

Appendix B

***Springs and Seeps of the
Llano Estacado Water Planning Region***

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Springs and Seeps of the Llano Estacado Region

By

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The Environmental Committee of the Llano Estacado Regional Water Planning Group is aware that springs and seeps historically existed in the region. They never emitted water in quantities comparable to the high-volume springs noted elsewhere in Texas. Most of the region's springs and seeps disappeared as native grassland was cultivated and irrigated agriculture evolved. Ogallala aquifer pumpage that drew down the water table is usually blamed for the demise of springs. In his 1981 work "Springs of Texas," Gunnar Brune maintains that siltation that began when the native grass cover was removed from the land was also a factor. Topsoil that washed into creeks and draws choked many springs. Landscape lost capacity to absorb recharge water. Brune notes invasive brush species including salt cedar and juniper adjacent to many now-defunct spring sites. Interception of recharge flow by brush species cannot be discounted as a factor in the loss of spring flow.

Springs and seeps still occur in the Llano Estacado Region. Their flow is minimal in comparison to historic times. While some springs pour water from the Ogallala aquifer, others flow only after prolonged, substantial rainfall. Water that soaks into surrounding lands still gradually feeds the springs. Many springs and seeps are located on private land and their presence can only be confirmed through frequent and close observation. Landowners may be reluctant to allow public access to these sites due to concern over liability, the wish to avoid damage to the landscape, etc. The flow from most of these springs is local and does not contribute to river flow. Spring water may travel a short distance and generally evaporates or runs back into the ground. Seeps are generally little more than small pools sustained by minimal flow from underground. Where springs and seeps still exist they are important to local wildlife and may be a source of livestock or recreational water.

The Llano Estacado region experienced unusually heavy rainfall during 2004 that renewed spring and seep flows in some locations. Where normal annual rainfall is roughly 18 inches, 42 inches of more of precipitation fell on parts of the region. Renewed spring flows noted in 2004-2005 are out-of-the-ordinary, localized, and a direct result of abundant rainfall.

According to "Major and Historical Springs of Texas" published by the TWDB, and from information garnered by area residents, several active springs and seeps are located within the Llano Estacado Planning Region. Their flows can fluctuate substantially. Included here is a list of historic springs in the Llano Estacado Region, as well as information on any spring and seep sites still active. Material in this report is taken primary from "Springs of Texas" Volume 1 by Gunnar Brune, and is supplemented

with anecdotal information.¹ **BOLD TYPE IN THE DESCRIPTIVE TEXT INDICATES CURRENTLY ACTIVE SPRINGS AND SEEPS.**

BAILEY COUNTY: At the time of his 1978 documentation, Brune found that the springs of Bailey County had nearly all ceased flowing. Through history, several springs issued from Tertiary Ogallala sand and more recent sand and caliche, and from Cretaceous limestone. Springs were located primarily along Blackwater Draw and its larger tributaries, and adjacent to the larger lakes. Cultivation of grassland diminished the soil's ability to absorb recharge water and the springs along Blackwater Draw were largely gone by the 1930s. Among historic springs mentioned by Brune, and their location are Alkali Springs, 1.5 miles south of Baileyboro; Barnett Springs, 6.8 miles southeast of Coyote Lake and just over a half-mile northeast of Baileyboro; Blackwater Lake and Springs, 6.2 miles west of Muleshoe; Jumbo and Turnbo Springs, 1.8 miles northeast of Muleshoe; Butler Springs, in the northeast corner of the county on the Parmer County line and just over a half-mile west of Lamb County line; and White Springs, in the Muleshoe National Wildlife Refuge 6.2 miles south of Needmore. **In a telephone interview on March 24, 2005, Mr. Jim Young of Muleshoe reported that springs have consistently maintained seeps on property he owns south of Baileyboro Lake just south of the Baileyboro community for the 10 years he has owned the land. These are not large flows but do maintain standing water. Mr. Harold Beierman, manager of the Muleshoe National Wildlife Refuge near Needmore said that abundant rainfall during 2004 has caused seeps to moisten the ground at several sites on the refuge. Beierman said that spring flow also occurred at Paul's Lake on private property north of the refuge, and that water was present in the lake throughout the fall and winter of 2004-2005.**

BRISCOE COUNTY: Most of the historic springs in Briscoe County issued from Tertiary Ogallala sand and Quaternary sands and gravels such as the Tule, in the western part of the county. From 15,000 years ago, when Clovis man frequented the springs, until over a century ago, nearly all of the springs ran continuously. Remains of mammoths hunted by the Clovis people have been found in Briscoe County, Hearths, projectile points, knives and scrapers and paintings on rock cliffs indicated that from Clovis to historic times, man and animal have associated with spring sites here. Irrigation caused a severe decline in the water table, a major cause of the failure of most springs, but extensive erosion also resulted in creeks being choked with sand and silt, and many springs were buried. Evidence indicates that Coronado followed the waters of Tule Creek in 1541 and stopped at **HULSEY SPRINGS**, located just below the caprock in Palo Duro Canyon, approximately nine miles north of Vigo Park. This name evidently represented several small springs at that location. Brune documented springs still running on **Deer, Turkey, and Cedar** springs with flow rates of 20.5, 39.6 and 15.8 gallons per minute respectively on September 4, 1978. **According to NRCS records, Dick Cogdell is the current landowner of the site. A telephone interview with Mrs. Dick Cogdell on February 2, 2005 revealed that Turkey Springs remains the primary active spring at that location. The spring does not flow during hot, dry summers. Any spring flow is dependent on abundant rainfall soaking into the surrounding**

¹ Brune, Gunnar, Spring of Texas, Vol I, Texas A&M University Press, College Station, Texas, 2002.

landscape and feeding the spring, and water does not flow a large distance from the site when the spring is running.

A number of other spring sites were also documented by Brune in Briscoe County. Some of these go by other localized names. **In favorable seasons such as 2004, when abundant rainfall provides a recharge source, some of these springs revive, but run only a small distance before going back underground or evaporating. Mr. Rank Cogdell of the Vigo Park area reported in a phone interview on February 2, 2005, that he observed many active springs along Tule Canyon during a helicopter flight over the area in January of 2005. He reported that the Tule has numerous springs along its length, and that in the winter Tule Creek and Deer Creek are the only locations with spring flow sufficient to provide dependable livestock water, with flow from Deer Creek estimated at roughly 20 gallons per minute. The best of the small localized springs on the Tule was located within two miles of Highway 207 that runs between Claude and Silverton. Mr. Cogdell commented that a favorable fall and winter of rainfall had created spring flows in Briscoe County that likely would not be maintained once dryer weather set in. Water from these springs does not travel large distances or contribute to river flows.**

Among other historic springs mentioned by Brune are Marting Springs, roughly 5 miles southwest of Brice; Burson Springs, 9.3 miles northwest of Turkey; Bell Springs, 6.2 miles northwest of Turkey; Gyp Springs, 5.5 miles northwest of Quitaque; Haynes Springs, 2.4 miles upstream from Gyp Springs on the South Prong of the Little Red River; Cottonwood and Red Rock Springs, 4.3 miles west-northwest of Quitaque on Little Cottonwood Creek; Las Lenguas Springs, 8.6 miles west-southwest of Quitaque; Rock Springs, 7.4 miles west-northwest of Silverton; and Mayfield Spring, 1.8 miles north-northeast of Rock Springs.

CASTRO COUNTY: As late as 1978 Brune indicated that no springs flow in Castro County, although in historic times many issued from Ogallala sand, gravel, silt and caliche. Springs once maintained a flowing stream in Running Water Draw, but this has not been the case in modern times. Decline of the water table due to pumping from the Ogallala and siltation contributed to the failure of springs. Among historic spring sites and their locations was Flagg Springs, 3.1 miles south of the Flagg community and 6.8 miles upstream from Sunnyside on Running Water Draw. Jumbo Lake, 6.2 miles northeast of Easter, was once kept full by seeps from Ogallala silt and sand. Middle Tule Draw northeast of Nazareth held some pools of live water, as did the North Fork of the Running Water Draw. Running Water Draw was fed by springs near Sunnyside.

COCHRAN COUNTY: Brune documented in 1978 that hardly any springs still flowed in Cochran County, although they issued in abundance from the Ogallala when the water table was at or near the surface. Springs were especially numerous around Silver Lake and along the major draws. Historic spring sites include Morton Springs, 3.1 miles west of Morton, that dried up in 1907, and Silver Springs, on the northwest side of Silver Lake. Discharge of springs around the lake was impacted by irrigation pumping, and the presence of salt cedars could also account for some water loss. South-southeast of Lehman about 6.2 miles springs or seeps may have flowed in former times. In the southeast corner of the county just over a half-mile from north of the Yoakum County

line and 8.6 miles west of the Hockley County line springs formerly kept a draw running with water year-round.

CROSBY COUNTY: Historically, Crosby County was abundantly endowed with springs, mostly in the canyon breaks below the caprock, with water flowing from Ogallala and Triassic Dockum sands. Over the past 75 years the springs declined markedly as the Ogallala water table dropped. Brune noted in 1978 that Crawfish Creek was dry except in times of heavy rainstorms. Among historic creeks and their location, as listed by Brune were Rock House Springs, near the junction of Highway 651 and 193 in northern Crosby County; Ericson Springs, 1.2 miles west-southwest of Mount Blanco, issuing in a ravine with vertical caliche cliffs, the site offered only a seep in 1978; Dewey Springs, a group of springs on the north side of Dewey Lake located 4.3 miles east-northeast of Crosbyton, now dry; Silver Falls, below the Highway 82 crossing of the White River, was once a source of water for White River Reservoir, but the spring flow diminished; Couch, or English Springs, 8 miles east of Crosbyton in Blanco Canyon, dry now; Davidson Springs, 4.9 miles southeast of Crosbyton; Cold Springs, 8 miles southeast of Crosbyton; L7 Springs, 9.3 miles south-southeast of Crosbyton; Wilson Springs, 2.4 miles east-southeast of Cap Rock; Cottonwood Springs, 9.9 miles east-northeast of Slaton on Plum Creek; C Bar Springs, 8.6 miles east-southeast of Slaton; and Gholson Springs, 6.2 miles east-northeast of Slaton.

DAWSON COUNTY: The larger springs of Dawson County were in the breaks and canyons below the caprock such as TJF Draw, Tobacco Creek and Gold Creek Canyons. Small springs on the plains such as those along Sulphur Springs Draw were the first to fail as the water table began declining. Many creeks also were filled with drifting sand during dust storms. Brune's field studies during 1975 showed the springs issuing from Pleistocene sand, Tertiary Ogallala sand and lower Cretaceous limestone. Among spring sites documented by Brune and their location are Sulphur Springs Draw, 3.1 south of Welch, where several small springs or seeps are speculated to have flowed during historic times; Rock Crusher or Turner Springs, 6.8 miles south of O'Donnell, where Brune metered a flow rate of 30.1 gallons per minute in October of 1978, with the water flow increasing greatly over that metered in June of 1938; Earl Springs, 1.2 miles north of Rock Crusher Springs; Tobacco Springs, at the head of Tobacco Creek, 8.6 miles south-southeast of O'Donnell; Indian Springs, 5.5 miles east-northeast of Tobacco Springs, where an historic people lived in caves and left pictographs on the walls; West Tobacco Springs, 4.9 miles south-southwest of Tobacco Springs; and Mullins Springs, 14.2 miles east of Lamesa and 3.7 miles northeast of the Midway community in a canyon. Mullins Springs flowed until 1969.

DEAF SMITH COUNTY: Springs flowed along Tierra Blanca and Palo Duro creeks below the caprock in the northwest corner, and at Garcia Lake and other large lakes or deep depressions. In nearly all cases historic springs flowed from Ogallala sand and caliche, with a few issuing from Dockum sandstone. Tierra Blanca Creek once flowed constantly and large blue holes of spring water flowed to the surface at the community of Blue Water, later named Hereford. While irrigation's drawdown of the Ogallala aquifer was a factor in the decline of spring flow, Brune's studies indicated the

plowing of native grasslands loosened fragile topsoil that washed into Tierra Blanca Creek and smothered many springs. Ability of the soil to recharge water to the aquifer was also damaged. During studies in May of 1977, Brune documented historic spring sites and their locations. Based on his studies at that time, Brune concluded that Big Springs on the Gault Ranch along Tierra Blanca Creek, about 4.3 miles west of the Randall County line, was the only flowing spring in Deaf Smith County, with a flow of about 5 gallons per minute. **Southeast of the Big Springs site about 3.1 miles, Parker Springs flowed from the base of caliche caprock. Most of the springs at this location had disappeared by April of 2002, but one small spring has continued to seep, maintaining a small pool of water. Heavy rains in the area revitalized Devil's Canyon, south of Parker Springs. Seepage continues to maintain water in a cattle watering tank at that site. Sulphur Springs in Sulphur Park on the old L.R. Bradly farm, just upstream from the junction of Tierra Blanca Creek and Frio Draw was once the site of a lake popular for recreation. The Sulphur Springs area is today part of the City of Hereford's farm, some 4.9 miles northeast of Hereford, and two or three springs run intermittently here. Brune believed that Sulphur Springs failed by the 1940s. Recharge from rainfall or some other factor served to rejuvenate at least light flow, and several seeps can be found along Tierra Blanca Creek on the City of Hereford property. Spring flow in this area travels only a small distance before evaporating or going below ground. Just east of the Sulphur Springs area, several live springs are present on ranch property along the Tierra Blanca Creek. From 1972 through 1994 the flow of some 20 springs on the site did not stop, although it was often minimal. Most springs at this location flow intermittently, declining during the heavy irrigation season. During the fall and winter months water may flow for a mile or more in the channel of Tierra Blanca Creek. One spring at the site has flowed at a rate as high as 30 gallons per minute, but the flow falls off to approximately 15 gallons per minute during irrigation season. There is some question as to whether this water originates from the Ogallala, or a local perched aquifer.**

Bridwell Springs, on the Bridwell Ranch in the northwestern corner of the county have gone dry. Fowler Springs was found 1.8 miles west of the Randall County line on Palo Duro Creek, and Hodges Spring, 2.4 miles west of the Randall County line, are among springs that formerly flowed along Palo Duro Creek. Ojo Frio or Cold Spring was located in the Frio Draw upstream from its junction with Tierra Blanca Creek. Punta De Agua or Source of Water was 5.5 miles west of Hereford in Tierra Blanca Creek. Below this point Tierra Blanca Creek flowed constantly, but began to falter in 1925, well before massive development of irrigation, and after about 1940 there was no flow except from surface runoff. In western Deaf Smith County, 2.4 miles east of the New Mexico state line, the XIT Ranch used Escarbada Springs in historic times, but they are now dry. At least one small seep is still active in this area of western Deaf Smith County, adjacent to the New Mexico border. Ojo de Garcia or Little Garcia Springs formerly flowed from Dockum sandstone 1.2 miles west-northwest of Garcia Lake in western Deaf Smith County. Spring flow eventually decline to seeps, and water is only present in Garcia Lake now when large localized rainstorms cause runoff to flow to the lake.

DICKENS COUNTY: The northwest corner of Dickens County lies on the High Plains, underlain by Tertiary Ogallala sand, gravel and caliche. Abundant springs once flowed from this formation all along the caprock escarpment, but most have disappeared due to heavy pumping for the Ogallala aquifer. The remainder of the county lies in the Rolling Plains, where springs trickle from Permian gypsum and sandstone. Some historic springs were choked by erosion and buried as early as 1914. Most springs declined permanently by 1979. Historic springs and their locations include Browning Springs, 3.1 miles northwest of Dickens in Hobble Scobble Canyon; another spring is 4.9 miles northwest of Dickens. Pecan Grove Spring was 5.5 miles southeast of McAdoo. On Grapevine Creek were White House Springs, 4.3 miles northeast of McAdoo. Cottonwood Springs were just over a half-mile west of Afton, which can still flow in the event of heavy local rainfall. Erosion choked the creek bed in this area. A half-mile north of Afton are Patton Springs, which was eventually covered by a lake; Jackson Springs, 6.2 miles north of Dickens went dry and the creek channel filled with sand; **Sanders Springs, east-northeast of Afton, is also subject to rainfall recharge, with Brune documenting a flow of 158.4 gallons per minute in August, 1979 after a heavy local rainstorm; Shinnery Springs 6.2 miles southwest of Dumont on the Pitchfork Ranch still run year around according to Wyman Meinzer of Benjamin, TX. Brune documented a flow of less than 5 gallons per minute in August, 1979. Meinzer reports the flow is not large but is consistent. The water does not flow a long distance.** Dripping Springs are 5.5 miles southwest of Dumont, and were termed similar to Shinnery Springs. Law Springs are 2.4 miles northeast of Dickens. Dickens or Crow Springs are less than a mile northeast of Dickens. Brune noted a flow of 38 gallons per minute in August, 1979 following heavy rain. Mitchell Springs are 1.8 miles east-southeast of Dickens.

FLOYD COUNTY: Brune pronounced the story of springs in Floyd County as largely one of water sources that were once important, but are no more due to decline of the water table. Springs formerly issued from sands and gravels of the Ogallala formation. Blue Hole Springs was on Quitaque Creek 6.2 miles east of South Plains. It had no water flow in July of 1978 and had been partially filled with cobbles and gravel. Likewise, Bain Springs 8.6 miles southwest of Flomot, just below the caprock, was dry. Montgomery Springs, in Blanco Canyon, just north of the Crosby County line, ceased flowing in 1948. Massie Springs, 6.2 miles southwest of Floydada, ceased flowing about 1945.

GAINES COUNTY: Most of the springs here flowed from Ogallala and more recent sands. Decline of the Ogallala aquifer is cited as a cause for most springs drying up. Boar's Nest Springs in northwest Gaines County were dry by 1955. Cedar Lake or Laguna Sabinas in northeastern Gaines County was once surrounded and fed by numerous fresh and saline springs. Buffalo Springs on the north side of the lake and Johnson Springs on the south side of the lake had only small flows by 1963, but none of the Cedar Lake springs were flowing by 1977, although a few seeps were still evident. Balch Springs on McKensie Draw south of Cedar Lake was still yielding 39.6 gallons of water a minute when Brune measured in March, 1977, but **Bobby Tabor, soil conservationist with the Seminole Field office of NRCS, in a telephone interview on**

February 3, 2005, reported there is no flow in that area today. A number of seeps were cited by Brune as existing along McKenzie Draw. Mr. Tabor related that a local landowner reported to him early in 2005 that at McKenzie Lake 19.2 miles east of Seminole and south of Cedar Lake two springs located on private property still run into McKenzie Lake. The flow rate isn't known, but probably isn't large. South of Seminole 5.5 miles, Indian Wells was the site of as many as 20 seeps issuing from Ogallala sand. Downstream on Seminole Draw, six springs formerly flowed. Brune projects there were probably also seeps along Monument Draw in the southwestern corner of the county. Ward's Well at Hackberry Grove 2.4 miles south of Seminole was a former area of shallow water that could be hand-dipped, but the water table declined at this site.

GARZA COUNTY: The western edge of the county lies on the High Plains and on the edge of these plains springs flowed from Tertiary sand, gravel and caliche. Much of the county lies on the Red Bed or Gypsum Plains where some springs issued from Quaternary sand, gravel and caliche and from Triassic Dockum sandstone. Many springs weakened or failed as groundwater declined and severe erosion filled many stream channels and buried springs. **Mr. Glen Killough, district conservationist with the Post field office of the NRCS, says many seeps still exist off the caprock. They are local and their waters do not contribute to in-stream flows. Seeps and any small spring flows remaining are highly dependent on rainfall.** In the way of historic references: Post Springs, 3.1 miles west of Post, once a source of part of the water for that city, are now dry. Golf Course Springs 3.1 miles northwest of Post once discharged water over a mile downstream and were strong in the 1930s, declined to only a seep in 1975. Tipton Springs, 4.3 miles northwest of Post, have been dry since about 1945. Barnum Springs were 7.4 miles north-northwest of Post. Live water existed in holes until about 1975. Double U Springs were noted 3.7 miles southeast of Eastland. Brune measured a flow of 3.1 gallons per minute in June, 1979. Whiskey Springs, 3.1 miles northeast of Southland were a tiny trickle of 0.79 gallons per minute in June of 1979 and a similar spring in Red Creek 1.2 miles south-southwest flowed even less. Llano Springs 8 miles north of Post on the northeast side of the Brazos River flowed until the 1940s, and seeps could still occur in the event of wet weather. Lane Springs 6.2 miles southwest of Calgary had declined to seep status by the time of Brune's survey and Indian Springs 5.5 miles south-southeast of Calgary trickled at 1.9 gallons per minute when Brune measured in August of 1979, and might be subject to some seepage in the event of favorable rainfall. Chimney Springs were noted less than a half-mile upstream. K Springs were located 3.7 miles east-southeast of Indian Springs. Southeast of Lane Springs some seeps were noted and 2.4 miles farther south Slick Nasty Springs were once an important watering site on the Spur Ranch, but reduced to seeps. OS Springs was cited 9.3 miles east of Post, south of the North Fork of the Double Mountain Fork of the Brazos River, characterized even in 1979 as only wet weather seeps. Reed Springs, 4.9 miles east of Justiceburg was a seep from Dockum sandstone. Rocky Springs, 5.5 miles east-southeast of Justiceburg fed Rocky Creek with slightly saline water from Dockum sandstone bluffs. Spring Creek Springs were 4.3 miles southeast of Grassland, and were about seven groups of springs that flowed 34.8 gallons per minute in the winter, but less in summer. Spring water flowed as much as two miles. Cooper Springs in Cooper's Canyon 4.3 miles south of

Post were once strong but flowed only about 11 gallons per minute in 1979. Boy Scout Springs, 2.4 miles southwest of Post stopped flowing about 1946 but there were still wet weather seeps in 1979. Box Canyon Springs, 2.4 miles west-southwest of Post flowed at 13.1 gallons per minute in June of 1979.

HALE COUNTY: Brune noted no flowing springs in Hale County, although historically, springs and spring-fed creeks were abundant. Decline of the water table is a factor in the demise of the springs. Norfleet Springs were in the northwest corner of the county 1.2 miles from the Lamb County line on Running Water Draw and bubbled up in 12 or 13 springs in the 1930s, but failed by 1945. Downstream on Running Water Draw 6.2 miles west of Edmonson was Ojo de Agua Springs. These and other springs maintained a running stream in Running Water Draw. These springs dried up in the 1950s with some seepage until the 1960s. Jones Springs were 3.1 miles west of Edmonson. Running Water Springs were roughly 2.4 miles south of Edmonson, on the north side of the draw. Up to 12 feet of silt from erosion had filled the draw by the late 1970s. On Crawfish Draw were once Crawfish Springs 7.4 miles south of Hale Center. They dried up by 1920. Eagle Springs were 7.4 miles west-northwest of Abernathy on Blackwater Draw. It dried up in the 1930s and seeped intermittently until the 1940s.

HOCKLEY COUNTY: The springs of Hockley County issued from Tertiary Ogallala sand and gravel. Decline of the water table impacted local springs. Silver Springs was located at Silver Lake or Laguna Plata, in the northwest corner of the county, where springs issued at various points around the lake. The flow was less than a gallon per minute in October of 1978. The Devil's Ink Well was a pool of water in Sucker Rod Draw 3.7 miles east-southeast of Pep. Yellow House Springs were two small springs 4.3 miles east of Pep. Small springs once flowed 4.3 miles northeast of Pettit. Some seeps existed in Yellow House Draw until about 1920.

LAMB COUNTY: The channel from Water Draw 6.2 miles east-southeast of Sunnyside, has been choked with sand washed in by erosion. King Springs was 6.8 miles north of Olton. It fed into Running Water Draw, but failed in the 1950s, however there was some seepage into the 1960s. Many springs once flowed on Blackwater Draw. Alamosa Springs was 4.3 miles east of the Bailey County line on Blackwater Draw. Soda Lake and Springs were two miles farther south. Spring Lake was located on Blackwater Draw 4.9 miles west of Earth. Springs here lasted until 1942, with seeps persisting until the early 1960s. In the sandhills, many lakes were once fed by springs and seeps. Sod House Spring 6.2 miles north of Amherst on Blackwater Draw flowed until the 1950s. Rocky Ford Springs were just upstream from the Highway. Brune noted only a few springs still flowing here in the late 1970s. Springs formerly ran on County Road 385 crossing of Blackwater Draw 6.8 miles northeast of Amherst, but faltered in the 1940s and were gone in the 1950s. Fieldton Springs south of Fieldton were gone around 1949. Hart Springs were a little over a half mile southeast of Hart Camp, but the springs, draw and lake that dried up in the 1930s. Bull Springs, at Bull Lake 8 miles west of Littlefield, were already only a seep by 1978. Rains could cause some seepage. Roland Springs formed a chain of pools in Bull Draw, and they were only seeps in October of 1978, although the springs ran a bit in the winter. Glumpler Springs were 3.1 miles north-

northeast of Pep and flowed about 8 gallons per minute in October, 1978. Just south of Glumpler Creek on Goat Creek Green Springs flowed 11.8 gallons per minute of slightly saline water in October, 1978. Illusion Springs on the north end of Illusion Lake flowed 25.3 gallons per minute of moderately saline water in October, 1978. At the end of Yellow Lake Yellow Springs was part of a series of freshwater springs once present along the eastern shore of Yellow Lake, and flowed an intermittent 2.2 gallons per minute in October, 1978. Some saline springs were 1.8 miles west of Yellow Lake, near the Hockley County line, with one flowing 11.2 gallons per minute in 1978 and several others dry.

LUBBOCK COUNTY: Springs once flowed abundantly along Yellowhouse and Blackwater Draws, emerging chiefly from Ogallala sand and gravel. Lubbock Springs were at the Lubbock Lake archaeological site near the intersection of Highway 84 and Loop 289. These springs had failed to flow by the early 1950s. **Buffalo Springs, in Yellow House Canyon 9.9 miles southeast of Lubbock, were immersed by a lake at the site. Brune reported that measurement of the flow of Buffalo Springs could be made only by comparing discharge above and below Buffalo Lake and allowing for evaporation. Discharge including all springs in the Buffalo Lake area was 1,246.9 gallons per minute as measured by Brune in 1976, and the historic high discharge was 1,521.2 gallons in 1969, when all spring flow combined was measured. Currently, effluent from Lubbock of 1 to 2 million gallons per day flows into Buffalo Lake. Johnson Springs are at Lake Ransom Canyon just downstream from Buffalo Lake and may receive some recharge from Buffalo Lake. Brune measured 15.8 gallons per minute in December, 1975, but the flow had declined to less than a gallon per minute by August, 1978. Tinsley Springs, 3.7 miles downstream in Yellow House Canyon, flowed 11.5 gallons per minute in August, 1978.**

LYNN COUNTY: In Lynn County, spring water flowed mainly from Ogallala sand and gravel, with some from Triassic Dockum sandstone, but spring output has been reduced due to the decline of the aquifer. Double Lakes Springs, 8.6 miles northwest of Tahoka on the north side of Double Lakes, issued 15.8 gallons per minute in December 1975. Spring sites were partially buried by sediment. **Tahoka Springs on the west side of Tahoka Lake 6.21 miles north of Tahoka included a large spring near the north end of the lake that flowed 53.8 gallons per minute in December, 1974, and several other springs farther south combined for a flow of 95 gallons per minute at that time.** Moore Springs, 2.4 miles southeast of Grassland in Moore's Draw produced 25.3 gallons per minute in 1975. Guthrie Springs were in Chimney Draw northwest of Guthrie Lake, 3.7 miles southwest of Tahoka, but last flowed some 75 years ago. Saleh Lake and Seeps were noted 3.7 miles southeast of New Moore. Gooch Springs about 1.2 miles farther west at Gooch Lake, and the largest spring flowed 12.3 gallons per minute in October 1978. **Frost Lake, 4.3 miles south-southwest of New Moore was fed by water from Frost Springs, which discharge 66.5 gallons per minute in October, 1978. New Moore Springs, 1.8 miles west-northwest of New Moore were reported by Brune as being suddenly rejuvenated in 1968 by a combination of high rainfall and potential injection of water brought in from Rich Lake at the upstream Ozark-Mahoning mine. Brune measured a flow of 90.3 gallons per minute of moderately saline water**

in October of 1978. Historically, the flow at this location has been greater in the winter months. Mr. Pat Childress of O'Donnell reported in a telephone interview on February 6, 2005, that a lake had formed at the New Moore Springs site as the spring flow had been greatly enhanced by the heavy rainfall of 2004. The springs were at that time covered by the lake water and Mr. Childress estimated that the flow was probably comparable to past measurements, although spring flow had declined severely and the springs had about dried up prior to the high rainfall year of 2004. The lake at the location is filled with what Mr. Childress called "gyppy" water, not suitable for human consumption, but used by wildlife. Frost Springs was also reported by Mr. Childress to have regained strength thanks to the high rainfall. Brune noted in 1975 that water flowed into the swampy area at New Moore Springs from Ogallala sand and that salt cedars were numerous around the site, with flow increasing in the winter when salt cedars and other vegetation were dormant. Spring and seep-fed lakes and pools in this area have historically been important to large numbers of sandhill cranes as well as to wintering ducks.

MOTLEY COUNTY: Nearly all springs in the county flow from Ogallala sand and Triassic Dockum sandstone. Pumping from the Ogallala aquifer has caused a decline in the aquifer and lessened spring flow. Quitaque Creek, estimated in the 1940s to be capable of furnishing 3 million gallons per day, had greatly reduced flows by the mid-1970s. **Roaring Springs, 3.1 miles south of the town of that name, remains one of the crown jewels of spring flow in the Llano Estacado Region, although its flow is greatly diminished from historic levels. The area around the springs has been developed with a golf course, camp ground and RV parking. Spring waters fall with namesake sound over a sandstone ledge. The recharge area for Roaring Springs is 12 miles or more to the west, where rainfall runoff slowly seeps into Ogallala sands. Today, irrigation of pasture land just upstream from the spring site can greatly diminish the flow when wells begin operating in the summer. Brune noted, when measuring spring flow in 1978 at 633 gallons per minute, that very little decline in spring flow had occurred in the previous 40 years; i.e., the flow was 664 gallons per minute in 1962, and the all-time high flow since records began in 1937 was 1,125 gallons per minute in 1946. However, heavy irrigation pumping wasn't occurring adjacent to the springs at that time. While anecdotal information was obtained via phone calls in February 2005, current flow measurements were not available. Anecdotes from local residents indicate that spring flow has declined appreciably over the past two decades. One local resident related that filling a recreational swimming pool with flow from the springs could once be accomplished overnight, but now the process takes days. Water from Roaring Springs feeds into a swimming pool and runs only a short distance before entering the South Pease or Tongue River, where it quickly goes underground. The South Pease merges with the Middle and North Pease to form the Pease River that eventually flows into the Red River. Scab Springs, 13.6 miles east of Matador on Highway 70, have been dry since 1945. Wolf Spring, 7.4 miles southwest of Roaring Springs were the source of Wolf Creek, where the combined flow of several springs at the site amounted to 112.5 gallons per minute when Brune noted them in June of 1975. Anecdotal information taken in February 2005 indicated they do not flow now. Dutchman Springs on Dutchman**

Creek 6.21 miles west-northwest of Roaring Springs was measured by Brune at 36.4 gallons per minute in July, 1979. Anecdotal information gathered in February 2005 indicated that some seasonal seepage still occurs at the site, though it is little more than a trickle. The presence of several earthen dams along the headwaters of the spring drainage may be one of the reasons for the decline of this spring. Ballard Springs, 1.2 miles south of Matador, were measured at 13.4 gallons per minute in July, 1978, and fed an earthen stock tank. Priest Springs, 2.4 miles southwest of Matador, measured 20.5 gallons per minute in August 1978. Willow Springs, 3.7 miles southwest of Matador, flowed 15 gallons per minute in August 1978. Dripping Springs, now dry, were 6.21 miles west-southwest of Matador. Lost Canyon springs were 5.5 miles west of Matador in Lost Canyon. Mott Camp Springs were 10.5 miles west of Matador. Chimney Springs were 1.2 miles northwest of Mott Camp Springs and were only wet weather seeps in 1978. Burleson Springs, 8.6 miles west-southwest of Whiteflat, had ceased flowing by 1978. Chimney Springs, 1.2 miles northwest of Mott Camp Springs were cited as wet weather seeps in 1978. Miller Springs, 7.4 miles west of Whiteflat flowed only 1.5 gallons per minute in 1979.

PARMER COUNTY: Springs were once numerous along the county's major draws, but they began to disappear by 1900. On Frio Draw, about a half-mile east of the Texas-New Mexico state line, on the north side, a spring flowed intermittently from a cave in 1927. At Mustang Lake, 2.4 miles north-northwest of Bovina, springs flowed until the 1930s. A spring also once flowed intermittently 3.7 miles east of Bovina on Running Water Draw.

SWISHER COUNTY: In Swisher County, springs once flowed along Tule Creek, and historically, spring water flowed in North, Middle, and South Tule Creeks. As the aquifer level declined, spring flow diminished. Some springs were also buried by silt from severe erosion. Rogers Springs in western Mackenzie Lake Park offered only seeps from Triassic sandstone when measured by Brune in September 1978. Prairie Dog Springs were at the Highway 2301 crossing of Tule Creek, but are now only a seep. About a half-mile northwest of the bridge JA or Anderson Springs once flowed, but they were dry when Brune noted them. Hackberry Springs were some 1,600 feet farther upstream. They dried up in 1974. Dawson Springs were 3.1 miles downstream from the Highway 1318 crossing of Tule Creek. They ran until the 1930s when some were buried by silt. Just over a half-mile downstream from the Highway 1318 crossing were Elkins Springs, now, long dry. Edwards Springs were 1.2 miles upstream from the Highway 1318 crossing. They flowed in winter until drying up in 1956. Poff Springs were 0.62 miles downstream from the Highway 146 crossing and 3.1 miles north-northeast of Tulia. They ceased flowing about 1940. Faulkner Springs were in Mackenzie Park in southeast Tulia, and flowed until the 1930s. Maupin Springs, 1.8 miles upstream from Highway 87 flowed until the 1920s. Hardy Springs, 3.1 miles past the Highway 87 crossing, are dry.

TERRY COUNTY: Springs in Terry County issue primarily from Ogallala sand and caliche, and in modern times, are highly wet-weather dependent. **Mr. Jason Coleman of the South Plains Underground Water Conservation District reported in February 2005 that abundant summer, fall, and early winter rainfall in 2004**

contributed to a renewal of some springs and seeps that generally flow from Ogallala sands. Some on the perimeter of saline lakes are not Ogallala, but flow from a Cretaceous outcrop exposed at the surface. Mr. Coleman reports that many of his observations are of pools only, without measurable flow, probably supported by slow seeps. One member of the South Plains UWCD board has several such seeps on his dryland farm on the Terry-Lynn County line. Another board member reported several seeps/springs near his house north of Wellman along Sulphur Springs Draw. This gentleman had not seen water standing in that draw for nearly 60 years prior to the 2004 wet-weather-related events. Mr. Coleman found one section of Lost Draw running from southeast Terry County into Lynn County that contained a small lake lying in Terry County, probably spring or seep-fed. Decline of the groundwater level has been a factor in the demise of most springs and seeps in this county. At Rich Springs at Rich Lake, 4.3 miles south-southeast of Meadow, water issued from Tahoka Sand on Duck Creek shale. Brune measured flow from springs at the north end of the lake totaling 19 gallons per minute in October 1978, and noted the presence of many other very small springs flowing around the lake. Rich Lake has historically been important to sandhill cranes as a roost site. Local anecdotal information indicated that in previous times, the lake rose before rains, indicating that springs and the lake were impacted by barometric pressure. Mound Springs at Mound Lake, 10.5 miles east-northeast of Brownfield was documented by Brune as flowing 63.3 gallons per minute of highly saline water in December of 1975. This water fed into Mound Lake. On South Lost Draw, 10.5 miles southeast of Brownfield, Seven Lakes was fed by numerous springs and seeps, with the springs increasing flow before a rain when barometric pressure changed. Brune documented the historic presence of many small springs along Sulphur Springs Draw 6.21 miles east-southeast of Wellman. Many of these seep-fed lakes and pools have historically been important to wildlife including sandhill cranes and waterfowl.

YOAKUM COUNTY: Brune noted following studies in March 1977 that springs and seeps formerly existed along all of the major draws in Yoakum County, flowing mainly from Ogallala and more recent sands, but decline of the water table resulted in all of the springs of the county drying up. Oho Springs were in New Mexico, 3.1 miles west of Bronco, Texas. Ulou was downstream on Sulphur Springs Draw, about halfway between Bronco and Plains, where springs once likely existed. Other springs also likely existed farther downstream on Sulphur Springs Draw. Southwest of Plains 9.9 miles, INK Basin was once a seep-fed freshwater basin, has been dry since 1949. Evidence of springs was also found present in Lost Draw in the northeast part of the county.