THE Cross SECTION

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

Volume 4—No. 8 "THERE IS NO SUBSTITUTE FOR WATER" January 1958

Two Directors And Twenty-Six County Committeemen Elected January 14th

The annual election of District Directors and County Committeemen for the High Plains Water District was held January 14. Two Directors and twenty-six Committeemen were elected.

In District Precinct No. 2, which consists of Cochran, Hockley and Lamb counties, Roy McQuatters, Sr. of Littlefield was elected to the Board of Directors for a term of two years. He replaces Gus Parish of Springlake.

In District Precinct No. 5, consisting of only Floyd County, Marvin Shurbet of the Allmon Community in the southwestern part of the county was re-elected to continue on the Board of Directors for another two years. (Since the election, word has been received from the Attorney General's office that Mr. Shurbet must resign from the Water District Board due to his having recently been sworn in as a member on the newly-formed State Water Development Board. The Water District Board will appoint a Floyd County man to complete Mr. Shurbet's term of office.)

Two Committeemen were elected in each of the thirteen counties comprising the Water District. Each was elected to serve a term of three years.

Following is a list by counties of the men elected to the County Committees:

ARMSTRONG COUNTY
Willie Modisette, Wayside.
Cordell Mahler, Wayside.

BAILEY COUNTY
Leldon Phillips, Rt. 2, Muleshoe.
R. E. Ethridge, Rt. 5, Muleshoe.

CASTRO COUNTY
George Bradford, Dimmitt.
Tom Lewis, Rt. 4, Dimmitt.

COCHRAN COUNTY
Pat Hatcher, Morton.
Earl Crum, Rt. 2, Morton.

DEAF SMITH COUNTY
Earl Holt, Rt. 3, Hereford.
T. L. Sparkman, Rt. 1, Hereford.

FLOYD COUNTY
Robert Kellison, Rt. 2, Lockney.
G. L. Fawver, Rt. 5, Floydada.

HOCKLEY COUNTY
C. T. Pace, Levelland.
Henry J. Schmidly, Rt. 3, Levelland.

LAMB COUNTY
Henry Gilbert, Sudan.
Elmer McGill, Box 404, Olton.

LUBBOCK COUNTY
Earl Weaver, Idalou.
Vernice Ford, 3013 20th, Lubbock.

LYNN COUNTY
Frank P. Lisemby, Jr. Rt. 1, Wilson.
Earl Cummings, Wilson.

PARMER COUNTY
John Gammon, Lazbuddy.
A. B. Wilkinson, Bovina.

POTTER COUNTY
R. C. Sampson, Jr., Bushland.
T. G. Baldwin, Bushland.

RANDALL COUNTY
James B. Dietz, Rt. 2, Happy
W. A. (Bill) Patke, Box 423, Canyon.

We want to welcome these newly-elected men to the positions that the voters in their counties are entrusting with them. Also, we want to thank the retiring Directors and Committeemen for their able guidance of the Water District's activities in the past.

Roy McQuatters, Sr., New Director For Precinct No. 2

Governor Appoints Marvin Shurbet To New State Water Development Board

Marvin Shurbet, HPWD Board President, is shown in the center after receiving appointment by Governor Price Daniel, left, to the new State Water Development Board. He was sworn in by Supreme Court Justice Joe R. Greenhill, shown at right.

Marvin Shurbet, president of the High Plains Underground Water Conservation District, from the Allmon Community in southwestern Floyd County, along with five other outstanding water-conservation minded Texans, was recently sworn in as a member of the very important Texas Water Development Board.

On November 5, 1957 the Texas voters overwhelmingly passed a constitutional amemdment which established a $200-million State Water Development Fund and a six-man Board to administer it.

The money in the Fund will be made available through the sale of State bonds, and in turn, the Board will loan money from the Fund to political subdivisions of the State for the construction of water projects.

Mr. Shurbet was appointed to the Board by Governor Daniel because of his long service to the High Plains area in the field of water conservation. In fact, since Mr. Shurbet's father drilled one of the first irrigation wells in Floyd County and purchased one of the first seven irrigation pumps sold in the county, Mr. Shurbet has been interested in water and soil conservation. He attended the first water meeting ever held in Floyd County—more than twenty-five years ago. He has attended most of the water meetings since.

Serving on the Water Development

(Continued on Page 4)

STATISTICS FOR DECEMBER

During the month of December, 31 new wells were drilled and registered with the District office; 4 replacement wells were drilled; and 5 wells were drilled that were either dry, or non-productive for other reasons. 65 permits were issued by the county committees. The new permits issued and completed wells follow by counties:

County	Permits Issued	New Wells Drilled	Replacement Wells	Old Wells Deepened	Dry Holes Drilled
Armstrong	0	0	0	0	0
Bailey	6	2	1	0	0
Castro	2	5	0	0	0
Cochran	12	0	0	0	0
Deaf Smith	10	3	1	0	0
Floyd	3	0	0	0	0
Hockley	9	9	1	0	1
Lamb	1	0	0	0	0
Lubbock	8	8	0	0	0
Lynn	5	0	0	0	1
Parmer	4	4	1	0	0
Potter	0	0	0	0	0
Randall	5	0	0	0	3

THE Cross SECTION

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ALLAN WHITE
Editor

BOARD OF DIRECTORS

Precinct 1

Elmer Blankenship, Vice Pres. ... Route 2, Wilson, Texas

Precinct 2

Gus Parish ... Box 67, Springlake, Texas

Precinct 3

A. H. Daricek ... Maple, Texas

Precinct 4

V. E. Dodson, Secretary ... Hereford, Texas

Precinct 5

Marvin Shurbet, President ... Route 1, Petersburg, Texas

District Office

Tom McFarland ... General Manager
W. L. Broadhurst ... Chief Hydrologist
Allan White ... District Secretary
Y. F. Snodgrass ... Field Representative
Wayne Wyatt ... Field Representative
Mrs. M. McVay ... Secretary-Bookkeeper
Mrs. Dana Wacasey ... Secretary

COUNTY COMMITTEEMEN

Armstrong County

Clifford Stevens ... Happy, Texas
James Bible ... Wayside, Texas
Jack McGehee ... Wayside, Texas
Guy Watson ... Wayside, Texas
H. C. Newsome ... Wayside, Texas

Bailey County

Mrs. Ruth Roberts, Bailey County Farm Bureau Office, Muleshoe

Guy Austin ... Route 1, Farwell, Texas
Ross Goodwin ... Route 2, Muleshoe, Texas
W. R. Carter ... Muleshoe, Texas
Robert Blackwood ... Route 1, Muleshoe, Texas
F. A. Carter ... Box 644, Maple, Texas

Castro County

Eugene Ivey, Dimmitt

Ivor Bagwell ... Route 4, Dimmitt, Texas
Sid Sheffy ... Dimmitt, Texas
Rodney Smith ... Hart, Texas
L. H. Gladden ... Star Rt. 1, Hereford, Texas
Frank Annen ... Route 2, Dimmitt, Texas

Cochran County

J. B. Knox, Western Abstract Co., Morton

Max Bowers ... Morton, Texas
Hume Russell ... Morton, Texas
Herbert Cadenhead ... Route 1, Morton, Texas
Roy D. Greer ... Star Rt. 2, Morton, Texas
Haskell Milligan ... Morton, Texas

Deaf Smith County

Mrs. Pauline Lovan, Deaf Smith County Farm Bureau Office, Hereford

George K. Muse ... Box 574, Hereford, Texas
Ed Dziuk ... Route 2, Hereford, Texas
Ralph Hastings ... Route 4, Hereford, Texas
Austin C. Rose, Jr., 108 Beach St., Hereford, Tex.
George T. Turrentine, Route 5, Hereford, Texas
Committeemen meet the first Monday of each month in the Farm Bureau Office, Hereford, Texas at 7:30 p. m.

Floyd County

Mrs. Ida Puckett, 319 South Main Floydada

Tate Jones ... Floydada, Texas
J. R. Belt ... Lockney, Texas
Chester W. Mitchell ... Lockney, Texas
Robert L. Smith ... Lockney, Texas
Ernest Lee Thomas ... Route 1, Floydada, Texas

Hockley County

Z. O. Lincoln, 913 Houston, Levelland

Henry Schmidley ... Route 3, Levelland, Texas
Cecil Pace ... Levelland, Texas
J. J. Hobgood ... Route 2, Anton, Texas
H. C. Janes ... Route 4, Levelland, Texas
Joe W. Cook, Jr. ... Route 1, Ropesville, Texas
Committeemen meet first and third Fridays of each month at 1:30 p. m., 913 Houston, Levelland, Texas.

Lamb County

Mrs. Jane Shipley, Chamber of Commerce Office, Littlefield

J. B. Davis ... Route 1, Amherst, Texas
Elmer McGill ... Olton, Texas
Roy McQuatters ... Box 295, Littlefield, Texas
Price Hamilton ... Earth, Texas
Bill Nix ... Sudan, Texas

Lubbock County

Mrs. Jean Lancaster, 1628-B 15th Lubbock, Texas

Earl Weaver ... Idalou, Texas
Bill Alspaugh ... Box 555, Slaton, Texas
Leroy Johnson ... Shallowater, Texas
Vernice Ford ... 3013 20th St., Lubbock, Texas
Howard Alford ... Route 4, Lubbock, Texas
Committeemen meet first and third Mondays of each month at 2:30 p. m., 1628-B 15th Street, Lubbock, Texas.

Lynn County

Mrs. Jean Lancaster, 1628-B 15th Lubbock, Texas

Roger Blakney ... Route 1, Wilson, Texas
Erwin Sander ... Route 1, Wilson, Texas
Lit H. Moore, Jr. ... Route 1, Wilson, Texas
Aubrey Smith ... Route 1, Wilson, Texas
H. D. Dean ... Route 6, Lubbock, Texas
Committeemen meet first and third Tuesdays of each month at 10 a. m., 1628-B 15th Street, Lubbock, Texas.

Parmer County

Aubrey Brock, Bovina

John Gammon ... Friona, Texas
Lee Jones ... R. F. D., Farwell, Texas
Carl Schlenker ... Route 2, Friona, Texas
Dick Rockey ... Route, Friona, Texas
A. B. Wilkinson ... Bovina. Texas
Committee men meet first and third Thursday nights at 8:00 p. m. in Bovina.

Potter County

Jim Line, Box 87, Bushland

James W. Walton ... Bushland, Texas
Eldon Plunk ... Route 1, Amarillo, Texas
Jim Line ... Box 87, Bushland, Texas
E. L. Milhoan ... Box 45, Bushland, Texas
W. J. Hill, Sr. ... Bushland, Texas

Randall County

Mrs. Eutha Hamblen, Farm Bureau, Canyon

J. L. Weick ... Route 1, Canyon, Texas
Leo Artho ... Route 1, Canyon, Texas
L. E. Mason ... Wildorado, Texas
John Butler ... Route 2, Happy, Texas
W. C. Angel ... Route 2, Canyon, Texas
Committeemen meet first Monday night each month at 7:30 p. m., 1710 5th Avenue, Canyon, Texas.

ELMER L. BLANKENSHIP

In previous issues of "The Cross Section" we have attempted to give our readers a thumb-nail sketch on members of the High Plains Underground Water Conservation District's Board of Directors.

Sketches on new members to the Board will appear in this and the next two editions of the paper. This month we present Mr. Elmer L. Blankenship, Director of Precinct No. 1

Precinct No. 1 consists of Lubbock and Lynn Counties and is represented on the Board of Directors by Elmer L. Blankenship of Route 2, Wilson, Texas. His home is located 1 1/2 miles southeast of Wilson.

Mr. Blankenship was born in 1914 at Vernon, Texas. His parents, the P. H. Blankenships, were farmers. After graduating from Vernon High School in 1934, he began attending Texas Technological College in Lubbock. He left in 1936 and started to Draughon's Business College in Lubbock.

This same year Miss Natalie Crosby of Wilson, a History major at Texas Tech became Mr. Blankenship's wife.

The next year, 1937, they moved to Farwell in Parmer County and entered into a farming venture with a cousin, Keith Pigg. After one year, Mr. Blankenship bought a 123-acre farm at Wilson. The family lives on this original tract at the present time.

In 1938, the first of the Blankenship's two children was born; Judy is now 19 years old and is a sophomore at Hardin-Simmons University in Abilene. She is a Home Economics major and plans to transfer this fall to Texas Tech. Jimmy, 17 years old, is a junior at the Wilson High School. He has been active in FFA work. His entries have won numerous awards in livestock shows throughout the area.

During the spring of 1948, Mr. Blankenship drilled his first irrigation well. He now operates 3 wells on his home place; 4 wells on 320 acres near the New Home community in Lynn County; and 6 wells on a section of land in Yoakum County. The Yoakum County land is watered by using sprinkler systems.

Aside from Mr. Blankenship's duties as a member of the High Plains Water District's Board of Directors, he serves on the Lynn County Soil Conservation Service Board of Supervisors; is a member of the Lynn County Farm Bureau; Wilson Lion's Club; Wilson Methodist Church; and Masonic Lodge at Slaton. Before being elected to the High Plains Water District Board he served as a member of the Lynn County Committee.

For relaxation during the summer, the Blankenships usually camp out for a week or so in New Mexico or Colorado. They also have a boat at Lake Thomas near Snyder. Mr. Blankenship is not a fisherman, but he does enjoy boating, sight-seeing and taking pictures with his 35mm camera.

Mr. Elmer Blankenship is well versed on the water problems of his Precinct and of the High Plains of Texas, and he is a great asset to the Water District Board of Directors and to Lubbock and Lynn County residents.

"Next month, Precinct No. 3—Director, Mr. A. H. Daricek, Maple, Texas."

EDITOR
THE CROSS SECTION
1628-B 15th Street
Lubbock, Texas
Dear Sir:
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RELATIONSHIP OF GEOLOGY TO SALT WATER POLLUTION EXPLAINED

By W. L. Broadhurst

Dr. E. H. Sellards, former Director, Bureau of Economic Geology, The University of Texas, states that perhaps the most nearly complete section of marine Permian rocks in America is that of the Glass Mountains in Trans-Pecos Texas. Rocks of this system are found underground throughout the Permain Basin extending from the Pecos Valley in West Texas northward into New Mexico, Oklahoma, and Kansas. These deposits at the surface around the High Plains and underground include varying facies; among these are normal marine limestones, sandstones, and shales; massive dolomites, often occurring in great reefs; non-marine and partially marine red beds; beds of gypsum at the surface and anhydrite underground; and underground, various salts of which common table salt is the chief constituent, although other salts, particularly potash, are also present.

Permian rocks crop out in New Mexico along the Pecos River; they also crop out in Texas along the Canadian River, and east of the Southern High Plains from Armstrong County southward to Sweetwater. From these outcrops the rocks dip generally into the Permian Basin, the center of which occurs beneath the Southern High Plains. Near the center of the Basin, the Permian strata are more than 4,000 feet thick and are buried beneath more than 2,000 feet of younger deposits. Along the Pecos River in New Mexico the Permian rocks yield large quantities of fresh water to artesian wells, and east of the Plains they yeild relatively large quantities of "Gyp" water, but beneath this area, insofar as is known, they yield no fresh water. However, from the dolomites, limestones, and sandstones of this system is obtained much of the oil of the Permian Basin. Unfortunately, in connection with the production of oil, large quantities of salt water are also brought to the surface from the Permian rocks. Much of this oil-field brine is highly concentrated, containing more than 25 per cent dissolved solids. Thus, one of our most serious problems, insofar as salt-water pollution is concerned, it the disposal of this oil-field brine.

Next in the series of deposit overlying the Permian are the Triassic rocks. The Texas Triassic is entirely non-marine, and it is part of an eastward extension of the red beds deposited in Arizona and New Mexico. In Texas these red beds and other materials are comprised in the "Dockum beds", and in certain parts of western Texas and eastern New Mexico the lithologic portions of the Dockum have received separate formation names. However, since we are not paticularly interested in geologic names, suffice it to say the Triassic in this area consists primarily of basal shales and sandy clays, middle "Santa Rosa" sandstone and conglomerates, and upper shales, sandy clays, and siltstones.

Extensive outcrops of Triassic rocks occur along the western edge of the Plains in Quay, Guadalupe, DeBaca, Chaves, and Eddy Counties in New Mexico, along the Canadian River in Texas and from Palo Duro Canyon southward to Big Spring, between the Escarpment and the Permian outcrop.

Triassic rocks were deposited on an older eroded surface and in most places dip gently to the southeast. In the southern part of the area, however, the dip of the beds is very irregular because of the lenticular nature of the strata, which were laid down as river-channel and flood-plain deposits. The regional dip, measured on the top of the Santa Rosa, is toward the center of the Llano Estacado. This suggests that the downwarping of the Permian Basin continued after Triassic times and also that the western margin of the Basin was elevated with the upfolding of the mountains in New Mexico.

W. L. BROADHURST

The sandy zones in the Triassic yield fresh water to wells in the southern part of the Permian Basin, notably in Loving, Winkler, Ward, and Crane counties, in the southwestern part of Mitchell and Scurry counties, and locally in Randall and Deaf Smith counties; but as we approach the central part of the Southern High Plains the sandy zones occur at greater and greater depths below the land surface and the water in these zones becomes more highly mineralized.

Reliable reports are that in northern Hockley County the Santa Rosa sandstone occurs at a depth of about 1,500 feet and that the water from that zone contains more than 30,000 parts per million chloride.

A 2,000-foot test well was drilled at Lubbock in 1949. Analysis of water from a sand (Santa Rosa?) from 960 to 1,000 feet, showed about 11,000 parts per million chloride. However, available data show that the static water level in this stratum was 344 feet below the land surface—some 200 feet below the base of the fresh-water aquifer.

An 800-foot test well in southwestern Floyd County showed fine-grained sand in the Triassic from 740 feet to 780 feet. The static water level was 290 feet below the land surface and the well produced only 75 gallons of water a minute, which contained 3,020 parts per million chloride.

Based on available data, throughout that portion of this region where the Triassic rock contain salt water, the hydrostatic head is such that there is little opportunity for pollution of the over-lying fresh-water sands, either through abandoned wells, seismograph shot holes, or deep water wells. However, where deep wells encounter oil or gas under high pressure, the surface casing of all such wells should be thoroughly cemented below the top of the Triassic rocks in order to prevent salt-water pollution by upward movement through the well and lateral movement into the fresh-water aquifer.

Cretaceous rocks underlie practically the entire High Plains south of the Santa Fe Railroad from Farwell to Slaton and are exposed notably in Ector, Midland, and Glasscock counties, from Dawson to Crosby County, and around numerous alkali lakes on the Plains. In general they consist of a basal sand, overlying limestones, and blue and yellow shale or clay. Meager to moderate supplies of fresh water are obtained from these rocks in the western part of the Plains from Ector County northward to Bailey County, in northern Lubbock and southern Hale counties. In general, however, in the interior of the region, the deposits contain meager supplies of water that, although generally not salty, contains a high percentage of sodium bicarbonate. Futhermore, data at a few localities show that the hydrostatic head in the Cretaceous strata is above the level of the water in the overlying Ogallala sands. Consequently if the water is not used, wells, test holes, and seismograph shot holes that penetrate the Cretaceous rocks should be thoroughly plugged to prevent commingling of the waters.

The surface of the Plains is underlain by soil and caliche and by gravel, sand, and clay of the Ogallala formation which contain the bulk of ground water available to wells and springs in this region. In general these deposits contain fresh water and consequently present no salt-water pollution problem.

Based on the foregoing discussion, we must conclude that the principal sources of salt-water pollution to the groundwater supply within the bounds of the Southern High Plains are (1) improper or inadequate construction of oil and gas wells, (2) failure to plug or fill seismograph shot holes or other deep test holes, and (3) disposal of oil-field brine.

About 1946 or 1947, under the able direction of the Honorable Walter N. White (retired) former head of the Ground Water Branch of the United States Geological Survey in Texas, a program was started whereby the Texas Railroad Commission required oil producers to set and cement surface casing in such a manner as to protect all fresh-water sands from potential salt-water pollution in connection with the drilling of oil and gas wells. Today, unless a field rule has been established, each drilling contractor is required to obtain a letter from the State Board of Water Engineers stating the depths to which fresh-water sands must be protected. The Commission, in turn, grants drilling permits for oil and gas wells with the understanding that such recommendations shall be followed. Hence, in nearly every part of Texas, the potential danger of pollution from present day oil and gas development is greatly reduced. However, no doubt some of the older wells that were drilled in parts of this region were inadequately cemented and may represent a real threat to the groundwater supply. If any public water supply is withdrawn from wells in or near an old producing or abandoned oil field, detailed data should be obtained regarding the oil well drilling, completion, and abandoning reports. Such reports may give a clue as to potential danger so that corrective measures can be taken before polluted water enters the supply lines.

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

Investigations have shown conclusively that a large percentage of the salt water that was placed in open earthern pits did not evaporate. As the salt water sinks into the ground and additional water is added to the pit the first water is driven down both by gravity and hydrostatic head. Furthermore, as the salt water moves downward most of the salt remains in solution, and because of greater density the salt water will continue on to the bottom of the permeable material at which point it will start moving laterally in the direction of the hydraulic gradient. Consequently, in general, a greater concentration of brine will be found east and southeast from the pits, because in general the hydraulic gradient in the Plains region is southeastward parallel to the slope of the land surface.

In general, where the ground water is not affected by pumping, the lateral movement of a particle of water is at the rate of 300 to 500 feet per year. However, when a well is pumped, a drawdown in the water table causes an increase in the hydraulic gradient and as a result the rate of movement of water increases accordingly. Because the drawdown will occur in all directions from a pumped well, the gradient may be reversed, and, therefore, a well within reasonable distance in any direction from a salt-water pit may eventually show pollution.

On September 6, 1957, the Board of Directors of the High Plains Underground Water Conservation District promulgated a rule which states that *"No person shall pollute or harmfully alter the character of the underground water reservoir of the District by means of salt water or other deleterious matter admitted from some other stratum or strata or from the surface of the ground".*

CONSERVATION CONVERSATION

A well drilling permit is valid for a period of four (4) months from the date that the application is filed with the County Committee.

* * * * *

Before replacing a well that has been lost, the landowner must apply for and be granted a permit to do so. In order to qualify for a "replacement well" permit the applicant must agree that the well will be drilled within one hundred fifty (150) feet of the old well. It must not be located toward

(Continued on Page 4)

CONSERVATION CONVERSATION

(Continued from Page 3)

any other well unless the new location complies with the minimum spacing requirements. Of course, if the new location does comply with the minimum spacing requirements then the well shall be considered to be a "new well" rather than a "replacement well."

* * * * *

The minimum spacing for new wells is as follows:

4-inch or smaller pump must be a minimum distance of 200 yards from the nearest well.

5-inch pump must be a minimum distance of 250 yards from the nearest well.

6-inch pump must be a minimum distance of 300 yards from the nearest well.

8-inch pump must be a minimum distance of 400 yards from the nearest well.

10-inch or larger pump must be a minimum distance of 440 yards from the nearest well.

It is contemplated that the pumps of the respective sizes set out above shall produce water at the ordinary or usual pumping rates of pumps of such sizes. The ordinary or usual pumping rates of such pumps are to be regarded as follows:

4-inch or smaller pump, 70 to 265 G. P. M.
5-inch pump, 265 to 390 G. P. M.
6-inch pump, 390 to 560 G. P. M.
8-inch pump, 560 to 1,000 G. P. M.
10-inch or larger pump, more than 1,000 G. P. M.

If the pump which is to be used by the applicant is of a different size, or is to be operated at a different rate in gallons per minute from the pumps in general use as set out above, such fact shall be made known in the permit application; and in such case, the actual rate at which the well is to be pumped shall be the determining factor in the spacing for such well instead of the size of the pump.

Please Close Those Abandoned Wells!!!

We have found in practically every county in the Water District abandoned wells left open, or closed inadequately, by their owners. These wells can cause much trouble since it is against the law to not close wells properly when abandoning them.

As the aftermath of a California State tragedy, when a small girl fell into an abandoned well and was recovered dead, the Texas Legislature passed a bill providing that it shall be unlawful for any person who shall drill, dig, or otherwise create, or cause to be drilled, dug, or otherwise created, any hole or well as much as ten (10) feet in depth and more than ten (10) inches in diameter, to abandon said well or hole without first completely filling same from its total depth to the surface of the ground or plugging said well or hole with a permanent type plug at a depth of not less than ten (10) feet from the surface and completely filling said well or hole from the plug to the surface.

This law further provides that it shall be unlawful for the owner of any well or cistern to fail to keep it entirely covered at all times with a covering capable of sustaining weight of not less than 200 pounds, except when such well or cistern is in actual use by the owner or operator. Also, any person violating the above provisions shall be guilty of a misdemeanor and shall be subject to a fine of not less than $100, and not more than $500.

The above law, Article 1721, Texas Revised Civil Statutes, is called to your attention in an effort to obtain your consideration of the seriousness of leaving wells open on your property. Even if there were not a law against this practice, would you not be the last one to want to be the cause of an accident that perhaps would result in a terrible tragedy?

Please close those abandoned wells!

Lakes Drained Into Recharge Wells Yield Crops

Above is pictured a very fine cotton and grain sorghum crop growing in a lake west of Idalou, in Lubbock County. During the spring and early summer of 1957, the lake was drained five times into a recharge well. The land is owned by J. A. Howell.

Above is pictured a field of Red-Top cane growing in a lake southwest of Slaton, in Lubbock County. In 1957, the lake was drained several times into the recharge well shown in the background. The water level in the recharge well is six feet higher than it was when the well was drilled three years ago. The land is owned by Joe Rhoads.

WELL DRILLING STATISTICS FOR 1957

Drilling activity in the High Plains Water District during 1957 increased slightly over the number of wells drilled in 1956.

In 1957, there were 2319 wells drilled and registered with the District Office, as compared to 2170 wells drilled during 1956. The thirteen counties which comprise the Water District issued 2377 drilling permits. This represents an increase of 65 permits over 1956.

The yearly records for 1957 are shown below:

County	Permits Issued	New Wells Drilled	Replacement Wells	Old Wells Deepened	Dry Holes Drilled	Total Wells For 1957
Armstrong	4	4	0	0	0	4
Bailey	248	201	24	1	8	234
Castro	171	182	9	0	5	196
Cochran	110	84	1	0	1	86
Deaf Smith	167	149	14	1	1	165
Floyd	168	178	5	0	2	185
Hockley	314	336	15	0	7	358
Lamb	401	215	18	1	7	241
Lubbock	410	436	19	5	13	473
Lynn	131	145	1	0	2	148
Parmer	187	157	14	0	0	171
Potter	3	1	1	0	0	2
Randall	63	49	2	1	4	56
TOTALS	2377	2137	123	9	50	2319

State Water Board—

(Continued from Page 1)

Board with Mr. Shurbet are: Marvin Nichols of Fort Worth, Chairman; W. F. (Buck) Tinsley, of Austin; C. Y. Mills of Mission; Bill Taylor of Longview; and James D. Sartwelle of Houston.

Joe D. Carter, widely-known water attorney of Austin, has been employed by the Development Board to serve as its Executive-Secretary.

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

Second Class Permit

THE Cross SECTION

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

Volume 4—No. 9 **"THERE IS NO SUBSTITUTE FOR WATER"** *February 1958*

Board Meets To Swear In New Members And Reorganize For 1958

During the first regular meeting in 1958 of the Board of Directors of the High Plains Underground Water Conservation District held in Lubbock on February 3, two new Directors were sworn in as members of the Board. James G. Denton, 99th District Judge, administered the oath of office to Roy B. McQuatters, Sr. of Littlefield, and to J. R. Belt, Jr. of Lockney. Mr. McQuatters was elected by the people of Cochran, Hockley and Lamb Counties to represent them on the Board. He replaces Gus Parish of Springlake. Mr. Belt was appointed by the Board to fulfill the unexpired term of Marvin Shurbet of Floyd County, who will continue to serve the High Plains area as the farmer-rancher member on the important six-man State Water Development Board. Both Mr. McQuatters and Mr. Belt will serve two-year terms on the Water District's Board of Directors.

Among those attending the ceremonies were the Honorable Jesse Osborn of Muleshoe, State Representative; Arthur P. Duggan, Jr., Littlefield attorney; Ray Lawrence, Lubbock auditor; John Akin, Hereford attorney; Marvin Shurbet; and Gus Parish.

During the regular quarterly meeting several items of general business were discussed pertaining to the conservation program of the District. Four representatives of the City of Slaton were guests of the Board at an informal discussion of a water supply problem with which Slaton is confronted.

In reorganization of the Board, Virgil E. Dodson of Hereford was elected to serve as President for 1958. Elmer Blankenship of Wilson was elected to serve as Vice-President for the coming year and A. H. Daricek of Maple was chosen to serve as Secretary and Treasurer.

Lincoln To Be Site Of Water Meeting

The National Water Resources Institute will be held March 11-13 in Lincoln, Nebraska.

Included in the program will be discussions of water supply and use; water control; water requirements for agriculture, industry and navigation; water conservation; and sectional water problems and policy.

Heading the list of speakers on the opening day will be Luna B. Leopold of Washington, D. C., chief hydraulic engineer of the U. S. Geological Survey; Don Williams of Washington, D. C., chief of the Soil Conservation Service, U. S. Department of Agriculture; C. Petrus Peterson of Lincoln, former president of the National Reclamation Association and now a consultant to the Secretary of Interior; and Nolan Fuqua of Duncan, Oklahoma, president of the National Association of Soil Conservation District Supervisors.

Featured at succeeding sessions will be Maj. Gen. E. C. Itschner of Washington, D. C., chief of Army Engineers; A. C. Ingersoll, Jr., of St. Louis, Missouri, president of Federal Barge Lines; W. H. Pringle of Pierre, S. D.; president of the Isaac Walton League of America; Dr. Frank J. Welch of Lexington, Kentucky, a director of TVA; and Harvey O. Banks, director of the Department of Water Resources, State of California.

About 50 irrigation equipment exhibits will be set up in connection with the Institute.

Headquarters for the Institute is the Pershing Municipal Auditorium. Complete information on the Institute including programs and reservations may be obtained by writing: National Water Resources Institute, Pershing Municipal Auditorium, Lincoln, Nebraska.

Former Water District President Cited For Outstanding Agricultural Leadership

W. O. Fortenberry, Lubbock County cotton farmer, businessman and former president of the Board of Directors of the High Plains Underground Water Conservation District, has been named "Man of the Year in Texas Agriculture in 1957" by "The Progressive Farmer" magazine. He was a member of the HPUWCD Board when the District's original rules and regulations were adopted.

Mr. Fortenberry, who at present serves the Plains Cotton Growers, Inc. as its president, was cited for his outstanding agricultural leadership in the High Plains and in cotton affairs of Texas and the Nation.

The 63-year-old native Texan has been a resident of the Texas High Plains since 1916 when he moved from Hunt County to Groom, in Carson County, and began wheat farming. He continued his farming operations in the North Plains until 1923 when he moved to Ropesville in Hockley County and planted his first High Plains cotton. He has had a cotton crop every year since.

In 1925, he entered the cotton ginning business at Pep in Hockley County, and from then until 1952 was extensively engaged in both ginning and farming.

During the more than thirty years Mr. Fortenberry has been producing cotton, he has held virtually every office in farming and ginning organizations on community, state and national levels.

We congratulate Mr. Fortenberry on the well-deserved recognition and "The Progressive Farmer" on its very excellent judgment.

James G. Denton, 99th District Judge, is shown at the right above as he administers the oath of office to two new Water District Board members. Taking the oath are, Roy B. McQuatters, Sr. of Littlefield, and J. R. Belt, Jr. of Lockney. Each will serve a two-year term on the Board.

Pictured above is the 1958 Board of Directors of the High Plains Underground Water Conservation District. They are, left to right, top row, Roy B. McQuatters, Sr. of Littlefield; J. R. Belt, Jr. of Lockney; Elmer Blankenship, Vice President of Wilson; bottom row, left, V. E. Dodson, President of Hereford; and A. H. Daricek, Secretary-Treasurer of Maple.

THE Cross SECTION

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

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ALLAN WHITE
Editor

BOARD OF DIRECTORS

Precinct 1

Elmer Blankenship, Vice Pres. .... Route 2, Wilson, Texas

Precinct 2

Roy B. McQuatters, Sr. .... Box 295, Littlefield, Texas

Precinct 3

A. H. Daricek, Secretary-Treasurer, Maple, Texas

Precinct 4

V. E. Dodson, President .... Hereford, Texas

Precinct 5

J. R. Belt, Jr. .... Lockney, Texas

District Office

Tom McFarland .... General Manager
W. L. Broadhurst .... Chief Hydrologist
Allan White .... Publicity-Public Relations
Y. F. Snodgrass .... Field Representative
Wayne Wyatt .... Field Representative
Mrs. M. McVay .... Secretary-Bookkeeper
Mrs. Dana Wacasey .... Secretary

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Clifford Stevens .... Happy, Texas
Willie Modisette .... Wayside, Texas
Jack McGehee .... Wayside, Texas
Cordell Mahler .... Wayside, Texas
H. C. Newsome .... Wayside, Texas

Bailey County

Mrs. Ruth Roberts, Bailey County Farm Bureau Office, Muleshoe

Leldon Phillips .... Route 2, Muleshoe, Texas
Ross Goodwin .... Route 2, Muleshoe, Texas
R. E. Ethridge .... Route 5, Muleshoe, Texas
Robert Blackwood .... Route 1, Muleshoe, Texas
F. A. Carter .... Box 644, Maple, Texas

Committeemen meet fourth Friday of each month at 2:30 p. m., Farm Bureau Office, Muleshoe, Texas.

Castro County

Eugene Ivey, Dimmitt

Tom Lewis .... Route 4, Dimmitt, Texas
George Bradford .... Dimmitt, Texas
Rodney Smith .... Hart, Texas
L. H. Gladden .... Star Rt. 1, Hereford, Texas
Frank Annen .... Route 2, Dimmitt, Texas

Cochran County

J. B. Knox, Western Abstract Co., Morton

Max Bowers .... Morton, Texas
Pat Hatcher .... Morton, Texas
Earl Crum .... Route 2, Morton, Texas
Roy D. Greer .... Star Rt. 2, Morton, Texas
Haskell Milligan .... Morton, Texas

Deaf Smith County

Mrs. Pauline Lovan, Deaf Smith County Farm Bureau Office, Hereford

George K. Muse .... Box 574, Hereford, Texas
Earl Holt .... Route 3, Hereford, Texas
T. L. Sparkman .... Route 1, Hereford, Texas
Austin C. Rose, Jr., 108 Beach St., Hereford, Tex.
George T. Turrentine, Route 5, Hereford, Texas

Committeemen meet the first Monday of each month in the Farm Bureau Office, Hereford, Texas at 7:30 p. m.

Floyd County

Mrs. Ida Puckett, 319 South Main Floydada

G. L. Fawver .... Route 5, Floydada, Texas
Robert Kellison .... Route 2, Lockney, Texas
Chester W. Mitchell .... Lockney, Texas
Robert L. Smith .... Lockney, Texas
Ernest Lee Thomas .... Route 1, Floydada, Texas

Hockley County

Z. O. Lincoln, 913 Houston, Levelland

Henry Schmidley .... Route 3, Levelland, Texas
Cecil Pace .... Levelland, Texas
J. J. Hobgood .... Route 2, Anton, Texas
H. C. Janes .... Route 4, Levelland, Texas
Joe W. Cook, Jr. .... Route 1, Ropesville, Texas

Committeemen meet first and third Fridays of each month at 1:30 p. m., 913 Houston, Levelland, Texas.

Lamb County

Mrs. Jane Shipley, Chamber of Commerce Office, Littlefield

J. B. Davis .... Route 1, Amherst, Texas
Elmer McGill .... Olton, Texas
Henry Gilbert .... Sudan, Texas
Price Hamilton .... Earth, Texas
Albert Lockwood, Star Route 2, Littlefield, Texas

Lubbock County

Mrs. Jean Lancaster, 1628-B 15th Lubbock, Texas

Earl Weaver .... Idalou, Texas
Bill Alspaugh .... Box 555, Slaton, Texas
Leroy Johnson .... Shallowater, Texas
Vernice Ford .... 3013 20th St., Lubbock, Texas
Howard Alford .... Route 4, Lubbock, Texas

Committeemen meet first and third Mondays of each month at 2:30 p. m., 1628-B 15th Street, Lubbock, Texas.

Lynn County

Mrs. Jean Lancaster, 1628-B 15th Lubbock, Texas

Frank P. Lisemby, Jr. .... Route 1, Wilson, Texas
Erwin Sander .... Route 1, Wilson, Texas
Lit H. Moore, Jr. .... Route 1, Wilson, Texas
Aubrey Smith .... Route 1, Wilson, Texas
Earl Cummings .... Wilson, Texas

Committeemen meet first and third Tuesdays of each month at 10 a. m., 1628-B 15th Street, Lubbock, Texas.

Parmer County

Aubrey Brock, Bovina

John Gammon .... Friona, Texas
Lee Jones .... R. F. D., Farwell, Texas
Carl Schlenker .... Route 2, Friona, Texas
Dick Rockey .... Route, Friona, Texas
A. B. Wilkinson .... Bovina. Texas

Committee men meet first and third Thursday nights at 8:00 p. m. in Bovina.

Potter County

James W. Walton .... Bushland, Texas
Eldon Plunk .... Route 1, Amarillo, Texas
R. C. Sampson, Jr. .... Bushland, Texas
T. G. Baldwin .... Bushland, Texas
W. J. Hill, Sr. .... Bushland, Texas

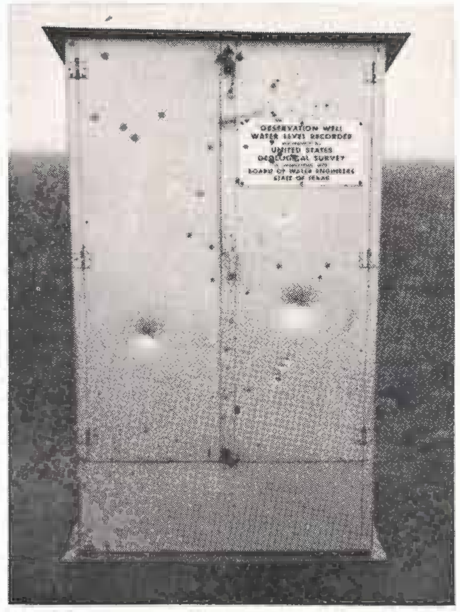
Randall County

Mrs. Eutha Hamblen, Farm Bureau, Canyon

W. A. (Bill) Patke .... Box 423, Canyon, Texas
Leo Artho .... Route 1, Canyon, Texas
L. E. Mason .... Wildorado, Texas
John Butler .... Route 2, Happy, Texas
James B. Dietz .... Route 2, Happy, Texas

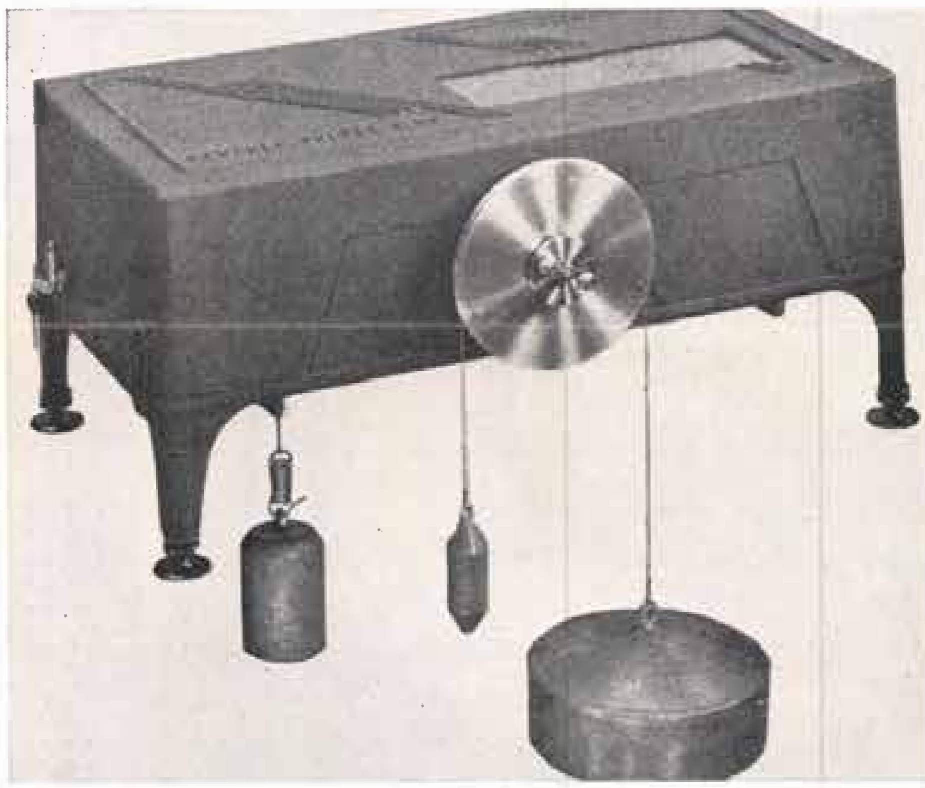
Committeemen meet first Monday night each month at 7:30 p. m., 1710 5th Avenue, Canyon, Texas.

WATER-LEVEL RECORDERS IN

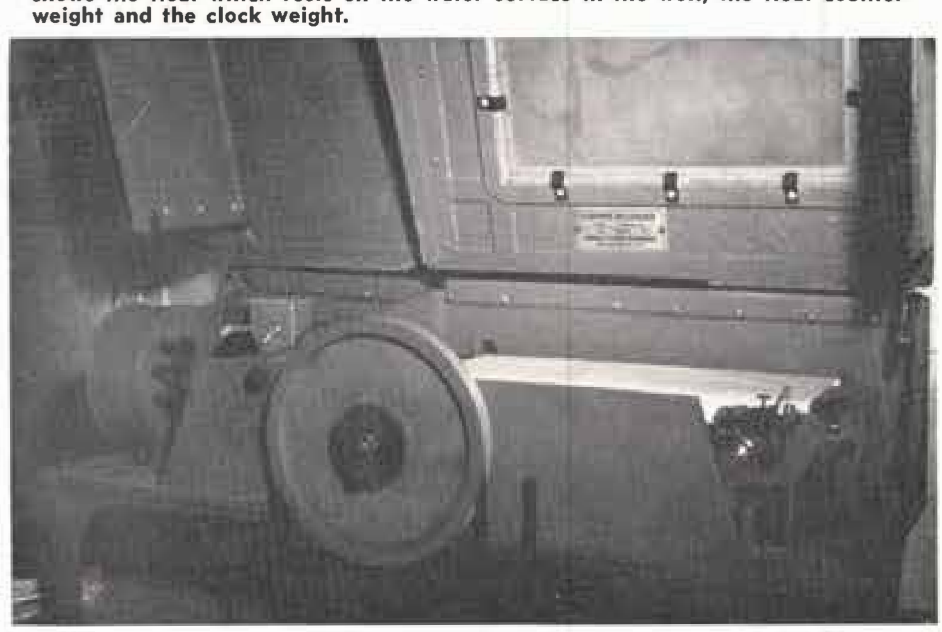


Above is a shelter used to house a very delicate instrument which records the fluctuations of the water level in a well.

Above is pictured a water-level recorder at work. Any slight increase or decrease in the well's water level is recorded by the instrument.



Shown above is an overall view of a model A-35 water-level recorder. The picture shows the float which rests on the water surface in the well, the float counterweight and the clock weight.



The above picture shows a close-up of the inside of a recorder in use. You will note at the right in the picture the pen which records impulses from the float in the well on the graph paper.

HIGH PLAINS WELLS REVEAL IMPORTANT INFORMATION

By W. L. BROADHURST

A simple and accurate method of measuring the decrease of the supply of oil in the crankcase or oil reservoir of an automobile engine is by the use of a slim metal rod. This is done by sticking the clean rod through a hole in the engine block, pulling it out, and looking at the place on the rod that is covered with oil. With a knowledge of the characteristics or capacity of the crankcase it is a simple matter to determine at regular intervals the percentage of the oil supply that has been used. It is generally understood that measuring the oil level while the engine is running or immediately after the engine is stopped does not give an accurate reading of the oil level, but after the engine has been shut off for considerable time and before it is again started, such a measurement gives an accurate check on the oil remaining in the crankcase.

In like manner, a simple and accurate method of measuring the decrease of the supply of water in an underground reservoir is by the use of a slim metal tape. This is done by sticking the tape through a hole in the pump base, pulling it out, and looking at the place on the tape that is covered with water. As with the crankcase, with a knowledge of the characteristics or capacity of the underground reservoir, it is also a simple matter to determine at regular intervals the percentage of the water supply that has been used. Furthermore, all hydrologists understand that measuring the water level in a production well while the pump is running or immediately after the pump is stopped does not give an accurate reading of the static water level, but after a pump has been shut off all winter and before pumping starts in the spring, such measurements in numerous wells gives an accurate check on the water remaining in the underground reservoir.

In order to show conclusively that measurements of water levels each January in several hundred observation wells throughout the High Plains reveal the actual changes in the groundwater supply from year to year, the United States Geological Survey, in cooperation with the Board of Water Engineers, State of Texas, maintains several continuous automatic water-level recorders.

The upper left hand picture on the opposite page shows one of the shelters for the recorders. Although it appears this shelter has been used for a target during rifle practice, we take the opportunity to inform our people that it should not be used as a target because one well placed bullet could seriously damage the instrument and as a result the record would be unnecessarily interrupted. Please do not disturb the shelter or the instrument, because they are in operation to collect valuable records of our supply of underground water.

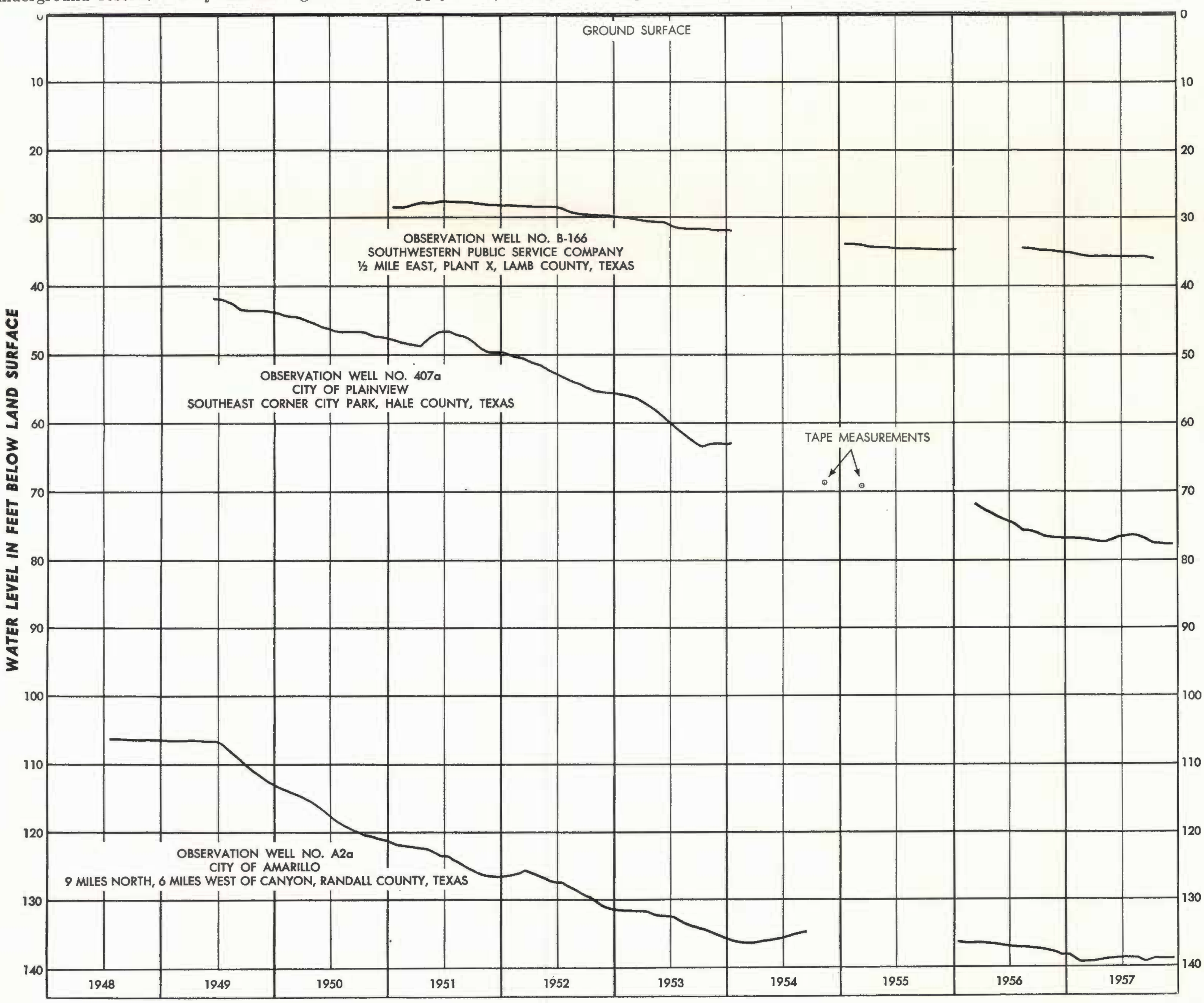
In the center is a picture of the recorder showing the float which rests on the water surface down in the well, the counterewight on the opposite side of the pulley, and the long tape connecting the weight and float. As the water level in the well rises or declines the float moves, the counterweight takes up the slack, and the pulley in turn is connected to an arm holding a pen or pencil whereby the up or down movement of the water is transferred to a roll of paper. The large weight on the left drives a clock which in turn rolls the paper and as a result a continuous line on the paper, which is divided into blocks representing hours and days, represents a continuous record of the water level in the well.

The upper right hand picture shows the recorder inside the shelter with the tape going down into the well.

The bottom picture shows the inside of the recorder with the pen or pencil arm marking the line on the roll of recorder paper.

The illustration below shows in condensed form records of water levels in three wells in the High Plains. These records were taken from the charts of recorders which are maintained by the U. S. Geological Survey in cooperation with the Texas Board of Water Engineers. The wells were drilled and cased specifically for use as observation wells. These wells are

(Continued on Page 4)



DEVELOPMENTS IN COTTON IRRIGATION

By EARNEST L. THAXTON, Assistant Irrigation Engineer, Sub-station No. 8, Texas Agricultural Experiment Station, Lubbock.

A wide range of climatic conditions made 1957 a year of opportunity on the High Plains of Texas. The extremes in weather were not always helpful to the farmer, but to those of us in research, they offered the opportunities necessary to confirm many ideas previously developed and of gathering much valuable data and information concerning the production of cotton under irrigation.

The weather extremes allowed us to compile data pertinent to irrigating alternate furrows as compared to irrigating every furrow; irrigating land plowed on the contour; and irrigating level-bordered land. Contentions were further strengthened that seed variety selection and good water management practices are very important in growing cotton under irrigation.

No difference in yield was noted in irrigating every furrow as compared to alternate furrows where a like amount of water was applied per acre. In this case a 4 acre-inch irrigation was applied to each. In order to apply the same amount of water per acre, it was necessary to run twice as much water down the alternate furrows as was run down every furrow. When the amount of water was cut in half by irrigating every other furrow with a 2 acre-inch application of water the yield was reduced 71 pounds per acre, or 35 pounds of lint per inch of water.

In 1956, a hotter and dryer year, there was an advantage of 29 pounds of lint favoring every furrow irrigation over alternate furrow irrigation. However, there was only a 7.5 pound of lint per inch of water difference between the 2-inch and the 4-inch applications in alternate furrows.

Contour irrigation proved very practical this past year. By planting on top of the bed and thereby maintaining a good furrow all season, no difficulty was encountered in irrigating furrows with .2 fall per hundred feet. Previous tests planted in the furrow with only .1 fall per hundred feet spilled water over the bed sideways at sharp turns. No damage was caused to the contoured bed by rainfall up to 3-inches, and seed emergence was not prevented as it was in normal furrow planting.

Much of the land in the High Plains could be better irrigated on the contour than is now being done with furrows running straight down 3 to 4 percent slopes. By contouring slopes and planting on the bed instead of in the furrow a large part of the rainfall, now lost as runoff, could be saved. Also, irrigation water distribution efficiency would be bettered.

EARNEST L. THAXTON

Level borders proved to be more efficient than the contour furrows. Yields of over one bale per acre, 516 pounds, were obtained on plots where no irrigation water was applied. The 12-inches of rain in late April, May and early June proved sufficient to double the yield of other dryland plots which were not in level borders. Level bordered plots with a preplanting irrigation and one summer irrigation at time of peak bloom yielded 1-1/2 bales per acre, or 1/2 bale more than the contour irrigation study.

Choice of seed variety proved to be quite important this past year in an irrigation water management study, especially when a 26-78-0 fertilizer application was made. You will note in the accompanying table, where the supply of water was kept to a minimum the yield was increased on the late and medium maturing varieties but decreased on the early determinate variety. As the water supply was increased, fertilizer tended to increase yields on the early and medium varieties but either did not effect the yield on the late variety or lowered it. There was a definite tendency in 1957 toward lower grades and a lower micronaire rating on plots receiving summer irrigation. Those maintained at a high moisture level were either near or below the point that the trade accepts as desirable. Micronaire ratings less than 3.5 normally indicates immature fiber, and will probably sell at a discount in the future.

The outstanding water management procedure was that of only one summer irrigation at the time of highest bloom rate. This treatment, Number 7 in the table, yielded almost as well as did the highest moisture level, with 12-inches less water, and produced a fiber of acceptable staple and micronaire qualities. The micronaire rating was well above those of the highest yielding moisture treatment on both the fertilized and unfertilized plots.

In summary, we would conclude that soil preparation, water management and seed variety all play a definitely important role in the economics of producing irrigated cotton in the High Plains of Texas.

EFFECT OF MOISTURE AND FERTILIZER LEVEL ON YIELD AND FIBER OF THREE COTTONS DIFFERING IN FRUITING HABIT

*Moisture Level**	*Variety***	*Lint Per Acre, Lbs.* 26-78-0	0-0-0	*Micronaire* 26-78-0	0-0-0
1. Dryland	L	592	467	4.5	5.0
	B	558	516	3.6	3.8
	P	485	491	4.1	4.1
2. 4-inch Preplant	L	654	615	5.0	4.9
	B	618	573	3.6	3.7
	P	586	543	4.0	4.5
3. 8-inch Preplant	L	569	457	4.8	4.7
	B	559	584	3.9	3.8
	P	597	542	4.6	4.7
4. Maintained 25%	L	803	772	3.4	3.9
	B	694	713	2.9	3.4
	P	838	780	3.2	3.5
5. Maintained 50%	L	845	805	3.8	3.5
	B	701	741	2.8	3.2
	P	763	834	3.6	3.4
6. Maintained 50%	L	838	715	3.7	3.5
	B	712	716	3.2	3.4
	P	821	799	3.5	3.6
7. One Summer	L	677	799	4.0	4.0
	B	786	766	3.4	3.6
	P	793	692	4.0	3.9

*Moisture level treatments were as follows:

1. Precipitation totalled 22.81 inches.
2. 4-inch preplanting was designed to wet soil profile to a depth of 3 feet. Total irrigation and rainfall—26.81 inches.
3. 8-inch preplanting was designed to wet soil profile to a depth of 6 feet. Total irrigation and rainfall—30.81 inches.
4. 8-inch preplanting irrigation and maintained 25 percent available moisture to August 25. Applied 16-inches of irrigation water. Total irrigation and rainfall—38.81 inches.
5. 8-inch preplanting irrigation and maintained 50 percent available moisture to August 25. Total irrigation and rainfall—38.81 inches.
6. Same as treatment No. 5 except first summer irrigation was applied before bloom. Total irrigation and rainfall—38.81 inches.
7. 8-inch preplanting irrigation and one summer irrigation at peak bloom. Total irrigation and rainfall—34.81 inches.

**Seed varieties are as follows:
"L"—A medium maturing cotton.
"B"—A late maturing cotton.
"P"—An early maturing cotton.

Recorders Reveal—

(Continued from Page 3)

not equipped with pumps and no water has been taken from them. Nevertheless, they do show the general decline of the water table caused by pumping from production wells in the surrounding areas.

The records obtained from the automatic water-level recorders show conclusively that measurements made in January of each year with a steel tape show a true picture of the annual change in water levels in wells, just as a check of the oil level in your automobile engine each time you fill up with gasoline shows a true picture of your oil supply in your engine.

For more detailed information regarding these or other water-level recorder records or the recorders themselves, we suggest that you contact Mr. R. W. Sundstrom, District Engineer, U. S. Geological Survey, 807 Brazos Street, Austin, Texas, or Mr. J. G. Cronin, Engineer in charge of the cooperative program at Plainview.

Please Close Those Abandoned Wells!!!

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

Second Class Permit

THE Cross SECTION

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

Volume 4—No. 10 "THERE IS NO SUBSTITUTE FOR WATER" March 1958

Principal In Request For Depletion Of Underground Water Visits High Plains

Joe R. Greenhill, Associate Justice of the Texas Supreme Court, visited in several High Plains counties March 13, 14 and 15.

Before being appointed to the Texas Supreme Court, Judge Greenhill was a practicing attorney in Austin and was considered to be one of the State's most outstanding lawyers in matters involving water and mineral rights. He worked on several projects for the High Plains Water District, one of which was a request presented to the Internal Revenue Service for an income-tax deduction for the depletion of undeground water used to produce income. The request is at the present time pending before the IRS, and even though Judge Greenhill may no longer participate in the project, he played an important part in the original presentation.

Judge Greenhill has written many papers concerning various phases of the water problems from a legal aspect. Probably the best known of his papers is the one co-authored with Thomas Gee, Austin attorney, which deals with the ownership of underground water.

We of the High Plains area are very fortunate to have a friend who is sympathetic to our problems in such an important position as Associate Justice of the Supreme Court of Texas.

Salt-Water Conversion Is Theme Of Bills

During the first two months of Congressional activity in 1958, two separate bills have been submitted to the Senate which propose a $10 million expenditure for the construction of a full-scale demonstration plant for the production of fresh water from brackish water and sea water.

Senator Case of South Dakota and Senator Anderson of New Mexico has each submitted a bill which would set up experimental de-salting projects. The proposed pilot plants would not only deal with problems of de-salting sea water but would also study those of improving quality of alkaline and brackish waters.

Further experimental work will possibly reduce the cost of de-salting sea water to a figure at least comparable to the present maximum cost for fresh water. When this becomes a reality, the economic ramifications of such a development will be far reaching.

Several methods have been successfully used to extract salt from saline waters; however, at present, the cost in each method is prohibitive to users of municipal, industrial and agricultural water.

Pictured second from left, with members of the Floyd County Committee of the High Plains Underground Water Conservation District, is Judge Joe R. Greenhill, Associate Justice of the Texas Supreme Court. Judge Greenhill recently visited with the Committee and others in the southern High Plains area. Committee members are, left to right, G. L. Fawver, Robert Kellison, Ernest Lee Thomas and Chester Mitchell. Robert L. Smith, other member of the Committee, was not present at the meeting.

J. B. Knox, Secretary Of Cochran County Committee Claimed By Death March 18

Report Of 1957 Rainfall

The U. S. Weather Bureau recently published precipitation data for 1957 for the State of Texas. Total annual amounts and departures from the long-term station average for several Southern High Plains stations are shown below. — Denotes below average.

Station	1957	Departure From Average
Abernathy	29.41	—
Amarillo	21.24	.12
Brownfield	24.31	—
Canyon	23.76	3.83
Claude	27.34	6.93
Crosbyton	27.05	5.88
Dimmitt	21.14	2.14
Floydada, 2SW	30.33	—
Friona	14.97	—1.26
Hale Center	22.50	—
Hart	20.08	—
Hereford	15.70	—3.94
Littlefield	22.79	5.04
Lorenzo	24.97	—
Lubbock	24.56	5.67
Morton	16.67	—
Muleshoe	22.51	4.06
Plains	22.11	—
Plainview	27.02	5.74
Post	31.14	10.71
Silverton	28.15	—
Slaton, 5SE	26.88	—
Tahoka	30.28	9.46
Tulia	24.91	2.71
Umbarger	19.33	—
Vega	19.40	—1.05

J. B. Knox, Secretary for the Cochran County Committee of the High Plains Water District, died March 18 at the age of 78 years. He had lived in the Morton area since 1922.

Mr. Knox and his wife, who preceded him in death in June 1956, moved to Morton from Waco. They celebrated their golden wedding anniversary on March 6, 1955.

When arriving in Cochran County from central Texas, Mr. Knox began farming south of Morton. In 1935 he was elected Cochran County Clerk and served in that capacity for 12 years. Since then, he has been a partner in the Western Abstract Company of Morton.

Mr. Knox was a member of the Methodist Church. He also was a Mason and a charter member of the Morton Lions Club.

Cochran County residents and others of the Texas plains area will miss J. B. Knox.

STATISTICS FOR JANUARY AND FEBRUARY

During the month of January, 50 new wells were drilled and registered with the District office; 7 replacement wells were drilled; and 4 wells were drilled that were either dry or nonproductive for other reasons. There were 132 permits issued by the County Committees.

In February, 86 new wells were drilled and registered with the District office; 9 replacement wells were drilled; and 3 wells were drilled that were either dry or non-productive for other reasons. There were 151 permits issued in February.

The new permits issued and completed wells follow by counties:

County	Permits Issued		New Wells Drilled		Replacement Wells		Old Wells Deepened		Dry Holes Drilled	
	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.	Jan.	Feb.
Armstrong	0	0	0	0	0	0	0	0	0	0
Bailey	10	2	8	3	0	0	0	0	0	0
Castro	7	10	4	4	0	0	0	0	0	0
Cochran	7	1	1	14	0	0	0	0	0	0
Deaf Smith	20	18	3	7	1	1	0	0	0	0
Floyd	9	23	5	9	0	1	0	0	0	0
Hockley	31	37	5	19	0	2	0	0	1	2
Lamb	8	16	3	5	0	1	0	0	1	0
Lubbock	15	17	6	11	1	0	0	0	0	0
Lynn	12	11	4	4	0	0	0	0	1	1
Parmer	13	13	10	6	5	4	0	0	1	0
Potter	0	0	0	0	0	0	0	0	0	0
Randall	0	3	1	4	0	0	0	0	0	0

EDITOR
THE CROSS SECTION
1628-B 15th Street
Lubbock, Texas

Dear Sir:

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

Name__________

Street Address__________

City and State__________

(Please cut out and mail to our address)

MEASUREMENTS SHOW WATER TABLE CHANGES IN OBSE

EDITOR'S NOTE

Below are shown official water-level measurements for a majority of the observation wells in the Southern High Plains of Texas which the U. S. Geological Survey measures each year in cooperation with the State Board of Water Engineers. The map on the opposite page gives the locations of the observation wells together with identifying well numbers.

Many of the wells listed have a long-time record of water-level changes even though we are only listing the last three years measurements. These measurements are made in January each year prior to the beginning of pumping for pre-planting irrigation. The figures are in feet below land-surface datum.

All water-level measurements are on record in the office of the Texas Board of Water Engineers, Austin and the U. S. Geological Survey, Austin.

ARMSTRONG COUNTY

Well No.	1956	1957	1958
463	153.90	159.47	157.64
464	170.05	175.11	171.16
465	114.48	117.90	116.58
467	155.07	155.92	155.65
468	132.37	133.41	133.22

BAILEY COUNTY

Well No.	1956	1957	1958
1a	105.87	—	—
2a	102.31	105.76	108.08
3b	—	63.00	65.94
9	69.20	70.39	73.34
11a	—	51.79	54.29
21b	—	55.84	61.56
25	50.80	53.86	57.29
31	40.14	45.58	46.89
33	59.53	65.16	71.29
36	44.52	48.51	50.51
45	—	48.46	47.55
49	45.09	48.48	51.70
53	54.03	56.12	58.44
62	66.17	66.08	68.78
63	59.65	—	66.65
66a	—	65.59	65.75
67	60.08	64.79	65.31
69	49.68	52.49	56.22
95	—	55.29	57.04
116a	53.17	57.14	59.75
117	61.23	—	—
130a	—	52.79	55.60
131	48.88	53.59	56.09
132	—	54.00	56.95
135	39.01	43.24	46.26
137	35.54	39.30	43.18
141	31.57	37.09	40.22
205a	69.71	72.07	73.21
207	88.12	88.59	88.71
450	34.34	35.53	36.33
495	—	87.38	—
573	—	25.55	27.32
809	78.47	80.58	—
811	93.09	98.06	98.07
815	52.76	52.01	—

BRISCOE COUNTY

Well No.	1956	1957	1958
107	88.67	89.03	89.37
119	112.34	121.29	120.72
122	—	107.47	106.99
134	102.00	105.67	107.77
148	107.23	103.93	101.74
159	114.67	119.40	123.10
168	110.10	116.17	119.43
170	114.55	116.71	119.58
217	132.38	—	—
227	89.60	91.18	84.29
234	119.14	124.49	—
253	90.19	102.70	101.81
255	104.03	111.98	112.83
256	93.40	97.24	97.74
257	175.41	180.49	180.09

CASTRO COUNTY

Well No.	1956	1957	1958
8	95.65	103.26	105.24
20	94.77	101.03	103.74
32	86.36	92.34	93.64
36	117.46	123.55	126.44
40	98.51	—	—
48	78.87	91.29	83.20
52	106.91	103.06	102.79
53	95.66	99.18	101.37
57a	110.79	117.59	118.43
58a	165.64	169.03	172.28
201	167.40	176.19	178.67
202	111.43	112.77	116.45
202a	162.15	167.48	169.89
278a	176.22	181.07	183.29
330a	137.90	—	—
394	114.22	—	121.53
410b	96.62	98.75	102.94
465	112.05	—	—
465a	111.99	116.71	—
508	97.55	103.59	105.54
524a	96.23	—	104.06
528a	111.26	116.30	117.62
529	—	111.58	114.82
544a	—	122.16	125.87
601	125.60	130.54	134.58
602	130.28	124.35	127.92
604	169.85	183.03	186.36
605	154.34	167.38	169.42
606	175.92	179.96	183.26
608	118.83	120.95	124.70
611	96.74	101.98	—

COCHRAN COUNTY

Well No.	1956	1957	1958
F-1	118.56	122.36	125.48
F-2	125.23	131.08	134.93
F-3	139.97	144.94	150.62
F-4	132.41	—	140.08
1	148.80	149.80	148.80
5	132.00	137.80	137.88
12	140.90	144.72	147.24
13	121.70	122.80	124.34
15	106.05	101.73	103.10
16	102.45	103.91	104.97
19	126.20	128.66	131.27
20	118.32	119.70	120.68
21	146.28	156.15	157.08
22	147.37	149.38	151.90
23	123.50	124.77	126.53
24	149.17	150.97	152.88
25	129.15	132.48	135.56
26	121.05	124.80	128.20
27	142.00	142.66	142.60
28	138.55	139.74	141.22
29	84.16	85.84	87.36
30	140.02	141.77	143.40
31	125.54	126.45	126.40
32	93.72	96.38	96.22
33	103.50	106.62	109.25
34	169.17	169.70	169.25
36	88.85	90.54	91.73
37	128.50	131.12	133.73
38	174.65	177.12	179.79
39	156.78	160.35	163.21
40	120.88	119.10	119.22
41	106.75	109.91	113.63
42	125.30	127.75	131.04
44	97.97	103.97	110.93
45	139.50	137.90	140.25
46	142.65	145.13	147.15
47	120.58	120.63	121.09
48	119.65	123.53	127.25
49	164.50	168.40	169.51
50	178.38	175.73	176.08

CROSBY COUNTY

Well No.	1956	1957	1958
1	—	144.07	148.48
4	201.23	—	208.17
7	—	—	150.53
7b	178.48	190.61	191.92
8	122.33	125.97	138.39
10b	135.27	—	152.55
11b	127.06	132.81	135.64
11c	139.13	149.04	154.72
12b	154.88	168.40	172.92
13a	127.24	134.88	143.03
14	132.92	140.10	144.03
17a	136.25	141.91	149.14
21a	139.22	145.01	149.50
23b	148.45	153.85	155.74
340a	—	149.00	147.23
401b	—	104.47	126.41
415a	94.62	—	100.79
G-6	—	—	195.95
G-7	—	—	190.97
G-8	—	—	183.37
G-9	—	—	210.59

DEAF SMITH COUNTY

Well No.	1956	1957	1958
44a	181.75	188.30	185.06
113a	122.20	125.03	126.54
130a	—	158.64	163.02
134	—	166.67	169.38
140a	—	181.56	178.59
193	131.60	136.83	—
201	124.37	127.20	132.27
205	122.27	120.58	125.73
207	81.68	84.82	87.98
212	99.50	105.25	113.66
216	81.72	85.02	88.42
217	106.92	123.34	115.54
219	—	108.64	104.56
220	104.88	109.80	119.09
224	78.40	86.96	89.66
226	89.70	90.80	100.56
230	64.23	66.40	65.67
234	58.19	59.00	57.22
235	66.22	—	70.14
236	70.00	80.56	—
241	—	68.45	67.07
245	—	74.10	68.40
247	—	48.80	45.82
258	—	93.78	—
261	82.90	87.30	88.75
272	108.96	117.79	121.77
281b	120.89	127.80	124.74
283	—	95.60	93.45
288	104.35	112.32	119.11
302	68.29	73.20	73.37
305	117.57	124.72	132.21
311	71.60	78.65	80.97
315	83.11	89.44	87.28
322	105.17	100.18	114.32
326	128.88	135.05	138.25
331	107.54	110.60	115.54
336	118.79	123.85	127.21
340	107.10	—	—
342	—	121.20	121.45
394	92.95	95.01	96.04
431	89.01	93.34	—
459a	139.77	138.80	137.18
486	111.54	121.90	112.79
502	239.40	147.10	147.27
506a	96.4	—	103.19
513a	99.40	102.74	106.83
514	132.22	143.10	154.71
546	—	140.56	143.75
558	72.90	84.00	—
566	197.13	201.00	206.49
919	106.40	108.29	112.76
934	124.90	128.76	130.15

FLOYD COUNTY

Well No.	1956	1957	1958
5	81.17	85.57	88.74
5a	74.79	80.50	83.36
20	112.59	118.70	130.18
21a	—	116.30	118.27
32	123.36	129.60	137.16
42	105.93	114.44	114.10
55	100.48	—	—
56	92.40	94.63	—
57	102.43	108.84	115.86
106	—	—	123.20
108	—	129.05	—
110	122.72	125.94	132.22
111	104.81	—	109.16
120	—	—	145.29
138	—	138.39	137.81
139	—	133.07	138.76
140	116.14	123.67	135.65
143	121.05	133.74	136.02
157	113.56	120.05	128.60
161	123.42	131.84	—
185	115.53	127.90	129.68
216	203.59	—	216.10
263	112.00	119.93	121.92
264	91.65	94.65	98.59
265	112.51	117.86	120.65
315a	235.78	235.80	235.95
326	156.77	165.89	167.20
410a	114.28	121.00	126.28
414	129.05	—	138.16
416	132.67	137.74	138.52
420	—	—	144.79
421	131.43	137.40	138.95
428	120.24	—	128.58
435	136.75	145.24	146.53
448	130.03	139.08	141.11
463	119.43	125.40	128.57
467	97.06	104.88	108.25
472	116.82	125.57	126.10
486	—	39.28	38.27
502	110.65	—	114.88
510	102.44	102.77	107.02
511	115.43	126.76	124.55
519a	120.18	129.80	128.00
523	130.05	139.31	141.25
529	111.25	113.55	—
542	115.06	—	131.49
546	111.09	127.16	126.97
554	108.66	—	—
562a	160.13	—	158.44
610a	—	237.82	229.72
610b	—	236.08	225.82
612	166.93	—	174.10
627	109.22	112.80	123.44
630	140.18	144.28	149.30
652	129.81	131.55	133.04
701	123.35	132.00	130.90
704	130.21	—	138.92
720	109.14	121.30	123.15
726	95.98	105.01	111.70
727	—	127.10	124.35
728	—	130.89	130.80
729	108.16	119.83	119.94
730	152.69	—	158.38

HALE COUNTY

Well No.	1956	1957	1958
31a	90.10	95.98	100.20
36	115.62	—	126.07
40a	—	116.39	123.62
70	93.33	94.49	100.80
81	—	95.60	102.51
86	111.85	119.70	125.50
93	118.43	123.07	129.68
103	74.37	78.10	84.05
105	84.97	92.49	93.92
124b	111.33	121.00	119.98
138	—	77.72	87.65
154	94.15	105.45	—
159	96.55	104.55	107.11
163	—	94.52	98.84
202	109.65	115.42	118.88
206	107.69	118.28	117.15
212	94.05	98.94	101.92
220	94.90	101.20	102.09
225	100.12	106.37	114.15
238	92.90	107.23	113.49
241	—	102.69	103.47
285	—	102.37	106.57
305	107.50	110.79	114.25
314a	87.36	94.74	91.48
316	—	89.13	91.62
317a	—	89.35	91.02
323	97.94	103.78	106.08
330a	90.70	94.12	97.31
331	88.87	95.27	95.84
334	99.72	98.54	101.73
338	81.53	87.95	92.84
370	91.13	94.89	97.10
389	97.55	105.24	107.92
427	99.18	106.58	109.07
435	—	105.50	—
436	112.36	115.47	117.48
449	105.83	114.87	123.16
454	116.39	121.65	126.02
467	62.30	65.94	69.24
511	—	78.34	81.15
539	107.41	121.40	119.35
546	99.35	106.47	115.29
547a	103.45	108.50	113.76
553	98.15	111.80	112.14
564	—	112.94	113.56
569	72.26	80.13	85.49
641	99.16	105.87	110.00
661	—	107.72	108.83
704a	100.12	122.14	108.64
714	109.06	121.10	117.43
719c	103.53	116.10	119.24
724	122.12	127.73	130.39
798	—	118.78	122.18
816	74.47	81.68	82.41
824a	85.43	90.41	106.27
825a	99.53	104.12	106.40
829	100.26	110.00	107.67
834a	123.88	132.06	135.17
840	87.54	92.95	—
848	116.00	122.85	—
852a	148.63	152.90	155.18
859	110.25	117.80	121.37
906a	66.30	67.79	69.33
923	76.97	83.90	87.83
929a	68.14	74.56	76.84
942	88.45	95.80	96.58
958	—	90.80	93.38
964	—	110.16	114.00
978	120.00	130.26	131.38
1223	92.02	101.68	104.39
1231	—	101.38	102.61
1336	91.85	97.09	99.48
1358	102.71	108.75	109.60
1403	86.31	93.60	103.18
1417	99.14	104.67	111.13
1430	80.99	86.73	90.48
1433	—	115.57	—
1436	105.82	122.04	115.16
1604	96.84	—	108.04
1811	115.84	128.15	126.93
1921	101.42	105.75	110.11
1957	107.95	120.00	118.49
A-59	108.73	121.32	117.52
C-14	84.68	89.43	—
K-50	85.64	95.20	101.76
N-65	76.73	80.47	82.88
P-71	96.52	100.37	103.38
R-36	115.33	123.10	127.64
V-25	86.90	90.80	93.31
V-58	101.54	106.35	109.42
Y-36	62.88	70.74	75.10
Y-38	60.47	66.85	66.65
CC-31	121.40	138.00	140.88
DD-68	86.53	94.20	—
DD-101	110.10	121.22	119.11
FF-78	98.33	101.80	104.52
GG-32	106.22	111.10	116.08
HH-9	128.58	133.45	135.72
HH-107	116.85	121.15	127.50
HH-108	77.39	83.49	90.28
JJ-50	123.07	127.16	130.18
LL-35	107.95	115.54	121.88
LL-80	127.04	136.25	147.60
MM-104	121.07	132.14	135.17

HOCKLEY COUNTY

Well No.	1956	1957	1958
F-2	132.81	132.60	135.51
F-7	90.48	95.68	96.22
5a	94.45	95.13	—
24	37.25	42.03	41.50
25a	39.38	40.90	41.22
28	58.00	58.22	58.53
247a	121.86	126.95	147.59
263b	138.36	144.46	148.84
403a	66.98	65.75	67.03
429b	125.67	128.26	131.12
434	172.99	172.77	174.20
434a	158.85	165.40	174.39
434b	—	126.08	127.18
443a	94.00	97.88	106.64
443b	51.08	54.85	55.02
444	74.96	79.08	80.37
447a	70.40	73.46	92.11
452	90.12	96.46	101.67
453a	83.64	81.84	89.09
453a	91.17	93.29	95.81
458	108.15	111.24	114.86
458a	81.30	86.37	89.62
528a	163.80	168.68	171.96
576	108.03	113.15	115.85
587a	134.96	141.02	147.70
662a	110.07	116.08	121.50
717	108.25	110.45	111.80

LAMB COUNTY

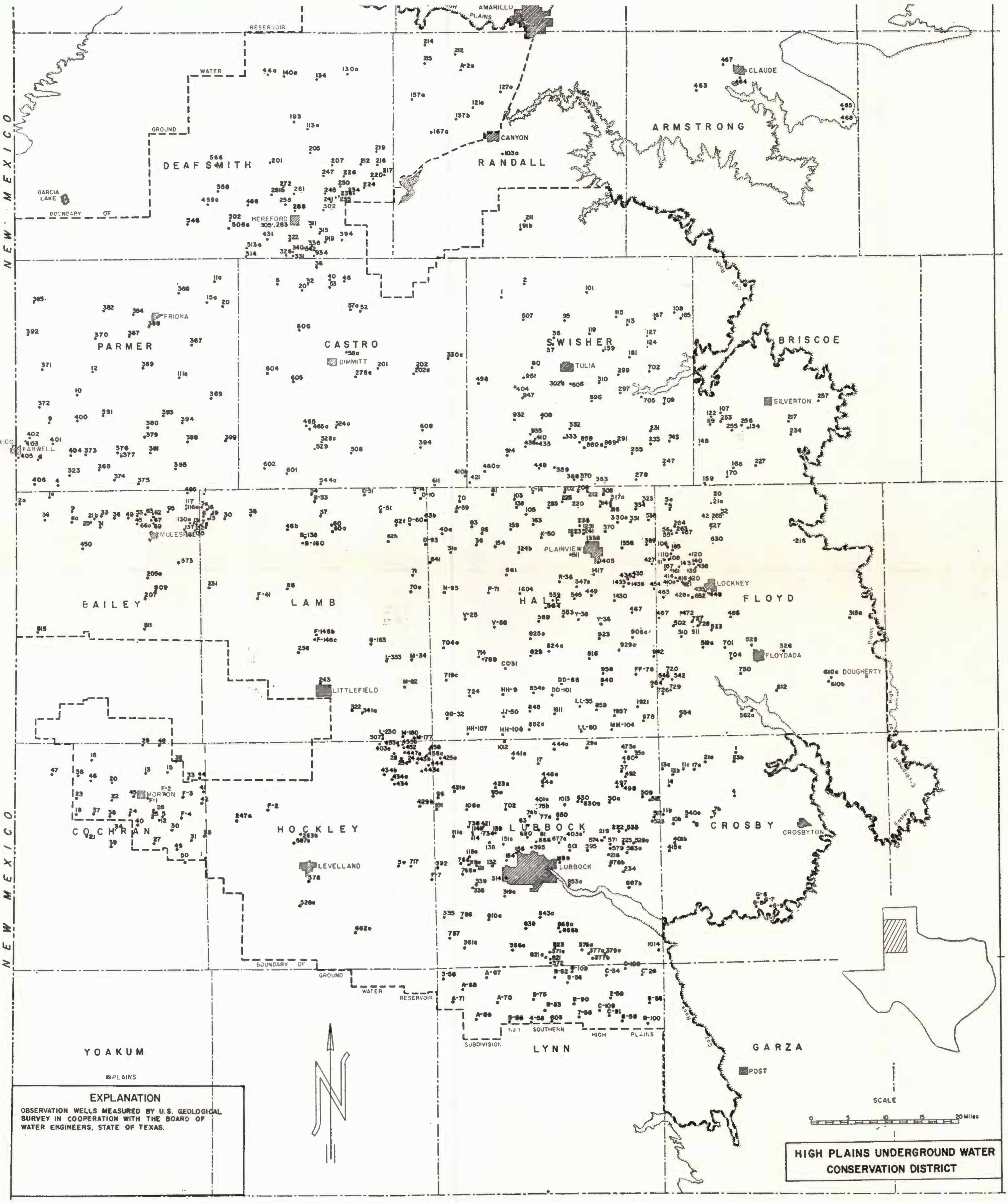
Well No.	1956	1957	1958
1	90.11	93.65	98.79
3a	56.67	61.59	—
6	50.40	54.59	58.71
7	43.91	48.78	53.98
8	42.45	48.38	51.91
13	52.87	58.06	62.36
16	64.40	67.61	71.52
19	50.25	54.79	—
30	51.10	57.40	58.30
38	56.97	60.01	62.79
46b	51.08	55.07	57.15
54	111.99	116.27	120.48
57	114.40	117.98	123.13
60	93.85	98.25	105.83
60a	73.44	—	—
62f	124.07	131.73	134.88
62h	114.57	120.62	122.64
63b	126.80	131.91	140.04
70a	76.10	78.91	79.95
71	82.60	89.73	90.43
88	43.26	—	44.36
231	101.03	104.60	109.59
236	87.50	89.20	91.30
243	—	80.13	81.68
307	62.93	63.25	65.61
322	69.04	72.58	75.25
341a	76.07	81.71	86.99
B-33	115.53	120.17	124.63
B-138	56.81	66.58	72.54
B-160	—	64.56	66.59
C-31	103.15	107.78	110.34
C-51	124.13	129.55	132.36
D-10	92.35	111.27	105.94
D-14	103.93	—	111.74
D-60	108.31	113.27	119.42
D-93	124.55	130.24	133.33
F-41	46.74	50.98	44.90
F-146b	70.46	73.04	75.50
F-146c	99.46	103.39	106.59
G-163	108.00	114.93	115.34
L-230	59.34	62.59	63.20
L-333	122.05	126.23	—
M-34	106.82	111.13	111.95
M-82	124.78	129.89	140.49
M-177	114.25	117.23	118.56
M-180	105.55	108.18	110.39

LUBBOCK COUNTY

Well No.	1956	1957	1958
17	134.55	139.45	141.05
29a	129.02	135.25	141.75
35a	124.4	—	137.30
37	113.03	113.67	117.90
50a	114.62	121.53	126.90
64a	119.65	121.21	123.62
74b	43.32	47.86	49.08
75b	99.92	103.92	106.87
77a	98.87	102.96	107.25
81	59.32	62.32	64.09
83	64.66	67.7	69.70
95a	118.40	121.20	122.40
99	45.86	55.02	53.52
101	103.95	107.71	108.70
106a	58.42	63.50	65.03
111a	119.42	123.08	125.12
114	89.25	91.83	94.30
114b	86.38	88.20	86.30
118a	124.69	129.60	131.35
119a	121.59	126.00	—
121	119.61	124.67	127.16
132	92.30	96.85	95.53
138	70.20	76.06	73.60
139	51.91	55.44	53.87
151a	71.80	77.94	76.28
154	76.63	—	72.44
156	76.88	79.75	77.45
188	90.12	92.33	92.63
216	76.89	79.75	81.16
219	71.58	75.07	75.88
222	83.60	96.17	100.75
223	50.76	53.47	53.17
234a	73.75	76.28	75.23
314	60.26	61.29	62.19
319a	106.12	108.70	108.93
335	107.52	111.74	112.30
338	104.70	107.45	107.36
339	97.13	99.63	100.66
361a	99.93	104.66	101.01
366a	98.70	106.08	99.90
371a	119.98	122.20	122.35
372	121.14	125.87	126.88
376a	110.66	112.95	113.57
377a	107.12	110.98	111.78
377b	109.85	113.95	115.68
379c	98.58	101.43	102.27
392	109.00	109.88	110.08
395	68.46	72.00	72.70
401a	101.8	106.72	110.30
403a	65.82	69.78	72.88
421	68.39	69.52	69.66
423a	119.59	122.88	124.09
425a	99.45	102.57	104.10
431a	114.68	118.72	120.96
441a	152.11	156.72	158.52
444a	146.16	153.95	152.45
448a	133.4	136.43	139.40
473a	125.73	132.00	138.30
490	127.60	133.52	136.96
492	107.31	113.00	117.06
497	—	131.20	135.95
498	124.25	129.79	134.70
509	116.05	131.94	127.00
515	122.55	131.34	—

(Continued on Page 4)

RVATION WELLS THROUGHOUT SOUTHERN HIGH PLAINS



ALEX H. DARICEK

This month "The Cross Section" presents another member of the Board of Directors of the High Plains Underground Water Conservation District—Mr. Alex H. Daricek, Director of Precinct No. 3.

Precinct No. 3 of the High Plains Underground Water Conservation District is composed of Bailey, Castro and Parmer Counties and is represented on the Board of Directors by Alex H. Daricek of Maple, Texas. Maple is in the southern part of Bailey County.

Mr. Daricek was born in Chicago, Illinois on August 10, 1901 to Mr. and Mrs. Frank J. Daricek. The elder Mr. Daricek was a machinist by trade.

In 1904, the family moved to Frederick, Oklahoma and purchased an 80-acre farm. Mr. Daricek attended public schools in the Oklahoma towns of Chattanooga and Tishimingo.

In 1918, Mr. Daricek went to work in the oil fields near Electra, Texas. There he transported fuel, by wagon and team, which was used to operate oil well pump jacks.

When moving to Weatherford, Texas in 1919, Mr. Daricek met and married Miss Cliffie Campbell. They farmed at Weatherford for two years before moving to Corsicana where Mr. Daricek opened an automotive garage.

Two children were born into the Daricek family by this time—Afton, a daughter and Jimmy, a younger son.

In 1926, the Daricaks moved to a small town near Vernon, Texas named Greyback. Mr. Daricek operated a garage there until 1928 when he rented his business to a friend and was employed by the W. T. Wagner Refining Company to manage a casing-head gasoline plant at Greyback.

In 1930, the Dariceks sold their interests in Greyback and moved to Bailey County where they bought a 160-acre tract of land located 2 miles west of Maple. They still maintain their home on this farm.

Only 65 acres could be cleared and broken out for farming the first year; however with hard work and much determination, by 1939 Mr. Daricek had increased his farming operation to include the 160 acres west of his home place. Then, in 1942, he bought the 160-acre farm that joined him on the east.

In the spring of 1946, Mr. Daricek drilled his first irrigation well, which was also south Bailey County's first well. The well produced about one-third of an 8-inch pipe of water. The first year he irrigated 40 acres of cotton with the well—the 40 acres grossed $6,000. He grossed $6,600 that same year on 250 acres of dryland cotton. The results of this first encounter with irrigation showed other farmers in the community what the underground water could mean economically to them; so the struggle to find a suitable supply on their farms was begun. Mr. Daricek now has three wells with which he irrigates his 480 acres of land. He has plans for another well to be drilled in the near future which will be a combination production and recharge well capable of draining a wet-weather lake which covers about 30 acres of his land.

Aside from being a capable farmer, Mr. Daricek is possessed with inventive abilities. In the early 1940's he invented a farm implement designed to break the hard top crust which covers a seed bed after most spring rains. The implement was patented in 1956 and is being produced by Mr. Daricek in a modern well-equipped machine shop on his farm.

Mr. Daricek is a member of the Maple Baptist Church; the Muleshoe Chamber of Commerce; the Bailey County Farm Bureau; he is Chairman of the Board of Directors of the Maple Cooperative Gin; and is Senior Warden in the Morton Masonic Lodge and plans to take the 32nd degree Scottish Rite work this spring in El Paso.

Mr. Daricek is an avid fisherman. He also enjoys taking pictures of his seven grandchildren with his 8mm movie camera.

As Secretary of the Board of Directors of the High Plains Underground Water Conservation District, Mr. Daricek contributes much in beneficial service to the people of his precinct.

WATER LEVELS, Continued from Page 2—

517	131.64	142.78	145.15
523	115.80	116.50	124.00
528a	84.03	87.38	89.44
533	103.70	112.01	117.20
571	68.49	72.64	72.65
574	76.98	80.06	82.88
579	70.50	74.52	74.82
583a	63.05	65.06	66.74
595	83.33	86.06	87.15
601	84.18	86.16	87.51
630	105.96	115.47	119.74
630a	104.34	116.44	120.25
650	98.67	103.77	107.90
666	74.10	77.40	78.02
677a	85.08	87.58	88.78
690	69.93	74.26	75.81
702	102.32	104.75	107.27
734	76.53	77.45	78.78
736	73.58	77.20	79.32
766	118.85	——	122.50
766a	121.35	122.53	123.52
786	133.53	135.24	135.12
787	107.22	108.82	109.41
810a	117.34	120.11	121.57
821	119.40	122.80	——
821a	118.89	122.07	122.48
823	121.60	124.48	124.48
839	106.73	109.34	109.73
843a	99.79	103.09	103.46
853a	54.45	53.56	53.24
868a	103.29	107.41	107.41
868b	113.90	117.68	118.90
878b	72.95	76.35	78.20
887b	83.46	84.36	85.36
1012	107.45	112.35	113.79
1013	103.78	111.04	115.60
1014	167.16	178.5	182.60

LYNN COUNTY

Well No.	1956	1957	1958
A-67	——	90.72	93.17
A-68	——	108.16	107.78
A-69	——	82.41	85.86
A-70	——	81.30	70.45
A-71	——	83.25	84.93
B-52	——	117.34	118.65
B-56	——	——	102.52
B-75	——	104.15	106.55
B-83	——	90.15	90.10
B-90	——	77.62	78.04
B-100	——	66.77	72.55
B-109	——	117.66	119.77
C-26	——	——	63.16
C-34	——	39.07	35.51
C-61	——	77.22	78.67
C-108	——	84.26	85.47
C-109	——	74.53	75.00
2-58	——	——	69.35
3-58	——	——	91.58
4-58	——	——	92.29
5-58	——	——	121.13
6-58	——	——	59.65
7-58	——	——	46.55
8-58	——	——	65.84

PARMER COUNTY

Well No.	1956	1957	1958
4	121.36	124.23	127.30
6	159.64	163.12	166.7
9	——	227.66	230.22
10	179.18	183.90	189.38
11a	131.85	134.10	136.31
12	173.81	175.00	174.28
15a	156.88	164.90	171.32
20	127.98	138.20	133.41
111a	185.45	193.60	195.03
323	106.05	——	114.37
366	173.21	170.17	——
367	225.18	230.84	235.74
368	123.17	127.01	132.84
369	153.70	163.96	160.08
370	266.84	274.12	278.00
371	188.90	197.08	198.33
372	225.13	228.35	234.41
373	146.30	149.36	154.51
374	110.70	114.92	117.60
375	94.80	103.46	103.99
376	157.70	161.85	164.25
377	150.63	154.25	157.11
379	191.71	198.60	201.13
380	184.60	190.54	194.24
381	163.10	169.75	173.28
382	188.56	193.76	197.84
384	198.14	186.30	204.39
385	229.09	231.88	232.99
387	243.53	258.00	251.16
388	201.68	208.10	212.12
389	217.13	221.23	228.18
391	212.27	217.45	221.67
392	279.68	286.90	292.83
393	173.64	192.15	183.49
394	157.52	163.10	164.94
395	144.07	152.51	153.39
398	179.84	179.66	183.91
399	139.12	143.32	147.03
400	214.76	222.08	224.31
401	175.09	179.90	183.84
402	209.26	213.18	215.63
403	184.28	188.35	189.78
404	150.91	153.06	156.38
405	194.76	198.03	199.31
406	170.70	173.36	175.10

RANDALL COUNTY

Well No.	1956	1957	1958
A-2a	138.70	139.52	——
103a	6.53	8.12	6.53
121a	147.60	149.00	142.31
127a	143.74	145.90	144.30
137b	123.83	126.35	125.84
157a	116.50	118.30	118.99
167a	136.44	——	128.37
191b	184.47	199.20	186.88
211	——	170.20	172.04
212	158.15	163.25	166.55
214	177.50	181.37	184.05
215	148.60	155.29	159.08

SWISHER COUNTY

Well No.	1956	1957	1958
1	105.25	106.32	106.60
2	77.08	——	79.43
36	74.30	80.37	81.82
37	——	97.57	——
80	98.68	99.70	95.49
95	——	97.26	99.50
101	90.62	——	97.35
108	95.99	101.24	——
113	96.14	82.76	79.02
115	79.33	——	82.39
119	75.50	87.94	79.85
124	74.06	75.18	——
127	74.00	94.72	98.23
139	64.38	82.70	75.75
165	——	——	111.75
167	76.57	78.84	78.30
181	81.97	85.11	87.93
231	91.38	111.00	109.41
233	96.87	101.42	99.79
247	91.58	97.92	98.94
255	74.28	79.47	83.03
278	103.55	110.64	109.25
291	81.74	83.78	——
297	68.61	75.57	——
299	——	62.99	60.59
302a	92.10	97.20	98.60
310	87.35	101.02	99.32
332	94.65	97.64	103.95
333	101.08	104.20	106.95
359	119.14	126.59	129.86
368	120.83	——	138.65
370	116.29	119.34	122.67
383	109.53	148.60	116.66
404	——	134.34	136.13
408	118.58	137.64	132.82
410	126.16	——	116.68
421	——	93.46	96.67
433	——	129.41	——
438	148.18	151.24	——
448	118.35	124.29	129.10
480a	——	——	110.67
498	113.99	121.14	122.68
507	105.07	111.65	110.45
702	50.50	49.63	47.83
705	78.38	79.37	76.51
709	105.85	108.62	108.70
743	75.60	80.48	——
806	83.84	97.40	92.90
858	——	106.03	——
860a	104.26	106.96	——
889	101.29	106.66	108.58
896	78.26	84.49	82.41
914	134.33	142.36	143.19
932	136.40	138.66	137.41
935	112.25	——	119.85
947	102.26	112.24	——
951	81.44	86.15	——

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

Second Class Permit

THE Cross SECTION

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

Volume 4—No. 11 "THERE IS NO SUBSTITUTE FOR WATER" April 1958

MOST OF NATION SUFFERS FROM PROBLEMS OF WATER SHORTAGES

The Population Reference Bureau is warning that "water shortages are now a national problem" and that the United States "might not have enough of this precious mineral to go around" in the not-too-distant future.

The Bureau said the nation as a whole has stepped up development and conservation of its water resources over ten years ago, but added that "our steady population growth is placing heavier and heavier demands on supplies of this most basic natural resource."

The Bureau, a nonprofit, private group devoted to the distribution and interpretation of population facts and figures, said communities in 45 of the 48 states are feeling the water pinch at one time or another. In 1957, an estimated one in every four Americans felt the water shortage in some manner, the Bureau said.

The hardest hit states are those in the southwest. Paradoxically, this area received a very large influx of persons from other states in recent years. Projections of the U. S. Census Bureau indicate that five of these states (Nevada, Arizona, California, New Mexico and Utah) are expected to be among those showing the highest percentage of population increase between 1955 and 1970.

The Bureau's Director, Robert C. Cook, predicted that some of these localities might be forced to take steps to restrict the number of new residents, and more especially of new industries in some communities.

Cook cited the example of Arizona where population will very likely increase by 65 percent by 1970. He said: "Hard-pressed Arizona, as early as 1950, was meeting some 60 percent of its water needs by 'over-pumping' its wells."

But the rest of the nation is suffering, too, Cook emphasized. He cited these examples from news reports:

In Dallas, Texas, last year, "water bars" did a lively business selling distilled water at 50 cents a gallon—more than the price of gasoline.

Last fall, the three large reservoirs that serve northeastern New Jersey industry and cities were down to about one-third of normal capacity.

Even in the humid parts of the nation, startling increases in water use have been noted, especially in Indiana and Massachusetts. In southern Indiana, some 100,000 gallons of water a day had to be trucked into rural areas where farm wells went dry during the record drought in the summer of 1953. Since then, ground water reserves have improved, but there are considerable areas suffering chronic summer shortages. With an estimated population increase of close to 20 percent for the northeastern United States by 1970, greater expenditures to meet water shortages are predicted there as in large sections of the Midwest.

Cook called for "more careful development of presently known water resources and a concerted drive to conserve water throughout the country." He said such programs, in the form of watershed development, pollution control and increased storage capacity, are "essential but costly. Desalted sea water may help some, but even partial de-salting is still very costly." He said that "it will remain too expensive for inland communities for many years to come."

Cook added: "Even with these programs, some local areas will continue to be plagued by the water problems resulting from rapid expansion of human numbers and industrial development.

"This means that there should be vigorous appraisal of some of the economic and social factors behind current fertility trends and migration."

Modern industrial civilization thirsts for water. In 1900, the per capita daily consumption of water (amount of water used divided by number of population) was 530 gallons. In 1950, it was 1,340 gallons. By 1970, it is expected to climb to 1,947 gallons, according to the U. S. Department of Commerce's most recent projection. The greatest single use is industrial. For example, to make the steel needed for one 1958 model car, it takes more than 68,345 gallons of water. (More than five tons of water is needed to make the "Wash 'N Wear" synthetic materials for one man's summer suit.)

Gallon for gallon, industry takes 46 percent of the water, irrigation another 46 percent and the consumer the remaining eight percent.

On the average, the nation receives about 4,300 billion gallons of water a day in the form of rain or snow. About 70 percent of this is lost, chiefly through evaporation to the air. Another 765 billion gallons is carried by floods into the oceans.

More than six times as much water flows across the continental United States as water vapor in the air, as is carried by all the rivers of the country.

WTCC Holds 40th Annual Convention

The West Texas Chamber of Commerce held its 40th annual convention in Fort Worth on April 23-29.

Among the noted authorities on the program was the Honorable Durwood Manford, Chairman of the State Board of Water Engineers. He spoke the morning of the 29th on the subject *"New Developments in Water Resources Planning for Texas."*

Others on the talent ladened program were: William H. Grove, Executive Vice-President, EMC Recordings, St. Paul, Minn.; Hon. Ottis Lock, Senator from Lufkin; Dr. Lloyd D. Black, Office of Area Development, U. S. Department of Commerce, Washington, D. C.; Thurman Sensing, Executive Vice-President, Southern States Industrial Council, Nashville, Tenn.

Entertainment for the Convention was furnished by the Choir of the Southwestern Baptist Seminary, Fort Worth.

MORTON MAN APPOINTED OFFICE SECRETARY OF COCHRAN COUNTY

Mr. W. M. Butler, Jr. of Morton has been appointed by the Cochran County Committee of the High Plains Underground Water Conservation District to act as its Secretary. He will accept applications for well drilling permits from Cochran County landowners. Mr. Butler replaces J. B. Knox, deceased, in this capacity. The County Committee offices will remain in the Western Abstract Company offices in Morton.

W. M. BUTLER, Jr.

Mr. Butler also will manage the Western Abstract Company. His wife, Mary Helen, and Miss Barbara Carter will assist him in its operation.

The Butlers moved to Cochran County in March 1951 and he assumed the duties of Coordinator-Instructor for the County G. I. Vocational Agricultural School. He holds a B. S. degree from East Texas State College in the field of Agriculture.

Mr. and Mrs. Butler maintain their residence on 9th Street in Morton. They have one daughter, Regina Gail, who is five years old.

The Cochran County Committee is composed of Earl Crum, Max Bowers, Pat Hatcher, Roy D. Greer and Haskell Milligan.

DRILLING STATISTICS FOR MARCH

During the month of March, 92 new wells were drilled and registered with the District office; 13 replacement wells were drilled; and 12 wells were drilled that were either dry, or non-productive for other reasons. 88 permits were issued by the County Committees. The new permits issued and completed wells follow by counties:

COUNTY	Permits Issued	Replacement Wells	New Wells Drilled	Old Wells Deepened	Dry Holes Drilled
Armstrong	0	0	0	0	0
Bailey	14	9	1	0	1
Castro	5	7	3	0	0
Cochran	0	4	0	0	0
Deaf Smith	8	7	2	0	1
Floyd	5	7	1	0	0
Hockley	15	10	1	0	4
Lamb	23	18	3	0	0
Lubbock	7	11	0	0	1
Lynn	1	2	0	0	1
Parmer	8	14	2	0	4
Potter	0	0	0	0	0
Randall	2	3	0	0	0

THE Cross SECTION

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ALLAN WHITE
Editor

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Committeemen meet fourth Friday of each month at 2:30 p. m., Farm Bureau Office, Muleshoe, Texas.

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George Bradford .... Dimmitt, Texas
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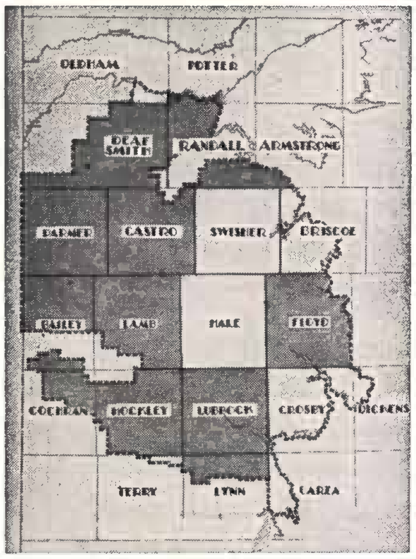
George T. Turrentine, Route 5, Hereford, Texas

Committeemen meet the first Monday of each month in the Farm Bureau Office, Hereford, Texas at 7:30 p. m.

Floyd County

Mrs. Ida Puckett, 319 South Main Floydada

G. L. Fawver .... Route 5, Floydada, Texas
Robert Kellison .... Route 2, Lockney, Texas
Chester W. Mitchell .... Lockney, Texas
Robert L. Smith .... Lockney, Texas
Ernest Lee Thomas .... Route 1, Floydada, Texas



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Cecil Pace .... Levelland, Texas
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H. C. Janes .... Route 4, Levelland, Texas
Joe W. Cook, Jr. .... Route 1, Ropesville, Texas

Committeemen meet first and third Fridays of each month at 1:30 p. m., 913 Houston, Levelland, Texas.

Lamb County

Mrs. Jane Shipley, Chamber of Commerce Office, Littlefield

J. B. Davis .... Route 1, Amherst, Texas
Elmer McGill .... Olton, Texas
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Price Hamilton .... Earth, Texas
Albert Lockwood, Star Route 2, Littlefield, Texas

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Bill Alspaugh .... Box 555, Slaton, Texas
Leroy Johnson .... Shallowater, Texas
Vernice Ford .... 3013 20th St., Lubbock, Texas
Howard Alford .... Route 4, Lubbock, Texas

Committeemen meet first and third Mondays of each month at 2:30 p. m., 1628-B 15th Street, Lubbock, Texas.

Lynn County

Mrs. Jean Lancaster, 1628-B 15th Lubbock, Texas

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Erwin Sander .... Route 1, Wilson, Texas
Lit H. Moore, Jr. .... Route 1, Wilson, Texas
Aubrey Smith .... Route 1, Wilson, Texas
Earl Cummings .... Wilson, Texas

Committeemen meet first and third Tuesdays of each month at 10 a. m., 1628-B 15th Street, Lubbock, Texas.

Parmer County

Aubrey Brock, Bovina

John Gammon .... Friona, Texas
Lee Jones .... R. F. D., Farwell, Texas
Carl Schlenker .... Route 2, Friona, Texas
Dick Rockey .... Route, Friona, Texas
A. B. Wilkinson .... Bovina, Texas

Committee men meet first and third Thursday nights at 8:00 p. m. in Bovina.

Potter County

James W. Walton .... Bushland, Texas
Eldon Plunk .... Route 1, Amarillo, Texas
R. C. Sampson, Jr. .... Bushland, Texas
T. G. Baldwin .... Bushland, Texas
W. J. Hill, Sr. .... Bushland, Texas

Randall County

Mrs. Eutha Hamblen, Farm Bureau, Canyon

W. A. (Bill) Patke .... Box 423, Canyon, Texas
Leo Artho .... Route 1, Canyon, Texas
L. E. Mason .... Wildorado, Texas
John Butler .... Route 2, Happy, Texas
James B. Dietz .... Route 2, Happy, Texas

Committeemen meet first Monday night each month at 7:30 p. m., 1710 5th Avenue, Canyon, Texas.

ROY B. McQUATTERS, Sr.

This month "THE CROSS SECTION" presents another member of the Board of Directors of the High Plains Underground Water Conservation District—Roy B. McQuatters, Sr., Director of Precinct No. 2.

Roy B. McQuatters, Sr. of Littlefield represents Precinct No. 2 on the Board of Directors. Precinct No. 2 consists of Cochran, Hockley, and Lamb Counties.

Mr. McQuatters was born at Alvarado, Texas in Johnson County on November 8, 1891. His parents were Mr. and Mrs. W. W. McQuatters. The elder Mr. McQuatters was farming at the time Roy was born, even though he was a machinist by trade and for the next few years to come followed several various occupational lines. He built and managed a water and light plant for the town of Alvarado in 1904. He helped build dams for the Mexico communities of Parral and Chihuahua in 1907. Then in late 1908, he and the family moved to Andrews County, where they bought two sections of land and began raising stock. The land he bought included the 1908 Blue Ribbon Farm at the Texas State Fair.

Even though the family lived in Andrews County in West Texas, the McQuatter's three sons, including Roy, attended and finished high school at Alvarado, in central Texas. Upon completion of his formal education in 1912, the young Roy McQuatters took a job as a cowboy with the Scarbauer Cattle Company at Midland.

In 1917, the Army called, and Mr. McQuatters left the plains of Texas for the battlefields of France, leaving behind his new bride, the former Mary L. Marshall, a young school teacher of Eunice, New Mexico. He served with the 90th Infantry Division until discharged in May 1919.

The young couple then moved to New Mexico in 1919, where they homesteaded a section of land. Then in 1920 their only son, Roy, Jr. was born. During that same year, Mr. McQuatters went back to work for the Scarbauer interests at Judkins, Texas. He was foreman over one of their ranches—the Scarbauer and Eidson Ranch.

At Midland, in 1921, twin girls, Vera and Veta, were born into the McQuatters family.

Mr. McQuatters went to work for an oil field pipe-line company in 1923 and stayed with them until he and his family moved to Littlefield in 1929 and bought their present home quarter-section farm which is located five miles east of Littlefield.

The McQuatters have always been virtually interested in the growth and betterment of their community, and in 1937, they were partially rewarded for their civic efforts when presented *THE PROGRESSIVE FARMER* magazine *"Master Farm Award"* for excellent farming, home-making, and citizenship. They were selected to represent a 21 county area.

In 1945, Mr. McQuatters drilled the first of his two irrigation wells.

Aside from serving as a member of the High Plains Water District Board of Directors, he is a member of the Board of Stewards of the Spade Methodist Church, Chairman of the Board of Directors of the Cooperative Compress of Lubbock, Chairman of the Board of Directors of the Littlefield Farmers Cooperative Gin, Vice-Chairman of the Plains Cooperative Oil Mill Board of Directors of Lubbock, member of the Lamb County Farm Bureau, and a producer delegate to the National Cotton Council of America.

Mr. and Mrs. McQuatters enjoy making trips by automobile for relaxation. They have toured various parts of the United States, Canada, Alaska, Mexico and Cuba.

The people of Precinct No. 2 are fortunate indeed to have a man such as Roy B. McQuatters, Sr. representing them and their area on the Board of Directors of the Water District.

Artificial Recharge Wells In Texas High Plains Will Aid In Prolonging Area Economy

By ALLAN H. WHITE

W. L. (Bill) Broadhurst, Chief Hydrologist for the High Plains Underground Water Conservation District, estimates that there are approximately 37,000 playa lakes in the High Plains of Texas. Mr. Broadhurst further estimates that during a year when rainfall is average, approximately 1.4 million acre-feet of run-off water collects in the 37,000 lakes.

Records of the rate of decline of the water level in at least one High Plains lake show that during the hot months of July, August and September the rate of decline is almost parallel to the rate of evaporation.

Since a large part of the natural recharge to the underground reservoir is derived from the water that collects in the lakes and since the records indicate that the evaporation rate from the lakes is very high, it follows that natural recharge to the underground reservoir is very meager indeed.

If we assume that an acre-foot of water on the Plains is now worth a minimum of $20, and that an estimated 90 percent of the 1,400,000 acre-feet which annually collects in the High Plains lakes is lost to evaporation, the net annual loss is 1,230,000 acre-feet of water, or an annual monetary loss of $24,600,000.

To make this figure even more startling, it is a known fact that at least a percentage of the stored underground water pumped annually in the High Plains (over 5 million acre-feet in 1956) is worth considerably more than $20 an acre-foot. Probably closer to $75 per acre-foot.

In order to develop an economical means of removing the lake water to the underground water reservoir and thereby eliminate the high evaporation losses that occur on the surface, the High Plains Water District has for several years conducted experiments involving the use of artificial recharge wells.

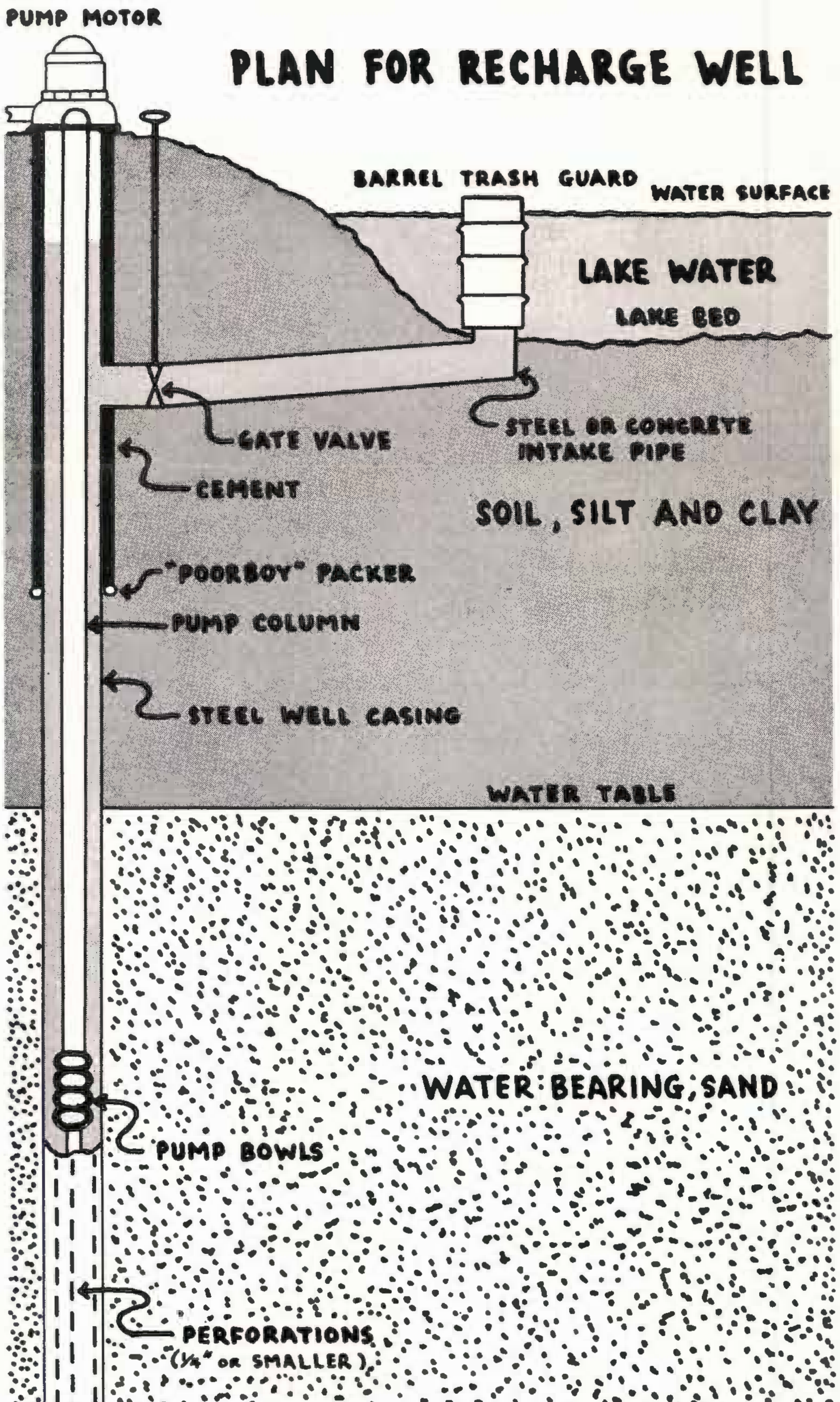
The recharge wells used in these experiments have been constructed in the normal production well manner with the exception that they are each equipped with a water intake line from a nearby lake. When the lake fills with surface runoff water, a recharge intake valve is opened to allow the lake water to flow by gravity into the well. The lake water enters the underground sand and gravel formations from the well through the perforations in the casing.

Each acre-foot of surface runoff water that can be salvaged by drainage into the underground reservoir

(Continued on Page 4)

Pictured above is one of the estimated 37,000 wet-weather lakes in the Texas High Plains. It is further estimated that approximately 1.4 million acre-feet of surface runoff water collects in these lakes during a year when average rainfall is received, and that about 90 percent of the total amount is lost to evaporation.

Above is shown a recharge well which experienced a partial cave-in because a packer was not installed.



The picture above shows an improved lake intake for a recharge well. The intake pipes are attached to oil drums which will float on the surface of the lake. It has been established that the most silt-free water in a lake is near the surface, consequently, it is believed that this floating intake will allow less clogging matter to drain into the well.

Recharge—

(Continued from Page 3)

through a recharge well will be an additional acre-foot available for use at a future date.

It was pointed out in a recharge experiment conducted in the City of Amarillo well field northwest of Canyon, Texas, that approximately 80 percent of the water drained into the underlying formations by recharge may be recovered by pumping the recharge well within a reasonable length of time. Of course, the longer the duration between recharge and pumping the less the percentage of recovery.

Many recharge wells have been operated for 7 to 8 years by individual farmers in the area. Most recharge well installations have a record of trouble-free service. However, it would be misleading to say that no trouble has been encountered in the operation of recharge wells in the Texas High Plains.

Suspended particles in the lake water tend to clog the pores in the underground formations as it percolates through the sands and gravel. This problem has been partially solved by pumping the recharge well at least once each day during the recharging operation for approximately 30 minutes to an hour. To further guard against clogging of the underground formations during recharge, a maximum rate of recharge intake should probably not substantially exceed the well's production capacity. By following this last rule, the pump will be able to more nearly recover all the foreign materials which collect in the pore spaces of the formation which surround the well.

Because of a greater concentration of potential well-clogging particles near the bottom of a lake, it is suggested that a recharge well intake be so designed as to float near the lake's surface and thereby take the most silt-free water that is available.

In order to successfully cope with a more insignificant recharge problem, and prevent a possible cave-in of the earth immediately below the block which supports the pump's discharge head, a packer should be installed in the recharge well. During the recharge operation the water level in the well will rise to a point near the elevation of the water in the lake. This elevation in the well is usually very near the land surface and if the recharge water is not retained inside the casing it may undermine the pump base. Note accompanying field picture which illustrates this point.

A packer, which will prevent this undermining action from occurring, is economically made by placing a used automobile tire around the well casing at a point as near the well's static water level as possible and filling the space outside the casing and between the packer and the land surface with cement.

Secondary benefits which are derived from a recharge well program include the reclaiming of fertile land in the lake itself, and also reclaiming surrounding acres which may be inundated by occasional high water which submerges growing plants just long enough to kill or severely damage them.

More adequate control of disease-carrying insects is another of many benefits which is probably secondary to the salvaging of the lake water but nevertheless is a real and genuine benefit.

Other benefits an individual will receive from having a recharge well is that it provides a means by which agricultural tail-water may be easily salvaged.

Recharging underlying formations in the High Plains of Texas with surface runoff water which collects in lakes and at present is being almost wholly lost to evaporation appears to be one major solution to the problems confronting the area in prolonging its present agricultural, industrial and municipal economy.

GOOD IRRIGATION PRACTICES PAY

By D. W. SHERRILL

Irrigation Agent, District 1 and 2, Texas Agricultural Extension Service

Irrigation is big business in Texas. There are 6,962,234 acres irrigated on 39,706 farms. On the High Plains of Texas 4,568,880 acres on 18,344 farms are irrigated from 42,225 wells.

Geologists estimate that in the High Plains Ogallala formation there were originally about 300 million acre-feet of water. If we assign a value of only $30. per acre-foot, the value of this resource would be $9 billion. If underground water increased land values only $100. per acre (which is low) we would have increased capital assets by $456,888,000.

Irrigation is big business from an investment point of view. The table below contains ultra-conservative figures on only a few investment items. Costs probably are higher.

42,225 wells @ $4,000	$168,900,000
2,800 miles of underground pipe systems @ $5,280	14,784,000
3,460 sprinkler systems @ $3,000 each	10,380,000
TOTAL	$194,064,000

Wise and successful use of irrigation water should be the goal of every farmer; however our job is also to use the greatest reservoir, the soil itself, to store surface runoff water for future plant use. This reservoir is greater than all the dams that could ever be built. Too often we see a flood of muddy water from a quick heavy rain gathering momentum down the steep crop rows to the bar-ditches, and thence to the lakes. Does it not seem reasonable that we should use every mechanical and agronomic means to capture this water at the opportune time. It is free, God given water.

We must cooperate with Nature. We need to have the soil in such a condition with enough organic matter to soak up rainfall quickly. If we do this—use rainfall more, irrigation water less—we will have the use of underground water for a much longer time.

In 1957, spring rains after preplanting irrigation caused delay in planting, and fall rains on top of summer irrigation caused slow maturity and low grades of cotton. But due to these rains and moisture received in 1958, we have the best underground season since the spring of 1942. Enough in fact that except in a few localities we have the equivalent of a good preplanting irrigation without the expense of same.

How does the farmer know whether or not he should irrigate? Until we have an inexpensive simple instrument to measure moisture content of the soil, the best method is to dig in the ground by means of a post-hole digger, soil auger, or sharpshooter shovel and feel of the soil. Your county agents have a chart for all types of soil to describe how your soil will react to the feel test when it has moisture at field capacity. Of course we want the soil wet to six feet before planting, or through depth of soil if it is less than six feet deep.

In the summer while crop consumptive use of water is great we need to examine the top two feet of soil to see if moisture needs replenishing. Most of the roots are in the top two feet of soil. By digging and feeling of this soil we can determine when to irrigate.

With cotton we do not want to irrigate too early and throw the plant into vegetative growth. Wait until the cotton plant loads up or until blooming begins. Dryness of soil and length of time necessary to get over and to get the right amount of water needed has to be taken into consideration. Both cotton and grain sorghum in their peak water use will use three-tenths of an inch of water per day. For grain sorghum this period is in the boot, bloom and soft-dough stages. For cotton it occurs between bloom stage and August 15th.

With cotton, if we do not let it suffer, we should quit watering between August 15 and 25 to secure quality cotton. Cotton fruit set September 1 or later seldom makes anything but bollies, which helps pull the grade of good cotton down.

Irrigation must fit in with good soil management which must include nutrients and organic matter. Every farmer is acquainted with the benefits of using cotton burs, manure, shredded sorghum stalks and legumes for improving water intake, water holding capacity of soil and ease of cultivating soil.

Farmers of the High Plains have constantly improved their methods of irrigation; there is room, however, to improve irrigation efficiency. Do you know the gallons per minute your well produces? When you irrigate an acre of ground, do you know how much water a foot of soil will hold on your farm? Did you apply 3 acre-inches of water or 6 acre-inches of water? What is the depth to the water table in each of your wells? What is the drawdown for each of your wells? These are some of the things each farmer should know about his operation.

We can eliminate costly waste of water. We can use wisely Nature's moisture which falls on the soil. We can learn more about the Good Earth, its structure, texture, organic matter and water-holding capacity. We can irrigate more wisely, putting the right amount of water in the soil at the right time. We can keep adequate plant nutrients in balance. When we do these things we will have an irrigation economy for a long time in the High Plains of Texas.

When you move, please notify "The Cross Section" 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 your paper.

Please Close Those Abandoned Wells!!!

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

Second Class Permit

THE Cross SECTION

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

Volume 4—No. 12 "THERE IS NO SUBSTITUTE FOR WATER" May 1958

Number Of Water District Flow-Meter Installations Have Been Increased By 9

The High Plains Water District has added nine new flow-meter installations to its list of eleven which was published in "The Cross Section" in December 1957. The new installations will add to the program greater cross-sectional coverage of soils type and crop varieties.

The nine new irrigators have each been supplied with a rain gauge, an engine time-clock and a record book in addition to a flow meter. They will record amounts of rainfall and irrigation water applied to the various crops and the time consumed in making each irrigation application. The flow meter will be used to measure the amount of irrigation water which the well is supplying to the crop.

The flow-meter program was commenced by the District in an effort to establish (1) that good water management depends to a large extent on the tools employed, and (2) to substantiate research data on moisture and yield relationships.

The new installations are at the following farm locations. Drive by and visit the ones in your area.

BAILEY COUNTY

Cora O. Wilhite, owner; J. F. Wilhite, operator. SE 1/4 of Section 4, Block X, State Capitol Land. 8-inch pump. Open-ditch distribution system is used. To visit farm travel 5 1/4 miles northwest of Muleshoe on Highway 84, turn west on Farm-to-Market road and proceed for 3 miles, then turn north and go 1/2 mile to well site.

CASTRO COUNTY

C. W. McFarland Estate, owner; Clinton McFarland, operator. NW 1/4 of Section 11, Block S-2, E. L. & R. R., R. R. Co. Survey. 8-inch pump. Open-ditch distribution system is used. To drive to the farm from Hart, travel 3 miles east on the Kress road then 1 mile north.

FLOYD COUNTY

J. R. Belt, Jr., owner and operator. SW 1/4 of Section 73, Block RG. 8-inch pump. Closed distribution system. Well is easily reached by driving 1 mile south of Lockney on Farm Road, then turn 3/4 mile west and .6 mile north.

HOCKLEY COUNTY

"A"—Mrs. M. Butler, owner; Henry J. Schmidly, operator. Labor 7, League 720, Abstract 221. 8-inch pump. Open-ditch distribution system. To visit the flow-meter installation, travel from Levelland on pavement north for 1/2 mile then 1 mile west, 6½ miles north and ½ mile east to well.

"B"—Haskell Grant, owner and operator. Tract 2, League 7, Abstract 146, Wilbarger County School Land. 6-inch pump. Open-ditch distribution system is used with some aluminum pipe. Installation is easily visited by traveling northeast from Ropesville on the Lubbock Highway for 3 miles, 1/2 mile west on Farm Road, then 1/4 mile north to well.

LAMB COUNTY

E. A. Langford, owner; Bill Langford operator. NW 1/4 of Section 33, Block O-2, D & SE RR Co. Survey. 8-inch pump. Open-ditch distribution system. From Olton, travel 1 mile south and 1/3 mile west to reach the well.

LUBBOCK COUNTY

"A"—Ira A. Ashley, owner; Buddy Winters, operator. NW 1/4 of Section 5, Block RG, TT RR Co. Survey. 6-inch pump. Combination open-ditch and closed distribution system. To visit farm from Idalou, travel 1 mile south, 1 mile west and then 1 mile south.

"B"—L. L. Lindsey, owner; Jerry Lindsey, operator: NW 1/4 of Section 31, Block D-5, E. L. & R. R., R. R. Co. Survey. 6-inch pump. Open-ditch distribution system. Drive 3 1/4 miles west and 1 1/2 miles south of Shallowater to visit the farm.

RANDALL COUNTY

J. L. Weick, owner and operator. East 200 acres of Section 42, Block B-5, Great Northern Railroad Company Survey. 6-inch pump. Combination open-ditch and closed distribution system. To reach the farm from Umbarger, travel northeast on Highway 60 for 2½ miles then ½ mile north.

Income-Tax Deduction Reviewed By IRS

The Internal Revenue Service is making a re-evaluation of the facts presented in a brief prepared by the High Plains Underground Water Conservation District involving a Floyd County couple, Mr. and Mrs. Marvin Shurbet. The brief requests that the taxing bureau allow an income-tax deduction for the depletion of underground water.

The Internal Revenue Service is giving the request further study at this time. Some word from their Washington office should be forthcoming.

Associate Justice Joe Greenhill, Texas Supreme Court, worked on the original brief that was presented by the Water District. He was a practicing attorney in Austin at the time.

SIMPLE TOOLS WILL AID IRRIGATOR

"To be or not to be? That is the question," is a Shakespearean quotation. Whether or not Mr. Shakespeare knew anything about irrigation is perhaps debatable; however if we alter his famous quotation somewhat we can come up with a very thought-provoking irrigation question. "To irrigate or not to irrigate? That is the question."

This question has probably been posed by men as far back in time as history records the practice of irrigation.

There are other questions of course that today's irrigator needs to ask himself concerning his own operation before he can provide suitable solutions to his problems.

"What is the moisture-holding capacity of my soil?"

"How much water will be applied to a given number of acres in a given length of time using the amount of water that I have available?"

"How much water should be applied in order to bring the plant root zone to "field capacity?" ("Field capacity" is reached when a maximum amount of available moisture is stored in the soil profile.)

These are basic questions; however few irrigators are acquainted with their answers.

To take the questions in the order that they are presented and attempt to more closely analyze them, we will think first about the question, "What is the moisture-holding capacity of my soil?"

First, the soil texture must be determined. Is the soil a coarse, light, medium or heavy texture? Most farmers know the answer to this question, at least approximately. Once the texture of the soil has been established the following table will show the amount of moisture available to the plant per foot of soil depth.

Soil Texture	Available Moisture (Inches per ft. of depth)
Sandy (coarse)	1/2 to 1
Sandy loams(light)	1 to 1-1/2
Silt and clay loams (medium)	1-1/2 to 2
Clays (heavy)	2 to 2-1/2

To apply more water to a given soil than it will hold, (approximately the

(Continued on Page 4)

Manager Attends Washington Meeting

Tom McFarland, Manager of the High Plains Underground Water Conservation District, attended the 45th Annual Convention of the National Rivers and Harbors Congress in Washington, D. C. on May 13-16.

Portions of the Convention which were of particular interest to the Water District were those dealing with irrigation and with the age-old question concerning the most workable unit of groundwater development. At meetings of this type and particularly those of national scope, this question invaribly is raised. After having discussed the matter with many of our own people, the Water District, at every opportunity guards against convention resolutions which would advocate development of ground water by river basin units, since local control over development by this method would probably be impossible.

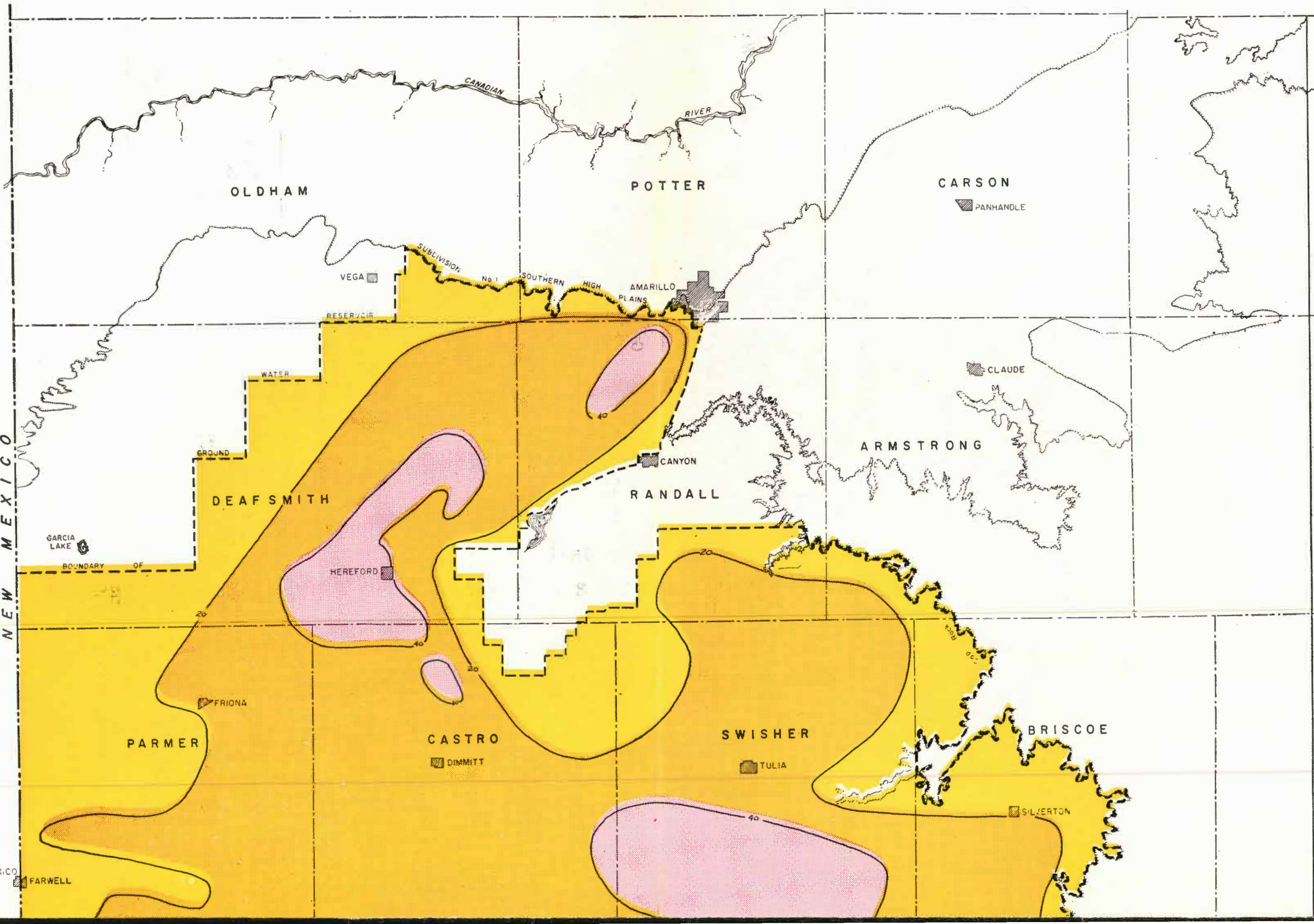
Marvin Shurbet, of Floyd County, former president of the Board of Directors of the High Plains Water District and presently a member on the State Water Development Board, also attended the Convention. A total of forty-three Texas delegates were present at the four-day Washington meeting.

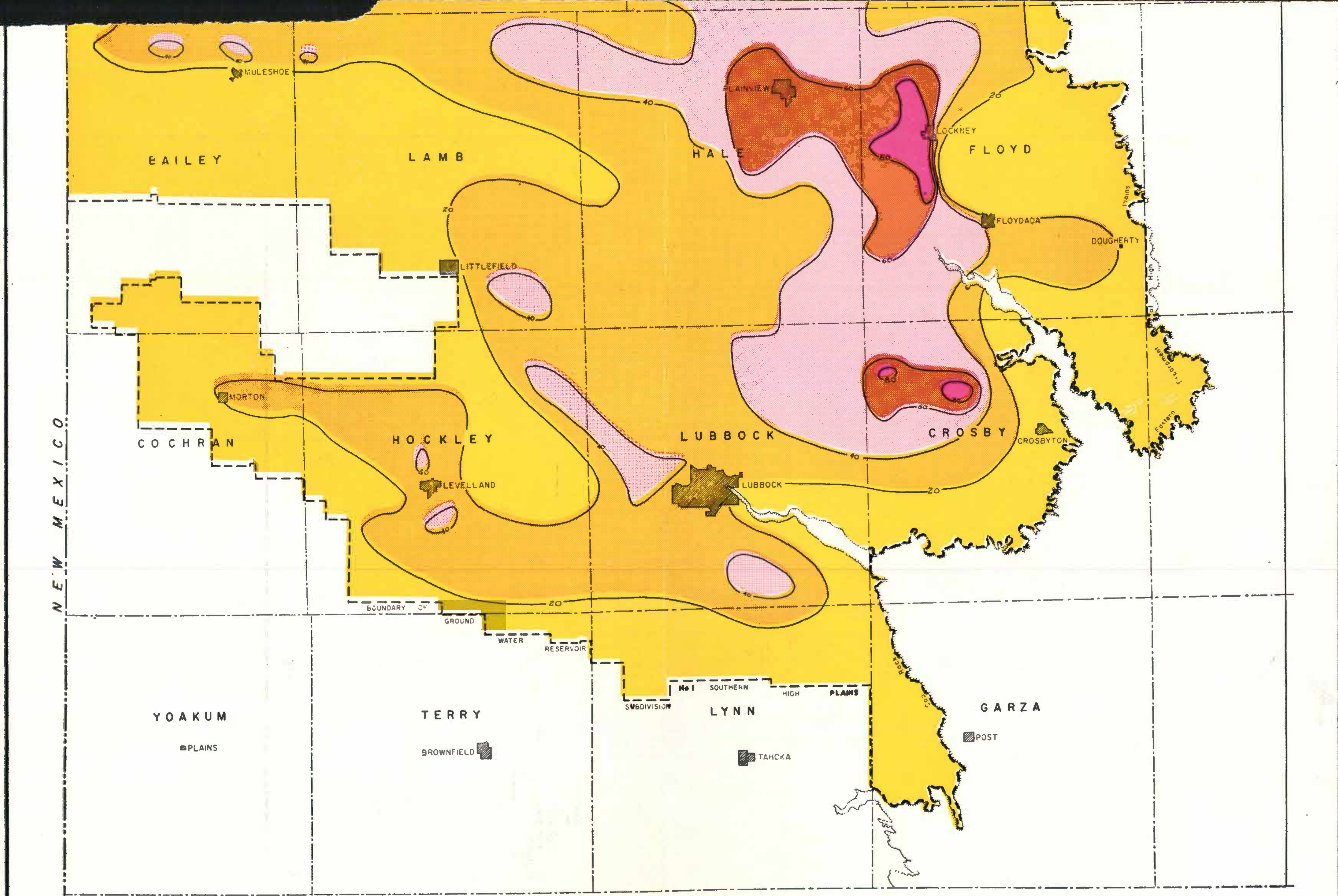
DRILLING STATISTICS FOR APRIL

During the month of April, 73 new wells were drilled and registered with the District office; 11 replacement wells were drilled; and 4 wells were drilled that were either dry, or non-productive for other reasons. 56 permits were issued by the County Committees. The new permits issued and completed wells follow by counties:

County	Permits Issued	New Wells Drilled	Replacement Wells	Old Wells Deepened	Dry Holes Drilled
Armstrong	0	0	0	0	0
Bailey	1	1	1	0	0
Castro	8	7	2	0	0
Cochran	5	4	0	0	1
Deaf Smith	12	8	3	0	0
Floyd	4	9	0	0	0
Hockley	7	15	0	0	2
Lamb	3	3	0	0	0
Lubbock	10	12	2	0	0
Lynn	0	9	0	0	1
Parmer	3	4	3	0	0
Potter	0	0	0	0	0
Randall	3	1	0	0	0

APPROXIMATE DECLINE OF THE WATER TABLE
January 1938 - January 1958





SCALE

0 5 10 15 20 Miles

EXPLANATION

- LESS THAN 20 FEET
- FROM 20 FEET TO 40 FEET
- FROM 40 FEET TO 60 FEET
- FROM 60 FEET TO 80 FEET
- MORE THAN 80 FEET

PREPARED FROM RECORDS OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1, THE UNITED STATES GEOLOGICAL SURVEY, AND THE STATE BOARD OF WATER ENGINEERS. SUBJECT TO REVISION WHEN ADDITIONAL DATA ARE AVAILABLE.

HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT

MANAGER
THOMAS J. McFARLAND

CHIEF HYDROLOGIST
WILLIAM L. BROADHURST

MAY 1958

SIMPLE TOOLS—

(Continued from Page 1)

amounts shown in the table above), will result in a situation whereby the excess water will leach plant food below the plant root zone where it can not be used. Of course, this practice is undesirable and cuts down on the irrigator's net profit.

The second question posed is, "How much water will be applied to a given number of acres in a given length of time using the amount of water that I have available?"

It is only reasonable to assume that an irrigator must know approximately the amount of water that he is applying to the land per hour before he can know the number of feet of soil profile that he is wetting.

Upon determining the amount of water the well (or wells) is pumping to the plant rows, counting the number of rows and measuring the length of the rows, the irrigator may then calculate the number of inches of water that is being applied per acre of land.

A simple formula for computing the acres irrigated per set and an easy-to-use-table for figuring the amounts of water being applied per acre, are given below:

Number of rows irrigated per set x row spacing in feet x length of rows in feet divided by 43,560 square feet per acre equal acres irrigated per set.

Typical Example: An irrigation farmer has a supply of water which totals 500 gallons per minute. He waters twenty 40-inch rows per set and the rows are a quarter of a mile in length. How many inches of water will be applied in one hour? How many inches will be applied in 10 hours?

$$\frac{20 \text{ rows x } 3\text{-}1/3 \text{ ft. x } 1320 \text{ ft.}}{43560} \text{ equals } 2.03 \text{ acres}$$

By using the formula, we find that the number of acres irrigated per set is 2.0. Then move on to the table and look down the column marked "2" until you reach the figure parallel to "500 G.P.M." This figure is .56, which means that 500 G.P.M. running for one hour, if spread uniformly, will cover 2 acres to a depth of .56 inches, or in 10 hours it will cover 2 acres to depth of 5.6 inches.

Mr. M. H. Kinard, Lubbock County farmer, demonstrates the use of three simple tools with which soil samples are obtained, (1) the sharpshooter, (2) the core sampler and (3) the soil auger.

We now proceed on to the third question, "How much water should be applied in order to bring the plant root zone to 'field capacity'?"

A practical table is shown that will aid in estimating this amount. By using a sharp-shooter, post-hole digger or soil auger samples may be obtained from various soil over the field to determine the percentage of moisture available to the plant.

If a soil auger is used to obtain samples, it should be pulled out of the ground about every six inches of depth and the soil that is held in the bit removed. Squeeze the soil sample to form a ball. Observe its reaction to the applied pressure and then refer to the table. When the approximate sample reaction is located in the table under the proper soil texture, follow horizontally to the left and in the first column the percentage of available moisture remaining in the soil at the depth from which the sample was obtained will be shown.

Percent of readily available moisture remaining in soil	Feel or appearance of soils			
	Coarse	Light	Medium	Heavy and very heavy
0	Dry, loose, single-grained, flows through fingers.	Dry, loose, flows through fingers.	Powdery, dry, sometimes slightly crusted but easily breaks down into powdery condition.	Hard, baked, cracked, sometimes has loose crumbs on surface.
50 or less	Still appears to be dry; will not form a ball with pressure.*	Still appears to be dry; will not form a ball.*	Somewhat crumbly, but will hold together from pressure.	Somewhat pliable, will ball under pressure.*
50 to 75	Same as coarse texture under 50 or less.	Tends to ball under pressure but seldom will hold together.	Forms a ball, somewhat plastic; will sometimes slick slightly with pressure.	Forms a ball; will ribbon out between thumb and forefinger.
75 to field capacity	Tends to stick together slightly, sometimes forms a very weak ball under pressure.	Forms weak ball, breaks easily, will not slick.	Forms a ball and is very pliable; slicks readily if relatively high in clay.	Easily ribbons out between fingers, has a slick feeling.
At field capacity	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.	Same as coarse.	Same as coarse.	Same as coarse.
Above field capacity	Free water appears when soil is bounced in hand.	Free water will be released with kneading.	Can squeeze out free water.	Puddles and free water forms on surface.

*Ball is formed by squeezing a handful of soil very firmly with fingers.

By way of example, assume that samples have been taken over the entire field and it is determined that the top foot of soil has less than 50 percent moisture available to the plants. The second foot has 50-75 percent available moisture, and the third and fourth feet are up to field capacity.

How much water should be applied to bring the top two feet of soil to field capacity?

In this case we will assume the soil texture to be "medium." We know from the moisture-holding capacity table that the "medium" textured soil is capable of making available a maximum of 2-inches of moisture per each foot of depth. If approximately 75 percent of this amount has been depleted from the top foot of soil and 50 percent from the second foot, then the irrigation should apply enough water to replace this moisture and thereby bring the top two feet back to field capacity. In this case, the irrigator would need to apply 1-1/2 inches of water for the top foot and 1 inch for the second foot, or a total irrigation of 2-1/2 inches.

In any irrigation operation the period of time that will elapse from the first rows wetting until the entire field is irrigated must be given consideration. Failure to provide adequate time for covering the field may result in the plant going into a stress for moisture and consequently being permanently damaged.

Valuable savings in underground water without jeojardizing crop yields can undoubtedly be made by applying the use of these and other simple and inexpensive irrigation tools to the individual's operation.

So we find that there are some relatively simple and absolutely sound methods available which will aid the irrigator in answering the revised Shakespearean quotation, "To irrigate or not to irrigate? That is the question."

"The Cross Section" gratefully acknowledges the assistance of Mr. D. W. Sherrill, Texas Agricultural Extension Service, Lubbock, Texas, in the preparation of this article. Tables from Extension Service bulletins.

DEPTH OF WATER IN INCHES APPLIED TO VARIOUS NUMBER OF ACRES IN ONE HOUR IF SPREAD UNIFORMLY

Gallons per minute	Acre inches per hour or cubic feet per second	Acres Irrigated Per Set					
		½	1	1½	2	2½	3
100	0.22	0.44	0.22	0.15	0.11	0.09	0.07
150	.33	.66	.33	.22	.17	.13	.11
200	.45	.90	.45	.30	.23	.18	.15
250	.56	1.12	56	.37	.28	.22	.19
300	.67	1.34	.67	.45	.34	.27	.22
350	.78	1.56	.78	.52	.39	.31	.26
400	.89	1.78	.89	.59	.45	.36	.30
450	1.00	2.00	1.00	.67	.50	.40	.33
500	1.12	2.24	1.12	.75	.56	.45	.37
550	1.23	2.46	1.23	.82	.62	.49	.41
600	1.34	2.68	1.34	.89	.67	.54	.45
650	1.45	2.90	1.45	.97	.73	.58	.48
700	1.56	3.12	1.56	1.04	.78	.62	.52
750	1.67	3.34	1.67	1.10	.84	.67	.56
800	1.79	3.58	1.79	1.19	.90	.71	.59
850	1.90	3.80	1.90	1.27	.95	.76	.63
900	2.01	4.02	2.01	1.34	1.01	.80	.67
950	2.12	4.24	2.12	1.41	1.06	.85	.70
1000	2.23	4.46	2.23	1.49	1.12	.89	.74
1200	2.68	5.36	2.68	1.79	1.34	1.09	.89
1400	3.12	6.24	3.12	2.08	1.56	1.25	1.04
1600	3.57	7.14	3.57	2.38	1.79	1.43	1.19

Entered as second-class matter June 22, 1954, at the Post Office at Lubbock, Texas under Act of August 24, 1912, as amended by the Act of August 4, 1947.

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

Second Class Permit

THE Cross SECTION

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

Volume 5—No. 1 "THERE IS NO SUBSTITUTE FOR WATER" June 1958

DISTRICT MAPS SALT-WATER DISPOSAL PITS IN FIELD SURVEY

The High Plains Underground Water Conservation District has recently completed a field survey of earthen salt-water disposal pits which apparently are still being used in the Cochran County and the Hockley County areas.

In September 1957, the Board of Directors of the Water District passed an order forbidding the pollution of underground water by salt water admitted from the surface of the ground or any underlying strata.

Most oil production within the District is accompanied by salt water. After being pumped to the land surface together, the oil and salt water are separated. The oil is routed into storage to await transportation to a market point, and the salt water, having no immediate monetary value is disposed of.

In the past, most producers disposed of salt water in earthen surface pits. The theory which is applied to salt-water disposal in this manner assumes that the sun and wind will evaporate the water from the pit and leave the salt deposited in crystal form. Actually, however, the salt water in the pit normally becomes coated with a thin layer of oil which prevents any appreciable amount of evaporation. In reality, the salt water percolates beneath the pit through the underlying formations to the water table where it comingles with the fresh underground water.

Salt will not be filtered from the water; it will remain in solution even though the salt water may pass through hundreds of feet of sand and gravel. As the salt water mixes with the fresh water there will naturally be dilution, but the salt will nevertheless be present.

The courts of our land have upheld

(Continued on Page 3)

Judge Joe R. Greenhill, now Associate Justice of the Texas Supreme Court, is shown at the spring meeting of the 69th District Bar Association in Dumas, Texas. Judge Greenhill discussed, among other things, the Depletion Allowance Brief he helped draft for the High Plains Underground Water Conservation District. The brief has been presented to the Internal Revenue Service. It requests the taxing Bureau to allow an income-tax deduction for the depletion of underground water.

The case was reveiwed in Washington this month. The Water District Board of Directors is hopeful for a favorable ruling sometime in the near future. Judge Greenhill represented the High Plains Water District in several cases before his appointment to the Texas Supreme Court.

PROCEDURE OUTLINED FOR THE INSTALLATION OF A RECHARGE WELL

District Will Publish Comic Book

The Board of Directors of the High Plains Underground Water Conservation District has approved an expenditure to defray the costs involved in publishing an educational pamphlet in the form of a full-color comic book.

The book is being prepared primarily for distribution to the grade-school-aged child. It will attempt to convey basic information concerning the geology of the southern High Plains area, the source of water supply, development of water for industry, agriculture and municipal use and conservation measures that are being used to prolong irrigation and sustain a balanced economy.

The Directors believe that the problems of water conservation which are at present confronting adults of the area will in a matter of a few years be a major concern of their children. The concern will then probably be greater than it is today because the problems will be more acute. The future guardians of our most valuable natural resource need to know the facts concerning that resource.

The comic book will probably be ready for distribution sometime during this fall.

By WAYNE WYATT

The High Plains Underground Water Conservation District, in cooperation with a Hockley County farmer, Mr. H. L. Moreland, recently completed a recharge well which is about 3 miles east and 4 miles south of Levelland.

A picture of the recharge well and the playa lake to be drained, together with a drawing of the underground formations and installations, are shown on Page 4.

This recharge project was started on September 3, 1957, with the drilling of a test hole. The test hole was drilled in order to determine the characteristics of the water-bearing formation; that is, whether the formation would produce a sufficient quantity of water for a production well and also take in the recharge water at a rate that would drain the lake within a reasonable period of time.

At the site of the test hole, 94 feet of relatively coarse-grained water-bearing sand and pea gravel was present. The production well was drilled at this site with a rotary drilling rig, using an 18 inch bit, to a total depth of 242 feet. New 16-inch casing was installed with perforations from 152 to 242 feet below the land surface. The slots were cut vertically 3/16 inch by 12 inches with six rows

(Continued on Page 4)

Pictured above as they consider certain changes in the District's rules are, left to right: George McCleskey, Lubbock; Tom McFarland, District Manager; George Broome, Anton; John Aikin, Hereford; Willis Hawkins, Hart; Gus Parish, Springlake; Roy McQuatters, Littlefield; Sam Aldridge, Farwell; Virgil Dodson, Hereford; W. L. Broadhurst, District Hydrologist; Hon. Jesse Osborn, Muleshoe; J. R. Belt, Lockney; Elmer Blankenship, Wilson; A. H. Daricek, Maple; and Arthur Duggan, Littlefield. W. O. Fortenberry of Lubbock, who attended the meeting, was not present for the picture.

BOARD CONSIDERS RULES CHANGES

The Board of Directors of the High Plains Underground Water Conservation District met in Lubbock on June 18 to consider certain recommended changes in the rules and regulations of the District.

Several of the past Directors of the Water District were present at the meeting, as guests of the Board, as were four attorneys of the area.

Several rules changes and amendments were suggested and discussed at great length. The present Board will take these suggestions under advisement. Most suggested changes would pave the way to more efficient administration of the District's basic rules.

Those who attended the meeting in addition to the present Board of Directors and staff members were: The Honorable Jesse Osborn, State Representative and past Board member from Muleshoe; Arthur Duggan, Littlefield attorney; Sam Aldridge, Farwell attorney; Willis Hawkins, past Board member from Hart; George McCleskey, Lubbock attorney; Gus Parish, past Board member from Springlake; John Aikin, Hereford attorney; George Broome, past Board member from Anton; and W. O. Fortenberry, past Board member from Lubbock.

THE Cross SECTION

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ALLAN WHITE
Editor

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Precinct 1

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Roy B. McQuatters, Sr. .... Box 295, Littlefield, Texas

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F. A. Carter .... Box 644, Maple, Texas

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Castro County

Eugene Ivey, Dimmitt

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Austin C. Rose, Jr., 108 Beach St., Hereford, Tex.
George T. Turrentine, Route 5, Hereford, Texas

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Floyd County

Mrs. Ida Puckett, 319 South Main Floydada

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Robert Kellison .... Route 2, Lockney, Texas
Chester W. Mitchell .... Lockney, Texas
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Eldon Plunk .... Route 1, Amarillo, Texas
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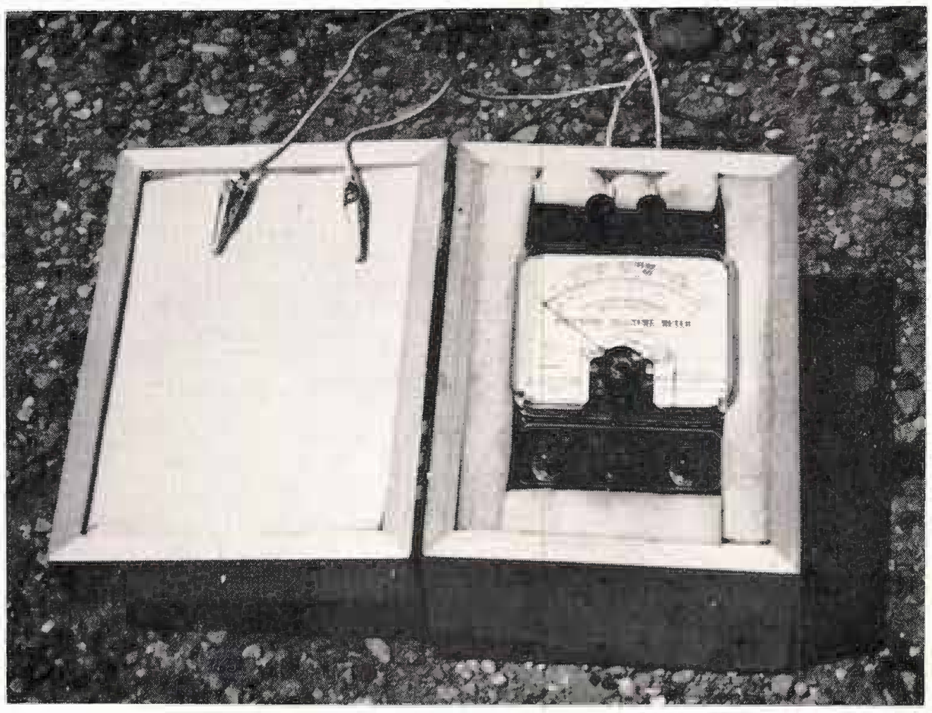
WATER DISTRICT USES AVAILABI



Meter which measures amount of moisture available in the plant root zone is battery powered and portable. "Field capacity" is represented on the meter dial by 100 percent.

The pictures above show the steps which are followed to install meter blocks. (1) A small hole into which blocks are buried is dug in field. (2) soil is returned to the approximate depth from which it was taken. (3)

District field representatives are shown above as they take meter readings from electrodes buried at various depths below cotton row. Generally speaking, the crop should be irrigated before 50 percent of the available moisture is depleted. This general rule will vary with crops, growth stage and soil types.

E-MOISTURE METER TO DETERMINE WHEN AND HOW MUCH TO IRRIGATE

The High Plains irrigation farmer who irrigates according to the way he feels is soon to become about as up-to-date as a bathing suit with sleeves and legs.

We have published on various occasions in "The Cross Section" articles explaining the use of simple, economic tools that can be used to aid the irrigator in his quest for more efficient use of his available water supply.

This month we will explain another of these devices. Namely, a meter that measures electrically the amount of moisture which is available to a plant at various soil depths.

Small electrodes used with the device are buried beneath the crop row at a sufficient variety of depths to give an adequate picture of the available moisture in the upper three or four feet of the root zone. The electrodes are imbedded in small gypsum blocks and attached to wires which lead to the surface.

The meter itself contains batteries and is portable. It may be attached at any time to the electrode wires at the land surface to obtain a reading. The amount of moisture present at the block depth which is being tested registers on the meter.

The more moisture present the better electrical conductance, and consequently a higher meter reading. The meter dial is calibrated in percentages of available moisture, with 100 per cent representing "field capacity." ("Field capacity" is a term used to indicate a condition whereby a maximum amount of available moisture is stored in the soil profile.)

When the moisture-holding character of the soil is known by the irrigator (your County Agricultural Agent can assist you in making this determination) he will then know from the meter readings whether or not he needs to irrigate; and if so, the quantity of water that needs to be applied.

The Water District is experimenting with these available-moisture meters and are publicizing them not in an effort to sell another gadget, but in an effort to inform the water-user as to the effectiveness and necessity of using the tools available to make more efficient use of the water pumped for agricultural purposes.

Several meters of the type discussed above are on the market today and they are all relatively inexpensive.

Gypsum blocks that contain small electrodes are buried at various soil depths throughout field. Colored wires lead to the surface from imbedded electrodes. Each color represents a certain depth at which block is buried below surface. Readings are taken by attaching meter to electrode wires.

Block is placed at measured depth below surface. Wires from electrodes lead to the surface. (4) Shallowest block is shown immediately before being covered with soil back-fill. Note wires from blocks buried below.

Above, the available moisture present in an onion field is being measured. The moisture available at the depths which blocks are buried registers on the meter dial.

Salt-Water Pits—

(Continued From Page 1)

the contention that salt water can and has percolated to the underground water table from disposal pits used by oil producers in the past. Some operators at the present time are using surface pits to dispose of salt water as evidenced by the results of the recent field survey.

The Water District expresses its thanks to those oil producers who are concerned for the welfare of the High Plains people and their water and who have changed to approved methods of salt-water disposal. Most have drilled deep injection wells through which their salt water is safely pumped into a formation far below the fresh water producing aquifer.

The Water District is in the process at this time of contacting the oil producers that are still using surface pits in their salt-water disposal program. To these producers we convey our sincere wish that during the very near future with their cooperation we will be able to publicly state that no further salt-water pollution is occurring as a result of surface-pit operation.

PLEASE CLOSE THOSE ABANDONED WELLS ! ! !

WELL DRILLING STATISTICS FOR MAY

During the month of May, 73 new wells were drilled and registered with the District office; 10 replacement wells were drilled; and 1 well was drilled that was either dry, or non-productive for other reasons. 56 permits were issued by the County Committees. The new permits issued and completed wells follow by counties:

	Permits Issued	*New Wells Drilled*	*Replacement Wells*	*Old Wells Deepened*	*Dry Holes Drilled*
Armstrong	0	0	0	0	0
Bailey	5	5	2	0	0
Castro	10	10	2	0	0
Cochran	0	1	0	0	0
Deaf Smith	12	16	2	0	1
Floyd	0	4	1	0	0
Hockley	5	6	0	0	0
Lamb	7	14	0	0	0
Lubbock	8	6	0	0	0
Lynn	2	2	0	0	0
Parmer	7	9	3	0	0
Potter	0	0	0	0	0
Randall	0	0	0	0	0

Recharge—

(Continued From Page 1)

around the casing.

Before the casing was set the water level was measured and the drillers log was studied to determine the depth at which a packer was to be set. The location for the packer was selected opposite a hard formation just above the static water level.

The packer, which consists of an old automobile tire that was cut in half around the center of the tread with the cup turned up to hold the cement, was placed around the casing at the selected place as the casing was lowered into the well.

After the casing was set a test pump was installed to determine the capacity of the well. After the well had been pumped for about 12 hours, a pumping test was run to determine the most efficient speed to run the pump in relation to the gallons per minute pumped at a given pumping level. The best results showed the pump running at 1700 revolutions per minute and the pump delivering 700 gallons per minute with a pumping level of 185 feet below the land surface.

After the well had proved to be a good producer, cement was poured around the outside of the casing, filling the annular space between the casing and the well bore, including the pump base. One major precaution in doing this is to pour the cement slowly at first, making sure that the packer holds and that the cement does not slip by on down opposite the water-bearing formation.

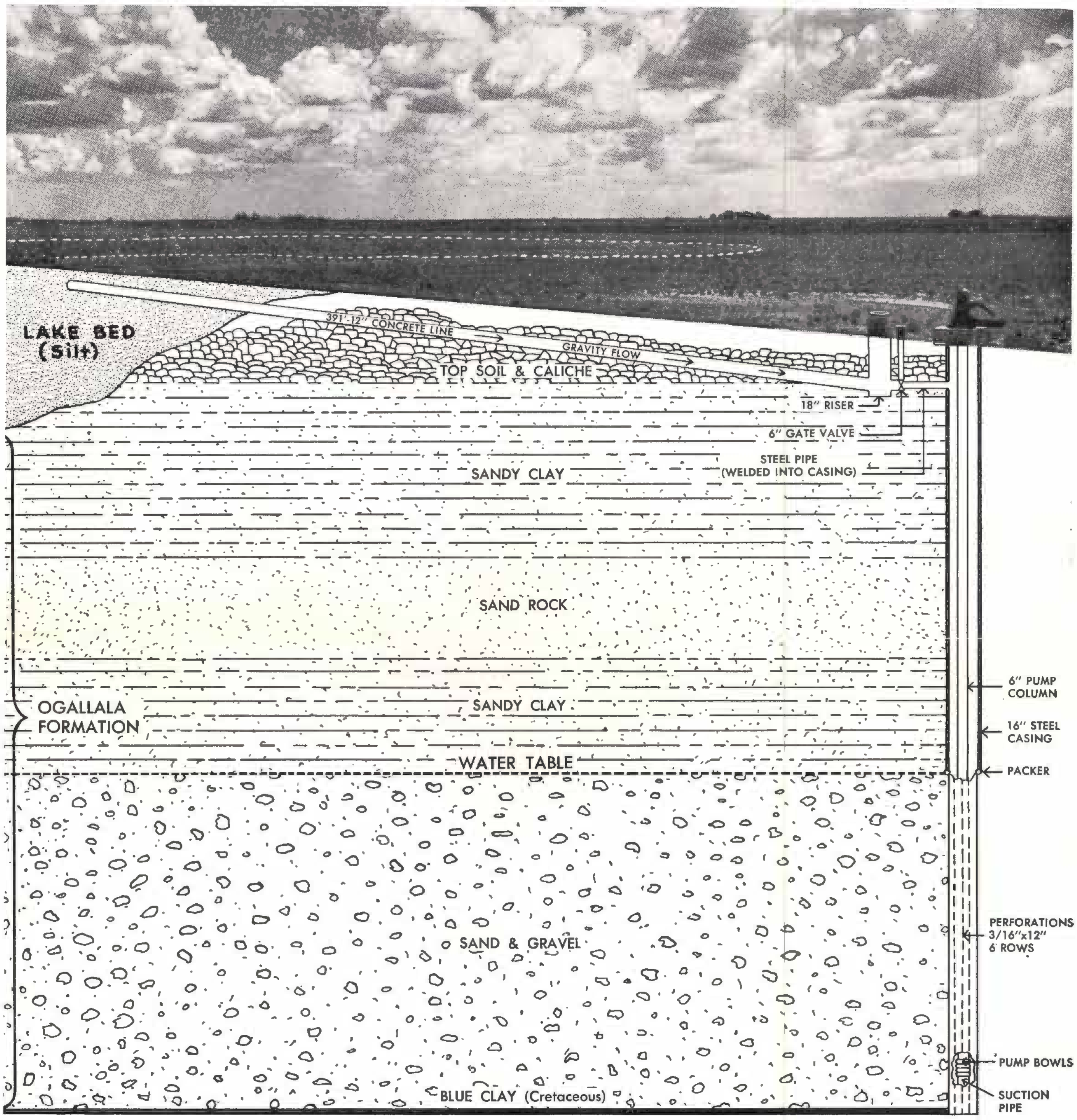
The reason for the packer is that when recharging at a rate faster than the well will take water, the water will rise on the outside of the casing to reach the level of water in the lake. This sometimes results in the undermining of the pump base and allowing mud to fall down into the well.

The next part of the installation was the surveying of the lake bed with a level in order to determine the low point. After the low point was found, elevations from the well to this point were determined in order to know how much cut had to be made to have a gravity flow from the lake to the well. In this lake the low point was 400 feet north of the well. The difference in elevation, allowing 0.15 foot per hundred feet fall back to the well, from the low point in the lake to the land surface at the well was 10 feet. This meant that with the available ditching machine, which would cut only about 5 feet, we must use a maintainer to make our first cut.

The cut made by the maintainer at the well was 5 feet; at 100 feet from the well, 2.5 feet; at 200 feet, 1.5 feet; feathering out to land surface at 300 feet. This then enabled the ditching machine to make the maximum cut needed for the laying of the gravity flow line.

The next part of the installation was the laying of the gravity flow line. A point 13 feet from the well was selected as the point for the installation of a riser. The purpose of the riser is to allow the air which collects in the line to escape when recharging. It also houses a meter that is installed in the concrete line in order to measure the rate and quantity of water that flows into the well. After the riser was set, 391 feet of 12-inch concrete line was laid from the riser to the low point in the lake.

The next step was the installation of a 6-inch steel pipe welded into the casing and extending back to the riser. At a point between the well and the riser a 6-inch steel screw type gate valve was installed. The valve is used to regulate the flow of the water from the lake into the well, and also to stop the flow of water into the well each day during recharging operations in order to pump the well and remove the silt that enters the water-bearing formation with the lake water.



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

Second Class Permit

THE Cross SECTION

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

Volume 5—No. 2 "THERE IS NO SUBSTITUTE FOR WATER" July 1958

REPORT DISCUSSES OVER-ALL WATER SITUATION IN TEXAS

United States Senator Lyndon B. Johnson and Governor Price Daniel this month released to the public a 175-page report entitled, "Water Developments and Potentialities of the State of Texas."

The report was jointly prepared, at the request of Senator Johnson by the Texas State Board of Water Engineers, the U. S. Army Corps of Engineers, the Bureau of Reclamation and the State office of the Soil Conservation Service. It does not outline a water-development plan for the State of Texas, but rather it presents a general picture of the over-all Texas water situation.

The report reviews at great length the scope of individual river basin resource planning and development and the intra-basin transfer of water (that is, it proposes to transfer water from a river basin that has more water than it needs for its ultimate potential development to another river basin that needs additional water to accomplish this end). The report states, "The scope of the economic impact of large-scale water exchange in Texas is impressive. If exploited to its logical conclusion there is solid evidence that the increase in Texas income would be of great magnitude. Accomplishments of this objective involves provision of regulatory storage, where economically justified, and provision of distribution works to deliver surplus water from points of origin to points of need".

The report recognizes the fact that much additional data will be needed before a complete water development plan for Texas can be forthcoming. Concerning ground water, the report states: "In 1956, approximately 10,320,300 acre feet of ground water were pumped for irrigation, municipal and industrial uses in Texas.—This figure represents nearly one-half of the entire water use in the State for the year 1956. Therefore, it must be recognized that the source, availability and chemical quality of ground water are at present of great importance to irrigated agriculture, urbanization and industrial expansion.—Expansion of ground water studies in all parts of Texas will be needed to determine the potential capacity of ground water resources to supply the State's future water demands."

The report has apparently been praised generally as a useful reference that can be used by many. The demand for the report has been tremendous and requests should be sent to the State Board of Water Engineers, 1410 Lavaca Street, Austin, Texas.

Water Conservation Is Individual's Responsibility

Is your own operation comparable to the one shown above? Note in the foreground the top soil that has been eroded from the field and the water lost by allowing it to escape from the land.

Are you practising water conservation as is the one who owns the farm shown in the above picture? Note the heavy dirt border at the end of the crop rows which is designed to hold irrigation water on the land.

HIGH PLAINS WATER DISTRICT IS LOCAL-CONTROLLED TOOL OF AREA

The District Office personnel is often asked what relationship the High Plains Underground Water Conservation District has to the Federal and State governments and how it is financially supported.

The High Plains Underground Water Conservation District is a local-controlled political subdivision of the State government. The District has no actual relationship with the State except that it was established following procedures set out in a State statute. The District has absolutely no connection with the Federal Government.

The District is financially supported by a 5c tax on the $100 assessed valuation of property within the District. The tax is assessed and collected only from those who own property within the Counties that are included in the District. In other words, the District's conservation program is paid for by those recipients directly benefitting.

The Water District conducts its conservation program under the direction of its Board of Directors. The District is divided into five precincts, each precinct is represented on the District's governing Board by one man. The precinct director is elected for a two-year term of office and all qualified, tax-paying resident voters are eligible to cast a ballot in the Water District elections which are held each year on the second Tuesday of January.

The Board of Directors may pass rules and regulations designed to conserve, preserve, protect and recharge the underground water of the underground water reservoir providing that the rules do nothing to deprive an owner of land of his rights and ownership in the underground water.

The Water District, in a sense, is a tool of the people designed to aid in prolonging the life of our underground water reservoir and in reaching an optimum economic return for the underground water pumped.

Americanism Defined

"Americanism means the virtues of courage, honor, justice, truth, sincerity and hardihood—the virtues which made America. The things that will destroy America are prosperity at any price, peace at any price, safety-first instead of duty first, the love of soft living and the get-rich-quick theory of life." —Teddy Roosevelt

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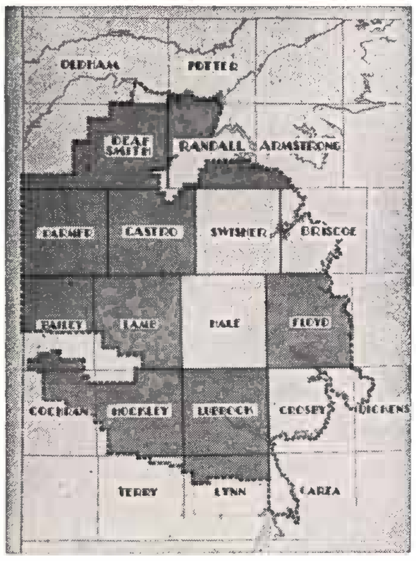

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J. R. BELT, Jr.

"The Cross Section" presents this month to its readers the last member of the present Board of Directors of the High Plains Underground Water Conservation District but by no means the least of its membership—Mr. J. R. Belt, Jr. of Lockney, the Director of Precinct No. 5.

Mr. J. R. Belt, Jr., of Lockney represents Precinct No. 5, consisting of only Floyd County, on the Board of Directors of the High Plains Underground Water Conservation District.

Mr. Belt is the son of Mr. and Mrs. J. R. Belt, Sr., of Lockney. He was born June 5, 1916, on a farm north of Lockney and has two sisters and one brother. He attended school through the ninth grade at the Prairie Chapel rural school, then completed his formal education at the Lockney High School.

In 1934, Mr. Belt married Miss Maye Golden. She and her twin sister are the youngest in a family of fifteen. Mrs. Belt's family, the Taylor Goldens, moved to the Prairie Chapel community from Bosque County in 1916.

The young Belt couple moved to an 80-acre farm located west of the Belt home place north of Lockney and began farming.

The farm was owned by the Texas Land Development Company. The T. L. D. company had drilled an irrigation well on this tract in 1916 and equipped it with a very large and inefficient turbine pump and a tremendous 2-cylinder engine. Mr. Belt, Sr. operated the large engine in years following its original installation. The well was drilled about 200 feet deep with the top 60 feet being hand-dug and approximately 6 feet in diameter. The well bore had to be big enough to accommodate the large pump. The well was originally developed by using a steam engine as a power unit.

Mr. Belt worked the 80-acre tract and also rented another 240 acres of farm land west of Lockney. This land had one irrigation well drilled on it at that time. He grew mostly cotton and wheat.

In 1936, a daughter, Elizabeth Ann, was born to the Belts. She finished Texas Technological College this year and is married to Eddie Joe Foster, a Tech business major.

By the way, Mr. and Mrs. Belt are expecting their first grandchild this winter through the courtesy of Mr. and Mrs. Foster.

Through the thirties farming was not too profitable, but in 1942 the Belts had saved money enough to make a down payment on their present home place located just southeast of Aikin. The 197-acre farm was part of an original 320-acre place bought by Mr. G. W. Tierce from the railroad in 1901 for $1 per acre. When the Tierce family bought the farm there were many evidences of Indians having hunted buffalo in the immediate area.

Mr. Belt had 38 acres of potatoes planted on the rented place west of Lockney in 1943 that netted him enough money to finish paying for the home place.

In 1945, the Belt's second child was born. Carolyn is now quite a young lady who will be in the eighth grade next year at Lockney.

During the following years Mr. Belt acquired several small tracts of land that joined his home farm. Several of these small tracts were purchased from the old Texas Land Development Company and many of the original irrigation wells are still being used today with new modern turbine pumps and engines replacing the old and less efficient units.

In 1947, Steve, the Belts eleven-year-old son was born. He will be in the sixth grade at Lockney next year.

An interesting side-light in the life of Mr. Belt is his obsession for level farm

ALGAE AND BACTERIA CONFRONT MANY HIGH PLAINS WATER USERS

During the past few months the appearance of a gelatin-like substance in many irrigation and domestic wells has been reported from throughout the High Plains area.

This substance has been baffling and disturbing to well-owners because they have been unable to explain its presence.

Dr. J. K. G. Silvey, head of the Biology Department of North Texas State College in Denton, has recently analyzed samples of the gelatin-like substance and reports that it is a Blue-Green Algae accompanied by Iron and Sulphur Bacteria. This type algae when accompanied by bacteria is reported to have the appearance of axle grease—very dark green or black in color. When the algae is not accompanied by bacteria it is usually a flesh-color.

Dr. Silvey reports that the alga is usually found as a single-cell plant and can appear in many different hues and colors. The presence of the blue-green algae in a well can cause contamination and a disagreeable odor and taste. The alga does not need oxygen to exist and it feeds on phosphate and nitrogen. It is water formed.

The algae is reported to be present in most areas of the Southern High Plains. It is known in at least one case to have become so dense inside a pump bowl assembly during a period when the well was inoperative that it completely froze the impellers. The pump could not be operated until it was pulled from the well and the bowl assembly dismantled and cleaned.

The algae has been observed in a wide variety of stages, from a very thin slimy film which coated only the column pipe and bowl assembly to a gelatinous mass one-half inch in thickness that completely covered all metal below the water level in the well, including the inside of the pump.

Dr. Silvey states that in laboratory tests he has found that the algae can be killed with Chlorine Dioxide in a concentrated solution of 4 parts per million. However, the alga cell itself, secretes the gelatin-like matter which surrounds the plant and in time builds up to such an extent that the Chlorine Dioxide has a difficult time in penetrating to the alga. (Chlorine Dioxide is a gas and can be explosive when mixed with water, consequently only those experienced and qualified to do so should handle it.)

From the standpoint of the irrigator the presence of algae in a well is a matter of concern primarily because it is quite possible for the plant to become so plentiful in a well that it clogs the perforations in the casing and consequently prevents water from moving freely to the pump. Also, the algae may even clog the pores of the water-bearing formation itself.

Dr. Silvey would not commit himself on the matter of chemical prevention of algae and bacteria from growing and multiplying in a well because he has not done enough experimental work as yet; however further laboratory tests will undoubtedly develop an adequate preventive formula.

Should you discover that a foreign matter or bad odor is present in your well, please help us by reporting it to either your County Committee or to this office. We want to work with you in every way possible.

Above is shown a pump bowl-assembly on the left and oil tubing at the right which has just been pulled from an irrigation well. The encrustation visible on these pump parts is Blue-Green Algae accompanied by Iron and Sulphur Bacteria.

The dark greasy-like algae and bacteria growth which covers the pump bowl-assembly shown above can clog well casing perforations and even the pores of the water-bearing formation.

WELL DRILLING STATISTICS FOR JUNE

During the month of June, 70 new wells were drilled and registered with the District office; 5 replacement wells were drilled; 1 old well was deepened; and 2 wells were drilled that were either dry or non-productive for other reasons. 49 permits were issued by the County Committees during June. The new permits issued and completed wells follow by counties:

County	*Permits Issued*	*New Wells Drilled*	*Replacement Wells*	*Old Wells Deepened*	*Dry Holes Drilled*
Armstrong	0	0	0	0	0
Bailey	1	4	2	0	0
Castro	1	10	0	1	0
Cochran	1	0	0	0	0
Deaf Smith	14	6	1	0	0
Floyd	6	4	0	0	1
Hockley	5	12	0	0	1
Lamb	1	9	0	0	0
Lubbock	9	16	2	0	0
Lynn	0	2	0	0	0
Parmer	10	6	0	0	0
Potter	0	0	0	0	0
Randall	1	1	0	0	0

J. R. BELT, Jr., (Continued from Page 2)

land. He says that when he was a boy growing up his family lived on a place that was rather hilly and that while neighbors were producing good crops on level farms his family was not making good yields. This has stayed with him through the years and has greatly influenced his land purchasing. He now owns 900 acres of land and not one acre is unsuitable for farming.

Mr. Belt is on the Board of the Lockney Cooperative Gin and a member of the Lion's Club. He is a past member of the Lockney School Board. The Belt family attends the Lockney Church of Christ.

Mr. Belt raises Shetland ponies as a hobby. His herd now numbers 23 ponies. He also enjoys an occasional fishing and hunting trip to New Mexico, Colorado and Wyoming. The family takes a trip to Rockport in south Texas each year.

It is fortunate for the people of the Southern High Plains of Texas to have the experience and integrity of men such as Mr. J. R. Belt, Jr. representing them on the Board of Directors of the Water District.

Extension Service Releases Irrigation Survey

Mr. D. W. Sherrill, Irrigation Agent with the Texas Agricultural Extension Service in Lubbock, has recently released an annual irrigation survey. The survey shows irrigation data for a 42-county area in the High Plains of Texas.

According to the survey, there are 4,582,570 acres under irrigation in the High Plains Area (Oklahoma panhandle to Midland and New Mexico to eastern escarpment). This constitutes an increase of 183,690 acres over the number of acres irrigated in 1957.

The survey further reveals that there are 18,605 irrigated farms in the area, 3,106 miles of underground irrigation pipe installed, 3,804 sprinkler systems and 45,522 irrigation wells. Of the total number of irrigation wells 33,766 of them have pumping lifts in excess of 125 feet.

The survey also shows that there are 95 recharge wells in the High Plains.

The survey presents the following data for Water District Counties:

County	*Farms Irrigated*	*Total Acres Irrigated*	*Irrigation Wells*	*Sprinkler Systems*	*Recharge Wells*
Armstrong	94	25,550	150	4	
Bailey	830	162,000	1600	200	
Castro	900	405,000	3800		2
Cochran	340	70,000	925	400	
Deaf Smith	700	320,000	2300		
Floyd	1300	300,000	2500	5	13
Hockley	1350	275,000	4350	115	3
Lamb	1787	325,000	5045	60	8
Lubbock	1800	350,000	4936	5	13
Lynn	550	65,000	1375	14	6
Parmer	1100	370,000	2350	3	5
Potter	21	14,500	34	1	
Randall	430	90,000	710	3	
TOTAL	11,202	2,772,050	30,075	810	50

Does Alternate-Furrow Irrigation Pay?

Many irrigators in the Southern High Plains are watering alternate furrows in an effort to cover more land with small capacity wells.

Is this method more or less efficient than watering only half as much land by irrigating each furrow?

Well, the answer to that question is probably one that will come only after more time for experimenting has passed. However, there are some research data available pertaining to alternate furrow irrigation.

Mr. Shelby Newman, Assistant Irrigation Engineer at the Lubbock Experiment Station says that on the basis of only two years of research experience on alternate furrow irrigation, the practice appears to be a poor method of distributing irrigation water.

The Lubbock Experiment Station conducted in 1956, 1957 and now in 1958 three experimental irrigation treatments designed to point out the efficiency of spreading water by using the alternate-furrow method.

The three treatments are as follows:

1. Water each furrow with a 4 acre/inch application.

2. Water alternate furrows with 4 acre/inch application.

(This treatment applies the same amount of water per acre as does treatment No. 1 by running twice as much water down the alternate furrow.)

3. Water alternate furrows with a 2 acre/inch application.

The Lubbock Agricultural Experiment Station is conducting alternate-furrow irrigation efficiency tests. Above is shown Shelby Newman, Assistant Irrigation Engineer, who has charge of the Station's experiments, as he inspects cotton being irrigated in alternate furrows. Tom Haddox, Texas Tech Student Assistant, shown standing, assists Mr. Newman.

The treatments have been applied to cotton and the lint yield under each treatment checked.

In 1956, which was a hot dry year, the cotton grown under treatment No. 1 (every furrow irrigated) yielded 29 pounds of lint per acre more than did treatment No. 2 (4-acre/inch application in alternate furrows). There was a difference in yield of only 7.5 pounds of lint per acre between the 2-inch and the 4-inch applications in alternate furrows.

Then in 1957, the results showed no difference in yield between cotton grown under treatment No. 1 and treatment No. 2. In other words, when the same quantity of water was applied to each tract the yields were comparable, regardless of whether the water was run down every furrow or alternate furrows. However, when the amount of water was reduced by half (treatment No. 3) the yield in lint decreased by 71 pounds per acre.

It is difficult to say that the results of the last two years experiments in Lubbock are conclusive evidence that alternate-furrow irrigation is less efficient than the every-furrow irrigation method. The data is simply not taken over long enough period of time; however on the basis of these tests an irrigator would do well to take a long hard look before deciding definitely to irrigate alternate furrows.

A typical Southern High Plains cotton field is shown above. Irrigation water is being applied in every other furrow in an effort to water more acres with the available supply of water. Tests show that following this distribution method may be false economy.

In the cotton field shown above every furrow is being irrigated. Available data seem to indicate that this distribution method is more profitable than is the method where only every other furrow is watered.

High Plains Underground Water
Conservation District No. 1
1628-B Fifteenth Street
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DISTRICT TO TAKE ADDITIONAL STEPS TO ENFORCE RULES AGAINST WASTE

In a meeting at Lubbock on August 20, the Board of Directors of the High Plains Underground Water Conservation District discussed at great length one of the Southern High Plains' major problems—waste of agricultural "tail-water."

"Tail-water" is the term which describes unused irrigation water which is allowed to run from the end of crop rows. Most of this "tail-water" is uncontrolled by the irrigator, and usually it enters a road-ditch from the crop rows and from there meanders toward a low place, depression or lake.

Included in the rules of the District is a regulation which forbids the habitual and willful waste of agricultural irrigation water. The District's staff, under the Board's leadership, has attempted to enforce this rule in the past by employing educational methods.

The District has shown that from an economical standpoint the practice of allowing "tail-water" to escape the land from which it is produced is very unwise. It does not take a highly educated man to determine that money is being thrown away when it is used to produce irrigation water that is allowed to run into a lake and there evaporate without serving a beneficial purpose for anyone.

The District has pointed out that agricultural "tail-water" is also a detriment to our society from a health and safety standpoint. The road-ditches, depressions and lakes when filled with "tail-water" represent excellent breeding environments for disease-carrying mosquitoes. Also, "tail-water" represents a public safety hazard when allowed to run across or stand on public roads. Many accidents have occurred when an unaware motorist comes upon a large gully washed across the road by "tail-water." One would suppose, when facts such as these are known, that a sound-thinking irrigator would do everything in his power to protect his family and others of the community by ceasing to allow any "tail-water" to run into lakes and thereby contribute to the preservation of mosquito-breeding habitats, or across public roads and thereby create traffic hazards and maintenance problems.

The District has also approached the problem from the standpoint of this present generation leaving a useful heritage of an adequate water supply to future generations who will attempt to earn a living from the farm land we now call "ours." When water is produced and is not put to a beneficial use, someone down the line of succession is deprived of his rightful heritage.

The District has attempted to stress these forementioned reasons for conserving "tail-water" and has in the majority of instances, with such logic, been able to solve acute waste problems.

However, there remains a minority element within the Water District that persists in allowing "tail-water" to escape their land. To this group we would like to point out that under a democratic-type government such as the one we enjoy, each individual is responsible to see that the use of his property does not do damage to others of the community, and that he is morally and spiritually obligated to use resources entrusted to his care as wisely as is possible.

The District is now taking additional steps to enforce the rules against waste. These steps represent a more positive approach to the problems of conserving our precious resource, protecting community life and health and facilitating a greater economic return from irrigation water pumped.

Agricultural Research Facilities Studied

Secretary of Agriculture Ezra Taft Benson has announced the appointment of a working group to study facility needs for soil and water conservation research. The study is being made at the request of the Senate Committee on Agricultural Appropriations.

Members of the working group are: Dr. G. M. Browning of Iowa State College, representing the State Agricultural Experiment Stations; Gerald E. Ryerson of the Soil Conservation Service; and Dr. Cecil H. Wadleigh and Dr. Darnell M. Whitt of the Agricultural Research Service.

Secretary Benson directed the working group to focus its attention on problems of national and regional importance, leaving for the attention of the States problems having only State or local significance.

The Senate and House Committees on Agricultural Appropriations received a number of proposals for soil and water conservation research facilities during the hearings on appropriations for fiscal year 1959. The Committees stated that the recommendations received had merit, but that the total needs of the country for soil and water conservation research facilities should have careful study.

The study inaugurated by Secretary Benson will provide an estimate of total soil and water conservation research needs with respect to problems of regional and national significance, of the capacity of existing research facilities to meet those needs, and the need for any additional research facilities.

The working group will receive recommendations from Federal, State and local organizations concerned with the conservation of soil and water resources. Interested parties are invited to present their evaluation of the kind and extent of soil and water problems needing research. Presentations should be addressed to Dr. Darnell M. Whitt, Plant Industry Station, Beltsville, Md.

Hydrologist Presents Rare Book To Tech

A rare book, entitled "Geology and Underground Waters of the Northern Llano Estacado," has been presented to the Texas Tech College Library by W. L. Broadhurst, Chief Hydrologist for the High Plains Underground Water Conservation District.

The book was written by Charles Laurence Baker and published in 1915, as Bulletin No. 57, by the University of Texas. It is the first comprehensive report of ground water in the Southern High Plains.

Earlier, when Mr. Broadhurst attempted to find a copy of the book for reference and it could not be located, he began an intensive search and finally found two old copies in a book store at Brownwood, Texas. After the copies were rebound, one was retained in the Water District library and the other given to Tech.

Mr. Broadhurst presented the publication to Tech's library so it will be available as a reference for students, geologists, and others who are interested in facts pertaining to High Plains water.

WATER DISTRICT FIELD OFFICE TO BE LOCATED IN HEREFORD

The High Plains Underground Water Conservation District will establish a field office in Hereford. The office will primarily serve the north part of the District.

The new office will be opened about September 1. Mr. Wayne Wyatt, District Field Representative, will be transferred from the District office in Lubbock and will make his home in Hereford.

Due to the increased work load of District field operations and to the vast size of the District, the Board of Directors voted to establish this field office and situate it near the north boundry so that the area might be better served.

The District plans to run several new experiments on water use in the Hereford-Dimmitt area. The experiments will require close supervision and should supply valuable information to irrigators as to proper amounts of water that should be applied to various crops.

Exact location of the new field office in Hereford will be 317 Sampson Street.

Landowners in Deaf Smith County will still obtain well drilling permits from the Farm Bureau office in Hereford.

WELL DRILLING STATISTICS FOR JULY

During the month of July, 61 new wells were drilled and registered with the District office; 7 replacement wells were drilled; and 2 wells were drilled that were dry, or non-productive for other reasons. 69 permits were issued by the County Committees. The new permits issued and completed wells follow by county:

County	*Permits Issued*	*New Wells Drilled*	*Replacement Wells*	*Old Wells Deepened*	*Dry Holes Drilled*
Armstrong	0	0	0	0	0
Bailey	5	7	0	0	0
Castro	8	3	0	0	0
Cochran	1	0	0	0	0
Deaf Smith	6	13	3	0	0
Floyd	1	2	0	0	0
Hockley	11	8	4	0	0
Lamb	3	7	0	0	0
Lubbock	19	10	0	0	0
Lynn	6	2	0	0	2
Parmer	6	5	0	0	0
Potter	1	0	0	0	0
Randall	2	4	0	0	0

THE Cross SECTION

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ALLAN WHITE
Editor

UNDERGROUND WATER RES

Water that occurs below the surface of the earth in the zone of saturation has been clothed with mystery for centuries. However, underground water, or ground water as it is commonly called, obeys the laws of physics and a great deal can be learned about it. The depth to which a well should be drilled in a given locality in order to tap the best available supply of ground water can be calculated with reasonable accuracy. The areas in which water sinks underground can be identified, and in some localities the rate of infiltration to the underground reservoirs can be computed. The natural discharge from some underground reservoirs can be measured, and these data afford valuable clues as to the amount of the perrennial supply. Through systematic study the yields of underground reservoirs can be estimated either for short periods or long periods of time. Furthermore, the areas in which no important supplies exist can be mapped with reasonable accuracy.

The economic use of underground water involves conservation. Conservation of ground water in West Texas should be each person's rightful work and personal concern because such conservation has a direct relationship to present as well as future commercial and industrial enterprises of the area.

Conservation of underground water is defined as the orderly development and provident use of this valuable natural resource, based on the knowledge and the economic conditions of the times. Consequently, conservation is not something fixed and unchangeable; rather, it is a progressive economic proposition which changes as the conditions change.

During the first half of the Twentieth Century, we permitted much of the water in West Texas to be wasted —because we did not fully recognize the need for more rigid conservation measures which deal specifically with water management. However, if this region is to retain its recognized economic position, we must all use our intelligence and ability, with divine guidance, to reap the full benefits of our water resources.

Nature of Reservoirs and Source of Underground Water

The region covered by the *West Texas Business Report* may be subdivided into four basic hydrologic units: (1) the Trans-Pecos, (2) the High Plains, (3) the Rolling Plains, and (4) the Edwards Plateau.

The water that enters the various underground reservoirs beneath the four areas has the same general source; it is from precipitation that either falls on the areas or seeps from streams that cross the areas. However, the quantity and quality of the underground water that is available to wells and springs depend more on the geologic formations that underlie each area than on the amount of annual precipitation or the flow of surface streams.

In the Trans-Pecos area important supplies of fresh water are available from Bolson deposits in the vicinity of Van Horn and along the Rio Grande and the Pecos Rivers; and from beds of porous limestone at Dell City, Balmorhea, Fort Stockton, and other localities.

Throughout most of the High Plains unconsolidated or loosely cemented sand, silt, and gravel in the Ogallala formation of Tertiary age underlie the surface soil. These sediments range in thickness from a few feet to more than 800 feet, but in most places where large capacity wells have been developed they are between 200 and 500 feet thick. The debris was transported chiefly by meandering streams that flowed across the region from the Rocky Mountains and was deposited on an undulating surface of Cretaceous, Triassic, and Permian rocks. The Ogallala formation has been eroded away east of the eastern High Plains escarpment, west of the western escarpment in New Mexico, and from the valleys of the Canadian and Pecos Rivers which are deeply entrenched in Triassic and Permian rocks.

A large quantity of water, which has accumulated over centuries, is stored in the underground reservoirs formed by the sands and gravels in the Ogallala formation. In general the water occurs under water table conditions, and beneath most of the Plains the water table slopes eastward or southeastward at about the same rate as the slopes of the land surface. However, near the western escarpment of the Plains and along the south rim of the Canadian River valley in Texas there is a water table divide; a small amount of ground water moves westward from the High Plains and discharges into the Pecos River, and along the north edge of the Southern High Plains a small amount of ground water moves northward and discharges through springs into the Canadian River. Thus, in the Southern High Plains the water table in the Ogallala formation is above the Pecos River, to the west, and the Canadian River, to the north; the beds of the Ogallala formation have no underground connections with water-bearing beds outside the area except through the underlying older rocks which contain more highly mineralized water. The source of fresh water in the Ogallala formation, therefore, must be from precipitation that falls on the surface of the High Plains.

In the Rolling Plains to the east, sands in the Trinity group of Cretaceous age furnish water for industrial purposes at Fort Worth and Waco as well as municipal supplies for many smaller towns in the adjacent territory. The sands crop out at Weatherford some 30 miles west of Fort Worth and dip eastward. At Fort Worth they occur about 1000 feet below the land surface. Originally wells in Fort Worth had a natural flow, but as a result of large withdrawals the artesian pressure has been released and water levels in wells now stand several hundred feet below the land surface. However, the sands are still full of water, so the big problem is not one of physical exhaustion but one of economic pumping lift.

Much of the central and western parts of the Rolling Plains are underlain by thick deposits of relatively impermeable clays and associated material. In general these formations yield only meager supplies of somewhat highly mineralized water; however, locally porous strata do yield relatively large quantities of water to wells which contain a high concentration of calcium sulfate (gypsum). Such mineralized water is undesirable or unsuitable for most industrial and municipal uses but is satisfactory for irrigation.

The ground water reservoirs in the Edwards and the associated limestones

SOURCES OF WEST TEXAS AND THE ECONOMICS OF THEIR USES

By W. L. BROADHURST

of Cretaceous age throughout parts of the Edwards Plateau, and especially along the Balcones fault zone which extend from Del Rio eastward to San Antonio and northeastward beyond Austin, yield large supplies of fresh water both to wells and springs. The source of water in this area comes from precipitation within the area itself, and the underground reservoirs of the Edwards Plateau have no relationship to those of the Rolling Plains, the High Plains, or the Trans-Pecos.

Ground-Water Resources and Droughts

The value of porous rock formations comprising the underground reservoirs is seldom fully appreciated. As a matter of fact, there is a general misconception about the relationship between the supply of ground water and prolonged droughts. The underground reservoirs are the principle agencies that maintain the fair weather or normal flow of perennial streams, and contain a large part of the fresh water in the world. They furnish the supplies obtained from wells and springs, and in many localities, particularly in the arid and semi-arid regions, they are the only available sources of supply. They respond slowly to the effects of drought, and if the water-bearing beds are of considerable extent and thickness they are generally not materially depleted even by prolonged droughts. During dry periods the water table may decline, stream flow may dwindle, and shallow wells may become dry; but the wells that have been drilled to considerable depth below the water table seldom are effected by extended droughts.

Although water levels in wells have declined in areas of heavy withdrawals for municipal, industrial, and irrigation purposes, not a single ground water reservoir of consequence in West Texas failed or was seriously depleted during the recent severe droughts. It is true that some individual wells and even some well fields have declined in yield. But as a matter of fact, throughout this part of Texas, which has been subject to droughts for centuries, had it not been for the abundant supply of underground water several million acres of land would have produced no crops at all and a multitude of people would have been without drinking water.

Economics of Water Use

Numerous articles have been published in magazines with national distribution which imply that because ground water is being "mined", particularly in the High Plains area, enterprises that are built on a ground water economy are insecure and have an uncertain future. This we hold to be without sound foundation.

Underground water in West Texas is being developed and used by thousands of individuals, many of whom are not versed in the laws of nature and do not understand the rudiments of the occurrences and movements of underground water. Consequently, some of the major problems regarding conservation of this valuable natural resource relate to the conveyance of fundamental concepts to the individual. This is necessary so that he may have a better understanding of the present and the future effects that his operations will have on himself, his neighbor, and the region as a whole.

The two major factors regarding development and use of water from an underground reservoir relate to (1) the amount of water that can be physically extracted, and (2) the amount of water that can be extracted economically.

According to present concepts some water in each and every underground reservoir throughout the world will be held in storage by capillary attraction and surface tension; hence, in a technical sense, it is physically impossible to extract all the water from an underground reservoir by pumping from wells. Many unconsolidated, saturated sands and gravels have a pore space of 30 to 45 percent of their total volume and as a result a cubic foot of such material would hold 0.3 to 0.45 of a cubic foot of water. However, fine-grained sands normally yield by gravity to wells only 15 to 20 percent of their total volume or approximately one half to two-thirds the total water in storage.

The High Plains of Texas extend from the Oklahoma Panhandle southward to Odessa-Midland-Big Spring and from the New Mexico line eastward to the caprock, and embrace about 22,000,000 acres. The quantity of water in storage in this area before the start of pumpage for irrigation amounted to some 400,000,000 acre-feet. To date roughly 40,000,000 acre-feet have been withdrawn from storage, more than 98 percent of which have been used for irrigation. Neither the developments nor the withdrawals have been uniform throughout the area. In some areas the concentration of wells and withdrawals of water have resulted in greater water level declines in those wells than in the wells in the less heavily pumped areas. For example, in one of the oldest areas of development where the pumpage was heavy the water levels in wells declined more than 80 feet from 1939 to 1958. The area, however, beneath which the decline has been this great amounts to less than one half of one percent of the currently irrigated area.

The pumpage for irrigation in the High Plains during 1954, 1955, and 1956 averaged approximately 5,000,000 acre-feet per year. Because of favorable precipitation, pumpage was somewhat less in 1957 and unquestionably will be much less in 1958 than during each of the preceeding three years.

The time during which irirgation will be practical cannot be determined mathematically by dividing acre-feet of water in storage available to wells by the average of annual pumpage for the period 1954-56 inclusive. The problem is not that simple. Water cannot be withdrawn from existing wells at the current rate until exhaustion. The current rate cannot be maintained because the yield drops more rapidly than the fall in the water tables. For example, if a well that penetrates the full thickness of an aquifer and has a maximum yield of from 800 to 1000 gallons per minute has the sand sections that contribute water to the well decreased by one half, the yield will decrease to one fourth the original or 200 to 250 gallons a minute.

In addition, the continuing development of wells will take increasing amounts from storage. The result will be a continued decline in the water levels. Other things remaining constant, as the water levels decline and the yields are lowered, the relative over-all cost of pumping water will increase. This will do two things: (1) it will force the application of water into its most economic uses and (2) it will decrease the rate of withdrawal.

Thirdly, a constant relationship between cost and revenue may not be maintained. A change in either relative cost or revenue will further make mathematical computation of the life of irrigation reserves inexact. Historically these changes have occurred. Climatic conditions will also affect the rates of recharge and withdrawal, further adding to the inexactitude of this computation.

Efficient and Inefficient Utilization of Ground Water

A recent irrigation survey by the Extension Service of Texas A & M College shows more than 4,000,000 acres under irrigation in the High Plains area from approximately 45,000 irrigation wells. The survey shows that during the ten-year period from 1948 to 1958 more than 3,000 miles of underground pipe was installed to convey water from the wells to the fields. No detailed survey has been made, but it is conservatively estimated that there is at least one mile of open ditch for each irrigation well on the Plains. This means, then, that a large percentage of the water pumped is conveyed through more than 40,000 miles of open ditches. Studies by the Agricultural Experiment Station, Texas Technological College, the High Plains Water District, and others reveil that 20 to 30 percent of the water conveyed in open ditches is lost through seepage and evaporation before the water reaches the fields. Studies by the same groups further show that because of under-watering or over-watering another 25 to 30 percent of the water applied to the fields does not produce income. Consequently, it can be readily understood that through orderly development, distribution of water through closed systems, and application of the water according to scientific methods, perhaps one half or even one third the annual withdrawals of ground water in the future, coupled with more efficient use of the natural rainfall, can and will sustain a favorable economy.

In parts of the Southern High Plains of Texas only meager supplies of ground water can be obtained from wells. That is to say, some wells will yield only 100 to 200 gallons per minute. In such areas the irrigators are water conscious. They prepare their land in such a manner as to effectively store the natural rainfall in the soil. They apply the pumped water at the most opportune times, and under such practices many produce a bale of high quality cotton per acre. In contrast, many of their neighbors throughout a large part of the irrigated district, who have wells that will produce 600, 800, 1000, or even 1500 gallons per minute, pay little attention to land management in order to store precipitation in the soil. Instead, they plant crops in rows down the slopes, irrigate down the furrows, permit tail water to escape from the field, and escape into the natural lakes from which a large part of the water is lost through evaporation. As a result of such management practices, many operators with large capacity wells pump several times as much water from the underground reservoir as their neighbors with small wells, and in the end they produce a bale or maybe a bale and a quarter of cotton per acre.

This is not intended to cast reflection on current operations of any irrigation farmer; rather it is intended as constructive criticism to point out the fact that when the time comes that the 8-inch and the 10-inch wells deliver only 4-inch and 5-inch streams of water, the operators can and will use available water more prudently and continue to produce excellent crops.

The Future

Records of the U. S. Weather Bureau indicate that the average annual precipitation in the High Plains area is about 20 inches a year. Available records collected by the U. S. Geological Survey indicate that less than one percent of the precipitation that falls on the Plains runs off as stream flow. Data compiled by the Soil Conservation Service of the U. S. Department of Agriculture indicate that throughout the Southern High Plains the average annual runoff from the land surface into the playa lakes is about 0.85 of an inch per year. This means approximately 45 acre-feet of water runs off from each square mile into the playa lakes. Other records show that of the water that runs into the lakes, approximately 10 percent penerates downward to become ground water; the other 90 percent goes into the air through evaporation and transporation with no economic value to the people of the Plains.

The High Plains Water District has been instrumental in advocating use of the water that is now lost from the playa lakes. How can such water be used effectively? First, we believe detailed studies should be made by the individual land owner to determine whether or not he can prepare his soil in such a manner as to store the precipitation in the root zone and prevent it from running off to the lakes. Second, if the water cannot be effectively stored in the soil, a study should be made of the economics of pumping the water from the lakes directly to the field with a lift ranging from 5 to 20 feet. Third, and last, if the water can neither be stored in the soil zone nor pumped from the lakes to the fields, it should be stored underground in the water-bearing formations where it will be available for use when needed.

As has been stated, more than 98 percent of the water pumped from the underground reservoirs in the High Plains of Texas is used to irrigate some 4,000,000 acres of land. Less than 2 percent is used for all other purposes including municipal, industrial, and domestic uses.

Are we obtaining the greatest dollar value from the water (and believe it or not, we are selling water) by using such a large percentage for irrigation? According to the June, 1958, irrigation survey by Dave Sherrill, District Irrigation Specialist, Texas Extension Service, nearly half the acres irrigated in the High Plains were grain sorghum. According to an economic appraisal of ground water use for the High Plains Water District in August 1957, when expressed in terms of added income due to irrigation per unit of water used, an acre-foot of pumped water resulted in additional income of $10.13 when used in the production of grain sorghum and $62.88 for cotton. When markets are favorable the application of water to vegetables has resulted in several

(Continued On Page 4)

QUALITY COTTON

By GEORGE W. PFEIFFENBERGER

Executive Vice President, Plains Cotton Growers, Inc.

There has been a great deal of publicity given to the production of "Quality" cotton. This is well because quality is necessary for ready marketing. But what is quality? The popular concept of quality as being only high grade and long staple is quite erroneous. Quality is a relative thing and is meaningful only when related to use and price. One can have as much quality in a pickup truck as in a luxury automobile considering their uses and prices.

Grade and staple have long been the measures of quality, and these two factors also dominate the price. They still serve their original purpose as rough screenings of quality, but other factors such as the micronaire test, which is primarily a measure of maturity, and the Pressley test for fiber strength, have been added. Also the fibrograph instrument which measures the length and uniformity of the fiber is used.

At present the instrument which has gained the greatest foothold in the industry is the micronaire. It is nearly impossible now to buy or sell cotton without some interest being shown in micronaire value. The trade has already incoroporated the micronaire into its price structure. The cotton exchanges have set 3.5 as a minimum for tenderable cotton and this has lead to discounts on cotton below that point, with discounts increasing as the micronaire decreases.

It is vital to produce cotton with good micronaire values, as low micronaire is associated with wastiness, and wasty bales are no longer eligible for government loan, causing severe financial loss to the farmer.

Proper water control in irrigation is vital to the production of quality cotton and is directly connected to fiber strength and maturity. If Plains farmers are to attain stronger fiber cottons with better micronaire readings, correct irrigation may be one of the first steps.

Irrigation before plantings is important along with proper irrigation during the peak bloom period but probably more important is the final cut off time for irrigation in the relation to strength and maturity.

Cotton plants that are watered late tend to put on more vegetative growth and additional top crop, which, mainly because of the early frost on the Plains, does not have enough time to come to proper maturity. Immature fibers are weak and wasty, have low micronaire values, and are greatly discounted in price. The mixing of these late boles with earlier fiber causes lower quality throughout the bale.

The 1957 crop was an excellent example of low quality cotton because of a lack of time for maturity. Production of quality cotton is tied closely to enough time for maturity under maximum ideal conditions.

Other tests which have obtained some degree of acceptance in determining quality cotton are the Pressley test and the fibrograph. While these have not yet been incorporated into the price structure directly, they certainly have some bearing, since mills desiring high strength and uniform strength have learned which general areas of the country produce these qualities and plan their purchases accordingly.

One very important feature of cotton research which has been neglected is that of testing cotton with respect to how it actually spins. The conditions under which cotton is spun greatly affect the operation and sometimes may be more important than the cotton itself. Spinnability is measured in terms of "Ends down". This simply means the number of threads breaking during the course of an hour in units of a thousand spindles. Excessive ends down are detrimental to the work, in that when a thread breaks that particular spindle is not spinning yarn, but is producing waste. Also, the piecing or repairing of the end so that the spindle will again be in production increases the amount of labor required. It is important that cotton spin as well as it possibly can with as few ends down as possible in order to keep down costs.

It is a fairly easy matter today to use fiber tests to predict waste percentages, yarn strength, and yarn appearance without a spinning test. An actual spinning test of some size, however, is needed to predict "ends down".

For this reason the recently reactivated pilot spinning plant at Texas Tech, which is being operated in conjunction with Tech, the Texas Cotton Research Committee, and the Plains Cotton Growers, Inc. has set as one of its goals the study of South Plains cottons with relation not only to the quality of the finished yarns and fabrics but also to the performance during the spinning operations.

A problem of major importance with High Plains cottons is what to do with lower micronaire bales. While it is true low micronaire cottons have some undesirable features which limit their use it frequently happens that the medium low micronaire cottons will actually improve the spinning if properly blended with the more mature cottons.

It is our hope to establish enough technical data from the Texas Tech spinning plant during the first year to give us a sound basis for making recommendations to cotton mills on the proper use of our cottons and to provide information such as price, quality, quantity and availability.

A TURN - ROW PHILOSOPHY

"I have been having a lot of trouble with my own conscience lately about the way I'm using this irrigation water the good Lord put under my land out here. I look at me and then think of my moral obligation to this boy of mine, he will be using this farm after I'm done and he is going to need a little water too, to keep it going. My neighbor says, 'Let's pump her out while prices are right and put her in the bank as money, then we know where it is, besides this will be a good dry land country again, it was once.' Well, maybe yes, maybe no. I don't much think it will be good dry land again the way we are using up this soil with this one and a half and two bale cotton every year. It just won't work that way. And this thing of putting it in the bank now—I'm not so sure I like that either—this part of Texas wasn't made that way. It was made by work, and I want my son to know how to work and to work hard, and I want him to have a good farm to do it on—one that still has some water under it, like I had—and that puts me right back where I started—that's why my conscience is bothering me.

"I have to teach this boy to keep this water where it belongs, not down the bar-ditches or in some neighbor's lake. He sure ought to be taught to use it as insurance against dry or lean years and pump it out as he needs it, not just turn the well on and run it hours at a time down a few rows. So I'm more or less obligated to teach this boy to do some things I'm not doing too well myself right now.

"Of course, I have another moral obligation to the fellow what put the water under this farm in the first place. It was put there as sort of a gift; like a lot of other things for me to use as I need it—like the forest and the rivers and the soil. And since I am just kind of a tenant here on His land I know some day He is going to call on me to answer for the way I used those things.

"So when I'm coming home from town or some place and see water running down the bar-ditch or out of some neighbor's field, I just naturally get uneasy and turn my head so I don't have to look at it—By Gum! that ain't right. I need to get started at—Hey, Son! come here a minute, you and I need to have a talk."

UNDERGROUND WATER —

(Continued From Page 3)

times the additional income derived from the application to cotton or grain sorghums.

On today's market, when a man buys an irrigated farm in the Southern High Plains, he pays about $10.00 per acre-foot for the water under the farm. A statement by J. Wayland Bennett, in the July, 1958, issue of *West Texas Business Report,* is to the effect that of each dollar spent by the consumer of finished grain products, the farmer receives only 20 cents. Why, then, should we not encourage the local processing of many agricultural products that are produced on the Plains and as a result sell our water at a much higher price? The processing of cotton seed is a good example of what can be done.

Summary

In summary, the records show that in parts of West Texas large quantities of water suitable for agricultural, municipal, and industrial purposes are stored in the natural underground reservoirs. The water, as such, is a natural resource, but it creates wealth only when brought to the surface and used by man. There is definitely a limit to the available supply, and so far as is economically possible, not one drop should be wasted. As a result of the use of this resource at an accelerated rate, especially since World War II, the people throughout much of the region have established a high standard of living. The evidence is conclusive that where large quantities of water are being withdrawn for irrigation in the High Plains and the Trans-Pecos areas, the rates of withdrawals cannot be continued indefinitely; but the evidence is just as conclusive that through orderly development and optimum use of both underground water and natural percipitation for supplemental irrigation of special crops and industrial uses, a favorable economy can be sustained for generations.

Through Courtesy of "West Texas Business Report"

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

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

Volumne 5—No. 4 "THERE IS NO SUBSTITUTE FOR WATER" September 1958

"WATER FOR TEXAS" CONFERENCE HELD AT TEXAS A&M COLLEGE

The Fourth Annual "Water for Texas" Conference was held September 15-17 on the Texas A & M College campus at College Station.

Curtis L. Godfrey, of the A & M College Agronomy Department, and his Program Committee presented an array of capable speakers headed by Governor Price Daniel and Governor George Clyde of Utah.

W. L. Broadhurst, Chief Hydrologist for the High Plains Underground Water Conservation District, spoke on the subject, "Conservation Measures by Texas Ground Water Users."

Texas Tech's new Dean of Agriculture, Gerald W. Thomas, presented a paper on "Vegetation and Runoff."

Governor Clyde got the conference off to a fine beginning with his excellent presentation of his speech entitled, "Water—A National Problem."

"Water Developments and Potentialities of the State of Texas", a report jointly released recently by the State Board of Water Engineers, the U. S. Corps of Engineers, the Bureau of Reclamation, and the Soil Conservation Service was pointed to by Governor Clyde as a splendid example of what could be accomplished by cooperation between agencies of both the local, state and federal governments. He pointed out that this type of cooperation between the various governments is essential to make the fullest and best use of our water resources.

Governor Clyde, who is a profession engineer, said that the Texas water problem is a picture of the National water problem, only in miniature. That is, Texas has arid, semiarid, and abundant rainfall areas with which to deal. Without complete river-basin development and a full recognition of the need for trans-basin diversion of water from areas of water abundance to areas in need of water the picture can be dark indeed for our Nation.

The spreading and rapidly growing population of our Nation and the steady shrinking of our best farmland under the encroachment of cities, highways, airports and other modern developments will within a few years wipe out our exisiting food surpluses and leave us faced with serious problems of food shortages, according to Governor Clyde.

Governor Clyde further commended Texas for the long-range planning program it had outlined under the leadership of Governor Daniel.

What can we do to assure the maximum use of our limited water supply in the regions where it is most needed? According to Governor Clyde there are several avenues of approach:

1. Regulate our river systems to prevent waste.
2. Have man-made storage dams properly placed on all our major streams and tributaries.
3. Make available basic data on underground water reservoirs and plan for the most efficient use of this resource of water.
4. Plan for distribution systems to carry critically needed water from storage sites to cities, industrial and farm areas.
5. Man-made lakes and dams should incorporate "multiple-use" ideas.
   a. Recreation
   b. Hydro-electric power
   c. Municipal, industrial and agricultural
   d. Re-use of unconsumed water
6. Control of evaporation from man-made lakes.
7. Further exploration of the principles of weather modification (rain-making).

The use of federal funds will probably be necessary to undertake such a program of development; however, Governor Clyde stated that in his opinion the money should only be borrowed from the federal government and repaid by the direct beneficiaries.

In outlining a National Water Policy, which Governor Clyde says is the crux of our water problem, he points out four very important facts:

1. A National Water Policy must be sufficiently flexible to deal with the great variety of conditions that exist across this vast land of ours.
2. A National Water Policy must recognize States' rights and the fact that they are paramount.
3. A good National Water Policy should recognize that "consumptive-users" of water have first priority whenever there is direct competition between uses.
4. A National Water Policy should provide for unending study, research and exploration to develop additional sources of usable fresh water.

Governor Daniel followed the Utah Chief Executive to the speakers rostrum and emphasized the fact that Texas has now made a start toward solving its water problems.

He pointed out that the State has made available a plan to help in financing water development projects through the establishment of the State Water Development Board.

A bill was passed by the State Legislature in Special Session last year, stated Governor Daniel, which provides for a Planning Division within the State Board of Water Engineers. This Planning Division is presently attempting to organize its work. The Planning Section will conduct new studies pertaining to surface and ground water supplies of the State.

Governor Daniel pointed out that a comprehensive report on the "Water Developments and Potentialities of the State of Texas" has been prepared in an effort to analyze the wide variety of water problems exisiting in the State and draw conclusions pertaining to ultimate development. The Governor also pointed out that the report includes present and future water needs of Texas municipalities, industries and agriculture.

The needs now, as viewed by Governor Daniel, are adequate financing by the State of its planning and research program, and for delegating additional authority to the Chief Engineer in charge of the State Board of Water Engineer's Planning Division.

Governor Daniel concluded his remarks by saying that the future growth and prosperity of Texas depends on proper soil and water conservation.

Donald W. Hood, Associate Professor of Oceanography and Meteorology, Texas A & M College, gave in a speech entitled, "New Developments in Modification of Water Quality," a very concise description of the methods now being used to convert sea water into fresh water.

According to Mr. Hood the demand for good quality water is growing in every section of the Nation—non-consumptive and consumptive uses alike. Consequently, the major problem becomes one of large scale production of water that can be used for municipal, industrial and agricultural requirements.

The ever-increasing demand for

(Continued on Page 2)

Governor Price Daniel of Texas, Governor George Clyde of Utah and P. L. (Pinky) Downs, Jr., are shown left to right as they swap friendly greetings at the opening of the fourth annual conference on "Water for Texas" at Texas A&M College, September 15-17.

Governor Daniel called 1957-1958 "milestone years" in Texas water development and Governor Clyde urged a clear and effective national water policy, recognizing that states' rights are paramount.

Downs is A&M's official visitors greeter.

LAMB COUNTY WATER DISTRICT OFFICE MOVED TO NEW LOCATION

The Lamb County office of the High Plains Underground Water Conservation District has been moved to a new location in Littlefield. The office is now located in the new Frank Cummings Insurance and Real Estate Company building at 600 East 4th Street. The telephone number is 424.

Miss Nancy Cotham will handle the clerical work for the Lamb County Committee, and will assist county landowners in applying for well drilling permits.

If you have questions that pertain to underground water or to the operation of the Water District, go by and visit with Miss Cotham. She will be happy to assist you in dealing with your problems.

THE Cross SECTION

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ALLAN WHITE
Editor

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"Water For Texas"—

(Continued from Page 1)

water has created a present market of 10c to 30c per 1000 gallons; however, the supply of such water from conversion is far away, if ever in sight, states Mr. Hood.

He said further, that based on past experience of the basic requirements for desalination of water, it does not seem realistic that large scale production of drinkable water can be derived from the sea for much less than 50c per 1000 gallons unless a major breakthrough on such items as power, heat exchanges, or better than usual operating expenses are met. This corresponds to a figure of approximately $160.00 per acre foot.

Mr. Hood says that five basic methods of desalination are now being studied. They are:

1. Thermal Distillation
2. Solar Distillation
3. Ionic Exchange Membranes
4. Freezing
5. Solvent Extraction

Dean C. Muckel, Irrigation Engineer, Agricultural Research Service, Berkeley, California, presented a paper entitled, "Artificial Recharge in Relation to Ground Water Storage."

He first pointed out that the primary purpose of artificial recharge activities is to increase the amount of available ground water, even though many specific objectives are encompassed within this purpose including:

1. To compensate for man's activities that tend to reduce natural recharge.
2. Reduction of ground water overdraft (pumping more from the aquifer than it receives from natural recharge.)
3. Control of sea-water intrusion.
4. Control or prevention of adverse salt-water balance.
5. Maintenance or raising of water levels to avoid increased water well construction and pumping costs.
6. Reduction of land subsidence in areas where overdraft results in compaction of sediments.

According to Mr. Muckel artificial recharge of ground water supplies is not a new devlopment. It began more than a century ago in Europe and today is standard procedure for augmenting municipal water supplies.

Many methods of artificially recharging are being used and all with a degree of success, including the use of injection wells such as those in the High Plains of Texas.

According to Mr. Muckel, no two locations or conditions are identical and detailed information on site conditions is required for determining the best design and operational procedures.

W. L. Broadhurst, Chief Hydrologist for the High Plains Underground Water Conservation District, pointed out in his discussion entitled, "Conservation Measures by Texas Ground Water Users," that although more than half of the people in Texas are ground-water users, only a very small percentage actually practice conservation. The reasons given for this lack of interest in water conservation are:

1. Because many people do not understand the fundamental principles of the source, occurrence, and movement of ground water, and
2. Because they have not realized the significance that unwise use of ground water will have on the future commercial and industrial enterprises of their communities.

According to Mr. Broadhurst, only industry has practiced to any real extent, conservation of ground water. They have realized this valuable resource is as significant in the future prosperity of their business as are the numerous other raw materials.

Mr. Broadhurst further stated, that the irrigation farmer, as a general rule, does not realize the significance of ground-water conservation until his water supply begins to fail. With education however, the irrigator is learning that it is more profitable to produce the maximum pounds of crops per acre-inch of water instead of the maximum prounds of crops per acre of land irrigated.

The subject, "Contamination of Ground Water in Texas," was ably explored by Jack R. Barnes, Consulting Engineer-Geologist of Austin.

Mr. Barnes said that ground water in good quality is very important to the continued well-being of the State, since Texas produces about 20 percent of all the ground water withdrawn in the Nation. The U. S. Geological Survey has tabulated figures which indicate that wells in Texas supply 84 percent of the total water used in rural areas, 22 percent of the self-supplied industrial water, 63 percent of irrigation requirements and 52 percent of the water used in public supplies.

Mr. Barnes pointed out that because of the important role ground water plays in Texas it is very important that ground-water reservoirs of the State be protected from contamination.

Mr. Barnes said, generally ground-water bodies are contaminated in one of three ways: (1) Seepage of foreign liquids from the ground surface, (2) Subsurface movement of salt water through improperly cased holes, and (3) by vertical or horizontal encroachment of salt water resulting from head differentials created by pumping wells.

Contamination problems of import to the economy of the State involve the disposal of brine in oil field operations. Mr. Barnes said specifically this type of contamination was caused by insufficient or inadequate casing, cementing and plugging of oil wells and test holes, injecting brine under high pressure into shallow formations, disposal of brine produced with the oil into earthen pits upon the land surface, and seepage of the salt residues removed in excavating subsurface storage for petroleum products in salt domes and other beds of salt.

Widespread contamination of ground water in Texas, continued Mr. Barnes, has occurred and continues to occur along the Gulf Coast, where fresh water formations are filled with salt water in downdip areas. When wells are pumped in the fresh water areas and water levels lowered, the adjacent salt water slowly invades and replaces the fresh water.

In regard to the alleviating of contamination by oil-field brines, Mr. Barnes suggests that the Railroad Commission or another selected agency be given legislative authority to protect fresh water by whatever means necessary. The methods that may be devised for protecting fresh water should be explicit, simple and require the expenditure of the least possible amount of money to accomplish the objective.

In respect to the coastal encroachment of salt water from the sea, Mr. Barnes suggests there are a number of measures which may slow or halt the invasion. (1) Well fields moved nearer the outcrops of the water-bearing formations and spread out over wider areas parallel to the outcrops. (2) The construction of barriers be-

BAILEY COUNTY FARMER DISCOVERS ALGAE IN IRRIGATION WELLS

Mr. L. C. Crews of Lubbock who owns a farm, the southeast quarter of Section 49, Block B, in the southern part of Bailey County, has found that two of the three irrigation wells on his farm are contaminated with an algae growth.

The wells have decreased in yield each year since they were drilled in 1954. One of these was originally a good 6-inch well. On September 11, 1958 the pump was pulled from the well because the yield had dropped to only a trickle. The growth of algae was then discovered.

Inside the irrigation pump the column pipe and oil tubing were coated from top to bottom with a thick layer of the gelatinous mass of algae. The outside of the column pipe was covered only from the static-water line downward.

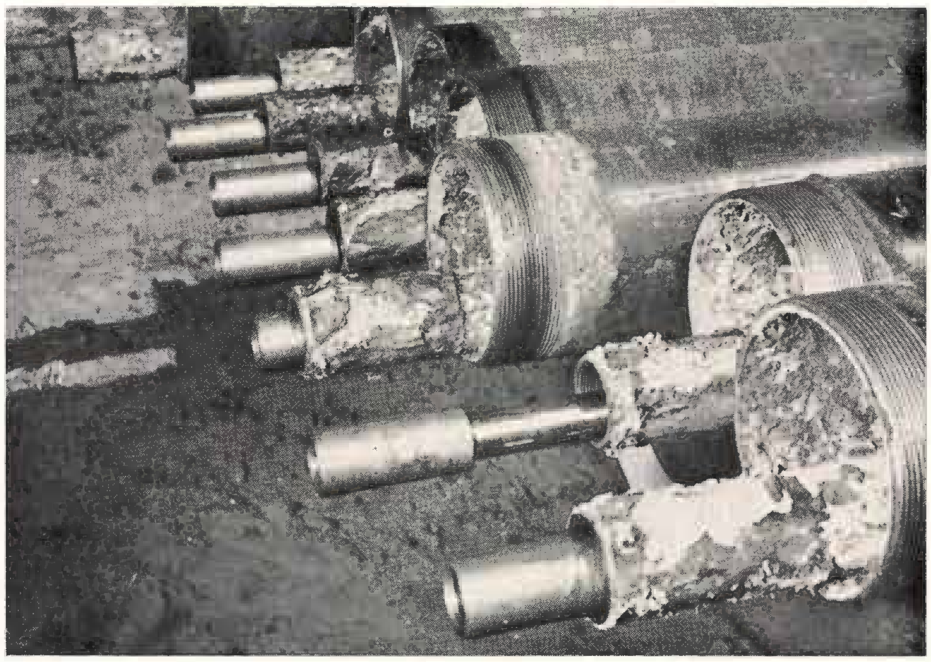
Mr. Crews and a Lubbock chemical company obtained samples of the algae and they were sent for analysis to Dr. J. K. G. Silvey at North Texas State College.

The casing was pulled from the well and inspected. It was absolutely free of any growth.

In a telephone conversation with Dr. Silvey at Denton, "The Cross Section" was advised that the samples have not as yet been analyzed but that they would be checked for both algae and bacteria. Dr. Silvey stated that from off-hand observation it might be possible that bacteria which usually accompanies the algae found in High Plains wells is obtaining its food from the oil used in lubricating the pump.

Mr. Crews has pulled the remaining two pumps from the farm wells. One was covered with the algae growth but not as extensively as the first. The other pump did not show to have any algae on it.

L. C. CREWS



Shown above is 6-inch pump column pipe with oil tubing and shafting. Note the algae growth on inside of column pipe and outside of oil tubing.

Looking into column pipe laying across the trailer bed the thick mass of algae can be seen covering oil-tube retainers. Algae was present on the outside of column pipe only from the static water line downward.

The picture above shows a thick accumulation of algae on the 6-inch strainer which was in the Crew's well below the bowl assembly.

Picture above shows extent of algae growth on pump oil tubing. The oil tubing and inside of column pipe were coated with algae from top to bottom.

tween the well fields and the salt-water front. The barrier could consist of wells drilled parallel to the front through which fresh water or air could be injected. (3) Conceivably a liquid chemical with the properties of delayed hardening could be injected into the formations through closely-spaced wells allowing an impermeable subsurface dam to be developed. (4) A line of wells southeast of the salt-water front could pump salt water and thereby lower the formation pressure and tend to stabilize the salt-water front.

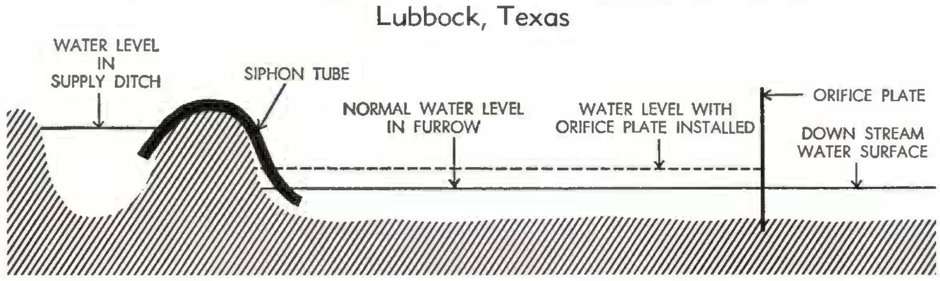
Others on the program were: Harry P. Burleigh, Bureau of Reclamation, Austin; Morris E. Bloodworth, A & M College; D. F. Smallhorst, State Department of Health, Austin; H. N. Smith, Soil Conservation Service, Temple; H. E. Joham, A & M College; Wells A. Hutchins, Agricultural Research Service, Berkeley, California; Frederic O. Sargent, A & M College; T. L. Satterwhite, Humble Oil & Refining Co., Baytown; W. S. Mahlie, City of Fort Worth; and R. D. Lewis, Director Texas Agricultural Experiment Station, College Station.

Mr. Bryan Blalock with The Borden Company of Marshall, was the principal speaker following an evening banquet. His subject dealt with "Americanism" and was spiced with a large portion of humor.

We commend the forward-looking leaders of Texas A & M College who planned this Fourth Annual Water Conference.

CIRCULAR ORIFICE PLATE CAN BE HELPFUL TOOL FOR IRRIGATOR

By W. F. SCHWIESOW, Assistant Professor
Agricultural Engineering Department, Texas Tech College, Lubbock, Texas



The use of the submerged circular orifice for measuring water flow in a furrow has several attractive features. It is easily constructed, low in cost, and easily installed or removed. From a prepared table, flow through the orifice can be determined immediately after a head measurement is made.

Now the question may arise, *"Why measure the water flow in the furrow?"* One answer is this—it can be and should be an important phase in the overall planning of an efficient irrigation operation. Efficient irrigation is a stepping stone to reduced operating costs and increased net profits.

One procedure for using this tool of irrigation follows. Placing the orifice plate at one location gives us a measurement of the water flowing at that point. After this flow is measured, the orifice plate is moved down the furrow one hundred feet and another flow measurement is taken. The difference between these two flow measurements will tell you how much water has been absorbed by the soil. With this information and the following formula, the intake rate of your soil can be calculated.

Field Intake Rates

To determine the field intake rate I. R. (acre inches per acre per hour) from the rate at which water is being absorbed along a furrow in g.p.m. per 100 feet of furrow.

$$IR = \frac{\text{GPM absorbed per 100 feet}}{\text{Furrow spacing in feet}}$$

If our field measurement determines that one and three-fourths gallons per minute are being absorbed for each 100 feet of furrow and the row width is 42 inches or 3½ feet, we calculate the intake rate by dividing the 1 3/4 by 3 1/2. This gives us an intake of 1/2 inch per hour.

$$IR = \frac{1.75}{3.5} = .5 \text{ inches}$$

The intake rate or infiltration rate as it is also known is one of the factors in deciding how long one should allow water to run for each set. An example of how this fits into the picture is given now. If you have a deep soil that will use the five foot root growth of a cotton plant, you will want to place water within that zone and no deeper if at all possible. For the purpose of the example we must make some assumptions. However, it is all important that these values be actually determined for each farmer in order to obtain maximum success. Let us estimate that this soil will hold 1 1/2 inches of available moisture per foot of soil or a total of 7 1/2 inches in the five foot root zone. Proper practice requires that we start irrigating when one-half to one-fourth of this available soil moisture is still remaining. Our maximum water replacement would be (7.5 x .75 equals 5.525 inches) five and one-half inches. How long will it take to replace it? Our intake rate gives us the answer. From the earlier example, our intake was determined to be .5 or 1/2 inch per hour. Dividing the amount of water needed (5.5 inches) by the intake rate (.5 inches per hour) we find that it will take 11 hours to apply the 5.5 inches of water. No mention has been made of the several other factors that must be considered in the overall planning. Only the flow measurement in the row with an orifice plate has been discussed with an example of its application.

When properly used this method gives accurate measurements. If not correctly used, the measurements will be misleading. The first item to consider is the location in the furrow. This is especially important when siphon tubes are used to take the water from the supply ditch to the furrow. Placing the orifice plate too close to the siphon tube can cause water to rise at the tube outlet. The resulting decrease in head—distance between water surface in the supply ditch and water surface in the furrow—will decrease the flow of water through the siphon tube.

When the plate is removed, the flow through the siphon will increase again.

A second caution is that the user must be sure the water surface, both upstream and downstream, is above the top edge of the orifice. Failure to obtain this condition will cause errors in measurements. Proper construction of the plate can eliminate this problem by making it impossible to measure the head unless a submerged condition exists.

The third caution is to be sure that there is no silt or other debris obstructing the opening. To function properly, water must be able to flow freely through the orifice.

Measurement of flow should be made an hour or more after the water has been turned into a furrow. Earlier measurement will give abnormally high intake rates. The plate is pushed into the ground at right angles to the flow of water. After checking to see that all flow conditions are satisfactory, the water surfaces are allowed to become stable. Then the difference in elevation is measured and the flow determined from a chart similar to Table I.

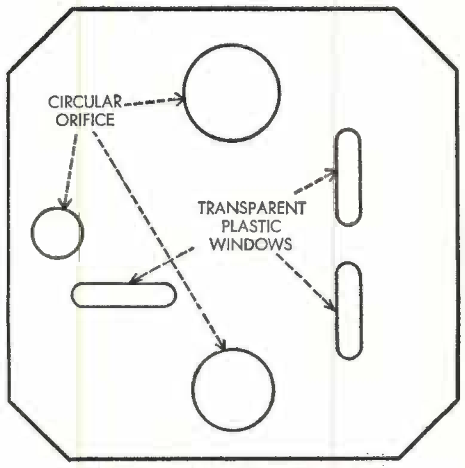
TABLE I

(1 3/4 inch orifice)

HEAD (inches)	FLOW g.p.m.
1/2"	6.8
5/8"	7.6
3/4"	8.4
7/8"	9.0
1"	9.7
1 1/8"	10.2
1 1/4"	10.8
1 3/8"	11.3
1 1/2"	11.8
1 5/8"	12.3
1 3/4"	12.8
1 7/8"	13.2
2"	13.6

This table can be extended for larger heads.

Which size orifice should be used? Use the smallest one possible that will fit the furrow size and flow rate. This will give a relatively large difference between water surfaces. An error of 1/16" in measurement will cause less error in the flow calculations when a large head (2") is used on a small orifice than will result if a small head (1/2") is being measured on a large orifice.



SHEET METAL ORIFICE PLATE
(14 or 16 guage galvanized sheet steel)
Orifice sizes, 1¾", 2½" and 3½"

Some information pertaining to the construction and use of the orifice plate will be helpful. The orifice plate can be made from a medium weight galvanized sheet metal. Three circular openings (orifices) 1 3/4", 2 1/2", and 3 1/2" in diameter are cut as indicated on the sketch. These three openings will measure flows ranging from about 7 to 50 gallons per minute. A transparent plastic window is provided for each orifice as indicated on the sketch. This provides an easy means of measuring the difference in water surfaces. Beveling the corners allows easier installation of the plate and removes the sharp corners that might be a hazard to the user.

PLEASE CLOSE THOSE ABANDONED WELLS ! ! !

EDITOR
THE CROSS SECTION
1628-B 15th Street
Lubbock, Texas

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THE Cross SECTION

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

Volume 5—No. 5 "THERE IS NO SUBSTITUTE FOR WATER" October 1958

District Hydrologist To Speak At National Reclamation Association Meeting

The National Reclamation Association will hold its 27th Annual Convention, November 19, 20, and 21, in Houston. Convention headquarters will be in the Rice Hotel.

The NRA is an organization that originially was established by groups of people from the seventeen western states who were primarily interested in developing hydro-electric power and irrigating arid farmland. It advised the Bureau of Reclamation in matters concerning the development of surface water resources in the western states.

Today, however, the organization encompasses much more in its constructive program of work than irrigation and the development of hydroelectric power. Now, every segment of water resources development is studied and discussed, including underground water.

The seventeen western states have approximately 65 percent of the nation's agriculture. With the westward movement of industry, the region is experiencing an ever-increasing growth of population. Couple these realities to the fact that these seventeen western states contain only about 20 percent of the nation's water supply, and the problems which immediately are apparent assume staggering proportions.

The National Reclamation Association attempts to deal with such regional problems at the national level.

The outstanding convention program will include a paper on artificial recharge by W. L. Broadhurst, Chief Hydrologist for the High Plains Underground Water Conservation District. Other notables on the three-day program will be Governor Price Daniel; Wilbur A. Dexheimer, Commissioner of Reclamation; Donald Williams, Administrator, Soil Conservation Service; Elmer F. Bennett, Under Secretary, Department of Interior; Governor George D. Clyde of Utah; and United States Senator Ralph Yarborough.

Kansas Hydrologist Visits Water District

Mr. Gib Stramel, hydrologist for the City of Wichita, Kansas, was a visitor in the Texas High Plains for two days during the month of October.

At the invitation of the Board of Directors of the High Plains Water District, Mr. Stramel attended the Board's regular quarterly meeting which was held on October 22. He discussed the problems of water with which the farmers and cities in Kansas are confronted. According to Mr. Stramel, water laws in Kansas have established the general principal that all water within the State, both ground water and surface water, is dedicated to the use of the people, subject to appropriations, control and regulation by the State.

Mr. Stramel was particularly interested to learn more about the method of artificial recharge being

MR. GIB STRAMEL

used in this area. He is recharging on a limited scale, but indicates that in time, the aquifer from which Wichita obtains its municipal supply will be artificially recharged by water-spreading and pits. Water to be used for recharging will be diverted from surface streams that flow through the area.

In years past, Mr. Stramel and W. L. Broadhurst, Water District Hydrologist, were associates working for the U. S. Geological Survey in Texas.

San Antonio Will Be Site Of Conference

A two day irrigation conference of interest to farmers, agricultural leaders and the irrigation equipment industry has been scheduled November 20-21 at the Hilton Hotel in San Antonio.

This conference is the second annual meeting sponsored by the Texas Irrigation Council. Last year the event was held in Lubbock.

According to an announcement by Bob Thurmond, Texas A & M Irrigation Specialist, and Program Chairman for the conference; the meeting will bring together some of the leading irrigation and water conservation authorities in the nation.

DRILLING STATISTICS FOR AUGUST AND SEPTEMBER

During the month of August, 58 new wells were drilled and registered with the District office; 19 replacement wells were drilled; and 7 wells were drilled that were either dry or non-productive for other reasons. 79 permits were issued by the County Committees. In September, 35 new wells were drilled; 10 replacement wells were drilled; and 5 wells were drilled that were considered to be dry. 84 permits were issued by the County Committees. The permits issued and completed wells follow by counties:

County	Permits Issued		New Wells Drilled		Replacement Wells		Old Wells Deepened		Dry Holes Drilled	
	Aug.	Sep.	Aug.	Sep.	Aug.	Sep.	Aug.	Sep.	Aug.	Sep.
Armstrong	0	0	0	0	0	0	0	0	0	0
Bailey	3	4	1	0	1	2	0	0	0	0
Castro	9	7	3	5	3	1	0	0	0	2
Cochran	0	5	5	0	0	1	0	0	2	0
Deaf Smith	8	9	6	8	3	0	0	0	0	0
Floyd	15	7	5	6	3	1	0	0	0	0
Hockley	16	17	11	0	3	0	0	0	1	0
Lamb	13	1	6	1	0	0	0	0	0	0
Lubbock	7	16	7	9	1	0	0	0	2	3
Lynn	0	3	2	0	0	0	0	0	1	0
Parmer	6	8	7	4	5	4	0	0	0	0
Potter	0	2	0	0	0	0	0	0	1	0
Randall	2	5	5	3	0	0	0	0	0	0

Texas Highway Department Will Drain Area Rights-Of-Way With Recharge Wells

An experiment which may knock wet weather lakes from the list of Texas Highway Department bugaboos was authorized today by the Texas Highway Commission, said Marshall Formby, the Chairman.

The drilling of an experimental recharge well in a ditch on stated-owned right of way located in the High Plains area was approved during September by Formby and Commissioners Herbert C. Petry Jr. and Charles F. Hawn, after close study of a report from the Research and Development Committee composed of professional engineers on the Highway Department staff. D. C. Greer, State Highway Engineer, was instructed by the Commission to select a suitable site for drilling and equipping the experimental well and for conducting studies in connection with drainage of wet-weather lakes.

"The Texas Highway Department long has sought some solution for the problem of the inundation of farm to market and state highways when surface lakes develop following heavy rain of short duration," Formby said. He pointed out that the High Plains area particularly abounds in "playa," or "wet-weather lakes," which are natural depressions into which runoff rainfall accumulates.

"Because there is no drainage for these lakes, five or six feet of water may remain at highway intersections or alongside the right of way for weeks at a time. Motorists and farmers lose time and money in the necessary rerouting, and the Highway Department must make maintenance expenditures to raise the roadbeds," Formby explained.

The Commission Chairman stated that it is hoped that the installation of recharge wells will lower the water from paved roads within a matter of a few days. Another advantage of such wells would be the increase of the underground water supply in their vicinity, he said.

The Department's research report stated that recharge wells have been used for a number of years by the California Division of Highways.

The High Plains Underground Water Conservation District is working in cooperation with the Highway Department to find suitable locations for experimental recharge wells.

THE Cross SECTION

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ALLAN WHITE
Editor

OIL VERSUS

DR. A. W. YOUNG

Some readers may question the liberties taken in introducing the subject of oil in connection with West Texas Agriculture.

Justification for such liberties may be found in several areas. There are those who say that an oil well on each forty acres of land is one of the best crops a man can have on his farm. In recent months the author has taken opportunity to ask several land owners, with both oil wells and irrigation wells on their farms, which they would rather do without if they could not have both oil and irrigation wells on their land. In every case the farmers have stated that they would rather give up the oil wells.

On owner hastened to say that the present allotment on pumping had resulted in an average monthly income of approximately $40 per well, whereas the income prior to the present pumping restrictions had exceeded $125 per month per well.

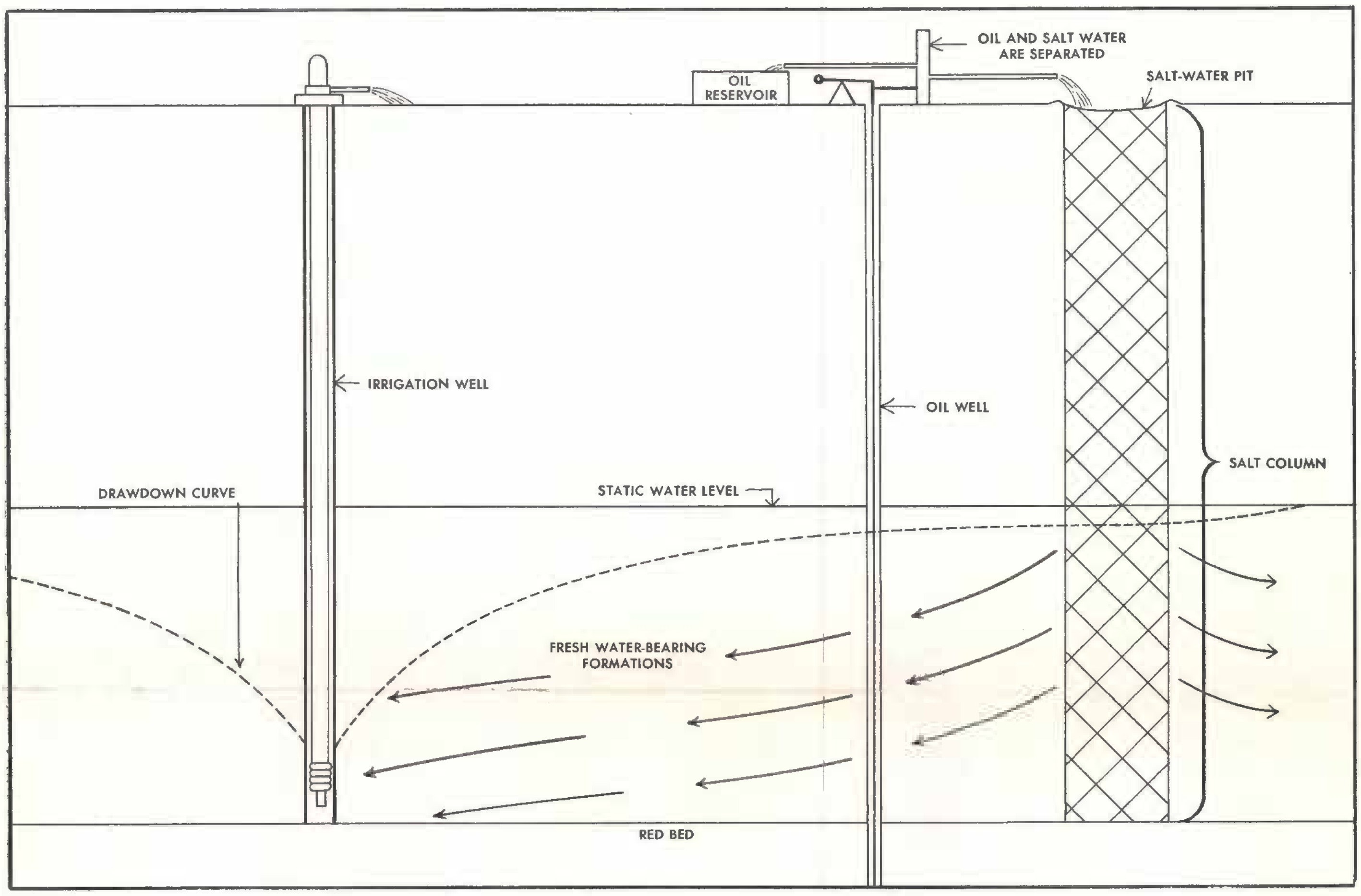
Another farmer reported that he was now receiving approximately $400 per month from his wells, whereas he had previously received approximately $1300 per month from the same wells.

If a farmer had one oil well per forty acres this would provide an annual income of $480 per forty acres of land based on the $40 per month income. The farmer with an irrigation well to supply an average amount of water can reasonably expect to increase his cotton yield by at least 330 pounds of lint or 3.000 pounds of

The pictures above indicate the effect of excessive salt upon plant behavior. Salt tolerance of the pepper plants is less than that of the beets, but greater than that of the onions. Comparative growth of each of these crops on soils with different concentrations of salt is demonstrated on the greenhouse pot plants.

WATER IN WEST TEXAS AGRICULTURE

By A. W. YOUNG
Head, Department of Agronomy, Texas Technological College



sorghum grain per acre each year. Thus, the value of the increase in lint cotton would be $80 or more per acre or $3200 for a forty-acre block. The increase in sorghum grain due to the water would have a value of $50 or more per acre or $2000 or more from a forty-acre block.

Not all of the $3200 increase from cotton nor the $2000 increase from the sorghum grain crop is profit since additional production costs must be subtracted from the gross income.

If the value of the income from the oil well is compared with the income from the irrigation well, one can see why the farmer with good soil and a good irrigation well would be wise to choose the irrigation well over the oil well. Obviously, pumping allotments for oil wells, water yields and water quality, prices of farm commodities and similar factors could modify the farmer's opinion of the relative value of the oil and water wells.

Water wells in the High Plains of Texas have increased tremendously in number during the past twenty years. In 1938 there were less than four thousand irrigation wells in 42 of the High Plains counties. Today it is estimated that these same 42 counties have 45,522 irrigation wells, used to irrigate 4,752,570 acres of land. This water is used to irrigate over two million acres of sorghum grain, approximately 1.5 million acres of cotton, over one-half million acres of wheat, 85,000 acres of alfalfa and nearly a million acres of other crops which include irrigated pastures, oats, barley, corn, vegetables and other crops.

During this same period of twenty years the number of oil wells in the same 42 High Plains counties have increased with much of the oil development overlapping the irrigation developments. Oil men tell us that the present tax structure has made possible development of oil fields not profitable under previous tax structures.

The typical oil well in this area has been developed and pumped with the material extracted from the lower strata containing both oil and salty water or brine. Separators removed the brine from the oil and the brine has been discharged at the well site into a brine pit where it was allowed to evaporate or soak into the soil. The brine varies in salt content from 100,000 parts per million to over 250,000 parts per million of salt.

These figures represent concentration of 10 to 25 per cent of salt in the brine solutions. The brine pits are confined to a relatively small area near the pump and the only direction for movement of the salt water is downward. One oil well was recently reported to have discharged over 48,000 barrels of brine into the nearby pit. If one assumed that the brine contained 150,000 parts per million of salt, the calculated total salt deposited into the salt column beneath the brine pit would approximate 1850 tons.

Table above shows how this salt moves primarily downward into the soil. It may move laterally when the downward movement is slowed or stopped by a rock or other impervious layer.

When a well has been pumped a sufficient length of time, the salt column will finally extend deep enough into the soil to reach the water bearing strata and increase the salt content of the water. If this water bearing strata is the source of water for nearby irrigation wells, the salt content of the irrigation water may become great enough to influence plant growth when the water is applied to the cotton, sorghum or other crops.

The length of time required for the salt to move into the underground water strata and thus contaminate the irrigation water depends upon a number of factors such as the soil permeability, volume and concentration of the brine discharged into the soil, the nature of the underground structures through which the salt water must pass before reaching the irrigation water strata, the nearness of an irrigation well to the brine pit and the rate of water movement from the salty area towards the irrigation well.

The number of cases where salty water is being pumped with the irrigation water and applied to the soil is not known.

More and more of such cases are being found each pumping season.

A salinity problem exists in this area at present; no one knows the extent of the present damage nor the potential salt water problems in the future. With hundreds of these vertical salt columns extending from the surface soil to the underlying aquifer which provides our irrigation water, who can tell when or how much of this salt will one day be in our irrigation water. Oil companies have been sued and have paid damages on many crops and on many acres of land. Some of the payments were probably too high and some settlements probably too low. As a result of the suits filed and prosecuted most oil companies have now ceased to discharge the brine into open pits. Many companies are now injecting the brine back into the earth several hundred feet below the surface where there is much less danger of contamination of domestic and industrial water supplies.

A survey made by the High Plains Water District in April 1958, revealed 181 open pits in use in an area of approximately 110,000 acres in Hockley county and 31 open pits in use on approximately 9,000 acres in Cochran County. There were no open pits in use in Lubbock County in an oil field area of approximately 12 square miles. A large part of the farm land in each of these oil field areas is under irrigation.

Under each of these open brine pits a column of soluble salts extends from the soil surface into the underlying materials as indicated by the drawing. The amount of soluble salts in each column is determined by the amount of salts deposited during the time these pits were in use. These soluble salts will be moved downward whenever water moves downward in these salt columns. Whenever high rainfall occurs, with heavy soaking of the soil, more salts will be carried down deeper into the soil. If irrigation water is allowed to flow into these areas over the salt columns, or if runoff water from rainfall accumulates in the area above the salt column; movement of the salts downward toward the underground water supply will occur. The filling of all brine pits and mounding of soil over each such area to prevent either rain water or irrigation water from penetrating into the salt column will tend to insure a minimum movement of these soluble salts into the underground irrigation or domestic water supplies.

The salinity problem at present may affect only a small portion of the total irrigated area of the High Plains, but it is extremely important to the farmer whose land and crops are affected.

What may happen when the farmer pumps the salt contaminated water onto his crop land?

Plants absorb water from the soil by a process known as osmosis which operates to bring water into the roots of the plant when the total salt concentration of the soil solution is appreciably less than the concentration within the plant tissues. Thus, when the water content of a normal soil is reduced by evaporation and plant use; the amount of water in a soil may become so limited that the normal concentration of dissolved salts in the soil solution approaches the concentration within the cells of the plant root. The end result is that the plant can no longer take up sufficient water for normal growth, until more water is applied to the soil.

The same end result may be obtained when the salt concentration of the soil solution is increased by the accumulation of salts in the soil.

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 on 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

(Continued On Page 4)

Oil vs. Water—

(Continued From Page 3)

salts from the sandy soils and smaller amounts from finer textured soils where the permeability is less than in the sandy soil. Seasonal checks by proper analyses will indicate when the soil is nearing the danger point in salt concentration.

Once a soil has reached too high a concentration of soluble salts, suitable treatments must be applied to remove the excess salts and 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.

During the time the salt is building up in a soil due to the use of salt contaminated irrigation water, the plants may be showing various responses to the condition.

Three forces may produce effects upon plants growing on salty soils.

1. A direct physical effect in which the concentration of the salt in the soil solution may prevent water uptake by the plants.

2. Direct chemical effects of the salts in disturbing the nutrition and metabolism of the plants.

3. Indirect affects of the salt in altering soil structure, permeability and aeration.

Sodium chloride, due to its active chemical nature, will produce a solution which will prevent water uptake from the soil solution at a lower concentration than most other salts. In other words, the sodium chloride produces a greater osmotic pressure than most other salts in soils.

Toxic affects which interfere with plant metabolism occur when as much as 0.2% of sodium chloride (or 8000 pounds per acre foot of soil) is found in a soil. Sodium sulfate would require 0.4% 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 distruction 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 microbial 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, location 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.

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. Cereal 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. With fruit trees the accumulation of salts often occurs in the leaf margins causing a burning in the marginal areas of the leaves.

Plants growing on soils with excessive salt accumulations seldom show wilting symptoms at an early stage of 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 may appear to be moist enough for plant growth, but due to the salt content it will not permit normal plant functions.

The presence of harmful amounts of salts in soils or irrigation water may be detected by two principal methods. The older method involves the determination of salt content of either the soil or water samples in question. When a soil is analyzed, we use the following rating to indicate the expected plant response to salt concentrations:

0 to 0.2% 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% concentrations of salt.

0.2 to 0.4% salt (8000 to 16,000 lbs. per acre in each foot of soil depth). Non-salt-tolerant plants cannot be grown. 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.

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

If an irrigation water sample is analyzed, it is questioned when it contains 2000 parts per million of total dissolved salts or 200 or more parts per million of chlorides. Electrical conductivity determinations are now used in many laboratories to determine the potential danger from salts in the soil and in irrigation water.

The monetary value of our underground water supply should also be considered. If a dry farm area was purchased without an irrigation water potential under it, it would probably cost from $70 to $100 per acre for a good deep soil with little or no improvements.

If you purchased a deep fertile land farm in a good irrigation belt with irrigation water facilities undeveloped it would probably cost $300 to $400 per acre. Where the irrigation wells are already constructed and the irrigation system developed, the cost would be near $500 per acre.

A farmer would thus pay $200 to $300 per acre for the underground water in this High Plains area. It has been estimated that the underground water costs the farmer approximately $10 per acre foot when he purchases the land. It often costs another $10 per acre foot to get this water to the surface and applied to the crop land.

The farmer's job is to use soil and water in such a way that he and society in general can profit from the use of these natural resources.

The development of the oil industry in the irrigated areas of West Texas has definitely provided a hazard which can seriously reduce the value of our soil and water resources.

A problem of this kind must first be recognized; then must be understood by the public in general before a solution can be found. The writer believes that there are many problems to be solved before the potential salt contamination of our West Texas underground water supplies is known. Many acres of the High Plains soils, where irrigation farming and oil well development have overlapped, may already be reduced from an irrigated potential to a dry farm economy by the salt contamination of the underground water wrich renders it unsuitable for use as irrigation water. Additional acres of fertile land, to which salty irrigation water has already been applied in sufficient amounts to materially reduce crop yields, has been reduced far below the value of the dry farm soils. These salty soils cannot be expected to produce an average dry farm 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 underdrainage, three to five years of average rainfall (18 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 clay loams 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 soils fewer applications of the water will be required to free the soil of harmful salts.

In all cases dealing with 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 burs or other plant residue materials to the affected acreages should be practiced. These burs 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 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. Technical assistance may be needed to determine when the excessive salts have been removed from the soil.

A poor physical condition may persist in the finer textured soils after the excess salts have been removed. Timely tillage and the maximum possible use of available organic matter additions to such soils will help improve the physical conditions of these soils.

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

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

Second Class Permit

THE Cross SECTION

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

Volume 5—No. 6 "THERE IS NO SUBSTITUTE FOR WATER" *November 1958*

Oil Producers Cooperate With Water District To Close Earthen Brine Pits

Within the jurisdiction of the High Plains Underground Water Conservation District, the use of earthen salt-water disposal pits, in connection with the production of oil, is almost a thing of the past.

Undoubtedly, this is the results of enforcement of a new rule passed in September, 1957, by the Water District's Board of Directors which defined as "waste" the continued use of earthen pits.

When the rule was adopted, oil producers were immediately notified and were made aware of the reason necessitating its adoption. Some operators did not recognize the serious nature of the problem. Most producers were probably not aware that salt water in solution would percolate from the disposal pits through the underlying formations to the fresh water below. In many cases, the commingling of the salt water and the fresh water rendered the latter unfit for domestic use.

When these facts were made known to the oil producers, most of them immediately began using methods other than earthen pits for the disposal of their salt water.

Even though most oil producers now recognize that a problem of pollution can exist where earthen disposal pits are used, and even though most are taking action which will alleviate the problem; there are others who have completely closed their eyes to the known facts.

In April 1958, a field survey was made in the principal oil-producing areas within the District. Results of the survey showed that all open disposal pits known to be operating in the Lee Harrison field in Lubbock County were in the process of being abandoned; 31 open pits were in use in Cochran County; and 181 open pits were still being used in Hockley County.

In each case, the operators were notified that their disposal pits were being operated in violation to the rules of the District and that cooperation by complying with the rules would be expected and appreciated. Also, each operator was asked to advise the District about any plans that perhaps had been developed concerning the disposal of salt water, and that would

(Continued On Page 4)

Well Capacity Increased By Chemical Treatment

One of the important steps in construction of an irrigation well, or any large capacity water well in this region, is adequate development after the well has been drilled and cased. In general, development is done simply by installing the permanent equipment then pumping and backwashing until the well yields clear water. In many localities this method of development has been acceptable to the well owners, but unquestionably numerous wells have not performed at maximum efficiency from such development.

Various methods of well development, in addition to pumping, include bailing, the use of surge-blocks, and treatment with chemical compounds. Treatment with chemicals such as hydrochloric acid, dry acid, detergents, and other patented compounds have proved advantageous in many localities. For example, a new well that was drilled recently on the Agronomy Farm at Texas Tech was developed by pumping and then treated with a liquid chemical.

According to Dr. A. W. Young, Head of the Department of Agronomy at Texas Tech, a pumping test on the well after development but before treatment with the chemical showed a yield of 200 gallons a minute and a pumping level of 139.2 feet. However, after treatment with 15 gallons of the chemical it showed a yield of 250 gallons a minute and a pumping level of 139.5 feet. Although this treatment may not seem to show a large increase in yield, it did increase the yield 25 percent more than the yield before treatment.

In relating this story, the District is not sponsoring any special treatment or method of well development; rather the intent is to present to the general public information relating to the economic development of ground water.

Commendation For Anti-Pollution Efforts

The Texas Water Conservation Association recently commended the High Plains Water District for its efforts in combatting salt-water pollution of underground water.

A resolution adopted in October during the annual convention of the T.W.C.A. at Houston reads as follows:

"WHEREAS, It has now been proven that pollution of underground water strata has resulted from disposal of salt water in earthen surface salt water disposal pits; and

"WHEREAS, The Texas Water Conservation Association foresaw this danger and helped prepare and pass in 1949 a statute which makes possible prohibition of this menace within boundaries of underground water conservation districts; and

(Continued On Page 4)

DRILLING STATISTICS FOR OCTOBER

During the month of October, 29 new wells were drilled and registered with the District Office; 10 replacement wells were drilled; and 5 wells were drilled that were either dry or non-productive for other reasons. 59 permits were issued by the County Committees. The permits issued and completed wells follow by counties:

County	*Permits Issued*	*New Wells Drilled*	*Replacement Wells*	*Old Wells Deepened*	*Dry Holes Drilled*
Armstrong	0	0	0	0	0
Bailey	2	0	3	0	1
Castro	2	4	3	0	0
Cochran	0	0	0	0	0
Deaf Smith	4	6	1	0	0
Floyd	3	5	0	0	0
Hockley	19	5	0	0	2
Lamb	6	3	1	0	0
Lubbock	16	2	1	0	0
Lynn	3	0	0	0	1
Parmer	2	2	0	0	1
Potter	0	1	0	0	0
Randall	2	2	1	0	0

Nation's Water Subject Of Much Concern For Federal Government

By SAM A. HANNA

A drop of water falls on the American land. Before it reaches the sea, no fewer than 25 different federal government agencies will claim it, examine it, dam it, name it, or fight over it.

Probably no other material attracts the constant attention of so many segments of the federal bureaucracy as the nation's No. 1 resource. Normally, the sprawling system works well enough, but sometimes agency rivalry breaks into open paper warfare.

While it is still in the air, that drop of water is almost exclusively in the domain of the Weather Bureau, a branch of the Commerce Department.

But once it's on the ground, the trouble starts. If it falls on Public Land, it is literally owned by the Bureau of Land Management of the Interior Department,—that is, unless the public land is part of a national forest, which is administered by the Agriculture Department, or a national park, which is under the control of the National Park Service, another Interior Department agency.

The Bureau of Land Management, which owns as much as 70 per cent of some states, often builds small dams to cut down runoff. The Forest Service does the same thing—mainly to help trees grow. The Park Service, on the other hand, wants no reservoirs encroaching on its natural areas.

If the water turns to snow, it is measured by the Forest Service, whose findings are published by the Soil Conservation Service. The SCS is another agency of the Agriculture Department.

But if the water seeps into the ground, it is measured by the Water Resources Branch of the Geological Survey, which is part of the Interior Department.

If the groundwater becomes brackish, still another Interior Department unit enters the picture. The Office of Saline Water will try to remove the minerals.

Water streaming across farmland is of great concern to the Agriculture Department, which has its own set of agencies to deal with the erosion problem.

One program provides for small dams to hold water on farms to halt downstream flooding. This is the small watershed project, administered by the Soil Conservation Service.

Meanwhile, the Agricultural Conservation Program also is paying farm-

(Continued On Page 4)

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ALLAN WHITE
Editor

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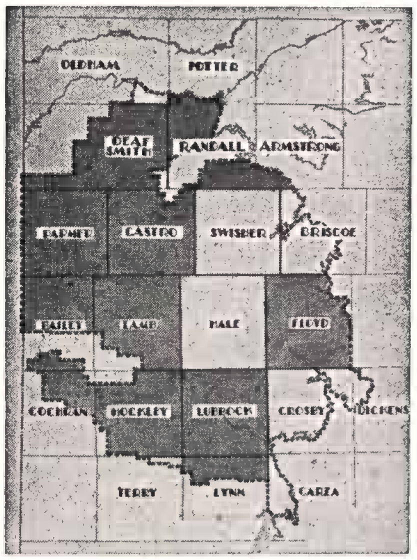

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GOOD LAND PREPARATION

The end of each crop growing season generally leaves us with a mental summary of how the crop grew and the yields that were produced. We also know what the profit was on each crop. Generally we are deciding, with these facts, that we want to improve some of our management practices in growing the next crop. Some of the practices, which are necessary to grow a crop, must be changed for special reasons during the season. Selecting an early maturing variety for late plantings is a good example of a quick change that we have to make. Methods used in "putting up our land" are not practices that have to be changed in the period of a few days or a week. At the same time, we need to realize that a mistake in number or type tillage practices may cost years in correction, plus what is lost in crop yields. Therefore, it is extremely important that we collect our ideas about the growth and profit in our last crop so that we may intelligently plan our program for next year.

BASIC CONSIDERATIONS IN LAND PREPARATION

Our soil is just as much alive as the plants that grow in it. Land preparation practices that destroy any part of the life in the soil will rob plant growth. The amount of robbing done by our tillage practices may never be measured close enough for us to always pinpoint the cause. It is left to us, individually, to find out if our tillage practices are accomplishing the desired purposes.

Land preparation or tillage operations should have the following aims:

(1) Increase or maintain a high water intake rate and movement into the soil.

(2) Stabilize the soil surface and incorporate leaves of crop residue so that there is little or no wind erosion.

(3) Weed control by covering seeds deep or actually cutting off the growing weeds.

(4) Facilitate aeration of soil by breaking hardpans and undesirable horizontal zonations.

(5) Obtain a firm seedbed that is not excessively cloddy.

Having some of the detailed aims of land preparation in mind, we can give some consideration to fall versus spring plowing. There is no single answer to the question of when to begin our tillage operations. It is questionable, however, to rate ourselves, or our neighbor by the amount of fall plowing that is done.

The following are points for consideration in taking a realistic look at fall vs. spring plowing.

(1) Heavy soils should not be plowed while wet. This tends to puddle the soil or cause it to run together. On the other hand, they should not be plowed when too dry because of the resulting large clods. Plowing a seedbed in very cloddy land causes soil structure to break down; consequently it is a great fallacy to say that we do not damage the soil by plowing it when it is dry. This does not mean that there is no right time to plow, but it does mean that we should keep the number of operations to a minimum.

Generally fall plowing is to be favored on heavy soils if they are near the correct moisture content. If they are too wet or too dry, then it is very doubtful if we should plow regardless of what others might think. Fall fertilization on the heavy and mixed soils is an acceptable practice. There is some possibility of slightly speeding the rate of decomposition of plant residue by adding plant food in the fall. We should remember that the rate of decomposition by soil organisms decreases when the soil temperature falls below 60 degrees F. The greatest advantage of fall fertilization may be the fact that we are restoring plant food to the soil during a time when we are not rushed. There is also a question of the advantage of trying to rush decomposition of moderate amounts of crop residue that is not plowed under.

(2) Light or sandy soils can be plowed over a wider range of moisture content than can clay soils. It does not take as many tillage operations on a sandier soil to prepare the seedbed. If erosion can be controlled with crop residues or cover crops, there may be considerably less nitrates and

Contour rows facilitate uniform distribution of both rainfall and irrigation water. The movement of water down the furrow is slowed to minimize erosion and aid penetration.

AND SOIL MANAGEMENT ARE KEYS TO AGRICULTURAL SUCCESS

By HARVEY J. WALKER

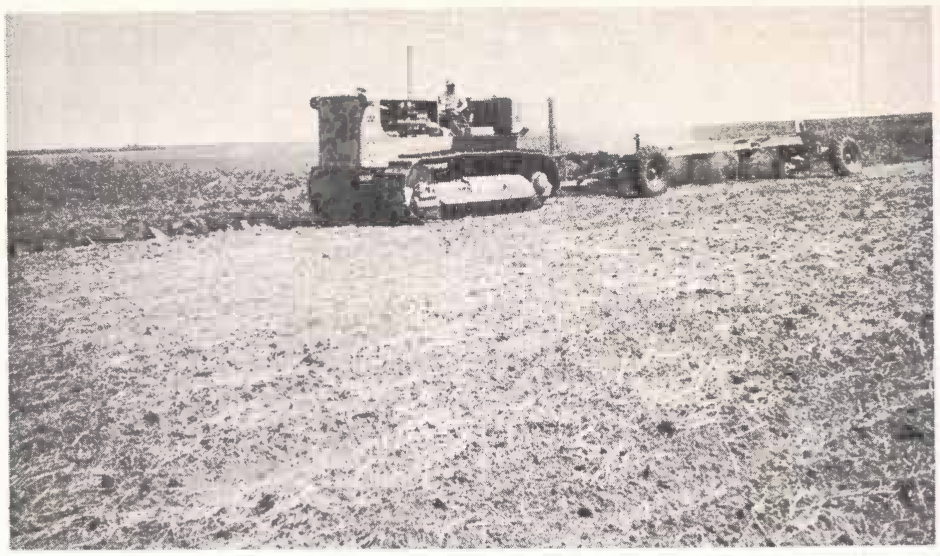
Assistant Agronomist, Texas Agricultural Experiment Station, Substation No. 8, Lubbock, Texas

HARVEY J. WALKER

soil moisture lost if the sandier soils are plowed in the spring.

Fall fertilization with nitrogen is not recommended on sandy soils. It is often more profitable to feed the crop rather than to feed the soil on sandy lands.

Chiseling land 8 to 10 inches deep after shredding crop stalks is a very good practice. Wind and water erosion is controlled, shallow hardpans are broken and water penetration rate is increased.



Deep plowing, 12 inches or more, is beneficial on light soils to help prevent surface wind erosion. Deep plowing can be hazardous, however, in localities where only a small amount of clay can be brought to the surface.

OPERATIONS IN LAND PREPARATION TO ACCOMPLISH OUR AIMS

Shredding sorghum and cotton stalks or other crop residues makes them easier to incorporate into the soil and helps to eliminate trash problems when planting. The idea of trying to leave the crop residue in the surface inches of the soil is becoming more popular. Ideally the residue should be in the soil only deep enough so that it does not blow off the land. The purpose of this practice is to help control soil blowing and prevent the surface of the soil from sealing which severely lowers water intake rate. Runoff is increased sharply when the surface of the soil runs together.

At or before the time of stalk shredding, we should determine if we had a good crop on each end of the field and a poor crop in the middle. Plowing, fertilization, insect control, or irrigation will not correct the lack of water in these spots caused by uneven water penetration. Production of crops, on dry or irrigated land, demands that we hold and uniformly distribute the available water. This cannot be done on all soil types and slopes that are encountered. Still, there are many farms on which improvement in uniform water penetration could be made. Two common practices available for holding and distributing water on land are: (1) contour or level rows (2) bench levelling. The major operation of bench levelling is a relatively expensive job and probably should be used only in special situations. Special planning should be done and experienced counsel obtained for this type of job.

Changing row direction so as to go across, rather than up and down the slope is a very easy operation. Too often we may run our rows up and down the slope simply because they were that way last year.

When our decision on row direction has been made we are ready to proceed with our plowing job. After the cotton or sorghum stalks have been shredded we can decide on which plow to use. At this point we must call on our individual philosophy of land preparation. Many of us may have in mind that the largest tractor and plow we can get, will do the best job. Some of us have decided to plow no more and no deeper than necessary. The best solution is probably to recognize that both ideas are good when used as needed.

Deep plowing, twelve inches or more, is known to be beneficial on certain of the lighter soils where shallower tillage will not prevent blowing. There are some lighter or sandier soils which are hazardous to deep plow if only a small amount of clay can be brought to the surface. On these soils, the clay is the portion which blows out, leaving only the coarser sand which has extremely low water holding capacity. The practice of deep breaking the heavy, or clay soils, deeper and deeper each year is questionable. Increasing the percent of clay on the soil surface can seriously lower water intake rates. It is wise to give considerable thought to the decision of whether or not to deep break—in some cases is it necessary, while it may be harmful in other situations.

On land where it is decided not to deep break, we are concerned with a normal land preparation procedure. Chiseling 8 to 10 inches deep after stalk shredding is a good practice. Erosion is controlled, shallow hardpans are broken and rainfall and irrigation water are allowed to more easily penetrate the soil. Chiseling works best when the soil is just dry enough to prevent too many large clods from being broken out.

Flat breaking 8 to 10 inches deep is also a good practice, but it is comparatively expensive and may not be necessary more often than every third year. Crop residues are turned under by this method which is a practice that may not be advisable.

The chiseling or flat breaking operation is all that is necessary to do to the land until it begins to blow, or until it is time to list for preplanting irrigation.

These ideas of land preparation are based on a minimum amount of traffic over our land. It is not denied that we make the best crop where we plow, but still it is not implied that four plowings will make twice as much as two plowings. Perhaps a good job of land preparation is automatically done if we keep the special purposes of tillage in mind. At the same time it should always be realized that our soil can become lifeless, and powdered or puddled by improper tillage practices.

Plowing water furrows straight down the normal slope of the land is a questionable practice. Note in the picture above the erosion that has occurred from high water velocity. Uniform distribution of water is difficult to achieve with this method—water stands in flat places which subjects the land to over irrigation, while on steeper grades movement of water is to fast and penetration is not sufficient to adequately wet the soil.

Conservation Conversation

With the time rapidly approaching when most people in this area will consider the question of whether or not to drill a new irrigation well, many will be wondering about the procedure involved in obtaining a drilling permit. Some facts that pertain to the rules of the High Plains Water District that should be known are listed below.

No person shall begin to drill a well, or increase the size of a well, which could reasonably be expected to produce in excess of 100,000 gallons of water per day, (69.4 gallons per minute) without having first applied to the Board and had issued a permit to do so.

Each of the county offices listed on page 2 of "The Cross Section" may accept well drilling permit applications for their respective county. Each will provide application forms, and assistance will be offered the applicant in filling out the form.

The application shall supply the following information:

1. The name and mailing address of the land owner.
2. The complete legal description of the land upon which the proposed well is to be drilled.
3. The size of the pump.
4. The approximate date drilling operations are to begin.
5. The proposed use of the well to be drilled, whether municipal, industrial or irrigation.
6. The exact number of yards to the nearest two non-parallel property lines.
7. The location of the three nearest wells within a quarter of a mile of the proposed location, together with the names and addresses of their owners.

Complete records shall be kept and reports made to the District concerning the drilling, equipping and completion of the well drilled. Such records shall include an accurate driller's log, and data concerning the description of the well, its construction and equipment. Report forms are furnished by the District and may be obtained from the county office.

A well to be equipped with a 4-inch or smaller pump shall be located at least 200 yards from the nearest well or authorized well site; a well to be equipped with a 5-inch pump shall be located at least 250 yards from the nearest well or authorized well site; a well to be equipped with a 6-inch pump shall be located at least 300 yards from the nearest well or authorized well site; a well to be equipped with an 8-inch pump shall be located at least 400 yards from the nearest well or authorized well site; and a well to be equipped with a 10-inch or larger pump shall be located at least 400 yards from the nearest well or authorized well site.

Commendation—

(Continued From Page 1)

"WHEREAS, Under this statute the High Plains Underground Water Conservation District No. 1 and the North Plains Water Conservation District have been established and are now aggressively combatting underground water pollution by such means;

"NOW, THEREFORE, BE IT RESOLVED, by the Texas Water Conservation Association—

1. That High Plains Underground Water Conservation District No. 1 and the North Plains Water Conservation District be commended for their fight against underground water pollution.
2. That areas overlying other underground water reservoirs facing such pollution be urged to act to protect such endangered underground waters; and
3. That attention be given the desirability of encouraging the enactment of statewide laws prohibiting pollution of underground water by salt water or other deleterious matter whether from the surface of the earth or from other stratum or strata.
4. That legislation be adopted which will prohibit disposal of brines in surface pits and requiring disposal of said brine into an appropriate underground strata which will not pollute either surface or underground fresh water."

Brine Pits—

(Continued From Page 1)

require additional time to place into actual practice. It seemed only reasonable to expect that many would have plans that would require a certain length of time to install.

Realizing that a fair and equitable approach to this problem should be made, the Water District took no further action until September 1958. At that time, checks were again made in the field as a means of ascertaining whether or not proper changes were being made.

It was determined that at least one operator had apparently made no changes in his disposal operation from the time of the original survey. Promised action by the operator was not made within the time limit determined to be satisfactory and fair by both the oil operator and the Water District. With expiration of the agreed-upon time limit an injuctive law-suit was filed in Hockley County against the operator by the District.

Almost immediately, action was taken by the oil producer to do away with the open salt-water disposal pits and thereby comply with the District's rules and regulations.

It is most unfortunate that drastic legal action, which literally forces the oil operators to take action, should be required in order to accomplish compliance with the District's rules, particularly when the operator apparently realizes the consequences that can result from continued use of open pits.

The High Plains Underground Water Conservation District heartily thanks those oil producers who are now disposing of their brine through safe and approved methods. Also, a sincere desire is expressed, that through the cooperation of all, the District will soon be able to publicly state that no earthen pits are being used in connection with the disposal of oil-field brine.

Federal Government—

(Continued From Page 1)

ers to build small dams. Every now and then someone proposes to merge the ACP with the SCS, but most farm block congressmen are violently opposed.

At the same time, the Soil Bank Conservation Reserve is urging farmers to build small dams and paying them bonuses if they do. The Soil Bank is administered by the Commodity Stabilization Service, which is a separate and distinct branch of the Agriculture Department.

In 10 plains states, the Great Plains Program is also making money available for conservation practices—including small dams.

In practice, this is less confusing than it appears. The farmer merely goes to his county agent and gets whatever help he can.

When there is enough water in a river, several agencies will try to dam it up. The Bureau of Reclamation, another branch of the Interior Department, does much of the dam building in the 17 western states, especially if irrigation or electric power is involved.

But the Army Engineers, part of the Department of Defense, also build big dams. Theoretically, the engineers are concerned only with inland navigation, but this job has long since involved them in flood control—which means upstream dams. Upstream dams are often good hydro-electric sources—and the overlapping continues.

But neither the Reclamation Bureau nor the Engineers build a dam without approval by the Fish and Wildlife Service, which is also in the Interior Department. The FWS makes sure that salmon and other fish get home to spawn.

The FWS also runs the widespread system of wildlife refuges, most of which are at least swampy. It also keeps it eye on swamps in general.

There are thousands of "prairie potholes" in northern Minnesota and North Dakota that the Soil Conservation Service has been trying to drain over the bitter protests of Fish and Wildlife officials, who claim drainage would destroy nesting grounds for ducks and geese.

The Federal Power Commission, an independent agency, has its say-so whenever a dam produces electricity.

If there is a dispute over whether to call a little stream Whisky Creek or Sweetwater Gulch, there's a federal agency to decide the question. It is the Board of Geographic Names, in the Interior Department. The BGN has pretty well covered the U.S. map and is now naming all the places in foreign countries.

If the water becomes polluted, the Public Health Service will analyze it—and strongly urge somebody to purify it. The Community Facilities Administration, part of the independent Housing and Home Finance Agency, will supply matching funds for the purification plant.

So far, we haven't mentioned the Treasury Department, but it has not been left out. Besides taxing all those dam-builders, farmers and fishermen, it runs the Coast Guard, which polices the waterways.

No list of water agencies would be complete without mention of the Federal Flood Indemnity Administration; or the International Boundary and Water Commission of the U. S. and Mexico; or the International Pacific Halibut Commission, or the International Pacific Salmon Fisheries Commission.

Or—perhaps—the Securities and Exchange Commission. This agency is constantly on the lookout for watered stock.

Please Close Those Abandoned Wells!!!

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

Second Class Permit

THE Cross SECTION

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

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Board Of Directors

County Committeemen

Office Personnel

THE Cross SECTION

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

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ALLAN WHITE
Editor

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Committeemen meet fourth Friday of each month at 2:30 p. m., Farm Bureau Office, Muleshoe, Texas.

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Committeemen meet the first Monday of each month in the Farm Bureau Office, Hereford, Texas at 7:30 p. m.

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Robert Kellison .... Route 2, Lockney, Texas
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Robert L. Smith .... Lockney, Texas
Ernest Lee Thomas .... Route 1, Floydada, Texas

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J. J. Hobgood .... Route 2, Anton, Texas
H. C. Janes .... Route 4, Levelland, Texas
Joe W. Cook, Jr. .... Route 1, Ropesville, Texas

Committeemen meet first and third Fridays of each month at 1:30 p. m., 913 Houston, Levelland, Texas.

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Vernice Ford .... 3013 20th St., Lubbock, Texas
Howard Alford .... Route 4, Lubbock, Texas

Committeemen meet first and third Mondays of each month at 2:30 p. m., 1628-B 15th Street, Lubbock, Texas.

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Mrs. Jean Lancaster, 1628-B 15th Lubbock, Texas

Frank P. Lisemby, Jr. .... Route 1, Wilson, Texas
Erwin Sander .... Route 1, Wilson, Texas
Lit H. Moore, Jr. .... Route 1, Wilson, Texas
Aubrey Smith .... Route 1, Wilson, Texas
Earl Cummings .... Wilson, Texas

Committeemen meet first and third Tuesdays of each month at 10 a. m., 1628-B 15th Street, Lubbock, Texas.

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Leo Artho .... Route 1, Canyon, Texas
L. E. Mason .... Wildorado, Texas
John Butler .... Route 2, Happy, Texas
James B. Dietz .... Route 2, Happy, Texas

Committeemen meet first Monday night each month at 7:30 p. m., 1710 5th Avenue, Canyon, Texas.

Hearing Held On Waste Case

The Board of Directors of the High Plains Underground Water Conservation District No. 1 held a hearing at the offices of the District in Lubbock, Texas, on December 9, 1958. The hearing was called in order that testimony might be heard pertaining to a complaint against a Deaf Smith County vegetable grower, the Chalmar Company, Incorporated. The company is owned and operated by Al and Charles Trautman. The land from which underground water was escaping is located six miles north of Hereford.

Testimony was presented to the Board by Mr. Wayne Wyatt, an employee of the Water District who operates the field office in Hereford. Mr. Wyatt testified that water was allowed to escape from the land being operated by the Corporation and that a road adjacent to the land was made impassable for several days. He further testified that as soon as the matter was called to the attention of Mr. Trautman, the wells were cut off and a border was run on the west side of the land and that since that time no further water has escaped from the premises.

Mr. Al Trautman appeared at the hearing on behalf of the Chalmar Company. He testified that he was unaware of the situation when it was called to his attention but admitted that the road had been made impassable due to the "tail water." He told the Board that he had immediately placed a border along the west side of the field where the water was escaping, and also that there would be no further violation of the District's rules and regulations prohibiting waste. He further stated that he was in complete accord with the rules and regulations and that he realized fully the necessity of the prevention of the escape of "tail water." He stated that it was his feeling that the regulations prohibiting waste were passed for the benefit of all persons in the area and that they should be complied with.

The Board of Directors, after careful deliberation, concluded that the Chalmar Company had violated the Statutes of the State of Texas, as well as the rules and regulations of the District, prohibiting waste and so advised Mr. Trautman. Mr. V. E. Dodson, President of the Board, commended Mr. Trautman for taking immediate action to stop the waste after the matter was called to his attention, but also warned him that further violations would not be tolerated. The Board decided that no court action would be taken against Chalmar Company because the testimony showed that the situation had been temporarily corrected.

Water District Awards Scholarships

An important step forward in the research program associated with the development and conservation of ground water in the southern High Plains area has been taken by the directors of the High Plains Underground Water Conservation District.

At a meeting of the Board early in December, research fellowships were awarded to two graduate students in geology at Texas Technological College. The students will investigate certain phases of the large problems of artificial recharge. By this action a cooperative program of ground water research is established. Results of these investigations should prove of benefit to the people of the District. Also, this means, additional research workers are made available to the HPUWCD, plus the facilities of the Tech Geology Department and the advice of the members of the staff of that department. The students will be given an opportunity to become familiar with the problems of ground water geology and the possibilities of a future career in that phase of their subject.

Proposed Water Bill Outlined

The San Antonio Express in its December 11 edition, outlined a proposed underground water development bill which will be proposed to the coming session of the Texas Legislature by the San Antonio Chamber of Commerce.

The bill calls for the creation of the Edwards Underground Water District and would affect Uvalde, Bexar, Comal, Medina, Kinney and Hays counties.

The Water Resources Committee of the Chamber of Commerce calls the bill a proposal to meet the problems of selfishness in some areas, and a more-useful distribution of Texas' available water supplies.

The proposed bill would create the District and give it authority to:

1. Study and develop the underground water reservoir and to police pollution and waste that would affect the reservoir.
2. Conserve, preserve and improve the reservoir with dams, wells for recharge purposes, easements and authority to appropriate surface water for recharge.
3. Provide for tax levies with which to finance the program. Initial tax would be 2-cents on the county valuation. Maximum tax would be 25-cents and any increase from the original 2-cents would have to be approved by the people in the District.
4. Each county would have three directors and they would control funds collected from their part of the District. Each county delegation would name a chairman who would automatically become a member of a District-wide "executive committee."

This proposed bill will be scrutinized to ascertain exact meanings of certain words and phrases used in its content. On the surface, however, the proposed bill appears to offer only limited improvement over present underground water laws of the State, and it further appears to contain some things that could prove very detrimental indeed to our inherent doctrine of individual ownership and development of underground water.

There is one section which could be helpful to underground water users of Texas. That is the one which would give authority to the District to request of the State Board of Water Engineers an appropriation of unused surface water for use in underground reservoir recharge.

On the other side of the ledger, however, the deviation from present laws that is immediately apparent and the one which could prove very dangerous, is the one that gives the District authority to develop underground water. If the law of the State were altered to comply with this line of thinking it could conceivably mean the end of individual development of underground water in Texas.

ANNUAL WATER DISTRICT ELECTIONS -- JANUARY 13

On January 13, 1959, the High Plains Underground Water Conservation District will hold its annual election of Directors and County Committeemen.

The two-year terms of office of three Directors will expire in January, and also the three-year terms of office of two Committeemen in each county will expire. There are a total of five men on the Board of Directors and five men on each county committee.

The voters in District Director's Precinct No. 1, which consists of Lubbock and Lynn Counties, will elect a Director from their area to serve on the District Board for a two-year term. The same will be true for Director's Precinct No. 3, which consists of Bailey, Castro and Parmer Counties, and for Director's Precinct No. 4, which consists of Armstrong, Deaf Smith, Potter and Randall Counties.

Those who are qualified resident voters and live within the bounds of the Water District are urged to cast their ballots on January 13.

The voting places in each county are listed below. Ballots may be cast at any of the voting places within the county in which the voter resides.

ARMSTRONG COUNTY
1. School House in Wayside, Texas

BAILEY COUNTY
1. Community House in Muleshoe, Texas
2. Enochs Gin Office, Enochs, Texas
3. Three-Way School House

CASTRO COUNTY
1. County Courthouse, Dimmitt, Texas
2. School House in Hart, Texas
3. Jumbo School House
4. Community Hall in Nazareth, Texas

COCHRAN COUNTY
1. County Activity Building, Morton, Texas

DEAF SMITH COUNTY
1. County Courthouse, Hereford, Texas

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

HOCKLEY COUNTY
1. City Hall, Anton, Texas
2. Hockley County Library, Levelland, Texas
3. School House in Whitharral, Texas
4. City Hall, Sundown, Texas
5. Farm Center Gin, Ropesville, Texas

LAMB COUNTY
1. County Courthouse, Littlefield, Texas
2. City Hall, Olton, Texas
3. Springlake Elevator Office, Springlake, Texas
4. City Hall, Sudan, Texas
5. School House, Spade, Texas

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

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

PARMER COUNTY
1. American Legion Hall, Friona, Texas
2. Wilson & Brock Real Estate Office, Bovina, Texas
3. County Courthouse, Farwell, Texas
4. School House in Lazbuddie, Texas

POTTER COUNTY
1. School House in Bushland, Texas

RANDALL COUNTY
1. Hollywood Service Station
2. Randall County Grain Company, Ralph Switch
3. School House in Umbarger, Texas

The nominees for District Directors and for County Committeemen whose names will appear on the ballots to replace those whose terms expire are as follows:

FOR DISTRICT DIRECTOR

DIRECTOR'S PRECINCT NO. 1 — LUBBOCK and LYNN COUNTIES
(One to be elected)
1. Elmer Blankenship, Route 2, Wilson, Texas
2. ____________

DIRECTOR'S PRECINCT NO. 3 — BAILEY, CASTRO and PARMER COUNTIES
(One to be elected)
1. A. H. Daricek, Maple, Texas
2. John Gammon, Route 1, Friona, Texas
3. Johnnie M. Haberer, Route 4, Muleshoe, Texas
4. ____________

DIRECTOR'S PRECINCT NO. 4 — ARMSTRONG, DEAF SMITH, POTTER and RANDALL COUNTIES
(One to be elected)
1. G. A. Dietz, Route 2, Happy, Texas
2. T. L. Sparkman, Jr., Route 1, Hereford, Texas
3. ____________

FOR COUNTY COMMITTEEMEN

ARMSTRONG COUNTY
(Two to be elected—Commissioner's Precinct No. 3)
1. Wayne McNeill, Route 1, Happy, Texas
2. Robert Adams, Wayside, Texas
3. Charles Kennedy, Route 1, Happy, Texas
4. John Patterson, Route 1, Happy, Texas
5. ____________

BAILEY COUNTY
(One to be elected—Commissioner's Precinct No. 3)
1. F. A. Carter, Maple, Texas
2. Doyle Davis, Maple, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 1)
1. Robert Blackwood, Route 1, Muleshoe, Texas
2. Loyd Throckmortin, Route 1, Muleshoe, Texas
3. ____________

CASTRO COUNTY
(One to be elected—Commissioner's Precinct No. 3)
1. Ernest Jones, Dimmitt, Texas
2. Owen Andrews, Star Route, Hereford, Texas
3. ____________

(One to be elected—Commissioner's Precinct No .4)
1. Fred Annen, Dimmitt, Texas
2. Ed Drerup, Route 2, Dimmitt, Texas
3. ____________

COCHRAN COUNTY
(One to be elected—Committeeman-at-large)
1. Weldon Newsom, Route 2, Morton, Texas
2. Lloyd Miller, Box 246, Morton, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 2)
1. O. L. Castle, Route 1, Morton, Texas
2. L. L. Taylor, Route 1, Morton, Texas
3. ____________

DEAF SMITH COUNTY
(One to be elected—Commissioner's Precinct No. 3)
1. Clinton Jackson, Route 5, Hereford, Texas
2. Ira Scott, Route 5, Hereford, Texas

(One to be elected—Commissioner's Precinct No. 4)
1. Jack Higgins, Route 4, Hereford, Texas
2. ____________

FLOYD COUNTY
(One to be elected—Commissioner's Precinct No. 1)
1. Ernest Lee Thomas, Route 4, Floydada, Texas
2. David Battey, Jr., Route 4, Floydada, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 3)
1. Don Probasco, Silverton Route, Lockney, Texas
2. Grigsby "Doodle" Milton, Silverton Route, Lockney, Texas
3. ____________

HOCKLEY COUNTY
(One to be elected—Commissioner's Precinct No. 1)
1. Joe W. Cook, Jr., Route 1, Ropesville, Texas
2. ____________

(One to be elected—Commissioner's Precinct No. 2)
1. Earl G. Miller, Route 5, Levelland, Texas
2. ____________

LAMB COUNTY
(One to be elected—Committeeman-at-large)
1. J. B. Davis, Route 1, Amherst, Texas
2. Robert Dysert, Route 1, Amherst, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 2)
1. Price Hamilton, Route 4, Muleshoe, Texas
2. ____________

LUBBOCK COUNTY
(One to be elected—Commissioner's Precinct No. 1)
1. Ford Bell, Route 4, Lubbock, Texas
2. W. W. Allen, Route 4, Lubbock, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 4)
1. Jack Noblett, Route 1, Shallowater, Texas
2. Lee Pierce, Shallowater, Texas
3. ____________

LYNN COUNTY
(One to be elected—Commissioner's Precinct No. 1)
1. Roy Lynn Kahlich, Wilson, Texas
2. Weldon Bailey, Route 1, Wilson, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 4)
1. E. M. Rudd, Route 1, Wilson, Texas
2. Robbie Gill, Route 1, Wilson, Texas
3. ____________

PARMER COUNTY
(One to be elected—Commissioner's Precinct No. 2)
1. Carl Schlenker, Route 2, Friona, Texas
2. Franklin Bauer, Route 2, Friona, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 3)
1. Dick Rockey, Route 1, Friona, Texas
2. Coy Patton, Route 1, Friona, Texas
3. ____________

POTTER COUNTY
(Two to be elected—Commissioner's Precinct No. 4)
1. James S. Line, Bushland, Texas
2. E. L. Milhoan, Bushland, Texas
3. ____________

RANDALL COUNTY
(One to be elected—Commissioner's Precinct No. 3)
1. Harold Bryan, Route 1, Happy, Texas
2. Jackie Meeks, Route 2, Happy, Texas
3. ____________

(One to be elected—Commissioner's Precinct No. 4)
1. A. C. Evers, Route 4, Box 391, Amarillo, Texas
2. Ervin Podzemny, Route 4, Box 352, Amarillo, Texas
3. ____________

DRILLING STATISTICS FOR NOVEMBER

During the month of November, 39 new wells were drilled and registered with the District Office; 4 replacement wells were drilled; and 6 wells were drilled that were either dry or non-productive for other reasons. 111 permits were issued by the County Committees. The permits issued and completed wells follow by counties:

County	*Permits Issued*	*New Wells Drilled*	*Replacement Wells*	*Old Wells Deepened*	*Dry Holes Drilled*
Armstrong	0	0	0	0	0
Bailey	9	7	0	0	0
Castro	12	3	0	0	0
Cochran	5	0	0	0	0
Deaf Smith	3	2	0	0	0
Floyd	7	3	0	0	0
Hockley	15	12	0	0	1
Lamb	8	2	0	0	0
Lubbock	24	8	2	0	2
Lynn	12	1	0	0	2
Parmer	10	1	1	0	0
Potter	0	0	0	0	0
Randall	6	0	1	0	1

FIELD EXPERIMENT REVEALS VALUABLE IRRIGATION DATA

By Y. F. SNODGRASS

An irrigation farmer can undoubtedly raise crops with more efficiency if he employs the use of such devices as moisture blocks and flow-meters. With such tools, he can enlighten himself concerning amounts of moisture available at all times to his plants, and may thereby guard against over-irrigating or under-irrigating his growing crop. In order to obtain data relating to this proposition, the District conducted the following tests in an onion field in Floyd County.

Soil moisture blocks which are used to measure the percentage of available moisture in the root zone were placed in the ground at depths of 6, 12, 18, and 24 inches. A Moisture Meter was used to read the percentage of available moisture.

The 18 and 24 inch block readings were not used in the accompanying graph because the readings indicated that the moisture was approximately 100 percent at all times.

The graph shows the average readings of the 6 inch and 12 inch blocks. The three sets of blocks were buried at different places in the onion field. The number 1 set was about 25 yards from the upper end of the field near the outlet line of the concrete pipe. The number 2 set was about 400 yards from the outlet line, near the center of the field, and the number 3 set was about 785 yards from the outlet line near the lower end of the field. The total length of the rows was 810 yards.

Water is pumped from an 8-inch well and metered through an 8-inch flow-meter. It is distributed through a concrete line and aluminum pipe. The flow-meter was used to calculate the acre-inches applied at each watering.

The amount of water pumped on the onions was 13.05 inches and the precipitation amounted to 12.25 inches, for a total of 25.30 inches of water after the onions were planted.

Onions were planted April 1, 1958, and were watered for the first time on April 3, with 3.85 inches. No more irrigation water was applied during the month of April as 3.30 inches of precipitation was recorded.

Rainfall during May amounted to 3.35 inches, which sustained the onion plants until May 27 and 28 when 2.4 inches of irrigation water was applied.

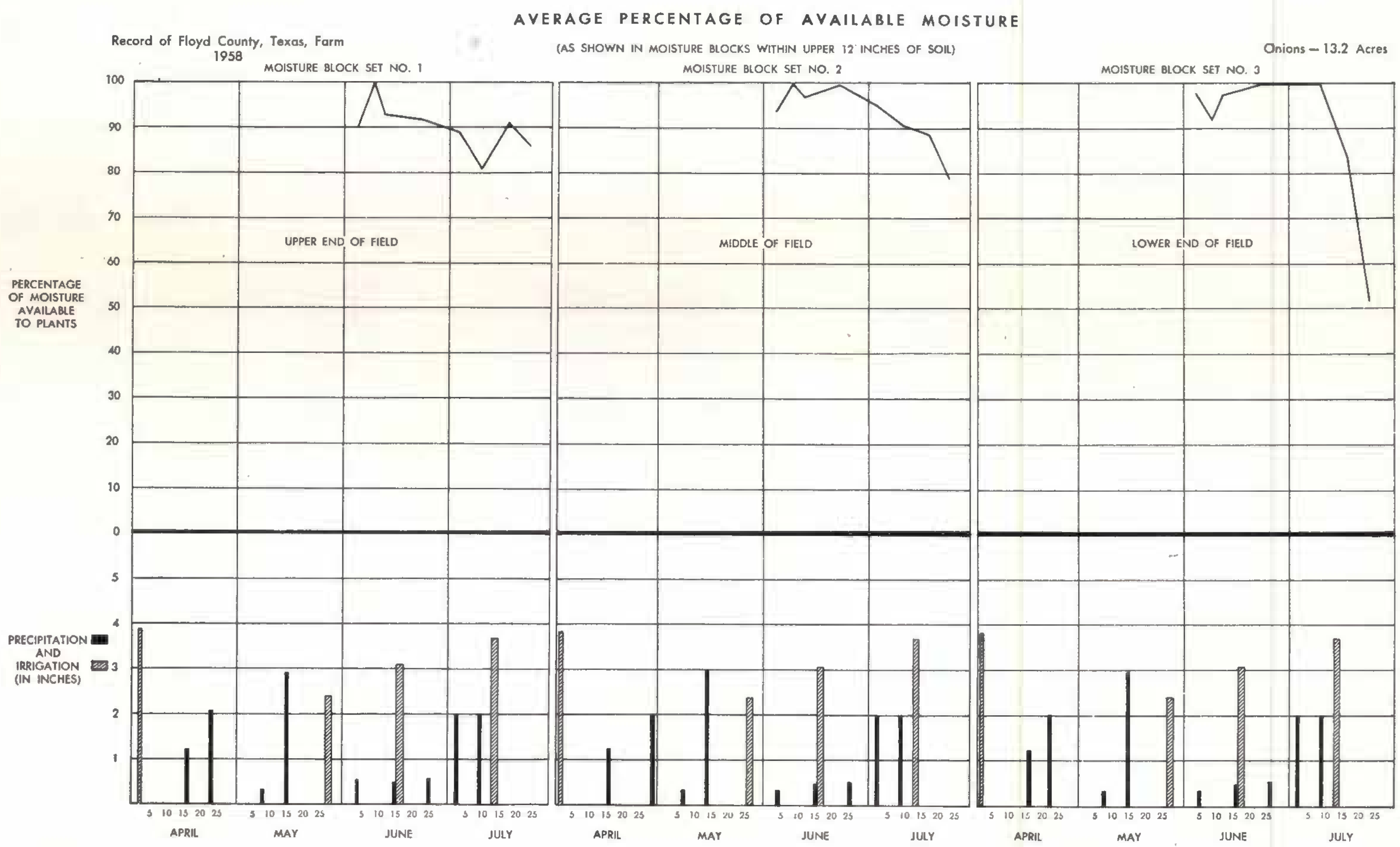
June rainfall totalled 1.60 inches and the onion crop was aided by one irrigation of 3.10 inches.

During the first days of July, 4.0 inches of precipitation fell and in the middle of the month, a final watering of 3.70 inches was applied.

Before planting, 300 pounds of 16-20-0 fertilizer was applied per acre. The onions were harvested about July 20. The yield was reported to be 540 sacks of 50 pounds each, or a total of 27,000 pounds of onions per acre.

The Water District plans to conduct additional research during the coming crop year by expanding the soil block and flow-meter program to include all major crops grown in the southern High Plains area.

Available moisture present in the root zone of the Floyd County onion field is being checked by District field representatives. They are using a moisture meter to read percentages of available moisture in blocks of gypsum buried beneath the surface.



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High Plains Underground Water
Conservation District No. 1
1628-B Fifteenth Street
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