THE OGALLALA AQUIFER IN TEXAS
Physical and Legal Perspective

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ABSTRACT

Fights at the water hole were a part of the recorded history of settlement in the west. Windmills, well drilling machinery, and other innovative technology helped make water available at the point of need. Surface water limitations were rapidly forgotten as the arid areas enjoyed the magic and widespread abundance of underground water. Forty years of increasing demand coupled with serious depletion of the reserves again presents substantial opportunity for conflict and competition among classes of users. The "economics of the market" do not offer acceptable solution under the "rule of resource capture" and a more appropriate legal framework will ultimately evolve. Hopefully, such governmental intervention will not destroy the utility of competitive business practices.

INTRODUCTION

The location of early settlements in the Southern High Plains was primarily dictated by water availability. Areas with very shallow water tables, spring fed streams and perennial playa lakes were favorable sites. Utilization of all such locales still left substantial areas uninhabited and greater density of development awaited introduction of the windmill and associated technology.

Commencing during the mid-1880's, a gradually increasing influx of farmers and homesteaders settled the area and made the windmill a constant vision throughout the region. Universal success in being able to find and produce water at each drill site strengthened the illusion that a great "river" flowed underground and water was everywhere available for the taking. Small nuclei of irrigation wells were located in the Plainview, Hereford, Muleshoe, and Portales regions by 1910 and substantial irrigated acreage was noted.

The transition of the High Plains from its early development of raising beef cattle to dry-land farming and finally to the state's most extensively cultivated and irrigated area did not occur without some fore-warning of the consequences of excessive pumping from the Ogallala. As early as 1934, the Texas Board of Water Engineers asked the Texas Legislature: "First to declare the underground water of the state the property of the state; second, to guarantee vested rights to those who already have made beneficial use of underground water; and third, to exercise proper control over future underground water development."[1] In spite of such warnings, bills concerning ground water legislation introduced into the Texas Legislature in 1937, 1941, and 1947 were all defeated.

GROUND WATER QUANTITY

The water resources of all or parts of the Southern High Plains have been evaluated in many reports based upon investigations by various federal, state, and local agencies and private consultants. Among the most comprehensive preliminary reports was one by Barnes and others in 1949 wherein the authors attempted to analyze the extent and quantities of ground water and the degree of development.[2] With further refinement and added data, Cronin mapped the region in 1963 and these data were summarized in a hydrologic atlas.[3]

Commencing in 1974 and continuing to date, individual county reports by Wyatt and others are being published by the Texas Department of Water Resources (TDWR).[4] These reports contain estimates of, and projections by decade periods through the year 2020 for, Saturated Thickness of the Formation and Rates of Water-Level Declines. The information is displayed graphically by contoured maps and also in tabular formats. To date, approximately twenty county publications have been distributed and the remaining 25 counties await printing.

Table 1 presented here tabulates the estimated volumes of water in storage in the Ogallala aquifer and projected estimates of volumes which will be available for recovery by decade periods through 2020. Table 2 provides estimates of historical and future pumpage with incorporation of allowances for natural recharge from precipitation and for irrigation recirculation. Contoured and color coded maps have been prepared to depict the hydrologic parameters but are not included within this paper because of insurmountable printing difficulties. (These maps will be made available at the presentation and may also be acquired from the author by request.)

Currently ongoing studies in the area include a six million dollar appropriation to the Economic Development Administration of the U.S. Department of Commerce to study and make determinations of the effect of declining ground water supplies on various sectors and the economic impact associated with depletion of the Ogallala aquifer. The Water and Power Resources Service (formerly Bureau of Reclamation) is in the third year of a five year study to determine the quantity of playa lake water and its availability through time and to evaluate the possible uses of playa lake water.

The U.S. Geological Survey has an Ogallala Regional Aquifer study underway to describe the water resource and to model the aquifer system throughout the eight state area. The TDWR has contracted for the Texas portion of the study and the High Plains Water District has sub-contracted for that area within its boundaries. The published portions of this project will include large scale maps with twenty foot contours depicting the altitude of the base of the Ogallala Group, the altitude of the water table in the Ogallala aquifer, and the saturated thickness of the Ogallala.

County	1970	1974	1980	1990	2000	2010	2020
Andrews	690	680	637	573	491	414	306
Armstrong	4,236	4,172	3,692	2,956	2,320	1,797	1,360
Bailey	6,933	6,463	5,715	4,656	3,772	3,049	2,461
Borden	215	210	199	168	147	128	115
Briscoe	1,810	1,585	1,247	859	599	447	389
Carson	13,101	12,377	11,346	9,665	8,168	6,841	5,640
Castro	13,944	12,837	11,262	8,806	6,591	4,803	3,301
Cochran	3,148	2,970	2,615	2,093	1,645	1,280	1,052
Crosby	5,689	5,160	4,568	3,748	3,037	2,456	1,877
Dallam	21,556	21,108	19,215	15,969	13,029	10,430	8,192
Dawson	3,860	3,717	3,502	2,905	2,375	1,908	1,528
Deaf Smith	11,211	10,290	8,620	6,349	4,544	3,159	2,351
Donley	2,839	2,614	2,306	1,865	1,509	1,236	1,027
Dickens	284	233	210	170	137	116	96
Ector	110	105	96	76	60	46	38
Floyd	9,473	8,824	7,784	6,322	5,088	4,104	3,274
Gaines	11,036	10,071	10,065	8,620	7,311	6,103	5,024
Garza	396	378	337	275	222	184	160
Glasscock	905	867	809	671	565	480	411
Gray	9,963	9,589	8,627	7,176	5,907	4,793	3,849
Hale	12,859	11,863	10,444	8,515	6,909	5,553	4,427
Hansford	19,968	18,772	12,626	10,690	8,860	7,189	5,719
Hartley	27,572	27,174	22,676	19,322	16,100	13,141	10,494
Hemphill	8,806	8,783	7,747	6,119	4,701	3,555	2,661
Hockley	3,868	3,579	3,155	2,520	1,989	1,582	1,267
Howard	838	800	745	605	497	431	386
Hutchinson	7,932	7,663	7,209	6,086	5,016	4,052	3,188
Lamb	11,727	10,964	9,683	7,931	6,413	5,180	4,160
Lipscomb	15,910	15,871	15,829	13,506	11,293	9,255	7,413
Lubbock	5,970	5,564	4,999	4,219	3,548	2,973	2,487
Lynn	2,097	1,986	1,751	1,428	1,159	1,007	942
Martin	1,629	1,550	1,429	1,145	915	727	573
Midland	1,000	921	807	649	530	456	401
Moore	14,477	13,804	9,834	8,240	6,796	5,509	4,383
Ochiltree	23,760	23,429	22,896	20,172	17,560	15,113	12,799
Oldham	829	793	691	533	398	299	220
Parmer	12,955	11,923	10,268	7,896	5,796	3,991	2,756
Potter	1,663	1,529	1,373	1,119	895	711	558
Randall	5,216	4,979	4,333	3,386	2,625	2,022	1,571
Roberts	19,004	18,602	17,275	14,761	12,395	10,228	8,265
Sherman	19,766	18,566	10,855	9,252	7,710	6,273	4,982
Swisher	6,924	6,137	4,932	3,420	2,274	1,522	1,205
Terry	3,320	3,138	2,750	2,194	1,691	1,316	1,066
Wheeler	2,121	1,951	1,706	1,377	1,121	939	808
Yoakum	4,721	4,591	4,151	3,450	2,804	2,249	1,807
TOTALS	356,331	340,082	293,016	242,457	197,512	159,047	126,989

TABLE 1—ESTIMATES OF RECOVERABLE VOLUME OF WATER IN STORAGE IN THOUSANDS OF ACRE-FEET AND PROJECTED ESTIMATES OF VOLUMES WHICH WILL BE AVAILABLE FOR RECOVERY FROM THE OGALLALA AQUIFER, HIGH PLAINS OF TEXAS (AFTER WYATT, ET AL).

County	1970	1980	1990	2000	2010	2020
Andrews	13,866	14,405	14,838	19,609	15,026	12,345
Armstrong	39,649	32,270	30,022	26,985	22,060	18,839
Bailey	196,500	190,098	168,274	149,878	135,929	124,300
Borden	5,839	9,124	7,892	7,577	6,708	6,078
Briscoe	51,684	64,768	50,441	41,217	31,103	30,701
Carson	192,610	198,646	185,222	164,305	150,378	131,743
Castro	291,991	278,810	255,010	214,958	189,540	147,293
Cochran	91,749	113,394	107,133	101,667	89,795	83,763
Crosby	144,529	140,227	127,169	111,405	102,232	89,788
Dallam	219,483	264,377	365,763	330,735	219,314	207,745
Dawson	103,323	115,255	107,629	101,185	90,838	77,676
Deaf Smith	277,092	236,939	210,704	170,590	130,053	109,596
Dickens	4,937	9,253	8,638	7,389	7,294	6,901
Donley	30,000	35,000	30,000	26,000	22,000	18,000
Ector	3,930	3,906	3,674	3,444	2,468	2,208
Floyd	259,368	235,260	209,244	179,361	161,447	144,976
Gaines	213,829	225,063	210,858	200,817	188,931	176,062
Garza	13,090	10,921	9,563	8,877	7,951	6,852
Glasscock	18,251	21,374	20,268	17,322	16,171	15,346
Gray	53,196	75,177	73,641	69,472	61,158	54,012
Hale	341,109	310,079	267,693	238,642	212,489	185,039
Hansford	230,016	277,828	239,804	216,805	199,691	178,808
Hartley	123,124	266,813	364,978	364,978	338,850	308,230
Hemphill	2,778	13,928	111,773	106,153	97,565	88,407
Hockley	144,563	136,335	126,804	118,066	110,381	102,120
Howard	1,932	3,233	2,734	2,146	1,774	1,645
Hutchinson	86,678	114,560	127,964	119,325	111,887	98,441
Lamb	285,707	277,042	249,634	217,179	193,590	172,971
Lipscomb	9,983	45,606	281,728	270,029	249,780	237,772
Lubbock	171,094	157,719	145,025	137,268	125,737	118,667
Lynn	66,100	108,323	102,950	100,861	96,379	95,489
Martin	27,185	39,970	34,685	30,354	27,267	23,684
Midland	26,796	32,353	29,579	23,091	19,789	16,356
Moore	155,927	230,893	194,943	177,373	155,809	136,918
Ochiltree	127,350	150,329	299,436	289,494	273,332	256,543
Oldham	38,020	31,869	31,600	24,950	25,170	22,680
Parmer	302,299	267,530	239,290	214,355	160,369	134,141
Potter	10,215	10,115	9,648	8,521	6,721	6,703
Randall	76,742	64,488	56,837	48,229	39,666	35,254
Roberts	10,989	34,344	310,203	296,002	285,660	270,961
Sherman	217,138	202,671	216,989	208,584	192,075	173,176
Swisher	227,069	168,109	135,639	106,253	78,850	70,846
Terry	115,801	126,353	123,395	110,485	100,879	94,955
Wheeler	5,900	5,700	4,800	4,000	3,300	2,700
Yoakum	98,568	135,533	129,446	120,739	111,051	101,005
TOTALS	5,128,818	5,485,990	6,033,560	5,506,675	4,868,457	4,397,555

TABLE 2—ESTIMATES OF HISTORICAL AND FUTURE PUMPAGE IN ACRE-FEET FROM THE OGALLALA AQUIFER, HIGH PLAINS OF TEXAS (INCLUDES FACTORS FOR NATURAL RECHARGE AND IRRIGATION RECIRCULATION) AFTER WYATT, ET AL.

GROUND WATER LAW

Laws governing the extraction and use of ground water have become complex through time as dependency has evolved with settlement of arid lands in the western states. Basically, however, the states apply one of four doctrines — absolute ownership, reasonable use, prior appropriation, or correlative rights.

Absolute Ownership

No Texas statute specifically addresses the legal aspects of ground water ownership. Case law has been built upon the decision rendered in the so-called East Case.[5] In that case, the Supreme Court of Texas decided that the landowner has absolute ownership of the water beneath the surface of his land and is entitled to pump as much water from his wells as he desires, even though the effect might be to dry up the wells of adjoining property.

The effect of the court decision in the East Case was to reaffirm the doctrines of absolute ownership as it had been applied in the "common law" of the English system. In 1843, the English Court decided a lawsuit brought by a ground-water irrigator against a miner who had drained his mine, and in doing so, had dried up the irrigator's water supply. The case presented a difficult decision for the court inasmuch as it did not involve competing uses of the water, but rather the question of the water itself being an asset to the irrigator and a liability to the miner. The court decided for the defendant miner on two grounds.

First, the defendant had a right to use his land, which he owned from the 'heavens to the center of the earth.' Second, the way of ground water is 'unknown and unknowable.'[6]

In Texas, the rule applies only to percolating waters and not subterranean streams or tributary stream underflows. However, the presumption is that all ground water is percolating, thus allowing a landowner to take and use or sell all the water he can capture from beneath his land. Among the High Plains states, only Texas, Minnesota, and Missouri have retained the doctrines of absolute ownership.

There have been, in recent years, two breaches of the doctrine in opinions delivered by the Supreme Court of Texas. In the matter of Sun Oil Company v. Earnest Whitaker, the court reversed its prior opinion and held "As owner of the dominant estate by virtue of its (Sun) oil and gas lease, it has the implied right as a mineral lessee to use such part of the surface and so much thereof as may be necessary to effectuate the purposes of the lease, and it possesses an expressed contractual right to 'free use of ... water from said land except water from Lessor's wells for all operations hereunder ...' "[7]

In the second case, Friendswood Development Company Et Al v. Smith Southwest Industries, Inc. the question before the court was ... 'whether landowners who withdrew ground water from wells on their land are liable

for subsidence which resulted on lands of others in the same general area."[8] The court noted their agreement that some aspects of the English or common law rule are harsh and outmoded and have been severly criticized. In affirming the judgment of the trial court the Supreme Court noted that the trial court followed a long-established common law rule that, in the absence of willful waste or malicious injury, a landowner has the right to withdraw ground waters from wells located on his own land without liability for resulting damage to his neighbor's land. However, the court further noted "... our decision results from what we conceive to be our duty to apply a rule of property law as it existed during the time of the actions complained of in this suit, even though we disagree with certain aspects of the existing rule." The court further noted ... "As to future subsidence caused by wells hereinafter drilled or produced, this court will recognize and apply the law of negligence along with willful waste and malicious injury as limitations on the present rule ..."

Reasonable Use

Due to the extreme position of ground water use without liability as proclaimed under the absolute ownership doctrine, many western states began to modify ground-water laws into what has come to be known as the "American Rule of Reasonable Use." The rule of this doctrine reasons in essence that ... 'since the rights of adjacent landowners are similar, and their enjoyment in the use of ground water is dependent upon the actions of the other overlying landowners, each landowner will be restricted to a reasonable exercise of his own rights and reasonable use of his own property, in accordance with the similar rights of others.'

Prior Appropriation

Many states have attempted to apply their systems of law that was developed initially for surface water as the need for ground water regulation became necessary. Essentially, the doctrine of prior appropriation creates the right of private use of a public resource under certain conditions, and for uses that have been declared to have a public interest.

The rights acquired by appropriation have two legal characteristics. First, the right itself becomes a real property right, which can be defined, has value and can be sold, transferred, mortgaged or bequeathed. Secondly, the right is usufructuary and can only be exercised when the resource is avaliable and can be applied to beneficial use. There is no absolute ownership in the water until it is extracted and if it can not be put to beneficial use, the right must not be exercised.

To obtain an appropriative right, the user must comply with statutory requirements to acquire the permit or license, and the states' administrative official must determine if unappropriated ground water exists. The state must also determine what adverse effects would occur in approving each application. In most states, the laws require a determination of critical ground-water basins under differing mathematical approaches to "overdraft" with respect to allowed extraction versus time.

Correlative Rights

The doctrine of correlative rights in ground water originated in and is now applicable only to rule in California. It is a further refinement of the reasonable use concept. The doctrine holds that among the overlying landowners of a ground-water basin, each landowner can make a reasonable use of the supply for so long as the source is sufficient to meet the demand. If the supply becomes insufficient through depletion, each landowner is entitled to the remaining supply only in proportion to the percent of his land in mathematical relationship to all other lands overlying the ground-water basin. The concept is an attempt to maximize the use of the resource and still provide an equitable allocation if a shortage occurs.

THE FUTURE

During the decade of the 60's, the nation began to take a look at the extent of water development and started a concerted effort to temper development with management. In the early 70's, the environmental ethic emerged causing new and harder looks at water law.

The water users, courts and law makers in most states have still to address several major issues including:

1. Conjunctive management control of surface and ground water;
2. Allocation of water among competing uses and users;
3. Mechanisims for water quantity and quality control;
4. The proper role of federal intervention in state water policy and administration.

The thesis of western water law has been 'beneficial use is the basis and measure of the right to use water.' In Texas for example, surface water laws requires "that no more water be allocated and used than that amount economically necessary for the purpose authorized when reasonable intelligence and reasonable diligence are used in applying the water to that purpose." Additionally, many states have adopted criteria outlining the statutory duty of water.

In a society kept current through legislative changes and judicial interpretations, good practices of the past may now be considered poor by contemporary community standards. The legal rules applied as a relative concept to govern a finite resource must by dynamic. The users, the legislators and the courts must be fully appraised of current and future water use and the long term or irreversible impacts their actions will have before action is taken.

As the many problems are addressed, we can expect to see substantial changes in water law and the ethics of water use.

REFERENCES

[1] Report of the Texas Board of Water Engineers, Austin, 1934, pp 36-37.

[2] Barnes, J.R. et al, "Geology and Ground Water in the Irrigated Region of the Southern High Plains in Texas": Progress Report 7: Texas Board of Water Engineers, 1949.

[3] Cronin, J.G., "A Summary of the Occurrence and Development of Ground Water in the Southern High Plains of Texas": U.S. Geological Survey Water-Supply Paper 1693, 1965.

[4] Wyatt, A. Wayne et al, "Analytical Study of the Ogallala Aquifer in Hale County, Texas," Texas Water Development Board Report 200, 1976.

[5] Houston and T.C. Railroad Co. v. East, 98 Texas 146, 81 S.W. 279 (Texas Supreme Court, 1904).

[6] Acton v. Blundell, 12 Mees. and W. 324, 152 Eng. Rep. 1223 (1843).

[7] Sun Oil Company v. Earnest Whitaker, 483 S.W. 2d 808 (Texas Sup., 1972).

[8] Friendswood Development Company Et Al v. Smith-Southwest Industries, Inc., 576 S.W. 2d 21 (Tex. Sup., 1978).