacher and his FFA members recently took over the Burnet project. The Lorenzo FFA also utilizes the effluent of that town. This appears to be a very fine arrangement for the smaller communities.

Odors

Properly treated sewage effluent does not possess objectionable odors or other undesirable characteristics. The authors visited several fields where effluent was being used and noted the absence of offensive odors. No odors were detected around the lagoons at Llano and Fredericksburg. Effluent coming from the secondary sediment tanks at San Antonio looked as clear and free from impurities as water from a flowing fountain. Very little additional treatment would be necessary to convert it to a supplemental source of drinking water.

The tendency with land disposal of sewage is to apply as much sewage as possible on a limited area at rates higher than can percolate through the soil. Waterlogging of the soil and development of odors result from such practices. When the application of sewage effluent to the land is geared to the needs of the soil and the crop, odor and waterlogging difficulties do not arise. Effluent may have unpleasant odors also if the processing plant is overloaded and the sewage is not properly treated.

Conclusions

From the information obtained by the survey, supplemental data provided by the Texas State Department of Health, and personal inspection of several sites where sewage effluent is being used, the authors have drawn the following conclusions:

1. A resource of great economic value is not being used.
2. In many instances this resource is looked upon as "something to be gotten rid of," and a minimum expense of application results in low efficiency of the resource.
3. Much of the effluent is used on low-value crops.
4. Under proper climatic and soil conditions, the use of sewage effluent need not create nuisance conditions or health hazards.
5. Crop irrigation with effluent can contribute to the economy of the area and solve satisfactorily the sewage disposal problem.
6. It may be desirable or necessary to impound sewage during the nongrowing season for irrigation use during the growing season.

Advantages Of Pumping Playa Lakes

1. Utilization of lake water will either offer the farmer an additional supply of water—raising the potential income of the farming unit substantially, or else will prolong his irrigating economy by using this lake water instead of the underground water which is being exhausted.

2. The pumping of water from playa lakes offers vast potential in salvaging valuable land for crop production.

3. Lake water which has been sampled has shown that this water contains between 3 and 15 tons of silt per acre foot. By utilizing lake water this valuable top soil, some of which stays suspended in the lake water, may be redistributed back on the land from which it eroded.

4. Chemical analysis of lake water has shown that this water contains most of the major, minor, and trace elements which are necessary for the production of crops grown on the High Plains of Texas. Perhaps the most valuable chemical found in lake water is nitrate nitrogen; quantities exceeding 30 pounds per acre foot have been analyzed.

5. Temperatures made of the water pumped from the Ogallala formation average about 63 degrees F, whereas water in playa lakes averages about 80 degrees from April through September. Most major crops grown on the Southern High Plains of Texas are greatly affected by soil temperatures. The warmer water pumped from playa lake water will not lower soil temperatures as greatly as the colder water pumped from the Ogallala formation and will not, therefore, retard growth.

6. Pumping the water from playa lakes and/or modification virtually eliminates the production of mosquitoes.

HIGH PLAINS FARMERS CAN'T AFFORD TO LOSE . . .

IRRIGATION TAIL WATER

By BILL J. WADDLE

During the last few days the High Plains Water District has served several injunctions on High Plains' farmers for allowing irrigation water to escape from their land. Many more will be served in the near future if farmers continue to allow their irrigation water to escape from their land.

Farmers who have been served should not feel that they are being made examples, everyone allowing water to escape will be treated in the same manner.

The injunctions ask the court to order the farmer to stop wasting water. Waste as defined by the State Statutues of the 51st and 53rd Legislatures reads in part as follows:

> Willfully causing, suffering, or permitting underground water produced for irrigation or agricultural purposes to escape into any river, creek ,or other natural watercourse, depression, or lake, reservoir, drain, or into any sewer, street, highway, road, road ditch, or upon the land of any other person than the owner of such well, or upon public land.

If the injunction is granted, the farmer then must comply. If he fails to comply with the ruling of the court, he is then in contempt of court.

What can a farmer and land owner do to prevent the waste of water? Many proven practices are available for farmers if they will only use them. Many use the excuse that these practices are bad economics and will not pay for themselves. Well folks, the time for paying for the installation on good economics is about gone. If you are gambling with your livelihood (your water) you are taking a big gamble. We only have so much water and when we deplete this supply we must look for importation of outside water sources.

There are several plans for the importation of water into West Texas. There is one plan that for all practical purposes completely ignores the High Plains area as far as the importation of water is concerned. The plans that do include West Texas are large and great and will take many years to develop. What do we do between now and the time these plans become a reality? We go to work to conserve and use wisely what we have.

Now, back to the original question. What can a farmer do to prevent waste? He can bench level, terrace, use more of his ingenuity in irrigating, and he can re-use water.

One of the most frequent arguments representatives of the District hear concerning tail water losses is that, "my neighbor down the road has a lake or pit about a mile from here, and he picks up all of my water and uses it to irrigate." This may be true, but a lot of water is still being wasted and lost in transit. Also, if this water is transported in county road ditches, this violates the waste statute of the State of Texas.

Let's assume that this water is transported in ditches cut on the property of the land owner. Tests conducted by the Agricultural Engineering Department of Texas Tech in 1954 in co-operation with the Soil Conservation Service and the Water District show ditch losses to range from 10 to 40 per cent per 1000 feet. These tests were conducted in prepared ditches where losses to vegetative uses were almost nil. Most ditches were constructed with ditching machines and the water was not allowed to spread over a large area such as in the ditches along county roads.

Losses from a wide ditch such as the ones along county roads would probably be higher than regular ditch losses due to the additional area of seepage, vegetative growth, and the additional surface area exposed for evaporation.

Using a 20 per cent loss per 1000 feet, how much water will actually get into a lake or pit if the water runs down the county ditch.

See Chart ——→

If the water should enter a tail water pit located on the farm, then the loss would almost subside due to the quick removal and re-application to the farm. If the water runs to a large lake a great loss continues from evaporation.

Evaporation Losses

(Losses computed on average evaporative loss of 0.3 of an inch per day free surface evaporation from records of the United States Weather Bureau, April through September)

Estimated Losses By Evaporation From Playa Lake Surfaces

Surface Acres of Lake	Gallons Lost Per Minute
5	28
10	56
15	84
20	112
30	168
40	224
50	283
75	423
100	556

One might assume that if 400 gallons per minute (and this is not a large stream of water) escapes from a farm and travels a mile in a county ditch and then into a surface lake of about twenty-five acres, then for all practical purposes every drop of this water is *wasted.*

The author finds it difficult to understand how a farmer can go to the expense of pumping water and then giving it to his neighbor or letting it go to waste. Production costs as they are today, this would seem to be *bad economics.*

Gallons Leaving Farm	Traveling (in feet)	Water Lost	Available for Recovery
400 G.P.M.	1000	80 Gallons	320
400 G.P.M.	2000	144 Gallons	256
400 G.P.M.	3000	195 Gallons	205
400 G.P.M.	4000	236 Gallons	164
400 G.P.M.	5000	268 Gallons	132
400 G.P.M.	6000	294 Gallons	106
400 G.P.M.	7000	315 Gallons	85

Simple arrangements to capture and save water can be developed on many farms. This simple siphon tube lifts water from behind an earthen dam and puts it in ditch for irrigation. Notice the small primer on the bank of the dam. This is used to prime the siphon tube. There are no

Mineral Leases —

(Continued From Page 1)

the District court at Levelland, Texas, Sun Oil Co. vs. Whitaker, the oil company alleges that the free wood and water clause allows it to use fresh water for a water flooding project on the defendants land. The defendant landowner alleges that the underground water beneath his land is his property and that the oil company has no right to use his fresh water for any purpose other than drilling and developing a well, which is what he feels was the original intent of the mineral lease.

The Courts will decide this issue in the near future it seems quite evident.

Individuals or parties negotiating mineral leases should be aware of the following provisions of many leases.

1. Almost all standard lease forms give the free use of wood, water, and coal for the production of oil. If the lessor objects, the oil company frequently will omit this clause from the lease. In some instances the lease contains a clause that specifically gives the free use of water for water flooding or secondary recovery.

2. If you are purchasing land with no minerals, it is a good idea to check the existing mineral leases on the property. In some instances waivers can be obtained from the oil company stating that no fresh water will be used in secondary recovery operations or "water flood" projects under that land.

3. Before purchasing land one should make a thorough search for any unitization agreement that might exist involving minerals beneath the land in question. Unitization agreements frequently contain specific language granting the oil operator the right to use fresh water for "water flood" projects on the land as well as other land included in the unitization agreement.

A little time and care spent in examining mineral leases diligently can save many worries in the future for land owners, royalty owners, and oil producers.

Please Close Those Abandoned Wells!!!

fuel costs here and the water being used is rainwater and irrigation tailwater. You may have a place on your farm for such an installation.

WATER RESOURCES COMMITTEE . . .

WEST TEXAS CHAMBER OF COMMERCE

The West Texas Chamber of Commerce held its annual meeting in Fort Worth April 22 and 23. The Water Committee of the Chamber met and passed the following resolutions.

Federal Water Pollution Control Activities

In 1965, the Federal Water Pollution Control Law was amended to provide, among other things, for the establishment of water quality standards and the abatement of pollution of interstate or navigable waters. The Law sets up procedures under which each state may establish criteria and a plan for implementation and enforcement to be filed with the Secretary of Health, Education and Welfare prior to June 30, 1967. If a state does not establish adequate water quality standards, the Secretary may do so.

As required by the law, the Governor of Texas filed a letter of intent that Texas will comply with the Law by adopting water quality standards for certain interstate waters and developing a plan for the implementation of such standards. The Texas Water Pollution Control Board and the other state agencies are moving to meet the June 30, 1967 deadline.

This year, legislation has been introduced which would greatly expand the federal authority in water pollution control. S. 2987 (Muskie), HR 13104 (Fallon) and HR 13105 (Wright) are identical bills which would amend the Federal Water Pollution Control Act in such manner as to bypass many of the procedures established in the 1965 Act and give the Secretary of Interior greatly increased authority in establishing and enforcing water quality standards on interstate or navigable rivers or tributaries thereto (which probably includes every stream in Texas).

Among other things, the proposed legislation would give the Secretary authority to set up River Basin Commissions and the right to approve comprehensive river basin pollution control plans and the means of enforcement thereof. The Secretary would be empowered to require notice of any proposed waste discharge and to enforce pollution abatement, even including the right to enter private property without a warrant . . . Hearings will be held on S. 2987 beginning April 19 and running through the week of May 2.

Playa lakes are being modified all over the High Plains. A simple modification shown here is channeling the water from the shallow parts of the lake to the pump. The lake water is pumped directly into a concrete line for distribution to crops.

The Water Quality Act of 1965 gave the states two years in which to establish water quality criteria and implementation plans and there has not yet been time to determine whether or not this Act will be effective in combating pollution. There can be no doubt that Texas will file its standards and plans with the federal agencies before the deadline and, because of the threat of federal action if the states do not act, it is reasonable to assume that all, or nearly all, of the states will meet the deadline. In this situation, Congress would be acting prematurely in passing further legislation giving more authority to the federal government until it is known that the 1965 Act is not sufficient to resolve the nation's pollution problems.

An agency which has almost unlimited power to establish and enforce water quality standards will control the water supplies and as a result, the destinies of every water user, particularly all industrial and agricultural users. West Texans have demonstrated many times their ability to solve their water problems without federal intervention ,and there is no doubt that they can and will cooperate with and aid the state agencies in complying with the requirements of the 1965 Act. Therefore, the Water Committee recommends the following resolution for adoption by the West Texas Chamber of Commerce and urges its distribution to members of Congress and others as appropriate:

RESOLVED, that the present Federal Water Pollution Control Act, as amended, (33 U.S.C. 466 et seq) provides the necessary authority and procedures under which the states may establish water quality criteria and plans for their implementation and enforcement. No additional federal authority should be authorized unless and until it has been determined that the states are not acting under the present Law. The West Texas Chamber of Commerce opposes the enactment of S.2987, HR 13104 and HR 13105.

The Committee also feels that Texas industrial and agricultural interests should establish an interim committee having state-wide representation to work with and aid wherever possible the Texas Water Pollution Control Board and the other state agencies in their efforts to comply with the 1965 Act. The West Texas Chamber of Commerce should express its willingness to join with the other Texas chambers, the Texas Manufacturers Association and/or other industrial and agricultural organizations in establishing such a committee.

House Resolution 4671

Whereas, HR 4671 would authorize the secretary of interior to make a study of the movement of water into the Colorado river basin,

Whereas, It would be to the benefit of West Texas to be included in any study involving the transferal of water from an area of surplus to an area of deficit,

Therefore, Be it resolved that the West Texas Chamber of Commerce urges the Texas Congressional Delegation to amend HR 4671 to include Texas in this plan and any other study concerning the movement of water into the Southwest area.

Resolved, That the West Texas Chamber of Commerce supports the efforts of Texas Technological College to establish an underground water laboratory at the college.

Whereas, The state water plan, as it is now being prepared by the Texas Water Development Board, is predicated upon projections to the year 2020, and

Whereas, Spokesmen for the Texas Water Development Board have been publicly quoted to the effect that the plan, as now being prepared, will make no provision for an increased water supply for the geographical area of West Texas not included in the plan

Now, Therefore, Let it be resolved by the West Texas Chamber of Commerce in convention assembled at Fort Worth, Texas this 21st day of April, 1966 that the water development board be petitioned and urged to make adequate provision in the forthcoming Texas master water plan for meeting the needs of West Texas to 2020 and thereafter.

Water Is Your Future, Conserve It!

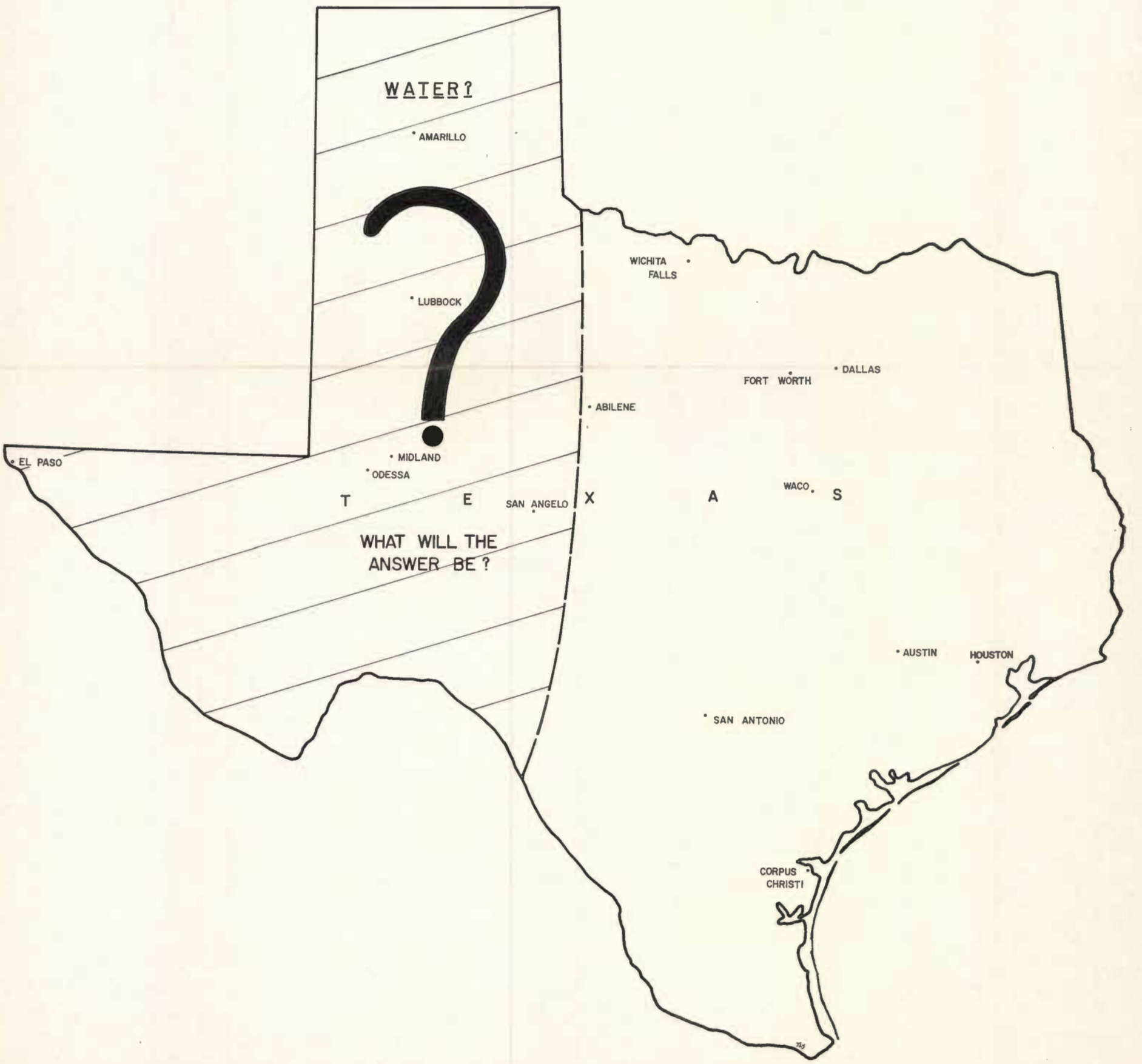
High Plains Underground Water Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas 79401

Second Class Permit

THE Cross SECTION

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

Volume 12—No. 12 **"THERE IS NO SUBSTITUTE FOR WATER"** *May 1966*



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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

Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

STATE WATER PLAN . . .

What Will The Answer Be?

Texas is a big and mighty state. It covers many millions of acres of land of all descriptions and is populated with some of the finest people in the world.

Sometime over a year ago, Governor Connally directed the Texas Water Commission to prepare a comprehensive water plan for water development of the entire State. Immediately after the Governor's directive had been issued, the 59th session of the legislature passed S. B. 146 which related to the reorganization of the Commission, transfering water planning responsibilities to the Texas Water Development Board.

This same legislation also directed the Texas Water Development Board to prepare the water plan the Governor had requested of the past commission.

Today, the Water Development Board is in its final drafting of a water plan for the State of Texas projected to the year 2020. But what is included in this plan for future water supplies for West Texas?

As of this writing, the plan has not been released to the public, but from indications made through public statements by Water Development Board personnel it seems there is no provision for Texas water to help supply West Texas.

The plan is expected to call for diversions of water from East Texas, South and West to the Rio Grande and Coastal areas but West Texas will be left out. It appears the only hope West Texas might have for additional water must come from being made a part of a regional plan calling for importations of surface water from other states.

East Texas, where an apparent ample supply of water is available has been projected and foreseeable water needs can be met for future years.

The West Texas, Trans Pecos and El Paso areas in 1960 had a combined population of 1,111,191 persons or approximately 11.6 per cent of the population of the State. The land area of this part of the State is approximately 76,108 square miles or 29 per cent of the total land area of the State.

Farming, ranching, petroleum and industry are quite intense in this area, and water is a necessity if this economy is to continue to live.

The time will come when the ground water supplying this highly productive area must be supplemented.

Water Development Board representatives state that if any surface water was available for diversion from East Texas to West Texas, pumping expense would make the cost prohibitive. Three hundred miles at a lift of 3000 ft. would make a cost in the water of about $168.00 per acre foot the Board estimated. Diversion may be expensive and the price of an acre foot of water prohibiitive, but nevertheless, West Texans still want to be made a part of the Master Plan.

Years from now, ways and means might be found to cut those costs. One thing seems sure, if we aren't included in the plan now, we will never be included because canals and dams aren't easily moved.

In a speech given by Joe Kilgore, who is a member of the advisory panel to the Texas Water Development Board, at the Conference on Water Law at the University of Texas, he made the following comments.

"The most urgent water requirement facing the State is an adequate surface water supply for irrigation in El Paso, The Trans-Pecos and High Plains areas of West Texas. There is not enough surface water in the rest of the State, excess to other foreseeable requirements, to provide for these needs, even at the present level of irrigation water use."

He further stated, "The Plan will recognize that all Texans, not just those in the west, have a vital interest in sharing the continued and expanding contribution of West Texas, through its irrigated agriculture, and its unique culture and environment, to the State's economy. The Plan will propose the following specifications to aid in meeting the water needs of this area:

(1) Active and vigorous leadership at t he State level in proposals before the Congress for inclusion of West Texas in regional plans for the movement of water from northwestern United States, or from the Mississippi and Missouri, to the West Texas area, and participation by the Texas Water Development Board in development and financing of such plans.

(2) State financial participation in carefully designed recharge projects to increase the storage in the underground water-bearing formations which supply the West Texas area.

(3) Establishing a district office of the Texas Water Development Board in West Texas, adequately staffed with able personnel to assist in the wide range of research, data collection programs, improved water application studies, and continuing technical and economical analyses, required to assure the optimum conservation and utilization of available water supplies.

(4) State financial participation with local and federal agencies in a modern, large-volume inland desalination plant to provide additional municipal and industrial water supply.

(5) Continued exploration of the economic feasibility of import of water from in-state sources of municipal and industrial water as specific unforeseen needs are projected.

(6) Intensified efforts to improve surface water quality in the upper reaches of the Red, Brazos, and Colorado Rivers to permit multiple uses."

Any way you analyze the situation, there is no surface water available in the State Water Plan for West Texas. West Texans will help pay for the diversions that are called for in the plan, but no water will be coming their way from other sections of Texas.

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."

It Was Worth The Effort

The water depletion allowance for water used in the business of irrigation farming is now an official revenue rule and is now being used by many West Texas land owners who utilize underground water for irrigation.

For several years the Water District fought for such a rule and concluded the fight with the U. S. vs Shurbet tax case. Many observers told officials of the district that it was just a waste of time and money, and would never be of much value to the tax payers. Critics of the case also maintained that the deduction would be so small that it wouldn't be worth the time to take the deduction.

The Water District has recently dome some investigating to see what the indicated results of the tax case might be.

The Internal Revenue Office in Dallas reported that they had received approximately 4000 claims for a water depletion allowance. Most of these claims were filed on the 1962 returns. Due to the small amount of time tax accountants had, most of them only filed claims for their clients' 1962 returns to prevent losing the claim under the statute of limitations rule. During the remainder of the year, claims for 1963, 1964 and 65 will be filed.

A local tax consultant recently reviewed some of the water depletion tax claims made for his clients for the benefit of this article. He reported that of the claims he reviewed the water depletion allowance was the result of the tax refund due his clients.

These refunds ranged from $25.00 to more than $2,500, and the average refund was approximately $550.00.

Assuming that the $550.00 average held true for the 4,000 claims already filed, this would amount to some $2,200,000 to be refunded to the land owners in this area in the near future.

The I.R.S. is expecting several more thousand claims in the near future for the years accountants did not file for.

One can quickly see that from the small number of claims already filed that the effort was well worth it to fight so hard and long for a water depletion allowance.

The I.R.S. has advised that tax payers should be receiving their refund checks in the near future.

PLEASE CLOSE THOSE ABANDONED WELLS ! ! !

Something New For State Rep.

Early in 1966, Bill Clayton, Springlake farmer and State Representative discussed with the Water District the possibility of installing a tail water return system.

"There really isn't much water lost off of my land at this location, but it sure does look bad," said Clayton during the early planning stages.

The pit was constructed by Clayton using his own equipment, and is now in operation.

The wells are being metered and a time recording wier is installed at the intake of the pit. Accurate records will be kept on the amount of water pumped from the well and the amount of tail water that reaches the pit.

The pit pump is also being metered to determine how much water will be captured and reapplied to the land.

The Water District will keep records on the amount of water pumped, captured, and returned to the land. We hope we will be able to obtain accurate records to determine evaporation and transportation losses.

One last thought — that little bit of water that looked bad was enough to water twenty acres of land with a pre-plant irrigation.

NO PIT ORDER ISSUED

The Railroad Commission has issued orders banning the use of salt water disposal pits in all oil and gas fields in all thirteen West Texas Counties in the Ogallala Ground Water Region. The orders require that all pits (not just unlined) be drained and filled by the deadlines established.

Deadlines are May 1, 1967, for pits in Martin, Andrews, Bailey, Cochran, Dawson, Gaines, Hale, Hockley, Lynn, Terry and Yoakum Counties. Deadline for compliance in Hemphill and Swisher Counties is September 1, 1966.

Similar orders had been issued by the Water Pollution Control Board in parts of the Ogallala region before the Courts held, and the Legislature decreed, that the Railroad Commission has exclusive jurisdiction over oilfield wastes.

During the hearings, some operators asked for exclusions from the orders, and others asked that parts of the area of some Counties be left with pits.

The Commission's orders cover the entire County in each case.

Oklahoma Wins Court Battle Over Water

On May 19, a three-judge Federal Court ruled unanimously that the State of Texas cannot prohibit a person or persons from selling underground water from beneath their land and transporting it out of the State.

The case involved Mr. and Mrs. C. F. Mock, Oklahoma residents who own land in Wilbarger County, Texas. The Moks had sold underground water to the City of Altus, Oklahoma in December of 1964. In January of 1965, State Representative, Bill Heatly, whose district includes Wilbarger County, sponsored a bill banning such sales ,which was passed by the Legislature.

The opinion written by Circuit Judge Homer Thornberry overturned the year-old Texas law banning such sales unless specifically authorized by the Legislature.

The Court granted the Mocks a permanent injunction against enforcement of the law on the grounds it violates the commerce clause of the Constitution.

Joining in Thornberry's opinion were U. S. District Judge Spears of Austin, and Suttle of El Paso.

This decision once again emphasizes that underground water in Texas is private property and can be used or sold as the owner desired as long as it is not wasted.

Water Is Your Future, Conserve It!

Evaporation Studies

An initial grant of $10,850 for studies of water evaporation losses has been approved by the Office of Water Resources Research, U. S. Department of Interior, for the South Plains Research and Extension Center here.

The grant will support research to get basic scientific information about evaporation and to find methods to control it, according to Charles E. Fisher, research superintendent at the center.

"Learning what atmospheric factors and soil properties exert major influence on the evaporation process will be the first objective of the study," Fisher said.

Supervisor of the project will be Dr. C. W. Wendt, who was recently appointed associate soil scientist at the Research and Extension Center.

Meteorologist Oliver Newton, with the U. S. Weather Bureau at the center, and Agronomist Shelby Newman, in charge of water conservation and utilization research there, will cooperate in the study.

The Department of Interior grant also calls for efforts to find methods of decreasing evaporation losses by biological, cultural, mechanical or chemical treatments.

"Approximately 40 per cent of the total annual water budget for Texas is lost to evaporation of water from soils," Fisher said.

"If we could avoid just one per cent of this loss," he said, "it would save enough water to supply 26 cities the size of Lubbock for one year or enough water to irrigate the South Plains cotton crop 1 1/2 years."

Related Studies Noted

"The evaporation study will combine into the current program of research on conservation and utilization of rainfall and underground water at the center," Fisher said.

Related research underway there includes irrigation requirements of crops, techniques and practices of adjusting to limited irrigation water, influence of slope on runoff and crop yield, different methods of applying irrigation water, land leveling, plastic and chemical mulches, planting techniques and breeding crops especially suited to limited water.

"The Department of Interior grant is one of two approved for the State of Texas, and it will receive high priority at the Center," Fisher said.

Drilling Statistics For Jan, Feb, Mar. And April

	Completed Wells					Permits Issued					Replacements					Dry Holes				
	Jan	Feb	Mar	Apr	Total	Jan	Feb	Mar	Apr	Total	Jan	Feb	Mar	Apr	Total	Jan	Feb	Mar	Apr	Total
Armstrong	3	0	0	0	3	2	0	0	0	2	0	0	0	0	0	1	0	0	0	0
Bailey	4	10	15	0	29	3	4	10	3	20	0	0	0	0	0	0	1	0	0	1
Castro	20	5	12	10	47	14	8	8	16	46	1	0	0	0	1	0	0	0	0	0
Cochran	3	6	1	0	10	3	1	6	0	10	0	0	0	0	0	0	0	0	0	0
Deaf Smith	18	7	15	22	62	25	32	18	18	93	0	0	1	0	1	1	0	0	0	1
Floyd	7	17	13	14	51	22	7	27	13	69	1	0	0	1	2	0	0	0	0	0
Hockley	11	13	17	24	65	23	19	24	24	90	1	1	0	1	3	1	1	1	0	3
Lamb	8	8	13	8	37	8	12	12	14	46	0	0	3	0	3	1	2	0	0	3
Lubbock	18	22	18	58	116	39	37	43	16	135	3	0	0	2	5	1	0	0	1	2
Lynn	4	11	6	14	35	7	13	14	11	45	0	0	0	0	0	0	0	1	0	1
Parmer	10	16	14	17	57	13	21	15	27	76	1	0	1	0	2	0	0	1	0	1
Potter	1	0	1	0	2	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0
Randall	5	3	5	6	19	3	4	10	19	36	0	0	0	0	0	1	0	0	1	2
	112	118	130	173	533	162	158	189	162	671	7	1	5	4	17	6	4	3	2	15

Importation Of Water For West Texas

The distant future of West Texas and its giant agricultural economy is dependent on the importation of water.

The High Plains of Texas contains about one-third of the potentially irrigable lands of Texas. It is estimated that the 5.1 million acres of land irrigated in 1964 will increase to at least 7.1 million acres in 1980 and to 8.6 million acres by 2020 if sufficient water at a reasonable cost can be imported. Unless an adequate supply of irrigation water is made available to continue and expand our irrigation farming, large areas will retrogress to dry land farming and could cause quite an economic loss to the area, the state and the nation.

Studies for the State water plan have revealed conclusively that there is not sufficient surplus water in East Texas in excess of higher priority needs to make it feasible to transport water from East Texas to West Texas for irrigation. The plan further reveals that if the water were available it would cost $168.00 per acre foot to deliver it to the High Plains from East Texas. High Plains farmers are now spending approximately $15.00 per acre foot for the water they extract from the Ogallala formation.

Officials of the Texas Water Development Board and members of their planning group have revealed that out-of-State sources will have to be relied on for a supplement supply of irrigation water.

What alternatives do West Texans have to explore?

A present alternative is to be prudent in the use of the available ground water. By conserving and cutting down on the consumption and waste, several years of irrigated production can be assured. Researchers are diligently working on the development of crops that require small amounts of water but yet produce good yields. Their efforts will contribute greatly to the conservation of water.

Two long range water importation plans are now being pursued by West Texans and the Texas Water Development Board.

One is the proposed federal study of the Colorado River Basin Regional Water Supply Plan. This plan is known as HR 4671. The object of this act is to provide a program for the further comprehensive development of the water resources of the lower Colorado River Basin and for the provision of additional and adequate water supplies for use in the upper as well as in the lower Colorado River Basin.

Representative George Mahon of Lubbock and Walter Rodgers of Pampa, as well as the High Plains Water District, Texas Water Development Board, and the Water For the Future Committee of the West Texas Water Institute have been working diligently to have West Texas included in this study.

If West Texas is included in this study it may reveal that irrigation water can be imported to the area cheap enough to maintain and increase our irrigated acres and crop production.

Another plan under study is the NAWAPA concept of the Ralph M. Parsons Company. This plan is a water collection and distribution system utilizing the surplus waters of Alaska, the Northwest territories and the Rocky Mountain regions of Canada. West Texas is presently included in this plan and has been allocated twelve million acre feet annually for irrigation in West Texas.

The cost of the water will be offset by the sale of power generated by the series of dams proposed by the concept. It is hoped that the water can be delivered to West Texas at a cost of fifteen to seventeen dollars per acre foot.

If a source of irrigation water is not found for West Texas total irrigated acreage in the region is expected to "peak out" at a little less than six million acres about 1980, up from the current 5.1 mililon, according to the Texas Water Development Board.

Gradual acreage reduction overall, will then ensue until by 2020 only about 2.2 million acres can be expected to be supportable with ground water.

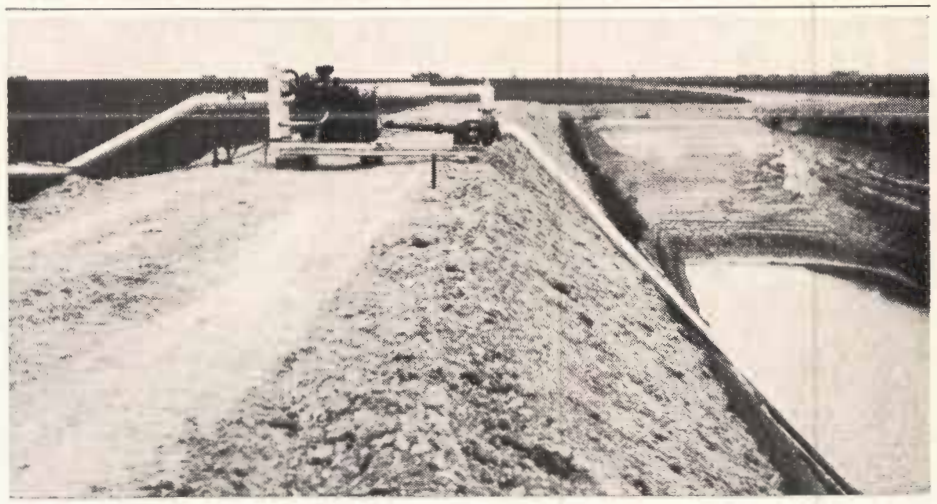
Early studies reveal that it would be physically feasible to import substantial quantities of water to meet irrigation demands in this area from the North and Northwest areas of the United States.

If sufficient irrigation water can be imported to West Texas at the same relative cost that it is now costing the irrigator to pump from the Ogallala, the irrigated acreage in West Texas could be expanded to 10.7 million acres and there would be sufficient market demand to take care of the production by 2020.

Storage of water would be no problem in West Texas. Water could be imported around the clock and stored in the greatest natural underground storage facility that has no evaporation or leakage—the Ogallala formation. The water could be withdrawn and used for irrigation or municipal demands with little or no treating needed for purification.

Importation of water to West Texas is not only a local and State problem but a National one also. If this area is not supplied with adequate irrigation water the nation's f ood and fiber supply will be greatly cut.

This map shows the NAWAPA concept of water importation to the Western States. Notice the Staked Plains aquiduct that would bring water to West Texas



This Tailwater Return System has recovered over 400 acre feet of water for J. B. Taylor of Friona, Texas.

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

Volume 13—No. 1 "THERE IS NO SUBSTITUTE FOR WATER" *June 1966*

IN LUBBOCK...

State Water Plan Presented

The Texas Water Development Board presented the State Water Plan to West Texans in a meeting in Lubbock, June 17th.

About three hundred municipal, industrial and agricultural leaders from the High Plains, El Paso and Trans Pecos areas attended the public hearing called by the Water Development Board to discuss the State Water Plan.

The plan set out the projected water needs of various sections of the state until the year 2020.

As now presented, the plan calls for extensive efforts to import water to the West Texas area from other northwestern states. No provision is made to move surplus water from East Texas to West Texas. The Board says that studies reveal that the cost would be prohibitive for people to use water for irrigation if it could be imported from East Texas.

The Board proposes the folowing specific steps for implementing the Texas Water Plan as it relates to West Texas.

1. The Board will aggressively seek action by Congress to authorize and direct the Secretary of Interior to investigate and report on the feasibility of a regional plan for water supply which will include West Texas.

2. The State of Texas should participate financially in this regional study to the extent of one-half of the cost thereof allocated to Texas. Funds for this purpose should be made available as soon as possible, with appropriations for fiscal bienniums 1968-1969 and 1970-1971 for this purpose in the amount of $500,000 per biennium.

3. If a regional plan which would provide adequate supplemental water for West Texas is found feasible, the Texas Water Development Board would participate in the implementation thereof on the same basis and in the same manner as is currently proposed in connection with the State Water Project. Creation of a number of master districts covering appropriate areas in West Texas would be necessary including authority and responsibility described for the districts needed in the Coastal Bend and Lower Rio Grande Valley areas.

Additional West Texas Programs.

Gradually depleting ground water supplies in West Texas, plus natural pollution of the upper Red and Brazos Rivers, require the immediate implementation of the following programs.

1. Further research efforts and demonstration projects are urgently needed to achieve the maximum feasible degree of conservation and the most efficient use of the limited local water resources available in the High Plains, El Paso, and portions of the North Central Texas and Trans-Pecos areas.

2. Acceleration of playa lake modification as a cooperative water conservation and public health program, participated in by the State, local agencies and individuals, and federal agencies.

3. Creation of a West Texas Division office of the Texas Water Development Board to coordinate research, demonstration projects, data collection, quality protection, and water conservation activities of the State with the programs of local water agencies, municipalities, colleges and universities, and other interested groups.

4. Acceleration of the topographic mapping program to complete by 1971 the mapping of the High Plains, North Central Texas and portions of the Trans-Pecos areas.

5. Implementation with respect to projects to control natural pollution in the Upper Red and Brazos River Basins, and after evaluation of the projects under operating conditions, a re-examination of the Upper Red and Upper Brazos River Basin streams for development of possible additional surface water supplies for local and/or regional use.

6. Participation by the State in the cost of a saline water conversion plant with a capacity of 5 million gallons per day or more as a pilot project for West Texas. This project would include initial financing from State, local and Federal sources. Although the State would not assist in the annual operational and maintenance costs, it would participate with local and Federal entities in the evaluation of the project. The State would participate in the selection of an appropriate site, the negotiation of agreements with local and federal agencies, and cost of pre-construction design of the installation. Costs for this participation during fiscal biennium 1968-1969 is estimated at $200,000. Financing during the 1970-1971 biennium for construction would be dependent upon the design adopted, the plant capacity, and federal and local participation.

Interested individuals discussed the State Water Plan recently in Lubbock. Shown with Congressman George Mahon, left to right, are Joe Pate, Jr.. Frank Gray and Dan Johnson. Pate and Gray are local farmers and Johnson is ex-Vice President of the Plains Cotton Growers.

Actions contemplated in the above programs will require the following appropriations for the fiscal bienniums shown.

Program	1968-1969 Biennium	1970-1971 Biennium
Participation in Development of out-of-State Water Plan	$ 500,000	$ 500,000
Research	100,000	100,000
Demonstration Projects	175,000	175,000
Playa Lake Modification	130,000	130,000
Additional Topographic Mapping	100,000	100,000
Saline Water Conservation Plant Design	200,000	
	$1,205,000	$1,005,000

It is anticipated that each of the above programs would have financial participation by local entities and Federal agencies.

Program	1968-1969 Biennium	1970-1971 Biennium
Creation of West Texas Division office of TWDB		
Salaries	$ 132,000	$ 141,000
Office Space, equipment and Vehicles	36,000	20,000
Sub Total	$ 168,000	$ 161,000

The total cost per biennium for these important programs is $1,373,000 for 1968-1969 and $1,166,000 for 1970-1971.

Congressman George Mahon spoke briefly concerning the State Water Plan. Mahon said, "I am alarmed, disappointed and concerned that the Texas Water Plan does not take adequate note of the requirements of this area."

He also commented on how difficult it would be to obtain water for West Texas by importation from other states. "They are jealous over their water. You will have to fight over many a dead Congressman's body to get it", he said.

G. H. Nelson of Lubbock, representing the Water for the Future Committee of the West Texas Water Institute reiterated Mahon's feelings in a 30-minute dissertation on West Texas water needs.

Both Mahon and Nelson urged the Board not to let the present productive area deteriorate while planning to develop new unproven areas for irrigation.

The Water Development Board will hold another hearing in Lubbock in September to receive testimony concerning the State Plan.

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Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

GUEST EDITORIAL . . .

An All Texas Water Plan

Lubbock Avalanche Journal

West Texas is, as it certainly must, looking to a number of out-of-State sources for surface water it will have to have in the future.

But, quite naturally, it is still hoping, and working, for a change in its "orphan" status under the Texas Water Plan. This was made clear at the Texas Water Development Board's meeting in Lubbock. More convincing proof — much, much more — is wanted that it would be economically prohibitive to move supplies from water-rich East Texas to the High Plains.

Long-range plans to import water from the Mississippi, Missouri and Columbia Rivers — or from Canada if and when the North American Water and Power Alliance could be developed — are excellent as ideas. This despite the fact that the prospective costs, and the inter-State and international problems involved, are staggering.

But West Texans are still not satisfied with the idea that this area must be "written out" of the Texas plan, especially in view of the TWDB's assessment that the needs of West Texas are "the most urgent water requirement facing the State."

A most interesting point was noted at the meeting here by Cong. George H. Mahon and G. H. Nelson, chairman of the Water for the Future Committee of the West Texas Water Institute.

The elaborate system of water interchanges proposed in the State plan would include supplies to irrigate more than 800,000 acres of additional farm land in the Coastal Bend and the Rio Grande Valley. As pointed out by Representative Mahon, the State plan should focus more attention on "maintaining the agricultural economy of this area before concentrating on areas not even in the irrigation business at this time."

Mr. Nelson insisted, and properly so, that West Texas farmers should be given the opportunity to assess their ability to pay for East Texas surplus water. He also noted that it would be much easier for East and South Texas to tap the vast runoff of the Lower Mississippi than it would be for West Texas to withdraw water farther up the stream.

The TWDB has stressed that its plan is still "tentative." West Texans are hoping it will remain that way until an "All-Texas" plan is developed.

CHEMICAL TREATMENT OF WELLS

If you are thinking about chemically treating your irrigation well for increased yields, it probably would be wise to consider a few points concerning your well to determine the possibilities of your well being helped by this chemical treatment before you spend your money. You should first determine if your pump is producing all the water that the well bore will yield. If the pump is breaking suction, then it is apparent that it is, if not, then it would be wise to check the pumping level in the well bore. If the pumping level is several feet above the pump bowls, perhaps by simply adjusting the impellas in the pump, you could increase the Well's output. Your pump dealer will be glad to advise and help you with this matter.

Another good indicator is to compare the well yield with other wells in the immediate area. If your well is drilled to a comparable depth with a similar pump setting, and it is producing less than the average well, then chemical well treatment has possibilities.

Biological pollution by blue-green alga is probably one of the major problems of decreasing well production.

Contamination of wells by these blue-green alga is thought to be from dry spores which are carried in the air and find their way into the well bore through the small openings around the pump base.

This alga is found primarily in wells equipped with oil-lubricated pumps. The alga is thought to feed on the hydrocarbons or properties found in drip oil.

A good way to determine if the well has alga is to back wash the pump several times. This will usually break loose small pieces of slime material from the well which can be observed in the water that is first pumped.

Also, some wells emit unusual odors, which is another good indicator of pollution. Visual observation of the pump when it is pulled, which shows an accumulation or buildup of greasy, slimy foreign material on the pump column which was below the water level is usually a sure method of determining pollution. Tape, electrical line or other devices lowered into the well below the water level usually will collect enough foreign material on it when it is removed from the well to indicate contamination.

A water sample can be collected and sent to a laboratory to be analyzed. This will give positive proof of whether or not the well is contaminated.

There are several chemical companies operating in the High Plains which have sterilization agents which kill on contact this blue-green alga and other biological growths found in wells.

Some of the materials used, such as Chlorine are highly corrosive and should not be left in the well for any great length of time. A good way to check the corrosive properties of a chemical on metal is to pour some of it on the pump base and/or inside the discharge pipe and observe it for a period of time. Another way is to put a sample of the chemical in a jar and place nails or other pieces of metal in the jar and observe the reaction. Unfortunately, most of these sterilizing agents only kill the spores that they come into contact with. This does not completely solve the problem of the accumulation of the alga which has built up in the column pipe, outside the column and on the casing of the well. The accumulation of spores forms a slimy oily material which

(Continued on page 3)

2020 Committee Report

Agriculture will continue to provide a half-billion dollars to the economy of the High Plains of Texas in 2020, the Texas Water Development Board and area residents were told recently at a "town hall" type meeting held by the Water Development Board in the Lubbock Municipal Auditorium.

The prospect for the future of agriculture in the area was contained in a 56 page report by the 2020 Committee, a group of High Plains agriculture, education, industry, and business leaders, to the Water Development Board. The report provided the information about High Plains water resources and needs for "Water For The Future", the 50 year program of the TWDB. The 50 year plan was unveiled to the public for the first time at the meeting.

Edward G. Weber of Amarillo, a member of the group, presented a commentary on the 2020 Committee's report.

"The report shows a 1959 value of agricultural production at just under 500-million dollars. It projects to a high of 616-million dollars in 1980, but still sees agriculture as a half-billion dollar business in 2020. And production of a half-billion dollars in farm products will be a major contribution to this state — and our nation," the committee's summary, as delivered by Weber, said.

Dr. Herbert Grubb, agricultural economist from Texas Tech, who made the projections on production and irrigation contained in the report, said the 2020 farm income figure was based on 1959 commodity prices, and didn't take into consideration increases in value or increased crop yields that will probably take place in the next 50 years.

Dr. Gerald Thomas, dean of agriculture at Texas Tech and a member of the 2020 Committee, said: "There is no area in the State of Texas that lends itself to agricultural science and technology as the High Plains does. Improvement in agromony and management technique will reduce our use of water and our farm economy will remain high although, if additional water is not available, we will have a higher percentage of dryland production."

In this connection, the Committee's report urged the committee to take the high productivity record of the area into consideration in the allotment of several million unassigned acre-feet of water from other sections of the state.

"We ask that before you put undeveloped — and unproven — acres in irrigation in other sections of the state, that every means of bringing water to the High Plains — where the productivity of the land is already a proven fact — be studied in detail. So, before it is determined that it is not feasible to bring excess water from other areas of this great state of ours to the High Plains, let us determine together how much water is available and how much it will cost," the committee suggested in the summary it presented.

Concerning the earlier report by the Water Development Board that new resources for the High Plains would have to be imported from other states, the committee said: "We would urge you that if this is truly a statewide water plan, that every avenue within the power of the state government be investigated before the conclusion is reached that our sole solution is importation. This solution is obvious. The question is — Is it inescapable?"

Earlier in the summary, Weber, speaking for the group, said: "Several billions of dollars would be a conservative estimate of the investment in the future of this High Plains area that was represented in the membership of the 2020 Committee.

"Now, this fact is important for two reasons. First of all, it assured the area that the information provided for the Water Development Board would be realistic. You don't kid when you're talking about billions of dollars. And the second thing that was important about this several billion dollars in investment is that it is evidence of confidence in the future of this area — long-range confidence."

The 2020 Committee derived its name from the fact that the statewide water plan is designed to meet the needs of Texas through 2020. The group began meeting in early 1965 to provide High Plains water resources and needs information for the Texas Water Development Board. Its members include the leading hydrologists and agricultural economists of the area, along with representatives of business, industry, banking and agriculture.

Chemical Treatment —

(Continued from page 2)

makes penetration difficult for most sterilizing agents.

Normally when the well is badly contaminated, it requires two treatments. First with a chemical which contains properties which will penetrate and cut loose the alga build-up on the pump and casing and allowing it to be pumped from the well. Then a sterilizing agent should be used to kill any live spores left in the well. Sterilizing agents should be used in the well at regular intervals to make sure that the problem does not reoccur.

"To be continued in next month's issue."

Udall Calls For Water Safety Care

There were 6,000 water accidents, 1,381 of them fatal, during the past ten years in waterways throughout the nation controlled by the Dept. of the Interior. Secretary Stewart L. Udall has called for an intensified safety campaign to cut down the accident rate this year. The official order came after a special task force had completed its study of safety problems on nearly 7,000,000 acres of water supervised by the Federal Government. The investigators found that most of the boating fatalities could have been avoided if people had stayed ashore during bad weather. Among the swimming deaths reported from Recreation areas, use of unauthorized areas was mainly responsible, followed by "inexperienced swimmers", and "lack of supervision of children". Disregard for safety measures rather than ignorance of them caused most accidents.

Mr. Joe G. Moore, Jr., Executive Director of the Texas Water Development Board delivering the opening statements for the Texas Water Development Board whose members also are seated in the background.

Mr. Weber delivers his address for the 2020 Committee to the Texas Water Development Board at the June 17 hearing.

West Texas water leaders which were in attendance at the Water Development Board's unveiling of the Texas Water Plan.

WATER IS YOUR FUTURE CONSERVE IT

WHEN USING SALT WATER FOR IRRIGATION . . .

Proceed With Caution

BY A. WAYNE WYATT

Probably the most simple explanation of the fact that salt will kill or injure plants is that the plant absorbs water and nutrients from the soil by a process known as osmosis. Webster's Dictionary defines osmosis as a diffusion through a semipermeable membrane typically separating a solvent and a solution that tends to equalize their concentrations. This definition, when applied to a plant, would indicate that the plant would have to have a salt concentration within its root system higher than the salt concentration of the soil solution to absorb or take in the necessary water and nutrients to grow and produce as it should.

One danger in using salty water for irrigation is that as the soil solution concentration of salt builds up, the processes of osmosis slow down, resulting, therefore, in wilted or stunted plants. The higher the salt solution of the soil, the greater damage to the plant.

Toxic effects which interfere with plant metabolism occur when as much as 0.2 percent of sodium chloride (or 8000 pounds per acre foot of soil) is found in a soil. Sodium sulfate would require 0.4 percent concentration (or 16,000 pounds per acre foot of soil) in the soil to produce an equal toxic effect.

High concentrations of calcium ions in a soil may have a tendency to lessen the toxic effects of sodium chloride in a soil, but cannot nullify the harmful effects of excessive amounts of sodium chloride in a soil.

Sodium chloride in a medium to fine textured soil will tend to cause destruction of the normal granular structure of the soil with the result that the salty soils become sticky when wet, slowly permeable, poorly aerated, and difficult to till. Organic matter decomposition is limited because microbail activity is retarded by lack of air and the poor physical condition of the soil.

Crop tolerances to salt accumulations in a soil are affected by time of salt accumulation, locations of the salt accumulation in the soil profile, and the soil temperature. The changing of one or more of these factors may change the tolerance of a plant to the salinity.

By all means, the first thing that you should do if you know your water contains salt is to have a complete chemical analysis made of the water. Your chemist will furnish you a report giving you the amounts of chemicals found in the water in parts per million. The following table may help you estimate the amounts of salts you will be applying with your irrigation water.

Water Analysis Shows	Approximate Pounds in 1 acre inch of Water *	Approximate Pounds in 1 acre foot of Water **
100 parts per million	25	300
150	37.5	450
200	50	600
300	75	900
400	100	1200
500	125	1500
1000	250	3000
2000	500	6000
3000	750	9000
4000	1000	12,000
5000	1250	15,000

* An acre inch is enough water to cover 1 acre 1 inch deep with water or 27,154 gallons.

**An acre foot is enough water to cover 1 acre 1 foot deep with water or 325,851 gallons.

Caution should be exercised if the water contains in excess of 2000 parts per million of total salts, or 200 or more parts per million of chlorides.

The writer does not mean to imply that if water has the above quantities of salts that it should not be used for irrigation, but that good management practices will have to be observed to keep the soil at its highest productivity. For example, if a farmer applies one acre inch of water containing 2000 parts per million of soluble salts the water will add approximately 500 pounds of the soluble salts to that soil. Thus, a farmer using three 5-acre inch applications of this irrigation water (a total of 15-acre inches of water) during the growing season will add approximately 7,500 pounds of soluble salts per acre. Annual application of this amount of soluble salts per acre will eventually build up sufficient salinity to affect plant growth in the soil. No one can accurately predict how long it will take to make a soil unsuitable for plant growth since all the salt added does not remain in the root zone of the plants. Heavy rainfall, or large applications of irrigation water which tend to carry the soluble salts downward may remove most of the soluble salts from the sandy soil.

Seasonal checks by proper analysis will indicate when the soil is nearing the danger point in salt concentration. When a soil is analyzed, use the following rating to indicate the expected plant response to salt concentrations.

0 to 0.2 percent salt (8000 lbs. per acre in each foot of soil depth). Little difficulty is expected in plant growth with a normal moisture content of soil. With limited water and non-salt-tolerant plants some damage may be expected at the 0.2 percent concentrations of salt.

0.2 to 0.4 percent salt (8000 to 16,000 lbs. per acre in each foot of soil depth). Plants with medium salt tolerance may be mildly affected on medium to fine textured soils and severely damaged in sandy soils. Salt tolerant plants can be satisfactorily grown with proper management and adequate water, whereas non-salt-tolerant plants cannot be grown.

Above 0.4 percent salt. Only salt tolerant plants with adequate water and careful management can be grown on these soils.

Plants vary greatly in their symptoms of injury from salt accumulations. Generally the first noticeable symptoms would indicate a low fertility condition where the plants appear stunted and unable to grow normally. As the salty conditions become more severe the plants often take on a deep bluish-green color. Crops such as wheat, oats, and barley tend to show a reddish color on the leaves as the plants approach maturity. Grain sorghums often show this reddish color to a striking degree.

Plants growing on soils with excessive salt accumulations seldom show injury, instead they will show the stunted, slow growing, bluish-green colored leaves which make it nearly impossible to detect danger early enough to irrigate to relieve the condition. The soil moisture may appear to be most adequate for plant growth, but due to the salt content it will not permit normal plant functions.

Once a soil has reached too high a concentration of soluble salts, suitable treatments must be applied to remove the excess salts and to reclaim the soil. Such treatments depend largely on movement of the excess salts downward by means of large applications of water which is low enough in soluble salt content to pick up and carry the soluble salts from the soil below the root zone of the plants grown. Use of gypsum or sulfur or large amounts of organic matter may be helpful under some conditions. Salty soils cannot be expected to produce an average dry crop yield until the accumulated salts have been washed out of the root zones by the normal rainfall. The time required to reclaim such soil areas may vary from a few years to many years. On the sandy, more permeable soil areas with good under-drainage, three to five years of average rainfall (19 to 20 inches per year) could be expected to largely remove the harmful salt concentrations from the root zone. With less than average rainfall, these same sandy soils might retain harmful amounts of the salts for many years.

On the finer textured soils such as the clayloams and clays a longer period of time will be required to move the harmful salts deep enough to allow normal plant growth.

If a farmer with salty soil can secure adequate salt free irrigation water, he can expect to push the harmful salts downward out of the root zone by heavy, frequent applications of water to the soil. One to two years of monthly floodings (6 to 12 acre inches of water per application) of the salty soil with good irrigation water should free even the finer textured soils of the excessive salts. On this sandier, more rapidly permeable soil, fewer applications of the water will be required to free the soil of harmful salts.

In all cases dealing with the reclaiming of the salty soils the farmer should use every means to keep the affected areas in the best possible condition to receive and hold all rainfall so that the maximum penetration of the water will occur and remove the salts as rapidly as possible. The application of large amounts of cotton burrs or other plant residue materials to the affected acreages should be practiced. These burrs or residues should be worked into the surface of the soil to keep it open and receptive to moisture. Periodic use of the chisel plow to keep the subsoil open and receptive to water penetration may be desirable where the salt accumulations have caused the surface or subsoil to "seal off" or become tight and slowly permeable to water.

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THE Cross SECTION

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

Volume 13—No. 2 "THERE IS NO SUBSTITUTE FOR WATER" *July 1966*

Area Water Case Heard In District Court At Levelland

A very interesting case was recently heard in the District Court of Hockley County, Texas, Judge M. C. Ledbetter presiding.

The case, Sun Oil Company VS. Earnest Whitaker, ET Al, was heard to determine if the Oil Company has the right under an oil and gas mineral lease to produce water from Whitaker's land for a water flood project on their lease.

The lease in question was negotiated in 1946 with the land owner named Gann. Gann sold the surface to Whitaker in 1948, subject to the mineral lease held by the Oil Company.

Several months ago, Sun proposed to drill water wells on Whitaker's land to obtain a supply of water for water flooding purposes. Sun contended during the hearings that the clause in the lease that gives the "free use of oil, gas, coal, wood and water from said lands except water from lessors' wells for all operations hereunder," gives them the legal right to use the water from under Whitaker's land for water flooding.

Several witnesses testified that there were several thousand acres of land in the area that were under leases of this type, all with a similar clause. They also testified that to their knowledge water was used only to drill wells and for use in steam operated drilling rigs in the late 40's and early 50's.

Witnesses also testified that they had never known of any coal deposits or vast supplies of wood in this area.

Testimony was heard relating to the fact that several oil companies in the area are using Ogallala water for water flooding but that all of the companies had either purchased the water from the surface owner or the surface owners had given permission for the use of Ogallala water for flooding operations.

The intent of the mineral lease in 1946 is the question the Court must decide.

Water flooding was a practice in the petroleum industry prior to this date, but it was argued that it was not a wide known practice. Witnesses who have lived in Hockley County testified they had never heard of water flooding until four or five years ago.

The practice of water flooding was not an issue in this case. All parties seemed to agree that water flooding

(Continued on Page 2)

Sprinkler systems are becoming more and more popular all over West Texas. Cheap operation, use of less water, and greatly reduced evaporation rates are strong points these systems offer farmers.

WATER RIGHTS IN TEXAS

Solomon has told us in the seventh verse, eighth chapter of his Songs that "many waters cannot quench love; neither can the floods drown it." With this, everyone agrees. However, the past and present Texas drouth has shown that a shortage of waters can cause many to lose their love for their neighbors, especially when the latter are capturing waters to which the complainants feel they are entitled. For this reason, a great deal of interest among Texans is directed to water law and rights in water.

There are two major classifications of water — surface and ground. Although there is an inter-relation between the two, in this discussion of water rights they will be separated. The law relating to ground water is also divided into two major classes:

1. Underground streams flowing in known and defined channels; the same legal rules applicable to surface water rights (to be discussed later) are followed for this class of water.
2. Percolating underground water defined by the courts as "rivulets of vagrant character percolating through invisible and undiscovered fissures." This includes water that appears on the surface as springs and water that supplies artesian wells.

As to percolating ground water, Texas follows the English doctrine that the owner of the land is the absolute owner of the water so long as it may tarry under his land, can drill wells without having to obtain a permit, and may pump all the water he can capture so long as he does not do it to harm his neighbor maliciously and does not waste the water. The land-mark Texas case is that of Houston & T. C. Railway Co. vs. East decided by the Supreme Court in 1904. This controversy arose in Denison when the railway company pumped so much water for its operations that the domestic well of Mr. East went dry and he filed suit, asserting that he possessed correlative rights to the ground water which the railway company was obliged to respect. The court, in deciding against Mr. East, stated:

> "The reason why the law recognizes no correlative rights in respect of percolating waters are: (1) Because the existence, origin, movement and course of such waters, and the causes which govern and direct their movements, are so secret, occult, and concealed that an attempt to administer any set of legal

(Continued on Page 3)

Conserving Irrigation Water Most Important

BY Y. E. McADAMS

Conserving irrigation water is of utmost importance on the High Plains of Texas. One problem causing a lot of concern is runoff in connection with graded surface irrigation systems. This runoff runs as high as 80 per cent of the irrigation water pumped. This not only results in a big waste of water but increases the irrigation cost to farmers and may be washing the soil away.

Several alternatives may be available to the farmer in solving the problem: 1) install a level surface irrigation system; 2) install a graded surface irrigation system and use a cut-back head to control runoff; 3) install a graded surface system with a tailwater recovery system to utilize runoff; and 4) install a sprinkler irrigation system.

A level irrigation system provides the tools for obtaining high efficiency in the application of irrigation water, as well as making the utmost use of rainfall. Level systems require less skill to operate as the water is applied at a much higher rate than the soil intake rate. Surface storage allows water to be ponded on the surface until sufficient time has elapsed for it to enter the soil. Level systems are adapted on mixed land and hard land soils. Drainage should be provided, especially on hardlands, to allow excessive rainfall to be drained off during critical periods, such as harvest time.

Where graded surface systems are installed the management of irrigation tailwater and the loss of rainfall from runoff are of primary concern. When grades in the direction of irrigation exceed .8 per cent excessive erosion will result from rainfall runoff. Even with grades of .8 per cent or less, erosion from rainfall runoff can become excessive if length of rows are too long. The management of the irrigation water requires skill to adjust the initial stream sizes to equal the intake of the furrow after the water has reached the distal end to prevent excessive runoff.

A tailwater recovery system can be used as an alternate to the cut-back head. Some of the skill required in using a cut-back head would not be required with a tailwater recovery system. The stream size used would remain the same for the entire set. Runoff is picked up for re-use in the irrigation system. Erosion from the irrigated field above the recovery system is a big problem. A conservation irrigation system should be installed

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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

Second-class Postage Paid at Lubbock, Texas.

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Editor

Conserving Water—

(Continued from Page 1)

prior to the installation of the tailwater recovery system to reduce erosion to a minimum. Even with a good system installed, the annual soil loss may be as much as 5 tons per acre per year. It is also important that all structures be designed and installed so that they can be maintained with normal farm equipment.

Three general types of recovery systems have been found to be satisfactory. Where irrigation wells are on the low side of the field the runoff is delivered to the wells and pumped back into the irrigation pipeline by the irrigation well pump. The irrigation well is modified by installing a concrete packer outside the well casing to a depth of 30 to 35 feet and vented to the atmosphere. An inlet valve and line is installed to discharge the water between the casing and column pipe into the irrigation well. Runoff water is allowed to enter the well only when the irrigation pump is operating. Provisions must be made to safely bypass rainfall runoff. This is the simplest to operate and the easiest type to maintain.

Where wells are on the high side of the field, temporary storage must be provided to store the runoff from one irrigation set. Sediment is a big problem in the maintenance of these systems. A conservation system must be installed to reduce sediment to a minimum. Storage will also collect sediment and should be easily maintained with normal farm equipment. A small pump and pipeline is required to deliver water from the temporary storage back into the irrigation system at a constant rate. Provisions must be made to safely bypass rainfall runoff.

Where playa lakes are available, they may be used for storing runoff from irrigation and rainfall. By installing a pump and pipeline this water could be used for irrigation. The size of the pump and pipeline would be limited only by the amount of water that can be handled in the irrigation system. When the lake pump is used for irrigation, the irrigation well would not be operated.

Any of the three tailwater recovery systems discussed could reduce skill required in the operation of graded surface irrigation systems. For each irrigation, adjustments in stream sizes would need to be made to fit conditions such as surface roughness, soil moisture level and degree of soil compaction. You can obtain technical assistance through your Soil and Water Conservation District by contacting the work unit office of the Soil Conservation Service.

Agricultural Teachers Visit Water District Office This Month

A group of high school vocational agricultural teachers visited the High Plains Underground Water District this month.

The visit was a highlight of a Vocational Agriculture Teachers Short Course Tour, sponsored by the Agricultural Education Department of Texas Technological College.

The group was shown lake pump operations, tailwater return systems and other water conservation practices being utilized in the Hereford and Friona areas.

Water Is Your Future, Conserve It!

Chemical Treatment Of Water Wells Helps In Many Problems

Continued from the June, 1966 issue of the Cross Section.

Chemicals have been used as an effective tool in helping to solve many problems in the irrigation industry. Some of these problems are man made and some occur naturally under the forces of nature.

Some man-made problems are created during the drilling processes. It is necessary for your driller to build a mud cake on the wall of the well bore and/or compact the wall of the well bore to keep it open during the drilling processes and until he has had time to set the casing in the hole.

Bailing and pumping combined with the hydrostatic head of the water will usually remove a majority of the mud from the lower portion of the formation. Well development chemicals which usually contain a detergent type agent will help break down the mud cake and allow it to be pumped from the well.

Carbonates which are relative unstable chemicals found in the waters of the Ogallala Formation often time bond themselves together and/or react with metals in the casing and form a deposit commonly referred to as a scale.

The scale build-up, often time, cuts the pore space of the perforation or screen, consequently, not allowing the full flow of water into the well bore.

This scale can be removed from the casing by mechanical measures such as with the use of a "Pig" (a large steel brush which is lowered into the casing.) The pig expands as it is pulled upward. The wire bristles help break loose and clean the scale from the perforations.

Heavy boiling has also been reported to help remove the scale.

Acids such as sulfamic and hydrochloric have proven successful in dissolving this scale. (There are also several other acids which will chemically react on the chemicals in the scale.)

Closely related to the scale deposits is another substance which blocks the perforations many times referred

Water Case Heard—

(Continued from Page 1)

an oil producing formation is a good conservation measure for the recovery of oil. Use of Ogallala water was not attacked. The method Sun Oil Company was using to obtain Ogallala water was attacked.

If the Court rules in favor of the Sun Oil Company, oil companies will be allowed to drill water wells on any lease and use water to water flood any field. Not only will the oil companies be able to drill water wells in Hockley County, but they can do it all over the State of Texas.

As precious as fresh water is becoming in Texas, what will the residents of the areas involved do for good water when their water is depleted, the oil all gone, and the oil companies have moved on. The road looks a little rough, not only for Hockley County, but for the entire State. If we don't have fresh water we sure won't need much oil.

to as clay balls.

There are two types of clay balls commonly found in perforations of casings pulled from wells in the High Plains.

One type is clay banded together by the chemicals found in the water. This ball is usually very hard and has a gritty feeling when it is broken or crushed. When this type of ball is first removed from the well and is broken the appearance of the inside gives the impression that the ball has never been wet in the center.

This type of silt or clay ball is a form of carbonate and should be treated similar to procedure as outlined for scale treatment.

The other type of clay ball or clay wedge which also blocks the perforation or screen is actually predominately clay. The most effective treatment is a dispersant agent and detergent.

In some areas of the Ogallala Formation, the pore spaces between the sand and gravel grains are filled with a cement type substance which cuts down on the water holding capacity of the formation, as well as restricts the flow of water through the sands and gravels to the well.

This cement type substance can be dissolved by most acids. In treating this problem, remember that the acid has to come in contact with the cement type of material to be effective. Back washing the well after the acid has been added to the hole will push some of the chemicals back into formation. Probably the most effective method of pushing the chemical back into the formation is to add water to the well.

The preceding does not necessarily cover all the problems of irrigation wells nor mention the chemicals that have been used effectively.

If you have well problems, perhaps by discussing your problem with your driller, your pump dealer or chemical distributor it will help you determine if chemical treatment would be a wise investment.

Water Rights—

(Continued from Page 1)

rules in respect to them would be involved in hopeless uncertainty and would, therefore, be practically impossible. (2) Because any such recognition of correlative rights would interfere, to the material detriment of the common wealth, with drainage and agriculture, mining, construction of highways and railroads, with sanitary regulations, building, and the general progress of improvement in works of embellishment and utility."

As late as 1954, the Supreme Court reaffirmed the doctrine announced in the East Case. Thus, once it is established that the ground water is percolating, the law is very easy to apply. Should land lie within the confines of an underground water conservation district duly established and voted on by the residents thereof, the owner may be required to space his wells, obtain drilling permits and submit to other requirements promulgated by such district.

Surface water also falls into two major classifications: Diffused surface water and water flowing in a water course. Diffused surface water falls from the heavens as rain or snow and is considered by the courts to be the private property of the owner of the land upon which it falls until it reaches a watercourse. The most difficult fact to determine is what constitutes a watercourse. The common idea of a watercourse is a river, stream or brook with permanent flow. The legal meaning of the term is, however, not so confined. If there be a channel, consisting of a well-defined bed with visible banks, down which water flows recurrently, there is a natural watercourse, though it be dry for months at a time. In other words, to constitute a watercourse the flow need not be continuous; it is sufficient if the source of supply be "permanent" — that is, the stream must be such that similar conditions will produce a flow of water and that these conditions recur with some degree of regularity.

When waters reach a watercourse, they cease to be diffused and become subject to an entirely different set of legal rules and principles. In Article 7467, the Legislature of Texas has declared that "The waters of the ordinary flow and underflow and tides of every flowing river or natural stream, of all lakes, bays or arms of the Gulf of Mexico, 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, and the right to use thereof may be acquired by appropriation in the manner and for the uses and purposes hereinafter provided, and may be taken or diverted from its natural channel for any of the purposes expressed in this chapter."

Article 7470 provides that the public waters of this State may be appropriated for any of the following purposes: Irrigation, milling, mining, manufacturing development of power, the construction and operation of water-works for cities and towns, for stock raising, public parks, game reserves, recreation and pleasure resorts, power and water supply for industrial purposes and plants and for domestic use. Provisions also appear in the statutes for making application for permits, sending out notices and holding hearings before the Texas Water Rights Commission, which is the agency charged by law with administering the water laws of the State. The commission is required to reject all applications and refuse to issue the permit asked for if there is no unappropriated water in the source of supply, if the proposed use will impair existing water rights, or is detrimental to the public welfare.

It is a fundamental rule of the appropriation system of obtaining permits from a state agency that the "first in time is the first in right." By this is meant that the one who is earliest in time of obtaining a permit and applying water to a beneficial use shall have a superior right to divert water over one junior in time. Thus, if Farmer Jones obtained his permit and used water prior to Farmer Brown, should the supply reach such a low point that there is sufficient water for only one to irrigate, Farmer Jones would get the available water and Farmer Brown would have to go without.

Naturally, it is confusing to many people why, if the State is the owner of all the surface water in watercourses, it has been unable to enforce adequately the many statutes requiring that no one shall divert water from streams without a permit. The reason is court-made law, which the most famous Texas case being that of Motl vs. Boyd, decided by the Texas Supreme Court in 1926 in an opinion written by Judge Cureton. In effect, the court held that the Legislature was without the power to take away from those persons owning land contiguous to a stream their rights to make reasonable diversions of water, and that to deprive them of these vested property rights would be an unconstitutional deprivation without due process of law. Judge Cureton's opinion traced the history of these riparian rights and attempted to settle once and for all time what constituted such rights.

There is no Texas statute defining riparian rights although the Legislature has been consistent in numerous instances in requiring that they be protected. Therefore, we must look to court decisions and opinions for guidance. The term is derived from the Latin word "ripa" meaning bank of a stream and a riparian is one owning land that abuts upon or fronts upon a stream or natural watercourse. Such land owner is deemed to have a correlative right in common with other riparians to share in the use of the normal flow of those waters which pass his land. There are many limitations upon the rights enjoyed by riparians, the principal ones being:

1. Riparian rights do not attach to the flow of a stream above its normal or ordinary stage. Judge Cureton defined the line of highest ordinary flow as "the highest line of flow which the stream reaches and maintains for a sufficient length of time to become characteristic when its waters are in their ordinary, normal and usual conditions, uninfluenced by recent rainfall or surface run-off." This definition is very difficult to apply and leads to great confusion among those attempting to compute what the normal flow of a stream might be. Without question, at times of low flow and water shortage the water is always below the highest line of ordinary flow and, hence, private riparian water which is free of regulation by the Texas Water Rights Commission. Thus, at times of emergencies and critical drouth conditions, the administrative machinery for distributing water breaks down, and riparians must fend for themselves in the local courthouses.

2. All land abutting upon a running stream is riparian as to that part of those original patents granted prior to 1895 which lie within the watershed of the stream. However, a parcel of land may lose its riparian rights when separated from the stream by grant or deed. For land to retain its riparian character, it must maintain its contact with the water, either by actual abutment or by easement giving access thereto. Should Farmer Brown sell acreage lying away from the creek, such land can lose its rights to water forever; nor can the grantee Farmer Jones later revive the right by acquiring land contiguous to the stream.

3. The fundamental difference between a riparian right and an appropriative water right is that as between riparian owners priority of use establishes no priority of right. This means that one cannot claim a superior right merely because he used the water first. However, a riparian right may be lost through prescription, as where by long, continuous and adverse use of water by one upstream, a right matures to divert even to the detriment of one below. But one downstream cannot obtain a prescriptive right superior to an upstream user, since the taking of water by lower diverter has no element of hostility which gives rise to the accural of a cause of action on the part of the upper riparian.

4. A riparian right is neither created by use nor lost by nonuse. This means that if Farmer Brown is being deprived of water by the diversions of Farmer Jones who has installed an irrigation system above, then Farmer Brown cannot obtain relief on the grounds that Farmer Jones had never used the water before. This is one of the major weaknesses of the riparian doctrine because there is not enough normal flow water in our streams to satisfy the needs and wants for all purposes of everyone owning lands thereon. Many authorities have concluded that on most Texas streams no riparian can afford to make a substantial investment based upon a dependable supply of riparian waters because he never knows when his riparian neighbors may start taking their proportionate part of the available waters, thereby reducing his share below that quantity needed to justify his investment.

5. The riparian owner is subject to the doctrine of reasonable use which limits his rights to the use of water to that quantity reasonably required for beneficial use and prohibits waste or unreasonable use, or unreasonable methods of use or diversion. Although a riparian may exhaust the entire normal flow of a stream for his natural wants such as domestic and livestock use, for the unnatural wants such as irrigation, mining and industrial use riparians are on an equal footing; and one has no right to make an excessive use of the water to the detriment of others having an equal right. Also, one upstream is not entitled to make diversions for the unnatural wants if it results in depriving one downstream of water for his livestock and domestic uses.

In announcing that the normal flow was held in trust for the use of riparians, the court in Motl vs. Boyd also declared that storm and flood waters were the property of the State of Texas and permits had to be obtained for use. The main exception to the latter requirement is provided by the Legislature in Article 7500a; this allows anyone to construct on his own property (and not in State-owned stream beds) a dam or reservoir to impound or contain not to exceed 200 acre feet of water without the necessity of obtaining a permit when the water is to be used for domestic and livestock purposes only. This is a considerable amount of water since an acre foot is that amount of water required to cover an acre to a depth of one foot and equals 325,851 gallons.

The fine points and niceties of water rights are so involved and complex that time and space do not permit a full treatment here. Suffice it to say that before going to the expense and trouble of installing an irrigation system, the Texas Water Rights Commission should be asked for its advice and suggestions. If the stream be over-appropriated and no permit can be issued to make diversions, then an attorney skilled in water law should be consulted to determine if the land sought to be irrigated possesses riparian rights that would entitle the land owner to divert water without the necessity of obtaining a permit. In

(Turn to Back Page, Please)

Texas Included In H. R. 4671 Water Bill

A bill, H. R. 4671, to authorize the $1.7 billion Colorado River Basin Development moved out of the subcommittee on Irrigation and Reclamation of the House Interior and Insular Affairs Committee on June 28 on a vote of 13 to 5 and was scheduled for consideration by the full committee on July 13.

As introduced, the legislation calls for a study of the feasibility of importing water into the Colorado River Basin of the West. While no specific source is mentioned, open hearings on the measure brought out that the Columbia River is the most likely source.

An amendment by Congressman Walter Rogers of Texas, chairman of the subcommittee, was adopted to make the study include that part of Texas west of the 99th meridian, the High Plains section.

Gov. Connally, the Texas Water Development Board and the Texas Water Conservation Association, recommended that Texas be included in the study.

Crosby County Seeks Water District Entry

Petitions have been received from interested land owners in Crosby County by the High Plains Underground Water District. These petitions request that the part of Crosby County that lies within the delineation of the Ogallala Formation Sub-Division No. 1 be made a part of the Water District.

The Board of Directors of the Water District will call a hearing in future weeks in Crosby County to hear testimony on the petitions. All interested parties will be heard concerning the annexation of the County.

If the County is annexed into the present Water District it must be passed by a vote of the qualified voters who live in the area involved. Likewise, the thirteen Counties already in the Water District would have to vote to accept Crosby County into the District.

Crosby County, by becoming a part of the Water District would have made available all hydrologic data, maps, water level measurements, and other technical data for use in their ground water inventories and tax depletion allowances.

Water Conservation Necessary To Life

Water conservation is a practice as necessary as life itself. Many farmers in the High Plains Underground Water Conservation District have done an excellent job in conserving water. Many others have failed to make any attempt at all to conserve water.

The day of habitually letting irrigation tail water run down country road ditches is about over for farmers within the District.

The Board of Directors of the District has instructed the District personnel to eliminate, by one means or another, the loss of irrigation tail water.

Several notices to stop wasting water have been issued in the area during the past few days. Court injunctions have been served to several land owners and tenants. If after receiving a notice to stop wasting water, a farmer continues to let water pour out of his fields, a court injunction will be served. Many have been given warning in previous years, but will not be warned again.

Studies in the area where tail water was escaping from the land, reveal that a quarter section will lose an average of 37 acre feet of water during the irrigation season. This could easily irrigate about 18 acres of land for the entire irrigation season.

Valuable top soil is also lost when irrigation tail water is allowed to fill bar ditches and lakes.

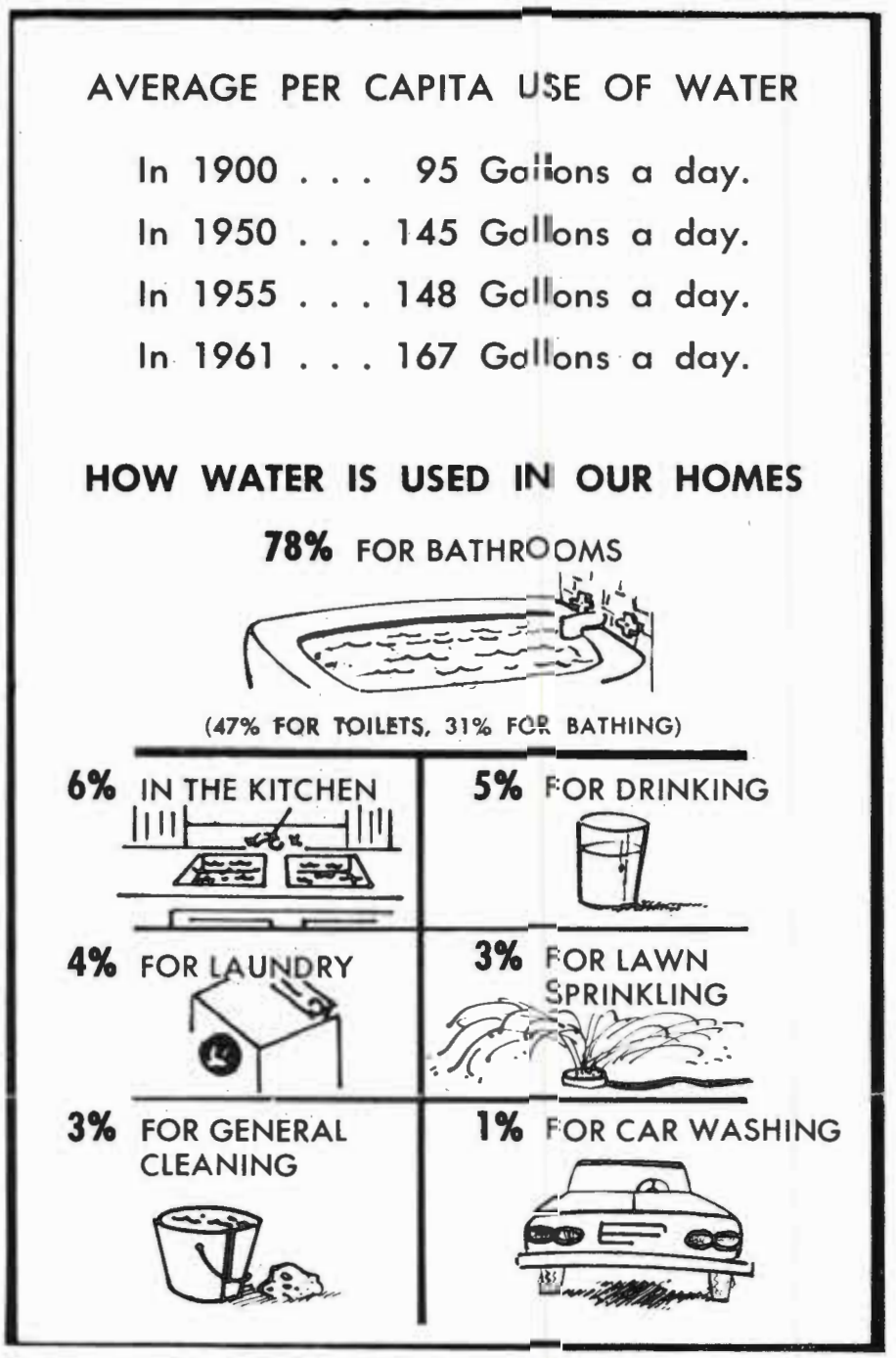
If you are allowing your tail water to escape from property you own or control, you should begin now to make plans to eliminate this waste. You too, will soon receive a notice and if compliance is disregarded, a court injunction will follow. The Water District is much more interested in motivating a desire in the minds and hearts of High Plains land owners to want to conserve their life-giving resource than it is in law enforcement.

Water Rights —

(Continued from Page 3)

the event the attorney concludes that no permit is necessary, the prospective irrigator should employ an engineer to make the necessary calculations to determine if it can be reasonably anticipated that there will be a sufficient flow in the stream to meet his water requirements and those below him during the irrigation season.

In periods of drouth and serious water shortage, every effort should be exerted by those taking water to prevent waste and to so conduct their operations that downstream users are not harmed. Everyone must shoulder his responsibilities to avoid a return to the frontier days of six-shooter justice in the settlement of water disputes.



Have you ever thought how our water is used in the home? Take a close look and see if this fits you. Try to see if you can justify how you use your water. Be more efficient with water use around the house.

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 13—No. 3 **"THERE IS NO SUBSTITUTE FOR WATER"** *August 1966*

Rayner Appointed Engineer For Water District

FRANK RAYNER

Frank Rayner of Austin, Texas has been employed as engineer for the High Plains Underground Water Conservation District.

Rayner comes to his new position from the staff of the Texas Water Development Board where he was head of the Quality Control program of the Ground Water Division for the agency.

No stranger to the area, Rayner lived in Lubbock for five and one-half years and represented the Texas Water Commission, now the Water Development Board, in their activities on the High Plains. During this time he worked exclusively with the observation well program in cooperation with the District. He also completed a comprehensive reconnaissance investigation of the occurrence and development of ground water in the 10,000 square mile area of the extreme Southern High Plains.

Rayner has conducted numerous hydrogeologic investigations and has prepared articles for the Cross Section and other national publications.

Rayner is a 1958 graduate of Texas A&M University and is a licensed professional engineer.

The directors and staff are very happy to have Frank working with the District in the High Plains area.

A weir with water being measured. Read the depth of the water in inches in the ditch and apply it to the large sign.

DISTRICT STUDIES WATER LOSSES

During the past few weeks the High Plains Water District has attempted to inform residents of Deaf Smith, Parmer, Lamb and Castro Counties of the actual amount of irrigation water being wasted from allowing "tailwater" to escape into country road ditches.

Accurate measurements of water are made by the use of weirs. The weirs are placed in the ditches and water is allowed to flow through, giving a reading of the amount of water in gallons per minute as it passes through the device.

Weirs have been used extensively during past years by the District as an educational tool for the public as well as the district staff. Detailed records obtained from these weirs have aided greatly in the design of tailwater return systems constructed by hundreds of landowners across the High Plains.

Information collected from these measuring devices shows immediately the amount of water being lost. If more than one well is contributing to the flow, sometimes it is important to measure each well separately, for land conditions and topography effect the handling of water. These factors along with many others are all considered in the design of an efficient recirculating system.

In most areas of the counties previously mentioned, it is still possible to develop large capacity wells (in excess of 500 gallons per minute), but the soils in this area generally have slow water intake rates. These two factors contribute greatly to irrigation tailwater losses.

Convincing farmers and landowners of the amount of tailwater actually leaving their land, in many instances, has been difficult. Many are astonished when they observe the amount of water being lost as it is measured through the weirs, or when they read the detailed records compiled from weir readings or recording meters.

Where measurements have been made, an average for five years has shown 100 gallons per minute per contributing well being lost as tailwater. The range of losses have varied from 44 gallons per minute to 250 gallons per minute per well, but a solution to a tailwater problem, in most cases, is simple.

In cases of small amounts of tailwater, simple borders can be constructed to hold the water on the land. Where large amounts of water are being lost, recirculating pits have not only proved economical by adding another source of water to an irrigation system, but if the landowner is the least bit conscientious about water pouring across his turnrows, the pit will serve to relieve his mind of his losing a valuable investment by the waste of a life-giving resource.

Signs are in place by all weirs so that anyone passing can make a quick check of the numbers of gallons of tailwater pouring through. There is something about cascading water that is hypnotic to man and curiosity will cause many people to take a second look, and when they do, they will see what is actually happening.

The Water District has attempted to control waste by educational programs such as the one described, however, many people refuse to accept these simple programs, and the District must then rely on the courts.

The Directors of the District have hoped that the information demonstrated by these devices would be a little alarming to a man, and in turn, create a desire in the heart of every landowner to want to conserve the water by putting to a beneficial use every gallon he pumps.

At the present time, the Directors of the District are diligently working,

(Continued on Page 4)

Approximate Saturated Thickness in the Ogallala Formation, High Plains Underground Water Conservation Dist. No. 1, 1963

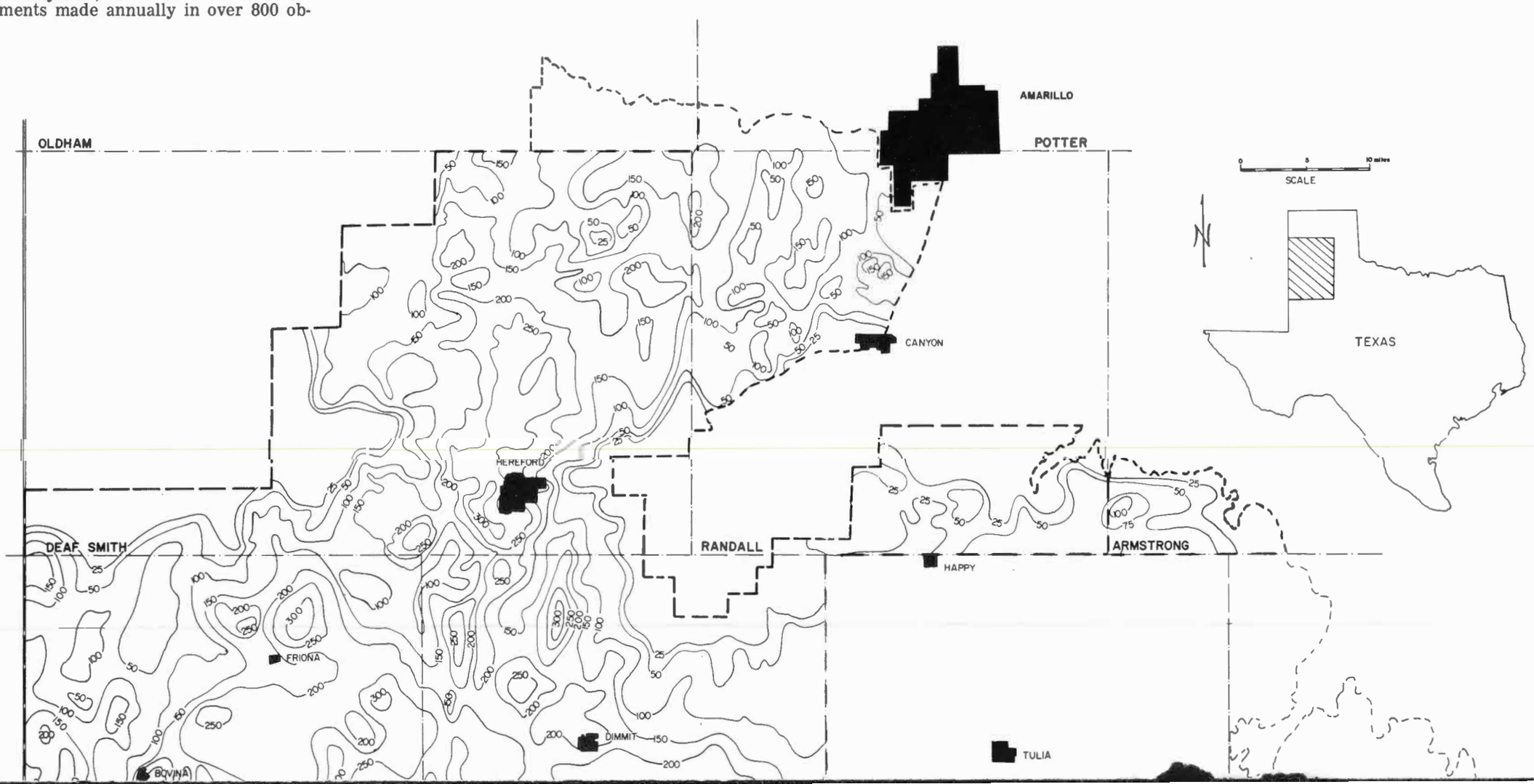
Prepared from records of the High Plains Underground Water Conservation District No. 1, and the Texas Water Development Board.

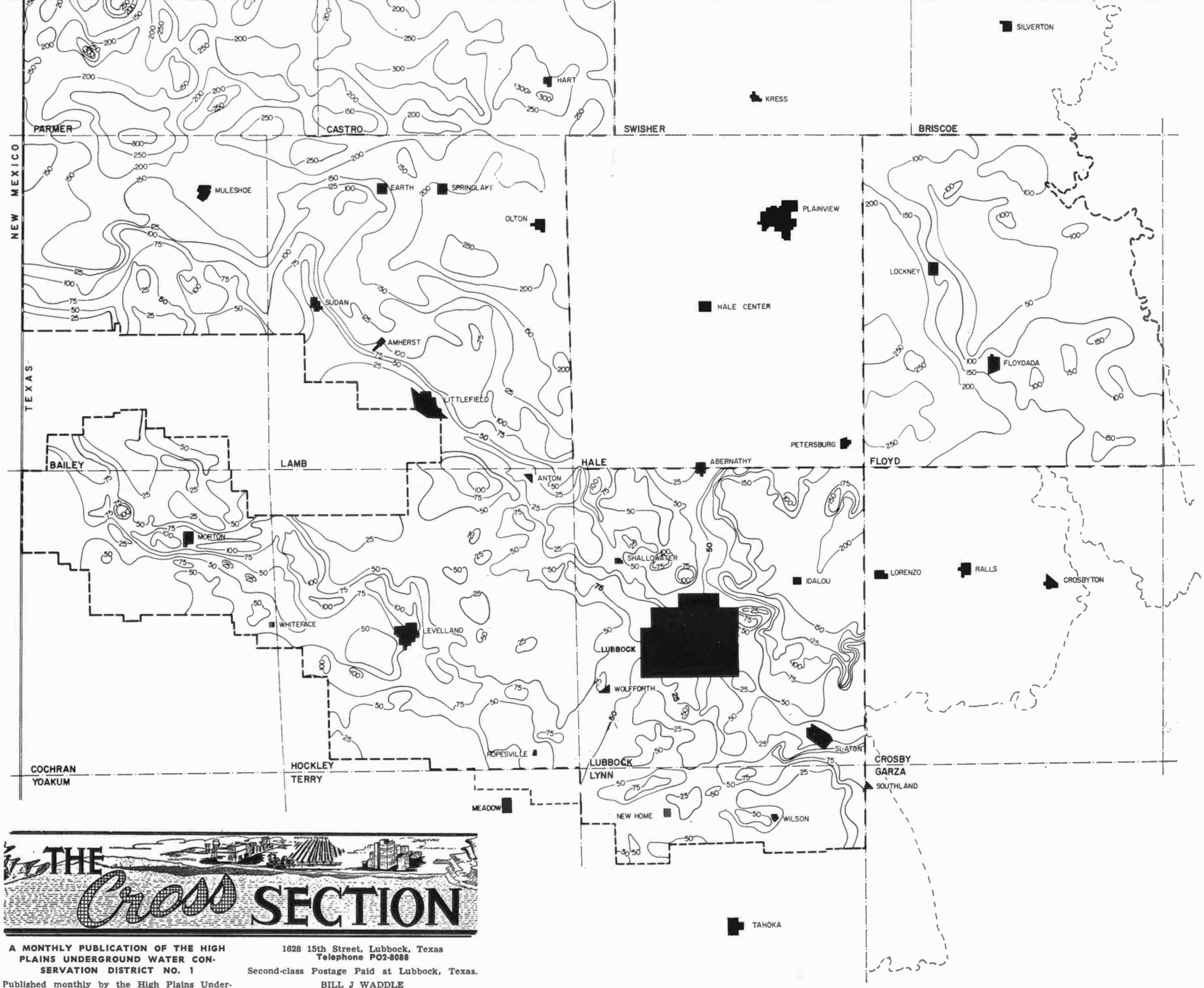
The general description of the saturation in the Ogallala Formation, within the High Plains Underground Water Conservation District, is shown by the subject map below of this issue of the CROSS SECTION. The saturation shown on this map consists of the thickness, in feet, of that interval extending upward from the base of the Ogallala Formation to the top of the water table. The water stored in this interval, commonly referred to as the Ogallala acquifer, constitutes, for all practical purposes, the areas' only fresh water supply.

This map represents the compilation of larger scale maps constructed using data collected as a part of the Water Districts continuing well-log data system, and water level measurements made annually in over 800 observation wells—a program maintained by the Texas Water Development Board in cooperation with the Water District.

Detailed sub-surface data are not available to map those counties and parts of counties—Oldham, Swisher, Briscoe, Hale, Crosby, Garza, and Terry—which did not elect to participate in the Water District.

The subject map cannot be used by landowners to calculate cost—in—water depletion income—tax allowances. Larger scale maps—accepted and approved by the U. S. Internal Revenue Service—for this purpose can be obtained from the High Plains Underground Water Conservation District at 1628—15th Street, Lubbock, Texas.





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

Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

COST OF IRRIGATION WATER

BY DR. HERBERT GRUBB

What price can irrigators in West Texas pay for water? Importance of water to the West Texas economy necessitates viewing water price and water importation possibilities with respect both to the farm and the non-farm sectors of the economy.

In order to obtain estimates of the price West Texas irrigators could and would pay for imported water, it is necessary to estimate the potential net returns to water on West Texas farms. Farm cost analyses which apply to the Texas High Plains provide information regarding the present net farm returns to major irrigated crops (cotton, grain sorghum and wheat). Similar analyses, however, have not been developed for the Trans-Pecos and low-rolling plains areas. It is expected that returns to water are widely different among West Texas sub-areas, and more refined sub-areas estimates are needed before water importation planning can be completed. The following discussion is based on estimates which reflect efficient management under High Plains production conditions. While estimates are realistic, they may not fit all actual situations. For analytical purposes it is necessary to choose representative situations to which specific instances can then be related.

Analyses of costs and expected returns for various irrigation levels show that returns to water and irrigation management vary considerably between irrigated crops (see Table 1). The three major irrigated crops have been produced under various levels of irrigation. The two irrigation levels shown represent 1) present practices (approximately one acre foot per acre irrigated) and indicate 2) the potential returns at higher rates of water use. At approximately one acre foot per acre, estimated returns are 19 dollars per acre foot of water used on grain sorghum, 20 dollars per acre foot used on wheat, and 54 dollars per acre foot used on cotton. At a higher rate of water use, approximately 1.75 acre feet per acre, estimated returns are 24 dollars per acre foot used on wheat, 36 dollars per acre foot used on grain sorghum and 50 dollars per acre foot used on cotton. Estimated returns per acre foot used on the

TABLE ⟶

minor crops range from a low of 28 dollars per acre foot used on soybeans to a high of 75 dollars per acre foot used on onions. It should be recognized, that significant expansion of vegetable production with present marketing facilities and in present markets probably would result in much lower prices and consequently, lowered returns to water used on vegetables.

The net returns data show that there are several possible water prices. Each different price would result in a different quantity of water use. It always is uneconomic for farmers to pay more for water than it can return in additional crop value. Accordingly, crops for which the water cost exceeded the return to water would not be irrigated. Four alternative water pricing criteria are presented below:

1) price equal to weighed average return to water used on cotton grain sorghum, and wheat,

2) price equal to returns to water used on cotton, and

3) differential water prices designed to permit irrigation of all crops presently irrigated and

4) price equal to net returns for the crop which yields the lowest net returns to water.

In considering alternative water prices it is necessary to make some assumptions about returns to irrigation management. First assume that 1) irrigation management is allocated a constant payment of X dollars per acre irrigated regardless of the crop produced and 2) the water price is set at the weighted average return on cotton, grain sorghum, and wheat i.e., ($28 - $x) and only one acre foot per acre is contemplated. Under these conditions only cotton would be irrigated. At a higher water use level of 1.7 acre a water price established at the weighted average return for this level of water application (36 - x at 1.75 feet per acre), both cotton and grain sorghum could be irrigated.

When it is assumed that the price of water is equated to returns in the most profitable use then only cotton of the three major corps, would be irrigated. Higher water prices could be paid at the headgate only if the more profitable crops were to be irrigated. In This situation, as in others, however, it would be necessary to construct a complete area network of water distribution facilities. West Texas most important crops are distributed throughout the area. Although the initial per unit cost of the delivery facilities under these conditions would be relatively high, the per unit cost of adding additional capacity would be relatively low. In any case, plans to engage in partial (restricted) diversion should be carefully studied before such decisions are made.

If the goal is to irrigate all present crops, then either a differential water price or a constant price set low enough to permit irrigating the crop which yields the lowest returns to water would be necessary. Differential pricing would require offering successive increments of water at successively lower prices. In a differential plan the first increment probably would be priced at a level equal to the returns to water used on the most profitable crops. Each successive increment would be priced at the successively lower returns for the next most profitable crops until all crops had been accorded opportunity to be irrigated. This alternative would be difficult and costly to administer and would effectively squeeze out practically all profits to water use.

An alternative assumption about irrigation management returns is that opportunity for employment elsewhere is low. Irrigation management returns therefore, approach zero for crops which yield lowest returns to irrigation. If for example, irrigation management returns are zero for the crop yielding lowest net returns to water, and only one acre foot per acre irrigated were considered, then water price would be 19 dollars per acre foot. Under the same assumption but with 1.75 acre feet per acre irrigated, the price of water could be 24 dollars per acre foot. At 19 dollars per acre foot, present irrigation presumably could be maintained if five million acre feet of water could be imported and distributed to farmers at this cost. Five million acre feet would provide one acre foot per acre. If more water could be made available so that 1.75 acre feet per acre could be applied, farmers could pay 24 dollars per acre foot. Setting water price low enough to permit irrigation of the crop which yields the lowest net return to water results in positive profits to management from the more profitable crops.

It should be clear that the problem of pricing imported water is a difficult one that can be solved only after study of both the costs and the returns for alternative projects. The goals of water importation will need to be clarified. Additional detailed sub-area agricultural production studies will be required, and the extent of participation by the non-farm sectors will need to be considered before water planning for West Texas can be completed.

Table 1: Returns to Water Delivered at Well Head* Major Irirgated Crops High Plains.

Crop	Price	Net Revenue 12" applied	Returns per Acre Ft.	Net Revenue 21" applied	Returns per Acre Foot
			(Dollars)		
Cotton	0.265/lb.	54.	54.	88.	50.
Grain sorghum	1.80/cwt	19	19.	64	36.
Wheat	1.86/cwt	20	20.	42	24.
Soybeans	2.50/bu	—	—	50	28.
Castorbeans	0.05/lb.	—	—	57	32.
Potatoes a	2.44/cwt	—	—	103	34.
Onions b	1.83/cwt	—	—	193	74.
Carrots b	1.80/cwt	—	—	170	65.
Weighted average return (cotton, grain sorghum and vegetables)			28		36

*Pumping costs have not been deleted.

a Use approximately 36"

b Use approximately 31"

District Studies —

(Continued from Page 1)

along with many other West Texans, toward the importation of water to West Texas so that this great agricultural area may continue to thrive. It is very difficult for some people to visualize the High Plains ever needing water when we waste as much as we do.

A chronic "water waster" is a culprit who makes us all suffer in many ways, but especially when we are talking with people in other parts of Texas about importation of surplus waters to the High Plains. If we want help from others, we must help ourselves first.

WHEN YOU MOVE—

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THE Cross SECTION

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

Volume 13—No. 4 "THERE IS NO SUBSTITUTE FOR WATER" *September 1966*

Request For Injunction By Sun Oil Company Has Been Denied

Sun Oil Company's request for an injunction against Earnest Whitaker to compel him to let the company drill Ogallala water wells on his land and use the water therefrom for water flooding under an oil and gas lease agreement has been denied.

Hockley County District Judge, M. C. Ledbetter refused to grant Sun the court order that would have directed Whitaker to refrain from interfering with the drilling of Ogallala wells on his land. Water from these wells would have been used by Sun to water flood their oil and gas lease on Whitaker's land.

Several months ago, Sun initiated plans to drill two Ogallala water wells on the Whitaker farm to water flood eight oil wells. Sun claimed a right to use this water under their oil and gas lease that gave them the "free use of oil, gas, coal, wood and water from said lands except water from lessors' wells for all operations hereunder."

Whitaker maintained that the underground water beneath his farm belonged to him and the oil company had no title to this water to be used in a water flood operation.

This conflict of opinions caused Sun to go to the District Court for the injunction.

Testimony during the hearing revealed that several thousand acres of land in the area were under lease of this type. Witnesses testified that to their knowledge water was used only to drill wells and for use in steam operated drilling rigs in the late 40's when the mineral lease was signed. Other witnesses testified that they knew of no coal deposits or vast supplies of wood in the area.

Water flooding was not attacked in this case. All parties agreed that it is a good conservation practice.

The parties, however, did disagree on the use of Ogallala water for the operation.

The High Plains Water District entered the case on Whitaker's side. The District was concerned that the injunction, if granted, would deprive surface owners of ther private property.

State Statutes say that the owner of the surface rights to land also has title to the underground water beneath this land. Had the court granted the injunction, farmers could have been deprived of their private property without just compensation.

Sun Oil Company has served notice it plans to appeal the decision.

CONTOUR ROWS

Americans must c onserve water to continue to live. This includes every man, woman and child in the United States.

In our particular area people usually think the largest "water waster" is the farmer. True, he is the largest water user, but most conscientious farmers do a good job of water management and conservation.

In 1963 James Mabry of Parmer County initiated work with the High Plains Underground Water Conservation District in a cooperative program to conserve his water and eliminate waste.

A tail water return system was installed and meters were installed on all his wells. During the past three years Mabry has recirculated 13.84 percent of the total water that was pumped from his wells.

Not being satisfied with just using the return system, and due to a nineteen foot slope in one half mile, Mabry decided to contour his rows.

The contoured rows slowed the movement of the irrigation water and allowed it to penetrate into the soil rather than escape as tail water. The slow movement of the water also eliminated "hot spots" in his crop at the low end of his field.

Mabry's farm is the first one on which the District has had a chance to observe the use of contour rows with a tail water return system. The limited results of the demonstration are encouraging.

In 1963, 57.36 acre feet of water was recovered by using straight rows—65.20 acre feet was recovered in 1964.

During the 1965-66 irrigation season 25.89 acre feet of water was recovered using contoured rows.

The contoured rows may have cut the amount of water lost as tail water by approximately 50 percent. However, in this case none of the water was lost due to the return system.

Contouring rows is not a new practice, but many farmers are reluctant to do it because they think it makes farming harder. If you can save water, any new farming practice is easy and worthwhile.

Many other farmers in West Texas use contour rows. If you are one who doesn't, now is the time to make plans for a change. It could be worse; you could be farming dryland.

Water Depletion Tax Deductions Now Being Felt In Plains Area

A boost of six to eight million dollars to the area economy from income tax deductions and refunds began to be felt during August.

Marvin Shurbet, Floyd County farmer, received three checks totaling $,3-661.30 as income tax refunds for irrigation water depletion for the years 1962, 1963 and 1964 on his 480 acre farm in Floyd County.

Shurbet's income tax refund checks are forerunners of "millions of dollars," that will remain on the Southern High Plains each year for qualified landowners.

The High Plains Underground Water Conservation District sponsored the case and the Shurbet farm was used to prove facts relating to the diminishing water supply under the Southern High Plains.

Initial tax refunds now being received by landowners will eventually become deductions.

The Water District and the IRS developed guidelines for the thirteen counties in the district for the computation of deduction allowances based on these factors: Average thickness of the Ogallala formation under the land at time of acquisition, average decline of the water table each year in which depletion is claimed and the owners investment in the water at the time he acquired the land.

Individuals who haven't received their refunds should be getting them in the next few weeks.

Annexation Hearings To Be Held In October

Two annexation hearings will be conducted by the Board of the High Plains Water District in October.

The hearings, one to be held in C rosby County and another in Hale County, are being conducted for consideration of the annexation of Crosby and Hale Counties to the High Plains Underground Water Conservation District No. 1.

Interested landowners of both counties have petitioned the board for the hearings.

Individuals who are interested in making statements concerning the annexation are welcome to do so at the hearings.

The Crosby County hearing will be held in the District Court Room at Crosbyton on October 17 at 9 o'clock.

The Hale County hearing will be held in the District Court Room in Plainview, October 18 at 9 o'clock.

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BILL J WADDLE
Editor

Visit Our Booth At The South Plains Fair

On September 9, the Texas Water Development Board held its final hearing on the State Water Plan. The hearing was held in Lubbock Municipal Auditorium.

A crowd of approximately three hundred listened attentively to testimony given by various individuals and groups.

Printed in this months edition are some of the speeches given, some in text and some in part.

The first is a portion of Joe Moore's summary following testimony received at the hearing. Mr. Moore's comments printed here reflect actions the Water Development Board will take in the future.

In addition to the specific programs outlined on June 17, and prior to tentative adoption of the Texas Water Plan, the Texas Water Development Board will examine as rapidly as available staff and funds will permit and in sufficient detail to provide cost estimates for surface water delivered for irrigation to various points in West Texas, the following four alternative sources:

(a) Waters available to Texas in Sulphur, Cypress ,and Lower Red River basins and possibly the Upper Sabine River basin, in excess of introbasin requirements and projected municipal and industrial requirements in the Dallas-Fort Worth area;

(b) Waters of the Lower Sabine and Neches River Basins presently unallocated under the Texas Water Plan;

(c) All water in East Texas surplus to intra-basin requirements and the demands for higher uses which must be satisfied by interbasin transfers;

(d) Imported water to West Texas from either the Mississippi or the Missouri River or their western tributaries.

The Board will examine the possible transport of excess surface water from the Eastern basins for potential municipal and industrial purposes in Abilene, Brownwood, San Angelo, Midland, and Odessa areas and possibly as far west as El Paso. In addition the Board has asked the Bureau of Reclamation to determine the costs of delivering for various quantities of both irrigation and municipal and industrial water supplies to West Texas utilizing a pumpback system up the Colorado River Channel.

We would further propose the creation of a small West Texas Advisory Group selected from the membership of the West Texas Chamber of Commerce Committee and others in West Texas interested in water development to work closely with the Texas Water Development Board on all of these matters affecting the State's best interests.

I would ask you here today not to abandon a course of objective and critical appraisal of the Texas Water Plan. I would ask you rather to join us in the continuing review of that Plan as it is implemented, and as it undergoes the inevitable modifications which changing conditions will impress upon it. I would ask you to look at all the facts clearly, and to think and speak of the Plan and of continuing water resource planning, not as West Texans, but as Texans.

The Board and its staff have dedicated their efforts to fulfilling the statutory directive provided by the 59th Texas Legislature — to prepare a State water plan for the benefit of the entire State. This effort has received the full measure of their capabilities and devotion. They have been and are committed to the task the Legislature assigned, providing a flexible guide to be considered by the Texas Water Rights Commission in granting permits for water development in this State. A part of that commitment is a continuing, aggressive pursuit of the best means to secure a supplemental surface water supply to West Texas.

In meeting the water needs of the future we need each other. West and east and north and south are mutually interdependent. Our history has made it so. Our future economic well-being through water development requires that we drop the prefixes "east", "north", "west", and "south" — and proceed jointly. Don't foreclose the long-range impact your economic and political strength can have on the decision making process of planning by assuming a purely local or regional posture. The rest of Texas needs you, and to meet your long-range problems you need the rest of Texas. A greater destiny beckons us all, together, than we can grasp separately.

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Remarks By State Representative Bill Clayton

Honorable Joe Moore, executive director Texas Water Development Board, chairman Mills Cox, board members and staff . . . I would like to take this opportunity to express my sincere thanks and appreciation for your untiring devotion and dedication in working long hours and understaffed to put together a comprehensive water plan for Texas.

In the beginning, let me say I am for a state wide water plan. I believe if we do not provide such a plan at the state level, the federal government will. States have too long shunned their responsibilities in many areas and consequently created vacuums into which the federal government is anxious to move. Now the time has come for Texas to demonstrate its leadership in water planning and development, but gentlemen to prevent federal intervention and chaos, a Texas water plan must provide for *and meet* the water needs for *all the state* . . . Let me repeat, *for all the state.*

Texas has needed a water plan for many years. A state that varies in rainfall from 55 inches in the east to nine inches in the west must have water planning and implementation of that planning if we are to maintain our position in the economy of the United States. Instead, I know that Texas will not settle for "status-quo," *It must, It will,* be a leader among the top states in economic development. The Texas water plan can be very instrumental in helping Texas maintain its leadership by providing necessary water for state-wide municipal, industrial, and agricultural growth.

However, being from West Texas, I must view the Texas water plan from a viewpoint of what it will do for this area and particularly for my district. The plan seems to leave us in the position of being a step-child. In other words, it seems that we, in this area, are left out as far as the benefits of the water plan are concerned. I will address myself to the Texas water plan in generalities rather than specifics. I realize that West Texas has been led to believe there is much in the plan for us. All I find in the plan is to try to get West Texas in the Colorado river basin study bill now pending in congress, modify a few playa lakes, and set up an office of the water development board in West Texas. These ideas are good, but in reality do not furnish West Texas a single drop of water.

As you must realize by now, this area of the state produces 14 percent of the nation's agricultural food and fiber products and if America is to feed the world, we cannot afford to decrease in productivity. In fact, we must increase production to meet the ever increasing demands and to keep Texas economy booming. To meet the demands of increased production, we must have water. If we only had the 2,000,000 plus acre feet of East Texas surplus water not allocated by the Texas water plan, we could maintain the present level of irrigation.

But aside from agriculture, let us think of industry for a minute. We have enjoyed industrial growth in West Texas, but if we continue this growth, we must provide water. It seems that there is not an absolute figure as to the cost of transporting East Texas water to this area. We wonder why a study that was being made to determine this cost was postponed or cancelled. Municipal and industrial water at suggested figures of $68 per acre foot is not unreasonable at all. When you think of the contribution that West Texas agriculture, oil and gas, and other industry in the area makes in tax dollars to the state of Texas, it only seems reasonable that we would be given more consideration in the Texas water plan.

Let me pose these questions to you for consideration before adopting a definite plan:

1. Why not continue a study on the cost of transporting East Texas water to West Texas?

2. Why not help an area continue its agriculture production instead of creating new areas by providing them water for irrigation of thousands of new acres?

3. Why not import water from Arkansas, Missouri, or Mississippi rivers into the East Texas complex, thereby, making available water for all the state?

4. Why not consider a transportation system to west Texas as a dual purpose system in the event North West water is ever imported to this area? In such event, water could be reversed in such a system to furnish water in other parts of the state in years of extreme drouth. This would make any plan more versatile and de sirable.

Gentlemen, water is the life-blood of any community or area or state. Having served two terms on the conservationand reclamation committee of the house of representatives and on two water study interim committees and presently on the steering committee of the West Texas Chamber of Commerce Water Resources Committee, I have become more aware of the importance of water, and share the feelings of our governor, who on August 12, 1964, wrote to the Texas Water Commission of his concern about drouth conditions in Texas and a need to develop adequate sources of water for *all our state.* The governor directed the water commission to develop a comprehensive water plan for Texas . . . *Longer in range and broader in scope than previous plans.* He felt that earlier plans were not adequate *to satisfy the water needs for all of Texas.*

Then again on January 27, 1965, in his address to a joint session of the 59th legislature, the governor said, and I quote, "we have in Texas the foundations for planning, financing, and developing water supplies for all our people. Texas has enough good water within its own boundaries to satisfy our needs as far into the future as any of us can see.

"Our cities, river authorities and water districts have made strides toward solving the water problems which can be attacked within the limits of their own jurisdictions. In addition, the federal government has proposed plans for development of major regions of the state. But these plans do not encompass all our needs and resources, and they still lack the coordination which only the state can provide.

"We in state government have a constitutional duty to conserve, develop, and distribute the water resources of Texas. The effective performance of the duty requires the preparation of a state water plan, flexible enough to meet evolving long-range needs but specific enough to solve immediate water supply problems," end of Quote. . . . .

If you noticed the governor's statement, you must have been aware t hat he said we had enough water within our own boundaries to satisfy our needs. John Vandertulip, chief engineer for the Texas Water Development Board also made a similar remark in Houston, April 9, 1965, when speaking to the associated general contractors and again I quote, "in response to the question I posed on whether Texas has enough water to meet its future needs, the answer is a qualified yes . . . if part of the water can be moved from areas of excess to areas of deficiency. Any such movements of water will require ample provision to meet future needs of any exporting river basin," end of quote.

In the preliminary "Water for Texas, a Plan for the Future." prepared by the Texas Water Development Board in May, 1966, on page no. 2, it says a plan is needed to move the State toward its objectives of con tinued growth, and the satisfaction of every citizen's just desire for an equitable share of the states natural resources. None of the previous plans obtained this objective or the objectives the governor sought for Texas in a water plan.

The U. S. Study Commission—Texas, only satisfied the needs of 63 per cent of the area of the state and along with other plans actually justified a real water plan for Texas. I doubt the plan we are discussing today in its present form includes as much as 60 per cent of the area or water needs of Texas. And I am sure it does not meet the objectives the governor set forth when asking for the preparation of a Texas water plan. I say this because in the hearings over the state, I find the plan does not satisfy the needs of Ft. Worth, Dallas, Waco, Houston, Austin, Denison, and Sherman. to mention a few places plus all West Texas.

In your hearings across the state, of which I have attended several, I am sure you find yourselves better equipped to finalize the Texas Water Plan in such a way to benefit all Texas. We gave you the authority to adopt a plan by passage of senate bill no. 146 during the last session of the legislature. We are grateful for the work you have done.

Governor Connally recently said, "water development is a continuing challenge. No one man, no one agency can validly claim a complete solution to the proper conservation of our most valuable natural resource. Solutions are found only by individuals and agencies working together in concert for the welfare of all the people."

We, in West Texas, accept our responsibilities, and will assist and help in any way possible working with the Texas Water Development Board to make a satisfactory and desirable water plan for *all of Texas.*

Let me say this . . . we have confidence in your purpose and believe you will, in final form, adopt a plan that will justify implementation. You well know, that before any plan can be implemented, there must be money provided. If the people of the state adopts the constitutional amendment in November providing for issuance of $200,000,000 in bonds, it will still take 2/3 vote of the Legislature before the bonds can be sold. Also, additional appropriations from the general revenue fund will be needed for implementation of the plan. What I am trying to say is simply this . . . it is essential and would behoove the board to develop a plan that meets the needs of the state and is palatable to all Texas. *In other words, gentlemen, include West Texas.*

Remarks Of West Texas Chamber Of Commerce Water Committee

Mr. Chairman, members of the Water Development Board and Staff, Ladies and Gentlemen. My name is George W. McCleskey. I am a member of the steering committee of the Water Committee of the W. T. C. of C. This statement is made on behalf of this Committee at the request of Mr. K. Bert Watson, Committee Chairman, who is unable to be personally present. Most of you have heard in full the policy statement of the West Texas Chamber of Commerce on the Texas Water Plan. Stating a basic belief in a statewide water plan, it insists that the preliminary plan does not adequately consider the needs and solutions to West Texas water problems and asks study or restudy of:

1. The amount of surplus water available in Texas — opinions with some apparent validity vary from 4.5 million acre feet to double that amount with the Water Development Board making the lower estimate.

2. Engineering and economic feasibility of delivery on this and other water to West Texas.

3. Importation of water to Texas—whether east, west, north or south—with or without displacement between these areas.

4. Diversion at the highest possible elevation or equivalent studies to same result.

5. Release of downstream water rights for upstream use on a priority basis both as required by the proposed constitutional amendment and as a general principle where water is available in the basin or from trans-basin transfer.

Concerning your recommendations, we do need additional work on conservation of our underground water and playa lakes, further correction of natural and artificial pollution, saline water conversion research, topographic mapping and implementation of the Red River Authority Development Plan. We also need remedial work on the upper Brazos, upper Red and Pecos on quality, salt cedar and silting: continuous improvement on the Rio Grande and removal of impediments to legal action on that compact. The Edwards Plateau underground system can be improved by additional recharge, reduction of silting and prevention of underground pollution. A study of all possible upstream reservoir sites is needed.

Concerning our whole area, we fail to understand how you project a 1 3/8 per cent per year growth for ten major cities of West Texas which have had a historical growth rate of almost 8 percent per year between 1940 and 1960 while projecting growth for other cities of comparable historical growth of 5 1/2 times during the same period.

We note your population projections on the following cities as compared with other estimates which were developed by the cities themselves:

	T.W.D.B.P. Projection 2020	City Projection 2020
1. Abilene	234,900	370,000
2. Amarillo	434,000	845,493
3. Fort Worth	1,271,000	1,985,000
4. Plainview	62,000	78,000

In view of its treatment of West Texas, it is our request that you delay

(Continued On Page 4)

REMARKS OF THE 2020 COMMITTEE

Early in the planning stages of Water for Texas—the 50-Year Water Plan prepared by the TWDB—the 20-20 Committee began working with the Board to provide information on water resources and necessary information of the 42-County High Plains region, one of the most highly developed and productive agricultural areas in the United States.

The 2020 Committee represented those groups in agriculture, education, finance, industry and commerce which have made major contributions to the economic growth of the area and HAVE INVESTED BILLIONS OF DOLLARS IN ITS FUTURE.

At an informal hearing held by the Texas Water Development Board in Lubbock on June 17, 1966, the 2020 Committee presented a paper outlining the techniques that it had employed in the preparation of the study used by the TWDB, and, in addition, presented some general observations and recommendations for future consideration by the Board.

At the formal hearing held on August 24, 1966, in Amarillo, the Committee restated some of the conclusions that are apparent from its work.

Assuming that the information presented at the previous hearing is a part of record and will receive careful consideration by the Board, that information will not be re-stated today, however, the 2020 Committee has additional recommendations to present to the Texas Water Development Board today at its final hearing.

Among these recommendations are:

1. To enlist the active assistance of the Texas Water Development Board insofar as the Red River Compact is concerned—the present state of discussion of the compact would indicate that water in the tributaries of the Red River located in this area will be lost to the region. The Committee regards it as impractical to take water from an already water-short region.

2. To urge additional study on the question of the amount of excess water available from East Texas sources —the figures that have been mentioned seem extraordinarily low and do not seem to take into account all of the available sources. The Neches and Sabine Rivers for example. In addition, it is conceivable that undeveloped groundwater sources in East Texas, if developed by individual owners, could free additional surface water for use in other areas. West Texas for example.

3. To ask the Board to update the basic information on which its preliminary conclusions have been reached and to expand its data collecting activities to be certain all pertinent information is available prior to adoption of the final plan.

4. To suggest a study of the feasibility of reservoirs at all possible sites on the creeks and draws of the High Plains to gather water for use in recharge or other beneficial uses—these studies should consider, in addition to the cost of the water, both available water rights and, if different, those that would be available if some downstream water rights were released.

5. To urge the Texas Water Development Board to take the initiative in the matter of importation of water. As an example, the 2020 Committee would suggest the opportunities offered by a Texas-Oklahoma-Arkansas-Kansas-Louisiana Compact, with the possibility that water from the Red, Mississippi, Missouri, and Arkansas Rivers could be made available to the High Plains area.

There is one economic consideration, insofar as meeting the water needs of the High Plains is concerned, which, because it so directly relates to the statutory directive to the Texas Water Development Board, calls for special attention.

The Board is directed "To plan for the orderly development and management of water resources in order that sufficient water will be available at reasonable cost to further the economic development of the *entire* state." (emphasis added)

The economic development of the entire state is dependent upon the maintenance of a high agricultural output on the High Plains. Texas cities situated many miles from this study area are the location for plants which process the production of this region. The shipment of agricultural products is a major business for Texas seaports, and this area is the source of much of this ship movement. Half of the wheat and one-third of the cotton and grain sorghum grown in this area is exported, most of it from Texas ports.

At the present levels of production —those which require water implementation in the practical ranges of 2 to 6 million acre-feet-irrigation, adds a half-*billion* dollars to the farm income of the 41-county study area. But, as impressive as this figure is, it is over-shadowed by the fact that the non-farm income of the entire State of Texas, including, of course, the agri-business segment of the area's economy, is increased by *one-and one-half billion dollars before the crops produced in the study area leave Texas.*

For further emphasis of this point so vital to the Board's responsibility "to further the economic development of the *entire* state" (emphasis added), let us submit one additional economic consideration.

The 132-county area which is generally called West Texas, and in which the membership of the West Texas Chamber of Commerce is located, has more agricultural income than all except 4 of the United States, and approximately 70 per cent of this farm income is produced in the 42-county High Plains area.

In conclusion, the 2020 Committee pledges its continued cooperation to the Texas Water Development Board. We have worked with you from the earliest stages of your endeavors and look forward to being your partner until a truly state-wide water plan is developed.

C of C REMARKS—

(Continued From Page 3)

the adoption of a Texas Water Plan until a plan for *all* of the State of Texas can be adopted in accordance with your charge by the Governor.

Specifically, we request the following studies of *Texas* water by you or through your cooperation with others:

1. Availability of additional water from the Red & Arkansas Rivers.

2. Availability of additional water by use of our Colorado River.

3. Availability of additional water by high elevation diversion from Northeast Texas.

We understand this study was considered but not pursued.

Each of these studies should consider municipal and industrial water and irrigation water in an incremental amount or amounts available from the source whether it be 1/2, 1, 2, 4, 8, or more million acre feet.

At the same time, studies should be made of out-of-state importation through the Red, our Colorado, Northeast Texas and from the lower Mississippi, Arkansas and Missouri, as well as from the Colorado River project, or NAWAPA. We recognize your efforts in this area and the long t erm expansive possibilities but we also foresee extensive interstate, national and international involvements. We understand that you may obtain cooperation from national agencies in making these studies.

It is our purpose to obtain these studies — through you, we hope. If not, it is our intention to obtain them by private contract, by legislation or by other available means.

Yet, we do not intend to trade studies for water. We completely understand the need for a Texas Water Plan — as much as any area. If, however, it does not include water for West Texas, we are, at best, neutral, and we do not intend to be idle while water which might be available here is committed elsewhere.

Information On Ground Water In U. S.

A Geological Survey Hydrologist, Dr. Joseph E. Upson, recently released the following observations concerning ground water in the United States.

Upson said that "the 48 coterminous States have a total of 53,400 cubic miles of available ground water, nearly all of which is potable, within one-half mile beneath the land surface." (19.6 billion gallons equal 1 cubic mile.)

"The average rate of replenishment of this ground water from rainfall is only about 340 cubic miles per year." "If there were no withdrawals and no outflow, it would take about 160 years to build up this amount starting with empty reservoirs."

In recent years the use of ground water has increased for public supplies, and irrigation, but has decreased for industry use. It is hard to tell whether the overall use will continue to rise or level off.

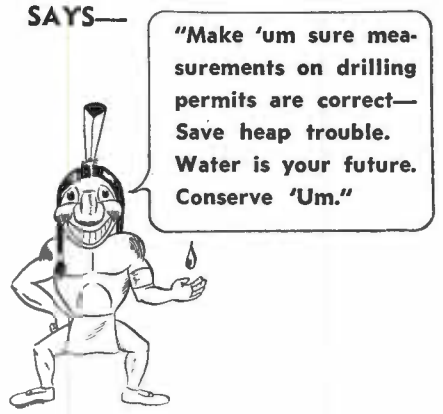
Ground water accounts for nearly 20 per cent of total water use in the United States. Public water supplies use about 30 per cent ground water, irrigation 30 per cent, rural water supplies 75 per cent and industry 4 per cent.

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."

INCLUDE YOUR ZIP CODE NUMBER

"CHIEF RUNNING WATER," SAYS—



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THE Cross SECTION

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

Volume 13—No. 5 **"THERE IS NO SUBSTITUTE FOR WATER"** *October 1966*

A NATIONAL

GROUND WATER LABORATORY

"Areas on this globe that will thrive, or even survive will be determined by the availability of water resources and their wise use to serve man."
Senate Select Committee on National Water Resources

An unprecedented population explosion is forcing America to move along uncharted avenues of growth. Hourly the momentum is increasing, creating in its wake an economic upsurge unequaled anywhere in world history. But with this headlong growth comes the unleashing of new and difficult problems. Foremost, among these are the tremendous pressures bearing down on our natural resources, and mainly upon our supplies of fresh water. In much of the Western United States the day has already arrived when future demands for water cannot be met entirely by new surface reservoirs. For sufficient, economically feasible storage sites no longer exist. Maximum water development can only be obtained by a coordinated utilization of surface and ground water reservoirs.

Ground water is water that is found beneath the surface of the earth. It includes both fresh water and saline water. Ground water can occur in all kinds of rocks. In gravel sand, sandstone and silt, it occurs in the voids between the rock matrix. In rocks such as quartzite, granite, limestone, and some indurated sandstone it is generally found in cracks and crevices. In some of the more soluble rocks, such as limestone, the water has a tendency to dissolve the rocks, form honeycombe structures, enlarging the crevices and channels to considerable size, even to caverns.

In whatever rock material ground water may be located, these materials and the water therein are usually definable aquifers, or underground reservoirs, that within themselves constitute a natural resource of great economic value. Aquifers provide a natural system of water distribution. Ground water reservoirs are a dynamic resource, dynamic both with respect to physiography and to man's activities. Relatively free from contamination, these natural reservoirs receive and discharge water and in the process filters and repurifies it. Of the vast amounts of fresh water presently stored in these underground reservoirs a certain, but unknown, amount can be utilized to provide much of the needs of our expanding population and industrial demands on a perennial basis. If conjunctive utilization of both surface and ground water reservoirs could be made to work, the process would essentially require that surface reservoirs impound rainfall and stream flow which could then be transferred at an optimum rate to ground water storage. With surface storage supplying much of the annual water requirements—ground water reservoirs, generally being many times larger, could be retained primarily for cyclic storage covering series of years having subnormal precipitation. Thus, ground water levels would be lowered during a cycle of dry years and raised during ensuing periods of heavy rainfall. Existing knowledge is grossly inadequate to form the basis for such an effective development. With ground water becoming a matter of concern to the entire nation and since no section of this nation is without its peculiar ground water problems, *A National Laboratory of Ground Water Research* is desperately needed. Fact gathering and data compiling still exists and will continue to exist but the urgent need today, to meet the problems facing the hydrologists, the engineers and the scientists in the field of research, is to provide a background against which such data can be interpreted. The concept of *A National Laboratory of Ground Water Research* does not envision a routine gathering of data, but rather should be oriented for the development of methods to be utilized in the field. Working knowledge gained through actual experience with a field condition could be of unlimited benefit in interpretation of the hydrologic and geologic perimeters of ground water basins. The end being that the performance of these basins could be more accurately predicted and managed for optimum beneficial use in the best interest of the Public.

Of necessity *A National Laboratory of Ground Water Research* would have to be staffed with top men in every description related to the occurrence, movement and development of water in underground reservoirs. Such discipline should include the fields of geology, hydrology both surface and ground water, engineers, soil scientists, chemical meteorologists, physicists, statisticians and lawyers.

Geophysical tools used in the fields of ground water studies have advanced very little beyond the peach limb and the chalk line. Instrumentation for the use of reservoir engineering in the production of ground water is practically unheard of.

Because of the very wide scope and complexity of the total problem of ground water development and management only a few of the critical problem areas needing immediate study have been set out.

1. The hydrology and storage capacity of ground water reservoirs.

2. Methods of determining the perennial or safe yield of ground water reservoirs.

3. Basic research into the origin and movement of waters constituting ground water basins.

4. The economics and ground water management including improved and more efficient methods for extracting ground waters from such reservoirs with particular aatetion to the problems relating to deep-seated reservoirs.

5. Quality control of ground water reservoirs including artificial contamination both chemical and bacterial, and the deterioration of quality from natural resources.

6. Basic studies into questions relating to natural recharge, artificial recharge and the salvage of water discharged from ground water reservoirs through natural processes.

7. The development of more effective instrumentation both for exploration and evaluation of ground water reservoirs and for data gathering in the management of such reservoirs.

8. Basic studies into the question of modification as this subject bears upon the larger question of water resources.

9. Basic research into legal and legislative requirements to provide the most efficient and economical utilization of ground water reservoirs.

These are but a few of the research projects that this nation desperately needs in order to provide the individual citizen, municipality, industry, the states and the nation as a whole with the tools for maximum utilization of a vital basic resource.

Area Driller Elected President of Assn.

J. D. KIRKLAND

J. D. Kirkland, Hereford, who has been in the water well drilling business for over twenty years, has been elected President of the National Water Well Drillers Association. The election took place at the recent National Well Exposition in Columbus, Ohio.

Kirkland was born in Gatesville, Texas. He and his family moved to Sudan in 1921, where he was educated in the public schools.

The president was in the automobile business in Sudan from 1934 to 1944.

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 Board of Water Well Drillers. He has served as secretary and president of the Lone Star Water Well Drillers and Contractors Association.

Kirkland makes his home in Hereford, Texas.

Water Is Your Future . . . Conserve It!

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

Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

A Note on Returns to Water Southern High Plains

By HERBERT W. GRUBB

What crops should I irrigate? How much water or how many irrigations should I plan to apply during the season? These are questions which confront High Plains irrigation farmers each year. Such questions cannot be answered once and for all, however, because agricultural prices received and paid by farmers are changing and production techniques are continually being improved.

A recent cost-returns study shows that in the Hardlands Soils, cotton returns the highest net revenue per acre inch of water applied at each level of irrigation considered. In the mixed soils, however, grain sorghum yielded the highest net returns to water at low levels of irrigation but at higher levels of water application on the mixed soils, cotton returns the higher net revenue per acre inch of water (see table).

Returns to water used in the production of wheat for grain are generally lower than returns to water used in cotton or grain sorghum production. Since wheat is a winter crop and does not compete with cotton and grain sorghum for water pumping time, farmers can irrigate wheat during a particular year without reducing irrigated acreage of other crops. Since there is a positive net return to water used in wheat production and since wheat irrigation does not compete with other crops for pumping time, it appears that wheat should be an irrigated crop in the High Plains. However including wheat as an irrigated crop may not result in an optimum long range allocation of the farm water supply.

Since High Plains irrigation water is an exhaustible resource, present irrigation of wheat reduces the irrigated acreage of more profitable crops later. Even though irrigated wheat yields a net return to water, the use of water for irrigating wheat could result in lower long range net returns to water than if wheat irrigation were foregone and the exhaustible irrigation water resource saved for later use on cotton or grain sorghum. For example, in the Hardlands, preplant plus three post-plant irrigations of wheat result in an estimated return of $1.44 per acre inch of water pumped. The same level of irrigation applied to cotton returns an estimated $5.07 per acre inch of water pumped. An equal amount of water applied to grain sorghum would have returned $2.42 per acre inch. The difference between returns to wheat and returns to grain sorghum or returns to cotton is a measure of the future income which could have been realized if present wheat irrigation had been foregone. Future income, when viewed in the present, however, is worth less than present income since future income is discounted by risk and interest rate factors.

Net returns per unit of water, the discount rate and the total quantity of water available are major factors which must be taken into account when making decisions pertaining to crops to irrigate and number of irrigations per season.

TABLE 1: ESTIMATED RETURNS TO WATER; SOUTHERN HIGH PLAINS, 1965 (a)

	Hardland Soils			Mixed Soils		
Irrigation (b)	Cotton	Grain Sorghum	Wheat	Cotton	Grain Sorghum	Wheat
	(Dollars per Acre Inch)			(Dollars per Acre Inch)		
Preplant only	6.28	0.79	0.00	0.00	0.25	0.10
Preplant + 1 Postplant	7.16	1.14	1.21	0.21	0.66	0.75
Preplant + 2 Postplant	6.37	2.66	1.37	2.67	1.20	0.94
Preplant + 3 Postplant	5.07	2.42	1.44	2.93	1.39	1.05

(a) Returns have been adjusted for the dryland component of irrigation income. Dryland net income estimates for the hardland were: cotton $17.00, grain sorghum $6.00 and wheat $18.00 per acre. In the mixed soils dryland net income estimates were: cotton, $18.00, grain sorghum, $10.00 and wheat, $16.00 per acre.

(b) Preplant irrigation requires pumping approximately 6.25 acre inches of water to apply 5 acre inches to the root zone.

Postplant irrigation requires pumping approximately 5.00 acre inches of water to apply 4 acre inches to the root zone.

(c) Does not include returns to wheat grazing.

INJUNCTION GRANTED TO DISTRICT

The District Court in Floyd County recently granted the High Plains Underground Water Conservation District an injunction against a Floyd County farmer for wasting water.

The injunction will remain in effect for an indefinite time.

This is the first time the District has ever had to go so far as to obtain an injunction against a landowner for allowing water to escape from his land.

The Board of Directors of the District hopes that farmers will become more aware of the critical water situation, and no more injunctions will have to be put into effect.

PLEASE CLOSE THOSE ABANDONED WELLS

SUB-IRRIGATION SYSTEMS

A declining water table on the High Plains has motivated researchers and farmers to explore every method to "stretch" and conserve all available underground water.

In the not too distant future, sub-irrigation may be the answer in many areas.

Research being conducted at the South Plains Research and Extension Center reveals that a great amount of water can be conserved by this system by eliminating evaporation and run-off losses. Other apparent advantages to a sub-irrigation system show great prospects to the farmers.

Sub-irrigation systems may be completely automated to eliminate all hand labor and provide exact control of application rates of water. Even without automation, the only labor required is the turning on of a valve when changing from one irrigation set to another.

By using a system of this type the top soil can remain dry, some cultivation is eliminated, fewer weed seeds are germinated, there is less soil compaction, and the soil temperature is increased which aids the growth of crops being produced.

Perhaps the most outstanding feature of a sub-irrigation system is the ability to be operated on a continuous basis, making it possible to utilize small capacity wells. As many readers know, small capacity wells are becoming more and more prevalent on the High Plains of Texas.

By continuous operation, a system that had a ten gallon per minute well could apply six inches of moisture to the root-zone within a six month period on thirty acres.

During the past year, several small systems have been installed on farms on the High Plains. Results of these installations have been encouraging.

One-half inch diameter polyethylene plastic pipe was used for lateral lines, with a uniformly designed orifice spaced on forty inch centers. The pipe is plowed in with a commercial type chisel, modified so the pipe can be fed behind the plow, and pulled behind a standard four row tractor.

Dale Crary, who farms about twenty miles northeast of Post, Texas, in a weak water area, installed a sub-irrigation system on ten acres. Crary purchased the necessary materials and performed the installation himself.

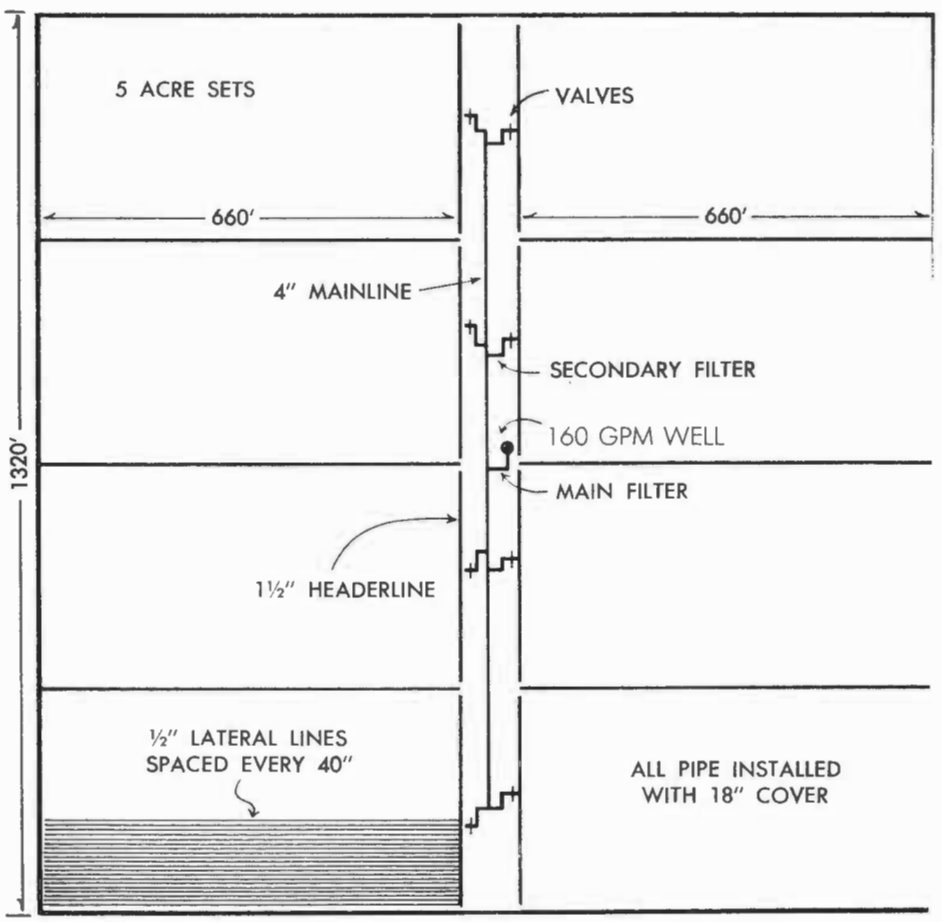
The pipe was plowed in to a depth of sixteen inches and was placed on eighty inch centers rather than the standard forty inch centers. By planting his rows of cotton at equal distances from the pipe, good results were obtained.

Crary reported that the cost of the installation was approximately $200.00 per acre or $2,000.00 for the ten acres.

With ten gallons of water per minute flowing from his wells, Crary was able to apply enough moisture during the growing season to produce over ten bales of cotton on the ten acre plot.

Irrigators who are contemplating the installation of a sub-irrigation system should provide an adequate filter system, as it is imperative that the water must be kept clean. Care should also be taken while the system is being installed to prevent any dirt or foreign material from getting in the pipe.

As long range as sub-irrigation systems might be to many, to a few it is a reality. Future research should prove it has a place in many plains farming operations.



A system designed to apply over three inches of irrigation water on forty acres, in sixteen days, with a 160 gpm well.

Water Resources Institute Annual Conference

Theme: Challenges of the Present

November 21-22, 1966

MEMORIAL STUDENT CENTER
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS

Sunday, November 20, 1966

7:30-9:00 p.m. Evening Registration—Serpentine Lounge

Monday, November 21, 1966

8:00-9:00 a.m. Registration—Serpentine Lounge

9:00 a.m. Morning Session—Ballroom
Presiding—Judge J. E. Sturrock, General Manager Texas Water Conservation Association. Austin

Invocation—Rev. William Oxley, Rector
St. Thomas Episcopal Church
College Station

"Welcome"—Earl Rudder, President
Texas A&M University

DEVELOPING THE TOTAL RESOURCE

9:20-9:50 a.m. Problems in Achieving Optimum Development—Institutional Considerations

Dr. Wilbur R. Maki, Professor
Department of Economics
Iowa State University
Ames, Iowa

9:50-10:20 a.m. Weather Modification
Dr. Horace Byers, Dean
College of Geosciences
Texas A&M University

10:20-10:40 a.m. Recess (Coffee available)

10:40-11:10 a.m. Evaporation Control Research

Dr. John Bartholic, Assistant Professor
Agronomy Department
South Dakota State University
Brookings, South Dakota

11:10-1140 a.m. Complete Reuse of Water
Mr. Frank M. Middleton, Chief

Advanced Waste Treatment Group and Acting Director of Research

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

11:40 a.m. Adjournment for Luncheon

12:10-1:45 p.m. Luncheon—Assembly Room
Presiding—Dr. Ernest T. Smerdon, Director
Water Resources Institute

Invocation—Rev. Richard Thomas
First Presbyterian Church, Bryan

Squeezing More Out Of The Water
Dr. Charles Renn, Professor
Department of Sanitary Engineering and Water Resources
The John Hopkins University
Baltimore, Maryland

2:00 p.m. Afternoon Session—Ballroom
Presiding—Mr. John W. Simmons, Executive Vice President and General Manager

Sabine River Authority and President, Texas Water Conservation Association
Orange

2:10-2:40 p.m. The Texas Water Plan—Progress to Date
Mr. Joe G. Moore, Jr., Executive Director
Texas Water Development Board
Austin

Estuarine Problems

2:40-3:10 p.m. Effect of Water Development on Estuarine Problems
Dr. Daniel L. Leedy, Water Research Scientist

Office of Water Resources Research
Department of the Interior
Washington, D. C.

3:10-3:30 p.m. Recess (Coffee available)

3:30-4:00 p.m. A Plan For The Management Of Galveston Bay
Dr. Dan Wells, Director
Water Resources Center
Texas Technological College, Lubbock

4:00-4:30 p.m. Legal Problems in Water Management
Dr. Corwin Johnson, Professor
School of Law
The University of Texas, Austin

4:30 p.m. Adjournment

6:00-7:00 p.m. Dutch Treat Social Hour—Ramada Inn

Tuesday, November 22, 1966

9:00 a.m. Morning Session—Ballroom
Presiding—Mr. Robert Singleton, Executive Director
Parks and Wildlife Department, Austin

Recreational Impact

9:10-9:40 a.m. Water Based Recreation Research
Mr. Ivan Schmedemann, Assistant Professor Department of Agricultural Economics and Sociology
Texas A&M University

9:40-10:10 a.m. Managing Large Reservoirs for Fish
Mr. Robert M. Jenkins, Director
National Reservoir Research Program
U. S. Fish and Wildlife Service
Fayetteville, Arkansas

10:10-10:30 a.m. Recess (Coffee available)

10:30-11:00 a.m. Potentials and Problems in Estuarine Areas
Mr. Robert M. Ingle, Director of Research Division of Salt Water Fisheries Florida Board of Conservation Tallahassee, Florida

11:00-11:30 a.m. Recreation Potential In Texas
Dr. Leslie Reid, Head
Department of Recreation and Parks
Texas A&M University

11:30-11:40 a.m. Closing Remarks
Dr. Ernest T. Smerdon
Director and Conference Chairman

Annexation Hearings Held in Crosby and Hale Counties

Two annexation hearings were held in October by the Board of Directors of the High Plains Underground Water Conservation District. These hearings were held in Crosby and Hale Counties.

Annexation hearings were held, following the presentation of petitions, asking that Crosby and Hale Counties be made a part of the High Plains Underground Water Conservation District No. 1.

Interested parties were heard by the board for and against the counties being made a part of the District.

The board has taken under advisement the testimony received and will make a decision concerning these counties in the near future.

If the board annexes the counties, it must be ratified by a vote of the people in the counties, as well as by the present members of the water district.

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."

INCLUDE YOUR ZIP CODE NUMBER

THE EFFECT OF PROPOSED CONSTITUTIONAL AMENDMENT No. 11 ON THE TEXAS WATER DEVELOPMENT FUND

For the third time in less than a decade, Texas voters are being given an opportunity to take another step forward in solving the State's water problems. They will decide on November 8, 1966 whether to increase the Texas Water Development Fund from its present $200 million to $400 million, to continue present programs of financial assistance and in addition to authorize its use, where necessary, for the construction by the Texas Water Development Board of water treatment and transportation facilities, and to provide a constitutional safeguard for the water requirements of each river basin of origin. The proposed amendment, No. 11, has the strong support of Governor John Connally and received the backing of the State Democratic Convention, which urged its adoption by Texas voters.

The amendment originated in a recommendation of the Texas Research League in its second report concerning Texas water administrative agencies and procedures. The amendment was originally intended only to expand the purposes for which the Texas Water Development Fund could be used by the Texas Water Development Board. Whereas the Board can make loans for water development and the necessary water treatment and transportation facilities, it cannot presently use bond proceeds from the Fund to itself construct filtration and transmission facilities. Just as the Fund's uses were expanded in 1961 to include the purchase of conservation storage in reservoirs to assure optimum development of these sites, this Amendment authorizes the Board to use the Fund to construct the same facilities for which it now can make loans. The Amendment was included in Governor Connally's recommendations to the Fifty-Ninth Legislature.

In addition, during the course of Legislative consideration, the total amount of the Fund was increased from $200 to $400 million. The requirement that the issuance of each $100 million in bonds must be authorized by two-thirds vote of the membership of each House of the Legislature before their sale by the Board was retained. Thus, the proposed additional $200 mililon in bonds cannot be sold without prior approval of the Legislature. The concept of the Fund as a revolving fund with repaying of loans to be made by the borrower and the States investment in conservation storage, water treatment, and transportation facilities to be recovered by the sale of water or storage space was also retained.

During Senate consideration of the proposed amendment, concern was expressed on behalf of those citizens living in river basins where excess water resources are presently undeveloped that the Fund might be used to transport water out of these basins to the detriment of their future requirements. Thus there was added the "basins of origin" protection prohibiting the use of the Texas Water Development Fund" or any other State fund provided for water development" to finance any project which would result in the "removal from the basin of origin of any surface water necessary to supply the reasonably foreseeable future water requirements for the next ensuing 50-year period within the river basin of origin except on a temporary, interim basis."

In a statement presented at Lubbock on September 9, 1966, the Texas Water Development Board commented in part as follows:

"The people of Texas should be aware that the proposed amendment gives the first constitutional recognition to protecting water users in every river basin from planned diversion of water which could be required (in the basin of origin) . . ." This protection is most important, of course, to water surplus basins.

"For water short areas of the State, the Texas Water Development Fund can be the banking facility to participate in the financing of, and the proposed amendment for the first time authorizes use of the fund for, construction of water treatment and transportation facilities. Without this authorization, local communities and regions of the State must depend upon their own resources to finance and construct the reservoirs and transportation facilities to move water from one area of the State to another. It may be that local and regional resources are sufficient to construct facilities to move *municipal and industrial water* . . .

"Construction of the massive facilities that will be required for transportation of large volumes of water many miles to meet multiple uses—including irrigation—over long term periods probably is beyond the financial capabilities of individual cities, water districts and regions.

"The Board's role in utilizing the Texas Water Development Fund is merely that of steward for the people of Texas. The fund is available for the use of communities or areas of the State that are unable to develop their water resources within their own financial capabilities.

"Benefits flowing from adoption of the amendment will accrue to the water users of the State, wherever located. Defeat of the amendment will be a loss to both the water-rich and to the water-poor areas of Texas. The consequences good or bad will . . . (affect) the people of this State and generations of Texans, yet unborn."

Preparation and release of, and hearings concerning, the preliminary Texas Water Plan have coincided with public attention to the proposed conconstitutional amendment. The Texas Water Development Board is presently giving attention to various alternatives presented in the preliminary Plan. Even when finally adopted, after notification by the Texas Water Rights Commission that it gives "adequate consideration to the protection of existing water rights and does take into account the equitable adjustment of water rights affected", the Plan "shall be a flexible guide to State policy for the development of water resources" and the Commission "shall take the Texas Water Plan into consideration . . . but need not be bound thereby." Thus, implementation of any comprehensive Statewide water plan will be achieved through the granting of individual water permits by the Commission. For any development proposed by the Board, it, too, must secure a permit from the Commission.

Increase in the authorized amount of the Texas Water Development Fund will be required whether or not there is a viable Texas Water Plan. Political subdivisions unable to finance water projects through other sources can still borrow from the Fund. Expansion of the purposes for which the Fund may be used can reduce the cost of water supply to water users throughout the State where large-scale water treatment and transmission facilities can achieve economcis not possible with piecemeal single purpose projects.. Certainly, assurance of adequate supplies for future water requirements of each river basin is a laudable objective.

Thus, although the preliminary Texas Water Plan and Constitutional Amendment No. 11 are coincidental in time, each can be evaluated on its own. Objection to the Plan is not sufficient justification for rejection of the Amendment. All Texans can surely agree that what we need is more, not less, development of our water resources. The economic future of this State, dependent upon water, is too great a sacrifice simply to register an objection.

What Is A Farmer

A farmer is a paradox—he is an overall executive with his home his office; a scientist using fertilizer attachments; a purchasing agent in an old straw hat; a personnel director with grease under his fingernails; a dietitian with a passion for alfalfa, amino, and antibiotics; a production expert with a surplus, and a manager battling a price-cost squeeze.

He manages more capital than most of the businessmen in town. He likes sunshine, good food, State Fairs, dinner at noon, auctions, his neighbors, his shirt collar unbuttoned and above all, a good soaking rain in August.

He is not much for douths, ditches, throughways, experts, weeds, the eight-hour day, grasshoppers or helping with housework.

Farmers are found in fields—plowing up, seeding down, rotating from planting to, fertilizing with, spraying for and harvesting. Wives help them, little boys follow them, the Agriculture Department confuses them, city relatives visit them, salesmen detain them and wait for them, weather can delay them, but only Heaven can stop them.

A farmer is both Faith and Fatalist—he must have faith to continually meet the challenges of his capacities amid an ever-present possibility that an Act of God (a late spring, an early frost, tornado, flood, drouth) can bring his business to a standstill. You can reduce his acreage but can't restrain his ambition.

Might as well put up with him—he is your friend, your competitor, your customer, your source of food, fiber and self-reliant young citizens to help replenish your cities. He is your countryman—a denim-dressed, business-wise, fast growing statesman in stature. And when he comes in at noon, having spent the energy of his hopes and dreams, he can be recharged anew with t he magic words: "The market's up!"—Source unknown.

THE CROSS SECTION
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THE Cross SECTION

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

Volume 13—No. 6 **"THERE IS NO SUBSTITUTE FOR WATER"** *November 1966*

LAKE MEREDITH DEDICATED

Sanford Dam and Lake Meredith were officially dedicated November 1, 1966.

The dedicatory address was given by the Honorable Stewart L. Udall, Secretary, U. S. Department of the Interior. Other dignitaries who made speeches were Governor Connally, Representative George Mahon and Walter Rogers.

Sanford Dam and Lake Meredith are located about forty miles Northeast of Amarillo and about twelve miles West of Borger on the Canadian River.

The multipurpose Canadian River Project was planned, designed, and constructed by the Bureau of Reclamation for the Canadian River Municipal Water Authority. The principal purpose of the Project is to furnish a supplemental supply of municipal and industrial water to the cities of Amarillo, Borger, Brownfield, Lamesa, Levelland, Lubbock, O'Donnell, Pampa, Plainview, Slaton, and Tahoka.

Sanford Dam is the principal structure of the Project. In addition to furnishing a source of water to the Project cities, the reservoir formed by the dam will control floods and sediment, and provide recreational and fish and wildlife benefits to the area. The Project acquired approximately 46,000 acres to be set aside for the construction of Sanford Dam and Reservoir, and the Public Use Areas, which extend into portions of three counties. From the reservoir, Water will be conveyed through an aqueduct system to the cities.

Sanford Dam was constructed in the heart of one of the world's largest natural gas fields. To protect the petroleum facilities in the reservoir area, contracts were executed with 11 oil and gas companies, involving 44 producing gas wells and several transmission pipelines.

Photo Courtesy Bureau of Reclamation

Some statistics concerning the dam, reservoir, and aqueduct are given below:

SANFORD DAM

Type—zoned earth fill	
Volume of earth	15,308,000 cubic yards
Height above streambed	198 feet
Elevation above mean sea level (top of dam)	3,011 feet
Length of dam at crest	6,380 feet

RESERVOIR (LAKE MEREDITH)

	Elevation above Sea Level (Feet)	Depth of Water at Dam (Feet)	Reservoir Capacity (Ac.-Ft.)	Surface Area of Reservoir (Ac.)
Streambed at dam axis	2813			
Top of maximum conservation pool	2936.5	123.5	864,400	16,505
Top of controlled storage	2965.0	152.0	1,408,000	21,640
Maximum water surface	3004.9	191.9	2,434,215	30,465

	Length of Reservoir (Miles)	Length of Shoreline (Miles)
Streambed at dam axis		
Top of maximum conservation pool	20	100
Top of controlled storage	24	135
Maximum water surface	30	200

AQUEDUCT

Pipeline—concrete pressure pipe	
Length	322 miles
Maximum pipe diameter	96 inches
Number of pumping plants	10
Maximum lift from average level Lake Meredith to high level near Amarillo	760 feet
Maximum design capacity	183 cfs, or 118 mgd

ANNEXATION HEARING SET BY BOARD

Petitions have been filed with the Board of Directors of the High Plains Underground Water Conservation District No. 1 asking for an annexation hearing to be held in Swisher County.

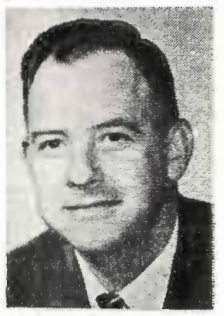
The petitions ask that Swisher County be made a part of the present existing Water District.

The Board has set the hearing for December 16 at 10:00 A.M. in the District Court Room, at the Courthouse in Tulia. All interested individuals are urged to attend and voice their opinions, either for or against Swisher County voting to become a part of the Water District.

Director Of Water Resources Center Named

Dr. Dan M. Wells has joined the Texas Tech faculty as associate professor of civil engineering and director of the water resources center.

A native of Graham, Dr. Wells received his bachelor of science degree in civil engineering from Tech in 1951, his masters from the University of Missouri in 1954 and his PhD from The University of Texas earlier this year.



WELLS

As director of Tech's Water Resources Center, Dr. Wells will coordinate the development of a broad-based interdisciplinary program in water resources education and research.

The Center, formed in 1965, has joined three other state institutions of higher education in a cooperative program of water resources research. Texas A&M, the University of Texas University of Houston and Tech have joined in the effort which is designed to eliminate overlapping research and academic programs.

Dr Wells' wife the former Rena Thomas of Floydada, is a 1951 Tech Home Economics graduate, They have two children, Hal, 13, and Gary, 10.

Annexation Election Called For Hale And Crosby Counties

The Board of Directors of the High Plains underground water Conservation District has called annexation election for Hale & Crosby Counties.

Hale and Crosby counties earlier this year had petitioned the Water District for membership in the present District. Annexation hearings were held in both counties and testimony was received by the Board concerning each county's membership in the District.

The election date has been set for the second Tuesday in January, which is January 10, 1967.

The proposition on the ballot for the two counties will be for or against becoming a part of the District and for or against the five cent property tax for support and maintenance of the District. Counties who are now members of the District will also vote to accept or reject the two counties.

If the counties vote to become a part of the Water District, they will be afforded all benefits now being supplied to members of the District; technical data, research programs and materials needed to claim income tax depletion on water used for irrigation farming. Also they will be pledging their support to the organized efforts of the High Plains District to provide water to West Texas through importation of water from other areas of the State or Nation.

Water Is Your Future, Conserve It!

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

Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

SYMPOSIUM HELD AT TEXAS TECH

Problems facing the dry Southwestern regions of the United States and Mexico were discussed at Texas Technological College October 31, at a symposium that set the stage for the inauguration or Dr. Grover E. Murray as the eighth president of Texas Tech.

Participants for the symposium included John W. Gardner, secretary of Health, Education and Welfare; Stewart L. Udall, secretary of the Interior, Emilio Portes Gil, former president of Mexico; Dr. S. Dillon Ripley, secretary of the Smithsonian Institution; Dr. W. T. Pecora, director of the U. S. Geological Survey, and Dr. Luna B. Leopold, senior hydrologist for the Geological Survey.

Governor John Connally addressed a noon luncheon attended by approximately 3000 persons.

Purpose of the symposium on arid and semi-arid lands was to underscore Tech's new mission—founding of an International Center for Arid and Semi-Arid Land Studies. No such center now exists for the recording, classifying, distributing and studying information on arid or semi-arid lands.

Dr. Murray, Tech's new president, in outlining the concept of the International Center for Arid and Semi-Arid Land Studies said, "It is a logical and natural mission" for Tech. The challenge is inherent in the fact that half of the world's land surface is arid or semi-arid.

The research and study center is a great idea and could probably coincide with a National Ground Water Laboratory. Tech officials and all West Texans will lend as much support as possible to achieve this goal for the establishment of the center.

Participants in the recent symposium held at Texas Tech are L—R W. D. (Dub) Rodgers, Lubbock Mayor, Portes Gil, Executive President of The Mexican Institute of Arid Zones; Stewart Udall Secretary of Interior and Dr. Grover E. Murray, Tech President.

Commission Sets Hearing On Disposal Pits

Salt-water disposal pits have been banned in 41 Texas counties and 226 fields in other counties, and the Railroad Commission Dec. 6 will hold a hearing to consider issuing a statewide order banning the use of surface pits to dispose of brine produced with oil and gas.

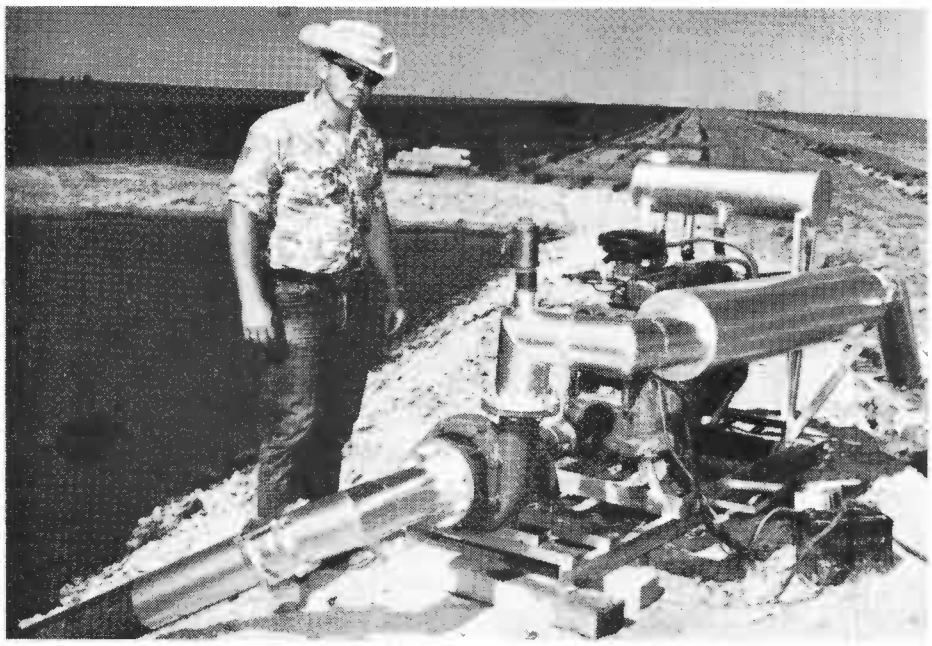
Five of those counties were added only recently, with various delays for compliance: operators in Coleman, Crockett and Nolan counties must dispose of their pits by April 1, 1967, pits in Harris County must be filled by Sept. 1, 1967, and Jackson County deadline is June 1, 1967.

In banning the pits, the Commission has found that their use produced the danger of widespread pollution of fresh-water supplies. If the operators have not complied by the deadline, their pipeline connections will be severed.

Oil and gas operators will have their chance to show cause why a statewide order should not be issued, when the hearing convenes Dec. 6 at 9 a.m. in the Ernest O. Thompson Building in Austin. The Commission was given clear jurisdiction over oilfield brine pollution by the Legislature in 1965.

Those counties, in addition to the five recent additions, where salt-water disposal pits have been banned: Andrews, Armstrong, Bailey, Callahan, Carson, Cochran, Concho, Dawson, Donley, Ector, Gaines, Gray, Hale, Hansford, Hartley, Hemphill, Hockley, Hutchinson, Knox, Lamb, Lipscomb, Lynn, Martin, Moore, Ochiltree, Roberts, Runnels, Sherman, Stephens, Stonewall, Swisher, Terry, Wharton, Wheeler, Yoakum and Young. (Texas Pollution Report, Oct. 5, 1966.)

Water Is Your Future . . . Conserve It!



Dwain Menefee of Route 1, Friona, Texas is one of the outstanding irrigation farmers and conservationists in the High Plains of Texas.

In the early spring of 1963, Mr. Menefee installed his first irrigation tailwater return system on a 320-acre farm he operates 2 1/2 miles South of Friona, in Parmer County, Texas.

The pit for returned tailwater measured 100 feet in length, 30 feet wide and was 10 feet deep, and has a capacity of about 1-acre foot of water (about 325,000 gallons). The pit cost Mr. Menefee $250.00.

At the return pit he installed a 4-inch centrifugal pump powered by a 6 cylinder Chevrolet motor and used butane as fuel. The pump, motor, fuel tank, and stand cost Mr. Menefee about $675.00.

For Mr. Menefee to receive the greatest benefits from this irrigation tailwater installation he felt that it was necessary to tie the pit pump into his existing irrigation pipeline system. To do so, he installed 2400 feet of 10-inch lock-seal underground pipe at a cost of $3,240.00.

The entire outlay for the return system was about $4,165.00.

With Mr. Menefee's cooperation, the High Plains Underground Water Conservation District No. 1 installed flow meters on the tailwater return system. Meters were also installed on the irrigation wells contributing irrigation tailwater to this system.

The advantages of a tailwater return system are many according to Mr. Menefee. Many advantages are very obvious, others are apparent but hard to attach a direct value to.

"The conservation of water is especially easy to observe," Menefee states, "since meters have been installed to record the amount of water pumped from the wells and recovered through the return system."

"The re-circulation of the top soil and fertilizers that would have otherwise escaped with the tailwater is not quite as apparent except when you are changing sets, and begin noticing the silt build-up in the rows and watch the muddy water flow from the pipes," Menefee added.

Mr. Menefee states that he is not real sure of the reason, whether it is the fertilizers that are re-circulated, the soil temperature difference caused by using the warmer tailwater or recirculating the water a little longer, but his yields have been better on the acreage he has used tailwater primarily for irrigation.

Timing of applications of water to a crop is recognized as extremely important to all irrigation farmers. Many times, just a few days will make great differences in the yields harvested. Mr. Menefee states that his tailwater return system helps him irrigate his field faster and more efficient. He points with pride to the cut back in the number of days required to irrigate his farm now as to what it used to be before he installed the return system. Mr. Menefee explains how he has changed his watering pattern to get a more uniform penetration from one end of the field to the other. "It is many times more efficient now than it was when I had water pouring out the ends of the rows" he said ,and as an after thought he added "it doesn't hurt my conscience as much or the old pocket book either."

The savings in pumping cost of the return system compared to the cost for pumping water from underground through his irrigation wells is a definite advantage in favor of installing a return system. In fact, it cost Mr. Menefee about $3.40 per acre foot to pump water from the wells (fuel only) and about $1.80 per acre foot for the return system.

The value of the water Mr. Menefee is leaving in storage to be pumped years from now as a result of his using the tailwater return system is only one of those advantages to which it is hard to attach a direct value. No one could probably answer this question accurately, but assuming present day values of increased yields as a result of supplementary irrigation; a value of $40 per acre foot could very easily be applied to the 354 acre feet of water recovered through the return system since it was installed for a total value of $14,160.00.

Parallel to the value of water could be a value on top soil conserved as a result of recirculating the silt with the irrigation tailwater.

How much increased yields could be asserted to the fertilizer that is being recirculated or by changing the watering pattern to get a more uniform distribution of his irrigation water.

Many of Mr. Menefee's neighbors have joined him in installing tailwater return systems or other land and water management practices to prolong their underground water supply.

Here are the figures obtained from the meter readings proclaiming the results of the effectiveness of the return system.

(See Table at Right Hand Top of Page)

Year	Total Acre Feet of Water Recovered Through Return System	Total Water Pumped From Irrigation Wells	Percentage Recovered by the Return System of the Water Pumped from the Irrigation Wells
1963	57.00	No Record	No Record
1964	91.58	428.40	21.38 %
1965	81.05	240.06	33.34 %
1966	53.66	260.78	20.57 %
	70.82	309.78	25.09 % Averag

This tailwater system is located on the J. B. Taylor farm approximately 1-1/2 miles south of Friona in Parmer County, Texas. The pit measures 300 feet by 20 feet by 12 feet and has a capacity of 2.5 acre feet of water or 815,000 gallons. This tailwater return system was installed in 1963. Records kept on this installation reveal that Mr. Taylor recovered 132 acre feet of water in 1963 and 108 acre feet in 1964, 115 acre feet in 1965, 203 acre feet in 1966. There are 2—8" irrigation wells contributing tailwater to this installation. Mr. Taylor's farm consists of 345 acres. His primary crops are grain sorghum, soybeans, sugar beets, wheat and cotton.

This tailwater system located on the James Mabry farm 1 mile south of Hub in Parmer County, Texas was installed in 1963. Approximately 200 acres of this 320 acre tract of land contributes tailwater to this installation. There are 2—8" irrigation wells on this farm contributing tailwater to this pit. The system includes a pit with dimensions of 130 feet in length, 10 feet deep, and 20 feet wide which has a capacity of roughly 225,000 gallons of water, and a 5" Lane-Bowler pump with a 7-1/2 hp electric motor. Mr. Mabry installed approximately 2600 feet of 6" plastic line to tie the system into his existing irrigation pipe lines on his farm. Ths entire system, including the pipe, cost Mr. Mabry almost $2500. Records collected by the High Plains Underground Water Conservation District reveal that Mr. Mabry recovered 57 acre feet of water in 1963, 65 acre feet in 1964, 11 acre feet in 1965 and 26 acre feet of water in 1966. A four year average of 40 acre feet of water! Mr. Mabry has adopted other water and land management practices such as contouring (grading) his rows, to slow down the water, therefore receiving a more uniform penetration rate and allowing more silt to settle from the water before it reaches the pit.

Planning A Tailwater Return System

BY A. WAYNE WYATT

In planning a tailwater return system, estimating the amount of recoverable irrigation tailwater is of prime importance. The High Plains Underground Water Conservation District has measured losses of irrigation tailwater from hundreds of farms in Bailey, Lamb, Castro, Parmer, Deaf Smith, and Floyd counties during 1963, 1964, 1965 and 1966. Also, recording meters were installed on many tailwater return systems to record the amount of tailwater actually recovered. Based on records obtained from these studies, the average recovery is 125 gallons per minute per contributing irrigation well.

(The area covered by these records has a low-soil intake rate and irrigation wells with production capacities ranging from 600 to 900 gallons per minute.)

The storage capacity of the tailwater pit is important in an efficient irrigation system. The volume of irrigation tailwater will vary throughout the day, ranging from none to sometimes near total capacity of the contributing wells. Usually it is impractical to install a pump that will handle the maximum flow of tailwater, also it is undesirable to have frequent starts and stops of the pump. The most practical and successful tailwater return systems appeared to be those with pits with a designed capacity to match the total expected flow of tailwater for any 24 hour period. If the farm has two 8" irrigation wells contributing irrigation tailwater to the tailwater system and the average loss is 125 gallons per minute per contributing well, the capacity of the pit can be calculated as follows:

125 gallons per minute X 2 wells= 250 gallons per minute

250 gallons per minute X 60 minutes = 15,000 gallons per hour

15,000 gallons per hour X 24 hour day = 360,000 gallons

360,000 divided by 325,851 gallons (1acre foot) = 1.1 acre feet recommended size of pit.

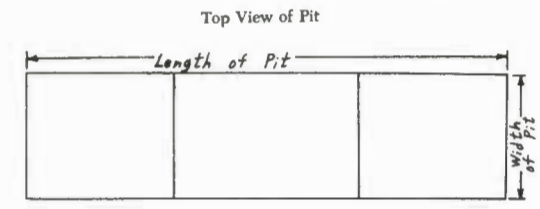
A dike or border should be built around the tailwater return pit to keep as little rainfall runoff water from running through the pit as possible. Rainfall runoff normally carries several tons of silt per acre foot of water. If the rainfall runoff water is allowed to run thorugh the pit it will slow in velocity and the heavier soil particles will settle to the bottom, consequently filling up the pit.

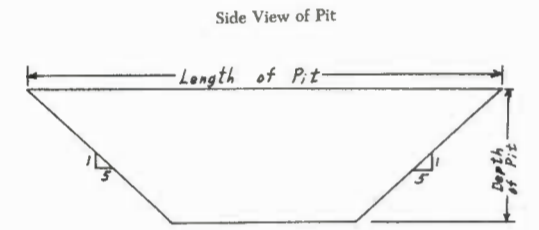
It is also recommended that only one inlet pipe be installed in the pit, with no outlet or overflow pipe. Naturally, when it rains the rain water will fill the pit, but once it is full and with the dike around the pit, the rest of the water will be diverted around the pit.

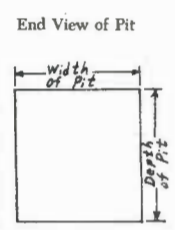
In selecting the pump to be used in the return system, it is recommended that the pump should have a capacity which equals the expected average flow of irrigation tailwater. Example: should you have 2 irrigation wells contributing tailwater, then a pump with a capacity of 250 gallons per minute should be installed. (125 gallons per minute X two wells = 250 gallons per minute.)

Flow line from the pit can be connected to the existing irrigation distribution system by surface or underground pipe. Underground pipe is used in most cases.

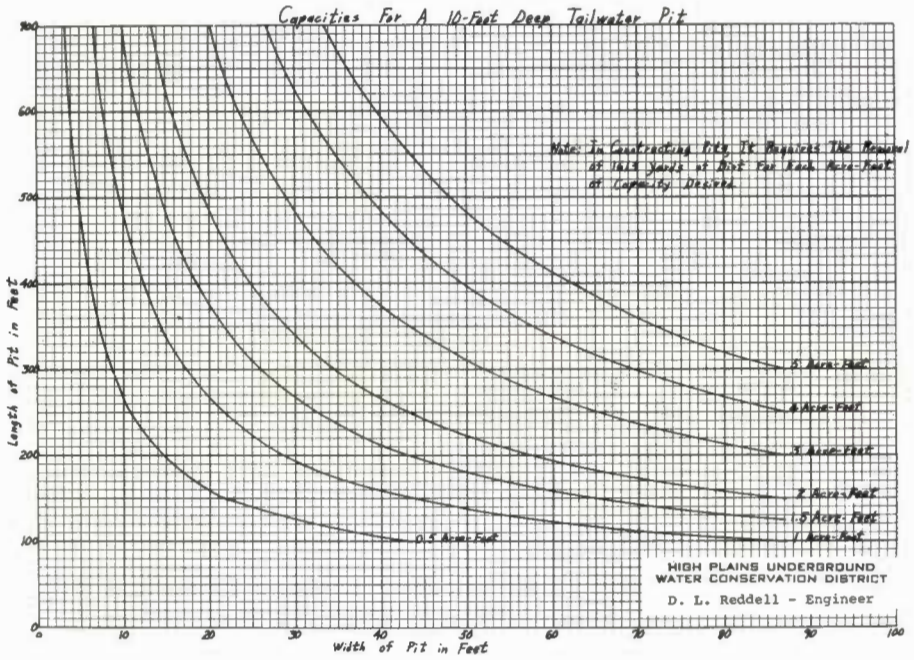
Careful consideration should be given in selection of a flow line. It should be large enough to allow the desired capacity of water to move through it with minimum friction and pressure losses.







The volumes computed in the curves are for a pit with two vertical sides and the two ends sloping with a 5:1 side slope. The depth of the pit is taken from the top to the lowest point in the pit. The length of the pit is the top length.



There are several types of switches available which will automatically start and stop electrical powered systems. These switches work with electrodes and/or floats which are placed in the tail water pit at different levels, usually one just above intake of the pump and one about the point in the pit which is considered enough build-up of tail water to insure continuous pumping from the supply of water running into the pit.

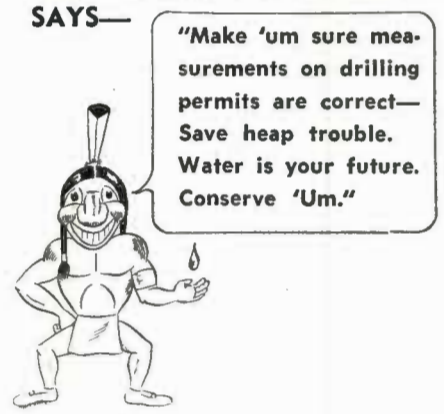
When the water in the pit reaches the top electrode or float it automatically starts the system and when the water lowers to the bottom electrode or float it automatically cuts off the system.

These automatic systems make it possible to have a more flexible system. The electrodes or floats can be adjusted to allow a larger build-up or storage of water in the pit to allow a longer pumping cycle for large capacity pumps or they can be set to start the pump when there is only a small amount of water in the pit for use of a smaller capacity pump on an almost continuous pumping cycle.

These automatic systems are available through most electrical contractors, pump dealers and service companies.

The greatest benefits of installing a return system will be to the landowner from this salvaged water, for the life of his investment will be extended. The tenant will be the next greatest recipient of benefits. He can be more assured of a return on his investment when farming under irrigation than by dryland farming. The community and area will also be helped by these individuals' foresight. It has been estimated by economists that each dollar's worth of farm product adds seven dollars to the economy of the area before the product is consumed.

"CHIEF RUNNING WATER," SAYS—



High Plains Underground Water Conservation District No. 1
1628 Fifteenth Street
Lubbock, Texas 79401

Second Class Permit

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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

Second-class Postage Paid at Lubbock, Texas.

BILL J WADDLE
Editor

Volume 13—No. 7

Economic Efficiency On The High Plains

BY JOHN SEIBERT

High Plains producers are constantly engaged in a cost-price squeeze which seems ever present in agricultural production.


JOHN SEIBERT

Increased production efficiencies is mandatory just for a producer to maintain a given profit margin. Prices received indexes on irrigated cotton farms on the High Plains have dropped from 105 to 94 from 1963 to 1965, while prices paid indexes have risen from 107 to 109 during the same period (using 1957-1959 average as 100 index).

In addition to changes in prices paid and prices received, the average value of land and buildings per farm and per acre are constantly rising. In each major cotton producing county on the High Plains, census data shows an increase of $25 to over $100 per acre from 1959 to 1964. Increases in farm values reflect changes to larger units, which is an attempt by producers to enlarge their operations and reduce their per unit costs of production.

Efficiency A Must

The ability of the manager to organize and employ his production resources for minimum costs consistent with economical yields is a major factor contributing to efficiency. Practically all South Plains Producers are faced with some limiting resource—whether it be water, labor, land or capital, Allocating these resources to produce maximum net returns requires the use of accurate and complete farm records, and an estimate of prices to be received for commodities marketed.

The capital structure of cash crop producer effects the flexibility of his operation. A certain degree of flexibility is necessary to adapt to changes in legislative program regulations. Changes in climatic conditions also exert influence on the degree of flexibility a South Plains producer maintains. A high ratio of fixed investments to annual operating capital could limit the maneuverability of a grower within any one year. The reverse condition could also limit a producer when fixed capital investments may enable more timely farm operations.

The physical layout of the farming operation also affects efficiency. Length irrigation runs, land leveling, field design and location of crops acreages are examples of items which affect efficiency of machinery use, labor and capital employment.

Changes In Capital Costs

Adjustment in interest rates changes costs of production to the High Plains producer. As shown in Table 1, a change in interest rates can increase or decrease capital costs, depending on the amount and length of time of capital borrowed.

For example: A producer borrowing $40,000 for a year's operation at a cost of 7 percent would pay $2800 interest. With an increase of 1 percent interest cost, he would pay $3200, an additional $400. The resulting change in capital costs increase the costs of production by 14 percent.

This example exemplifies the need for increasing production efficiency. Cost control could very easily be the key to profitable production. No longer can the High Plains grower produce at maximum production levels, but at levels which give the greatest net return. Individual farm records can serve as a basis for determining the most profitable level of production.

The farm manager who combines his resources to produce at minimum cost consistent with economical yields is the one who will continue to reap profits.

Table 1. Change in Interest Costs Associated with Varying Levels of Borrowed Capital

Amount of Capital Borrowed	1 Percent		2 Percent		3 Percent	
	6 months	1 year	6 months	1 year	6 months	1 year
$10,000	$ 50	$100	$100	$ 200	$ 150	$ 300
20,000	100	200	200	400	300	600
40,000	200	400	400	800	600	1,200
80,000	400	800	800	1,600	1,200	2,400

CROSBY, HALE AND SWISHER COUNTIES

Interested land owners in Crosby, Hale and Swisher Counties will be voting on January 10 to decide if they want to become a part of the High Plains Underground Water Conservation District No. 1.

Several years ago, the Texas Water Commission, now the Texas Water Development Board, delineated the Ogallala Reservoir, south of the Canadian River. These three counties were included in the delineation.

When the original election for the formation of the district was held these three counties chose not to become members of the Water District.

During the past year, these three counties petitioned the Water District for a hearing to allow the residents of the counties to express their opinions on becoming a part of the Water District.

The hearings were held and the Directors of the District, taking consideration of the testimony received at these hearings, decided enough interest was demonstrated to call an election in the three counties.

The propositions that the residents of these three counties will have will be to join the Water District and to accept their proportionate share of taxes.

Polling places for Hale County will be as follows: Court House, Plainview; Community Center in Petersburg; Community Center in Halfway; City Hall in Hale Center; School in Cotton Center and the City Hall in Abernathy.

Crosby County polling places will be; The Pioneer Memorial Building in Crosbyton; V. F. W. Hall in Ralls, and the Community Center in Lorenzo.

Swisher County polling places will be the County Court House in Tulia; City Hall in Happy, Kress Lions Club Building in Kress, and the Claytonville Gin in Claytonville.

Water District Election Time

The annual election for the High Plains Underground Water Conservation District will be held January 10, 1967. Voters will have several issues on which to make decisions.

At the end of this year two of the five men who serve as members of the Board of Directors will conclude their present terms of office. These two are Ross Goodwin of Muleshoe who represents Bailey, Castro and Parmer Counties; and Andrew Kershen of Hereford who represents Armstrong, Deaf Smith, Potter and Randall Counties.

The ballot will also include the nominees to fill places for each five man County Committee in the District. Each county in the District has a "County Committee", that approves well drilling permits and makes recommendations on various matters to the District Board.

The other issues on the ballot will be the annexation of Crosby, Hale and Swisher counties into the High Plains Underground Water Conservation District No. 1.

Residents of these three counties are applying for membership and the residents of the District will vote to accept or reject these three counties.

Residents living within the counties of Crosby, Hale and Swisher will vote to either join the District or remain separated from it. To vote on this proposal one must be a qualified voter and must live in the area effected. A person who owns property in the areas under consideration, but does not reside in the area is not eligible to vote on this proposal.

All qualified voters living within the District are eligible to vote for the District Directors, County Committeemen and to accept or reject the three counties who desire to become a part of the District.

A qualified voter is one who has a valid poll tax and owns property within the District. This property can be a house and lot, farm, business property or land of any type. You do not have to be a farmer or own an irrigation well. School teachers, bankers, mechanics, grocers, or anyone who owns property that is taxed by the Water District is eligible to vote.

Nominations of qualified persons for District Directors and County Committeemen are made by the respective County Committees or they are made by petition signed by twenty-five qualified voters in the area involved.

Voters must cast their ballots in their home counties; however, they may vote at any one of the voting places in that county.

Nominees for Directors' and Committeemen's places are as follows:

NOMINEES FOR DISTRICT DIRECTOR

(One to be elected for each precinct)

PRECINCT THREE (3), Bailey, Castro and Parmer Counties

Ross Goodwin, Muleshoe, Texas

PRECINCT FOUR (4), Armstrong, Deaf Smith, Potter and Randall Counties

Andrew Kershen, 201 Ranger, Hereford, Texas

Labry E. Ballard, 120 Beach St., Hereford, Texas

NOMINEES FOR COUNTY COMMITTEEMEN:

(Two to be elected for each county)

ARMSTRONG COUNTY

PRECINCT 3

James Bible, Wayside, Texas

Bill Heisler, Box 118, Wayside, Texas

C. D. Rodgers, Wayside, Texas

Foster Parker, Route 1, Happy, Texas

BAILEY COUNTY

PRECINCT 2

D. O. Burelsmith, Route 2, Muleshoe, Texas

Ernest Ramm, Route 2, Muleshoe, Texas

PRECINCT 4

W. L. Welch, Star Route, Maple, Texas

C. G. Lewis, Route 5, Muleshoe, Texas

CASTRO COUNTY

PRECINCT 2

James Bradford, 1603 W. Bedford, Dimmitt, Texas

Frank Wise, 716 W. Grant, Dimmitt, Texas

COMMITTEEMAN-AT-LARGE

Dale Maxwell, N. Highway 385, Dimmitt, Texas

George Sides, Route 4, Dimmitt, Texas

COCHRAN COUNTY

PRECINCT 1

Wayne Kuehler, Route 2, Morton, Texas

Hugh Hansen, Route 2, Morton, Texas

COMMITTEEMAN-AT-LARGE

Woody Dickerson, Route 1, Morton, Texas

D. A. Ramsey, Star Route 2, Morton, Texas

DEAF SMITH COUNTY

PRECINCT 1

Leroy Bodkin, Route 3, Hereford, Texas

L. B. Worthan, Route 3, Hereford, Texas

COMMITTEEMAN-AT-LARGE

Frank Zinser, Jr., Route 5, Hereford, Texas

C. C. (Bill) Ellis, 301 Cherokee, Hereford, Texas

FLOYD COUNTY

PRECINCT 2

Tate Jones, Route 4, Floydada, Texas

Henry Hinton, Route 4, Floydada, Texas

PRECINCT 4

Pat Frizzell, Box 1046, Lockney, Texas

Eddie J. Foster, Jr., Route 1, Lockney, Texas

HOCKLEY COUNTY

PRECINCT 3

Harley Stanley, Route 3, Levelland, Texas

Jimmy Price, Route 3, Levelland, Texas

COMMITTEEMAN-AT-LARGE

Paul Gilmer, 123 Cedar, Levelland, Texas

J. E. Wade, Route 2, Littlefield, Texas

LAMB COUNTY

PRECINCT 1

Royce Collins, Olton, Texas

Jack Thomas, 710 W. 5th, Olton, Texas

PRECINCT 4

Raymond Harper, Route 1, Sudan, Texas

Lee Roy Fisher, Hwy 303, Sudan, Texas

LUBBOCK COUNTY

PRECINCT 3

R. F. (Bob) Cook, Idalou, Texas

Delbert Robbins, Idalou, Texas

COMMITTEEMEN-AT-LARGE

Bill Dorman, Box 303, Lubbock, Texas

Kenneth Cox, 2610 Ave. H, Lubbock, Texas

LYNN COUNTY

PRECINCT 4

Joe D. Unfred, Route 4, Tahoka, Texas

Roger Blakney, Route 1, Wilson, Texas

PARMER COUNTY

PRECINCT 4

H. L. Ivy, R.F.D., Friona, Texas

Wesley Barnes, R.F.D., Friona, Texas

COMMITTEEMAN-AT-LARGE

Earnest Anthony, Friona, Texas

J. D. Kirkpatrick, Bovina, Texas

Henry Haseloff, Farwell, Texas

Jim Ray Daniel, R.F.D., Friona, Texas

POTTER COUNTY

PRECINCT 4

Vic Plunk, Rt. 1, Box 544, Amarillo, Texas

Fritz Menke, Rt. 1, Box 538, Amarillo, Texas

RANDALL COUNTY

PRECINCT 1

Marshall Rockwell, Jr., Rt. 2, Canyon, Texas

PRECINCT 2

Richard E. Friemel, Rt. 1, Canyon, Texas

FOR The confirmation of the annexation of Hale County to the High Plains Underground Water Conservation District No. 1.

AGAINST The confirmation of the annexation of Hale County to the High Plains Underground Water Conservation District No. 1.

FOR The assumption by Hale County of its pro rata share of all indebtedness and/or maintenance taxes that may be owed, contracted or authorized by or for the High Plains Underground Water Conservation District No. 1.

AGAINST The assumption by Hale County of its pro rata share of all indebtedness and/or mainttenance taxes that may be owed, contracted or authorized by or for the High Plains Underground Water Conservation District No. 1.

For The confirmation of the annexation of Swisher County to the High Plains Underground Water Conservation District No. 1.

AGAINST The confirmation of the annexation of Swisher County to the High Plains Underground Water Conservation District No. 1.

FOR The assumption by Swisher County of its pro rata share of all indebtedness and/or maintenance taxes that may be owed, contracted or authorized by or for the High Plains Underground Water Conservation District No. 1.

AGAINST The assumption by Swisher County of its pro rata share of all indebtedness and/or maintenance taxes that may be owed, contracted or authorized by or for the High Plains Underground Water Conservation District No. 1.

For The confirmation of the annexation of certain eligible lands in Crosvy County to the High Plains Underground Water Conservation District No. 1.

AGAINST The confirmation of the annexation of certain eligible lands in Crosby County to the High Plains Underground Water Conservation District No. 1.

FOR The assumption by Crosby County of its pro rata share of all indebtedness and/or maintenance taxes that may be owed, contracted or authorized by or for the High Plains Underground Water Conservation District No. 1.

AGAINST The assumption by Crosby County of its pro rata share of all indebtedness and/or maintenance taxes that may be owned, contracted or authorized by or for the High Plains Underground Water Conservation District No. 1.

POLLING PLACES

ARMSTRONG COUNTY

1. School House in Wayside

BAILEY COUNTY

1. Enoch's Gin, Enochs
2. Community House, Muleshoe

CASTRO COUNTY

1. Brockman Hardware Co., Nazareth
2. County Court House, 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
3. Alamo Gin, 8 miles east of Morton

DEAF SMITH COUNTY

1. County Court House, Hereford

FLOYD COUNTY

1. County Court House, Floydada
2. City Hall, Lockney

HOCKLEY COUNTY

1. City Hall, Anton
2. Farm Center Gin, Ropesville
3. County Court House, 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 Court House, Littlefield
5. Farmers Co-Op Gin, Spade

CROSBY COUNTY

1. Pioneer Memorial Bldg., Crosbyton
2. V. F. W. Hall, Ralls
3. Community Center, Lorenzo

HALE COUNTY

1. County Court House, Plainview
2. Community House, Petersburg
3. Community Center, Halfway
4. City Hall, Hale Center
5. School House in Cotton Center
6. City Hall, Abernathy

SWISHER COUNTY

1. County Court House, Tulia
2. City Hall, Happy
3. Lions Club Bldg., Kress
4. Claytonville Gin, Claytonville

LUBBOCK COUNT Y

1. Community Club House, Shallowater
2. City Hall, Wolfforth
3. Old County Court House, Lubbock
4. City Hall, Idalou
5. Community Club House, 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 Court House, Farwell
4. School House, Lazbuddie

POTTER COUNTY

1. School House, Bushland

RANDALL COUNTY

1. Consumer's Fuel Assoc. Elevator, Ralph Switch
2. V. F. W. Hall, 1 mile north of Canyon
3. Columbus Club Hall, Umbarger

Absentee Balloting

Absentee balloting for the annual election of the High Plains Underground Water Conservation District will be held December 22 through January 6th. With two exceptions, absentee balloting will be conducted by the secretaries of the county water district offices.

Potter County residents may cast their ballots at the County Clerk's Office. Armstrong County residents may cast their absentee ballots with John Patterson of Wayside.

Eligible voters of the Water District are urged to vote absentee if they are going to be absent from the county on January 10.

Proposals on the ballot will be two district directors positions, twenty-six county committeemen, and the acceptance or rejection of Hale, Crosby and Swisher Counties.

Be sure to vote, either absentee or on January 10.

WATER FACTS

Water fit to drink (fresh water) exists in the ground—in some quantity, and in quality at some depth—nearly everywhere on earth. The Sahara itself, a synonym for total aridity, is underlain by water—an estimated 150,000 cubic miles spreading over 2.5 million square miles of land area. Indeed, most of the world's entire stock of fresh water—2 million cubic miles, or more than 97 percent of the total available supply—is inside the earth. Half of this huge supply is believed to be within a half mile of the surface and is therefore reasonably accessible, particularly if it is under sufficient natural pressure to require little or no pumping and if wells are properly spaced and managed to insure the best possible yield.

The water at Warm Springs, Georgia, where many polio patients are treated, originally rained on Pine Mountain, two miles south of the village. The rain seeped into a rock terrain, known locally as the Hollis formation, which carried it northward at a depth of a few hundred feet. Its average temperature at the start is about 62 degrees F. However, the Hollis formation plunges down 3,000 feet during its northward travel until it is deflected by impermeable rock. The water is heated during this movement and also incerases in pressure before it is turned back to the surface where it emerges at a temperature of 88 degrees F.

The salt cedar tree, common in the Southwest, poses a large water-waste question. Extending its roots down to the water table, this tree in effect "breathes" ground water into the air through its leaves, transferring 20 trillion gallons to the atmosphere each year over 900,000 square miles of the Western United States and possibly causing an equivalent loss of usable water to the area.

In the United States ,a drop of water spends an average of only 12 days passing through the air; it may remain in a glacier for 40 years, in a lake for 100 years, or in the ground for hundreds of thousands of years. Eventually, however, every drop becomes involved again in the water cycle, even that trapped deep in the "water mine" which may need to wait for an earth movement to free it from its trap.

The first ice sheets of the Great Ice Age began to move about 1.5 million years ago, according to some evidence. The ice age was marked by at least four major advances and retreats. The most recent ice age reached its climax about 50,000 years ago. It covered much of northern Europe, all of Canada, and much of the northern half of the United States with packs often a mile and more thick. This ice did not leave the United States until about 10,000 years ago.

The world's oceans, ice fields, lakes and rivers contain more than 324 million cubic miles of water. Beneath the earth, in soil and rock, lies some 2 million cubic miles in the form of ground water. Another 3,100 cubic miles of water, mostly in the form of vapor, is contained in the earth's atmosphere.

If the world's total supply of water were poured upon the 50 United States, the land surface would be submerged to a depth of 90 miles.

About 95,000 cubic miles of water goes into the air annually. The greatest part—about 80,000 cubic miles—rises from the oceans. But 15,000 cubic miles of water is drawn from the land, evaporated off lakes, streams, and moist soil, and a significant amount is transpired from the leaf surfaces of living plants. The total process is called "evapotranspiration."

Of the water that goes into the atmosphere, most—71,000 cubic miles—falls back directly into the oceans. Another 9,000 cubic miles falls on land but runs into rivers and streams, and is returned to the oceans within days, or, at most a few weeks, being used many times by many successive users as it goes. The remaining 15,000 cubic miles of water soaks into the land, where some is available to life processes of plants and animals, some flows slowly underground through porous earth materials to supply water wells and some is trapped in "water mines," to remain indefinitely.

The perpetual global water cycle requires that at any moment an average of 3,100 cubic miles of water be distributed throughout the atmosphere as vapor, water vapor, or droplets. If all of it abruptly fell as rain, and the earth were perfectly smooth, the earth would be covered with barely an inch of water. The turnover is quite rapid once every 12 days, on the average, all the water in the air does fall and is replaced.

Water Is Your Future, Conserve It!

This tailwater installation system is located on the Jack Dunn farm, operated by Mr. J. D. Kirkpatrick. The farm is located about 2 mues west of Bovina, Texas. This system was installed in 1963. The pit was constructed 150 feet in length, 50 feet wide and 15 feet deep with a capacity of almost 700,000 gallons. Kirkpatrick installed a 4" centrifugal pump with a maximum capacity of about 700 gallons per minute, powered by a 7-1/2 hp electric motor. Only a few feet of underground pipeline was required to tie this installation into an already existing system. The system cost about $2000 to install. The High Plains Underground Water Conservation District assembled records on the amount of tailwater pumped by this system. In 1963, Mr. Kirkpatrick recovered a total of 53 acre feet of water In 1964, 158 acre feet of water; 1665, 103 acre feet of water; and in 1966, 113 acre feet of water for a total of 428 acre feet of water. An average of about 105 acre feet per year.

Happy New Year!

1966

12/66

DONALD C. TAYLOR
RES. AGR. ENGR.
S.W. GREAT PLAINS RES CT
BUSHLAND, TEXAS 79012

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