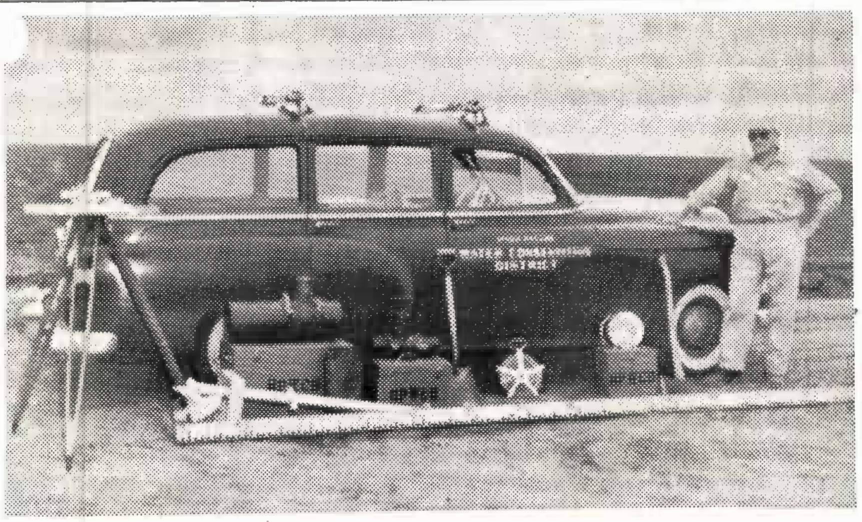
THE Cross SECTION

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

Volume I — No. 1 | There Is No Substitute For Water | June, 1954



"Doc" and the District's Water Wagon

G. W. "Doc" Willis is shown with the red station wagon and most of the equipment he uses in his work for the Water District. The equipment consists of an alidade, stadia rod, three Sparling flow meters, two water level testers, steel tape, and various hand tools. "Doc is the geologist for the District.

Possibility Of Water Depletion As Tax Deduction Now Under Study By District

The High Plains Underground Water Conservation District has received a number of inquiries in recent months relative to the possibility of obtaining the approval of the Internal Revenue Service for an expense deduction for income tax purposes of the cost value of underground water which is depleted by use for municipal, industrial and agricultural purposes.

At present no allowance is made for tax purposes for depletion of underground water. For example, if a person pays $400 an acre for 200 acres of land; if he pumps water from his land for twenty-five years and exhausts his supply of water; and if at the end of that time his land is worth only $100 an acre due to the fact that his water supply has become exhausted, the only way that he is permitted a deduction for the loss he has sustained, under existing income tax regulations, is through sale of the land.

Several problems present themselves in any study of the possibility of establishing an allowance for the depletion of underground water. First, it will be necessary to establish that the landowner has a cost in his underground water as distinguished from the cost of the soil; second, it will be necessary to establish that the underground water is depleted through its use; and third, it will be necessary to establish the annual rate at which such depletion occurs. Obviously, in areas where pumping does not deplete the underground water supply, the landowner would not be entitled to an allowance for water depletion. However in places where underground water is being depleted by continuous use, it would appear that a deduction should be allowed the landowner as a compensation for the asset (water) consumed in the production of income. A depletion deduction of this nature would be comparable to the present cost de-

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Greetings:

from the staff of The Cross Section. In this issue, as in each monthly issue to follow, we shall endeavor to present to you a cross section of the present day activities in the field of Underground Water as an instrument for keeping in touch with the plans and functions of your District.

Legal activities shall be reviewed under "Legislative Briefs"; "The Statistic" lists the wells which were registered with the District during the preceding month, and our readers will find of special interest the series of articles to be published relating to the installation of water wells.

The Cross Section is published for you. Let us hear from you.

State Board Of Water Engineers Hears Evidence At North Plains Water Meet

The State Board of Water Engineers journeyed to Dumas last week to hold a hearing on the delineation of an underground water conservation district.

It will take some time for the Board to make its final determination on where the exact bounds of the district should be placed, although sufficient evidence was presented by local citizens of each County to show the areas capable of producing the 150,000 gallons of water daily as is required by law before such an area would be eligible to participate in a conservation district.

Chief Engineer for the Board, Ivan Stout, and Jerry Cronnin of the U. S. Geological Survey presented the material and information gathered from a thorough survey of the area north of the Canadian in Texas. Several farmer, rancher, businessmen and industrialists attending the hearing were well pleased and surprised to hear the information and to see the cross sections of the location and the thickness of the water-bearing sands of the North Plains area.

The High Plains District is eager to see the North Plains District formed for that part of the Ogalla formation north of the Canadian River. It is also the feeling of the High Plains District that the formation of the new district would give the people of Texas who are dependent on ground water for a supply, strength in unity to protect the precious resource.

It's Later Than You Think -- But It's Not Too Late

W. L. Broadhurst

Every person within the bounds of the High Plains Underground Water Conservation District No. 1 should read the statements contained in President Eisenhower's message to the Congress on July 31, 1953.

The President called attention to the need for a strong Federal program in the field of resource development and at the same time he pointed to the necessity for cooperation of private citizens.

President Eisenhower said it is important for groups of farmers to work together in local organizations, such as the High Plains Underground Water Conservation District No. 1, to take the initiative, which means, don't wait for somebody else to tell you what to do in developing adequate plans for proper land use and resource improvement.

The President said that conserving and improving our land and water resources is high priority business for all of us, and that it is the purpose of the Administration to present to the next session of the Congress suitable recommendations for achieving the objectives set forth in his message.

We believe the President's message is of vital importance to the High Plains people, but we do not need to wait for the next session of the Congress. We have a local underground water conservation district authorized by the Texas Legislature and approved by a majority vote of the people who live in the District.

The High Plains Underground Water Conservation District No. 1 is authorized to formulate, promulgate, and enforce rules and regulations for the purpose of conserving, preserving, protecting,

(Continued on page 3)

McFarland Seeks Tax Deduction On Underground Pipe

In keeping with the policy of the Board of Directors of the High Plains Underground Water Conservation District on encouraging the use of underground pipe as a water conservation measure and through the cooperation of the concrete underground pipeline companies, a hearing before the Senate Finance Committee was arranged regarding the deduction for installation of underground irrigation pipelines from annual income tax returns.

It is the feeling of the District that all the encouragement possible should be given to the irrigation farmer to aid him in the installation of such lines.

It has been pointed out to the Board that pipeline would be more readily installed if it were possible to deduct the cost immediately upon completion instead of showing depreciation over a period of

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THE Cross SECTION

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1628-B Fifteenth Street, Lubbock, Texas

Telephone 2-8088

F. B. Jeu Devine
Editor

COUNTY COMMITTEEMEN

Armstrong County

H. T. Duke, Route 1, Happy

H. T. Duke, Chmn____Route 1, Happy, Tex.
Bill Heisler__________________Wayside, Tex.
Melton McGehee____________Wayside, Tex.
John Patterson________________Happy, Tex.
W. R. Stockett________Route 1, Happy, Tex.
No regular meeting date.

Bailey County

Mrs. Doris Traweek, Bailey County Farm Bureau Office, Muleshoe

Troy Atkinson, Chmn________Muleshoe, Tex.
Robert F. Byrd______Route 2, Muleshoe, Tex.
W. R. Carter_________________Muleshoe, Tex.
W. T. Millen________Route 1, Muleshoe, Tex.
D. V. Terrell__________Route 1, Morton, Tex.
No regular meeting date.

Castro County

Eugene Ivey, Dimmitt

Posie Cunningham, Chmn_____Dimmitt, Tex.
H. F. Benson____Star Route 1, Hereford, Tex.
Steve Brockman____________Nazareth, Tex.
T. R. Davis_______________________Hart, Tex.
Eugene Ivey________Box 157, Dimmitt, Tex.
No regular meeting date.

Cochran County

Mrs. Hallie Sybert, Cochan County Farm Bureau Office, Morton

Glenn Thompson, Chmn________Morton, Tex.
Max Bowers____________________Morton, Tex.
Syl Greener____________________Morton, Tex.
W. R. Key______________________Morton, Tex.
B. R. Stovall______Star Route 2, Morton, Tex.
Committeemen meet first Tuesday night of each month, Cochran County Farm Bureau Office, Basement of Court House, Morton

Deaf Smith County

Miss Nadean Hulse, Deaf Smith County Farm Bureau Office, Hereford

Frank J. Bezner, Chmn, Box 14, Hereford, Tex
Pete Carmichael____Route 1, Hereford, Tex.
Paul Corbett________Route 5, Hereford, Tex.
J. N. Fish___________________Hereford, Tex.
Floyd Walton________Route 5, Hereford, Tex.
No regular meeting date.

Floyd County

Mrs. Ida Puckett, 319 South Main Street, Floydada

W. Grady Walker, Chmn______Floydada, Tex.
R. C. Mitchell_______________Lockney, Tex.
Robert L. Smith_______________Lockney, Tex.
Sid Thomas_________________Lockney, Tex.
Lee Trice____________Rt. 1, Floydada, Tex.
No regular meeting date.

Hockley County

Z. O. Lincoln, 913 Houston, Levelland

H. T. Harrell, Chmn___Rt. 2, Levelland, Tex.
Aubrey Cook___________Rt. 5, Levelland, Tex.
W. H. Cunningham, Star Rt. 4, Levelland, Tex.
J. J. Hobgood_____________Rt. 2, Anton, Tex.
C. E. Padgett________Rt. 3, Levelland, Tex.
Committeemen meet first and third Fridays of each month at 1:30 p. m., 913 Houston, Levelland.

Lamb County

Mrs. Loretta Hucks, Chamber of Commerce Office, Littlefield

V. M. Peterman, Chmn__Rt. 1, Amherst, Tex.
Oscar Allison______Star Rt. 1, Earth, Tex.
L. Z. Anglin__________Box 86, Earth, Tex.
Eldon Franks Box 36, Olton, Tex.
Roy McQuatters________Rt. 1, Anton, Tex.
Committeemen meet second Wednesday of each month at 8 p. m. in the Littlefield Chamber of Commerce Office.

Lubbock County

Florence Jeu Devine, 1628-B 15th St., Lubbock
E. K. Hufstedler, Jr. Chmn.______2202 Ave. H
Lubbock, Texas

Leroy Johnson___________ Shallowater, Tex.
Henry Heck__________Box 106, Idalou, Tex.
Earl Reasoner________Box 335, Slaton, Tex.
Jackson West__________Rt. 3, Lubbock, Tex.
Committeemen meet first Monday of each month at 2 p. m. in the District Office at 1628-B Fifteenth Street, Lubbock.

Lynn County

Mrs. Joe Unfred, New Home
E. L. Blankenship, Chmn Rt. 2, Wilson, Tex.

A. E. Hagens_________Rt. 1, Wilson Tex.
D. W. Hancock________Rt. 4, Tahoka, Tex.
Wayman Smith________Rt. 1, Wilson, Tex.
J. D. Unfred__________Rt. 4, Tahoka, Tex.
Committeemen meet first Tuesday of each month at 8 p. m. at New Home Gin Company Office, and on the third Tuesday of each month at 8 p. m. at Wilson Co-op Gin Office.

Parmer County

Raymond Euler, Parmer County Farm Bureau Office, Friona

Raymond Euler, Chmn_____ Friona, Tex.
Bruce Parr __________Rt. 3, Friona, Tex.
D. B. Ivey __________Rt. 1, Friona, Tex.
Walter Kaltwasser___ Rt. 1, Farwell Tex.
C. V. Potts___________Rt. 2, Friona, Tex.
Committeemen meet first and third Thursday nights at 8 p m. at the Parmer County Farm Bureau Office, Friona.

Potter County

Eldon Plunk, Route 1, Amarillo

Eldon Plunk, Chmn. ___ Rt. 1, Amarillo, Tex.
T. G. Baldwin ______ Bushland, Tex.
Earl Barcley Bushland, Tex.
W. J. Hill, Sr. _____ Bushland Tex.
R. C. Sampson, Jr. Box 86, Bushland, Tex.
No regular meeting date.

Randall County

D. L. Allison, Happy, Texas

Marshall Rockwell, Jr., Chmn. Canyon, Tex.
D. L. Allison _ Happy, Tex.
Frank Begert _ Rt. 1, Canyon, Tex.
Neil Downing _ Rt. 4, Amarillo, Tex.
Donald Olson Rt. 4, Amarillo, Tex.
No regular meeting date.

TEST DRILLING

The Cross Section will present a series of six articles by G. W. "Doc" Willis, geologist for the Water District, pertaining to the installation of water wells. The articles cover test drilling, well construction, well development, and pumping tests. The following is the first of the series.

The drilling of a test hole is usually desirable before starting to drill a large capacity well. The purpose of test drilling is to explore the subsurface material to determine whether or not conditions are favorable for obtaining a satisfactory well, and in the event conditions are favorable, how the well should be constructed to give the most water with the least drawdown and the longest economic life.

One would not think of buying a farm without first determining how much of the land could be cultivated, whether or not the land is flat or rolling, what improvements there are, and whether or not the title is clear. Test drilling for water is just as sensible. Wouldn't it be more practical to have some idea of what you are spending your money for before you go to the expense of drilling and constructing a large capacity well? We think it would.

A test hole should be logged accurately to show the depth to each stratum and its thickness. A representative sample of each stratum should be collected in order to determine the nature and the size of the particles. The test hole should be drilled completely through all the strata to the underlying bedrock in order to determine the depth to which a well should be drilled. After the test hole has been drilled, the depth from the surface to the water table should be measured to determine the total thickness of the water-bearing strata. If the quality of the water is questionable, a sample of water for chemical analysis may be obtained from the test hole.

A careful study of the above information would enable one to make a reasonable estimate of the rate at which water may be pumped from the water-bearing strata and to design the well, pump and power unit to match the water-bearing characteristics of the formation.

So - - You're Going To Drill A Well

"I want to drill a well; what do I have to do?" are familiar words from new applicants around the offices where permits for water wells are issued.

In column one on page two of each issue of THE CROSS SECTION you will find the various counties in the District listed and the name and address of the person in charge of taking applications. Application for a water well permit should be made in the county in which the well is to be located. Permits must be obtained to drill, re-work, re- equip, re-drill or to replace an existing well.

The land owner must file the application or he may authorize someone else to act as his agent, for example, his tenant, but the name and address of the landowner must be given. To locate the well site, the section, block and survey; or labor and league or the abstract number must be quoted; and the measured yards from the property line or the quarter section line to the proposed well site. The Regulations state " . . . the well shall be drilled within ten yards of the location specified in the well permit as granted, and not elsewhere".

The application also requires that yardage be measured to the three closest wells (if within half a mile of the proposed well site) and the names and mailing addresses of owners of such wells be given.

To determine the spacing for your well, the size pump which you plan to install must be reported at the time of application.

Each county requires a deposit when the application is made against the return of the log and the registration forms (these are issued to you when the application is made). When these forms are completed and returned to the County Secretary, the well is then registered and your copies of the forms are issued together with the refund of your deposit.

Permits must be approved by three County Committeemen in the County where the well is to be drilled. The County Secretary will be glad to present your application for a well permit to the Committeemen at their next meeting.

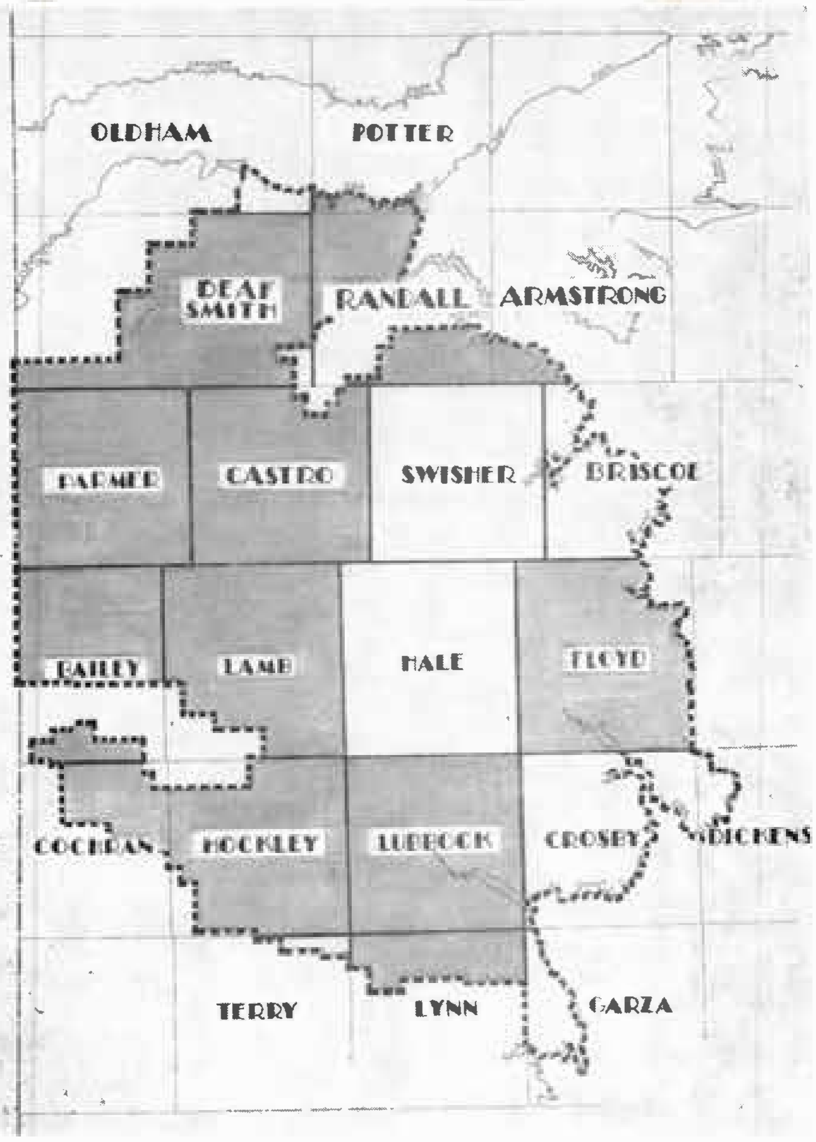
The application isn't complicated. If you come into the office equipped with the necessary information, just a few minutes time will be needed to complete the forms.

THE STATISTICS

During the month of May, 338 completed applications for the District were processed through the District Office. Distribution by County is as follows:

Armstrong	0	Hockley	28
Bailey	21	Lamb	46
Castro	47	Lubbock	38
Cochran	13	Lynn	18
Deaf Smith	64	Parmer	46
Floyd	10	Potter	0
		Randall	7

The High Plains Underground Water Conservation District No. 1 embraces 6,815,000 acres.



The above map shows the Delineation of the Underground Water Reservoir in the Ogallala Formation south of the Canadian River.

This is commonly known as the High Plains Underground Water Conservation District. No. 1 including all and parts of twenty-one High Plains Counties. At the time the District was created it was divided into five precincts for the purpose of electing Directors to represent the various parts of the District.

In the election for the conformation of the District, thirteen of the twenty-one counties voted in favor of becoming an active part of the Water Conservation District.

Since the last election, three of the remaining eight counties have petitioned the District to be included in the program of work being set up for the conservation of water and controlling of waste.

An election will be held sometime this fall to allow any of the remaining eight counties to become a part of the District.

To further prove the necessity of orderly development of the production of water in the High Plains, in 1934 there were approximately 300 wells in existence within the bounds of the District. Today, in 1954, there are 25,000 large capacity wells, some of which were drilled within a few yards of another well. The District noted that in the late winter and early spring months of 1953-54 as many as 30 wells per day were being completed within the thirteen counties participating in the well spacing program.

If the High Plains is to continue development and continue subdividing its farms into smaller blocks, each requiring an irrigation well, and keep up the high rate of production it has established, it will mean continued competition for the water stored beneath the land. An indication of competition for the water that collects in wet weather lakes has already been shown in areas where additional water is needed.

Who can tell what the next twenty years may bring for Texas and the High Plains in demands on the soil and water? It is not too early to be thinking about tomorrow for today was tomorrow only yesterday.

Possibility Of Water Depletion As Tax

pletion allowance now made in the case of oil and gas, minerals, and timber and would be similiar to the present allowance for depreciation on equipment used in a trade or business.

The High Plains Underground Water Conservation District, in carrying out another phase of its conservation program and in order to render additional service to the people within the District, has instructed Hearn and Lawrence, Certified Public Accountants, Lubbock, to make a study of the possibilities of securing the approval of the Internal Revenue Service for such an allowance and of the means by which such approval might be obtained.

It's Later Than You Think . . .

and recharging the underground water. Just what does that mean? Let's restate it in different words. The District, through its elected Board of Directors shall adopt rules that the people themselves think are best suited to provide for wise development and economic use of the underground water .The District requires that permits be obtained for the drilling, equipping, and completing of wells that produce more than 100,000 gallons of water a day (69.4 gallons a minute). The permits provide for the spacing of wells in order to reduce interference between wells while the pumps are in operation, and thereby eliminate unnecessary cost of pumping water. Since this procedure was started in February, 1953, more than 4,200 water well permits have been issued by the local committeemen in the 13 counties, and by and large applicants have complied with the provisions for the spacing of wells.

The District is authorized to formulate, promulgate, and enforce rules and regulations to prevent waste as defined by law. It is authorized not only to provide for the spacing of wells producing from the underground reservoir but also to regulate production therefrom so as to minimize as far as practicable the drawdown of the water table. The District is authorized to recharge the underground reservoir.

The Directors of the District and their co-workers, the 65 County Committeemen, are prominent, intelligent, trustworthy Plainsmen, who believe in the American way of life and who believe that the local citizens should take the initiative in practicing water conservation. They are devoting much of their time and efforts toward a sound program with the hope that through the knowledge of past experiences and other facts that the waste of underground water will be reduced or eliminated and that the supply will be developed and used wisely for the benefits of themselves and the future generations. They welcome both technical and non-technical advice that will prevent the promulgation of unsound rules and regulations which would not be in keeping with the fundamental rights and privileges of the individual American.

Again we repeat President Eisenhower's statement that conserving and improving our land and water resources is high priority business for all of us. Get in the middle of your soil and water conservation programs. Do your part and you will contribute to a higher standard of living and a better way of life.

*The President's message to the Congress on July 31, 1953 will appear in the next issue of The Cross Section.

Meeting Called

The High Plains Underground Water Conservation District has called a District meeting of the Board of Directors, County Committeemen and County Secretaries for June 16 at Littlefield.

The meeting will be held at the Community Center, 600 West Third Street at five p. m. Dinner will be served.

All of the Water District officials and employees are urged to attend the meeting

Legislative Briefs

The purpose of this column is to keep the people of the High Plains informed on what is happening in the Courts, the Legislature and organizations of the State pertaining to water, its use and conservation. From time to time we will encourage your opinion as to the disposition of certain actions mentioned in this column.

This column will be statements of fact and not opinions of the District.

The Texas Water Resources Committee has been very busy with its investigation of the water resources of the State and should be in a position before long to start some definite action.

The HPUWCD has asked its attorneys to file a brief in each of two cases recently appearing before the Courts. In the first case the District brief was filed with the Supreme Court. The case was that of the City of Corpus Christi vs. the City of Pleasanton, et al. In this case the City of Corpus Christi has been pumping water from an underground water field in Atascosa County by running it down dry stream beds for a distance of some 118 miles to Calallen, at which point it is treated and pumped into the city system. Since it has been shown that almost 80% of the water is lost by seepage and evaporation between the water field and the pumping station, this suit was brought about to control that terrific loss.

It is the feeling of the HPUWCD that: the right of ownership of fround water does not include the right to waste the water.

We have been informed that this is the first case to ever reach the Supreme Court of Texas on the waste of underground water.

In the second case the HPUWCD brief was filed in the Court of Civil Appeals in El Paso in the case, Pecos County Water Control and Improvement District No. 1, et al vs. Clayton W. Williams, et al. In this case the contention of the plaintiff district is that the owner of a spring also owns its underground source of supply, wherever it may be. The plaintiff district seeks to prevent

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Mr. Z. O. Lincoln
913 Houston
Levelland, Texas

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McFarland Seeks

years.

Section 175 of HR 8300, known as the Internal Revenue Code, allows for the deduction of several types of construction on farmland for the purpose of soil and water conservation and the prevention of erosion. However, it did not include the deduction for concrete underground pipe, which, according to sound engineering information, is one of the greatest water conservation measures that could be used in the High Plains.

It has been shown through studies of the open ditch method of distribution, which is very common to this area, that as much as 35% or more of the water is lost through evaporation and seepage.

Many farmers who recognize the conservation and economic value of these installations have been unable to provide them in their farming operations because of the large initial expenditure. It is the opinion of the District that many more miles of underground pipeline would be laid annually if the farmer could deduct the cost of the installation within the year that the line is completed.

In his presentation before the Committee, McFarland pointed out that the inclusion of this deduction would have a four-fold effect upon the agricultural economy of the nation. First, a greater economic return to the farmer through increased production would be shown; second, correspondingly greater tax return to the Government through increased income taxes; third, long-range benefits to the Nation as a whole through conservation of water and soil as our most essential natural resources; and fourth, an economically feasible means by which the individual farmer may contribute to the conservation of our most natural resource.

In concluding his statement Mr. McFarland stated, "I feel certain the encouragement of such conservation measures as the construction of underground pipelines, ditch-lining practices and structures for gully and soil control, by their inclusion in this Bill will not only be a wise investment taxwise but also will be a wise investment in the future agricultural economy of our Nation. I respectfully request the Committee to more thoroughly explore the details of these measures with the Department of Agriculture and the Secretary of the Treasury. It is my sincere feeling that the Committee, in its wisdom, will see the importance of including these very important practices in Section 175 of this Bill."

Value Of Plains Water Resources

Reprinted From The State Line Tribune, 5-20-1954

Evidence is all too plentiful to support the claim that irrigation farmers in this part of the High Plains, blessed with a tremendous amount of readily available underground water supplies, have as yet very little conception of the value of this God-given commodity.

A typical story that appears in the current issue of Acco Press, a magazine devoted to the cotton industry, tells of an irrigated cotton farm in deep Southern California, where some of the earliest and best cotton in the country is produced.

Farmers out there, just as we have done, started out with shallow irrigation wells. But heavy pumping from year to year constantly lowered the water table, and wells have gone deeper and deeper.

Now the typical well is drilled 1000 to 1500 feet, and usually costs from $30,000 to $35,000. That may be just a preview of what is in store for the Plains, except that we undoubtedly would be out of water before we ever got that deep anyway (and probably out of money, too).

The point to make is that farmers there are highly aware of the value of the water they have left, since it has been proved to be an exhaustible commodity. They have undertaken elaborate means of conserving water, regarded today on the Plains as unnecessary or even undesirable.

One of the most common instances of wasting water by farmers of this area is letting water get away that has run through fields and off the end into bar ditches. This is called "tail water", and admittedly it is exceedingly difficult to prevent this waste completely.

The California situation has gotten so critical, however, that this problem has been overcome. It is now a regular practice to construct a tail-water basin at the end of the rows.

Water which runs into this basin is pumped back up-field to again be channelled into the cropland. No water is wasted, period.

Farmers mindful of what may eventually be in store for them in this part of the country should take a lesson from the experiences of some of the older areas using underground water for irrigation. We must postpone as long as possible the depletion of our water because without it our economy will collapse.

A FOLLY OF THE PLAINS

In the years of drought, when the land is parched and cracked, crops are dying and communities are praying for rain, when people are living on faith and their credit at the bank, it is not an uncommon sight to see fields planted and cultivated in such a manner as to permit drainage into a nearby lake, such as we see in the picture above.

What a sad state of affairs when the people do not realize that the cheapest water they can use in the production of crops is that which God gives them in their annual rainfall. Several million acre-feet of water fall on the Plains each year, ony to be funnelled into the wet weather lakes instead of being held on the land through contour farming, bench levelling or any of several methods that could be used to hold the water where it falls and let it penetrate the thirsty soil.

One of the first principlese of sound water conservation is to make a better use of the water that is given to us by the Creator of the Master Plan.

LEGISLATIVE BRIEFS . . . .

land owners in the vicinity of Commanche Springs from pumping underground water that would affect the flow of the spring.

The District has shown through its brief that it favors the present Statutes, which declare that the owner of the soil owns the water therein, and he may make reasonable, non-wasteful use thereof, subject to valid statutes and rules for its conservation. The District also feels the law of ownership of ground water should be uniform throughout the State. Sound hydrologic and geologic data show that interference between wells does not necessarily indicate the presence of an underground stream.

A Little Life Is Worth More Than A Little Time . . . . Close That Abandoned Well

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Volume I — No. 2 | There Is No Substitute For Water | July, 1954

1628 B Fifteenth Street, Lubbock is the District Office of the HPUWCD. Equipment, files and personnel were moved last October from the downtown location to facilitate a greater parking area for clients and to provide larger office space at less expense to the District.

At this location the District Manager, Chief Hydrologist, Geologist and bookkeeper have their offices. Copies of files for each County within the District are here and all well registrations are made and recorded. The Cross Section is published in the District Office.

You Never Miss The Water-Until The Well Goes Dry

One of the objectives of the HPUWCD is to continuously call to the attention of the people of this area the fact that the water in the High Plains is a depletable resource. Water has, on occasion, been referred to as a mineral, and like any other mineral, if it is continuously mined, can be exhausted.

The annual reports of the State Board of Water Engineers and the U. S. Geological Survey show that in the Southern High Plains we have been taking out water at an unusually high rate in the past few years. We are going to present this factual information as it becomes available to impress upon the minds of the agricultural industrial and municipal water users the necessity of conservative, wise use of water before the well goes completely dry.

Since the principal economy of the Southern High Plains is agricultural, we have coined a new phrase that should become foremost on the tongue of every farmer, banker, pump dealer and well driller in the High Plains—"Conservation Irrigation".

Conservation Irrigation to us means the use of our irrigation water as an insurance, not as a means of getting rich quickly at the expense of our water and our posterity.

Conservation Irrigation should mean the prolongment of our present economy as long as possible, eliminating to a bare minimum the mining of our valuable resource for the benefit of the few of us who are using it today.

Certainly water in storage is like fruit in a jar. It is no good unless put to beneficial use. But few people have ever consumed a jar of fruit at one sitting, for in so doing, they not only suffer the physical consequences, but tomorrow they have no fruit for their next meal. We cannot say that harvesting the fruits of a bountiful harvest produced by indescriminate pumping would hurt us, but what of the harvest of tomorrow? As Benjamin Franklin so ably stated, "You never miss the water until the well goes dry".

Problems Face Ground Water Management

This is the first of a series of articles relating to Water District Management which will be featured in The Cross Section for the next few issues. We believe our readers will find them of high interest and importance, and certainly of timely attention.

Like any business there are certain essential facts that must first be known before adequate management can become effective. Usually a businessman starts out with a complete inventory of stock or the amount on hand the first day he opens his doors for business.

That is the first intangible that confronted the HPUWCD and one that must rapidly be overcome. That big problem is the inadequacy of factual hydrologic data on which to base our inventory, and our doors have already been flung wide for business. To enable the District to make effective recommendations to our people, we must know as quickly and accurately as possible the answer to three major questions:

1. How much water do we have in storage?
2. What is the average rate of recharge in years of average rainfall?
3. What is our annual average discharge?

The answer to these three questions plus a fairly accurate knowledge of the rate of movement of water through the reservoir would be great factors in the beginning of the adaptation of rules by the people of the High Plains for a longer and better use of our resource. Like all other inventories this will be a long, costly and tedious job.

People who have wells drilled in the next few years can contribute greatly to the speed and effectiveness of such a project by drilling their wells completely to the red beds, making good, accurate logs as they go and submitting them to the District for plotting. By so doing, we can soon begin to establish the average thickness of the water-bearing formation through the entire Southern High Plains. We are told that most sands will yield approximately 15% of their volume in water; therefore through calculation, a fairly accurate figure can be arrived at as to what we have on our shelves today to be used by the people.

The rate of average recharge or the replenishment of our stock is another momentous hydrologic task that must be undertaken in the very near future. It is a task that will entail many detailed studies and coordinated analyses of infiltration records, soil moisture storage, discharge and stream seepage, ground water storage in high recharge areas, discharge and stream seepage in the High Plains areas plus the rate of movement. Each is a problem within itself.

The annual average discharge is the only one of the three major problems of this particular phase on which any appreciable amount of information has been gathered, and certainly it is an alarming picture. Instead of knowing what is being pumped out each year, the only records that are available are the effects that such huge withdrawals are having on the reservoir. This, in effect, is like gasoline in an overhead tank. It runs fine until the tank goes dry, which in turn, brings us back to our original question, "Where is the bottom of the tank, and how much is our inventory?"

It certainly behooves all people of the High Plains to interest themselves in such problems—for, "You never miss the water until the well goes dry".

Significant News

The economic importance of irrigation in the High Plains, especially during the past four year drought, has been recognized by farmers and businessmen alike.

According to a report issued last month by the Board of Water Engineers and U. S. Geological Survey, the following information shows the rapid increase in irrigation development.

	Number of Wells	Acres Irrigated	Acre-feet Pumped	Decline of Water Table
1952	17,700	2,250,000	3,750,000	3.9 feet
1953	23,700	3,000,000	4,800,000	4.9 feet

A tabulation of data published in their ten progress reports, issued from 1938 to 1954, shows that a total of about 18,800,000 acre-feet of water has been pumped and that about 100,000,000 acre-feet of material has been unwatered. (An acre-foot of water will cover one acre to a depth of one foot).

(Continued on page two)

THE Cross SECTION

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

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Application for entry as second-class matter is pending.

F. B. Jeu Devine
Editor

COUNTY COMMITTEEMEN

Armstrong County

E. T. Duke, Route 1, Happy

H. T. Duke, Chmn.____Route1, Happy, Tex.
Bill Heisler________________Wayside, Tex.
Melton McGehee_____________Wayside, Tex.
John Patterson________________Happy, Tex.
Floyd B. Adams______________Wayside, Tex.

No regular meeting date.

Bailey County

Mrs. Doris Traweek, Bailey County Farm Bureau Office, Muleshoe

Troy Actkinson, Chmn.________Muleshoe, Tex.
Robert F. Byrd______Route 2, Muleshoe, Tex.
W. R. Carter_________________Muleshoe, Tex.
W. T. Millen________Route 1, Muleshoe, Tex.
D. V. Terrell__________Route 1, Morton, Tex.

Committeemen meet first Saturday of each month at 1:30 to 3 p. m., Farm Bureau Office.

Castro County

Eugene Ivey, Dimmitt

Posie Cunningham, Chmn.____Dimmitt, Tex.
H. F. Benson____Star Route 1, Hereford, Tex.
Steve Brockman______________Nazareth, Tex.
T. R. Davis_____________________Hart, Tex.
Eugene Ivey________Box 157, Dimmitt, Tex.

No regular meeting date.

Cochran County

Glenn Thompson, Morton, Texas

Glenn Thompson, Chmn.________Morton, Tex.
Max Bowers_____________________Morton, Tex.
Syl Greener_____________________Morton, Tex.
W. R. Key______________________Morton, Tex.
B. R. Stovall______Star Route 2, Morton, Tex.

Committeemen meet first Tuesday night of each month, Cochran County Farm Bureau Office, Basement of Court House, Morton

Deaf Smith County

Miss Nadean Hulse, Deaf Smith County Farm Bureau Office, Hereford

Frank J. Bezner, Chmn. Box 14, Hereford, Tex.
Pete Carmichael____Route 1, Hereford, Tex.
Paul Corbett________Route 5, Hereford, Tex.
J. N. Fish___________________Hereford, Tex.
Floyd Walton________Route 5, Hereford, Tex.

No regular meeting date.

Floyd County

Mrs. Ida Puckett, 319 South Main Street, Floydada

W. Grady Walker, Chmn.______Floydada, Tex.
R. C. Mitchell_______________Lockney, Tex.
Robert L. Smith______________Lockney, Tex.
Sid Thomas_________________Lockney, Tex.
Lee Trice _________ Rt. 1, Floydada, Tex.

No regular meeting date.

Hockley County

Z. O. Lincoln, 913 Houston, Levelland

H. T. Harrell, Chmn.__Rt. 2, Levelland, Tex.
Aubrey Cook___________Rt. 5, Levelland, Tex.
W. H. Cunningham, Star Rt. 4, Levelland, Tex.
J. J. Hobgood ___________Rt. 2, Anton, Tex.
C. E. Padgett________Rt. 3, Levelland, Tex.

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

Lamb County

Mrs. Loretta Hucks, Chamber of Commerce Office, Littlefield

V. M. Peterman, Chmn.__Rt. 1, Amherst, Tex.
Oscar Allison______Star Rt. 1, Earth, Tex.
L. Z. Anglin__________Box 86, Earth, Tex.
Eldon Franks________Box 36, Olton, Tex.
Roy McQuatters________Rt. 1, Anton, Tex.

Committeemen meet second Wednesday of each month at 8 p. m. in the Littlefield Chamber of Commerce Office.

Lubbock County

Florence Jeu Devine, 1628-B 15th St., Lubbock

E. K. Hufstedler, Jr., Chmn.____2202 Ave. H Lubbock, Texas
Leroy Johnson _________ Shallowater, Tex.
Henry Heck__________Box 106, Idalou, Tex.
Earl Reasoner________Box 335, Slaton, Tex.
Jackson West__________Rt. 3, Lubbock, Tex.

Committeemen meet first Monday of each month at 2 p. m. in the District Office at 1628-B Fifteenth Street, Lubbock.

Lynn County

Mrs. Joe Unfred, New Home

E. L. Blankenship, Chmn.__Rt. 2, Wilson, Tex.
A. E. Hagens__________Rt. 1, Wilson Tex.
D. W. Hancock________Rt. 4, Tahoka, Tex.
Wayman Smith_________Rt. 1, Wilson, Tex.
J. D. Unfred Rt. 4, Tahoka, Tex.

Committeemen meet first Tuesday of each month at 8 p. m. at New Home Gin Company Office, and on the third Tuesday of each month at 8 p. m. at Wilson Co-op Gin Office.

Parmer County

Raymond Euler, Parmer County Farm Bureau Office, Friona

Raymond Euler, Chmn.__________Friona, Tex.
Bruce Parr ________Rt. 3, Friona, Tex.
D. B. Ivy_______________Rt. 1, Friona, Tex.
Walter Kaltwasser___ Rt. 1, Farwell, Tex.
C. V. Potts ___ _ Rt. 2, Friona, Tex.

Committeemen meet first and third Thursday nights at 8 p m. at the Parmer County Farm Bureau Office, Friona.

Potter County

Eldon Plunk, Route 1, Amarillo

Eldon Plunk, Chmn.____Rt. 1, Amarillo, Tex.
T. G. Baldwin __ ___ Bushland, Tex.
Earl Barcley Bushland, Tex.
W. J. Hill, Sr. ________ Bushland, Tex.
R. C. Sampson, Jr.____Box 86, Bushland, Tex.

No regular meeting date.

Randall County

Mrs. Don Olson, Route 4, Box 388, Amarillo, Texas

Marshall Rockwell, Jr., Chmn. Canyon, Tex.
D. L. Allison Happy, Tex.
Frank Begert Rt. 1, Canyon, Tex.
Neil Downing Rt. 4, Amarillo, Tex.
Donald Olson _ Rt. 4 Amarillo, Tex.

Committeemen meet first Monday night each month, 8 p. m., County Agent's Office, Canyon, Texas.

A Silent Menace ......

Have you ever thought of the terror that would grip the heart of a little child who is trapped at the bottom of an old well? Have you ever thought how small a spot of daylight would be if you were looking up one hundred feet through sixteen-inch casing? How small the possibilities of recovery?

We are finding many holes with as much as forty inches of open space at the top.

We have been told many times ....."Yes, I closed my old well. I have two 1x4's over it with a brick laid on top"; or this is a common excuse, "Aw! No one will ever fall into THAT well, they all know it is there".

The little child who lost her life a few years ago in California did not know an old well was hidden in the weeds and grass where she was playing. As surely as day follows night, that will be the price that someday will have to be paid here in the High Plains of Texas before the average citizen will take the time to fill an old well. Maybe that life will be your child or someone in your community who is dear to you. What a terrible price to pay to press the necessity of doing a job that common decency has made us all feel should have been done long ago—the job of filling an old well.

It is the opinion of this District that every man who is responsible for an open well should be fined the maximum amount of the law which is $500.00 and be made to fill that old well before the day ends.

For we believe that:

A LITTLE LIFE IS WORTH MORE THAN A LITTLE TIME!

Water Board To Clamp Down On Riparians

The following article is reprinted from the June 17, 1954 issue of the Texas Water Report, a weekly news-letter devoted entirely to Texas water and soil-conservation problems.

Mr. Joe D. Carter, the Board of Water Engineers' legal examiner, recently addressed the water law conference at the University of Texas. In his talk he stated the Board plans to clamp down on riparians and in explaining the Board's rules which became effective last fall, he concluded his talk as follows:

"The Board will recommend to the Legislature that riparians taking water in this State for purposes other than domestic and livestock shall file a record of their activities with the Board and make annual reports on their use of water. Doing so will be a definite aid for inventorying the water resources and extent of water consumption. We feel established uses, whether they be riparian or appropriative, should be protected. We feel that future expansions of water use by anyone should be carefully controlled so that those with established rights will not be adversely affected.

"The maxim that 'no nation can exist half slave and half free' is equally applicable to a proper administration of the State's water resources. Administrative chaos will result and has already resulted where you have one set of water users, the statutory appropriators, subject to State control, and another group, the riparians, charged with the duty of policing themselves. With no complete and orderly system of administrative regulation the water user down the stream is at the mercy of all above him, and priority of right gives way to advantage or position.

"A Statewide water policy for Texas is being urged by every speaker who can find an ear that will listen. Such a needed program can never be evolved so long as there exists this basic conflict between appropriators and riparians. Texas stands at the crossroads—with one path leading to continued chaos and the other to orderly development. For a really successful water program, the choice should suggest itself."

Significant Neews

(Continued from page one)

A review of these records show that about 45% of all pumping was done during the last two years and 25% during 1953.

The report says: "As the water levels decline it becomes of increased importance to regard the declines in terms of the thickness of the remaining saturated sands. Areas where the Ogallala formation is relatively thin can be expected to experience diminishing yields sooner than areas where the sands are thicker".

Well Construction

Gordon W. Willis

The following is the second of a series of six articles pertaining to the drilling and developing of large capacity water wells. The first article entitled "Test Drilling" appeared in the June, 1954 issue of The Cross Section.

Several methods of well construction have been used in the Southern High Plains. Probably the method most frequently used is to drill a hole to a depth that is considered sufficient to obtain the yield of water that is desired (generally the full thickness of the water-bearing strata is not penetrated), case the hole with steel casing that is about two inches smaller in diameter than the wall of the drilled hole, and perforate the casing from the water table to the bottom of the hole with torch-cut slots ranging from about one-fourth inch to one inch in width and from about eight inches to twelve inches in length. It is a common belief that it is necessary to have such large openings in the casing in order to allow water to enter, but they also allow large amounts of the unconsolidated material from the formation to enter along with the water.

When the well is developed, an attempt is made to remove a large quantity of sand in order to form a cavity or cavities in the strata adjacent to the well. These cavities may form and remain open for several years; however, in many places the strata overlying these cavities collapse. When this happens the perforations may be clogged, the casing may be crushed, the pump bowls may be covered with sand, or the entire well may be a total loss.

This method of construction is the least expensive in initial cost, and in many instances it has been a satisfactory method in the High Plains. (It has served its purpose in the development of irrigation.) Although there is a large amount of risk involved, and the average useful life of wells constructed in this manner may be less than 10 years. One should not be unduly criticized for perhaps there is sufficient justification for using this method of construction in the development of an irrigated area.

Irrigation has now become extensive over a large part of the High Plains. More than 25,000 irrigation, industrial, and municipal wells have been drilled in the High Plains in Texas south of the Canadian River. Records of the U. S. Geological Survey and the Texas Board of Water Engineers show that static water levels in observation wells declined appreciably during the past several years of drought and heavy withdrawals of water. According to their computations about 75,000,000 acre-feet of water-bearing material was unwatered during the 15-year period 1938 - 1952. These figures are not intended to frighten anyone, but they are intended to impress upon everyone the importance of the way in which we utilize the natural resource that has been responsible for the development of the economy that we now have in the High Plains.

The rate at which a well may be pumped efficiently will decrease when an appreciable percentage of the strata that contributes to the well is unwatered. The usual method of well construction, while it may have been satisfactory in the past, may not be entirely satisfactory now that our underground reservoir has become extensively developed. Many wells that would yield a full pipe of water when they were first completed have declined appreciably in yield. Some wells that formerly yielded relatively sand-free water have started pumping sand and have even become failures because of caving. Why have these things happened?

When large capacity wells were first constructed in the High Plains, the underground reservoir was more or less in balance. The natural recharge to the reservoir was about equal to the natural discharge. Relatively shallow wells, many of them less than 100 feet in depth, would yield a full pipe of water. Water levels declined, however, and now the thickness of the water-bearing strata that contributes to these wells is considerably less. If the pumps are lowered and more bowls are added to compensate for lower pumping levels, water is withdrawn from the remaining saturated strata at a faster rate. The increase in the velocity of the water as it is withdrawn from the strata causes the loosening of sand and weakens the walls of the cavities until they collapse. Sometimes these wells may be redeveloped, and their usefulness extended for a time. Quite often, however, the well becomes a failure.

Many individuals who have made studies of the economy of the High Plains and the development of the underground reservoir feel that it is time to give more consideration to EFFICIENCY in the construction and the operation of our water wells. If a well is constructed and developed properly and equipped with the proper pump, it should have a useful life of about 25 or 30 years.

The method of constructing any large capacity water well should be determined after a careful analysis of the data obtained from TEST DRILLING. Test holes may be either large or small in diameter. It is important to obtain accurate logs of the holes and representative samples of the different water-bearing strata. These will indicate the best site for the location of a well with reference to the best water-bearing strata.

If the water-bearing strata are consolidated, rocks such as limestone, sandstone, or conglomerate, and the water in these strata is in crevices or solution cavities, it may not be necessary to case a well below the top of such strata. If these strata are interbedded with unconsolidated sand and gravel or clay, it is desirable to extend the casing to the bottom of the well. The perforations in the casing may be torch-cut slots opposite the good water-bearing strata. The casing should, however, be left blank opposite beds of clay and sandy clay.

If the good water-bearing strata are unconsolidated sand and gravel, the samples of these strata should be studied to determine what size perforations should be made in the casing. A bed of sand and gravel may contain enough coarse-grained material to form a natural gravel pack around the casing if the perforations are small enough to prevent the gravel particles from entering the well. A bed of unconsolidated fine-grained sand may not contain enough coarse-grained material to enable one to use casing with torch-cut slots. It is possible to use special screens in fine-grained sand.

These screens range in price from about $20 to $50 a foot, and it is necessary to obtain a truly representative sample of the sand in order to determine the proper size of screen opening to use. A gravel pack may be used to prevent the pumping of sand instead of using well screen. This method of construction has been carefully worked out over a period of many years. It is an effective method of preventing sand from entering a well if it is done properly.

The next article of this series will pertain to the construction of gravel packed wells.

The Statistics

During the month of June, 194 completed wells were registered with the District Office. Distribution by County is as follows:

Armstrong	2	Hockley	11
Bailey	11	Lamb	32
Castro	6	Lubbock	20
Cochran	3	Lynn	11
Deaf Smith	.24	Parmer	39
Floyd	28	Potter	0
		Randall	7

66 new applications were taken throughout the District during the month of June.

One acre foot of water is 325,829 gallons of water or enough water to cover an acre of ground to the depth of one foot.

Conservation Of Our Natural Resources

President Gives High Priority To Land And Water Conservation Measures

From Congressional Record, July 31, 1953 (H. Doc. No. 221)

In a special message to the Congress on July 31, 1953, President Eisenhower said:

"Conserving and improving our land and water resources is high priority business for all of us. It is the purpose of this administration to present to the next session of the Congress suitable recommendations for achieving the objectives set forth in this message." Following is the President's message:

"To the Congress of the United States:

"In the stress of dealing with urgent problems of peace and security and budget appropriations and tax revenues, we sometimes overlook the fundamental importance of our national well-being of constructive, forward-looking policies designed to conserve and improve the Nation's natural renewable resources.

"Before the Congress adjourns, therefore, I believe it will be useful to focus attention on some of our basic land and water resource problems and to point the way for constructive efforts to improve the management and use of these resources.

"In my state of the Union message, I called attention to the vast importance to this Nation now and in the future of our soil and water,

(Continued on page four)

Legislative Briefs

From all appearances water conservation is the main issue of all politicians this summer. There could not be a more timely subject, but certainly there is a wide range of opinion on how water conservation programs should be put into action. It is disturbing to see how little some people who are using the words "water conservation" have studied their lesson. Everyone in Texas is interested in the conservation of such a precious resource but they should also be cautious of the program and the way it is administered.

We understand President Eisenhower has recently appointed a water committee to make recommendations on a national water policy. This committee and its actions will certainly bear watching as the report of the Truman Committee was not too friendly to States and Local Rights of ground water development. A lot of that same information will probably be used by the new committee.

President Gives Priority

(Continued from page three)

our forests and minerals, and our wildlife resources. I indicated the need for a strong Federal program in the field of resource development. At the same time, I pointed to the necessity for a co-operative partnership of the States and local communities, private citizens, and the Federal Government in carrying out a sound natural resources program.

"In addition to the immediate danger of waste resulting from inadequate conservation measures, we must bear in mind the needs of a growing population and an expanding economy. At present we are faced with excess reserves of some agricultural commodities and the need for production adjustments to gear our agricultural economy to current demands. But in the long run, we shall need to give increased attention to the improvement and reclamation of land in its broadest aspects, including soil productivity, irrigation, drainage, and the replenishing of ground water reserves, if we are adequately to feed and clothe our people, to provide gainful employment, and to continue to improve our standard of living.

"Our basic problem is to carry forward the tradition of conservation, improvement, and wise use and development of our land and water resources—a policy initiated 50 years ago under the leadership of President Theodore Roosevelt. To do this within the framework of a sound fiscal policy and in the light of defense needs will require the maximum cooperation among the States and local communities, farmers, businessmen, and other private citizens, and the Federal Government. It will require the development of clear guidelines to be established by the Congress as to the proper functions of the Federal Government. It will require the revitalization of renewable resources by users who should be entitled to reasonable assurances in connection with authorized uses. It will require adherence to sound principles for financing and sharing of the cost of multiple-purpose land and water resource development. It will require improved Federal organization to accomplish a more logical division of responsibilities among the various Federal agencies in order that resource development programs may be carried on with the greatest efficiency and the least duplication. And it will require comprehensive river basin planning with the cooperation of State and local interests.

"This administration is moving ahead in the formulation of sound organization and improved policies for the use of our soil, our public lands, and our water resources. I have requested, and the Congress has granted through Reorganization Plan No. 2, increased authority for the Secretary of Agriculture to improve the organization of the Department of Agriculture. I have recently established by Executive order a National Agricultural Advisory Commission. A review is being made of the basic power policies of the Federal Government in connection with multiple-purpose river basin development as it relates to private economic development. The Corps of Engineers is making a study of the basis for State and local financial participation in local flood protection works. There are under detailed study various proposals for dealing with the complicated problems of overlapping and duplicative authority among the several resource development agencies. And the Bureau of the Budget and the resource agencies are reviewing the present standards and procedures for evaluation and cost allocation of water resource development projects.

"It is fortunate that today there is a growing recognition on the part of land users and the public generally of the need to strengthen conservation in our upstream watersheds and to minimize flood damage. Inadequate conservation measures and unsound land use patterns vastly increase the danger of loss of valuable topsoil from wind erosion in time of subnormal rainfall and from water erosion in time of floods.

"This should be done as an integral part of our total flood control and water use program. In our past efforts to better utilize our water resources, to control floods and to prevent loss of life and property, we have made large investments on the major waterways of the Nation. Yet we have tended to neglect the serious waste involved in the loss of topsoil from the nation's farms and the clogging of our streams and channels which results from erosion on the upper reaches of the small streams and tributaries of the Nation's rivers.

"It is important, too, for groups of farmers banded together in local organizations, such as soil conservation districts and watershed associations, to take the initiative, with the technical advice and guidance of the appropriate Federal and State agencies in developing adequate plans for proper land use and resource improvement in water sheds throughout the Nation. As these plans are prepared and local agreement and cooperation are assured, I believe that we should move ahead in the construction of works of improvement and the installation of land treatment measures as rapidly as possible consistent with a sound overall fiscal program.

"As we move forward in a cooperative and coordinated soil and water conservation program we must not overlook the essential role played by the Federal Government in the management of public lands. Approximately 50 percent of the land area of the Western States is owned and managed by a number of Federal Agencies. The National Park Service administers parks and monuments having national significance. The Forest Service administers the national forests, with their valuable timberlands and grazing resources, and in cooperation with State and local interests protects critical watersheds. The Bureau of Reclamation and the Corps of Engineers manage lands in connection with water resource projects built by these agencies. Fish and wildlife are protected by the Fish and Wildlife Service. The Bureau of Indian Affairs administers Indian lands, and the great public domain remaining is administered by the Bureau of Land Management.

"The Federal Government has a responsibility to manage wisely those public lands and forests under its jurisdiction necessary in the interest of the public as a whole. Important values exist in these lands for forest and mineral products, grazing, fish and wildlife, and for recreation. Moreover, it is imperative to the welfare of thousands of communities and millions of acres of irrigated land that such lands be managed to protect the water supply and water quality which come from them. In the utilization of these lands, the people are entitled to expect that their timber, minerals, streams and water supply, wildlife and recreational values should be safeguarded, improved, and made available not only for this but for future generations. At the same time, public lands should be made available for their best use under conditions that promote stability for communities and individuals and encourage full development of the resources involved.

"While, as I have indicated, our major problem is to carry forward a tradition of improvement and conservation of our natural resources, the best means of achieving this objective depends on keeping up with changing conditions. For example, the problems of water resource development in the West are undergoing considerable change. The pattern of western growth has broadened substantially in recent years. Industrial expansion has been extensive and varied. Increased activities in mineral and fuel processing have occured. Urban expansion has been well above the national average in many communities. These developments have brought about strong competition for existing water supplies and have stimulated the need for a broader approach in planning new water-resource developments. As a consequence, the Federal role in the cooperative development of these resources should now be re-examined in the interest of achieving a better balanced program for western growth.

"Conserving and improving our land and water resources is high priority business for all of us. It is the purpose of this administration to present to the next session of the Congress suitable recommendations for achieving the objectives set forth in this message. I am confident that the studies of governmental organization and functions authorized by this Congress can also make an important contribution to the solution of these problems. As the Congress moves ahead on a constructive legislative program in the resource field, it will have my full support and cooperation. We must build a balanced program for the use and development of all our natural resources. Such a program is indispensable to maintaining and improving our standard of living as we make the future secure for a growing America.

"Dwight D. Eisenhower

"The White House,
"July 31, 1953."

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

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913 Houston
Levelland, Texas

THE Cross SECTION

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

Volume 1 — No. 3 | There Is No Substitute For Water | August, 1954

District Checking On Well Locations

In accordance with the program that was started during the summer of 1953, progress is being made again this summer in checking the actual locations of wells that have been drilled within the District.

Mr. Raymond Harrell and Mr. Allen Owen have been working throughout a large part of the District for about six weeks. The results of their work are reviewed in the District Office each Monday morning. Although a few apparent violations have been found, it is indeed gratifying to know that nearly all persons who have obtained permits and have drilled wells have complied with the spacing regulations.

Again we urge every person who wants a well to select the well site, to measure the distances from his two nearest property lines or quarter section lines, and the distances from the three (3) nearest wells within half a mile of the well site, and then to furnish the measurements to his County Committee at the time of making application for a permit. If the distances meet the requirements of the published rules of the District, he should have no difficulty in obtaining the necessary permit to drill. The rules specify that the minimum distance for a 4-inch well is 200 yards; a 5-inch well is 250 yards; a 6-inch well is 300 yards; and an 8-inch well is 400 yards. A special permit is required for larger than an 8-inch well.

What Does It Cost You To Run Water In An Open Ditch?

W. L. Broadhurst

On July 8 and 9, 1954, a test was made on the Joe D. Unfred farm near New Home in northwestern Lynn County to determine the loss resulting from running water in an open ditch from his irrigation wells to his field. Two wells were used in the study: well No. 1 is in the southwest corner of the quarter section and well No. 2 is 1,250 feet east of well No. 1. Water from the two wells was discharged into the ditch connecting the wells and was diverted from the ditch to a field at a point approximately midway between the wells. Sparling flow meters were used to measure the discharge from the wells. A Parshall flume, which was furnished by the Soil Conservation Service, and a two-foot rectangular Weir were used to measure the discharge from the ditch to the field. The wells had been pumped 7 days and nights continuously into this same ditch before the test was started.

Well No. 1 is equipped with a 6-inch deep-well turbine pump and well No. 2 is equipped with a 4-inch deep-well turbine pump. The pumps are driven by small Allis Chalmers engines using butane for fuel.

Well No. 1 produced 250 gallons a minute. The motor used 2.5 gallons of butane per hour. At 8 cents a gallon, cost for butane was 20 cents per hour or $4.80 for 24 hours. This unit used 1 quart of motor oil at 35 cents per quart and one pint of drip oil at 5 cents per pint. Total cost for butane and oil was $5.20 per day. 250 gallons a minute for 1,440 minutes in a day is 360,000 gallons a day at a cost of $5.20 equals 1 44/100 cents per thousand gallons.

Well No. 2 produced 185 gallons a minute. The motor used 2.18 gallons of butane per hour. At 8 cents a gallon, cost for butane was 17½ cents per hour or $4.20 per day. This unit also used one quart of motor oil at 35 cents per quart and one pint of drip oil at 5 cents per pint. Total cost for butane and oil was $4.60 per day. 185 gallons a minute for 1,440 minutes in a day is 266,400 gallons a day at a cost of $4.60 equals 1 72/100 cents per thousand gallons.

The combined discharge of the two wells (250 and 185) was 435 gallons a minute. 435 gallons a minute times 1,440 minutes in a day is 626,400 gallons a day divided by 326,829 gallons in an acre-foot equals 1.92 acre-feet per day pumped. In other words, the pumpage from the two wells was sufficient to cover 1.92 acres to a depth of one foot.

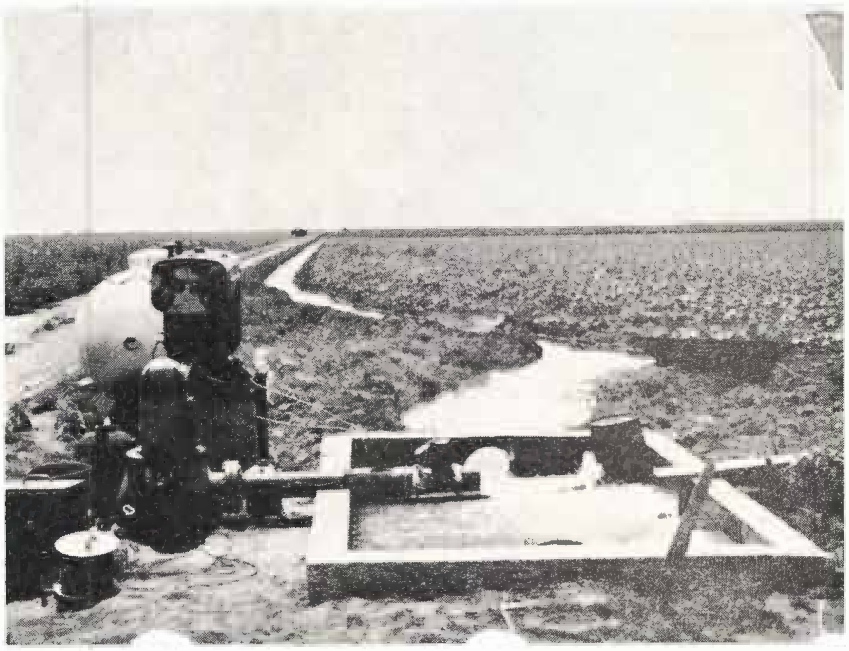
The total flow from the 1,250 foot ditch at a point about midway between the wells was 366 gallons a minute. This indicated that evaporation and seepage loss from the ditch was 69 gallons a minute (5½ gallons a minute for each 100 feet of ditch). 366 gallons a minute times 1,440 minutes in a day is 526,040 gallons a day divided by 326,829 gallons in an acre-foot equals 1.61 acre-feet per day delivered to the field. The difference between the amount pumped (1.92 acre-feet per day) and the amount delivered to the field (1.61 acre-feet per day) was 0.31 acre-foot. The loss from this 1,250 foot ditch was 0.31 acre-foot or 3 3/4 inches over one acre every 24 hours.

The cost of butane and oil was $9.80 per day to pump 1.92 acre-feet of water. The cost of pumping the 0.31 acre-foot that was lost was only $1.58 per day, but in 120 days it would amount to $189.60. This, however, is only an insignificant part of the loss.

Mr. Unfred reported that the two wells were pumped an average of 120 days a year. If each day he loses from this 1,250 foot ditch enough water to put 3 3/4 inches on one acre of land, in 120 days he will lose enough water to put 12 inches on 37.5 acres. If the 37.5 acres would produce 3/4 bale of cotton per acre, that means a loss of 28 bales of cotton. If the cotton would net $50.00 a bale, it means a loss of $1,400 a year.

If we add the $189.60 for butane and oil plus the $1,400 we did not produce, plus the extra wear and tear on the equipment, plus the costs of maintaining the ditch, plus the inconvenience of not being able to cultivate the field while the ditch is full of water, plus the additional time required to irrigate the field, the loss of 69

(Continued On Page Two)



Well No. 2 on Joe D. Unfred farm. Note four-inch flow meter on discharge pipe and the open ditch in the background.

Rectangular Weir and Parshall flume used to measure discharge from the irrigation ditch to the field.

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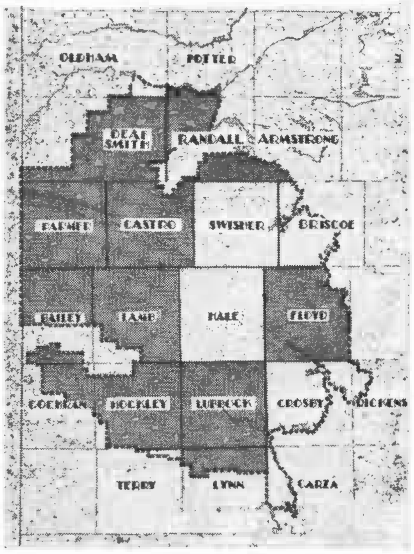


Significant Court Decision

In the June issue of The Cross Section we stated that the HPUWCD had asked its attorneys to file a brief in the Court of Civil Appeals in El Paso in the case of the Pecos County Water Control and Improvement District No. 1, et al vs. Clayton W. Williams, et al. We present a resume of the findings and court decision.

The facts were briefly these: The people who owned Comanche Springs brought a suit to enjoin persons who were pumping ground water. The pumping of the ground water substantially decreasd th flow of Comanche Springs. **The Court held that the the owner of the surface could produce water from his land and could not be enjoined by the owners of Comanche Springs.**

The owners of the spring maintained that they owned "correlative rights" in the ground water and could enjoin the production of the water by pumpers who took more than their correlative share. **The Court held that in the absence of legislation there were no correlative rights in the water.** The Court pointed out that the regulation of oil and gas, as a matter of correlative rights, depended upon a statute.

The owners of the spring also maintained that the water came to the spring in an underground stream. They contended that where production from the wells curtailed production from the spring, that this was evidence o fan underground stream, as distinguished from percolating waters. The Court held that this was not so. It indicated that the plaintiffs would have to show more to establish an underground stream: that is, course, banks, direction, velocity, etc. It reiterated the proposition that ground water is presumed to be percolating water. The Court concluded: "The mere fact that the wells of one man dried up springs or the wells of another neither proves nor indicates a well-defined channel of underground water."

Drillers Hear Broadhurst At Convention

W. L. Broadhurst, chief hydrologist for the High Plains Underground Water Conservation District, was the guest speaker at the convention of the Texas Water Well Drillers and Contractors Association at San Jacinto Battle Ground near Houston on July 31st.

Broadhurst's subject was "The Conservation of Underground Water." He pointed out that underground water isn't worth a dime if it is left undeveloped. "Conservation of underground water," said the hydrologist, "means the wise use of water for the maximum benefit to mankind."

His address included the recommendation that well drillers and contractors should be receptive to improved methods of well construction and development, and that an honest effort should be made to improve the efficiency of wells, pumping equipment and water use.

Today's Thought

Reprinted from The McDowell Irrigation Digest, May-June, 1954

"It's unwise to pay too much, but it's worse to pay too little. When you pay too much, you lose a little money—that is all. When you pay too little, you sometimes lose everything, because the thing you bought was uncapable of doing the thing it was bought to do. The common law of business balance prohibits paying a little and getting a lot—it can't be done. If you deal with the lowest bidder, it is well to add something for the risk you run. And if you do that, you will have enough to pay for something better."

—John Ruskin.

The Southern High Plains Underground Reservoir contains 16 times more water than the total capacity of all man-made reservoirs in the State of Texas.

The Statistics

During the month of July, 206 completed wells were registered with the District Office. Distribution by County was as follows:

Armstrong	1	Hockley	26
Bailey	14	Lamb	33
Castro	27	Lubbock	21
Cochran	3	Lynn	8
Deaf Smith	19	Parmer	35
Floyd	9	Potter	0
		Randall	5

149 new applications were taken throughout the District during the month of July.

WHAT DOES IT COST YOU—
(Continued From Page One)
gallons a minute from the quarter mile of open ditch may exceed $2,000 per year.

Wouldn't it mean extra dollars in your pockets and at the same time conserve water for future use if you would substitute a closed distribution system in place of the open ditch?

A Little Life Is Worth More Than A Little Time . . . . Close That Abandoned Well!

Gravel-Packed Wells

Gordon W. Willis

(The following is the third of a series of six articles pertaining to the drilling and developing of large capacity water wells. The preceding article entitled "Well Construction" appeared in the July, 1954 issue of The Cross Section.)

A gravel-packed well is one that is constructed with an envelope of gravel between the outside of the casing and the wall of the hole. The reasons for gravel-packing a well are to increase the permeability of the material next to the casing, to develop the maximum yield of the well, and to prevent the continuous infiltration of fine-grained sand into the well. It is often advantageous to gravel-pack wells in strata that consist of fine-grained unconsolidated sand. (See Figure 1.)

The principal water-bearing formation in the High Plains is the Ogallala formation. This formation is composed of clay, silt, sand and gravel that were deposited in discontinuous layers by streams carrying rock particles eroded from the Rocky Mountais. The coarse-grained materials, in general, are present in the lower part of the formation; however, the particles of rock material differ greatly in size and the strata differ greatly in thickness from place to place.

Unconsolidated sand that is saturated with water will enter a well and be pumped out with the water when casing is used that is perforated with wide torch-cut slots. The removal of large quantities of sand from the area adjacent to a well leaves a void space filled water. The material overlying these voids or cavities often caves and causes the casing to collapse, the slots to become clogged, the pump bowls to become sand locked, or even the total loss of the entire well and pumping equipment.

A well that yields sand along with the water is never desirable, therefore, a method of well construction that will prevent the pumping of sand and allow the production of large quantities of water would benefit many well owners who are tired of the expense of pump repair, the frequent replacement of wells and the other inconveniences of "sand pumpers". The gravel-packed well is a satisfactory method of construction in an area where the water-bearing strata consist almost entirely of fine-grained, unconsolidated sand.

The practice of gravel-packing a water well is nothing new, and it is not a hit or miss proposition if it is done properly. It is a process that requires a scientific approach to the problem and should be carried out in nine logical steps.

1. Test holes should be drilled. An accurate driller's log should be kept and representative samples of the water-bearing strata should be collected. The best location for a well may be selected from the data obtained from test drilling.

2. Select the proper size gravel to control the formation sand. The proper size of gravel should be determined from a screen analysis of the samples obtained from test drilling. (See Figure 2)

3. Determine the size of the openings in the screen or in the casing from the size of the gravel selected. The openings should be small enough to prevent the gravel from entering the well.

4. Drill the well completely through all of the water-bearing strata. The well should be as nearly straight and plumb as possible. The diameter of the well should be large enough to allow approximately six inches of annular space between the casing and the wall of the well.

5. Cage the well to determine whether or not it is straight and plumb. If the well is too crooked, it would be impossible to place a uniform envelope of gravel around the casing, and it may be impossible to install a pump at the desired setting.

6. Install the casing in the center of the well. Spacers or casing spiders should be attached to the casing to insure proper centering.

7. Place the gravel in the annular space between the casing and the wall of the well. This should be done in such a manner that the entire interval to be gravel-packed will receive a uniform envelope of gravel. It is a good idea to bail the well while the gravel is being paced around the casing. The bailing removes a large part of the fine-grained material from the gravel-pack and facilitates the proper arrangement of the gravel.

8. Develop the well thoroughly by the use of a swab and bailer or a surge block and bailer and then by pumping and back-washing wtih a test pump.

9. Test the well when it is thoroughly developed in order to determine the necessary data to select the proper size pump to be installed in the well.

The most common method of placing gravel in a well in the High Plains is to shovel the gravel into the annular space between the casing and the wall of the well. This method may be satisfactory if the wall of the well is firm and will not cave. Quite often, however, the particles of gravel in falling from the surface will dislodge clay and unconsolidated sand from the wall of the well and cause a bridge to form.

A good method to use, in order to insure a uniform gravel envelope, is to lower three-inch or four-inch pipe to the bottom of the well between the casing and the wall and to feed the gravel mixed with water through this pipe. The pipe can be raised as the annular space is filled. This method prevents bridging and makes a cleaner gravel envelope.

(See Figure Three)

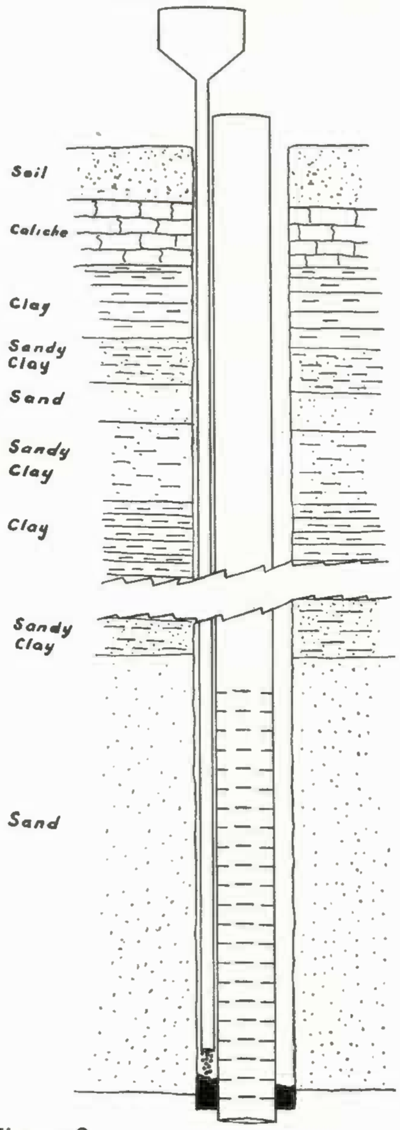


Figure 3

Sketch showing the placement of a gravel pack through a gravel-feed pipe. Pea gravel is placed in the hopper at the surface and washed down with water. As the annular space is filled, the pipe is raised and moved around the casing.

Several methods of gravel-packing wells have been developed. It is our desire to determine which methods are more suitable for use in the High Plains, and we will make additional data available from time to time when we find that it is practical and economically feasible.

The next article of this series will pertain to the development of large capacity water wells.

FIGURE I **FINE SAND (actual size)**

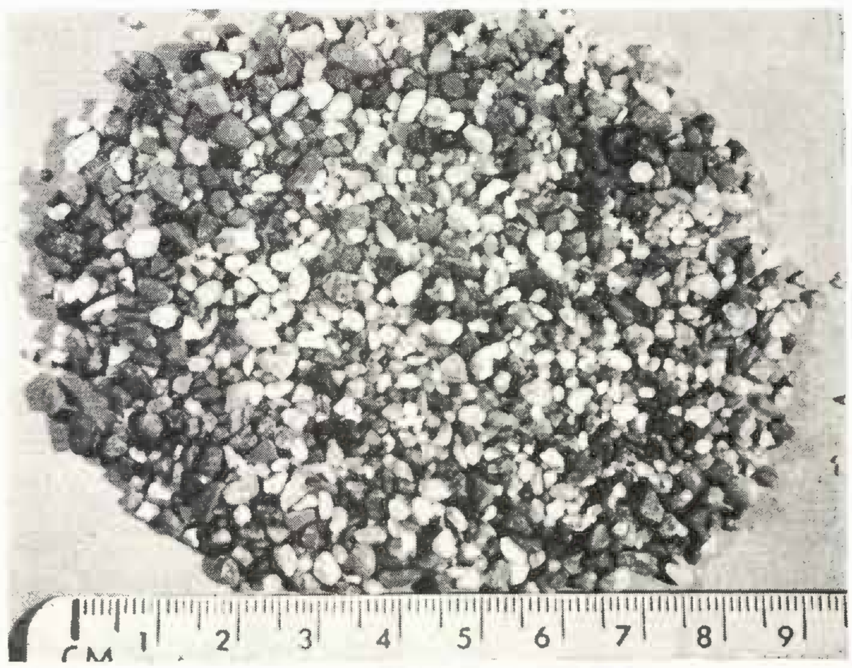


FIGURE 2 **GRAVEL PACK (actual size)**

The Geologic and Hydrologic Aspects of The High Plains Water District

W. L. Broadhurst

The Llano Estacado, or Southern High Plains, extends from the Canadian River in the Texas Panhandle southward to the Edwards Plateau in the vicinity of Big Spring and from the Caprock east of the Pecos River in New Mexico eastward to the Caprock in Texas near the 101st meridian.

The High Plains Underground Water Conservation District covers a large portion of the Llano Estacado in Texas, including all or parts of 21 counties extending from Amarillo southward into Lynn County and from the New Mexico line eastward to the Caprock. It embraces approximately 6,800,000 acres of fertile land.

Permian, Triassic, or Cretaceous rocks underlie the entire District at depths ranging from a feather edge to several hundred feet. These rocks are composed chiefly of consolidated sandstone, shale, limestone, gypsum and salt. In general, they are relatively impermeable and are of minor importance as sources of fresh water.

The Ogallala Formation of Tertiary Age, which overlies these older rocks, is the principal aquifer or groundwater reservoir beneath the District. The Ogallala consists chiefly of unconsolidated clay, silt, sand, and gravel.

The land surface of the Plains is relatively smooth and in general slopes southeastward at the rate of about ten feet per mile; but the bedrock on which the Ogallala was deposited is much more irregular than the present land surface. Consequently, the Ogallala formation ranges in thicknesses from only a few feet on the tops of the old redbed or Cretaceous hills and ridges to more than 500 feet in the ancient stream valleys.

The Ogallala formation consists of sediments that were brought to the Plains area chiefly by streams that headed in the mountains of New Mexico. These sediments were deposited first in the ancient valleys, but as the valleys became filled, the streams meandered back and forth from one valley to another.

Some material, of course, was washed into the valleys from the surrounding hills which accounts for layers or lenses of red and yellow clay within the Ogallala and above the true redbeds. After many centuries the valleys were completely filled but desposition continuel until all the hills and ridges were covered with Ogallala sediments. During more recent centuries, the Canadian River has carved a deep gorge across the Plains, and erosion along the Pecos River has removed the Ogallala material between the foot hills of the mountain and the western escarpment of the Plains. Consequently, the Ogallala formation beneath the Llano Estacado is isolated geologically from the Plains to the north and the mountains to the west.

Since the Ogallala formation beneath the Southern High Plains is geologically separated from the surrounding territory, so is it hydrologically separated from any important source of fresh water except precipitation on the surface.

Records show that the average annual precipitation over the District is about twenty inches. That, however, is a relatively large quantity of water. Twenty inches over 6,800,000 acres is equal to about 11,000,000 acre-feet, the actual quantity of water that falls within the bounds of the District during each year of average rainfall. Records further show that the surface run-off within the District is less than one inch, most of which drains into the thousands of depressions to form temporary ponds on the Plains. The run-off that contributes to stream flow below the Caprock is only a small percentage of the total run-off.

The rapid increase in the number of large capacity wells that have been drilled and the corresponding increase in withdrawal of groundwater in the High Plains of Texas have not only caused people to advocate conservation of water, but they have resulted in the formation of underground water conservation districts which are now actively engaged in water conservation programs. Although the precipitation averages about twenty inches a year, the potential evapotranspiration during years of normal plant growth is about thirty inches a year.

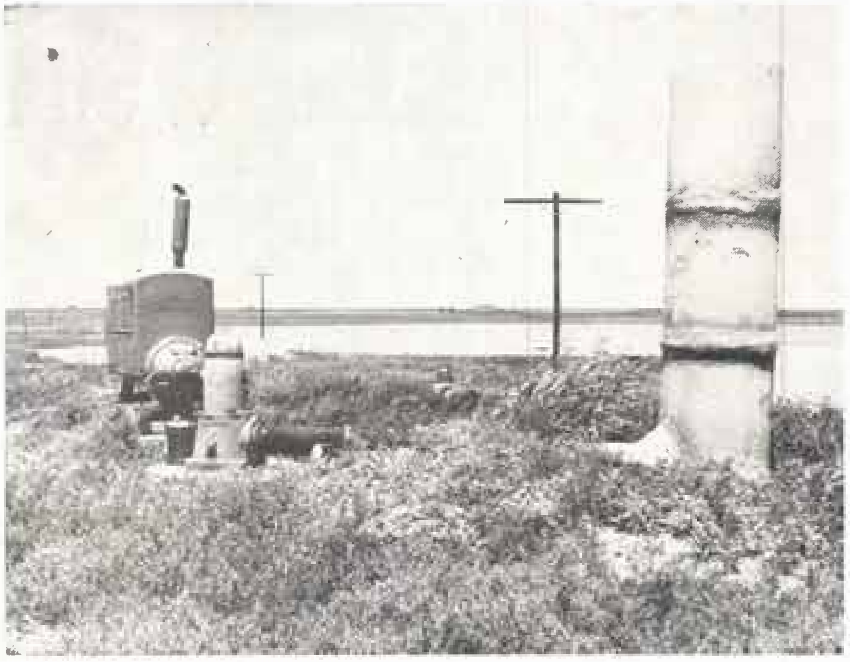
These records indicate that supplemental water is desirable for irrigation during most years of average or below average precipitation in order to produce large crop yields. However, as a matter of record, during some years of above average or even average precipitation, depending on soil moisture conditions and distribution of rain, larger yields of cotton, wheat, and some other crops have been harvested from dry-land farms on the Plains than from irrigated farms just across the fence.

The overall geologic and hydrologic problems of the Plains are relatively simple compared to many underground water reservoirs in other parts of the country. The Southern High Plains stand up like a great island surrounded by a sea of undulating redbeds both on the west and on the east. Throughout most of the region, the water table slopes southeastward, but along the north edge it slopes toward the Canadian River, and all along the western edge it slopes toward the Pecos River. Therefore, the underground water does not come from the mountains in New Mexico but is replenished entirely from precipitation on the Plains themselves, chiefly during exceptionally wet periods. Since there is no nearby source of water comparable to the supply now in storage, the primary problems are economic and equitable development. The situation becomes more complicated as it narrows down to smaller individual areas. The conditions vary from place to place and even from one farm to the next. One man may be able to develop a well that will yield 1,000 gallons a minute whereas his neighbor may be able to develop a well that will yield less than half that quantity.

The development and use of the underground water in this region is being accomplished by thousands of individuals, many of whom are not versed in the laws of nature and do not understand the rudiments of the occurrence and movement of underground water.

Consequently, the major hydrologic problems of underground water conservation districts are not necessarily the collecting or analyzing of the physical facts. Surely the greatest problems relate to the conveyance of those facts to the individual so that he may better understand the present and the future effects that his operations will have on himself, his neighbor, and the area as a whole.

Information that has been collected during the first half of the twentieth century shows conclusively that the supply of groundwater in the High Plains is definitely limited and is replenished from precipitation. The amount of annual replenishment is not definitely known, but beyond any question of doubt, it is only a fraction of the annual withdrawal.



Caught Conserving Water

Not only was he conserving the water that occasionally collects from rainfall, but he is also making a good use of run-off water that collects from adjoining farms.

Mr. Robert Veigel, who lives ten miles north of Hereford, is taking advantage of the water his neighbors have gone to the expense of pumping and then letting waste by lifting that water another two or three feet with a centrifugal pump and placing it in the same underground system that his irrigation pump uses. Mr. Veigel pumps the lake water with the same motor that pulls the irrigation well. Certainly a lot of farmers should be taking advantage of water that collects in lakes in the High Plains. For a cheap pumping cost, many thousands of gallons of water could be used on the land for irrigation that is now being lost to evaporation.

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

THE Cross SECTION

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

Volume I — No. 4 | There Is No Substitute For Water | September, 1954

Willis Addresses Water Works Assn.

The following is an abstract of an address given by Gordon Willis, HPUWCD Geologist, before a meeting of the Permian Basin Water Works Association at Midland.

Underground water resources are vital to most of the towns and cities of Texas, and this is especially true in West Texas. The 20th Biennial Report of the Board of Water Engineers states that 593 municipalities in Texas use underground water, and the total amount of underground water used by these municipalities in 1951 was about 420,000 acre-feet or about 136,800,000,000 gallons.

Conservative estimates indicate that underground water reservoirs in Texas contain more than 1,000 times as much fresh water as the total storage capacity of all of the surface-water reservoirs in the State. We realize, of course, that it is not possible to withdraw all of the water stored in the underground reservoirs, and it is not possible to obtain for use all of the water that can be stored in the surface-water reservoirs.

Development and conservation may seem, to some people, to be conflicting subjects. I shall attempt to show you how these subjects can be compatible. Development of underground water is the installation of structures and equipment necessary for the withdrawal and utilization of underground water. Conservation of underground water is the wise use of the water for the maximum benefit of mankind.

Water lying unused in the reservoir is of little value to us. Like oil, gold, diamonds, and uranium, water has only potential value until we develop it or extract it from its place of deposit and put it to beneficial use. Like other valuable resources, water can and often is wasted because of improper methods of development.

The first logical step in the development of an underground water reservoir is exploration. Exploration consists of:

(Continued on Page 2)

Problems Face Ground Water Management

The previous article written on problems facing ground water management (see July, 1954 issue) pointed out three major questions confronting the people of the High Plains. Answers to these questions must be had to the closest degree of accuracy before conservation and proper care can be given to the ground water of the District.

The principal object of a conservation program of water is parallel in nature to that of oil and gas which has been defined "to increase the ultimate recovery per field". Every person in Texas interested in conservation knows what such a program has meant to the economy of the oil industry.

The people of Texas are much more fortunate than people of some other states in the type of ground water law under which they are operating, for certainly management must be supplied in direct relation to the aquifer and not on a rigid state-wide program.

It is almost impossible to be fair and equitable to all water users with a program established along rigid lines. A certain amount of flexibility must be had, depending greatly on the nature of the aquifer being affected.

Within certain areas of the State where the supply is relatively constant, wise management might be hard to provide, but in areas such as ours here in the Southern High Plains, the future of our water lies in adequate management running parallel to wise use.

"The price we have paid for the growth of the country, as far as ground water is concerned, is the decline of the well-water levels and more costly pumpage. Perhaps this was a necessary price to pay for rapid growth. If rigid control measures had been in successful operation from the beginning, development might have been seriously retarded. In the balance sheet of benefits to the total population, restrictions on withdrawal fifty years ago conceivably might not have been the part of wisdom."

The above paragraph is an observation made by Dr. Harold E. Thomas in his book *The Conservation of Ground Water.*

A great portion of the people of the Southern High Plains subscribe to the idea of Dr. Thomas, but they also subscribe to the idea that our area has made its greatest growth agriculturally speaking in the foreseeable future. What is urgently required now is to learn quickly and reliably how much water we are using, what our future needs are likely to be and what we have in our storage to supply our present use and future needs.

A principal project to begin this fall of the High Plains Water Conservation District is an inventory of the amount of water now in storage. Mr. W. L. Broadhurst, chief hydrologist for the District, has been authorized by the District Board of Directors to use every means to obtain as nearly as possible reliable and factual figures on the number of acre-feet of water now in storage. Such a program will be costly and time consuming. This information today would be of untold value in supplying adequate conservation and sound management.

One forgotten axiom of ground water development and use is that there is no more water than there is. In other words, one cannot remove from the ground more water than originally fell. It is up to us here in the Southern High Plains to produce ultimate at the cheapest cost in gallons of water consumed. Our water should be looked upon as insurance —not as a means of making a fast dollar.

When the Ground Water Law of Texas was being passed by the State Legislature in 1949, the question was continuously asked, "Is this a law to take away from us the right we are now exercising, or a law to help us help ourselves?" Certainly it was not the intention of the Texas Legislature to take away from any of its citizens a right that they felt was justly theirs, as did the people of Southern California before "Paramount Rights" took over their water supply.

The 51st Legislature, in its wisdom, did establish two points that had not been established previously. The most important being that the percolating water under a man's land belonged to him, and secondly, it authorized the creation of self-governing districts with the authority and responsibility for the conservation and most efficient use of its water resources.

The District Board of Directors, with the capable assistance of sixty-five County Committeemen elected by the people in each county now participating in the water conservation program, have made wonderful progress in transmitting to the people of the High Plains certain very urgent elementary practices to aid in prolonging the life of our underground water and in the first organized procedure of gathering pertinent information for future determinations. As water levels decline and more information is gathered, the translating of such conservation practices and principles into action may become complex and difficult since habit is very hard to overcome.

Even now certain people who have no love for the land or consider their property in West Texas only as an investment to be disposed of when it is no longer economical to operate their wells object to the simple practice of spacing wells for the prevention of waste and to reduce the interference on their neighbor's well. Fortunately those people are far in the minority. The people of this great area who have grown up with the country or have a sincere feeling in their hearts about its welfare, both present and future, are almost unanimous in their attitudes toward the principles for which this District stands.

It is with this knowledge and encouragement that your County Committee Boards and your District Board of Directors spend countless hours each month working on the water problems of your community and West Texas. To preserve as long as possible the economy we are enjoying, built to a degree on a God-given resource of good underground water, management and economic use must run parallel.

Be Sure To See The HPUWCD Exhibit At The South Plains Fair, Lubbock, Sept. 27-Oct. 2

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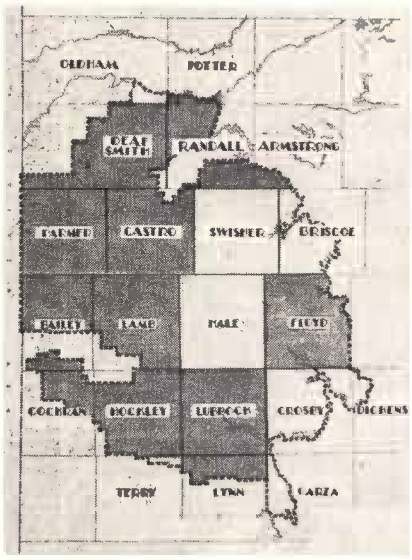

Legislative Briefs

The Texas Water Resources Committee has completed its public hearings of River Authorities, Water Districts and other agencies interested in water problems. The Committee is now spending a great amount of time in drafting recommendations for the 54th Legislature. It was the privilege and honor of the Board of Directors of the High Plains Underground Water Conservation District to appear before the Committee to outline the work being done by the District and to discuss future water conservation problems that may appear in the High Plains.

The District Board may ask the Water Resources Committee to recommend amendments to the Legislature for the clarification of certain points of the ground water law as it is now written.

* * * *

The Conservation of both surface and ground water has certainly held a strong position in the platforms of all the candidates seeking political offices these past few weeks. With the tremendous demands being placed on water supply today, this seems to be a very good plank in any platform. The question is, *"Can they deliver?"*

TWCA Committee Named

At the July quarterly meeting of the Executive Board of the Texas Water Conservation Association the Board instructed the President, Judge Guy C. Jackson, Jr., to appoint the Resolutions Committee in advance of the Tenth Anniversary Convention, which is to be held in Austin in October.

Judge Jackson named fifteen members to the Committee, three from each of the five classifications of water use represented by the Association: irrigation, municipal, industrial, navigation and river authorities.

West Texas is well represented on the Committee. Among the appointees are: T. J. McFarland, General Manager of the HPUWCD, Lubbock, Irrigation Panel; E V. Spence, General Manager of the Colorado River Municipal Water District, Big Spring, Municipal Panel; Tom C Craig, Phillips Petroleum Co, Amarillo, Industrial Panel; and G. C. Allen, Secertary of the Upper Colorado River Authority, Robert Lee, River Authorities Panel.

Willis Speaks . . .

(Continued from Page 1)

(1) A study of the surface geology to determine the nature and general structure of the geologic formations,
(2) Test drilling to determine the nature and the thickness of the water-bearing strata,
(3) Chemical analyses of water samples to determine the quality of the water,
(4) Pumping tests to determine the hydrologic properties of the water-bearing strata, and
(5) A comprehensive analysis of all of these data in order to intelligently plan the construction of wells and other facilities necessary to complete the development of the well, well field or reservoir.

Each of these components is important; however, the comprehensive analysis of all the data is the most important, for it is the guide to proper development.

The second step is the purchase of the property or the water rights to the property where exploration shows good water-bearing strata. This is a legal and business transaction rather than a technical procedure. Intelligent planning for future water needs and the acquisition of the water rights to meet these needs should be done before an emergency arises. Many cities run into difficulties because they try to drill too many wells and draw too much water from well fields within or adjacent to the cities. Future demands for water are going to necessitate the development of water supplies possibly several miles from the cities.

The third step is the correct spacing and the proper construction of water wells. Correct spacing and proper construction are necessary to minimize the interference between wells and to insure the maximum useful life of wells. Satisfactory wells are not always obtained by drilling a well near your water lines, in installing casing with some big slots in it, installing just any size pump you have on hand, and pumping as much water from the well as you can without breaking suction. Money that is spent for scientific exploration, research, and planning by competent ground-water geologists, hydrologists and engineers is a sound and logical investment in the development of an underground water reservoir. The development of underground water does not stop when the wells and equipment are put into operation.

The fourth step is a systematic procedure of keeping records of measurements of non-pumping and pumping water levels in wells, measurements of yields of wells, hours of operation of wells, total volume of water pumped, analyses of water samples and overall efficiency of wells. These records enable you to keep books on your city's investments and to make plans for the future. They will tell you when you need to expand your development, and, quite often, they will tell you where you are wasting money in the operation of inefficient wells.

All of these things, combined with the prevention of waste after the water is pumped, comprise what we call conservation of underground water.

Development Of Wells

Gordon W. Willis

The following is the fourth of a series of six articles pertaining to the drilling and developing of large capacity water wells. The preceding article, entitled "Gravel-Packed Wells", appeared in the August, 1954 issue of The Cross Section.

The development of a water well the process by which a well is cleaned, conditioned, and prepared to produce water. Development includes removing the drilling fluid and cuttings from the inside of the casing, cleaning the perforations or screen, removing the wall cake (deposited by the drilling fluid) from the wall of the well outside of the casing, and increasing the permeability of the formation adjacent to the well.

Some of the methods of development that are probably more practical for use in the High Plains are pumping and backwashing, surging and bailing, agitating with water, and agitating with compressed air. Chemical treatment after one or more of the above methods may improve the capacity of some wells if the water-bearing strata are receptive to chemical treatment.

Pumping And Backwashing

Development by pumping and backwashing requires only a pump with sufficient capacity to handle the estimated maximum discharge of the well. The bowls and suction pipe should be set near the bottom of the well so that the well can be cleaned out to the bottom. The rate of discharge should be kept as low as possible at first until the water becomes practically clear. The rate of discharge may then be increased slightly until more sand and mud show up in the water. Each time the water becomes clear the rate of discharge should be increased until no more sand comes into the well and the maximum capacity of the pump or the well is reached. The pump should not be shut down after starting until this preliminary pumping is completed, because there may be some danger of clogging the perforations or sand locking the pump if the sand is not kept moving.

Backwashing may be started after the preliminary pumping is completed. The pump should be shut off until the water in the pump column has drained back into the well and the water level in the well has been allowed to rise. The pump may then be started and the process repeated. The alternate stopping and starting of the pump stirs up the material surrounding the casing and causes the removal of the fine-grained material until the pore spaces in the coarser material surrounding the casing are cleaned out.

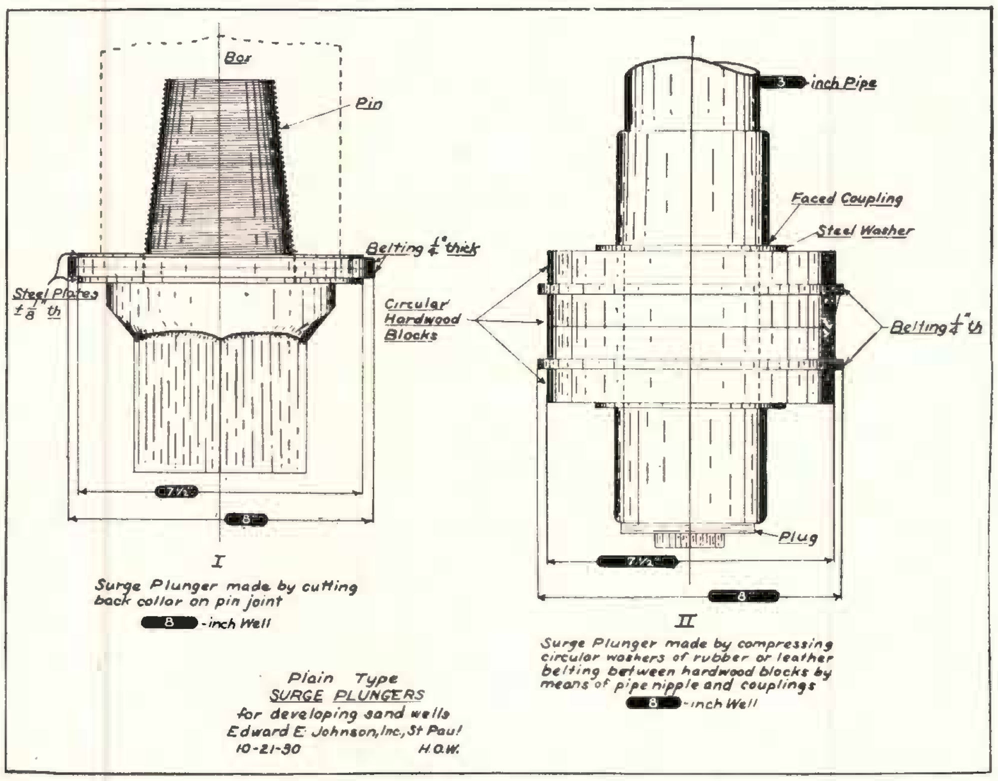

Figure 1. Solid surge plungers. (Reprinted from Bulletin 1033, "Principles and Practical Methods of Developing Water Wells", Edward E. Johnson, Inc.)

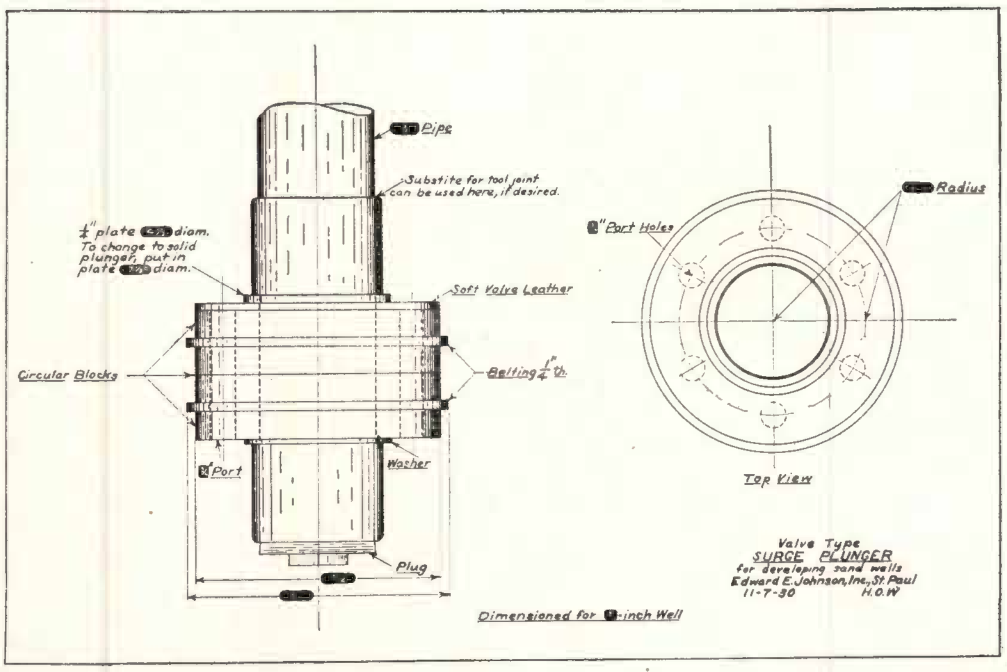

Figure 2. Valved surge plungers. (Reprinted from Bulletin 1033, "Principles and Practical Methods of Developing Water Wells," Edward E. Johnson, Inc.

The time required to develop a well by this method varies through wide limits. It may range from a few hours to several days. When the well will produce very little or no sand after backwashing and pumping, the development is complete so far as this method is concerned. Developing by pumping and back-washing is not as effective as some of the other methods; however, it often yields satisfactory results.

One of the most effective methods of developing wells is by surging and bailing. The essential feature of this method is the rapid up-and-down movement of a plunger in the casing below the static water level in the well. Raising the plunger draws water and sand into the casing and lowering it forces water out through the perforations. This surging action loosens the material adjacent to the screen or perforated casing, prevents the sand grains from bridging, and allows the fine-grained material to be washed into the well. The repeated application of this surging force will tend to shift the sand particles and change the entire arrangement of the water - bearing strata aound the screen or perforated portion of the casing. When the finer material is drawn into the well and removed, a new mixture of sand and gravel with a greater permeability is left adjacent to the perforations. The material that accumulates in the bottom of the well is removed from time to time by a bailer.

The surge plunger should be attached to the drilling line of a cable tool drilling rig or to the spudding line of a clean-out rig. In operation, the plunger is lowered into the casing until it is about 15 or 20 feet in the water. Water is practically incompressible; therefore, the surge plunger will work just as effectively at the upper end of the water column in the well as it will at the lower end near the screen. In any event, care should be taken not to lower the plunger far enough to batter the top of the screen if a screen is used in the well.

A long stroke should be used and the speed should be adjusted until there is no slack in the cable on the down-stroke. The material that accumulates in the bottom of the well should be removed frequently, and in no instance should the surging be continued when the perforated portion of the casing is full of sand.

Several kinds of surge plungers have been used successfully; however, they may be classified into two general types:

1. Solid surge plungers.
2. Valved surge plungers.

A brief description of these types and sketches of a few surge plungers will illustrate the essential features of most of the different kinds. The dimensions of the plungers shown in the sketches are for eight-inch I. D. casing. The dimensions may be increased proportionally for casing of larger diameter.

Solid surge plungers. The operation of a solid surge plunger exerts approximately equal force on the water in its inward and outward movement through the perforations. This repeated, forceful agitation of the water disturbs the material adjacent to the perforations and prevents the finer sand grains from bridging against each other and closing the openings between the larger grains of sand and gravel. In tight water-bearing strata the solid surge plunger has a tendency to force the water gradually out of the well and back into the adjacent strata. Sometimes this is merely a sign that the casing

(Continued on Page 4)

The Statistics

During the month of August, 186 completed wells were registered with the District Office. Distribution by County was as follows:

Armstrong	4	Lamb	24
Bailey	10	Lubbock	48
Castro	20	Lynn	8
Cochran	0	Parmer	23
Deaf Smith	20	Potter	0
Floyd	14	Randall	4
Hockley	11		

159 new applications were taken throughout the District during the month of August.

The Geologic And Hydrologic Aspects Of The High Plains Water District

W. L. Broadhurst

This is the second part of an article that appeared in the August issue of The Cross Section.

A recent article which was published in the Amarillo News entitled "Reservoir Engineering Adds Life to Oil Fields" should serve as a guide to ground water engineers.

The article states that when the oil industry was young, operators swarmed around each discovery like a high school crowd storming a soda fountain. Proper well spacing was unheard of and conservation was unknown. Oil was harvested as if each barrel might be the last. "Git it and git", was the battle cry. By such tactics operators unwittingly condemned themselves to bringing up only a small fraction of oil that might have been recovered under wiser production practices. Today, oil reservoirs are nursed along to make sure the maximum of recoverable oil is produced from them. Contributions to this happy situation are a relatively new science—the science of reservoir engineering.

Experience gained from research investigations has been applied to oil production. The goal, simply speaking, is to produce more oil in the long run and to produce it more efficiently. The article continues that, although there is still much to be learned, a good start has been made and progress is steady and encouraging. Ways have been developed to "look" down into a reservoir and evaluate what is found there.

Most reservoir problems deal with future problems in the light of past perfomance of the reservoir. Naturally, the more information engineers can gather, the better equipped they are to deal with problems and work out solutions. Four broad types of information needed are data on the reservoir rock, the properties of the fluid contained in the reservoir, a pressure history of the reservoir, and a production history of the reservoir.

After making tentative conclusions about a reservoir, the engineer should verify his findings. He should satisfy himself, as well as others, that his work reflects actual reservoir performance. These observations which relate to reservoir engineering of oil fields are equally important and applicable to the problems of ground water development.

Considerable data are available as to the geological and engineering aspects of the High Plains Water reservoir rock. Drillers' logs of several thousand water wells have been compiled and studied. They show in general the nature, characteristics and the extent of the Ogallala formation. A few wells in each county on the Plains have been drilled entirely through the Ogallala into the underlying Cretaceous, Triassic or Permian rocks, which in general yield only meager supplies of mineralized water. Several hundred of these logs have been published in reports by the U. S. Geological Survey and the Texas Board of Water Engineers. Several thousand additional logs are on file in the offices of the Water Conservation District, well drillers and pump dealers throughout the Plains. These logs show that in the Southern High Plains the Ogallala formation ranges in thickness from a feather edge to more than six hundred feet.

Within the bounds of the High Plains Underground Water Conservation District, the Ogallala formation averages about three hundred feet thick and the saturated portion of the formation is about two hundred feet thick. The District embraces 6,800,000 acres. Therefore, the total volume of saturated material is approximately 1,360,000,000 acre-feet. According to tests made by the U. S. Geological Survey, Board of Water Engineers and others, the saturated material has a porosity of about 34%. These data show that the amount of fresh water in storage within the District is about 462,000,000 acre-feet.

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 every drop of water by pumping from wells.

In order to clarify this subject the following is a quotation from the Board of Water Engineers Progress Report No. 7, Geology and Ground Water in the Irrigated Region of the Souhtern High Plains, which was published in March, 1949. "An estimate of the total quantity of water underlying the High Plains is of little value in iself, because much of the water will not drain out by gravity and will not be released to wells. If it is assumed that the water-bearing sands which comprise 65 per cent of the saturated material will yield water equivalent to 30 per cent of their volume, the product would be equivalent to a specific yield of about 20 per cent for the saturated part of the formation. The ultimate volume of the specific yield of the Ogallala formation is believed to be less than 20 per cent but greater than 15 per cent."

The High Plains Underground Water Conservation District covers 6.8 million acres, and if we use the same percentages given above, the amount of water within the District available to wells is about 204 million acre-feet. In other words, about half the water in storage could be pumped from wells.

According to the best information available, which we must admit is by no means exact, the total quantity of water that has been pumped from the Ogallala formation in the Southern High Plains since the start of irrigation in 1911 amounts to about 16 million acre-feet. Of that quantity about 10 million acre-feet were pumped during the three year period 1951-1953. More than 25,000 wells are now equipped with pumping facilities. As a result of these withdrawals, the water levels in wells have declined, the greatest decline having occurred in the most intensively developed areas. Consequently, it is a foregone conclusion, as pointed out in a recent report prepared by the U.S.G.S., that a continuation of the present trends in pumping and water-level declines will necessarily result in further declines of the pumping levels and decrease in the discharge of wells. In 1938 when the region had only about 1,500 wells, it was recognized that water was being pumped faster than it was being replenished and some people advocated that no more wells should be drilled. However, it would have taken 100 years for the 1,500 wells to have pumped the quantity that has been pumped to date. Another important hydrologic problem is to determine the quantity of water remaining in storage in different parts of the District, because even in the areas of greatest decline of water levels, more water is in storage than in areas of less decline where the sands are thin.

(To be continued)

Development Of Wells

(Continued from Page 3)

should be bailed out. When this tendency to lose water persists, it is evident that the solid plunger will not develop the well properly. Figure 1 shows the sketches of two solid surge plungers.

Valved surge plungers. The operation of a valved surge plunger also produces an in-and-out movement of water through the perforations; however, the in-rush is greater than the out-rush. Water is pulled forcibly into the well on the u[p] stroke of the plunger. On the down stroke, the water is forced down and out of the well; however, some of the water passes through the valve holes and allows a more rapid drop of the plunger.

In wells that have static water levels within about 15 or 20 feet below the surface, water may be pumped from the well by very rapidly operating the valved surge plunger. Sometimes the in-rush force is too great in relation to the out-rush force, and a condition of bridging and clogging is built up adjacent to or in the perforations. When this happens, the well should be backwashed with water or surged with a solid plunger until the bridging is disturbed. A valved surge plunger may be changer into a solid plunger by covering the valve holes with a circular steel plate. Figure 2 shows sketches of a valved surge plunger. Surge plungers are relatively simple to make and operate. They will accomplish excellent results in developing wells in sand and gravel if the wells are properly constructed and if the operator of the tool uses good judgment to make them work effectively.

References:

"The Principles and Practical Methods of Developing Water Wells," Edward E. Johnson, Inc., Bulletin 1033, 1933, pp. 10-19.

Rohwer, Carl, "Putting Down and Developing Wells for Irrigation", U. S. Dept. of Agriculture, Circ. No. 546, 1940, pp. 66-69.

(To be continued)

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THE Cross SECTION

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

Volume I — No. 5 There Is No Substitute For Water October, 1954

The Geologic And Hydrologic Aspects Of The High Plains Water District

W. L. Broadhurst

This is the last of a series of three articles. The two previous articles appeared in the July and August issues, respectively, of The Cross Section.

The 51st Legislature passed a bill known as Article 7880-3C, which permits the creation of local Underground Water Conservation Districts. The article starts by defining certain words. I believe the attorneys will admit that at times they have a little difficulty in understanding some engineering and hydrologic terms; unfortunately, I must admit, the engineers and hydrologists, as well as attorneys, also have mild difficulty in thoroughly understanding some legal terminology. Nevertheless, certain words and phrases need defining for specific uses.

I shall not attempt to give my version of all expressions used in the Article, but I should like to point out that clarification of some expressions is desirable to assist the people who are now and who in the future will be working with underground water conservation districts. I believe that if a series of words and phrases were given tentative definitions and then circulated among the engineering and legal professions a more thorough understanding would be developed before the words become part of a law.

The Directors of the High Plains Underground Water Conservation District are deeply concerned with the water problems of the Plains. They do not believe the District, as such, will solve all the future problems any more than a magnificant hospital, well equipped and adequately staffed, will cure all the sickness and diseases that affect our people. However, the prudent use of a hospital and well trained doctors may alleviate much suffering and prevent an epidemic. In a similar manner the operations of a water conservation district, with the cooperation of all water users, should prolong the life of a ground water supply and prevent economic disaster.

To date, the District has promulgated only three orders. The first, which went into effect in February, 1953, requires permits for well drilling. The other two were put into effect in February, 1954. Order Number Two contains rules governing waste of underground water, and Order Number Three contains rules concerning the drilling and spacing of new wells and the reworking or replacing of old wells.

In general the law seems adequate for the rules that have been adopted. But, unquestionably, court action will be necessary to test the validity of the rules.

The Directors of the High Plains Underground Water Conservation District are not so much concerned with strict enforcement of the rules as they are in being able to convince the water users of the economic importance and necessity of their cooperation. By and large, the cooperation has surpassed all expectations, and the water users are making the program work.

The primary goal of the High Plains Underground Water Conservation District includes several functions other than those required by law. Some of these functions are:

1. To disseminate facts regarding the supply of underground water in different parts of the District,
2. To develop comprehensive plans for the most efficient use of the water that is in storage,
3. To prevent waste (which includes pollution),
4. To investigate the practicability of artificial recharge with water that is currently lost by evaporation from wet-weather lakes,
5. To encourage the use of closed conducts to convey water from point of origin to place of use.
6. To aid in recovering the largest quantity of water at the lowest cost for the greatest economic use.

The biggest job for the engineer is to get the facts across to the thousands of water users. Once the users see the light as it affects their pocketbooks, the engineer has smooth sailing. Part of the conclusions of the Geological Survey Water Supply Paper 889F, which was published in 1946, is as follows:

"Questions in the minds of many owners of irrigation wells in the High Plains are these: What are the limits of safe pumping in my neighborhood? How much water should be pumped and how closely should the wells be spaced? The investigation shows that these are largely questions

(Continued on Page 4)

THE BOARD OF DIRECTORS of the HPUWCD. Seated left to right, Mr. Willis A. Hawkins, Sr., Hart, Vice-President and Director from Precinct Three; Mr. W. O. Fortenberry, Lubbock, President of the Board and Director from Precinct One; standing left to right, Mr. V. E. Dodson, Hereford, Director from Precinct Four; Mr. Gus Parish, Springlake, Director from Precinct Two, and Mr. Marvin Shurbet, Petersburg, Secretary and Director from Precinct Five. The picture was taken in the District Office during the quarterly business meeting in September.

The Future Of Texas

The following article was written by J. E. Sturrock, General Manager of the Texas Water Conservation Assn., Austin, and is reprinted from the August, 1954 edition of Texas Water.

During the past decade Texas has experienced an unprecedented agricultural, industrial and municipal growth and expansion. A growth and expansion beyond all the predictions and estimates of the most optimistic analysts, planning engineers and economists.

In addition to the ranching industry and dry land farming, Texas now ranks second only to California in acreage of land under irrigation; is now seventh among all States in size of non-farm employment; second in mining, which includes oil; fourth in construction; fifth in transportation; fifth in finance and insurance, and thirteenth in manufacturing.

This growth and expansion has brought a period of unexcelled prosperity to Texas, the continuation of which depends on a proper solution to the State's Number One problem—WATER.

During this same decade, Texas has experienced, and is still experiencing, a drought surpassing all other drought periods of record, while some areas have experienced severe and damaging flash floods surpassing all floods of record.

The agricultural, industrial and municipal growth and expansion has increased the many and complex water problems throughout the State. This fact is well publicized. It has been on the lips and in the minds of more people, on the front pages, editorial pages and headlines of more newspapers and heard on more radio and TV stations the past several years than has any other subject.

The present drought, combined with the huge increase in consumptive uses of water for agricultural, industrial and municipal purposes, has brought us up against the realization of the magnitude of the water problem as never before. All candidates for public office in this year's elections, from constable up, have urged a water conservation program for the State. Droughts are recurring, and with the progressively expanding demands of the State's increasing population, its agricultural, municipal, and industrial development, the next one will be much more severe and damaging unless storage reservoirs are constructed to impound flood and storm waters for use during drought periods.

The future of Texas depends on how well we develop, conserve and utilize our limited but replenishable water resources.

The next Legislature is duty bound to give prompt attention to the proper solution of this important problem which means so much to the future economic growth of Texas.

THE *Cross* SECTION

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F. B. Jeu Devine
Editor

Development Of Wells

Gordon W. Willis

The following is the fifth of a series of six articles pertaining to the drilling and developing of large capacity water wells. The present article is a continuation of the preceeding article entitled "Development of Wells", which appeared in the September, 1954 issue of The Cross Section.

Agitating With Water

Developing a well by agitating with water is a method of hydraulic backwashing. The tool that performs the operation is called an agitator, and it is designed for use with a rotary drilling rig. The agitator consists of a leng of drill pipe about five feet long with a packer on each end and perforation.. in the pipe between the two packers. (See Figure 1) The upper end of the agitator is coupled to the lower end of the drill collar, and the lower end of the agitator is closed.

In operation, the agitator is lowered into the well to the top of the screen or to the top of the perforated portion of the casing. The Kelly is attached to the drill stem, and water is pumped through the mud pump, through the drill stem, and out through the perforations in the agitator. The Kelly is lowered and raised slowly while water is pumped through the tools.

The developing action takes place when the water jetted from the agitator between the two packers is concentrated in a small area of perforations in the screen or slotted casing. The water has to pass out through the perforations into the strata adjacent to the casing. This concentration of water directed into the sand removes the wall cake and drilling fluid, and at the same time it disturbs or agitates the material adjacent to the well. The return flow passes through the perforations above the agitator and carries the fine-grained material and mud to the surface through the annular space between the drill stem and the casing.

The up and down movement of the tools performs a gentle surging action. As each section of the screen or perforated casing is developed, the agitator is lowered by adding another joint of drill pipe until the entire perforated section has been developed.

The agitator is a useful tool and is fairly simple and inexpensive to construct. It is important to have a mud pump that can deliver a large volume of clear water. The number and size of the perforations in the agitator should be determined by the capacity of the mud pump in order to prevent overloading the pump with pressure.

Development with an agitator gives better results in wells that are gravel-packed or in wells that are completed in tight water-bearing strata. This method is faster and more complete than development by pumping and backwashing, and it eliminates wear on the pump by removing the fine-grained material from the water-bearing strata before the pump is installed.

Developing With Compressed Air*

The proper use of compressed air in the development of wells is, under favorable conditions, a rapid and effective process; but unless conditions are right and adequate equipment is intelligently used, the process is of little, if any, value. There are two general methods of applying compressed air to the development of wells, namely:

Backwashing Method.
Open Well or Surging Method.

Backwashing Method.—The principle of the Backwashing Method is to force the water out of the well, through the screen, and into the water-bearing strata by means of compressed air which is introduced into the well through the top of the casing after it has been closed, much along the line that hydraulic backwashing is done. In order to prevent the possibility of "air-logging" the formation, some provision is made to prevent the air from entering the formation. This method is best used after the well has been cleared as thoroughly as possible with the bailer.

One type of hookup which has been successfully used for this method of development is shown in Figure 2. It will be seen that the top of the casing is closed airtight by means of flanges and a gasket. The upper flange is a flat blank flange in which two holes are bored off-center a sufficient amount to provide necessary clearance for a drop pipe in the well and for convenient connection of fittings overground. The smaller hole is tapped from above for any desired size of small pipe, commonly one-inch. The larger hole is drilled sufficiently large to clear whatever size of drop pipe will be used. A Tee of this size is then brazed or welded to the flange over the hole.

A drop pipe is extended down into the well with the upper end connected to the lower end of the Tee. The length of the drop pipe will depend upon the head of water, as a submergence of from 60% to 70% should be provided during pumping, if possible; but it is not considered good practice to extend the drop pipe down into the screen during development. (If necessary for purposes of submergence, the drop pipe may be extended into the screen when this hookup is used as a pump; and it is good practice to extend the pipe down to a point just above the screen, particularly during development, regardless of submergence, in order to clean the sand out as

*Article from "The Principles and Practical Methods of Developing Water Wells," Edward E. Johnson, Inc., Bulletin 1033, pp. 20-23.

thoroughly as possible.) By "submergence" is meant the extent to which the pipe is submerged in the water. Thus, for example, if a drop pipe 100 feet long is 65 feet down in the water when pumping, it has submergence of 65/100 or 65%.

The upper end of the Tee is provided with a packing gland through which is passed the air line down to a point within a foot or more above the bottom of the drop pipe, the distance depending upon whether or not a foot-piece is used on the air-line and, if so, the type.

The side outlet of a 3-way valve is connected to the upper end of the air line. The inlet of the 3-way valve is connected to the air delivery line, and the end outlet is connected to a Tee from which a pipe leads to the small hole in the flange. The Tee also has an air cock at the other opening, as shown in the illustration.

The size of fittings used will depend upon the quantity of water to be pumped, the size of the well, and the depth of setting. Under average conditions, the following sizes may be used with this type of unit, provided the size of well permits:

Pumping Capacity Gals. per Minute	Size of Drop Pipe	Size of Air-Line
25 to 50	2 - inch	½ - inch
50 to 100	3 - inch	¾ - inch
100 to 150	3½ - inch	1 - inch
150 to 200	4 - inch	1¼ - inch
200 to 300	5 - inch	1½ - inch
300 to 400	6 - inch	2 - inch
400 to 750	8 - inch	2½ - inch
750 to 1200	10 - inch	3 - inch
1200 to 1750	12 - inch	3½ - inch

The cross-connection for the air, leading from the 3-way valve to the flange, does not need to be larger than ¾-inch or 1-inch, regardless of the size of the air line, because it is very short and is used only during development or reclamation of the well.

In doing the work of development the 3-way valve is turned to deliver air down the air line, with the air cock preferably open. This pumps water out of the well through the discharge pipe. When the water comes clear, the supply of air is cut off, the water in the well is allowed to regain its static level, which can be determined by listening to the escape of the air through the air cock as the water rises in the casing. The air cock is then closed and the 3-way valve is turned so that the air supply is directed down the by-pass to the top of the well. This forces the water out of the casing and back through the screen, agitating the sand and breaking down the "bridges" of sand grains. When the water has lowered to the bottom of the drop pipe it will go no farther because the air will escape out through the pipe, thus making it impossible to air-log the water-bearing formation. Under certain conditions, if the air entered the water-bearing formation in large volumes, it might result in holding back the normal movement of the water, which is called "air-logging".

When the air is heard escaping out of the discharge pipe, or when the pressure stops increasing, the supply of air is cut off, and the air cock is opened again to allow the water to reach static level. The 3-way valve is turned and the air supply again directed down the air line to pump the well.

This procedure is repeated until the well is thoroughly developed. It is seldom necessary to bail the well after this, as the velocity of the water will usually clean out the sand which is brought into the well, provided the well has been bailed reasonably thoroughly at first to remove the first large "slugs" of sand which might be too heavy for this type of air lift to clean out properly.

Open-Well or Surging Method.—The principle upon which this method of development is accomplished is a combination or surging and pumping. By means of sudden release of large volumes of air a strong surge is produced by virtue of the resistance of water head, friction, and inertia. Pumping is done as with an ordinary air lift. It is upon the skillful application of this combination of surging and pumping that the success of the work depends.

The necessary equipment for this method of development consists of the following:

1. Air compressor of proper size with air receiver of 15 cubic feet capacity or more.

2. Drop pipe and air line in well with suitable means for raising and lowering each independently of the other. (The casing itself is sometimes used instead of a separate drop pipe, although this is not best practice.)

3. Flexible high pressure hose and pipe line to connect between tank and air-line in well.

4. Unless the compressor is fitted with "unloaders" the tank must have a relief valve of sufficient size to safeguard against accidental overloading.

5. Miscellaneous small fittings such as pressure gage and a quick-opening valve at the outlet of the tank.

In order that development by this method may be fully successful, it is necessary to have a ratio of submergence of at last 60%. That is, the water must rise high enough in the well so that it is possible to have at least 60% of the air line in the well under water. For example, if the well is 100 feet deep and the water rises 60 feet from the bottom, 60% of the airline in the well will be under water extended to the bottom of the well, thus having 60% submergence. Outside of cases where abnormally great depths are encountered which require excessive starting and working pressures, there is no upper limit for submergence in development of a well by this method. The static submergence may be as high as 100% in some cases and is best when over 65%. The efficiency of the work drops off rapidly when the submergence becomes less than 60%. Where the wells are quite deep so that there is a considerable head of water above the bottom even though the submergence is low, effective work can be done by "shooting heads" as will be described further along in this article. Where both the head and submergence are low, this method of development is not of much value.

The proper method of placing the drop pipe and air-line in the well is shown in Figure 3. The drop pipe may be conveniently handled with a chain to the drilling cable, and the air-line by connecting to the bailer line when a cable tool rig is used. A Tee at the top of the drop pipe is fitted with a short discharge pipe at the side outlet and at the top a bushing is placed just large enough to clear the couplings of the air-line. A sack is wrapped around the air-line where it enters the drop pipe to prevent the water from spraying about the top of the well.

The discharge of the compressor should be piped direct to the tank without any valve in the line. The discharge from the tank to the well should be the full size of the air-line in the well, or, if long, the next larger size, and should be fitted with a quick-opening valve near the tank. A heavy hose is used between the discharge pipe from the tank and the air-line in the well. This hose should be at least 15 feet long to allow sufficient space for moving the drop pipe and air-line up and down. A 25-foot or 30-foot length of hose as used in jetting or hydraulic rotary drilling is commonly used.

At the start of development, the drop pipe is lowered within two feet or so of the bottom of the screen, and the air-line is placed so that it is up in the drop pipe a foot or more. If there is plenty of submergence the air-line needs to be lowered only far enough to get 65% or 70% submergence. The air is turned into the air-line and the well is pumped in the manner of a regular air lift until the water appears to be free of sand. The valve between the tank and the air-line is then closed, allowing the tank to be pumped full of air up

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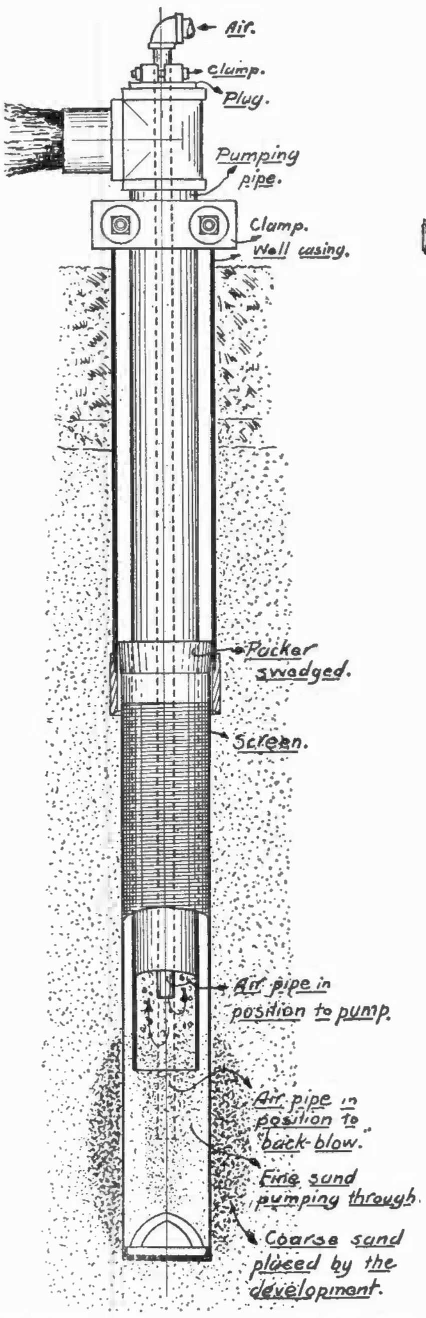

FIGURE 3.—Hook-up for developing well with compressed air by the Open Well or Surging method using separate drop pipe.

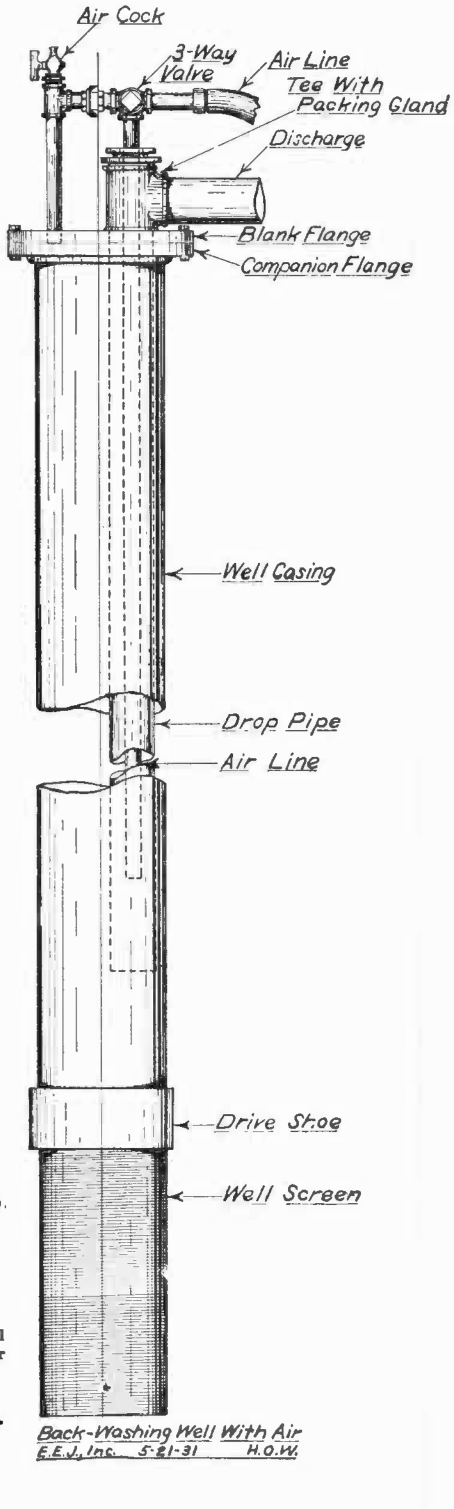

FIG. 2.—Details of hook-up for Back Washing Method of Developing Wells with Compressed Air.

Development Of Wells

(Continued from Page 3)

to a pressure of from 100 to 150 pounds. In the meantime, the air-line is lowered so that it is a foot or so below the drop pipe. The quick-opening valve is then thrown open, allowing the air in the tank to rush with great force into the well. There will be a brief but forceful surge of the water and then a "head" of water will "shoot"—partly from the casing and partly from the drop pipe. If the air-line is pulled back into the drop pipe as soon as the first heavy load of air has been shot into the well, it will produce a strong reversal of flow up the drop pipe which will quite effectively agitate the water-bearing formation.

The well is then allowed to pump as an air lift for a short time, and then another "head" is shot, repeating until the absence of further sand, etc., shows that the development is complete at this point.

The drop pipe is then lifted to a position two or three feet higher, and the same procedure is followed at this point. In this way the entire length of the screen is developed, a few feet at a time. It is then advisable to return the drop pipe to a point within a foot or two of the bottom of the well and one or two "heads" are shot at this point and then the well is pumped as an air lift with the air-line pulled up into the drop pipe, pumping this way both with a steady stream of air and by shooting occasional "heads" of air. This procedure will complete the work and thoroughly clean out any loose sand.

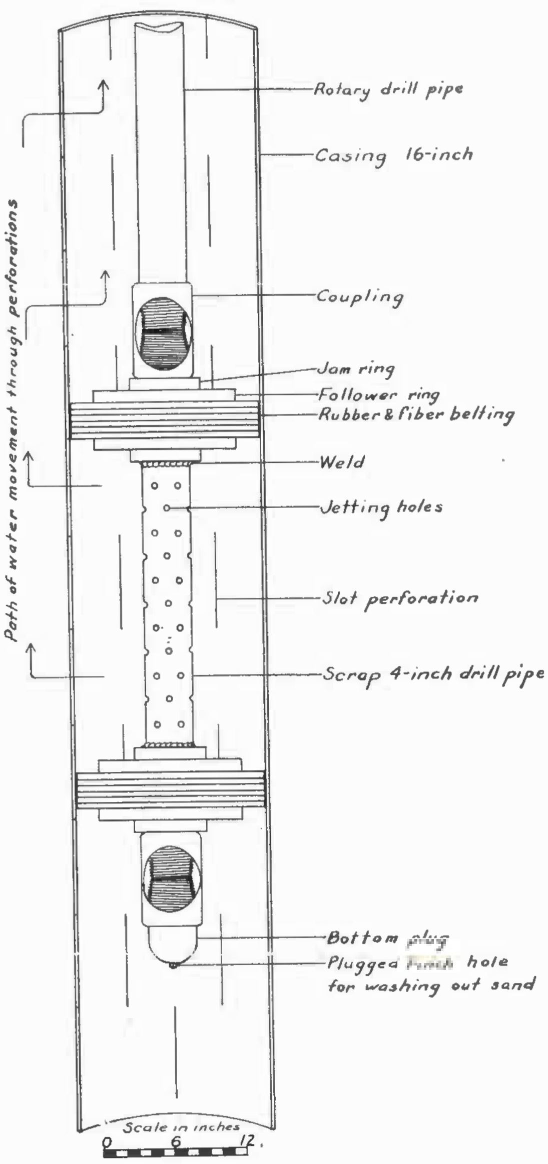

FIGURE 1.—Hydraulic Agitator for use in 16-inch casing or screen.

Geological and Hydrological Aspects

(Cont. from page 1)

of economics. With increased pumping the rate of decline of the water table and the pumping lift will increase. Moreover, as the uppermost sands and gravels are unwatered, the wells that draw from them will decline in yield. With their water supply, the farmers of the High Plains are in a position similar to that of a man who has a large capital but who uses a part of his capital each year.

"Obviously, the problem of the conservation of the stored ground water for future, as well as present, beneficial use deserves serious consideration."

Again, as stated in the article on Reservoir Engineering of Oil Fields, our goal, simply speaking, is to produce more water in the long run, and to produce it more efficiently.

Legislative Briefs

The following article is reprinted from the August, 1954 issue of Texas Water, the official publication of the Texas Water Conservation Association, J. E. Sturrock, General Manager.

Senator Dorsey B. Hardeman of San Angelo, Chairman of the Texas Water Resources Committee, has received state-wide publicity on his proposal for an amendment to the Texas Constitution authorizing the issuance of state bonds for water resources development.

The Senator suggested a "revolving fund" issue of 100 million dollars. He said he drew this figure out of the air; and that 500 million might prove a more feasible figure.

Senator Hardeman's proposal calls for the issuance of state bonds, similar to the Veterans Land program, to create a revolving fund to be used ' assisting in financing feasible and justifiable programs by those politica. subdivisions or state agencies which are unable to bear the full and immediate financial obligations.

* * * *

The following is reprinted from the State Line Tribune, September 2, 1954.

Sketchy information of what may prove to be vital legislation for farmers of this area trickled down to this newspaper this week. If reports prove to be accurate, it is now possible for farmers to borrow up to $25,000 from Federal sources to install irrigation equipment.

Rates, terms and details are not available at present, and the local FHA office, through which the loans will be handled, had not been notified through official channels of the measure.

Apparently, the legislation making available Federal funds for this and many other farm improvements was effective Wednesday, after having been signed into law by President Eisenhower last week.

It is believed that the program will work two ways: Loans will be made from funds supplied by private lenders and insured by the Government, or from funds appropriated by Congress.

These loans will be available to those farmers who are unable to obtain credit from normal private lending groups such as the banks, insurance companies, individuals, and the like.

Although no official information has been received here as yet, it is rumored that farmers will discover that they can install wells for as little as $1,000 down, have up to 20 years to repay at from four to five percent interest, and the only collateral necessary for the loan will be the well itself.

Obviously, this could have far-reaching effects for many farmers over a large area, and The Tribune will carry a full report on the new legislation as soon as it can be officially confirmed.

West Texan Appointed To WRPC By President

West Texas was very fortunate in having Congressman Walter Rogers appointed on the President's Water Resources Policy Committee.

Congressman Rogers will be working with Mr. Douglas McKay, Secretary of the Interior, Chairman of the Committee, and the Secretaries of Defense and Agriculture. The Advisory Committee on Government Operations will act in an advisory capacity.

It is our feeling that Congressman Rogers has been well chosen and will represent the people with great ability and forsight for the future.

The Statistics

During the month of September, 138 completed wells were registered with the District Office. Distribution by County was as follows:

Armstrong	0	Lamb	7
Bailey	14	Lubbock	19
Castro	14	Lynn	2
Cochran	12	Parmer	25
Deaf Smith	5	Potter	0
Floyd	21	Randall	6
Hockley	13		

122 new applications were taken throughout the District during the month of September.

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

Second Class Permit

Mr. Z. O. Lincoln
913 Houston
Levelland, Texas

THE Cross SECTION

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

Volume 1 — No. 6 "THERE IS NO SUBSTITUTE FOR WATER" December, 1954

NOW! Credit To Improve Your Farm Water Supply

The following article is reprinted with permission of the publisher from the November, 1954 issue of Country Gentlemen.

* * * *

You can now install a supplemental irrigation system, build a pond, put in tanks or make other water-or-soil-conservation improvements on your farm—and let the improvement help pay for itself.

That's one big benefit of the new $36,500,000 loan program for water facilities and conservation development passed by Congress recently. It is an outgrowth of an older program under which farmers in the 17 western states could get loans for installing water facilities such as storage reservoirs, wells, pumps, and irrigation equipment.

The new program now makes such loans available in all states, and also provides credit for certain types of soil conservation work. This program will be handled by the USDA's Farmers Home Administration, through its 1500 local offices. If you wish to apply for one of these loans, make your application through the nearest Farmers Home Administration office. You can get financing for cost of materials, equipment and services directly related to (1) the establishment of water facilities, (2) installation of soil-and-water-conservation practices, and (3) drainage. Such loans may NOT be used to refinance existing debts.

Are you eligible? You are if your experience and training indicate that you have reasonable prospects of being able to farm successfully, and in addition you must show that you are not able to obtain the necessary credit on reasonable terms from private or co-operative sources. The new program is designed carefully to supplement, but not to substitute for, private and co-operative credit. County committees of the Farmers Home Administration will pass on the eligibility of applicants.

Two types of loans are available to eligible farmers. One kind is arranged with a bank or other private or co-operative lending agency and is guaranteed by the Government. The interest rate to the lender will be 3½% on the unpaid principal, and in addition the borrower will pay an annual loan insurance charge of 1% on the unpaid principal. There is a total of $25,000,000 of insured credit available for this type of loan.

Or, your loan may be of the second type, directly out of Federal funds set up for this purpose. This direct loan will bear interest of 4½%, and there is no insurance charge. There is a fund of $11,500,000 for these loans.

As an individual farmer, your loans under this new program are limited to a total of $25,000. Applications from war veterans will get preference in processing. Loans may be made to eligible nonprofit associations, such as incorporated water associations, mutual water and drainage companies, and soil conservation districts.

Length of loans will be geared to the ability of borrowers to repay, with limits of 20 years for individual farmers and 40 years for associations. However, no loan will be scheduled for repayment over a period longer than the useful life of the improvement or the security. All loans will be secured by the best lien obtainable to protect the Government's investment.

Help in planning for the most effective development of your water and soil improvements will be available to you through state and

(Continued on Page 4)

Notice!

The Lynn County Committee of the HPUWCD has moved its office into the District Office, 1628-B 15th Street, Lubbock. All applications for permits are to be issued here and the Lynn County Committee will hold semi-monthly meetings to approve permits on the first and third Tuesdays at 1 p. m. in the District Office.

Water District Hearings Set On Annexation of Counties To District

Interest has been shown by all and/or parts of three counties within the present delineation of the High Plains Underground Water Conservation District to become an active part of the District.

Petitions have been received by the District Board bearing sufficient signatures to cause the Board to call hearings in Swisher County, Crosby County and the two south Commissioners' precincts in Hale County to determine the need for calling an election within these counties to allow the people to vote on the necessity of a water conservation program within their respective counties.

The District Board held public hearings in Tulia, Swisher County, on December 2, in Ralls, Crosby County, on December 3, in Petersburg, Hale County, on December 6, and in Hale Center, Hale County, on December 7. The hearings were well attended and the testimony indicated an increased interest in the necessity of a unified water conservation program.

A petition was presented to the District Office and the State Board of Water Engineers to alter the boundaries of the District to include a portion of Lynn County that at present is not in the delineation of High Plains Underground Water District No. 1. The petition bearing fifty (50) signatures of landowners in the Grassland Community which is located east of Tahoka, was received last Spring. The petition asked that the Board of Water Engineers include that area in the delineation of the boundaries of the Water District.

Water Tax Deduction Study Progresses

By RAYMOND L. LAWRENCE

In the June issue of The Cross Section there appeared an article relative to a study being made of the possibility of obtaining an expense deduction for income tax purposes for underground water which is depleted by use for agricultural, municipal and industrial purposes. Since that time considerable research and study have been made.

When the word "depletion" is mentioned, it is usually associated with the 27½ percent of the sale price allowed in the case of oil and gas produced and sold. Therefore the first phase of the study was to determine just what type of allowance would be made in the case of underground water if a favorable ruling could be obtained from the Internal Revenue Service.

There are basically two types of depletion allowances—cost and percentage.

The percentage depletion allowance, where allowed, is a specific percentage of the sale price of the asset sold, be it oil, gas, gold, sulphur or some other asset, the percentage varies with the different asset.

However, under the Internal Revenue Code of 1954, percentage depletion is specifically excluded in the case of water.

Therefore the only type of depletion allowance possible for underground water would be cost allowance.

In determining a cost depletion allowance for any year, it is necessary to estimate the percent of the entire asset that is depleted during that year.

The depletion allowance is that percent of the original cost of the asset.

In our study of the possibility of obtaining a cost depletion allowance in the case of undeground water, we have endeavored to perfect a "sample" case, taking facts and figures of a specific farm owner relative to his cost of land and his cost for underground water, thus showing the actual depletion of the underground water based on pumping and also showing the characteristics of the underground water formations in this area. We are planning to submit this data to the Internal Revenue Service's National Office in Washington, D. C. for a ruling on the matter. (Rulings on such far-reaching questions as this must be made by the Washington Office.)

(Continued on Page Three)

THE Cross SECTION

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

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

Telephone PO 2-8088

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.

F. B. Jeu Devine
Editor

COUNTY COMMITTEEMEN

Armstrong County

H. T. Duke, Route 1, Happy

H. T. Duke, Chmn. — Route 1, Happy, Texas
Bill Heisler .... Wayside, Texas
Melton McGehee .... Wayside, Texas
John Patterson .... Happy, Texas
Floyd B. Adams .... Wayside, Texas

Bailey County

Mrs. Doris Traweek, Bailey County Farm Bureau Office, Muleshoe

Troy Actkinson, Chmn. .... Muleshoe, Texas
Robert F. Byrd .... Route 2, Muleshoe, Texas
W. R. Carter .... Muleshoe, Texas
W. T. Millen .... Route 1, Muleshoe, Texas
D. V. Terrell .... Route 1, Morton, Texas
Committeemen meet first Saturday of each month at 1:30 to 3 p. m., Farm Bureau Office.

Castro County

Eugene Ivey, Dimmitt

Posey Cunningham, Chmn. ... Dimmitt, Texas
H. F. Benson—Star Route 1, Hereford, Texas
Steve Brockman .... Nazareth, Texas
T. R. Davis .... Hart, Texas
Eugene Ivey .... Box 157, Dimmitt, Texas

Cochran County

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

Glenn Thompson, Chmn. .... Morton, Texas
Max Bowers .... Morton, Texas
Syl Greener .... Morton, Texas
W. R. Key .... Morton, Texas
B. R. Stovall — Star Route 2, Morton, Texas
Committeemen meet first Tuesday night of each month, Cochran County Farm Bureau Office, Basement of Court House, Morton.

Deaf Smith County

Mrs. Nadean Hulse, Deaf Smith County Farm Bureau Office, Hereford

Frank J. Bezner, Chmn. .... Box 14 Hereford Texas
Pete Carmichael ... Route 1, Hereford, Texas
Paul Corbett .... Route 5, Hereford, Texas
J. N. Fish .... Hereford, Texas
Floyd Walton .... Route 5, Hereford, Texas

Floyd County

Mrs. Ida Puckett, 319 South Main Street, Floydada

W. Grady Walker, Chmn. — Floydada, Texas
R. C. Mitchell .... Lockney, Texas
Robert L. Smith .... Lockney, Texas
Sid Thomas .... Lockney, Texas
Lee Trice .... Rt. 1, Floydada, Texas

Hockley County

Z. O. Lincoln, 913 Houston, Levelland

H. T. Harrell, Chmn., Rt. 2, Levelland, Texas
Aubrey Cook .... Rt. 5, Levelland, Texas
W. H. Cunningham .... Star Rt. 4, Levelland, Texas
J. J. Hobgood .... Rt. 2, Anton, Texas
C. E. Padgett .... Rt. 3, Levelland, Texas
Committeemen meet first and third Fridays of each month at 1:30 p. m., 913 Houston, Levelland.

Lamb County

Jess Everett, Chamber of Commerce Office, Littlefield

V. M. Peterman, Chmn., Rt. 1, Amherst, Texas
Oscar Allison .... Star Rt. 1, Earth, Texas
L. Z. Anglin .... Box 86, Earth, Texas
Eldon Franks .... Box 36, Olton, Texas
Roy McQuatters .... Rt. 1, Anton, Texas

Lubbock County

Mrs. Lillian Maddox, 1628-B 15th St. Lubbock

E. K. Hufstedler, Jr., Chmn., 2202 Ave. H, Lubbock, Texas
Leroy Johnson .... Shallowater, Texas
Henry Heck .... Box 948, Idalou, Texas
Earl Reasoner .... Box 335, Slaton, Texas
Jackson West .... Rt. 3, Lubbock, Texas
The next meeting of the Committeemen will be on December 13 at 7:30 p. m. in the District Office at 1628-B 15th Street. January, 1955 meetings will be held on the 3rd 17th and 31st at 7:30 p. m. in the District Office.

Lynn County

Mrs. Lillian Maddox, 1628-B 15th Street, Lubbock

E. L. Blankenship, Chmn., Rt. 2, Wilson, Tex.
A. E. Hagens .... Rt. 1, Wilson, Texas
D. W. Hancock .... Rt. 4, Tahoka, Texas
Wayman Smith .... Rt. 1, Wilson, Texas
J. D. Unfred .... Rt. 4, Tahoka, Texas
Committeemen meet the first and third Tuesdays of each month at 1 p. m. in the District Office, 1628-B 15th Street, Lubbock.

Parmer County

Raymond Euler, Parmer County Farm Bureau Office, Friona

Raymond Euler, Chmn. .... Friona, Texas
Bruce Parr .... Rt. 3, Friona, Texas
D. B. Ivy .... Rt. 1, Friona, Texas
Walter Kaltwasser .... Rt. 1, Farwell, Texas
C. V. Potts .... Rt. 2, Friona, Texas
Committeemen meet first and third Thursday nights at 8 p. m. at the Parmer County Farm Bureau Office, Friona.

Potter County
Eldon Plunk, Route 1, Amarillo

Eldon Plunk, Chmn. ... Rt. 1, Amarillo, Texas
T. G. Baldwin .... Bushland, Texas
Earl Barcley .... Bushland, Texas
W. J. Hill, Sr. .... Box 86, Bushland, Texas
R. C. Sampson, Jr. ... Box 86, Bushland, Texas

Randall County

Mrs. Don Olson, Route 4, Box 388, Amarillo, Texas

Marshall Rockwell, Jr., Chmn., Canyon, Texas
D. L. Allison .... Happy, Texas
Frank Begert .... Rt. 1, Canyon, Texas
Neil Downing .... Rt. 4, Amarillo, Texas
Donald Olson .... Rt. 4, Amarillo, Texas
Committeemen meet first Monday night each month, 8 p. m., County Agent's Office, Canyon, Texas.

"Do It Yourself"

The following editorial is reprinted from the Amarillo Daily News.

* * * *

Rep. Martin Dies had a word of praise for High Plains folks in their willingness to do something about the water shortage by offering to pay for the Canadian River project, or such other solution as may be found, to correct the present situation.

Mr. Dies, in a short off-the-cuff talk to a group in Amarillo, was talking about all the rumpus kicked up from time to time over states rights and the trend towards centralization of the federal government. He cited as a case in point a situation which arose in his old district in Southeast Texas.

A city there has been swamped with an infestation of mosquitoes. City and county officials called a meeting on the situation, and decided to call on Washington for help. According to Mr. Dies, every member of the Texas congressional delegation was wired an appeal to get the powers that be to take over and save the city and its people from the mosquitoes.

Here was a situation that could have been and should have been handled immediately by the people affected, he said. But no, they thought they could pass the buck to Washington and have the job done without cost or inconvenience to themselves. They never stopped to think of the power, state and local, and of the individual freedoms they would have to yield if a federal agency did step in.

"Individuals and states cannot give away their sovereignty and keep it at the same time, any more than you can eat your cake and have it too. Everytime you call on Washington to meet a local emergency, take over your responsibilities, you sign away so much of your freedom. Freedom of action and responsibility for your actions are inseparable.

"And one thing more, if you send a fool to Washington you will be represented by a fool in all the business that he is called upon to handle," Dies observed.

REVIEW OF DISTRICT FILES BEING MADE

To enable us to get our entire files to date and to properly register all wells drilled within the District since February 1, 1953, each application for a well is being checked and the owner contacted to supply us with the lacking information regarding the log and registration.

In the early days of the District many applications to drill wells were filed with the intention that a well would be drilled, but in cross-checking these applications through letters of inquiry, we are finding that many of these were never drilled—and, the applicant has failed to notify us. If you have an old permit for a well on which you did not drill,

(Continued on Page 3)

Conservation Is A Religious Obligation

The Reverend Walter A. Norred

The following article is reprinted from the October, 1954 issue of Southwestern Crop and Stock through courtesy of the publishers.

* * * *

If religion is to be vital it must be practical for every phase of life. If man is to be able to live by religious principles he must possess a total gospel for total life.

Conservation, in all its phases, must certainly come within the scope of such a total gospel. By his acceptance or rejection of such a stewardship man reflects his attitude toward the creation in which God has placed him. There is a definite association of religion and conservation.

Man's religion is certainly more than making affirmation about God. It must be the practice of such professions in everyday life. In the Bible one finds a library of books, many of which were written in an agrarian background to agrarian people. The teachings of Jesus were couched in the language of the sower of the seeds, the trimmer of the vine and the shepherd of the sheep.

Either we believe what we profess or we do not. If we do, then it is time for us to treat the earth as a possession of God.

The practice of conservation is, in itself, a part of man's religious obligation. In its final form conservation is the effort of man to make the laws of natural science function in his environment. These laws have been in existence from the beginning. Where man breaks God's laws he can expect serious consequences.

When he mines the topsoil, depletes the woodlots and forests, uses his equipment to plow gullies into hillsides, creating erosion, or exploits any of our natural resources, he becomes a threefold sinner: First, as a destroyer of God's possessions; second, as a depletive of his society's wealth and well-being; and third, as a pillager of the health, security and living standards of our future generations.

Surely, the sins of such people will be passed on to their children and their children's children. Religion and conservation ARE tied together.

"Refilling Our Wells" Reprinted In Journal

In the Johnson National Drillers Journal, September - October, 1954 issue is a very interesting article "Refilling Our Wells" by Grant Cannon, managing editor of the Farm Quarterly. The article is reprinted from **The Atlantic Monthly.** In the re-printed article is the picture from the August issue of the Cross Section showing the water conservation measures practiced by Mr. Robert Viegel on his farm near Hereford.

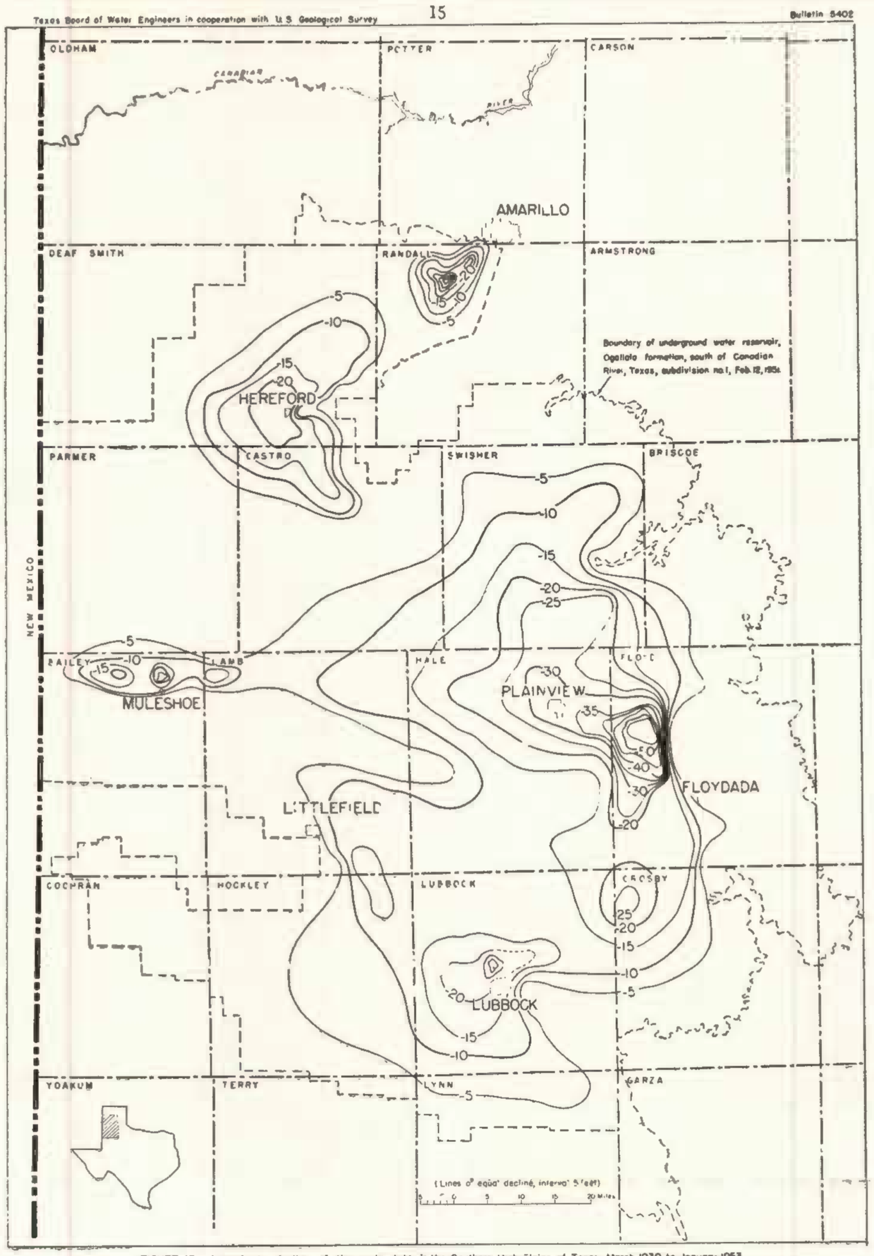

FIGURE 10.- Approximate decline of the water table in the Southern High Plains of Texas, March 1938 to January 1953.

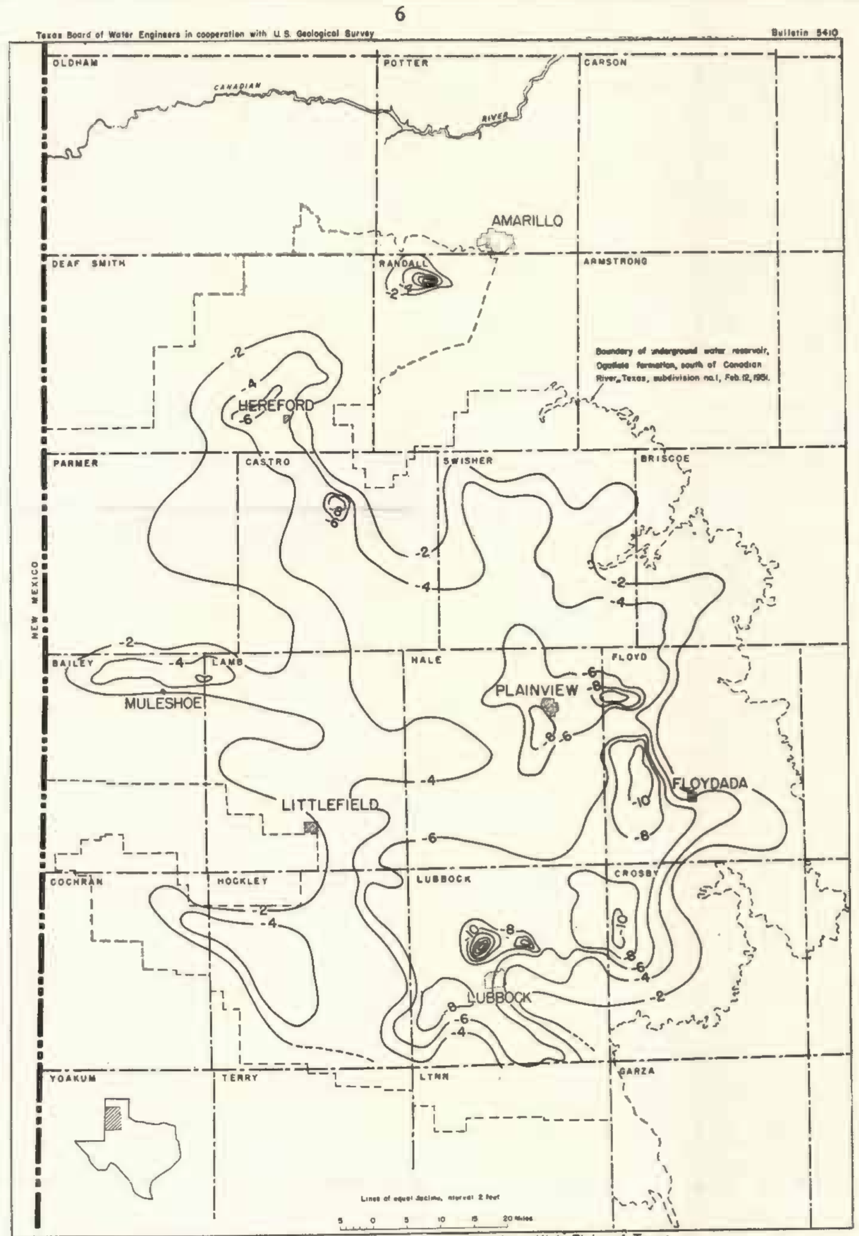

FIGURE 2.- Approximate decline of the water table in the southern High Plains of Texas, January 1953 to January 1954.

The decline of the Water table in feet, as interpreted from measurements of depths to water in observation wells, is shown by meandering lines. The boundary of the High Plains Underground Water Conservation District No. 1 is shown by the dashed lines near the edge of the map.

The two maps were reproduced from the Texas Board of Water Engineers Bulletins Nos. 5402 and 5410, which were prepared in cooperation with the Ground Water Branch of the U. S. Geological Survey.

THE STATISTICS

During the month of October, 160 completed wells were registered with the District Office and 215 new applications were submitted to the District Office. During the month of November, 184 completed wells were registered and 352 new applications were submitted. Distribution by County was as follows:

	Reg. Wells		New	
County	**Oct.**	**Nov.**	**Oct.**	**Nov.**
Armstrong	0	1	0	0
Bailey	13	2	14	1
Castro	15	8	13	15
Cochran	9	7	12	10
Deaf Smith	21	21	18	6
Floyd	14	41	12	35
Hockley	22	27	31	77
Lamb	15	18	33	49
Lubbock	29	27	37	59
Lynn	4	11	21	41
Parmer	14	11	12	43
Potter	0	1	2	2
Randall	4	9	10	14

REVIEW OF DISTRICT—

will you please so notify the District Office by post card, giving us the name of the landowner, the number (if any) of the application and the county in which your permit was issued.

We are finding that most of the people we have contacted do not realize that additional information is needed regarding their well after the issuance of the well permit and it is this fact that we are attempting to call to the attention of each permit holder.

Dry holes? If you drilled a well and it was a dry hole, the log of that well must be recorded rather than disregarded. Many times we have heard the statement, "I left that up to the driller." The obligation stands in the name of the landowner as does the permit issued, together with any authority delegated by him to his agent or tenant.

Water Tax Deduction Study—

(Continued from Page One)

On November 4, 1954 a conference was held in Dallas with officials of the District Department of Internal Revenue. The purpose of this meeting was to find the points that needed strengthening before the actual submission of the request for depletion was made to the National Office. From the Dallas conference we learned that our main problem will probably be whether or not underground water, in our situation, is a "natural deposit" as meant by the law relating to cost depletion. This law reads in part as follows:

> In the case of mines, oil and gas wells, other natural deposits, and timber, there shall be allowed as a deduction in computing taxable income a reasonable allowance for depletion . . . according to the peculiar conditions in each case.

Present plans are to submit the request for a ruling at an early date. It will then probably be several weeks before the decision will be rendered. As additional information becomes available, the High Plains Water District will endeavor to keep the public advised through The Cross Section.

Meeting Held For Gaines and Yoakum

Mr. Otha Dent, member of the Texas Board of Water Engineers and Tom McFarland, Manager of HPUWCD met with about 150 farmers and business men recently in Seagraves, Texas to discuss with the group the procedure that is necessary in establishing an underground water conservation district in the area of Gaines and Yoakum counties.

Mr. Dent explained in detail the water-bearing formations in the Gaines and Yoakum areas and showed colored cross sections of the formations, draw-down charts, etc., that were of great interest to the people of those areas. Mr. McFarland explained briefly the organization and administration of the High Plains District and encouraged the organization of a district in Gaines and Yoakum counties.

The Problem Of Water Resources

By L. K. SILLCOX

Reprinted from the July, 1954 edition of Journal American Water Works Association through permission of the author and the Journal.

* * * *

Excerpts from an address presented on April 22, 1954 at the New York Section Meeting, Watertown, New York, by L. K. Sillcox, President, American Society of Mechanical Engineers and Vice-Chairman of the Board, New York Airbrake Co., New York.

Part I

Countless millions of people are in want; actually hundreds of millions throughout the world are balanced on the starvation line. Worldwide communication causes them to hear and dream of the magic that is freedom or liberty. They are all well aware of the material resources that are required to nurture it. The determining question in the future of civilization is whether the supply of resources to be gained from the earth can prove adequate not only to meet the basic needs of the people but to support the complex requirements of modern culture and economy. What we call the "free world" has it in its power to find the answer to this primal question. To succeed, we must dearly understand the facts regarding existing and potential resources. Equally, the facts regarding populations, their growth and pressures, must be appraised and dealt with deliberately and clearly. It is needless to debate which of these two problems is the more immediate, or the more critical. The destiny of man depends upon the resolving of both. When resources have proved adequate not only to meet the basic needs of peoples but also to support their economics, nations and cultures have flourished. The so-called great periods of history are intimately identified with such a favorable relationship; lacking it, apparently indestructible empires have vanished.

Water Demand

There is an element in our national resource picture that is commencing to reach a critical point. This is water supply. With the surprise that comes from any new experience, some 40,000,000 Americans, living in various regions and communities, are now actually face to face with problems of water—either those of real shortage or of unsatisfactory quality, or both. During the last half century our per capita consumption of water has doubled, and, in view of the fact that our population has also doubled during this period, it is evident that our water needs have increased fourfold since 1900. Although part of this is due, of course, to domestic and municipal demands, the larger part is brought about by the expansion of industry and the extension of agriculture, including huge irrigation projects.

Table I — Water Use, 1950

17 Western States State	Quantity bgd.	31 Eastern States State	Quantity bgd.
California	22.3	Illinois	9.9
Idaho	13.8	New York	9.6
Colorado	8.9	Ohio	9.3
Arizona	6.0	Pennsylvania	7.0
Texas	5.9	Michigan	5.9
Montana	5.1	West Virginia	3.5
Washington	4.4	Virginia	3.2
New Mexico	3.4	Louisiana	3.1
Utah	3.3	Tennessee	2.6
Wyoming	2.9	Indiana	2.4
Others	9.0	Others	23.5
Total	85.00	Total	80.0
Use	**Quantity bgd.**	**Use**	**Quantity bgd.**
Municipal & Rural	5	Municipal & Rural	12
Industrial	3*	Industrial	65†
Irrigation	77	Irrigation	3
Total	85	Total	80

* Plus approximately 1 bgd brackish water.
† Plus approximately 12 bgd brackish water.

An isolated statistic, in itself, does not mean much, but it is of incidental interest that the present per capita use of water throughout the nation far all purposes except hydroelectric power runs to the fabulous figure of more than 1,100 gpd!

This figure is equivalent to about 1,700 tons per year. Of this amount, one-third disappears through evapotranspiration, supporting the growth of food and fibers. Most of the remainder does not evaporate, but returns, more or less polluted, to streams and rivers, often having passed through more than 250,000 mines, factories, and steam power plants (1).

All else consumed by man is outweighed by water, yet it is scarcely discernible in the family budget. In our billion-dollar-per-day economy, the total national water bill probably does not exceed $3 billion a year. The city dweller's share is about $500 million and agriculture's probably $200 million; the remaainder is borne by industry. The total investment in all types of water facility projects is roughly $40 billion (1), or a little more than our outlay for railways ($32 billion) and almost twice that for power, which stands at $25 billion but is advancing at the rate of $3 billion a year.

Looking back over the years, one can recall when a couple of buckets a day per person in a household did very well. Sanitary facilities, washing machines, air conditioning, and a score of other personal conveniences, including the luxury of doing without a water meter and working on an unlimited nonpenalty supply, have changed all that. Water has now become an essential factor in our way of life and exerts a powerful influence upon industrial and population trends.

The combination of a fairly high average rainfall and the superb natural arteries of large rivers and lakes in many regions of the continent has deluded the majority of us into believing that water is one resource about which we in America need have no concern. Consequently, a water problem is a brand new experience to many. In terms of maintaining our existing standard of living the question of adequacy of water supply is bound to be one of increasing importance. We can—indeed, we will be forced to—adopt better practices in the development and use of the water resources available; but, even then, water, like crops, forest products, and mineral resources, will limit population and industrial expansion.

The United States is not running out of water, but the seventeen western states, as a whole, are using about 70 percent of all the water they may expect to develop at reasonable cost. Arizona's water use already exceeds the dependable supply available within its borders. Texas is talking of importing water from the Mississippi, and Oklahoma plans a 450-mile water supply and irrigation canal linking the abundant watersheds of eastern Oklahoma with the drier central and western sections. The largest water-using states and the types of demand are shown in Table 1. From this tabulation it follows that the heaviest single withdrawal of water is for irrigation. The seventeen western states use nearly as much for irrigation as the 31 eastern states use for all purposes.

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To be continued in subsequent issues of The Cross Sestion.

Credit To Improve Farm Water Supply—

(Continued from Page One)

Federal agricultural agencies. Farmers who need engineering assistance in planning and installing improvements financed by these loans may obtain it from the Soil Conservation Service, the Extension Service or other agencies. The Farmers Home Administration will help applicants to determine the economic soundness of the improvements, and will aid in seeing that the construction is carried out according to required standards.

The U. S. Department of Agriculture officials believe that the new loan program comes at a time when it can help farmers put to more permanent use some of the acres which are being diverted from surplus crops. And dry weather in many parts of the country this year has highlighted the value of water improvements which help insure your farming operations against drouth.

High Plains Underground Water
Conservation District No. 1
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Second Class Permit

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